Book Reviews

X-Ray Diffraction Procedures. For polycrystalline and amorphous materials. Harold P. Klug and Leroy E. Alexander. Wiley, New York; Chapman & Hall, London, 1954. xiii + 716 pp. Illus. $15.

In their preface, the authors point out the need for a comprehensive treatise on the practice and interpretation of x-ray diffraction techniques, designed to "serve as both manual and teacher for the plant worker, the graduate student, the research scientist, and others who wish to do experimental work in the field." In general, they have done a meritorious job in filling this need, and have succeeded in turning out a comprehensive handbook on powder diffraction procedures.

The first 160 pages are devoted to a discussion, in simple terms, of the basic concepts of crystallography, x-rays, and diffraction. The remaining 520 pages are devoted to the practical aspects of obtaining and interpreting powder diffraction information. Single crystal techniques are not discussed. There are sections on small-angle scattering and scattering from noncrystalline material; useful tables are listed in the appendixes, together with instructions for laying out an x-ray laboratory and for handling film. The authors discuss in detail the various types of powder cameras (70 pp.) and the Geiger-counter spectrometer (80 pp.). It is my opinion that too much emphasis has been placed on spectrometer techniques. Thus, although Klug and Alexander say that "focusing cameras are not an indispensable adjunct to a diversified diffraction laboratory"—certainly a fair statement—no such remark is made concerning the Geiger-counter spectrometer which, in view of its cost and lack of versatility, is even less indispensable.

The sections concerning the techniques of preparing and analyzing specimens are complete to the most trivial detail, and include designs for light boxes, measuring scales, and camera supports. On page 302, where a method of preparing a powder sample for spectrometer analysis is described (with complete illustrations), we are told that Scotch tape may be removed more easily if a tip of the tape has been doubled back, and are also told to trim off excess tape with scissors. This sort of trivia abounds throughout the book, and may indeed be welcomed by many novice laboratory technicians. However, a majority of readers who must pay $15 for the book will probably feel that a substantial saving could have been realized by judicious condensing and editing.

In view of the thoroughness with which the authors discuss the various experimental techniques, it is unfortunate that the material concerning the interpretation of the data—and, in particular, the precision determination of lattice constants—has been presented in a rather offhand fashion. Indeed, much of the material in this particular section is misleading. The least-squares method of refining lattice parameters is discussed with the apology that "it assigns equal weight to all reflections regardless of whether they can be measured with good or poor accuracy." This statement is particularly unfortunate since the very essence of a least-squares treatment is that it allows and, in fact, requires that observations be weighted in accordance with their uncertainties. In particular, the uncertainty in the observed value of sin θ for a particular powder reflection is, to the first approximation, proportional to cos θ. Thus, in the back reflection region the weighting becomes an extremely important consideration. The authors are also negligent in their discussion of probable errors. Thus, on page 487 data from GeO_2 is analyzed to yield best values for lattice parameters. This analysis is followed by the statement: "The precision in a_0 is of the order of ± 0.0002 A." It is unfortunate that Klug and Alexander have not seized upon their opportunity to resolve the confusion in the minds of many, many workers concerning the meaning and methods of evaluating uncertainties.

On the whole, the authors should be complimented on their results. The book should provide easy, informative reading for a large body of untrained technicians, as well as form a convenient reference for all workers in the field of powder diffraction. It is pleasing to find, under one cover, such diverse topics as the radial distribution treatment of diffraction data, determination of crystallite size, and a discussion of refraction effects. The figures and printing are good, and references are abundant. The price is high.

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Evolution as a Process. Julian Huxley, A. C. Hardy, and E. B. Ford, Eds. Macmillan, New York; Allen & Unwin, London, 1954. 367 pp. Illus. $4.25.

Although the first centenary of Darwin's *The Origin of Species* is less than 5 years distant, the problem of evolution has again become the focus of theoretical (or shall one say, philosophic) biology. A symposium on evolution, held under the auspices of the British Society of Experimental Biology and the Genetical Society, was published in 1953 [reviewed in *Science,* 119, 156 (1954)]. The symposium now under review has been organized by friends of Julian Huxley and dedicated to him on the occasion of his sixty-fifth birthday. Only three of the 19 contributors also participated in the first symposium.

