The recalculation gives values which shift the curve for heptane (Fig. 4) slightly to the right, its general shape remaining, however, the same.

On p. 1077 the value for the molecular cross section of dimethylaniline molecules at the heptane-in-water interface should read 0.572×10^{-14}, instead of 0.695×10^{-14}. We also note a typographical error, p. 1079, for the cross section of triethylamine; the proper value is 0.41×10^{-14}, instead of 0.11×10^{-14} sq. cm.

The System, Magnesium Sulfate-Sodium Sulfate-Water and a Method for the Separation of the Salts, by E. H. Archibald and W. A. Gale.

P. 1768. The titles for the triangular diagrams should be transposed.

Note. The Atomic Weight of Zirconium, by F. P. Venable and J. M. Bell.

P. 1834. In line 11, for "91.22," read "91.60," and for "91.49," read "91.76." In line 12, for "91.19," read "91.24." In line 13, for "91.34," read "91.40." In line 14, for "91.36," read "91.68," and for "91.26," read "91.32." In view of the greater accuracy of the chloride results, in line 17, for "91.2," read "91.3."

Amine Oxides Derived from 4-bromodimethylaniline and from 3- or 4-nitrodimethylaniline, by Lauder W. Jones and Elden B. Hartshorn.

P. 1841, Equation 7. For the formula "$O^{\pm}\ {}^{\mp}CH_2$," read "$O^{\mp}\ {}^{\pm}CH_2$."

P. 1843, Footnote 14. In the last line the formula "$R_3N::O$" should read "$R_3N{}^{:}\!:O$."

P. 1852. In the third line under "HYDRIODIDE" instead of "methylaniline oxide," read "methylaniline oxide hydrochloride."

Hyponitrites, by Lauder W. Jones and Alfred W. Scott.

P. 2174. In lines 3 and 4, instead of "O=NH(OH)," read "O=N—NH(OH)."

In Footnote 10, instead of "H_2NON," read "H_2NOH."

NEW BOOKS

Das Leitvermögen der Lösungen. (The Conductivity of Solutions.) By PAUL WALDEN, Professor at the University, Rostock. Akademische Verlagsgesellschaft m. b. H., Leipzig, 1924. ix + 383 pp. 25 figs. 24.5 × 16.5 cm. Price, unbound, 17 Goldmarks; bound, 21 Goldmarks.

The author of this book has evidently set for himself the task of reading and appraising with substantial completeness all of the literature dealing with the subject embraced by his title. It is a commentary on the rapid growth of knowledge that such a task is today apparently beyond the physical capacity of one man, even for a small subdivision of a science. In this book, which is volume one of a series on the same topic, there are literally many thousands of references to original articles and to books, all of which the author attempts to place in proper relation to the subject as a whole. One noticeable result is that the book lacks a guiding idea or "plot," and problems do not get solved as the reader plows through it; on the contrary, his confusion is apt to be increased. Naturally, the best part of the work deals with subject matter with which the author has been most directly concerned in his researches, namely, the conductivities and viscosities of non-aqueous solutions. Here we have, for the first time, an adequate account of the data on the subject, and of the not very precise conclusions that have been reached in that field. On the other hand, in the portions of the book in which the backgrounds of theory and experiment are less familiar to the author, the treatment is far less satisfactory. The results of investigations are, in general, given with little or no comment on method or accuracy, so that data based upon sound theory and adequate experimental technique are given little or no more weight than the results of hastily conceived experiments for which a complete ignoring would be the soundest criticism. The mingling on a given page of discussion of good, bad and indifferent work gives a singularly qualitative tone to the whole treatise, and would make a reader unfamilar with the subject think that less progress has been made than has actually been the case. In practice, of course, the later workers have to a large extent corrected the errors and faulty assumptions made by the earlier investigators. In this book, however, the tendency is to give the larger amount of space to early work, and later, more adequate material frequently receives scant treatment, or is simply referred to. For instance, the method given by the author for the determination of transference numbers from e.m.f. measurements will give correct results only if the activities of the ions are given by the product of the concentration and the conductance ratio, which is, of course, practically never true. Ample reference is, however, made to articles in which the subject is correctly treated, but these have evidently been hastily read or misunderstood. The same criticisms applies to the statement that the moving-boundary method for determining transference numbers gives the "true" transference number. This has been shown to be false in an article, written for that purpose, by G. N. Lewis, and to which reference is given. These are the most serious errors that the reviewer has noticed, but instances are frequent of lack of critical care in the examination of the underlying theories of articles dealt with, and of cases in which the early work has been quite superseded by later publications which are barely mentioned.

