of the organism, hormonal activity, antimetabolites, and diet ingredients.

Some basic requirements for immunogenicity are assumed. These include the presence of specific (antibody-like) receptors on antigen-reactive cells, functional differentiation between various types of immunocompetent cells, cooperation between cells to trigger the immune response, and the involvement of a carrier. It is also assumed that "one cell produces only one immunoglobulin." Unfortunately, the possibility of the existence of a certain multipotential cell and step in the development of the immune response is not discussed.

It is interesting to mention some of the conclusions arrived at in the book. It is considered that probably all macromolecules can elicit antibody formation if given in the proper dose and schedule (chapter 1). This conception implies a great variety in the responsiveness of the immunocompetent system. It is claimed that the induction of antibody response or tolerance is directly related to the number of cell receptors. It is stated that the relative importance of molecular size and shape of antigens in determining immunogenicity varies greatly from one antigen to another (chapter 2). The dose and route of antigen administration determine not only immunogenicity but also the type of immune response elicited, that is, humoral versus cellular, affinity, and type of antibodies (chapter 3).

In connection with the action mechanism of adjuvants, it is of interest to mention the concept of "built-in" adjuvanticity for the antigen carrier and the possible action of adjuvants as surface-active agents and labilizers of lysosomal membranes (chapter 4).

Various hypotheses are proposed concerning the role of macrophages and cell cooperation in the induction of the immune response. The most appealing for the authors is that of the antigen functions as an inducer of protein biosynthesis (chapter 10).

The ability of histocompatibility antigens to provoke proliferation of immunocytes is postulated to be of utmost importance in determining the immune response of the host toward tumor cells. The possibility that some of the human lymphomas and leukemias are monoclonal, as are cases of multiple myelomatosis, is considered worthy of further investigation (chapter 16).

The book contains detailed chapters on various particulate antigens and on the evolution of immunological potential. The last chapter is devoted to some interesting predictions on the role of immunology in the future. In conclusion, the book fills a need in bringing together detailed information on factors governing immunogenicity.

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Membrane Biophysics

Biophysics and Physiology of Excitable Membranes. WILLIAM J. ADELMAN, JR., Ed. Van Nostrand Reinhold, New York, 1971. xvi, 516 pp., illus. $24.50.

This book, based on a series of lectures to summer trainees at Woods Hole, should be in the library of every person with a serious interest in excitable membranes. The book's uniqueness among publications in this field lies partly in the variety of approaches to understanding membrane excitability it presents and partly in the clearly conscious effort that is made throughout to pass on information that will be useful to a beginning investigator. Perhaps the epitome of this effort is a full FORTRAN IV computer program for simulating the squid axon via the Hodgkin-Huxley model.

It should be noted that the 18 contributors to this volume were free to expound from their own points of view. The reader who has been working on membranes will automatically adjust for this, but the student who is using the book as an introduction should be warned not to be dismayed by differing viewpoints elsewhere in the literature, or in fact in this book, as when in the chapter beginning on page 379 he encounters a model of excitability that he has been warned to consider "suspect" on page 139. But that's all right, as long as he understands that his task is not to choose sides but to synthesize some more comprehensive picture from the most significant work that has been done—and on balance this book is an excellent representation of that work.

However, I would have liked there to be just one extra chapter somehow placing this body of work in the larger context of physiology. If the sum total of all the work of this volume's contributors and the people they cite were merely to understand resting and action potentials in the nerve axon, then this would indeed be a great deal of effort for not much profit. Although there are a few references to other preparations, the student will not get from this book any idea of the extent to which its subject matter has been extended to help develop concepts of function at the membrane level for such things as receptors, synapses, and muscles. This is a crotchet of mine, but it seems to me that to keep reminding students of such perspectives is one of the things that makes the difference between training them to be scientists and training them to be technicians. Besides, the extension to other membranes of the electrophysiology that has been developed for the axon is a lively research endeavor, of which students should be made aware. But the lack of such a chapter does not detract from what the book is—namely, the best available survey, at a level of detail suitable for a beginning or ongoing researcher in the field, of the variety of techniques that are being brought to bear on the problem of understanding membrane excitability.

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Crystal Structures

The Crystal Chemistry and Physics of Metals and Alloys. W. B. PEARSON. Wiley-Interscience, New York, 1972. xx, 806 pp., illus. $34.95. Wiley Series on the Science and Technology of Materials.

W. B. Pearson is already well known for his two-volume *Handbook of Lattice Spacings and Structures of Metals.* Those volumes, which are a compilation of the structures formed by various alloy phases, are nicely complemented by the present volume, which is both a systematic description of the more than 600 crystal structures found in metals and a critical review of theoretical work on the problem of structural stability.

Most of the structures are described in terms of the stacking of close-packed layers. This system has the considerable advantage over those based only on crystal symmetry that structural similarities and differences are unambiguously exposed. (It is possible for two compounds belonging to the same space group, having the same site-set occupation, with values of free atomic

parameters differing by only a few percent of a cell-edge dimension, to have different crystal structures!) Unfortunately, the layer-stacking point of view requires the use of unfamiliar notations, and the reader will be surprised (and perhaps somewhat frightened) to find the NaCl structure denoted by the symbols

NaCl $\quad Na_0^A Cl_{17}^C Na_{33}^B Cl_5^A Na_{67}^C Cl_{83}^B$

or

NaCl (*cF* 8) $\quad Na_0^{1+4} Cl_0^5 Cl_5^{1+4} Na_5^5$

These notations are perhaps more suitable for computers than for people, and it will be interesting to see whether some advantage can be taken of this situation.

