cerned with the alteration of images by interposition of various types of masks in the diffraction field between object and image. The variety of results available is essentially unlimited, and the entire theory of linear filtering, a major area by itself, becomes the theoretical basis for the process.

The principal topics of the book are tied together by introductory discussions of diffraction and coherence. The chapters are self-contained and therefore may be taken up in any order.

EMMETT N. LEITH
Institute of Science and Technology, University of Michigan, Ann Arbor

Gas-Phase Chemistry

Unimolecular Reactions. P. J. ROBINSON and K. A. HOLBROOK. Wiley-Interscience, New York, 1972. xviii, 372 pp., illus. $19.95.

Unimolecular reactions are those in which a single chemical species decomposes or rearranges. In gases, these are the ones whose rates are most susceptible to theoretical explanation and prediction. They have been studied since the beginning of modern physical chemistry, and the field has been a model of how science ought to work. There have been a 1928 theory so far ahead of its time as to remain the standard treatment for 30 years, a rivalry between two mutually exclusive successors, a resulting outburst of inspired experimentation, and a culminating synthesis of ideas well described in this book.

The coverage of literature is extremely complete. Every piece of work of any surviving importance is there. The thoroughness with which the theoretical development is surveyed does not, however, detract from the experimentalist's outlook that characterizes the book. It is primarily about how to apply the fully developed theory.

The earlier treatments are introduced in a way which might at first lead the uninitiated reader to suppose they are still under test. This notion is quickly dispelled by the main part of the book, in which the authors undertake to induce people to make more widespread use of the theory. They do this by presenting a carefully structured general framework and a detailed analysis of the mathematical complexities that arise in practice. Best of all, they lead the reader by the hand through a complete "RRKM" calculation for a realistically chosen example. These parts alone are enough to sell the book. The reader who already has experience in unimolecular chemistry will turn first to the absolutely mandatory appendix A—comparison of the notational eccentricities of the principal researchers. In its later chapters, the book is an exhaustive survey of experimental results, including descriptions of chemical activation and of isotope effects.

It is hard to find anything to criticize. The authors have in a footnote anticipated my objection to calling the molecule's reactive configuration an "activated complex." An illustration of the confusion this engenders is the appearance and disappearance of maxima in their potential energy diagrams, which may perplex some readers. Imaginative solution chemists can also use the theory, and the authors might have given them a little more encouragement.

The book is billed as a text. Besides this, I think it will remain an important reference work for many years to come. Its publishers have produced it with a promptness that I hope will be diligently imitated by others. I was astonished to find on page 103 the very recently discovered molecule that may be the herald of the next round of surprises in this rich and unpredictable area of research.

DON BUNKER
Department of Chemistry, University of California, Irvine

Plant Problems

The Dynamics of Meristem Cell Populations. Proceedings of a conference, Rochester, N.Y., Aug. 1971. MORTON W. MILLER and CHARLES C. KUEHNERT, Eds. Plenum, New York, 1972. xviii, 310 pp., illus. $19.50.

Years ago I was told by a famous animal cell biologist that root tips made such good experimental material because all the cells were the same. This volume clearly and emphatically makes the case that plant meristems, both roots and shoots, are far more complex than even the most knowledgeable assumed a decade or two ago.

This volume ranges over a variety of topics concerned with meristems: their physiology, their dynamics, and the effect of radiation on them. The contributors include John Torrey, Jack Van't Hof, Elizabeth Cutter, Ernest Ball, F. A. L. Clowes, D. Davidson, Francesco D'Amato, Alan Haber, and others. The papers themselves contain large numbers of facts and are thoroughly documented. One of the most interesting, however, is one by J. R. K. Savage and M. W. Miller that is essentially a theoretical treatment of the problem of the heterogeneity of the cell population with regard to the collection of data. They deal specifically with radiation and chromosomal aberration, but the problems they discuss are applicable to many other situations.

Despite the obvious qualifications of the authors and the importance of the topics, the volume as a whole is disappointing. Many of the data presented have already been published, yet the papers are written as research reports rather than reviews. Moreover, little effort has been made to interest the reader in the topics. At least half of the papers are unnecessarily difficult to read. The transcribed discussions at the end of the papers could just as well have been left off for all they add of either information or interest.

More important than the writing is the feeling of frustration generated in the reader. The problems are there, even more problems than a few years ago, yet the answers seem no closer. The quiescent center in roots is a good example. As the papers by Torrey, Clowes, and Davidson make abundantly clear, the quiescent center exists and many of its characteristics are known in great detail. Yet, we still do not know its function. Torrey's proposal that it is the center of cytokinin production is interesting, but one made at least ten years ago and still no more than an interesting hypothesis.

The field of plant development is an exciting one, but if this volume is any indication it has gotten bogged down in details, and new, different approaches will be needed to answer the many questions that remain.

WILLIAM A. JENSEN
Department of Botany, University of California, Berkeley

Research on Muscle

Muscle Biology. A Series of Advances. Vol. 1. R. G. CASSENS, Ed. Dekker, New York, 1972. x, 300 pp., illus. $17.50.

This volume is based on a lecture series sponsored by the Institute of Muscle Biology in Wisconsin. There are

ten papers, mostly reviews of original work in the authors' laboratories.

