nearly horizontal rotating (20 revolutions per minute) disk A which is slowly turned through a worm gear by means of an electromotor. The inclination of the whole apparatus may be adjusted by a hand-screw, B, in the base. The separators lying on the rotating disk are gently tilted about so that no mixing of the two liquids takes place. To support the separator vertically while drawing off the contents, two right-angle screw hooks are inserted horizontally in the edge of the laboratory desk shelving with a space between them somewhat less than the diameter of the separator. The apparatus[1] has proven satisfactory in practice.

C. E. PARKER.

NEW BOOKS.

Methods in Chemical Analysis, originated or developed in the Kent Chemical Laboratory of Yale University. Compiled by FRANK AUSTIN GOOCH, Professor of Chemistry and Director of the Kent Chemical Laboratory in Yale University. New York: John Wiley & Sons. 1912. 8vo., 23 × 15 cm., xii + 536 pp. Cloth, $4.00 net.

All chemists, analytical and otherwise, will welcome the appearance of this volume, which collects and presents concisely "the principal results reached by workers in the Kent Chemical Laboratory of Yale University in the investigation and development of methods in chemical analysis." Although the book runs to 536 pages, the "compiler" regards it as a summary, and has, therefore, given rather complete references to the original sources.

After 70 pages, containing some admirable illustrations, devoted to appliances and general procedure, the succeeding chapters run the gamut of some 46 elements, with special discussion of the Yale analytical methods. Conditions of experiment and results obtained are given in tabular form, and in such a way as to make apparent the degree of accuracy reached in each case. The index of authors is limited to workers in the Yale Laboratory, and includes about 80 names. The perusal of these, by the way, leads one to look for "Drexel," which occurs frequently throughout the text in association with "washing bottle." No one of this name, however, appears to have worked at Yale. Doubtless E. Drechsel is referred to.

The book is excellently produced, and will, of course, form a necessary addition to our libraries.

ALAN W. C. MENZIES.

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[1] NOTE.—This paper was prepared in May, 1909, but withheld from publication for various reasons. The original form of separator (1908) had the stopcock attached midway of the side instead of at the top. This irregularity in the cylindrical wall of the separator produced in operation a slight regurgitation and emulsification, which are avoided in the improved form shown here.

Just before transmitting this paper for publication the writer's attention was called to a similar apparatus of prismatic instead of cylindrical form described by Schütte, *Chem. Ztg.*, **35**, 332 (1911); *C. A.*, **5**, 2203.

Tafeln zur Gebrauche bei der Bestimmung von Brechungsindices nach der Methode der konstanten Deviation von 40°. J. F. EIJKMANN. Gebroeder Hoitsema. 1909. Groningen. Price, $1.50.

Refractometers based on the principle of total reflection are so easily used that they have almost completely displaced the older, hollow prism method for the determination of refraction indices. Professor Eijkmann believes, however, that the older method is more accurate and, especially, that it is very much more suitable for the determination of this constant at different temperatures. He has developed a very perfect technique for making small, hollow prisms. In using such prisms in accordance with Professor Eijkmann's method of constant deviation of 40° (*Rec. trav. chim. Pays-Bas*, **13**, 14; *Z. Instrumentenkunde*, March, 1899; and Leiss, *Optische Instruments*, p.370) these tables will save tedious calculations and will be very useful. Tables are also given for the logarithms of the quotients $n + 1/n^2 + 2$ and $n + 1/n + 0.4$, for the volume of one gram of water weighed in air with brass weights from 0 to 29°, for the wave lengths of some of the important spectral lines and for the correction of refractive indices to a vacuum. W. A. N.

Recherches Recentes sur le Facies des Cristaux. M. P. GAUBERT. Paris: A. Hermann et Fils. 1911. 33 pages, 6 figures. Price, 3 frances.

The author describes many of the recent experiments dealing with crystal habit and discusses the older theories in the light of these experiments. For instance, the long existing theory of Vogelsang based on the study of the formation of sulfur crystals in carbon bisulfide which assumed the first germs of the crystal to be little spherical so-called "*globulites*" possessing power to attract, group, and arrange themselves, is stated to be erroneous, the "*globulites*" being merely drops of carbon bisulfide supersaturated with sulfur and prevented from evaporating by the viscous Canada balsam added during the experiment. Moreover, results have shown that from any pure solution the minutest crystals are of the same form as the larger ones.

