of the structure of atomic chlorine (pages 123 and 124) is given while modern physical chemists consider this a structure to be made up of three shells with two, eight and seven electrons, respectively. In his references the abbreviations approved by the American Chemical Society are not always used.

In the preface the author states:

"It is the purpose of this treatise to bring to the attention of the student of pharmaceutical chemistry certain special topics in gravimetric and electrometric analysis, organic and physical chemistry, a knowledge of which will enable him more intelligently to attempt to solve the problems of his comprehensive profession. In no manner has the author aimed to serve the end of completeness, for in a field so vast as this one, many volumes would be required to cover it completely, and the experiences of many authors would be necessary."

Perhaps he accomplishes what he set out to do, but the student of pharmaceutical chemistry leaves the book with a feeling that a complete treatment by the author of any one or more of the major subjects touched upon would have been refreshing. The book is a good reference work for those busy workers that need only the fundamentals of the subject, and will undoubtedly find wide use in this connection.

The pharmaceutical chemist is compelled to cover so great a variety of subjects that the reviewer fears that in some colleges of pharmacy considerable "old style" chemistry is still presented. It is difficult indeed for the pharmaceutical chemist to keep abreast of the advancement of so many phases of the science of chemistry and this perhaps explains the above unsatisfactory situation. It is indeed refreshing to find in the author at least one young pharmaceutical chemist who has had sufficient training in modern chemistry to treat understandingly of its application to the problems of pharmacy.—C. B. JORDAN.

*Mikrochemie der Arzneimittel und Gifte*, Microchemistry of Drugs and Poisons, by ADOLF MAYRHOFER, Ph.D. and Dr. Pharm., Part Two, Drugs of Organic Nature, published by Urban & Schwarzenberg, Berlin. Price 16 marks.

The volume before us is a highly technical and up-to-date treatise on microchemical examination of drugs and poisons of organic nature. It comprises 270 pages of text with 24 illustrations and 15 valuable plates. The work is a good example of German thoroughness in scientific exposition and will be found very valuable by pharmaceutical chemists, pharmacologists and those specializing in pharmacognosy.

The treatise is logically divided into two sections, a general one and a special one. In the general section, the author describes microchemical methods for determination of carbon, nitrogen, sulphur and phosphorus; technical methods for microsublimation and microdistillation; and other routine laboratory methods for microchemical work, such as the determination of the boiling point, etc. A very long chapter is then devoted to mineral optics. Here we find a complete discussion of the applications of the polarimeter and the polarizing microscope in pharmacognostic work. Refractometry receives a great deal of attention and a number of valuable tables are included, giving the refraction indices of various drugs and poisons, both in a solid form and in solution.

Following the general section, which comprises 65 pages comes the special discussion of individual drugs and groups of drugs. The author begins with a discussion on the hydrocarbons of the aliphatic and aromatic series and their halogen derivatives. Then follows discussion and description of the microchemical examination of alcohols, aldehydes, ketones, ethers, etc. Separate chapters are devoted to carbohydrates, glucosides, phenols, organic acids and their esters. A very extensive discussion of the amines comes next. An extremely valuable portion of the book is devoted to the alkaloids. Alkaloids are discussed according to their sources, the botanical classification being followed for the most part. There are a large number of very useful and lucid summaries and tables giving concise information in regard to color reactions, and the beautiful plates at the end are intended to give microscopical photographs of the crystalline structure of a great many drugs and poisons of great value to the microchemist.—D. I. MACHT.

*Chemical Reactions and Their Equations; a Guide for Students of Chemistry.* Second Edition pages IX–145, I. W. D. HACKH, Prof. of Chemistry, College of Physicians and Surgeons, San Francisco. P. Blakiston & Co., Philadelphia, 1928.

The transplanting of a knowledge of descriptive chemistry into the mind of the student is

ordinarily not a very difficult task—but, the teaching of stoichiometry—is another story. Prof. Hackh has in this little book restricted the data primarily to a consideration of purely chemical equations from a technical and arithmetical standpoint. We must not lose sight of the fact that so much depends upon the methods employed in the attempt to impart such knowledge to the student.

Chemistry has within recent years fully justified a prediction voiced by Prof. H. O. Jones[1] who ventured the opinion that "...the old purely descriptive chemists will drop more and more into the background, as the result of reconstruction of the basic science along physical and mathematical lines." On the other hand, the student of medicine and kindred sciences, has no practical use or need for the higher training in physical chemistry; the chemist in actual practice, in turn, relegates this phase of the science to the province of the academic specialist.

This little work by Hackh is therefore a welcome relief in the way of an elementary text whose sole claim to usefulness lies in its evident simplicity in presentation. The student is enabled to proceed through personal initiative. This is possible since the author has not, as is frequently the case with others, soared into the European realm of irrelevant material—thus making a more impressive-looking book—but of no more practical value to the student. The reason for the exclusion of impractical data is succinctly stated in a foot-note on page 2, to the effect that" chemists will continue to deal with atoms, and future progress in the sub-atomic realm will merely increase our knowledge of atomic structure, the relation among elements and their probably evolution—*but will not materially change the application of the Atomic Theory.*

The text occupies several chapters, each of which is concluded by numerous Exercises and Questions; certain portions of the appendix of the first edition have in this revision been incorporated with the text proper, as a matter of emphasis. The Appendix of the second edition consists of a key to Equations, Solubility Table, Preparation of Salts, Index and Glossary combined.

