

This work is in complete accord with a theory of partially oriented film structure proposed by us, which was advanced to explain qualitatively the results of film continuity studies.<sup>2</sup>

We have shown previously that the minimum coating weight of certain linear polymers on several metals varies essentially inversely as the average chain length.<sup>2</sup> If the chains made a 90° angle with the surface, a direct ratio of minimum coating weight to chain length would obviously be approximated. A system of oriented chains *parallel* to the surface would give a minimum coating weight independent of chain length. At any angle between zero and 90° which the chains make with the surface, a fixed chain length would give a coating weight directly related to the sine of the angle with the surface. Now, it is obvious from the work of Langmuir and others that a chain having only a single terminal polar anchoring group would tend to stand on end; with additional polar groups along the chain, the effective polarity gradient along the polymer would vary with the type and distribution of such groups. Assuming a relatively uniform distribution along the chain,<sup>3,4</sup> then the chain would incline at an

angle with the surface which was directly related to the polarity gradient. Finally, with uniform distribution of polar groups along the chain, the longer the chain the smaller would be this polarity gradient. Accordingly, the longer the chain the smaller would be the angle it makes with the surface and as a result, an increase in chain length would reduce the minimum coating weight. This was actually found by experiment.<sup>2</sup>

This line of reasoning had already led us to make electron diffraction studies, with inconclusive results. Storks' results obviously reopen this method of attack. They furnish independent confirmation of our theory of partial orientation in what are usually considered to be wholly amorphous films.

Unfortunately, our film continuity studies depend upon a specific method, namely, that of conductivity through discontinuous films. In the near future attempts will be made to get an independent check of this work by studying the diffusion of hydrogen through thin films on palladium and of helium through thin films on glass.

CONTRIBUTION FROM THE STONER-MUDGE, INC., INDUSTRIAL FELLOWSHIP  
MELLON INSTITUTE OF INDUSTRIAL RESEARCH  
PITTSBURGH, PA., AND G. H. YOUNG  
THE PENNSYLVANIA STATE COLLEGE W. K. SCHNEIDER  
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(2) Young, *et al.*, *Ind. Eng. Chem.*, **29**, 1277, 1280 (1937); **30**, 685 (1938). See also paper to appear shortly.

(3) Flory, *THIS JOURNAL*, **59**, 466 (1937).

(4) Marvel, *et al.*, *ibid.*, **60**, 280, 1045 (1938).

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## NEW BOOKS

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**Catalysis from the Standpoint of Chemical Kinetics.** By GEORG-MARIA SCHWAB, University of Munich. Translated from the First German Edition, with additions from the recent literature by the author, by HUGH S. TAYLOR, Princeton University, and R. SPENCE, Leeds University. D. Van Nostrand Company, Inc., 250 Fourth Ave., New York, N. Y., 1937. xi + 357 pp. 39 figs. 16 × 23.5 cm. Price, \$4.25.

The German edition [reviewed in *THIS JOURNAL*, **54**, 3017 (1932)] of Dr. Schwab's "Katalyse," which appeared in 1931, ably filled the need for an ordered and condensed theoretical treatment of the whole field of catalysis, both homogeneous and heterogeneous. The present translation, delayed by "the difficult economic conditions in the world," closely adheres to the original arrangement and purpose, but has been brought up to date by the addition of new material to the extent of some 15%. The result is a book admirably suited to graduate courses in

catalytic theory, and useful to the prospective investigator as an orientation into the many unsolved problems in this field.

The reader is assumed to be familiar with the principles of theoretical chemistry, including the kinetics of uncatalyzed reactions, and with elementary mathematics. The emphasis is on the significance of theories as applied to selected examples rather than on formal mathematical statements. The treatment of the various types of catalysis is organized on a systematic rather than historical basis. Experimental examples are frankly chosen for their value in illuminating general principles, and details are naturally minimized. The book is about equally divided between homogeneous catalysis (in gases and solutions) and heterogeneous catalysis (of gas reactions). Bio-catalysis is treated briefly; technical aspects of catalysis are excluded, as is also experimental technique.

Some idea of the current activity in catalytic investiga-

tion may be obtained from the fact that the 457 citations to the literature in the original text have grown in six years to 735. The increase is especially marked in heterogeneous catalysis, where new sections on "activated adsorption," "quantum mechanics of activated adsorption," etc., appear. All the original citations are retained but in the main the effort to incorporate the newer material into the old has been reasonably successful. The translation is mostly clear in spite of the fact that few liberties have been taken with the original text.

A few points are discussed in a way which may seem inadequate to the specialist, for example: entropy of activation, *absolute* rates of adsorption and of catalysis, determination of surface areas, adsorption by poisoned catalysts, catalysis of gas-solid reactions by solids. But on the whole the book should be as stimulating to the specialist as it will be indispensable to others interested in an authoritative survey of this vigorous branch of theoretical chemistry.

ARTHUR F. BENTON

#### Lehrbuch der Chemie. Teil II. Organische Chemie.

(Textbook of Chemistry. Part II. Organic Chemistry.) By WALTER HÜCKEL, Professor at the University and Institute of Technology, Breslau. Akademische Verlagsgesellschaft m. b. H., Markgrafenstrasse 6, Leipzig C 1, Germany, 1937. xvi + 602 pp. 38 figs. 16.5 × 24 cm. Price, RM. 16; bound, RM. 18.

This text is an introduction to organic chemistry for the general student, with special attention given to the needs of the pre-medical group. Sections of importance for these students are marked.

The special quality of this book lies in its spirit and choice of material, rather than in any novel order of presentation. The material is chosen with unusual discrimination. The classification by homologous series is well explained, and thereafter only examples of live current interest are used to illustrate types of compounds. The work is distinguished by the logical presentation which would be expected by all who know Professor Hückel's writings. There is frequent reference to the experimental methods behind the structures and interpretations presented.

