Plasma Physics

The Particle Kinetics of Plasmas. I. P. SHKAROFSKY, T. W. JOHNSTON, and M. P. BACHYNSKI. Addison-Wesley, Reading, Mass., 1966. 528 pp., illus. $17.50.

In this excellent book the authors have done a thorough job of organizing the various theories of plasma kinetics and placing them in an order that shows the range of applicability of each theory. The book contains sufficient details of derivations to make it useful both as a teaching and as a reference text. Its only drawback for teaching is the lack of problems, and this is offset by the completeness of those subjects that the authors have chosen to treat. There is more material than could be covered in a graduate course on plasma physics, which must deal with other subjects as well, but adjustment can be made readily by omitting whole chapters.

Chapter 1 is a general review, together with a schematic outline of the various theories, techniques, and ranges of applicability. Chapter 2 is a brief derivation of the moment equations, starting from the Boltzmann equation, together with a discussion of the collision integrals and the Boltzmann transport equation. Chapter 3 is a treatment of the expansion of the electron distribution function into spherical harmonics following the work of Lorentz. This is a good reference chapter, but could be omitted in a course on plasma physics.

The Maxwellian and Druyvesteynian distribution functions are derived in chapter 4, and the Boltzmann equation is used to study the conductivity and mobility in the weak-electric field limit. The authors treat electron cyclotron resonance here, using a collision frequency different from that normally used. This chapter, and chapter 5, which considers elastic collisions and cross sections, could also be omitted from a course in plasma physics.

The next two chapters treat the problem of bremsstrahlung, high-frequency conductivity, and the Fokker-Planck equation. The presentation is clear, and the material is vital to the field of plasma physics. These chapters would be extremely valuable in a course on plasma physics.

A collection of various transport properties of plasmas, together with results of computation and experiment, are covered in chapter 8. It is a useful reference section. The last two chapters include the conventional development of the plasma fluid equations in the magnetohydynamic approximation and in the double adiabatic or Chew-Goldberger Low approximation. The particle-orbit theory attached to the last chapter looks like an afterthought and could have been omitted without damage to the book.

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Polarography

Principles of Polarography. JAROSLAV HEYROVSKY and JAROSLAV KŮTA. Translated from the Czech edition (Prague, 1962) by Jiri Volke. Czechoslovak Academy of Sciences, Prague; Academic Press, New York, 1966. 581 pp., illus. $19.50.

No one is better qualified to write authoritatively on polarography than Jaroslav Heyrovsky, who in 1959 received the Nobel Prize in Chemistry for his invention of the subject and for his penetrating investigations of its many facets during more than 40 years. Thus this volume provides the unique opportunity to view polarography as its inventor sees it.

As implied by the title, the treatment is limited to the fundamental framework of polarography, and the book does not include practical analytical procedures or more than hints about other applications. This is in keeping with its intended role as an advanced textbook rather than a reference monograph. Although neither details of circuitry nor commercially available instruments are described, the essential principles of various types of polarographic techniques are well presented. In addition to all of the more classical aspects of polarography, there are discussions of such up-to-date matters as adsorption effects, kinetic and catalytic currents, and irreversible electrode processes.

The exposition is lucid, right to the point, and highly informative. The discussions are supported by many polarograms and other pertinent illustrations, and the coverage of the original literature is thorough. Polarographic experts should be pleased to see what they know presented so well, and the neophyte could not make a better choice than this book for his first introduction to polarography.

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Plant Disease

Viruses of Plants. Proceedings of an international conference, Wageningen, Netherlands, July 1965. A. B. BEEMSTER and JEANNE DIJKSTRA, Eds. North-Holland, Amsterdam; Interscience (Wiley), New York, 1966. 350 pp., illus. $12.75.

The conference whose proceedings are reviewed here was the latest of a series that has been devoted largely to potato virus diseases. This conference has gone a step further than its predecessors and is a general consideration of plant viruses and virus diseases.

The book reflects the general trends, problems, and shortcomings of current research in plant virology. Our knowledge of the viruses themselves and of the diseases they elicit is expanding rapidly. Expanded technology and the general availability of expensive equipment, such as the ultracentrifuge and the electron microscope, have allowed the isolation and characterization of viruses to become almost commonplace. The gel diffusion technique has made serology acceptable to plant virologists, and the relationships between viruses and their associated proteins are being actively studied. However, progress has been much slower in our understanding of the multiplication of plant viruses, the subcellular basis for symptomatology, and the effects of the virus on host metabolism. The lack of progress is largely a function of the complex nature of the virus-host systems available for study: bioassays are not sensitive enough, control over the time of infection of all but the first few cells in an inoculated leaf is poor, and the early (and most interesting) changes that take place in the small number of initially infected cells in a leaf must be measured against the background of an overwhelming number of uninfected cells. One may contrast this situation with animal and bacterial virology, where these problems are largely nonexistent and from which most of our knowledge of the fundamentals of virus multiplication have come. (Descriptions of some elegant studies on the details of the multiplication of RNA bacterial viruses may be found in the paper in this volume by Weissmann and his collaborators.)