Two ways are stated by which crystals grow, namely, slowly by diffusion with the growth in all directions, and rapidly by aid of concentration currents, which carry the material. As to the effect of concentration currents, Monsieur Gaubert discusses his experiments with crystals of nitrate of lead. A pure solution gave octahedral crystals, often milky from the presence of the mother liquor. The addition of nitric acid yielded cubo-octahedral crystals, usually clear. If a drop of the saturated solution was slowly heated, although there was evaporation, the increased solubility prevented precipitation until cooling, when octahedral crystals formed upon the faces of which were parallel, sometimes curved lines, nearly equidistant and a dozen or so in 0.1 mm. These were the limit-lines of successive deposits of the nitrate of lead, and showed that the crystal grew by a series of superposed parallel layers, due to *one* current. When one current only acts the crystals are transparent with few inclusions but with several currents the intersections of the deposits show inclusions and a tendency to opacity, and a transparent crystal transferred to a region of several currents becomes opaque. This mode of formation explains the vicinal planes growth markings, etc., and like etched figures, tends to show the true symmetry of the crystal.

Crystal Habit.—Concentration currents modify the development of the faces of the crystal but do not change the nature of the faces. Nevertheless, crystals have very varied habit, though artificial crystals, probably because the conditions under which they are obtained are less variable than in nature, show fewer variations. The principal causes (of which the second and third are the most important) known to modify the habit of crystals are:

(1) Concentration currents.
(2) Rapidity of crystallization.
(3) Presence of foreign matter dissolved in the mother liquor.
(4) Nature of the solvent.
(5) Temperature.
(6) Distribution of the material dissolved around the crystal.

Other actions are: The position of the crystal in the vessel and the viscosity of the liquid, but these are subordinate.

Rapidity of Crystallization.—This refers only to the relative rapidity of growth of crystals of the same substance and depends on the rapidity of cooling, evaporation, or reaction.

The ratio of the growth to the volume varies from one crystal to another in the same solution. On this depends the production of secondary faces. When the crystals are formed rapidly they are limited by faces with simple symbols and often just enough faces to close the crystal. Thus, in nitrate of lead crystals rapidly formed are octahedron; in halite, cubes; in calcite, the unit rhombohedron; in sulfates of barium, strontium and lead produced by rapid evaporation of a solution in sulfuric acid only the faces (102 and 011). The author designates those faces which are constant for the crystals of one substance and independent of the medium under the name of "fundamental faces." They depend only on the cohesion of the crystallin network, are the same for all substances of an isomorphous series and may be different from those of the primitive form. If the crystallization is slow, the edges and angles of this fundamental form are truncated by more or less developed facets, which often prove the symmetry of the substance.

The addition of mother liquor by diminishing the solubility of the substance prevents frequently the production of these facets.

Influence of Foreign Matter Dissolved in Mother Liquor.—The presence of foreign matter always reduces the size of the crystals. (*a*) Solid substances: In order to study the influence of foreign material, M. Gaubert used coloring substances and proved that the absorption takes place according to two rules: First, the coloring matter is deposited on the crystals during the growth *only when the solution is saturated by this material which can deposit crystals.* In other cases, whatever the degree of dilution of the color, the crystals are always more or less colored.

An example of the first method is the coloration of nitrate of lead by methylene blue. If little blue is present there are deposited first regular colorless octahedrons or these colored simply by liquid inclusions, but when the solution is saturated by methylene blue cubic faces appear on the octahedral crystals and they are blue, although the octahedral faces stay uncolored. Little by little the faces of the cube take a larger development, and may entirely replace the octahedral.

An example of the second method is the coloration of nitrate of urea by methylene blue and by picric acid. Crystals from pure water solution are generally flattened parallel the base and though monoclinic they resemble orthorhombic cryst als because of twinning. They arebounded by 001, 110, 010 and sometimes 100. In a solution of methylene blue the crystals are elongated parallel to the vertical axis and show only the faces 110 which with 101 alone absorb the coloring matter. With picric acids the crystals take a still, different habit. The faces 010 and 100 which disappeared with methylene blue are those which develop. If both coloring materials are used at once, *both sets of faces appear* and although appearing to be perfectly homogeneous a basal cleavage shows eight sectors, four blue adjacent to 110 and four yellow adjacent to 010 and 100.

Liquid Substances.—Liquid substances added to solutions also modify the crystal habit. Unfortunately the only liquid with a color proper to itself at ordinary temperature is bromine so that color effects could not be studied, but it was shown that crystals of phthalic acid were modified in exactly the same way by ethyl, methyl and propyl alcohols. The face 010 which is the dominant form of the crystal from pure water or water containing coloring matter is very little developed when alcohol is present and even completely lacking when the quantity of alcohol is very considerable and the crystal habit is that of crystals formed from pure alcoholic solution. The cause appears to be the absorption of molecules of liquid and mother liquor.