Experiments bearing on the exciting question of the etiology of muscle disease are reported in several papers. Hereditary muscular dystrophy is an affliction that strikes young children and cripples them to the extent that most die by age 20. Despite the efforts of hundreds of researchers and physicians, the root cause of the disease remains a mystery. It was long dogma that skeletal muscle lacked the ability to regenerate, until Studitsky and his school in the Soviet Union made the remarkable observation that implanting minced muscle fragments into the original muscle bed results, a few months after the operation, in a new, full muscle. In this book Carlson summarizes his own research and gives a full bibliography for this phenomenon, studies of which are not well known in the United States. Shafiq *et al.* compare the morphological aspects of human (Duchenne) and chicken muscular dystrophy. They find a muscle hypertrophy in the early stages of the disease which may also be related to the regenerative activity of the muscle. Current theories on the pathogenesis of hereditary muscular dystrophy assume either a myogenic or a neurogenic origin. Engel and Warmolts, impressed by small groups of regenerating myofibers typical of early Duchenne dystrophy, put forth the novel suggestion that the disease may be related to a defect in microcirculation. Shafiq *et al.*, using a battery of histochemical and electron microscopic techniques for comparison of various fiber types, find no difference between normal and dystrophic muscle; this speaks against the neurogenic origin of the disease.

A half-century of research on the relationship between heat production in muscle and the breakdown of adenosine triphosphate and phosphocreatine is expertly reviewed by Mommaerts, whose laboratory contributed much to this field. Stainsby and Barclay summarize the rather small quantity of literature on oxygen uptake measurements in muscle energetics. Brady, a pioneer in the analysis of force-velocity relations in heart muscle, discusses reasons why these are considerably more complex than the hyperbolic equation of A. V. Hill, which is the cornerstone in the physiology of skeletal muscle.

The dynamic area of muscle biochemistry is a neglected part of the book. Taylor and Lymn present high-quality studies on the pre-steady state of the myosin adenosine triphosphatase, and relate their results to the mechanism of muscle contraction.

Smith and Ovalle review intrafusal muscle fibers, to date a largely neglected subject. In contrast, Marshall's work on adrenergic neurotransmitters in the uterus adds to the already extensive knowledge on this tissue. Finally, Goldberg describes attempts to study growth and atrophy of skeletal muscle in terms of amino acid metabolism and protein turnover.

The individual articles often serve as good starting points for learning about a specialized area of muscle biology. This book is a useful reference.

MICHAEL BÁRÁNY
Department of Contractile Proteins, Institute for Muscle Disease, New York City

Blood Formation

Haemopoietic Cells. D. METCALF and M. A. S. MOORE. North-Holland, Amsterdam, and Elsevier, New York, 1971. xiv, 550 pp., illus. $41.50. Frontiers of Biology, vol. 24.

The authors present in a comprehensive manner modern concepts relating to hemopoietic cells and their development. One of their major intents is to delineate advances in the investigation of hemopoiesis that have prompted radical revision of formerly established views regarding the origin of blood cells. In addition, emphasis is placed on the mechanisms, both humoral and nonhumoral, concerned with the control of hemopoietic cell differentiation, proliferation, and maturation.

Previously held ideas that fixed populations of cells arise and develop in the blood-forming organs appear no longer tenable. Description is given of the relatively new evidence that continuous replacement of hemopoietic cells (with the possible exception of the bone marrow) occurs by migration of stem cells between different compartments of adult and embryonic hemopoietic organs. Since difficulty is still being encountered in identifying morphologically the spectrum of stem cells, it is natural that assiduous attention has been given in this volume to the description of techniques for exploring the functional potentialities of these primitive cells. These procedures include the in vivo spleen colony technique for detection of multipotential stem cells, the polycythemic mouse assay for the assessment of erythropoietin-responsive cells, the in vitro granulocyte-macrophage colony assay for determining the progenitor cells of these cell lines, and the focus test for antigen-sensitive cells derived from lymphoid precursors. The multipotential stem cell is preferably considered as an element endowed with properties for extensive replication and differentiation into various blood cell lines. The progenitor cell, also ancestral in nature, is defined as one limited to development along a specific line, an event triggered by specific humoral factors.

Emphasis in the text is placed on the role of the hemopoietic organ microenvironment in providing an internal milieu for the formation of progenitor cells from those with multipotentiality. The hemopoietic microenvironment may operate in this regard through endoderm-ectoderm inductive interactions in the yolk sac and fetal liver and between endoderm and ectoderm followed by epithelial-mesenchymal induction in the bursal and thymic environment. More complicated developmental interactions are envisioned to occur in the spleen and bone marrow, in which vascular and mesenchymal components comprise the determining microenvironment. Experiments are cited that lend support to the importance of cell-cell interactions probably involving contact with specific receptor sites at cell membranes, in establishing the hemopoietic environment necessary for differentiation of the multipotential stem cells. The suggestion is made that the microenvironment may induce the appearance of specific receptor sites at the surfaces of stem cells rendering them now responsive to only one type of humoral regulator. With regard to the latter control, the authors review the convincing evidence that humoral factors play a primary role in stimulating progenitor cell differentiation and possibly proliferation. Adequate description is given of the extraction, properties, and mechanisms of action of erythropoietin and the colony-stimulating factor. It is of interest that both of these factors are glycoprotein in nature with molecular weights in the vicinity of 45,000. This suggests the possibility that such humoral agents possess a common biologically active core with specificity of action derived from specific prosthetic groups attached to this core. Passing attention is also paid to the role of other humoral principles including the leukocytosis-inducing fac-