Although the Orbitron gauge is briefly mentioned, the Orbitron pump apparently was announced after the publication deadline. Nor is there any mention of the stainless-steel-to-glass Housekeeper seal, which is now in rather widespread use. Brevity of prose style occasionally leads to statements that are intelligible to an expert, but possibly not clear to a novice. All in all, these are minor defects.

During the past two years, at least six books on this general subject have been published in the United States. Several of these emphasize one part of the field, such as ultrahigh vacuum, new pumping techniques, or commercial applications. The Dushman-Lafferty book remains the most thorough treatment of the scientific foundations. For those who want a more concise treatment, a good guide to the literature, and the inclusion of the most recent developments, this volume by Lewin, *Fundamentals of Vacuum Science and Technology*, can be recommended as a first choice.

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Crystallography: Winter School, University of Madras

Advanced Methods of Crystallography. G. N. Ramachandran, Ed. Academic Press, New York, 1964. x + 279 pp. Illus. $10.50.

This book is a report of the lectures delivered at the Winter School on Advanced Methods of Crystallography held at the University of Madras in January 1963. The nine lectures can be divided into two internally related groups of three lectures on crystal structure analysis and three lectures on imperfections and disorder and a group that contains three miscellaneous talks. The first group consists of "Image methods in crystal-structure analysis" by M. J. Buerger, "Fourier syntheses for partially known crystal structures" by G. N. Ramachandran, and "The use of anomalous scattering in crystal structure analysis" by S. Ramaseshan. Buerger's lecture is a brief presentation on some aspects of image methods, a subject that is covered much more intensively in his book *Vector Space and Its Application in Crystal Structure Investigations.* The second lecture presents a good discussion of Fourier transforms and the effects of various modifications on the Patterson and electron density functions. The final lecture in the first group presents a good, concise discussion of anomalous dispersion in structure determination. These lectures are of primary interest to the specialist in crystal structure analysis. It is unfortunate that, for completeness, there were no lectures on phase determination and automatic devices.

The three lectures in the second group, "Diffuse x-ray reflections from crystals" by W. A. Wooster, "Diffuse disorder scattering by crystals" by H. Jagodzinski, and "Imperfections in crystals and their effect on x-ray diffraction by crystals" by Leonid V. Azároff, are written in a more general vein and as a unit can serve as an introduction to disorder effects. Wooster makes extensive use of optical transforms which are not only experimentally useful, but an excellent pedagogical device.

In the lecture "Group theory and crystal properties" S. Bhagavantam discusses the relationship between crystal symmetry and physical properties, with particular emphasis on photoelasticity as an example. "Elementary theory of neutron scattering by crystals," by I. Waller, is a very concise presentation, and the uninitiated would do well to use a more extensive source such as the book *Neutron Diffraction* by G. E. Bacon. "Aberrations and line broadening in x-ray powder diffractometry," by A. J. C. Wilson, is mainly a discussion of the effect of physical aberrations on line positions and widths. Wilson also presents a very short interpretation of diffraction broadening.

The majority of work presented in these lectures is available in more detailed analysis in books in the various fields. However, within its limitations, this book can serve as a brief and readable introduction for the crystallographer who desires a nodding acquaintance with work in related fields beyond his immediate specialty. Each lecture has a list of references and, at the end of the book, there are author and subject indices.

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Polymer Chemistry

Determination of Molecular Weights and Polydispersity of High Polymers. S. R. Rafikov, S. A. Pavlova, and I. I. Tverdokhlebova. Translated from the Russian edition (Moscow, 1963) by J. Eliassaf. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. viii + 357 pp. Illus. $14.

Synthetic Hetero-Chain Polymides. V. V. Korshak and T. M. Frunze. Translated from the Russian edition (Moscow, 1962) by N. Kaner. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. x + 564 pp. Illus. $17.95.

Both of these books on polymer chemistry were originally published by the Academy of Sciences of the U.S.S.R. and both were translated into English by the Israel Program for Scientific Translations, Jerusalem. Do the treatises merit translation?

I think they definitely do. The first book is of wide interest, and the second is more specialized. Both are serious and scholarly works that deserve respect and should be of definite value as reference texts. They have to some extent a flavor that is intermediate between a true textbook and an advanced review article. They are useful because of their comprehensive nature, but fall short of excellence because discrimination is sacrificed for comprehensiveness.