Next there is a review of the physics and chemistry of structural stability. This is a complicated business, because geometrical effects, chemical bond effects, electronegativity effects, and energy band effects can all make important contributions to the free energy of an alloy system. These contributions cannot be calculated very accurately, and only small energy differences decide the stability of one structure compared to another. Another serious difficulty in making a theory of structural stability is that, in metals, atomic sizes are a function of the structure, rather than vice versa. Metals are *not* made of billiard balls! Thus the "theories" can at present provide only ad hoc explanations or, at best, prohibitions (such as Hume-Rothery's 15-percent rule), not predictions.

Finally, the actual structures are introduced—hundreds of them. Each is described with a short paragraph usually in terms either of layer stacking or of relationships to other structures. Most of the discussions are accompanied by very useful drawings, and in each case references are given to the experimental structural determination. This section of the book should prove indispensable to those working with metals having complex structures.

Simply because of its incredible information density, the reading of this book entails a fair amount of work. One can only imagine how much work it was to write it, and Pearson deserves our thanks for having done so.

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Solid State Processes

Point Defects and Diffusion. C. P. FLYNN. Oxford University Press, New York, 1972. xii, 826 pp., illus. $51. International Series of Monographs on Physics.

Diffusion is an important phenomenon controlling many solid state reactions and transformations. The utilization of diffusion, or, in as many occasions, the reduction of its effect, is not only of fundamental interest, but also of significance for various technological problems. This requires the understanding of the diffusion phenomenon and hence the study of point defect properties. Research activities in this field have grown steadily over the last 20-some years or so. It is interesting now to compare the book *Atom Movements*, a seminar proceedings published by the American Society for Metals in 1951, with this book by Flynn. One is certainly impressed by the wide range of problems associated with diffusion being studied in recent years.

This book is a comprehensive one, covering a broad spectrum of fundamental aspects of diffusion and point defect properties. It is also quite an impressive one in the depth that the author can manage in treating such a broad range of subject matter. For example, there is a fine chapter on the electronic states of point defects and, in the other domain of diffusion phenomena, an equally comprehensive treatment of the precipitation problem. It is perhaps not unusual to see such a variety of topics discussed by different experts in a conference proceedings, but to find them systematically developed by one author is not common.

This book first shows the fundamental aspects of the equilibrium point defects and how the vibrational and electronic properties of the crystal change as a result of interaction with the defects. After the author has established the basic properties of point defects, he considers their diffusional behavior under different driving forces in various types of crystals. The characteristics of point defects in the four main classes of crystals, molecular, ionic, valence, and metallic, occupy the last part of the book. The author approaches the subject usually by a qualitative discussion of the physics involved, then proceeds to formulate the problem in detail. Considerable effort has been spent in showing the details of many mathematical derivations in the book. It appears to be the intention of the author that this book be used as an advanced level textbook. It should serve this purpose very well. Graduate students after completing the first one or two years' courses in physics or some related field should not encounter difficulties in understanding the material, and they will probably find this book a useful stepping-stone to the research field of point defects.

Some outstanding problems of current research interest have been included, among them the question of the validity of using the reaction rate theory to treat the details of the atomic jumping process, particularly the isotope effect; the dynamical theory of diffusion and the quantum effect of light interstitials in diffusion; the dielectric screening of impurity atoms in metallic and valence crystals; and the use of magnetic and optical resonance techniques to measure defect properties. These topics, of particular interest to the author, are explored to considerable depth. Researchers currently investigating diffusion and point defects would find the book very useful indeed.

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Books Received

Advances in Metabolic Disorders. Vol. 6. Rachmiel Levine and Rolf Luft, Eds. Academic Press, New York, 1972. xiv, 236 pp., illus. $13.

Advances in Virus Research. Vol. 17. Kenneth M. Smith, Max A. Lauffer, and Frederik B. Bang, Eds. Academic Press, New York, 1972. x, 336 pp., illus. $17.50.

Aerosols and Atmospheric Chemistry. Proceedings of a symposium, Los Angeles, Mar. 1971. G. M. Hidy, Ed. Academic Press, New York, 1972. xviii, 348 pp., illus. $14.50.

Albert Einstein. Creator and Rebel. Banesh Hoffmann with the collaboration of Helen Dukas. Viking, New York, 1972. xvi, 272 pp., illus. $8.95.

Annual Report on Support of University Research 1971–72. National Research Council of Canada, Ottawa, 1972. xiv, 618 pp. Paper, $2.50. N.R.C. No. 12724.

Annual Reports on the Progress of Chemistry. Vol. 68, 1971, Section A: General, Physical, and Inorganic Chemistry. The Chemical Society, London, 1972 (available from the Publications Officer, Blackhorse Road, Letchworth, Herts., England). xvi, 546 pp., illus. £6.

Annual Review of Materials Science. Vol. 2. Robert A. Huggins, Richard H.

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