shift from the method to the applications. The principal application is to the elucidation of structure on the colloidal level.

Although small angle X-ray scattering is now a fairly well established research tool, a first book should nonetheless attempt a wide coverage. The authors have succeeded in this, not only in the subject matter but also in the level of the treatment. The first two chapters (more than a third of the book) present a careful and expert discussion of the theoretical background. Especially valuable is the material on the scattering from dense systems, that is, systems in which interparticle interferences are important. Even at low concentrations of macromolecules in solution interparticle interference effects may distort the single particle scattering function and complicate the measurement of the radius of gyration. At high concentrations structure is introduced into the scattering curve which characterizes the relative spatial distribution of the molecules but which has been interpreted in too simplified a manner by many workers. Much of the material on dense systems will be interesting to physical chemists using light scattering techniques. They are accustomed to a thermodynamic rather than a geometric interpretation of concentration effects, but the problem is essentially the same. In fact a very promising but still undeveloped application of small angle X-ray scattering is the use of interparticle interference effects to determine molecular interactions.

The third chapter treats of experimental equipment. There is a good general discussion of the conflicting requirements of high intensity and high collimation of the X-ray beam and details of nearly all the collimators, scattering chambers and detecting devices which have been used successfully. This chapter includes also some very useful material on the correction of scattering curves for the finite size, particularly the height, of the apertures defining the beam.

The remaining chapters on the interpretation of experimental results and on applications again constitute somewhat more than a third of the book. The exposition is less mathematical than in the first two chapters but covers much of the same ground emphasizing, of course, the material most useful to the experimentalist. Here again the authors perform a notable service in warning against the dangers of over-interpretation of X-ray data.

It may be of interest to mention in greater detail the last chapter on applications. Up to this point the monograph is written for those who have a serious interest in learning of, and presumably using, small angle X-ray techniques. The last chapter is for the more casual reader. It will furnish a quick survey of the fields in which small angle X-ray scattering has been found useful, and spare him a great deal of wandering through a well scattered literature. These applications include the determination of size, shape and interaction of macromolecules in dilute solution, the measurement of long periods and partially ordered arrangements of micelles in natural and synthetic fibers, the measurement of size and surface area of commercial catalysts (this is now a routine procedure in some laboratories) and a large number of uses in physical metallurgy. In the latter field the method is particularly well suited to the investigation of the very early stages of the precipitation of a new phase, before changes are obvious under the microscope.

The authors have brought up to date and reprinted the 1952 bibliography on small angle X-ray scattering of the American Crystallographic Association. It contains almost six hundred titles, frequently followed by a descriptive sentence or two. The typography and the translation are excellent.

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Lithium Aluminum Hydride in Organic Chemistry. Monographs. Volume CCXXXVII. Section for Natural Sciences and Mathematics. No. 9. Edited by KOSTA V. PETKOVIC, Member of Academy, Secretary of the Section for Natural Sciences and Mathematics. By VUKIC M. MICOVIC, Ph.D., Professor of Chemistry in the University of Belgrade (Faculty of Sciences) and MIHAILO LJ. MIHAILOVIC, Ph.D., Lecturer in Chemistry in the University of Belgrade (Faculty of Sciences). Servian Academy of Sciences, Knez Mihailova 35, Boegrad, Yugoslavia. 1955. xi + 193 pp. 17.5 × 24 cm. Price $3.00.

Here, at a price within reach, is a review (in English) of the synthetic applications of lithium aluminum hydride. It is a concise, factual representation of the literature (1732 literature references) up to mid-1954. The flood of literature on this subject has probably reached its crest (*cf.* Fig. 1,

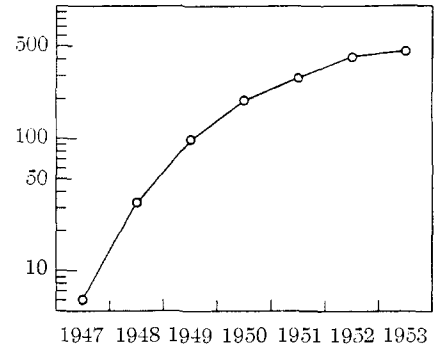

Fig. 1.—References cited 1947–1953.

showing distribution of references by year) and it is fair to say that the main outlines in the synthetic applications have been adequately delineated. The deviations from the normal pattern of reaction are already sufficiently numerous that one has no doubt the mechanistic problems will occupy the attention of physico-organic chemists for some time to come.

In a brief foreward Professor Schlesinger gives the work his blessing.