Nature of the Faces of a Crystal.—From the genetic standpoint:

1. Fundamental faces. Products of rapid crystallization of rigorously pure substances. In general they have very simple symbols.
2. Facettes which truncate the edges and angles of the fundamental form and result from slow crystallization. They often reveal the true symmetry.

3. Faces due to absorption of foreign material. In general with simple symbol and often revealing true symmetry.

If two crystallizations of the same substance yield crystals different in habit, in one or both there must have been absorption of molecules either of the mother liquor or of an impurity dissolved in this. Sometimes it is the water itself which has been absorbed and according to the temperature at which it is disengaged it is considered to be water of crystallization or water of constitution.

For some years mineralogists have considered a part of the water in certain silicates to be in solution in the crystal. This probably exercises an influence on the habit.

Habit of Natural Crystals.—The rapidity of crystallization and the absorption of foreign matter have certainly played the principal part in producing variety of habit. Analysis should give a clue to the action of foreign material but, as has been shown, very minute amounts may produce great changes and there are other inclusions which do not produce changes and which complicate results. The presence of foreign matter can be shown by the development of birefringence in isometric crystals and the development of unequal birefringence in different sectors of crystals of other systems.

Many crystals vary their form during growth. The brown garnet of Saint Christophe near Breitenbrunn has a dodecahedral kernel, then a shell of trapezehedron, then a final shell of dodecahedron. Each is birefringent in sectors, the bases of which are the faces of the forms mentioned.

Arizona wulfenite often shows a darker kernel of different form from the periphery.

Pure pyrite made artificially is octahedral. The more common natural form, the cube, is probably due to inclusion of marcarsite and is more easily decomposed than the octahedral.

Probably the greatest number of variations in habit are shown by the mineral, calcite, a very interesting publication on which was made by Mr. Whitlock of the N. Y. State Museum. Unfortunately, Monsieur Gaubert does not discuss this paper but does refer to the many changes produced on artificial calcite by the presence of the sulfates of calcium, sodium and potassium in different proportions.

Spherulites, Helicoidal Structures.—Foreign materials may also cause the production of spherulites with helicoidal structures similar to those described in the chalcedony of Paris. Wallerant has shown that certain substances crystallizing from fusion give enrolled spherulites on addition of a substance possessing rotatory power (optically active) and that the enrolment is right or left as the active body is dextrogyre or levogyre.

Tartaric acid is the favorite active agency and examples of substances yielding the helicoidal structures under its influence are: glycolic acid and hydroquinone. Similar action is obtained upon nitrate of sodium by bromate of sodium.

Taken altogether, the little pamphlet of 33 pages contains more upon this subject of crystal habit than the writer has ever seen collected together and is a valuable summary of facts not commonly known even to those well grounded in crystallography. ALFRED J. MOSES.

Conférences sur Les Alliages. Par MM. RENGADE, JOLIBOIS, BRONIEWSKI. Paris: Librarie Scientifique, A. Hermann et Fils. 1912. 36 pp. Price, 2 francs.

This is the third of a series of pamphlets published by the Societé de Chimie-Physique and is composed of three lectures by the respective authors on the thermal and micrographic methods for the study of alloys; the chemical methods; and the relations between structure and electrical properties. The subjects are necessarily treated briefly and incompletely, but they serve to give the reader an idea of an equilibrium diagram of a binary alloy, the microstructure, the chemical methods of identifying compounds, and the electrical properties as related to binary mixtures. The chemical methods of identifying compounds is of interest only from the historical point of view, and can add little of value to the pamphlet.

HENRY FAY.

The Measurement of High Temperatures. By BURGESS and LE CHATELIER. New York: John Wiley & Sons. Price, $4.00.

The new edition of "The Measurement of High Temperatures," by Burgess and Le Chatelier, is practically a new treatise upon this subject. Both of its predecessors, the original French treatise by Le Chatelier and Boudouard, and the first treatise by Le Chatelier and Burgess, were excellent and served very well in their time. The growth of the art of heat measurement has been very rapid in the years since the publication of these two older works and the new book has shown as great advance both in scope and quality over the older books as the art itself has shown during the same period. It is a fortunate combination of precise statement and of carefully collected data, useful to the pure scientist and research man, with such instructions and observations as will be found helpful by the engineer or more practical man who wants to know how temperatures may be measured and to get an idea as to what precision he may hope for. The book has been brought down to date, and considerable care has been exercised in avoiding any appearance of giving authority to results or methods which are not yet established beyond question.