While it may not be practicable to use a German text in the instruction of first-year American students, this book will be welcome for the way in which it combines an interesting story with the teaching of a logical science.

P. D. BARTLETT

- (1) **Collateral Readings in Inorganic Chemistry.** (2) **Readings in Elementary Organic Chemistry.** Edited by L. A. GOLDBLATT, University of Pittsburgh. D. Appleton-Century Co., 35 West 32d St., New York, N. Y., 1937 and 1938. 21.5 × 27.5 cm. (1) viii + 225 pp. Price, \$1.35. (2) viii + 150 pp. Price, \$1.25.

A chemistry major student on departing from a small college or large university should carry with him a thorough grounding in the fundamentals of chemistry and a humble realization that there is much more to his chosen science

than has been given in his lectures and textbooks. The one is a function of faculty and curriculum; the other requires in addition a judicious consultation of the original literature, and its acquisition frequently is rendered difficult by linguistic and library limitations as well as the problem of intelligent selection. In these photo-reproductions of the original articles (with notes and translations where needed), Professor Goldblatt has gone far toward solving the problem, presenting a comprehensive selection of recent inorganic and organic papers ranging from the "Fathers of the Chemical Revolution" to the Dow Process for Bromine from Sea Water, and from Wöhler's "Artificial Preparation of Urea" to the Use of Isotopes in the Study of Intermediary Metabolism, with plentiful dashes of general seasoning in the form of Nobel Laureates, Eminent Chemists, Summary Articles and Market Reports. The experiment seems worth while and its continuance, by revised selection editions, will depend upon the academic acceptance accorded these two inexpensive paper-bound volumes.

ALLEN D. BLISS

**Traité de Pharmacie Chimique.** (Treatise on Pharmaceutical Chemistry.) By P. LEBEAU, Professor in the Faculty of Pharmacy of Paris, and G. COURTOIS, Assistant in the Faculty of Pharmacy of Paris. Vol. I. Chimie Minérale et Chimie Organique. Vol. II, Parts 1 and 2. Chimie Organique. Second edition. Masson et Cie., Éditeurs, 120 Boulevard Saint-Germain, Paris VI<sup>e</sup>, France, 1938. 17.5 × 25 cm. Vol. I: xxviii + 1206 pp. Price, fr. 280. Vol. II: xxviii + 2128 pp. Price, fr. 460.

The rapid development during the last few years of the study of chemical medication compelled the authors considerably to increase the bulk of the second edition of their textbook on pharmacological chemistry. It is presented now in three volumes, a total of 3334 pages.

The first volume is still, as in the previous edition, devoted to the study of therapeutical material classified under inorganic chemistry and the acyclic part of organic chemistry, excluding the nitrogen derivatives.

The second volume consists of two parts. The first one deals with pharmaceutical substances of the cyclic group, both cyclic and acyclic nitrogen compounds, terpenic derivatives, and finally with the chemically well-defined substances of the hormone, vitamin and organo-mineral group. The second volume describes the therapeutically valuable substances of the heterocyclic, the alkaloid, the glucoside and the proteic groups.

The authors give special consideration in their work to phytopharmacy, to which they lend a very particular importance. The profession of pharmacist, in France, is quite distinct from what it is in this country so that it is evident that the requirements of a textbook on pharmaceutical chemistry will be different also.

The present work is primarily intended as a textbook and corresponds to a regular course in pharmaceutical chemistry as given at the Faculty of Pharmacy of the University of Paris.

Rather complete references to the literature are given so as to allow for more thorough study of the properties of the

different **pharmaceutical compounds**. This makes the Treatise of equal value to both the student and the pharmaceutical practitioner.

The first part of the work, dealing with mineral chemistry, is different from the usual textbook on general chemistry only in that more emphasis is given to the pharmaceutical aspect of the different substances described. It seems as if it would have been wise to pay even more attention to the pharmacological side and to reduce considerably the description of chemical properties and modes of preparations. The sequence of descriptions follows closely the trend in books of general chemistry. The relation between chemical structure and physiological activity has, however, been stressed by the authors as often as possible.

The recent advances in the field of vitamin and hormone investigation are only briefly described and the achievements of the last two years are practically entirely omitted. It might be stated once more, in this respect, that the aim of the authors was not to publish a monograph, but to provide the student with a textbook as a help to his course on the subject. Sufficient bibliography, including reference to more specialized textbooks, is given, however, so as to provide the student with all facilities for further study on a given subject.

The presentation of the subject matter of this book is very good indeed.

V. DESREUX

**A Textbook of Biochemistry.** By ROGER J. WILLIAMS, Ph.D., D.Sc., Professor of Chemistry, Oregon State College. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y., 1938. x + 525 pp. 17 figs. 14.5 × 22 cm. Price, \$6.00.

The book includes five sections: biochemical materials, Chapters 2-5; tissue composition, Chapter 7; food composition, Chapter 8; bodily mechanisms for promoting and regulating chemical change, Chapters 9-14; metabolism, Chapters 15-23. There is a glossary and an index.

The conventional description of fats, proteins, and carbohydrates is well balanced with proper attention to chemical properties on the one hand and biochemical significance on the other. Other materials of biochemistry usually are considered in relation to function rather than structure to the bewilderment of the student accustomed to the orderly system of organic chemistry. The author has wisely arranged these diverse substances in Chapter 5 according to chemical constitution, postponing until later questions of function.

Tables showing the chemical make-up of tissues are assembled in Chapter 6 from 166 sources. There are a few errors, some data of doubtful validity and no analyses are reported of extra- and intracellular phases of muscle, but it is a unique and valuable compilation.