Nevertheless, this book gives examples of the considerable ingenuity which has enabled plant virologists to learn some of the early events that take place in a virus-infected cell. For example, Siegel has pioneered in the inactivation of the infection center with

ultraviolet light as a means of timing the early events in the removal of viral coat protein and the subsequent multiplication of the infectious entity. Shlegel has applied autoradiographic techniques to locate the intracellular site of viral RNA multiplication; Bald has used the phase-contrast microscope to record the changes that take place in living cells following infection; and Hirai has taken epidermal tissue stripped from infected leaves to study the effect of virus infection on the metabolism of those cells which first receive the virus in a leaf.

This book would be a worthwhile addition to the library of specialists in the field. Unfortunately, some of the shorter research papers do not reach the standards of most of the review papers in the volume. The discussions that followed the presentations are not included; these might have helped to clarify some of the research papers where the work is often sketchily described.

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Studies of the Cell Cycle

Cell Synchrony. Studies in Biosynthetic Regulation. IVAN L. CAMERON and GEORGE M. PADILLA, Eds. Academic Press, New York, 1966. 408 pp., illus. $15.

"We hope that the suspicion that cell synchrony was at best an unnatural, artificial, and possibly specious occupation for cell biologists will have been dissipated once and for all." Thus the closing sentence of the preface to this volume crystallizes an attitude which, if not actually prevalent, certainly existed among many biologists. Fortunately, however, this critical attitude also existed among those working with cell synchrony techniques, and they may indeed be held to be their own most severe critics. This volume, as well as a preceding volume, *Synchrony in Cell Division and Growth* [E. Zeuthen, Ed., Wiley (Interscience), 1964], contains ample testimony to the efforts which those engaged in using cell synchrony techniques have made to insure that their populations are ergodic and that the responses observed accurately portray those to be expected in populations in general. The point has, in most cases, been well proven.

The earlier volume was an attempt to cover this new field in a comprehensive way and includes natural synchrony, induced synchrony, and selection of synchronous groups of cells. The book is divided into four sections entitled, respectively, Synchrony of Cellular and Nuclear Division in Tissues, Synchrony of Cell Division in Microorganisms, General Considerations, and Technical Procedures. It describes synchrony in no less than six classes of cells: bacteria, yeast, algae, ciliates, amoebae, and tissue cells.

The newer book developed from a symposium held at Oak Ridge in 1964 [*Science* **147**, 175–77 (1965)] and presents a broad cross section rather than a complete treatment of current work using synchrony techniques. Some of the speakers at the symposium did not contribute to the volume. Among those who did contribute, some expanded their symposium papers to form comprehensive discussions of their subjects; others apparently did not. This results in a lack of uniformity among the presentations, and for this reason alone most readers will not find all the chapters of equal interest or quality.

Nevertheless, there is much here to interest not only those concerned with and utilizing synchrony techniques, but all concerned with cell cycle phenomena. The book emphasizes, rather than methods of synchrony, results obtained with synchronous populations on the changing patterns of macromolecular synthesis during the cell cycle. Interesting data are presented on this matter for a variety of organisms, including *Bacillus subtilis, Escherichia coli,* yeast, a plasmodial myxomycete, *Euglena,* diatoms, *Chlorella,* root meristems, *Astasia longa, Tetrahymena,* and HeLa cells. The chapter on cycle variations in sulfhydryl groups by Dan is of unusual interest. Studies in mammalian cells, inevitably relegated to later chapters in the book, could profit from further expansion.

The subtitle of the book is particularly apt, for the book properly treats synchrony as a means to an end. Synchrony has, however, some features which deserve treatment for their own sake, and some of these (and a summary of methods) have been well outlined in the introductory chapter by James and in a paper on the theory of synchronous cultures by Engelberg and Hirsch. Evidence of the rapidly advancing sophistication of this technique comes from the introspective distinction between "synchronous" and "synchronized" cultures pointed out by James and by Halvorson *et al.* (chapter 6). The two terms, however, are not always used with such discrimination in later chapters of the book.

The book is pleasingly free of errors. One, of perhaps no more than personal moment to the individuals concerned, is the citation on page 354 of two independent members of the clan Sinclair as one and the same.

Molecular biologists and others should be aware of the contents of both this book and the earlier volume by Zeuthen, even though not all chapters will interest them equally. Many will find this volume impressive in the variety of synchrony techniques available and as a cross section of current results on variations in macromolecular synthesis throughout the cell cycle.

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Monograph on Glycoproteins

Glycoproteins. Their Composition, Structure and Function. ALFRED GOTTSCHALK, Ed. Elsevier, New York, 1966. 644 pp., illus. $35.

The field of glycoprotein research has reached the stage where it can stand on its own merits. The progress in the field and the development of appropriate methodology point to the future with confidence, as this volume, one of the first oriented predominantly toward the glycoproteins, demonstrates. The book covers the major phases of investigation on glycoproteins, including their distribution, isolation, physical chemistry, and structural analysis. It is a valuable source book more for the researcher in biochemistry, chemistry, and biophysics, the graduate student, and the teacher than for the clinician or biologist; it points the direction for future emphasis (biosynthesis and isolation of specific tissue glycoproteins), and it describes appropriate analytical techniques.

The introductory chapters deal with general methodology; the later ones treat individual glycoproteins in detail. The book covers a broad spectrum of the relevant literature through 1964 (and early 1965 in the addenda following most chapters). A historical introduction, not often included in such books, provides a valuable perspective.