The symposium covers a wide range of topics. Phylogeny building is represented by G. R. de Beer (discussing Hadzi's theory of the origin of Metazoa), A. C. Hardy (origin of the chordates), E. J. H. Corner (origin of the tropical rainforest flora), and J. Zuckerman (phylogeny of the primates, the Aus-

tralopithecines being regarded as a branch remote from human ancestry). The effects of natural selection on race formation are discussed by E. B. Ford (in Lepidoptera), P. M. Sheppard (snails, moths, Drosophila), D. Lack (variations in fecundity in races of birds), H. N. Southern (mimicry in cuckoos), and E. Mayr (continental and island races in birds). The evolution of behavior, primarily in birds, is dealt with by J. Fisher, N. Tinbergen, and H. B. Cott; B. Rensch considers the relations between body size, brain structure, learning ability, and behavior in mammals and other vertebrates. The bearing on evolutionary problems of certain aspects of sensory physiology is considered by E. N. Willmer, J. Z. Young, and B. Rensch. J. B. S. Haldane and E. Mayr examine the properties of some genetic population structures. R. A. Fisher comments on the history of the theory of natural selection. The lone paleontologist, T. S. Westall, considers the correlations (or the lack thereof) between the periods of intense mountain building and biological evolution.

It is impossible in a review to do justice to the wealth of ideas discussed in the symposium. One of the controversial issues to which considerable space is devoted concerns the role in evolution of random changes in gene frequencies, referred to as the genetic drift or Sewall Wright's effect. In his excellent paper, Sheppard presents evidence that variations in seemingly indifferent characters, such as the coloration of shells in certain snails, have considerable adaptive significance and are subject to strong selection. But he concludes that: "Thus Wright's concept of drift, though frequently invoked as an important agent in evolution, must be judged of negligible significance as compared to selection." Now, this is a wrong way to state the problem. Genetic drift is not an alternative to selection; its importance lies precisely in its interaction with selection and other directive agents of gene frequency change. The futility of much evolutionary speculation in the past resulted from attempts to picture evolution as caused by some one agent—by mutation, or selection, or hybridization, and so forth. Perhaps the most important advance in the evolutionary thought was the realization that it is the coaction of many agents that brings about evolutionary changes. What kind of change occurs in a population depends on the magnitudes of all the "forces" impinging upon it, as well as on the genetic structure of the population determined by its previous history. Haldane is certainly right when he insists on this quantitative approach to the study of population structure and evolution.

How important may be random changes in gene frequencies is shown by Mayr, who points out that widespread, common, and polymorphic species which inhabit continental areas are usually conservative in the evolutionary sense. And yet geographically peripheral populations of such species, isolated on small islands or by other means, often show striking divergence from the main body of the species, forming clear-cut races or derived species. Mayr ascribes the relative conservatism of continental populations to continuous migration of genes throughout the distribution range, which maintains a high degree of coadaptation of the components of their gene pools. The situation changes when a small number of individuals, perhaps a single pair, forms an isolated colony. The foundation stock of such a colony will almost always contain only a fraction of the genetic variability present in the parental population. This will necessitate a reintegration of the gene pool to arrive at a new adaptively coherent genetic system. An isolated population may thus give rise to a new species, even though it inhabits an environment which is not greatly different from that in which the original population lives. But it may also enter a new ecological niche, and thus produce a novel adaptive type. It would be interesting to examine from Mayr's point of view the remarkable island races of some British butterflies described by E. B. Ford in the same symposium. The origin of these races is not convincingly accounted for either by selection alone or by genetic drift alone, but it may be due to interaction of these factors in populations in which migration of genes is limited or excluded.

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Gas Dynamics of Thin Bodies. F. I. Frankl and E. A. Karpovich. Trans. from the Russian by M. D. Friedman. Interscience, New York–London, 1954. viii + 175 pp. Illus. $5.75.

The subject of this slender monograph is of interest to some aeronautical engineers but is unlikely to attract mathematicians or physicists. The basic equations of the theory of ideal fluids are linearized, and thereafter follow various further assumed simplifications. The method is well known; the purpose of this monograph is to present the minute details in certain special cases of aeronautical interest.

The work is typical of much now published in Russia. Hastily thrown together in a miserable ragged style, without any attempt to survey the entire literature of the subject, it presents recent Russian methods not easily available otherwise and serves as a unique handbook for those whose particular field is its subject. It is pointless to criticize the details: each person will esteem this book much as he does other recent Russian monographs, according to his personal tastes.

The topics include motion of an elongated body of revolution at subsonic or supersonic speed, accelerated motion, the theory of thin or thick wings of infinite or finite span, unsteady motion of wings and the theory of propellers, and conical flow and its generalizations. Each of these has various special cases which can be combined in many ways: symmetric or unsymmetric bodies, zero or non-zero angle of attack, and so forth. Among the names mentioned are Chaplygin, Prandtl, Busemann, Ackeret, Sedov, Smirnov, Sobolev, Christianovich, Krasilshchikova (here the