In spite of the adverse comment just given, the reviewer, for one, is very glad that the book has appeared, and will look forward to the appearance of the additional volume, or volumes (and of an index, which is missing from the present volume). It is certainly very convenient to have discussions of all, or practically all, of the publications referring to conductance of solutions and the related topics gathered together into compact form. Many readers will be led to important articles that they might very possibly, with the present ever-increasing number of publications, overlook. Certainly, as a source of references and of concise comments, which must, however, be used with care, the book is invaluable. Its faults are, possibly, inevitable, considering the magnitude of the task that the author has set for himself.

D. A. MacInnes

The Fitness of the Environment: An Inquiry into the Biological Significance of the Properties of Matter. By LAWRENCE J. HENDERSON, Assistant Professor of Biological Chemistry at Harvard University. The Macmillan Company, New York, 1924. xv + 317 pp. 20 × 13 cm. Price $2.00.

This is the reprinted edition of a book which first appeared in 1913, and was reviewed in THIS JOURNAL, **35**, 648 (1913). Since its first appearance the book has provoked considerable dissenting discussion from certain philosophers, from which discussion the philosophers have come off second best.

The book is intelligible to the non-scientific and shows with great detail that the physical and chemical properties of matter are preëminently fit for the support of life, that is, for the maintenance of mechanisms which are complex, regulated and metabolic. The relation of its argument to Paley's "Natural Theology" and the Bridgewater Treatises on the one hand and to Darwin's "Origin of Species" on the other is evident to students of the history of biological thought. To such thought the book is a permanent contribution.

TENNEY L. DAVIS

The Theory and Application of Colloidal Behavior (contributed by the foremost authorities in each division of the subject). Vols. I and II. By ROBERT HERMAN BOGUE, Ph.D., Editor. International Chemical Series, H. P. Talbot, Ph.D., Sc.D., Consulting Editor. McGraw-Hill Book Company, Inc., 370 Seventh Avenue, New York; 6 and 8 Bouverie Street, E. C. 4, London, 1924. xi + 829 pp. Illustrated. 21 × 14 cm. Price $8.00.

Such books cannot be reviewed in the usual manner, but should receive the usual effort. The reviewer's duty is to read and delicately touch what it is the editor's duty to collect, read, correct, balance, arrange and index. No one person could properly review this publication, but that would be simple compared to editing it perfectly. It is not the kind of book one reads at one sitting, but almost any chapter is of that kind. It is written by nearly as great a variety of chemists as there are of pickles. The reviewer was at once induced to look up the literature, for he doubted that "ten or fifteen years ago colloid chemistry was not recognized as a subject deserving any special consideration," and recalled that Graham, Hardy, Linder and Picton, Schulze, Perrin, Einstein, Lottermoser, Zsigmondy, Spring, Biltz, Bredig, Freundlich, Van Bemmelen, and many others had excited our interest before that. We naturally turned to the reference index to see if the names of these fathers and others (primarily, of course, the reviewer's) were disclosed. Finding that the proper references existed, we renewed our reading, realizing that the book was going to prove satisfactorily complete and discriminating.

The fact that Professor Donnan's name in the preface is only about half right augured ill for 100 per cent. accuracy. His real name is Frederick G. Donnan, not Frank—that is just his character. He is thereafter deified for his colloid potentials and has now acquired fame regularly by having had his name misspelled in print.

In order to make this review shorter than the book, many of the latter's good qualities will have to be omitted.