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Molecular Beams. By K. F. SMITH. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1955. x + 133 pp. 11 × 17 cm. Price, $2.00.

This little book by Dr. Smith gives an admirable account of many of the advances in the molecular beam art which have taken place since the publication by Methuen and Co. of a similar book authored by Ronald Fraser in 1937. One certainly welcomes this present edition; on the other hand, the 18-year intervening period has been long and the expansion from 66 to 127 pages of text does not appear to the reviewer to have been adequate. Thus there results a book covering the newer resonance techniques in insufficient detail to satisfy the needs of a man who wishes to enter the field; yet it is not sufficiently comprehensive in covering, in a reference fashion, the work of the intervening years so that the book can serve unfailingly as a guide to detailed accounts in the scientific literature. One hoped for a comprehensive and reasonably exhaustive treatise on the subject of molecular beams. Such a treatise should include in considerable detail the various aspects which deal with the processes of production of beams. Fraser's 1937 Cambridge University Press book entitled "Molecular Rays" has much more in it on these phases than the present book or its predecessor. Yet many of the things regarding mean free path-slit width criteria, more or less taken as gospel until recently, are now being re-examined and some discussion is in order, if for no other reason than to show how little we actually do know regarding the elementary process of effusion.

In spite of these limitations the present book definitely fills a well-felt need and the author is to be commended on his ability to cram so much into such a few pages and yet do it in a clear and understandable fashion. The first chapter covers the production and measurements of molecular beams, particularly the latter where the newer methods of beam detection are discussed. The second chapter includes a discussion of the velocity distribution in a beam and the deviations from the $v^3e^{-v^2/\alpha^2}$ law which can and do occur. A very interesting review of the use of atomic beams in optical spectroscopy is also included. Chapter III covers experiments on the wave nature of particles, crystal cleavage plane diffraction effects and beam scattering phenomena.

Only two references later than 1936, both dealing with the latter, are included. Thus the war and postwar years have not shown much activity in these interesting aspects. Chapter IV deals with the more or less classical problems of space quantization and magnetic deflection of beams. The more recent work of Friedburg and of Lemonick and Pipkin on focussing of neutral beams is discussed, otherwise experiments on direct magnetic deflection appear to have been confined for the most part to the years prior to 1940. Chapter V, on Atomic and Molecular Beam R.F. Spectroscopy, covers in 36 pages essentially material heretofore not covered in such a book and is undoubtedly the most important chapter. After the historical account and a discussion of the theoretical basis of the method, the author discusses the various kinds of experiments which have been done to obtain magnetic R.F. spectra of molecules and of atoms. Included are details of methods of obtaining nuclear g-values from unresolved molecular spectra, methods of obtaining quadrupole interaction constants, a discussion of the R.F. spectra of the hydrogen molecules, the Millman effect and the use of two R.F. fields in molecular experiments. The chapter also includes a description of the experimental arrangements and procedures for obtaining R.F. spectra of atoms of $J = 1/2$ and $J > 1/2$, also a discussion of the hyperfine structure anomaly, the electron magnetic moment and the Lamb shift. All in all the chapter is very meaty. The sixth and final chapter deals with the experiments on the electric deflection of molecular beams and includes a discussion of the electric R.F. spectra experiments concluding with a convenient and useful table of molecular constants of diatomic molecules measured by the electric resonance method.

I heartily recommend the book to anyone engaged in or interested in experiments on molecular beams.

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Advances in Virus Research. Volume III. Edited by KENNETH M. SMITH, Virus Research Unit, Molteno Institute, Cambridge, England, and MAX A. LAUFFER, Department of Biophysics, University of Pittsburgh, Pittsburgh, Pennsylvania. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1955. ix + 339 pp. 16 × 23 cm. Price, $8.00.

Repeatedly emphasized by some individuals interested in chemotherapy has been the desirability, indeed the necessity, for collaboration of chemist and biologist in order to achieve effective advancement in this field. This need is reemphasized from the information in the chapter, "The Chemotherapy of Viruses," by R. E. F. Matthews and J. D. Smith, which is nearly one-third of Volume III of "Advances in Virus Research." Other chapters of particular interest to the chemist are "Comparative Biochemistry and Virology" by Seymour S. Cohen and "Current Status of Bacterial Transformations" by Harriet Ephrussi-Taylor. While these three chapters merit special attention of chemists and chemotherapists interested in the biological implications of nucleoprotein metabolism, all of the chapters comprising this volume are written so as to be intelligible and rewarding to the inquisitive chemist even though he possess no special knowledge of viruses. Such a reader of the entire volume will learn of the problems and the techniques in the conduct of research on bacterial, plant and animal viruses and of the importance of nucleic acids in such studies, particularly in considerations involving attempts at chemotherapy.