Excellent chapters in the later sections cover the subjects of permeability, chemical mediation of nerve impulses and chemotherapy. It is the opinion of the reviewer that the first of these could be improved by including, with some elaboration, the discussion of colloid osmotic pressure given in Chapter 6—Colloidal Properties. Concealed in the latter chapter is an incomplete account of the physicochemical properties of proteins. Neither

here nor elsewhere is the role of proteins as buffers explained except for the special case of hemoglobin.

There are remarkably few errors. On p. 179, Steffanson's experiences are said to indicate that very high protein diets may be quite satisfactory. Actually, Steffanson became sick on a lean meat diet but thrived on a fat meat diet despite a moderate ketosis. His protein intake did not exceed that of the American soldier in active service. On p. 346, the small intestine is said to be 30 feet long. This is the length after death; a sound passed naturally through the gastro-intestinal tract of a healthy man shows a length of 7 or 8 feet from mouth to rectum. On p. 487 it is said that Cinchona bark has been used to treat malaria for two centuries. Presumably it had been used for centuries by the Indians before the first authenticated use in treating the wife of the governor of Peru about 1630.

The author is tolerant in his discussion of new theories and shows good judgment in evaluating current trends in biochemistry. He questions, for example, the validity of the assumption that the faster the rate of growth and the greater the body size, the better for the race, whether of rats or men.

D. B. DILL

**Textbook of Organic Chemistry.** By GEORGE HOLMES RICHTER, Assistant Professor of Organic Chemistry, the Rice Institute. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1938. viii + 711 pp. 83 tables. 15.4 × 23.5 cm. Price, \$4.00.

Professor Richter set himself the task of writing a book "directed specifically to that large body of ambitious students who wish to study beginning organic chemistry and gain more than a superficial knowledge of the subject." He has accomplished his purpose admirably; his book should prove most useful in a full year's elementary course; indeed, it contains far more material than one could hope to cover in the usual first course.

The order of the subject matter is the conventional one: after a very brief introduction in which types of valence and structural formulas are discussed, follow aliphatic hydrocarbons, saturated and unsaturated, alcohols, ethers, aldehydes and ketones, etc. The various homologous series are well illustrated by excellent tables giving pertinent physical properties of the more important members, with the result that such data are kept at an absolute minimum in the text with a consequent increase in readability.

Adequate consideration is given to compounds of industrial significance and to naturally occurring substances; these are to be found as illustrations of the particular classes to which they belong. Granting that this method of treatment is desirable up to a certain point, we are not entirely sure that the very early introduction of formulas as complex as those of the carotenes and the sex hormones is not objectionable from the pedagogic standpoint.

An unusually large number of substances find mention, and the choice of material is, on the whole, good. If Professor Richter has erred at all, he has attempted to give too complete a picture of organic chemistry in a book written specifically for ambitious beginners. Each chapter closes with a list of review questions which cover the subject matter very fully.

In one minor respect the author is not consistent: he points out carefully the objections to the formulation of the

nitro group as  $-\text{N} \begin{array}{l} \diagup \text{O} \\ \diagdown \text{O} \end{array}$ , and of sulfonic acids, etc., as

$-\text{S} \begin{array}{l} \diagup \text{O} \\ \diagdown \text{O} \\ \text{OH} \end{array}$ , and then proceeds to use the rejected formulas freely.

The book is clearly and interestingly written, it contains very few typographical errors, and is a very complete and accurate survey of the chemistry of organic compounds with emphasis on their nomenclature, structure synthesis, reactions and properties.

NATHAN L. DRAKE

**Introduction to Physiological Chemistry.** By MEYER BODANSKY, Ph.D., M.D. Fourth Edition. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1938. ix + 686 pp. 15.5 × 24 cm. Price, \$4.00.

The Fourth Edition brings this very satisfactory "Introduction to Physiological Chemistry" largely up to date. In each chapter some of the material has been rewritten, and several chapters have been entirely rewritten. As a whole, it takes into account work published in 1937, both in the text and in the many references. All this has been done with the addition of only twenty-five pages, but, as the type is smaller, the actual addition is substantially greater than appears at first sight. There are very few typographical errors or errors of commission, and, although any reader having intimate knowledge of the subjects included would probably write the subject coming within his special competence differently, it is none the less a thoroughly sound and satisfactory introduction to the wide variety of subjects covered under the general title bio-chemistry.

RONALD M. FERRY

**Organic Syntheses.** An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Vol. XVIII. By R. C. FUSON, C. F. H. ALLEN, W. H. CAROTHERS, L. F. FIESER, W. W. HARTMAN, J. R. JOHNSON, C. R. NOLLER and A. H. BLATT. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1938. v + 103 pp. 15.5 × 24 cm. Price, \$1.75.

Like the preceding members of this series, the present volume contains carefully tested methods for the preparation of a selected group of organic compounds. As will be noticed from the table of contents, the continued increase in biochemical interest is represented by several classical examples. Here, under "Barbituric Acid" might have been mentioned Hakon Lund's recently (1935) described method of condensation by means of magnesium methylate. As further indication of modern trends, the introduction of fluorine, and of selenium, into organic compounds is exemplified each by one substance.

The list of new preparations is as follows: 2-acetothione, acetylenedicarboxylic acid, allylamine, barbituric acid, betaine hydrazide hydrochloride,  $\beta$ -bromoethylamine hydrobromide,  $\alpha$ -chloroanthraquinone,  $\alpha, \beta$ -dibromosuccinic acid, 4,4'-difluorobiphenyl, 3,4-dihydro-1,2-naph-

thalic anhydride, diphenyl selenide, diphenylselenium dichloride and triphenylselenonium chloride, ethyl benzoylacetate, ethyl  $\alpha$ -phenylacetoacetate, *n*-ethyl-*m*-toluidine, *l*-histidine monohydrochloride,  $\alpha$ -hydrindone, malonic acid, methyl benzyl ketone, methyliminodiacetic acid, 1,2-naphthalic anhydride, *p*-nitrobenzaldehyde, phenoxthin,  $\alpha$ -phenylacetoacetonitrile, 2-phenylpyridine, potassium anthraquinone- $\alpha$ -sulfonate, protocatechualdehyde, taurine *p*-tolylcarbinol.