We are not holding an autopsy. The book is as live as a crate of healthy puppies, but the subject is terribly cut up, as you might expect it would be when treated by so many doctors. Colloids for sticking the chapters together are lacking, but this has its advantages, for one may read any disconnected chapter without having to read more. But then, if he reads one, he does not know what the others contain, so he has to read them all. He does not have to read any particular one to prepare him for another, which is good, but he will frequently discover that he has been repeatedly prepared. Some repetition could not be prevented, and most experiments bear repeating.

It is somewhat disturbing to plunge suddenly from the end of one highly developed chapter back to the elements of colloids at the beginning of the next chapter, but we like disturbances, and can highly recommend the book. If we tired temporarily of one author we jumped to Bancroft, on Adsorption, who reanimated us. You can warm up in the Fuel and Coal Sections with Sheppard, stick around in the Glue Sections with Bogue, feed on the Food with Alsberg, Rubber in Whitby's chapter, Gas and Smoke with Strong in his chapter, get into a Ferment with Armstrong, and everywhere enjoy yourself. Your interest cannot die anywhere. There is no chapter on dyes which ought to lend color to works on colloids, but the lexicon of these chemists contains no such word as dye.

Some idea of the breadth of the subject is indicated by the fact that there are probably over a thousand literature references. These cover almost every material in the world. Many subjects have been treated by experts which have not been heretofore classified among colloidal matters.

Boldness and simplicity are great assets of the writers of the theoretical half of this work. Others will be encouraged to guess, and possibly experiment, as they learn how important scientific contributions may be made by boldly extending the existing stock of boldness.

What we might call the mechanics of colloids interests us. The molecules at the interface between two liquids, which are in contact, are oriented. Many oils on water extend themselves until the films become one molecule thick. When the molecules are polar (when they have a head) they arrange themselves so that the body stands perpendicular to the surface, with all the heads either in or out of the water. Oleic acid arranges itself on water with the polar part (COOH) in the water and its long body vertical to the surface. A fat acid, with a paraffin tail, sticks this end into fat-like liquids, and a reverse picture is seen if this acid floats on oil. This oriented film theory is creeping through all colloids and catalysis. It explains the stability and the protection of colloids, the very intimate relation of colloids to catalysis and the augmented reaction velocities we call catalysis. I have selected rats to represent this film, because they have heads, plenty of body and tails and what is more important, they can stand abuse. A rat has just as much to do with colloids as a cat with catalysis. Its intimate relation to the cat is well known. Its head is always where water ends and reaction begins. Its body is the middle of space, and its tail sticks, in the end, to fat. Moreover, if its orientation is reversed, it still sticks. Rat-alysis is a temporary, superficial arrangement, but Langmuir films have come to stay.

The various chapters teach us that a particle of water stays colloidally suspended in oil after the two are mixed, because something like concentrated long-tailed rats (like soap molecules) persist in sticking their heads into the water and their tails into the oil. This is molecular orientation, used to explain the important colloid "protection" by stabilizing films. Thus we may say that, in general, no rats, no colloids. And apparently from the data, if no rat-alysis takes place then no catalysis can occur.

In a good mechanical picture Harkins has priority for his magnet-headed wooden images, which are shown oriented into standing surface-layers in oil films and protecting layers. But rats are more attractive than magnets. They put life into the subject, with its resultant reasoning process which is fittingly called ratiocination.

Now when cats, "walking by their wild lones" with Maxwellian regularity (and accustomed to finding random distribution of rats), meet a case of ratalysis and are photo-electrically activated by this orderly concentration of oriented rat-tails, they quickly react. This is catalysis, and it's a fine picture. Similarly, when long-tailed rats "find a toe-hold in the space-lattice of the bearing metal" (in the lubrication section) they hang on, and thus a revolving shaft rolls as on a ball bearing of countless waving tails.

A continuous mass of pure bred rats, all clinging to one another in regular order by claws, teeth and tails, constitutes one large molecule and represents any pure crystal. But just irregularly messed, or massed, they are a jelly. Finally, if a few cats crystallize in their well-ordered midst, the rat space-lattice becomes locally extended and the slip-planes are mechanically locked, so that what is physically structural hardness becomes augmented. With these simple explanations all modern colloid theories may be equally well elucidated, which shows how beautifully simple Nature is. No author is exactly responsible for these pictures and the errors are the reviewer's.