A Table of Atomic Weights and Atomic Numbers (1928) is included in which the most recently discovered elements, Illinium, Brevium, Polonium and Rhenium, are listed but no atomic weights are stated.

[1] New Era in Chemistry (1913), 298, N. Y.

The excellent features of this book having been discussed in the course of this review, render further summary unnecessary, particularly in view of the fact that the best criterion of value for any text usually lies in the demand for subsequent editions.—SIMON MENDELSOHN.

*Filterable Viruses*, The Williams and Wilkins Company, Baltimore, Md., 1928, cloth, 428 pages, with 27 illustrations, several microphotographs and 15 excellent plates. Edited by THOMAS M. RIVERS. The volume is neatly bound and well printed on unglazed paper. Price $7.50.

The book is the work of ten men who write with authority based on experimental research. Rivers, Carrel, Cowdry, Olitsky, Glaser and Bronfenbrenner are in the Rockefeller Institute for Medical Research; Mudd is assistant professor of experimental pathology in the University of Pennsylvania; Amoss is associate professor of medicine in Johns Hopkins Medical School; Goodpasture is professor of pathology in the Vanderbilt School of Medicine and Kunkel is in the Boyce Thompson Institute for Plant Research.

The filterable viruses affect man vitally in a multitude of ways, and this book treats of subjects of intense concern to every one. The reader will be convinced that the economic value of the results already gained outweigh all the money that has been spent in all fields of medical research, and it is obvious that greater advances will be made. The virus diseases include measles, mumps (?), scarlet fever, poliomyelitis, typhus, trench and yellow (?) fevers, rabies, smallpox, the common "cold" and grippe or influenza; also many which are of economic interest, such as hog cholera, swine pest and fowl-pox. The city dweller feels only a casual interest in animal diseases, but more than 100,000 animals were destroyed in order to control a recent outbreak of foot-and-mouth disease in California. It is desirable that the essential facts of virus diseases shall be appreciated as widely as possible.

In spite of the importance of the subject, space does not permit of adequate discussion here, because the book itself is little more than a presentation of the technic of research and the chief problems in this broad field, with summaries of the present status of the subject, and the space devoted to any chapter is not a measure of its value. The diseases caused

by the filterable viruses affect man in so many ways that it is difficult to decide what one may disregard in a review.

Rivers explains that the name "Filterable Viruses" was selected for want of a better. The classification is temporary and includes many infectious diseases of unknown etiology. In some cases filtration is difficult or impossible. Filtration methods are crude and one can only say that under certain conditions, a virus passes through a filter or does not, dependent on varying conditions, such as the electric charge. Efforts to measure the size of the viruses have proved disappointing, but probably a cubic inch would contain one million million million of the smaller ones. It is often difficult to deal with such minute substances and it is impossible, apparently, to cultivate many viruses in the absence of living cells. An atack of one of these diseases usually confers lasting immunity, whereas only exceptionally does a bacterial disease afford such immunity. Most of them show an extraordinary degree of specificity. Thus, poliomyelitis virus has been found active only in the monkey and in man, and rabies manifests its effects only after it has come into relation with cells of nervous tissue. Rivers stresses the importance of microscopic changes within the cell and warns against the danger of reports of inclusions not characteristic or of a specific nature. The reader becomes impressed with this view increasingly as he peruses the subsequent chapters. It is impossible to state whether certain viruses are living organisms or not, but it seems probable that the smallest contains not more than a few hundred molecules of protein. Rivers devotes 21 pages to the discussion and 29 pages to a well-classified bibliography.

Mudd discusses filters of various types and the technic of filtration. He says the apparent simplicity of filtration has been a pitfall and since an understanding of the process has not kept pace with the development of filters, confusion has resulted, and no one is competent to work in this field who is not well informed in this seemingly simple, but actually most complex subject. This chapter will interest those who use filters in other fields of investigation and assist them in selecting filters. Mudd describes filters of porcelain, kieselguhr with asbestos, plaster of paris and jelly, and discusses problems which their use involves. He points out that the diameter of the pores through which virus fails to pass is not necessarily an index of the size of the virus. He discusses that always interesting, and often troublesome, phenomenon, adsorption. The bibliography embraces 189 references.

Carrel discusses tissue cultures in the study of viruses. This chapter is largely concerned with the technic of the growth of tissues and their use in the preparation of cultures. Carrel says the contribution to the knowledge of viruses through tissue cultivation has been meager, but he says the technics described give us the best means of approaching the capital problem of the artificial production of a virus by the action of chemicals on cells, and he believes that the method of tissue culture may lead to the solution of some of the most important biological problems of the day, for example, that of malignant growths. A very small amount of pure tissue permits of the development of relatively large amounts of virus, and he says it is probable that a chick embryo crushed to a fine pulp is capable of producing as much vaccine as a living calf. The technic is simple and is susceptible of adaptation to the industrial production of pure vaccine virus.

