conceptual framework for laboratory studies, theory, and simulations of magnetic reconnection. However, no consensus has emerged on the microscopic processes responsible for departures from ideal magnetohydrodynamic behavior that are required for reconnection. The roles of kinetic instabilities, inertial effects, finite gyroradius effects, and more remain to be clarified. A subsidiary theme of the volume is the process of particle acceleration, which appears in many contexts, from laboratory devices to solar flares. Plasma waves and turbulence, wave-particle interactions, anomalous resistivity, and double layers are all discussed from several points of view. Again, there is little consensus on the relative importance of various processes.

The volume emphasizes theory, with no comprehensive review of relevant observations. Aside from the two reviews of laboratory reconnection experiments, there are two papers on spacecraft observations of flux transfer events and flux ropes and one on microwave observations of solar flares. There are no reviews of x-ray and optical observations of solar flares, although such observations are mentioned many times. Many of the contributions do not even cite the observational literature, let alone discuss it.

On the other hand, theory is very well summarized in the volume. The papers dealing with solar flare theory and astrophysical jet theory collectively provide a comprehensive view of the state of these subjects in 1983. Space physics is not as well covered; however, the proceedings of another conference, *Magnetic Reconnection in Space and Laboratory Plasmas* (Edward W. Hones, Jr., Ed., American Geophysical Union, 1984), complement the present volume with only minor overlap. The other volume provides a more complete account of reconnection in laboratory and solar system plasmas, from both theoretical and experimental points of view, but the present volume contains far more extensive treatments of microscopic plasma physics and astrophysical plasmas.

I enjoyed a number of the papers. The first chapter, by Sonnerup, contains as lucid an exposition of "classic" magnetic reconnection theory as I have ever seen. A review of coronal heating mechanisms by Heyvaerts and one of solar flare mechanisms by Priest are also excellent. A paper by Huba contains a useful summary of microinstabilities, and a paper by Coroniti contains a fascinating exploration of plasmas in accretion disks around black holes. A summary chapter by Vasyliunas provides an illuminating overview and commentary.

Most of the volume will be difficult reading for graduate students or for workers outside plasma physics. The volume will be most useful as a reference and a summary of current theoretical work in magnetic reconnection and plasma physics of solar flares and astrophysical jets. The discussions following each of the papers will be valuable to practitioners who understand the technical nuances, but an outsider may still find it difficult to separate the wheat from the chaff. The volume is recommended to libraries and to plasma physicists of all persuasions.

A. F. CHENG
*Applied Physics Laboratory,*
*Johns Hopkins University,*
*Laurel, Maryland 20707*

## Ecological Disequilibria

**The Ecology of Natural Disturbance and Patch Dynamics**. S. T. A. PICKETT and P. S. WHITE, Eds. Academic Press, Orlando, Fla., 1985. xvi, 472 pp., illus. $49.

Students of ecology have long divided into two schools of thought. Some have emphasized the equilibrial balance of nature whereas others have underscored a history of seemingly unnatural acts of geology, weather, and humans. The equilibrial view has received more attention from theorists because equilibrial models are more tractable, but it has become increasingly apparent that disturbance, on many scales of time and space, is a regular and natural component of real communities. The avowed purpose of this book is to compile and synthesize the scattered information on disturbance and patch dynamics in natural communities and ecosystems. The synthesis is weak, but the compilation is excellent. The 21 chapters by 29 contributors define most of the conceptual issues and give a representative sample of the best empirical studies. The book also serves as an annotated bibliography of over 1700 references.

The book begins with an introduction and ends with a synthesis by the editors. The burden of these two chapters is a system of conceptual definitions and a shopping list of measurements to be made in the real world. Pickett and White's definitions of disturbance and patch dynamics are necessarily vague because they must span three orders of magnitude in time and ten in space. Nearly the full range may be found at once in a single community. An annual disturbance in a square centimeter may be important for mosses on a forest floor, while the canopy trees may record the history of a hundred-year storm that devastated a thousand hectares.

If definitions are difficult to devise, the measurement of patch dynamics is a horrendous undertaking. Nevertheless, the first and last major sections of the book, on patch dynamics in nature and on their implications for the functioning of communities, record painstaking and elegant measurements. James Runkle makes the simple but powerful observation that for a wide range of temperate-zone forests the average rate of disturbance of canopy dominants is about the same, namely once in 300 to 500 years. It is the severity of disturbance and its dispersion in time and space that generate the extreme variations in life history that are apparent from one forest to another. Vertebrates are not exempt from variation in regimes of disturbance, despite the fact that they are often cited as archetypal denizens of equilibrium communities. John Wiens reviews the responses of vertebrate populations in arid lands to variation in climate, and James Karr and Kathryn Freemark review similar phenomena as found even in wetlands and tropical forests. Variation at a given scale of space and time may be interpreted at another scale as a mosaic or sequence of equilibria. Examples are given for marine communities on rocky shores and reefs by Joseph Connell and Michael Keough and for the flows of energy and nutrients in coniferous forests by Douglas Sprugel. The important observation that variation at one scale is equilibrium at another should be generalized to apply to many other communities, but nowhere in the book is this done.