All of the chapters are excellently presented on the basis of content and manner of expression. To single any one out for special praise would be but to disclose one's particular interest. The chapter by Cohen presents the diversity of data on chemical virology which serve to illustrate that viruses do not constitute a homogeneous group. The chapter on Chemotherapy presents methods of testing for virus inhibition, the relationship of structure and multiplication of viruses to chemotherapy, the effects of purines, pyrimidines and other types of compounds on viruses and incorporation phenomena in relation to anti-metabolite action. As would be expected, some but not a serious overlap of material is to be found in these two chapters. A more extensive but probably unavoidable overlap is to be found in the chapters, "Multiplication of Plant Viruses in Insect Vectors" by Karl Maramorosch and "Cross Protection Between Strains of Yellows-type Viruses" by L. O. Kunkel. The former discusses the question of insect vectors as alternate hosts of a number of plant viruses while the other chapter presents the studies on one type of plant viruses, in which cross protection is revealed by the influence of prior infection on reproduction of the viruses in plants and in the arthropod carriers. The chapter by Kenneth M. Smith can best be summarized here by its title, "Morphology and Development of Insect Viruses." The chapter by Ephrussi-Taylor presents a general summary of the knowledge of bacterial transformation and of transformation factors.

With Volume III of "Advances in Virus Research" the editors appear to have continued well the progress toward their objective (as stated in the prefaces of Vols. I and II) of giving virus researchers a comprehensive up-to-date view of virology as a whole. The book is well constructed and has helpful author and subject indexes. A number of typographical errors, which were detected, should not be causes of confusion.

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Biochemistry and the Central Nervous System. BY HENRY MCILWAIN, Ph.D., D.Sc., Professor of Biochemistry in the University of London at the Institute of Psychiatry (British Postgraduate Medical Federation); Honorary Biochemist, the Bethlehem Royal Hospital and the Maudsley Hospital. Little, Brown, and Company, Boston, Massachusetts. 1955. vii + 272 pp. 16 × 24 cm. Price, $9.50.

The growing burden of the care of mentally ill patients, which in New York State alone requires about one-fifth of the total state budget, is bringing about a greater recognition of the need for expanding research on the nervous system. The increasing support for such research both financial and otherwise is creating more favorable opportunities for biochemists who are interested in working in this area. Younger biochemists in particular, who may ask "Are there problems of biochemistry which are specific for the nervous system?" and "What is known so far?" will find this book very valuable.

In "Biochemistry and the Central Nervous System," Professor McIlwain presents in a most concise and factual manner a highly intelligent and readable summary of a good deal of modern biochemical thinking regarding the activities of the central nervous system. Under individual chapter headings are described the results of metabolic studies carried out with cerebral tissues *in situ* and *in vitro*, in development and in adult. Because of the obvious importance of glucose for the functioning of the central nervous system, much of metabolic work with brain has been concentrated on glycolysis and accordingly considerable space is given to this topic. Many of the author's own contributions are forcefully presented in the sections dealing with glycolysis and energy relationships. Other topics discussed in somewhat less detail include amino acids, vitamins and lipids. Separate chapters are also devoted to cytochemical and histochemical aspects, neurohormonal substances and drugs. Naturally no volume of this type can satisfy everyone. More experienced biochemists and pharmacologists will be aware of some uncritical presentation of unproven postulates or unconfirmed data, for example, the scheme of triosephosphate oxidation on page 72 or the reports of beneficial results in phenylpyruvica oligophrenia obtained by decreasing phenylalanine intake described on page 118. The necessity for condensing a complicated series of reactions into a terse summary has also resulted in occasional confusion. Thus, on page 194, the enzyme systems which oxidize glucose 6-phosphate are incorrectly referred to as glucose dehydrogenase; and the brief description of the pathway of pyruvate formation from malate on page 90 is not too clear without consulting the original papers. The lack of space available for development is evident and it is to be hoped that the ready acceptance of this volume will encourage the publishers to commission Professor McIlwain to considerably expand subsequent editions. Such expansion will also be of benefit to those phychiatrists and neurologists who, lacking biochemical training, may have some difficulty with this volume. On the whole though, Professor McIlwain and the publishers are to be commended for