A recent number of "Nature" contains a review of this volume, and it is a pleasure to endorse the statement, "In all respects this latest member of the series maintains the high standard of its predecessors."

M. GOMBERG

**The Origin of Life.** By A. I. OPARIN. Translated with Annotations by SERGIUS MORGULIS. The Macmillan Company, New York, 1938. 270 pp. \$2.75.

Probably there is no biologist or philosopher who has not at some time considered the basic question of biology, "How did life come to be?" In general they must be satisfied with the statement that somehow, somewhere on the surface of the earth special conditions, and perhaps an "accident," started the stream of life in motion. Few have attempted to expand the discussion past the limits of a few paragraphs. Oparin, however, has evolved a fascinating hypothesis and has expanded it into an exceedingly readable volume, one which challenges and provokes the thought of the scientist and which unquestionably will stimulate a certain amount of experimental investigation, although Oparin does not hold out much hope that experimental investigations based on the hypothesis will lead to its confirmation or rather will lead to the creation of life.

Oparin's viewpoint is radically different from most discussions of the subject of which the reviewer is aware. Most discussions presuppose an atmosphere in which carbon dioxide is highly concentrated and from which enormous quantities of carbon dioxide could be drawn by plants with the corresponding liberation of oxygen by the photosynthetic process. The great rise of the plant kingdom, culminating in the carboniferous era, is thus explained, and most hypotheses account for the tropical temperatures at that time by assuming a blanketing effect of the higher carbon dioxide content of the atmosphere.

Oparin begins his discussion of the origin of life by discussing the origin of the planetary systems. He points out that if the planets arose from the sun because of tides raised on the sun by the passage of another star, the gaseous masses which eventually became the planets would have had to pass through a progressive evolution as the masses cooled. He points out that the primary atmosphere of the earth must have been devoid of oxygen because the earth's crust is still far from being saturated with oxygen, and at the higher temperatures this lack of oxygen saturation by the lithosphere must have been still more pronounced. He, therefore, regards the free oxygen in the atmosphere as having arisen in a much later epoch and to have been formed secondarily as the result of the activity of living organisms. Furthermore, he regards the nitrogen of the atmosphere as being principally of secondary origin and concludes that the nitrogen must originally

have been present in the form of nitrides and of ammonia. He points out that at high temperatures carbon and hydrogen would preferentially unite to form hydrocarbons and that carbon would react with mineral elements to form carbides. As the temperatures became lower, water vapor and superheated water would react with the carbides to form hydrocarbons and with the nitrides to form ammonia. His primary atmosphere would then consist of a great variety of hydrocarbons, of ammonia, and of water vapor. As the cooling proceeded, the water would condense into the oceanic pools, the ammonia would largely dissolve in the water, and this mixture would be saturated with a variety of hydrocarbons.

As supporting evidence of this portion of his thesis, he cites Russell to the effect that the original oceans on Jupiter probably consisted of aqua ammonia, and as the temperature fell still lower, the water froze out, so that today at a temperature of  $-100^{\circ}$ , ice exists at the bottom of Jupiter's oceans and that this ice is covered with liquid ammonia, that the clouds on Jupiter are apparently clouds of ammonia snow, and that when we pass to Neptune at  $-200^{\circ}$  the ammonia is solidified and the clouds now are clouds of methane snow.

Up to this point Oparin has introduced no radically new hypothesis. He now points out, however, that the biocatalysts or the enzymes characteristic of living organisms in general only speed up reactions which take place very slowly in the absence of the catalyst. In the evolution of the planets there would be the opportunity for hydrocarbons and their oxidation products, aldehydes, alcohols, ketones, and organic acids, to interact with each other in an aqueous ammoniacal medium over long eons of time. He therefore believes that under the conditions which then prevailed most of the types of organic compounds, and which we now know to be characteristic of plants and animals, originated by the processes of this chemical interaction. This evolutionary process lasted for an incalculably long period of time. Condensations and polymerizations built up complex organic molecules. These probably reached colloidal size long before that phenomenon which we know as life came into being. Oparin suggests that relatively complex proteins may have originated *de novo* in this manner. He even accounts for the origin of optically active organic compounds and the specialized groupings around an asymmetric carbon atom by calling attention to the fact that sky light is plane polarized and that when this passes into an aqueous medium it is transformed into circularly polarized light, and then he cites experimental evidence that circularly polarized light preferentially decomposes either the *d*- or the *l*-form of a racemic mixture of organic compounds having appropriate absorption bands.

He continues with his thesis, assuming that certain of these organic colloids are positively charged and that others are negatively charged, and argues from the observation of Bungenberg de Jong that coacervate droplets would separate as a distinct phase. Here then we have what are essentially single cells but as yet incapable of self-propagation. He concludes, however, that since enzymes are in all probability chemical compounds with particular space configurations, there should be no essential reason why enzymes should not arise in the same way that the primary

organic compounds arose and that a coacervate system containing enzymes possibly represents the primary living cell.

From this point on the argument is somewhat more hypothetical and is based on the assumption that those coacervate systems more nearly adapted to the environment tended to persist and become stabilized, whereas those coacervate systems less adapted to the environment were eliminated and disappeared by a process of "natural selection." Those systems which persisted probably grew at the expense of the nitrilites in the aqueous environment, and those which possessed enzymes characteristic of anaerobic respiration found a source of energy in the interaction of organic substances with water molecules. In this way carbon dioxide and other products of fermentation were liberated into the atmosphere. This started a new cycle of reactions, since new building stones were available, and from these new series of reactions Oparin postulates the synthesis of certain special pigments which, when possessed by the coacervate system, rendered that particular system capable of utilizing the energy of sunlight for initiating and controlling chemical reactions. Such systems became the primitive life forms.

