pigmentation leave no doubt of extensive homology among pigment genes of all mammalian species. The closing synthesis suggests that more extensive study of genetic variations such as these would increase understanding of evolutionary processes.

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Cellular Structures

Cell Walls and Membranes. H. J. ROGERS and H. R. PERKINS. Spon, London, 1968 (distributed in the U.S. by Barnes and Noble, New York). xii + 436 pp., illus. $12. Spon's Biochemical Monographs.

The scope of this book is not as wide as its title would suggest. Perhaps "The Chemistry and Structure of Cell Walls" would have been more appropriate, since, with the exception of two brief chapters, functional properties are ignored. And, with 18 of its 25 chapters dealing with wall constituents in diverse organisms, the treatment of the cell membrane is limited. But the chemistry of the cell walls of higher plants, algae, fungi, and especially bacteria (eight chapters) is well covered, and discussions are included of the architecture of these walls and of the growth patterns involved. There is no mention of the ciliated or flagellated protozoa, and only a 4½-page chapter on amoebas.

The general pattern is to discuss the occurrence, chemistry, and synthesis of each chemical component of the wall for each major group of organisms. There is little attempt to relate chemistry to wall function, although some discussion of the relationships between chemistry and structure is presented.

This book had a remarkable ability to hold this reader's interest through what might have been a very dull recital of the natural chemistry of cell walls. I confess to some tedium toward the end of the book, brought on, in part, by the large quantity of tabular data. Although it is these data that will be of great use for reference, one wishes that some of the material might have been presented in graphic form (there are only seven graphs in the entire book, as opposed to 78 tables).

The very large number of diagrams, chiefly structural formulas, are useful to those readers who are not carbohydrate chemists. With this aid, it is not too difficult to follow the macromolecular twists and turns of this subject. The references (listed chapter by chapter) seem sufficient, and the book should provide a good start for an interested student.

There are the seemingly inevitable lapses of style: some jargon, some undefined terms and methods, some relatively common techniques described in what seems unnecessary detail. And I suppose every reader feels, when a general work touches on his own field, that more should have been made of this important subject! Thus the omission of so much of membrane physiology is a disappointment, brought on chiefly by the overly ambitious title. Within its true scope, the chemistry and structure of cell walls, this book is well worth having.

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Vacancies and Interstitials

Défauts Ponctuels dans les Métaux. Y. QUÉRÉ. Masson, Paris, 1967. 236 pp., illus. Paper, 80 F. Collection de Monographies de Physique, No. 5.

This timely book by Quéré should fill a wide need among those metallurgists and solid state physicists who strive to keep informed on development in understanding the defects of metals. This is a broad and by no means static field and merits periodic review. It has now been about five years since the book by Damask and Dienes appeared with the English equivalent of this title but with a somewhat different point of view, so that the present publication is well timed. Although it is not a big volume (217 pages of main text) it surveys a large field with a sure and even touch. Restricted by his title to point defects (namely vacancies and interstitials), the author has nevertheless considered all the usual interactions of these with other lattice imperfections and so touched on nearly every aspect of the defect state for metals.

The book is clearly written with a strong emphasis on the underlying physical concepts. The style is simple and direct. It reads rapidly. The analytical sections are succinct and clear, for the most part accurate and fundamental. The presentation is particularly well organized and careful.

The first five chapters are primarily concerned with the conceptual background. The first two deal with the elastic model for a center of pressure and its application to the point defects. The next chapter considers the ramifications which develop when the atomistic nature of the lattice is considered, usually in terms of two-body forces. The fourth chapter introduces consideration of electronic forces and shielded potentials. The importance of the Friedel oscillations to many problems involving point defects is emphasized. Chapter 5 gives the application of thermodynamic principles to the field. Chapters 6 and 7 are individually longer than the preceding five and aim to give a survey of significant revealing experiments in this area. For this, a considerable degree of selection was necessary and of course an arbitrary cutoff date for recent developments. Chapter 5 deals with investigations of defects in equilibrium at high temperatures and chapter 7 with metastable concentrations of defects as induced by quenching, irradiation, or cold working. All these are treated deftly and concisely. The great controversy still raging between the adherents of the one- or two-interstitial mechanisms for radiation anneal is presented with an even fairness and a good selection of the essential arguments for each side. Throughout, the parts are carefully interwoven by cross reference in an excellent workmanlike manner that is characteristic of Quéré's scholarly approach.

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Studies of Water Sources

Isotopes in Hydrology. Proceedings of a conference, Vienna, Nov. 1966. International Atomic Energy Agency, Vienna, 1967. x + 740 pp., illus. Paper, $15.

Increasingly sophisticated evaluation and exploitation of the resource potential of environmental hydrologic systems have led to ever closer scrutiny of the characteristics of these systems. Hydrologists consequently are faced with the necessity of arriving at accurate answers to a bewildering variety of questions, including ones about external input-output characteristics of systems and internal characteristics of

flow paths, residence time, storage, and mixing and dispersion. Used in labeling individual or packets of water molecules, environmental and artificially introduced isotopes offer a means for obtaining direct and relatively accurate answers to such questions. Under favorable conditions the results are preferable to, or at least supplement, results obtained by indirect methods based upon macroscopic flow considerations.