The book should be welcomed by all those who are called upon to use or to teach heat measurements. The chapters upon thermoelectric pyrometry, upon electric resistance pyrometry, and upon standardization of pyrometers are of exceptional value, and attention ought to be called especially to the delightful preface from the pen of Le Chatelier, whose inspiration can be seen in Mr. Burgess' later writing. C. L. NORTON.

The Preparation of Organic Compounds. By E. DE BARRY BARNETT, B.Sc., A.I.C. P. Blakiston's Son & Co., Philadelphia. 1912. pp. xv + 310. Price, $2.75, bound in buckram.

The author states his purpose to be the giving of "a general outline of the methods actually employed in preparing organic compounds, and thus providing not only a laboratory manual, but also a book which may be used as a companion volume to the usual theoretical text-books." In the description of processes, he is intentionally rather brief, his reasons being that he wishes to avoid reducing the work of the student to mere mechanical routine, and that those working in university laboratories, for example, can generally get help from others when in difficulties. Consequently the book is likely to be of much greater service to the somewhat advanced student than to the beginner.

In general plan, it resembles many other well-known books dealing with the same subject—Sudborough & James, for example. After introductory chapters on apparatus, manipulation, and reagents, a well-chosen and extensive list of preparations is given, arranged in chapters according to the class of compounds dealt with (hydrocarbons, alcohols, etc.), and within these chapters the individual preparations are grouped under the particular processes exemplified, thus driving home the synthetic methods given in the usual lecture course and showing the breadth of applicability of the reaction. In his choice of material, the author has kept in mind not only the undergraduate, but also the research man and the works chemist. Excellent features are the frequent references to the literature, including the patent literature.

For those wishing to keep abreast of the patent literature, he recommends the abstracts in the *Chem. Zentralblatt* and in the *Journal of the Chemical Society of London*, but omits the *Chemical Abstracts* of the American Chemical Society, which gives far more patent abstracts than either of those mentioned, as well as a much more extensive survey of the whole field of chemistry.

The book is published in attractive form, and the press work is good. It should prove a useful addition to the literature in this field.

MARSTON TAYLOR BOGERT.

Enzymes. By OTTO COHNHEIM. John Wiley & Sons. New York. 1912. 173 pp. Price, $1.50.

This book comprises six lectures delivered under the Herter Lectureship Foundation at the University and Bellevue Hospital Medical College in the City of New York in 1910. The various topics are taken up briefly in the following order:

I, Methods of Obtaining Enzymes; II, The Purification of Enzymes; III, The General Properties of Enzymes; IV, Enzymes as Catalyzers; V, The Reversible Action of Enzymes; VI, Enzymes and Optical Activities; VII, Mode of Action of Enzymes; VIII, Antiferments; IX, Specificity of Enzymes; X, Lymogens and Activators; XI, The Individual Enzymes; XII, The Lipases or Steapsins of the Alimentary Canal; XIII, Proteolytic Enzymes; XIV, Miscellaneous and Vegetable Enzymes; XV, The Hydrolytic Enzymes of Tissues or Autolytic Enzymes; XVI, Proteolytic Enzymes of Blood; XVII, Proteolytic Enzymes of Tissues; XVIII, Other Hydrolytic Enzymes of the Blood and Tissues; XIX, The Oxidases; XXI, The Metabolism Enzymes; and XXII, The Fibrin-Ferments.

No attempt is made at completeness; the author takes up the problems of most interest to biological chemists, describes the recent work done on them in a critical fashion and offers his own point of view.

According to the author, enzymes must be carefully separated into two classes: the catalytic ones exhibiting synthetic power, such as the lipases; and another class in which synthesis has not been observed. To the reviewer such a distinction is not justifiable. The mechanism of most reactions accelerated by enzymes is too little understood to exclude the possibility of its catalytic nature.

The enzymes combine with their substrate as well as with the dissociation products. The first explains their specificity, the second the retarding action of the products formed. The small difference in behavior of enzymes of the same type in different animals might well be attributed to differences in environment or in the method of obtaining them, rather than to the specificity of the enzymes. Many cases of antiferment action might also be explained on that basis; the author does not believe that the evidence at hand permits us to speak of specific antiferments.

In the chapter on oxidases, there are one or two statements which hardly seem accurate. On page 125: "Because enzymes are destroyed by heating, there seems to be a resemblance between inorganic catalysts and enzymes. But no further proof has been brought forward that the two processes are of a similar character." To the reviewer it seems that the great sensitiveness towards poisons, such as potassium-cyanide and the great activity of minute quantities are at least as good analogies.