The above is only a very brief and cursory review of a very fascinating hypothesis. Many chemists will want to read this volume over and over again. Every physiologist and biochemist should call it to the attention of his students, for while it is purely a hypothesis, there are many proven facts interwoven into the network, and in some places where the gaps in knowledge are great, it may be possible to supply at least a part of the missing links by further investigations.

ROSS AIKEN GORTNER

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**Colorimetric Methods of Analysis Including Some Turbidimetric and Nephelometric Methods.** Vol. II. **Organic and Biological.** By FOSTER DEE SNELL and CORNELIA T. SNELL. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y., 1937. xxiv + 815 pp. 49 figs. 16.5 × 23.5 cm.

In this second volume the authors have collected methods of colorimetric and nephelometric analysis applicable to organic and biological substances. They have also collected methods for the comparison and evaluation of the colors of various products such as oils and sugar solutions. The book is complete up to 1936.

As in the first volume, a number of methods are given for each substance, five, for example, being given for benzene. The general plan of Volume I is also continued. After a brief general description of each method, detailed directions for the preparation of samples are given. Then the procedure is described carefully and finally there are directions for preparing standards.

Although complete critical treatment of all of the methods described is impossible in a volume of this scope, a great deal of very valuable criticism and discussion of interferences has been collected from the literature and included in the book. Thus thirteen references are quoted on the determination of methanol and methoxy groups as formaldehyde by Schiff's reagent, and no less than sixty-four on the determination of cholesterol by acetic anhy-

dride. Incidentally, this bibliography in the form of footnotes is most convenient and accessible. Would that all compilers of chemical information would thus make short the path from datum to reference! The index is also complete and accurate.

The first chapter on hydrocarbons is followed by one on alcohols and then by a chapter on sterols. Next there are three chapters on aldehydes and ketones and then thirteen chapters on acids and related compounds, ranging from formic to abietic acid. Then follow chapters on hemoglobin, proteins, nitrogen in various forms, phenols, urea and related compounds, miscellaneous amines, imines, and nitro compounds. Five chapters on carbohydrates, four on alkaloids and one each on glucosides, halogen derivatives, and compounds with inorganic radicals, are included. Then there are two chapters on enzymes, one on hormones and one on vitamins. Finally a chapter on the measurement of bleaching power introduces a section of nine chapters on the measurement of color and turbidity itself in oils, sirups, extracts, pigments, etc. In this section various special instruments adapted to particular types of color measurement are described.

The authors may feel sure that a wide circle of chemists will be grateful to them for the labor of preparing this very useful and comprehensive survey of colorimetric and nephelometric methods.

C. H. GREENE

**An Outline of Organic Chemistry.** By ED. F. DEGERING, Purdue University, R. E. NELSON, Purdue University, and J. R. HARROD, Ohio Northern University, and seventy-seven Assistant Editors. Revised edition. Barnes and Noble, Inc., 105 Fifth Avenue, New York, N. Y., 1937. 317 pp. 14 × 21.5 cm. Price, \$2.25.

If at first one is inclined to regard this volume as just a soft short-cut for the student to a pass mark in a course in organic chemistry, a careful perusal of the book promptly corrects such a view. It represents a sincere effort on the part of a group of teachers to aid students in understanding what is to many a difficult subject, but it is no sugar-coated pill. Sixteen standard texts have been drawn upon in preparing the outline, and a pagination chart enables one to use it with any one of these texts in lieu of note taking in class. Throughout an effort has been made to indicate conditions and reagents requisite for the performance of each reaction. In addition to the usual material referred to in a one-year course, the book contains excellent special chapters contributed by authorities. The chapter on nomenclature, edited by Patterson, should aid in the gradual, and welcome, unification and simplification of naming schemes employed by American chemists. *Chemical Abstracts* usage is recommended. Lucas' excellent chapter on electronics makes evident to the beginning student in organic chemistry the fact that a knowledge of electrons and protons should not be relegated to limbo after a good course in Freshman chemistry. Careful attention to the brief, but good, section on pronunciation will spare users from censure (readily recalled by the reviewer from his student days) for the use of "damned Teutonisms." An excellent, *informative*, 17-page index is included. The publishers present with the book an "omis-

sion list," the use of which, without change, would in the reviewer's opinion lead to a pretty thin broth kind of elementary organic chemistry course. The outline, with no omissions, presents somewhat too much "red meat" for most students to digest in one year. The material given is very well organized, misprints and other errors are remarkably few, and the book work is very well done.

This little volume is interesting, stimulating, and should prove helpful to students and instructors alike.

G. ALBERT HILL

**Qualitative Analyse mit Hilfe von Tüpfelreaktionen. Theoretische Grundlagen, praktische Ausführung und Anwendung.** (Qualitative Analysis with the Aid of Spot Tests. Theory, Development and Application.) Third, revised edition. By Dr.-Ing. FRITZ FEIGL, Professor in the University of Vienna. Akademische Verlagsgesellschaft m. b. H., Sternwartenstrasse 8, Leipzig C 1, Germany, 1938. xii + 554 pp. 27 figs. 16 × 24 cm. Price, RM. 28; bound, RM. 30.

All chemists who are familiar with the first (1930) [THIS JOURNAL, 53, 1621 (1931)] and second (1935) [*ibid.*, 58, 863 (1936)] editions of this valuable work will be gratified to note the publication of this third edition. Although the total number of pages has increased from 513 (2nd edition) to 554 (3rd edition), yet substantial improvements in the typographical arrangements of the numerous tables have permitted the inclusion of much more material than would correspond to the page increase alone.