Cowdry's chapter deals with intracellular pathology in virus diseases. He discusses cytoplasmic or nuclear inclusions in vaccinia, rabies, herpes and varicella, smallpox and other diseases, and inclusions of doubtful nature in warts, psoriasis, swine-fever, epidemic encephalitis and many other diseases, in each of which he treats of a restricted field. He says that owing to failure to employ available methods of investigation and to devise better ones, our knowledge of the composition of the inclusion bodies remains negligible. Cowdry says the term "inclusion body" is applied equally to materials developed within the cell and to others taken in from without. The term does not distinguish between the bodies and droplets of fat, ingested pigment and many other substances.

One is surprised to read that we know little of the changes in cellular activity induced by the viruses. However, the subject presents difficulties. We do not know whether virus acts on the surface of the cell or penetrates into the interior, or how cell and virus react upon each other. Cowdry states that cells may become one million times larger in lymphocystic disease in fish. It is startling to consider the result should a corresponding change occur in a considerable proportion of the cells of a tissue in man. With such fantastic changes in mind, one must restrain one's imagination with

reference to the possible rôle that viruses or kindred substances play in evolution, but this thought of the reviewer is not discussed in the book. Cowdry gives several excellent drawings and microphotographs, and a beautiful plate. The bibliography includes 75 references.

Amoss discusses virus diseases of man as exemplified by poliomyelitis and gives a bibliography of 255 references. The article includes a historical review, symptomotology, physical examination, prognosis, pathology, etiology, immunity, epidemiology and treatment. It is extremely interesting but it cannot be reviewed adequately here.

Olitsky discusses virus diseases in mammals as exemplified by foot-and-mouth disease, and vesicular stomatitis, with a bibliography of 107 references, which is well classified. The virus of foot-and-mouth disease has been studied more thoroughly than any other. The virus of vesicular stomatitis of horses is considered briefly because its taxonomy is based on the recent work of Olitsky and the American Commission. Olitsky discusses the discovery of the ultramicroscopic character of foot-and-mouth disease virus, its cultivation, its properties, the susceptibility of man and other animals to it, carriers, pathology and immunity.

Rivers believes the confirmation of Olitsky's cultivation of the virus of tobacco mosaic in a simple medium, presumably free of cells, would settle one of the most important problems in the whole field. The discovery that there are two types of the virus of foot-and-mouth disease is especially important. They do not induce cross immunization, nor can they be distinguished clinically. Olitsky's presentation of the controversial literature serves largely to show the complexity of the problems involved rather than to settle the points in dispute, but he also indicates the solid advance that has been made.

Goodpasture treats of virus diseases of fowls, as exemplified by contagious epithelioma (fowl-pox) of chickens and pigeons. It resists diffuse sunlight and cold for many weeks; hence, it probably survives in barnyards over the winter. It was long supposed to be identical with smallpox and vaccinia. For a time the view was dropped, but of late it has been revived. Goodpasture believes that they are not indentical, and says viruses of fowl-pox and of the human disease, molluscum contagiosum, offer a more inviting field for study. He says that while many of the infections now classified among the diseases due to filterable viruses are actually due to bacteria, to protozoan parasites, and possibly to non-living agents, he believes the viruses of contagious epithelioma, molluscum, vaccinia, variola (smallpox), rabies and some others which exhibit the property of filterability, together constitute a much smaller, more closely related and compact group. The article is illustrated with thirteen figures in three plates.

Glaser discusses virus diseases of insects, devoting about half of the space (with three plates) to sacbrood of honey bees, with an excellent summary of practical interest to bee keepers. The bibliography includes five papers by G. F. White. The second part of this chapter deals with polyhedral diseases of other insects, some of which, such as the army worm and the gypsy moth, are enemies of man, and Glaser says, in the summary, that the maladies discussed affect some of our worst agricultural and forest pests, often producing huge epidemics among them and contributing inestimably towards their control. Unfortunately, the silkworm is also affected. The curious polyhedral bodies are of diagnostic, but not of etiologic, value. This part of the chapter concludes with a summary and bibliography of 36 references.

Kunkel treats of virus diseases of plants. He mentions some 200 species in an incomplete list of plants susceptible to mosaic diseases. He gives a brief summary and a bibliography of 102 references. He says that the virus diseases seldom kill plants, though they may lower their resistance to other diseases that do kill them. He emphasizes the fact that they are insect-borne.

Bronfenbrenner discusses virus diseases of bacteria—bacteriophagy. Bacteriophagy or transmissible lysis of bacteria, often called the Twort-d'Herelle phenomenon, is discussed, because d'Herelle believes that there is a disease of bacteria produced by an autonomous, ultramicroscopic, corpuscular virus. Bronfenbrenner states that many of his own views are not in agreement with those of d'Herelle. The author gives a historical review of the subject and theories relating to bacteriophage. The subject presents many questions that are still in dispute and no detailed review is attempted here, though it is conceivable that this division may eventually outweigh all the others in importance. This, however, does not seem probable. The bibliography includes references to 225 papers.—ROBT. A. HATCHER.