What is quite surprising to me is how eclectic these works are. We are accustomed to think of Russian science as being rather xenophobic. These books reveal an intensive study of American, British, German, French, and Belgian literature amongst others. We have thought of the Japanese as being always willing to learn from the best that the world has to offer. It seems that Russian polymer scientists may be beginning a similar trend in their country. There may come a time when the best way for polymer scientists in America to keep up with work originally published in English will be to have Israelis translate Russian texts, based largely on American papers, into English. Stranger things have happened in the course of world history. In the United States the monetary motivation for writing advanced and specialized scientific texts is not always very great, and the prestige value of such texts is sometimes less than the author could obtain by

using the same amount of time to travel (expenses paid) to various meetings.

If an international competition in the writing of advanced scientific texts does develop, it would have a healthy effect on the field.

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Museum of Microstructures

Interpretation of Metallographic Structures. William Rostoker and James R. Dvorak. Academic Press, New York, 1965. viii + 226 pp. Illus. $10.

"The book is an organized presentation of specimen microstructures, each chosen for its clarity of illustration and each or in groups forming the pretext for some discussion of interrelation between physical metallurgy and metallography." So the authors describe their intent, which is very satisfactorily achieved. There are some 139 photomicrographs illustrating chapters discussing polycrystalline structures, crystallization, solid state transformations, diffusion and transport processes, and quantitative metallography. The photographs (culled from years of materials development at the Illinois Institute of Technology Research Institute) range between good and excellent, both on the basis of metallographic technique and significance. They represent relatively exotic materials, but they were selected to show the universality of the physical principles of structure and are accompanied by a good discussion of the factors responsible for the particular shapes that occur. The sections on liquid-metal penetration and on diffusion and transport illustrate many important phenomena not commonly covered in metallurgical texts.

The book does not have the balance that would enable one to recommend it as an introduction to metallography, but it is a very useful museum of well-labeled specimen types for suggestive comparison with structures encountered in postmortem examinations and in the study of new types of materials. It is a well-made book, although the proofreader (?) has left errors in the simple equations for interface equilibrium angles and for grain shapes.

The rhythmic layering in chemically deposited nickel (see cover of this issue of *Science*) is strikingly uncrystalline and will be more familiar to fanciers of agate than to metallurgists with ordinary experience. Indeed people of any profession, or of none, will enjoy the structures as abstract art forms, and they will find suggestive analogies with biology, sociology, and virtually every field of knowledge and experience, for everything sensed or thought depends on some relationship between units and interfaces in structural hierarchies that are not unlike those here made visually manifest by the behavior of imperfect microcrystals interacting with each other.

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Note

The Year Book of the Royal Socity of London, 1965 (Royal Society, London. 351 pp. $3.15), provides a list, including addresses and professional affiliations, of the Fellows and Foreign Members of the Society and a separate list of those elected to membership in 1964. Among the other information provided is the Society's Calendar for 1965 and lists of its committees and boards, medals, lectures, and publications.

BIOLOGICAL AND MEDICAL SCIENCES

Biopsychology Comes of Age

Ernst Mayr recently wrote that "Typological thinking is unfortunately a disease that is highly resistant to all treatments. All we can hope for is to immunize the young against it, but whether we will be able to cure any of those afflicted with it is rather doubtful" (private communication, 1963). **Genetics and the Social Behavior of the Dog** (University of Chicago Press, Chicago, 1965. 468 pp., $12.50) by John Paul Scott and John L. Fuller is an important book, if not a great one. It is important because to my knowledge it represents the first systematic and methodologically sophisticated experimental analysis of behavior *not* cast in the typological mode of thought that has so long plagued the behavioral sciences. Scott and Fuller think in terms of populations and speak the clear language of modern evolutionary biology to present behavior-genetic analyses of individual and breed differences in the behavioral development of the polytypic species *Canis familiaris*.

Their theme is the role of heredity in the development of behavior. They provided puppies with an environment designed like a well-run school, then trained and tested the young from several breeds and attempted a partial Mendelian analysis of two breeds having the longest reproductive isolation. Throughout the highly readable account of 13 years of work we learn much about dogs and their long association with man.

The six chapters of section 1 lay the groundwork. The first, "A school of dogs," outlines the study and what follows. The second chapter, "Dogs, wolves, and men," discusses the origin of *C. familiaris* and its relationship to its congeners *C. dingo, C. lupus* (wolf), *C. latrans* (coyote), and *C. aureus* (jackal), then covers geographical distribution, fossil and prehistoric evidence, and evidence from comparative anatomy, physiology, and genetics. This chapter also presents a fascinating survey of historical evidence for man's role as selective agent shaping the