The middle section of the book is the most successful at the conceptual level. Taking as its subject Adaptations of Plants and Animals in a Patch Dynamic Setting, it is concerned with the biological functions of all the properties that have been defined and measured. In particular, Charles Canham and Peter Marks explore patterns of branching architecture and seed dispersion that adapt woody plants to various configurations and spatial distributions of gaps in a forest. Timothy Schowalter draws an elegant and convincing picture of how fire, beetles, and gradients of moisture interact to produce a changing mosaic of pines and hardwoods in Texas and discusses how the regularity of this pattern is affected by variation in the climate. Population genetics in patchy environ-

ments is reviewed, compactly and necessarily superficially, by Robert Vrijenhoek for animals and by Kevin Rice and Subodh Jain for plants.

In brief, this is a patchy collection of individually very good papers, with an entry into a huge and fascinating empirical literature and a scattering of excellent small insights into a field that is still searching for its conceptual organizing principles. It will be of most use to specialists and advanced students. Unfortunately there are still vestiges of an artificial dichotomy between equilibrial and dynamic schools of ecology. The very title of this book predisposes it toward the dynamic school. The importance of the spatial and temporal scale of patch dynamics is made explicit, but equilibrial processes may be important at other scales. Perhaps readers of this book will absorb both its explicit and its implicit lessons and take a role in developing a still broader conceptual view of patchy environments.

HENRY S. HORN
*Department of Biology,*
*Princeton University,*
*Princeton, New Jersey 08544*

## A Success of Medical Science

**Penicillin**. Meeting the Challenge. GLADYS L. HOBBY. Yale University Press, New Haven, Conn., 1985. xxii, 319 pp., illus. $32.50.

The history of penicillin is one of the most dramatic tales of the success of modern medical science. Much written about, it has been used as a demonstration of everything from the serendipitous nature of laboratory investigation (as witness Fleming's initial discovery of the moldy petri dish in 1928) to the benefits of wartime intensive project organization. Many participants in the events have published their accounts and numerous biographies have been produced. Most of these works have championed one or another interpretation, giving more or less credit to Alexander Fleming, or to Howard Florey, or to one or another of the institutions or corporations involved. Some historians have tried to make sense of parts of the picture, but few have fought through the extensive literature and interviewed on all sides of the still raging disputes. Hobby's general history has elements of all the earlier approaches but extends beyond a narrow focus or too partisan an approach. Herself a central participant in two major early experimental phases of the development, at Columbia University and at the Pfizer Corporation's successful large-scale production laboratory, Hobby has achieved a remarkably broad perspective.

Its collaborative nature may be the aspect of the story that is most difficult to appreciate. The agility with which scientists leapt to collaborate, complaining when hampered from sharing their research, might almost call in question the individualistic character of research. The excitement of transatlantic flights limited to VIP's and blacked out to hide from view the D-Day troops massing near the southern coast of England, the calculations with millions of dollars as large corporations together assessed the risks of involvement, the miraculous victories over bacterial endocarditis—these are the stuff of high drama. But collaboration had its seamy side, too. Questions about the appropriateness of sharing everything among the British and American scientists still plague those who will see pencillin as a British discovery unfairly commercialized in the United States. Disputes among the pioneers and their champions emerged repeatedly, most noticeably when knighthoods, Nobel prizes, and other awards were meted out. The chagrin of British manufacturers at having to pay royalties to American companies for mass production techniques long soured memories.

In no other single source are all these elements explained more fully, though considering the broadminded coverage of events a more dispassionate analysis might have been expected. In contrast to some British versions, this is an American perspective: "It was American ingenuity, U.S. dollars, and U.S. production acumen that led to penicillin's availability as an effective chemotherapeutic drug" (p. 281, note 1). Gratuitous as that may seem, Hobby supports the point well, and not without sympathy for British participants, despite her claim that there was a "strong conviction on the part of British investigators in the 1920s and 1930s that chemotherapy of bacterial infections was absurd and should not be contemplated" (p. 125). Similarly, Hobby believes that, simply because there was a clear need for effective antibiotics, penicillin would certainly have emerged some time around the years it did. This is a peculiar view to hold, especially given that the main point of this history is that special circumstances combined to create an international collaborative effort.