As in the previous editions the book is divided into two major divisions designated as theoretical (140 pp.) and special (373 pp.). Both are generously documented with references to the original literature. The first will be particularly welcomed since it was omitted completely from the recent English translation of the second edition [*ibid.*, 60, 734 (1938)]. Following a brief but adequate description of the general technique of "spot testing," the special part devotes itself to the particular methods for the detection of metals (127 pp.), the detection of acids (66 pp.), systematic investigation of inorganic mixtures (21 pp.), application of spot tests to qualitative organic analysis (104 pp.), tests for purity, technical testing and mineral examination (50 pp.) and finally to an extensive tabular review of the content of the special part.

As a work to which continual reference will gladly be made by workers in organic as well as inorganic chemistry, the present edition well deserves the attention of all chemists who may hitherto have overlooked this valuable assistant.

E. H. HUNTRESS

**Second Report on Viscosity and Plasticity.** Prepared by the Committee for the Study of Viscosity of the Academy of Sciences at Amsterdam. Nordemann Publishing Company, Inc., 215 Fourth Avenue, New York, N. Y., 1938. viii + 287 pp. 80 figs. 19 × 27 cm. Price, \$7.50.

The book consists of a series of six articles surveying various topics relating to the viscous and plastic deforma-

tion of liquids and solids. The contributors are J. M. Burgers, F. M. Jaeger, R. Houwink, C. J. van Nieuwenburg, and R. N. J. Saal.

In the first article, Chapter I, recent investigations on the structure of liquids are reviewed by Burgers. The results of X-ray scattering studies and the calculation of radial distribution functions receive particular attention. In the article by Jaeger, viscosity data on pure liquids and liquid mixtures are discussed in connection with a number of theoretical and semi-empirical formulas. Certain problems relating to the theory of lubrication are touched upon.

The article by Burgers, Chapter III, on the motion of small particles suspended in a viscous liquid is of particular interest to chemists because of its bearing on the molecular shape of proteins and of polymers of high molecular weight. The author develops in a rather simple manner an approximate theory of the influence of elongated particles on the viscosity of a liquid in which they are suspended. By employing a method due to Oseen for the calculation of the velocity field in a viscous liquid in laminar flow, under the influence of external forces, he is able to avoid much of the intricacy of the exact hydrodynamical treatment of Jeffery and others.

In Chapter IV, by Houwink, the various factors influencing the yield value of crystalline solids, amorphous solids, and suspensions are investigated. The last two chapters are concerned with the techniques of plasticity and viscosity measurements. In the article on plastometers by van Nieuwenburg a survey of the types of instruments in use is undertaken, and the significance of plasticity measurements is discussed. The author concludes that no plastometers of present design allow an unambiguous determination of the fundamental relation between the rate of shear in an element of the sample and a simple shearing stress acting through it. In the final chapter by Saal, types of technical capillary viscosimeters in current use are described.

The report provides a unified and critical survey of a large amount of material on viscous and plastic phenomena. It will certainly prove to be a source of useful information on the subject. It is perhaps to be regretted that certain of the latest theoretical developments in the theory of viscosity have not been included.

JOHN G. KIRKWOOD

**Tables of Reagents for Inorganic Analysis.** In English, German and French. First Report of the "International Committee on New Analytical Reactions and Reagents" of the "Union Internationale de Chimie": C. J. van NIEUWENBURG (Delft) President, W. BÖTTIGER (Leipzig), F. FEIGL (Vienna), A. S. KOMAROVSKY (Odessa), N. STRAFFORD (Manchester). Akademische Verlagsgesellschaft m. b. H., Sternwartenstrasse 8, Leipzig C 1, Germany, 1938. xxiv + 409 pp. 18 × 25 cm. Price, RM. 34; bound, RM. 36.

It should be clearly understood that this report deals only with reagents for use in *qualitative* inorganic analysis, and that the reagents that are covered are those that have been introduced in the period 1911-1936, inclusive. Spec-

troscopic methods, flame color reactions and methods of separation or concentration are not mentioned. Neither are the older standard reagents, unless they have been reinvestigated during this period.

The types of reactions described are those involving precipitation, color, catalysis, and certain miscellaneous operations. The procedures cover spot tests on drop plates or paper, micro tests under the microscope or in the micro test tube, and macro tests in the ordinary test tube.

Data are presented by an extensive use of symbols and abbreviations under the six general columns (1) cation or anion, (2) name and formula of the reagent, (3) type of reaction, (4) procedure, (5) sensitivity, and (6) remarks on compounds that are known to yield similar reactions or to interfere in the test. Extensive references to the literature are given under each test.

The section on cations deals with tests for some 57 elements plus the ammonium ion, while that on the anions covers some 38 anions. Finally, there is a very complete subject index listing the reagents and the tests in which they are used.

The book is a very worth while addition to texts on inorganic analysis, and is a mine of information for those who are prospecting or working in the field of qualitative analysis.

G. E. F. LUNDELL

**The Elements of Physical Chemistry.** By F. W. GODDARD, M.A., F.C.S. and E. J. F. JAMES, M.A., D.Phil. Longmans, Green and Co., 114 Fifth Avenue, New York, N. Y., 1938. viii + 251 pp. 66 figs. 13.5 × 20 cm. Price \$1.80.

The two British authors state in their preface: "This introduction to the study of Physical Chemistry is intended for the use of students preparing for Higher Certificate, First Medical, and University Entrance Scholarship Examinations. It is assumed that such students will have acquired a knowledge of elementary physics and chemistry up to the standard of School Certificate on Matriculation." In American colleges and in teacher training schools it could well find a place in a course following general chemistry, or as an introduction to the regular course in physical chemistry. The book is distinctly an elementary treatment of the subject. Little, if any, calculus is involved. The pitch is about right for our American type of pre-medical courses in physical chemistry, but the dearth of illustrative material drawn from the biological field probably renders this text unsuited for such a purpose. It is a bare skeleton outline cut almost to the bone.