The book is carefully edited and rather free from errors of printing. On page 23 by "The Law of Schulz," presumably Schütz's law is meant. On page 127, "furfurogallin" should be "purpurogallin," and on the same page the equation $C_{14}H_{18}O_2 = C_{14}H_{18}O_3$ is not balanced.

The reading of these lectures will undoubtedly be of great value to students of medicine and biochemists who wish to broaden their knowledge on the chemistry of enzymes. H. H. BUNZEL.

Die Physikalische Chemie der Proteine. By T. BRAILSFORD ROBERTSON. Translated into German by F. A. Wyncken. Dresden: 1912. Theodor Steinkopff. xviii + 447 pp. Price, 14 Marks, bound 15.50 Marks.

It is a remarkable fact that knowledge of the physical structure of protoplasm, its nature and laws, is far less extensive than knowledge of the chemical structure thereof. The last decade, however, has witnessed an apparently sudden renascence of interest in this subject, accompanied by an ever-growing conviction that, however slight the present results of the applications of physical chemistry to the phenomena of life, in the end the satisfactory description of living matter must be largely in terms of that science.

Nowhere in biology has the disparity between chemical knowledge and physicochemical ignorance been more striking than in the case of the proteins. And yet there is perhaps no other instance where physicochemical knowledge is relatively so important, for, while assuming a minor part in metabolism (chemical change), the proteins make up, with water, far the greatest part of the active cell. Hence it is the system protein + water, and including the salts, which is at the very foundation of life, and the adequate description of this system is in one sense the ultimate problem of morphology. The appearance of Professor Robertson's book, therefore, marks an epoch in the extension of physical science into biology.

The work is divided into four sections dealing respectively with "Chemical Statics in Protein Systems," "The Electrochemistry of Proteins," "The Physical Characteristics of Protein Systems," and "Chemical Dynamics in Protein Systems." There is an appendix dealing with methods of investigation.

A brief discussion of the chemical constitution of the protein molecule begins the book. This leads speedily to the author's application of certain of A. Werner's views upon valence to the constitution of the polypeptides of E. Fischer and then to further interesting hypothetical discussions regarding the chemical nature and mechanism of the union of acids and alkalis with proteins. The theory thus developed constitutes the central idea of much that follows throughout the work.

Chapter II presents a discussion of the preparation of pure proteins and in turn is succeeded by a very thorough systematic survey of the compounds of proteins with other substances.

The second section of the book is concerned with such problems as ionization of protein salts, the neutralizing power of the proteins, and the many complex problems, such as the isoelectric point, the solubility of proteins, coagulation, etc., which arise when the hypothesis of electrolytic dissociation, in its full modern extent, and with all its manifold bearings, is brought into relation with the author's views regarding the chemical structure of the products of ionization of protein salts.

The subject matter of Section III is more strictly physical and deals with the dissolution of proteins, colloidal swelling, the formation of gels, coagulation by heat, crystallization of proteins, and finally a welcome systematic survey of numerous physical properties of protein solutions, such as has long been needed in biochemical literature. Especially extensive is the treatment of viscosity and of the freezing point, boiling point, osmotic pressure, and physical nature of protein solutions. Various optical properties also find a place here.

Section IV consists of physico-chemical discussions of the hydrolytic cleavage of polypeptides and proteins, and of the problem of the synthesis of protein through the intervention of enzymes.

The work appears to be admirably planned, in that the arrangement is systematic and logical, and the treatment exhaustive. The survey of the literature, of a very disperse character, appears to be uncommonly complete, and there are probably few who will not be surprised at the amount of really reliable and significant information which now exists in this department of knowledge. The systematic nature of the work, moreover, greatly aids in the simplification of a very intricate subject. On the other hand, it cannot be denied that the simplification is in part artificial and forced and the connection between simplifying hypotheses and facts is less clear than as the author presents it. The facts now in existence concerning protein salts, for instance, are hardly so intelligible, nor are they probably so simple as they appear when transformed by Professor Robertson's theories, and it is scarcely conceivable that this subject is not destined to undergo extensive modifications. Hence the work must be used with some care, for the very excellencies of the treatment in other respects lead here and there to a confusion of fact with theory.

But such, in greater or less degree, are the inevitable defects of all efforts to apply the abstract sciences to that which, without change, cannot be abstracted from its environment. None the less is it clear that the work must now go on, and the author of the present book has done us all a very real service, for which he possesses and has employed high qualifications.

It is distressing to realize that such works can find a publisher only in Germany, and after translation into German. The work of translation is not entirely satisfactory, that of printer and publisher is very well done.

L. J. HENDERSON.