Everything can be made colloidal. A colloid is not a chemical matter, but an electro-physical state. According to the "Complex Theory," referred to by Thomas, colloids are sometimes stabilized by ions which, as usual, are unwilling to separate far from one another, even though one of them is preferred and absorbed by the colloid, and in other cases, they are stabilized by molecules in sticky oriented films, as shown by Harkins. This difference between the "complex theory" and complicated theories helps us fix the definition of these words. Complicated theories are not clear.

If catalysis be simply increased reaction velocity, due to molecules being made ready and concentrated active-end-up on a catalyst, as it evidently is, then the case of hydrophobes becoming stable hydrophils may be called "pairalysis," and we could stop there. But apparently there are two kinds of pairalysis. For the mutual precipitation of two colloids, as explained in the chapter on mutual reactions, becomes, perforce, pairalysis. We used to think of colloids as just naturally stable when pure and positive or negative by nature, and we thought one coagulated the other on mixing because the equivalent electrical charges were thereby neutralized. Now we apparently know that each colloid is generally stabilized by traces of salts, or ions, which react on mixing, and the two colloids merely lose their supports, settle out and are pairalyzed.

The subject of colloids has not been exhausted and more such coöperative, comprehensive treatises are on the way. Every organic growth, whether plant or animal, single cell, calcified shell or ossified skeleton, owes its growth to colloid reactions just as surely as does the river delta or the growing memory. What we ask of Science is to let us see the wonderful order through this chaos. With all the interesting data of these volumes before him, some Huxley should write a much needed textbook.

While much is admittedly omitted in this review, it is hoped that enough is mentioned to interest readers and to indicate that there is more knowledge of colloids in these volumes than has been put in books heretofore.

To quote a well known German chemist:

"All the world's a colloid
And all the stuff that's in it merely micelles
They have their charges and their migrations
And each one in its fineness has countless parts
Its acts being Brownian movements."

Willis R. Whitney

Ueber Naturprodukte. Chemische Abhandlungen zur Kenntnis und Verwertung Verschiedener Naturprodukte. Festschrift zum 70.Geburtstage Max Hönig von Fachgenossen, Freunden und Schülern Gewidmet. (Chemical Papers relating to the Knowledge and Utilization of Various Natural Products. A memorial volume issued in honor of the 70th birthday of Max Hönig by his colleagues, friends and former students.) Edited by Prof. Dr. B. M. Margosches und Priv.-doz. Dr. W. Fuchs, Deutsche Technische Hochschule, Brünn. Theodor Steinkopff, Dresden and Leipzig, 1923. x + 181 pp. Portrait and 7 figs. 23.5 × 16 cm. Price, unbound, $1.10.

The volume consists of an interesting collection of papers by colleagues, former students and friends of Professor Max Hönig, in honor of his seventieth birthday, and his forty-eight years of teaching and research activity at the Brünn Hochschule.

Among the contributors may be noted Pringsheim, Klason, Cross, Fischer and Hägglund, who discuss such problems as inulin, lignin, wood and cellulose—a tribute to the work of Hönig in the field of carbohydrate, polysaccharide and plant chemistry.

Hönig's great interest in the civic affairs of Brünn (water supply; water purification, etc.), is reflected by several contributions in this field.

The volume concludes with an interesting article by Frenzel on "Röntgen Rays and their Application in Chemistry and Technology," which should prove of interest to the student of chemistry.

To the reviewer's mind this custom of honoring a teacher on his seventieth birthday is a very charming one. Surely nothing can give a man greater pleasure than such a spontaneous tribute—a token alike of the value of his labors and the existence of a mutual, firmly-established affection between teacher, colleagues, students and friends.