The scope of the book is indicated by the chapter headings: I, The Atomic and Molecular Theory; II, Valency and the Structure of Atoms; III, The Gaseous and Liquid State; IV, Solution; V, Osmotic Pressure and Allied Phenomena; VI, Law of Mass Action; VII, Thermochemistry; VIII, Electrolysis and Electrolytic Dissociation; IX, Catalysis; X, Colloids.

The exposition is extremely clear, and the whole book is well organized. Every chapter is followed by a well-chosen list of good questions and problems (two hundred

and fifty altogether). The answers are supplied at the end of the book. There is also a supplementary list of miscellaneous questions. An author index, subject index, and atomic weight, four-place log and anti-log tables, are also given.

EDWARD MACK, JR.

**Laboratory Methods of Physical Chemistry.** By JOSEPH J. JASPER, Assistant Professor of Chemistry, Wayne University. Houghton, Mifflin Company, 2 Park Street, Boston, Massachusetts, 1938. xix + 312 pp. 34 figs. 15 × 22.5 cm. Price \$2.50.

This textbook is one of the series edited by Professor H. T. Briscoe. Following the Editor's Introduction, a Preface, Table of Contents and List of Figures, there are Preliminary Remarks to the Student, and the Chapters: I, Errors of Measurement and Corrections; II, Gases; III, Liquids; IV, Optico-Chemical Methods; V, Solutions; VI, Colloidal Systems; VII, Thermochemistry; VIII, Homogeneous Equilibrium; IX, Chemical Kinetics; X, Phase Equilibrium in Chemical Systems; XI, Electrical Conductance; XII, Transference Numbers; XIII, Electromotive Force; XIV, Photochemistry; Bibliography and Index. Altogether, Professor Jasper gives directions for about sixty experiments. The directions are clear and adequate and are featured by (1) the excellent figures, (2) helpful discussion of the pertinent theory at the beginning of every experiment, and (3) by specific instructions for treatment of results at the end.

It is perhaps somewhat surprising, or perhaps not surprising, to teachers of physical chemistry to find that several of the available laboratory manuals are constructed so nearly on the same pattern. Resemblances in the skeleton outline of book structure may be inevitable because of the necessity of acquainting the student with a representative set of the highly standardized laboratory techniques of the physical chemist. The author of such a textbook no doubt feels almost compelled to present the usual type of directions for making the classical measurements of molecular weight, surface tension, viscosity, electrical conductivity, hydrogen ion concentration, etc., through the whole list.

If a dozen, or several dozen, authors and their publishers are to give birth to laboratory manuals of physical chemistry, it is to be hoped that some distinctive flavor of originality may be found in a few of the new-born. Surely the vast literature of experimental physical chemistry, with its enormous wealth of illustrative material suitable for textbook use, has scarcely been sucked quite dry. Nor have the resources upon which the alert pedagogue may draw for setting forth the meaning and limitations and possibilities of the experimental method, and for arousing and sustaining the interest of the student, necessarily been exhausted.

The present book is a good one. It should find a wide adoption and usefulness, as have some of the other books which it resembles.

The author, the editor and the publishers are to be congratulated on its very fine appearance, and on the excellent job of book-making that they have done.

EDWARD MACK, JR.

**The Fine Structure of Matter. Part II. Molecular Polarization. Part III. The Quantum Theory and Line Spectra.** By C. H. DOUGLAS CLARK, D.Sc., A.R.C.S., A.I.C., D.I.C., Assistant Lecturer in Inorganic Chemistry in the University of Leeds. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1938. 14.5 × 22.5 cm. Part II: lxxii + 241 pp. 35 figs. Part III: lxxii + 185 pp. 29 figs. Price, \$4.50 each.

The chapter headings in the two volumes under review are the following: Part II, Molecular Polarization: Dielectric Constants, The Debye Theory of Polarization, Molecular Refraction, Polar Molecules, Molecular Fields; Part III, The Quantum Theory and Line Spectra: The Quantum Theory, The General Principles of Line Spectra, The Multiple Structure of Lines, Line Spectra and the Periodic Classification.

In the opinion of the reviewer, a reader unfamiliar with the subjects could not gain an understanding of molecular polarization and line spectra by the study of these books, although the author in his preface suggests that Part III might serve as an introduction to the study of spectra. The style in which the books are written is incoherent and confusing, and the author has not given a consecutive account of the topics treated. Unrelated subjects are grouped together as, for example, on page 285, where reference is inserted in a section on the additivity of molecular refraction values to a method of calculating the refractive index of nickel arsenide from its reflective power in air and in cedarwood oil. The lack of clarity in the discussions is due in part to the inclusion of references to outmoded suggestions as well as to the more satisfactory recent theories and to unreliable as well as reliable values of experimental quantities.

The theoretical parts of the books are poor; although a detailed mathematical discussion (pages 452-455) is given of Debye's old calculation, now unimportant, of the value 64° for the H-O-H angle in the water molecule (the actual value being 105°), no derivation of the Debye fundamental equation relating molecular polarization and dipole moment is given in the chapter headed "The Debye Theory of Polarization" or elsewhere in the book. In several pages of discussion of the Clausius-Mossotti equation mention is made of the electric displacement in cylindrical cavities, but the significant step of evaluating the factor  $1/3$  in the equation with use of a spherical cavity is omitted, the reader being left unenlightened as to the nature of the "certain assumptions, in accordance with the classical theory," which are involved.

The volumes are made somewhat unsatisfactory for reference purposes by the Author's selection of 1934 as the closing date for literature references, and by the existence of many errors. Fluorescent scattering and Raman scattering are said to require a decrease in frequency of the light. A figure showing experimental values of the molecular refraction of alkali halide crystals is confusingly described as based on estimates of  $R_{\text{crystal}} - R_{\text{free gas ion}}$ . Typographical errors such as CH<sub>2</sub>OH for CH<sub>3</sub>OH, SiF<sub>6</sub> for SeF<sub>6</sub>, Te(NO<sub>3</sub>)<sub>2</sub> for Te(NO<sub>3</sub>)<sub>4</sub>, and HeII for HeI occur rather frequently.