This symposium reflects the continued interest of the International Atomic Energy Agency in development of isotope techniques as hydrologic tools and follows an earlier symposium, Radioisotopes in Hydrology, held in Tokyo in March 1963. Development of isotope methods has progressed to the point where, under favorable conditions, practical applications yield useful results. Of the 41 papers, nearly all are devoted to field applications and related technology.

Applications of environmental isotopes, ^{14}C and ^{3}H—natural and bomb-produced—and stable isotopes of hydrogen and oxygen, have developed rapidly over the past five years. Ample reasons exist for this development. Because the concentration of stable isotopes in precipitation is dependent on geographic location, altitude, and season, they can be used for determining source areas and external inputs to hydrologic systems. The seasonal-geographic dependence of ^{3}H in precipitation permits it also to be used for the same purposes. Because of their decay and recent pulse-input, ^{3}H and ^{14}C are particularly useful in revealing the internal characteristics of flow systems.

This encouraging and very worthwhile development is well reported and is clearly the salient point of this symposium. In contrast to those in the earlier symposium, a large proportion of the papers, nearly half, concern the use of environmental isotopes. Several of the papers, notably one by J. R. Gat and Y. Tzur, make the significant point that modification of isotope concentrations may occur in the time-space interval between the interception of precipitation and its final incorporation into the ground- or surface-water system. Risk is involved in assigning the isotopic composition of precipitation to the input waters of hydrologic systems, particularly in arid areas of high evaporation. Additional work is needed on this matter.

As is evidenced by the proceedings, use of artificially introduced radioisotopes continues to be restricted to specialized situations, generally where flow times are short or velocities are high under natural or artificially produced conditions. Several sections of the proceedings cover this aspect rather adequately. A section of ten papers deals with the movement of sediment in surface waters by particulate labeling techniques. A short section of five papers deals with determination of local characteristics of aquifers. Another section covers applications in unsaturated flow and seepage. Instrumentation, tracer characteristics, and streamflow applications are also covered.

Only five papers are authored by Americans, and of these three deal with field measurement techniques. The lack of participation by American hydrologists is both a weakness and strength. Certainly American workers are active in the field and their absence limits the coverage of this symposium. On the other hand, the American worker in isotope hydrology will find the proceedings a valuable adjunct to his national literature, a ready reference to progress being made elsewhere. To those interested in gaining a general view of the field, the application approach of this volume will necessitate further reference to the literature on basic principles, much of it American, and to the American literature for complete coverage of applications.

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A Sampling of Helmholtz

Helmholtz on Perception. Its Physiology and Development. RICHARD M. WARREN and ROSLYN P. WARREN. Wiley, New York, 1968. x + 277 pp., illus. $9.95.

The opening sentence in the preface to this book asks, "Why read Helmholtz today?" Most scientists for whom his work is relevant and who have read Helmholtz would have quick answers. For those outside this set, the present collection of some of his shorter survey articles should help to make these answers plausible. There may be a number of reasons for reading Helmholtz's contributions—for example, to appreciate the man as a scientist or to gain historical perspective for many problems that are still being actively investigated. For many readers these reasons may spell past history, and in an era of rapid advancement our impatience and urge to move ahead have created an atmosphere in which such reading is frequently perceived as a luxury for all except the historian.

One hopes that what this volume will do is stimulate some readers to go back to Helmholtz's major works and read, not for history or biography, but for ideas and for an approach to the subject matter. Such readers need hardly be warned that much of the factual material has been enlarged upon in a substantial way. What they can be promised, however, is a discovery that understanding of a surprising number of problems discussed by Helmholtz has been little advanced in the intervening decades. In addition, much can be learned by all of us in following the reasoning and ingenuity of a man, competent as a physicist and physiologist, as he attacks sensory and perceptual problems.

Allowing for the size and the purpose of the present volume, the choice of material is excellent. It would be extremely difficult to select a portion of the three volumes of *Physiological Optics* and do justice either to Helmholtz's contributions or to his mode of thinking. The presentation of a popular article written shortly after he had completed this work allows Helmholtz to represent himself. This is done in the chapter on "The recent progress of the theory of vision." An almost analogous situation holds with respect to Helmholtz's monograph *Sensations of Tone* and the contribution in this volume entitled "On the physiological causes of harmony in music"; in this case, however, the popular writing proceeded, and provided a preview of, the longer and more detailed monograph. In all, six contributions are presented, and the comments by the editors, as well as their brief review of Helmholtz's life, help to round out the volume.

Two of the contributions appear for the first time in English: "The facts of perception" and "The origin of the correct interpretation of our sensory impressions." In both of these, and particularly in the former, we find Helmholtz's strongest arguments for the empiricist position in perception and his involvement in the nativism-empiricism debate of the 19th century.

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