ideals of systematic mechanization and progress. An enormous debt was owed to the Renaissance engineers by those, for example, who were to find fundamental physical law in the free fall of a stone. Gille demonstrates this forcefully toward the end of this extremely well-wrought volume by bringing the circle of our understanding to a close with the reminder that Galileo was one of them.

HARRY WOOLF
Department of the History of Science, Johns Hopkins University, Baltimore, Maryland

Physical Adsorption

The Solid-Gas Interface. E. ALISON FLOOD, Ed. Dekker, New York, 1967. Vol. 1, xviii + 514 pp., illus. $21.75; vol. 2, xvi + 661 pp., illus. $27.50.

This two-volume treatise brings together knowledge of essentially all aspects of physical adsorption of gases on solids, and at the same time treats the subjects in depth. The work consists of 37 chapters written by various authors, and each volume is concluded with a commentary on its contents. There is some overlap of subject matter among the chapters, but for the most part this duplication is useful in that a different point is emphasized in each chapter. Chemisorption is not comprehensively covered, but it is mentioned in many parts of this work; likewise, liquids are treated in relation to certain topics such as sorption.

After a historical survey of the study of adsorption, volume 1 goes on to cover most of the basic phenomena and the theory of adsorption. Subjects dealt with include thermodynamic analyses of adsorption, treatments which lead to the BET (Brunauer-Emmett-Teller) and other classical isotherms, adsorbent-adsorbate interaction forces, surface energy and structure, adsorbate equations of state, and lattice theories. The papers range from complete derivations and lucid discussions (for example, of Gibbs's isotherm) to more abbreviated developments, but each is complete in itself. Also covered in volume 1 are heats of adsorption and immersion, surface cleanliness, and very-low-pressure adsorption.

Volume 2 covers the various methods and techniques used to study surfaces and adsorbed layers and also covers sorption and transport properties of gases on or through solids. Among the methods discussed are dielectric, magnetic, optical, infrared, nuclear magnetic and electron paramagnetic resonance, Mössbauer, and low-angle x-ray scattering studies. A discussion of semiconductor surfaces complements the electronic studies. Adsorption accompanied by dimensional and other physical and mechanical changes is reported on, as are theories of pore structure. Ways in which pore structure and adsorption influence the interaction of gases and solids are discussed in chapters on chromatography, accommodation coefficients, and adsorption hysteresis. Active carbon, perhaps the most frequently used adsorbent, is given a chapter by itself, but otherwise the work is arranged according to the method or theory employed.

These volumes adequately present the principles of the various methods used to study adsorption in addition to comparing the various applications of these techniques. They also provide generous quantities of experimental results which are used to evaluate and test experimental studies and theoretical descriptions of adsorption, as well as to characterize adsorption phenomena. The treatise admirably fulfills its aim of combining theoretical and experimental results from a wide range of disciplines relevant to adsorption. It is readable and should be immediately useful to all workers in this field. The specialized researcher and the graduate student alike can gain a nearly complete background in physical adsorption from this treatise.

TERRELL N. ANDERSEN
Department of Chemistry, University of Utah, Salt Lake City

Technique in Protein Chemistry

Cross Electrophoresis. Its Principle and Applications. SHOJIRO NAKAMURA. Shoin, Tokyo, 1966; Elsevier, New York, 1967. x + 194 pp., illus. $17.

This little book, describing a modification of the usual paper electrophoresis procedure, demonstrates what can be done with imagination combined with a thorough knowledge of the technique. A recent issue of an authoritative journal devoted to biochemical research contained 20 papers (out of a total of 37) which could have been significantly improved by the use of paper or gel electrophoretic methods. More certainty of results, economy of experimenter's time, and reduction of material consumed are all desirable objectives in any experimental technique. This book provides evidence, which can easily be extended, that these objectives can be achieved by use of paper and gel electrophoresis techniques.

Why are these techniques used so ineffectively, if at all? Why, for example, do we continue to see the homogeneity of a protein preparation "demonstrated" by ultracentrifugation —or even by free-solution electrophoresis—when the example of the serum albumin polymers proves the superior resolving power of gel electrophoresis? Why is there not more use made of discontinuous buffer systems, two-dimensional gels, or ion-exchanger gels, all of which can contribute significant information, including some that cannot be obtained from any other experimental procedure?

One reason may be the absence of electrophoresis experiments in the usual undergraduate biochemistry courses. Another may be the tendency of the modern molecular biologist, accustomed to using digital computers and nuclear magnetic resonance, to look with disdain upon electrophoretic procedures: the apparatus is inexpensive (often homemade), the mathematical theory does not go beyond high school algebra, the results are little more than qualitative. Worst of all, good results demand more artistic talent than scientific technique. Whether or not these strictures are valid, the consequence is a serious deficiency of interest in electrophoresis methods, and failure to apply them as useful laboratory procedures.

Perhaps these characteristics of electrophoretic methods are really advantages. I myself prefer paper and gel methods to free-solution electrophoresis just because of them. At any rate, such purported deficiencies do not diminish the usefulness of the technique Nakamura describes in the present work.