HAROLD HIBBERT

Nitroglycerin und Nitroglycerinsprengstoffe (Dynamite) mit besonderer Berücksichtigung der dem Nitroglycerin verwandten und homologen Salpetersäureester. (Nitroglycerol and Nitroglycerol explosives (Dynamites), with especial reference to related and homologous nitric esters of nitroglycerol.) By Dr. PHOKION NAOÚM, Director of the Scientific Laboratory of the Dynamit-Aktiengesellschaft of Alfred Nobel and Co., Hamburg. Julius Springer, Berlin W 9, 1924. xi + 416 pp. 36 figs. 23.5 × 16 cm. Price, bound, $4.30.

This book is an excellent and up-to-date treatment of the subject matter named in its title. With due attention to significant detail it describes the manufacture of nitroglycerol and of dynamites of various kinds, safety explosives and explosives containing a little nitroglycerol but deriving their power from other substances like ammonium nitrate or perchlorate. Much valuable information is given relative to composition, explosion temperature, power, sensitiveness to detonation, etc. An historical account, sometimes brief, generally precedes the discussion of present manufacturing methods and patent references naturally enough are to German patents. For commercial development and use, and scientific investigations, credit appears to be properly given, when due, to those who are not of the nationality of the author. Nitroglycerol propellent powders are not treated.

The book gives directions for the preparation, in the laboratory, of nitroglycerol and many analogous substances, glyceryl mono- and dinitrates, and the nitrates of mono- and dichlorohydrin, of mono-acetin, monoformin, diglycerol, glycol, propyleneglycol, trimethyleneglycol, of nitro-*iso*-butylglycerol, penta-erythrite, etc., and contains an account of the chemical and physical properties of these substances with literature references.

There is a short chapter on the recovery of nitroglycerol from smokeless powder. The powder is extracted in a copper apparatus of the Soxhlet type with dichloro-ethylene which reduces its nitroglycerol content to 1% or less: nitroglycerol is obtained by concentrating the extract at a temperature below 70°.

Tenney L. Davis

The "Chemical Age" Chemical Dictionary: Chemical Terms. Ernest Benn, Limited, 8 Bouverie Street, London, E. C. 4, 1924. 158 pp. Price 16 shillings.

This volume, the first of a series of chemical dictionaries offered by the enterprising publishers of *The Chemical Age* of London, is an excellent compilation of about 3000 general terms used in the chemical sciences, particularly in the fields of physical and organic chemistry. The latter group comprises in part a really comprehensive list of compound types and this constitutes one of the most valuable features of the book. Structural formulas are frequently given. Few names of substances are listed as these have been reserved for subsequent volumes of the series. The type is large (10 point) and the alphabetically arranged titles are printed in black-faced characters. The pages are double-columned and the paper is sufficiently thick to make the volume easily handled.

The definitions are clear and, as a rule, exact; the length of definition varies from a few lines to sometimes as many as 2000 words. Americans will note certain differences in usage from those adopted by the American Chemical Society, for example, the spellings sulph- instead of sulf-, laev- instead of lev-, burette and pipette instead of buret and pipet and the somewhat confusing symbol A° instead of Å. (Ångström). The spelling "mercurization" is preferred to "mercuration."

The selection of terms is on the whole quite satisfactory. One finds here almost invariably the puzzling word or phrase, the exact meaning of which has been a little in doubt. A few inconsistencies may, however, be noted. Specific optical exaltation is listed alphabetically, but not exaltation; molar, but not molal, mole, or formal; Polenski number, but not Zeisel number; adiabatic, but not merodiabatic; space lattice, but not face-centered cube; chloryl, but not chromyl; buret and pipet, but not beaker or flask; guttameter and colloid mill, but not cathetometer or centrifuge or viscometer. The terms activity (ionic), entropy, Einstein's theory, Bohr atom, salt effect, are among those not given in the alphabetical arrangement, whereas such comparative rarities as allologic, caleometer, carberine, cryosel, lepton, rhodim and topotropy are included. It is entirely possible that the omission of certain somewhat familiar terms is a matter that will automatically be adjusted by their inclusion in subsequent volumes of the series. Altogether, the faults of the book are minor ones. It should prove to be a valuable desk book for all whose work takes them into strange chemical fields.

Willis A. Boughton