The books are not recommended either to readers in-



terested in learning about the subjects treated or to those seeking a convenient guide to the literature.

LINUS PAULING

## BOOKS RECEIVED

September 15, 1938–October 15, 1938

- SAUL B. ARENSON. "The Solution of Problems in Quantitative Analysis." Lithoprinted by Edwards Brothers, Inc., Ann Arbor, Mich. 41 pp. \$0.35.
- JAMES E. BELCHER and GUY Y. WILLIAMS. "A Course in Qualitative Analysis Based on Macro and Semi-Micro Methods." Houghton Mifflin Co., 2 Park St., Boston, Mass. 265 pp. \$2.40.
- WILLIAM H. CHAPIN and LUKE E. STEINER. "Second Year College Chemistry." Fourth edition. John Wiley and Sons, Inc., 440 Fourth Ave., New York, N. Y. 407 pp. \$3.00.
- REGINALD ALDWORTH DALY. "Architecture of the Earth." D. Appleton-Century Co., 35 West 32d St., New York, N. Y. 211 pp. \$3.00.
- EDWARD F. DEGERING and ASSOCIATE EDITORS. "The Quadri-Service Manual of Organic Chemistry." Houghton Mifflin Co., 2 Park St., Boston, Mass. 221 pp. \$2.25.
- HAROLD G. DIETRICH and ERWIN B. KELSEY. "Laboratory Manual to Accompany 'Introductory General Chemistry' (Brinkley)." Revised edition. The Macmillan Company, 60 Fifth Ave., New York, N. Y. 118 pp. \$1.90.
- L. ERHARD, Editor. "Blätter für Geschichte der Technik." Verlag von Julius Springer, Linkstrasse 22-24, Berlin W 9, Germany. 80 pp. RM. 4.
- O. GATTY and E. C. R. SPOONER. "The Electrode Potential Behavior of Corroding Metals in Aqueous Solutions." Oxford University Press, 114 Fifth Ave., New York, N. Y. 504 pp. \$8.00.
- L. A. GOLDBLATT, Editor. "Readings in Elementary Organic Chemistry." D. Appleton-Century Co., Inc., 35 West 32d St., New York, N. Y. 150 pp. \$1.25.
- P. H. GROGGINS, Editor-in-Chief. "Unit Processes in Organic Synthesis." Second edition. McGraw-Hill Book Co., Inc., 330 West 42d St., New York, N. Y. 769 pp. \$6.00.
- GEORGE HEVESY and F. A. PANETH. "A Manual of Radioactivity." Second edition. Translated by Robert W. Lawson. Oxford University Press, 114 Fifth Ave., New York, N. Y. 306 pp. \$5.50.
- HANS HOHN. "Chemische Analysen mit dem Polarographen." Verlag von Julius Springer, Linkstrasse 22-24, Berlin W 9, Germany. 102 pp. RM. 7.50.
- A. JENNY. "Die elektrolytische Oxydation des Aluminiums und seiner Legierungen." Verlag von Theodor Steinkopff, Residenzstrasse 32, Dresden-Blasewitz, Germany. 224 pp. RM. 14; bound, RM. 15.
- WALTER L. KUBIENA. "Micropedology." Collegiate Press, Inc., Iowa State College, Ames, Iowa. 243 pp. \$3.00.
- EUGENE W. NELSON. "The Magic Wand of Science." E. P. Dutton and Co., Inc., 300 Fourth Ave., New York, N. Y. 213 pp. \$2.00.
- ARTHUR A. NOYES and MILES S. SHERRILL. "A Course of Study in Chemical Principles." Second edition, rewritten. The Macmillan Company, 60 Fifth Ave., New York, N. Y. 554 pp. \$5.00.
- CARL OPPENHEIMER. "Die Fermente und ihre Wirkungen. Supplement, Band II, Spezieller Teil—Hauptteil XVIII-XX, Lieferung 10." W. Junk Verlag, Den Haag, Nederland. 160 pp. 10 Dutch florins.
- ERICH PIETSCH. "Sinn und Aufgaben der Geschichte der Chemie." Verlag Chemie, G. m. b. H., Corneliusstrasse 3, Berlin W 35, Germany. 33 pp. RM. 0.90.
- CARL L. A. SCHMIDT, Editor. "The Chemistry of the Amino Acids and Proteins." Charles C. Thomas, 220 East Monroe St., Springfield, Ill. 1031 pp. \$7.50.
- W. SEITH and K. RUTHARDT. "Chemische Spectralanalyse." Verlag von Julius Springer, Linkstrasse 22-24, Berlin W 9, Germany. 103 pp. RM. 7.50.
- CHAPLIN TYLER. "Chemical Engineering Economics." Second edition. McGraw-Hill Book Company, Inc. 330 West 42d St., New York, N. Y. 241 pp. \$3.00.
- L. ZECHMEISTER and L. v. CHOLNOKY. "Die chromatographische Adsorptionsmethode." Second edition. Verlag von Julius Springer, Linkstrasse 22-24, Berlin W 9, Germany. 354 pp. RM. 19.80.
- "Outfits for Absorption Spectrophotometry. Photographic, Visual, Photoelectric." Sixth edition. Adam Hilger, Ltd., 98 St. Pancras Way, Camden Road, London N. W. 1, England. 63 pp.
- "Spectrographic Outfits for Metallurgical and General Chemical Analyses." Ninth edition. Adam Hilger, Ltd., 98 St. Pancras Way, Camden Road, London N. W. 1, England. 63 pp.