I must confess that, on first reading this book, I was appalled by the opportunities I have missed. For years I have tried to eliminate "artifacts" and irregularities from my electrophoresis patterns, the object being to produce paper or gel electrophoresis patterns as much like the standard free-solution electrophoresis pattern as technical control can make them. Nakamura has perceived that deviations from the expected pattern are not after all purely accidental: they are the predictable results

of experimental factors in the system—predictable if we know enough about the system. By designing experiments so as to maximize (under proper control) the appearance of "artifacts," and by carefully distinguishing those due to the intrinsic nature of the migrating species from those due to extrinsic effects (temperature, physical condition of the paper, *p*H, and others), Nakamura has developed methods of great sensitivity and wide applicability in the study of the interactions of proteins with other proteins and with smaller molecules.

The basic idea is very simple: two substances are brought together and caused to interact by appropriate application of electrophoretic migration and endosmotic flow in a paper sheet or gel slab. The crucial interaction may be preceded by a preliminary one- or two-dimensional electrophoretic separation. Interaction is shown by distortions of the pattern compared to patterns in which interaction is absent. Semiquantitative estimates of interaction can be derived. The results are similar in some aspects to those obtained by thin-layer chromatography or gel filtration, but cross electrophoresis affords increased experimental control through the additional variables of electrophoretic mobility and geometrical design.

The Japanese group have applied their procedures to the study of diphtheria toxin, snake venoms, concanavalin A (a protein reacting specifically with a wide variety of other proteins), curare and other drugs, tissue proteins, trypsin inhibitors, enzymes, and substrates. Out of 140 references to this work, 120 are available only in Japanese. (There are also 260 background references.) This book will therefore be almost wholly new material to most of its readers. It will well repay careful study followed by practical application.

SAMUEL RAYMOND
University of Pennsylvania Hospital, Philadelphia

The Cell Cycle

Control of Cellular Growth in Adult Organisms. A Sigrid Jusélius Foundation symposium, Helsinki, Oct. 1965. H. TEIR and T. RYTÖMAA, Eds. Academic Press, New York, 1967. xxiv + 434 pp., illus. $17.50.

Here is a book that is both timely and out of touch with the times. It is timely because, increasingly, critical attention must be paid to the cell cycle and its controls, to mechanisms of cell replication and their role in differentiation, and to the maintenance of balance between cell loss and cell reproduction in the adult—in relation to aging, malignancy, and tissue repair. It is out of touch with the times not just because two years were required for publication but because many of the 30 articles were "old" when they were presented. It is true that the problems themselves are old—and difficult, as difficult as ever before. However, a symposium should provide an occasion for restating the problems in modern terms (which, if it is done well, can be a considerable accomplishment) and for effecting a synthesis of old and new. This book falls short of these objectives. The fault lies principally with the authors, but the editors must be held responsible for including articles that are trivial. At the root of the problem is the insistence of funding agencies, societies, and scientists themselves that the proceedings of symposiums be published in full. Usually the papers of invited speakers are accepted without critical review. Few are ever declined. Should the only "required" publication from a symposium be a brief "meeting report"? If that were the case, then speakers who wished to do so could submit review articles to the regular review journals, where they could compete for space.

The weakness of this volume does not mean that the subject lacks interest or importance. The basic question whether the mechanisms controlling cell replication in the tissues of vertebrates, including kidney and liver, muscle and nerve, conform to a common pattern remains unanswered. Is the genome in adult muscle or nerve completely and irrevocably "closed" or repressed? If not, what DNA-directed functions remain active? Following infection by polyoma and Rous sarcoma viruses, DNA synthesis is initiated in mature muscle, in vitro. But what part of the DNA is synthesized? What is the mechanism of "closure" of the genome? Are there, as is argued by Osgood, Glinos, Iversen, and Bullough and Laurence, among others, tissue-specific "chalones," functioning in tissue autoregulation?

There are a few highlights in the volume. For example, R. J. Goss, whose own book *Adaptive Growth* effectively covers much of the same ground as this volume, has provided an excellent introductory chapter, "The strategy of growth." On the whole, however, the volume falls short. Possibly those already working in the field may find it useful, in a limited way, but it is not sufficiently clear or critical to serve as a source for students of cellular, developmental, and molecular biology who should be entering the field.

JAMES D. EBERT
Department of Embryology, Carnegie Institution of Washington, Baltimore, Maryland

Organic Chemistry

Topics in Stereochemistry. Vols. 1 and 2. NORMAN L. ALLINGER and ERNEST L. ELIEL, Eds. Interscience (Wiley), New York, 1967. Vol. 1, xii + 254 pp., illus., $12.50; vol. 2, xii + 252 pp., illus., $12.50.

One of the major changes in the nature of organic chemical studies in the last decade has been the introduction of mechanistic concepts, which has enabled workers to predict and to rationalize the results of a wide variety of seemingly unrelated chemical reactions. The recognition of the stereochemical consequences of molecular reactions can be likened to a keystone, supporting the structural edifice of physical organic chemistry. During the last five years a number of thought-provoking textbooks on stereochemistry and conformational analysis have been published. It is particularly appropriate at this time that a secondary reference source has become available, not only to deal with "advances" in the field but also to supply greater detail and a critical review of topics that could not be treated at the introductory level. Such is the intended function of *Topics in Stereochemistry*. The series is meant for the teacher, the advanced student, and the researcher and presumes a knowledge of stereochemistry and conformational analysis at the level of *Stereochemistry of Carbon Compounds* (Eliel, McGraw-Hill, 1962) and *Conformational Analysis* (Eliel, Allinger, Angyal, and Morrison, Interscience, 1965). Each of the articles contains a detailed bibliography including references to introductory material that pro-