Even so, this is a valuable contribution to a most interesting story. Hobby has assured its utility by the numerous tables and graphs, the clear exposition of necessary technicalities, and the appendixes of economic and corporate data. This will not be the final word on the history of penicillin, but it presents more information more clearly than any predecessor.

JONATHAN LIEBENAU
*Business History Unit,*
*London School of Economics,*
*London WC2A 2HD, England*

## Books Received

**Biomass Energy**. A Monograph. Edward A. Hiler and Bill A. Stout, Eds. Published for the Texas Engineering Experiment Station, The Texas A&M University System, by Texas A&M University Press, College Station, 1985. x, 313 pp., illus. $32.50. The Texas Engineering Experiment Station Monograph Series, no. 2.

**Botany**. An Introduction to Plant Biology. Mathew Nadakavukaren and Derek McCracken. West, St. Paul, Minn., 1985. xxii, 591 pp., illus., + plates. Paper, $25.95.

**C for Personal Computers**. IBM PC, AT&T PC 6300, and Compatibles Based on Microsoft and Lattice Compilers. Narain Gehani. Computer Science Press, Rockville, Md., 1985. xiv, 301 pp. Paper, $19.95. Principles of Computer Science Series.

**Calcium and Contractility**. Smooth Muscle. A. K. Grover and E. E. Daniel, Eds. Humana, Clifton, N.J., 1985. xx, 487 pp., illus. $64.50. Contemporary Biomedicine.

**Catecholamines as Hormone Regulators**. Nira Ben-Jonathan, Janice M. Bahr, and Richard I. Weiner, Eds. Raven, New York, 1985. xiv, 382 pp., illus. $39.50. Serono Symposia Publications from Raven Press, vol. 18.

**The Catskill Delta**. Donald L. Woodrow and William D. Sevon, Eds. Geological Society of America, Boulder, Colo., 1985. viii, 246 pp., illus. Paper, $32. Geological Society of America Special Paper 201. From a symposium, Kiamesha Lake, N.Y., March 1983.

**Cell Culture in the Neurosciences**. Jane E. Bottenstein and Gordon Sato, Eds. Plenum, New York, 1985. xx, 383 pp., illus. $49.50. Current Topics in Neurobiology.

**Cell Surface Science in Medicine and Pathology**. E. N. Wardle. Elsevier, New York, 1985. viii, 607 pp., illus. $60.

**Contaminated Land**. Reclamation and Treatment. Michael A. Smith, Ed. Plenum, New York, 1985. xxii, 433 pp., illus. $65. NATO Challenges of Modern Society, vol. 8.

**Contemporary Astronomy**. Jay M. Pasachoff. 3rd ed. Saunders, Philadelphia, 1985. xx, 479 pp., illus., + plates + appendixes. Paper, $22.95. Saunders Golden Sunburst Series.

**The Continental Crust**. Its Composition and Evolution. An Examination of the Geochemical Record Preserved in Sedimentary Rocks. Stuart Ross Taylor and Scott M. McLennan. Blackwell Scientific, Palo Alto, Calif., 1985. xvi, 312 pp., illus. Paper, $23. Geoscience Texts.

**Contributions of Modern Biology to Medicine**. New Approaches to Pathogenesis, Diagnosis and Therapy in Immunological and Haematological Disorders. U. Bertazzoni, F. J. Bollum, and M. Ghione, Eds. Raven, New York, 1985. xii, 249 pp., illus. $34. Serono Symposium Publications from Raven Press, vol. 17.

**Control and Dynamic Systems**. Advances in Theory and Applications. Vol. 22, Decentralized/Distributed Control and Dynamic Systems, Part 1 of 3. C. T. Leondes, Ed. Academic Press, Orlando, Fla., 1985. xx, 398 pp. $55.

**Control of Communicable Diseases in Man**. Abram S. Benenson, Ed. 14th ed. American Public Health Association, Washington, D.C., 1985. xxvi, 485 pp. Paper, $9. Interdisciplinary Books, Pamphlets and Periodicals for the Professional and the Layman.

**Controlled Hypotension in Neuroanaesthesia**. D. Heuser, D. G. McDowall, and V. Hempel, Eds. Plenum, New York, 1985. x, 229 pp., illus. $35. From a symposium, Tübingen, Germany, Sept. 1981.

**Controlling Events in Meiosis**. Clive W. Evans and Hugh G. Dickinson, Eds. Published for the Society of Experimental Biology by the Company of Biologists, Cambridge, England, 1984 (distributor, Biochemical Society, Colchester, England). viii, 394

*(Continued on page 466)*