are sections for six different geographic areas, illustrated by many excellent photographs, and a shorter seventh section on Antarctica and continental drift.

The first section, on the Scotia Arc and Antarctic Peninsula, contains a review paper emphasizing the considerable effort that the University of Birmingham has devoted to studying the structure beneath the Scotia Sea and relating it to adjacent land. Magnetic lineations indicating a center of sea floor spreading in the eastern Scotia Sea are reported. A second review paper, and other papers, illustrate the recent advances in the geology and geophysics of the Antarctic Peninsula and suggest similarities to the Andean structure of southern South America. There are seven papers from Chile on the South Shetland Islands.

The second section is on western Antarctica, which includes Marie Byrd Land, bordering the South Pacific Ocean, and Ellsworth Land, south of the Antarctic Peninsula. Two distinct orogens are recognized—one in each of these two regions. Active volcanoes are still found in Marie Byrd Land. The United States has long been active in this part of the southern continent and contributed ten papers on this region. Here also Chile's interest is reflected, in four contributions.

The Transantarctic Mountains divide western from eastern Antarctica, the eastern part being the larger and containing the south geographic pole. These mountains pass just south and west of the Ross Sea and constitute much of Victoria Land, which forms the western margin of the Ross Sea. Because of McMurdo base nearby U.S. scientists have studied localities in Victoria Land extensively. That area fits against southeast Australia in continental reconstructions. Fifteen contributions are presented on this region by the U.S. scientists. These include one by E. H. Colbert, who presents a review on Antarctic tetrapods, especially the Triassic land-dwelling reptile *Lystrosaurus*, the fossil distribution of which in the Southern Hemisphere suggests continental drift.

The largest section of the book is devoted to the eastern Antarctic. Much of this area is unknown because of ice cover, which approaches 3 kilometers in places. Rock exposures near the coast of the South Indian and southeastern Atlantic oceans have led to a concentration of geologic studies there. The Soviets have been by far the most active in this sector. There are, however, contributions from ten countries, including important ones from the Republic of South Africa. For the interior of the continent a few radio-echo soundings beneath the ice cover are reported. These show, among other important topographic features, the buried Gamburtsev Mountains. Seismic refraction profiles have been made across the eastern part of the continent. In places they show lower crustal velocities as shallow as 4 kilometers below sea level. The United States has shown relatively little scientific interest in the area. Eight review articles, four by Russian scientists, offer a good opportunity to compare theories of the geology of this massive area.

A short section on the Southern Ocean, here meaning the far South Pacific Ocean, reports results from the ship *Eltanin*, which was operated by the National Science Foundation. Most of the marine geophysical results have been reported elsewhere. They provide strong support for the theory of sea floor spreading. Other papers report on deep sea sediment studies. Unfortunately the *Eltanin* has recently been taken out of service, and the far South Indian and Atlantic oceans will not receive the study which has been devoted to the Pacific sector of the Southern Ocean.

Intensive geological studies on the sub-Antarctic Islands of the Atlantic and Indian oceans have been undertaken by geologists of the University of Paris. Here they report on the petrology and geochemistry of a dozen islands extending from Macquarie Island south of New Zealand to Tristan da Cunha in the South Atlantic.

The concluding section on continental drift contains little new information but is of value since it reviews existing theories with emphasis on the special role of the Antarctic continent in these theories.

To echo one of the authors, "Although its scientific exploration began less than 80 years ago, Antarctica is destined to play a fundamental part in establishing the geological history of the Southern Hemisphere." The intense international effort on the southern continent as well as the recent results of the *Glomar Challenger* drilling program in Antarctic waters is showing the truth of that statement.

J. R. HEIRTZLER
Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, Massacushetts

The Leaf

Analysis of Leaf Development. ROMAN MAKSYMOWYCH. Cambridge University Press, New York, 1973. xiv, 110 pp., illus. $12.50. Developmental and Cell Biology Series.

Most human metabolic activity is sustained by the activity of leaves. In fact, the energy transductions carried out by leaves support the bulk of terrestrial life. By any engineering standard, a photosynthesizing leaf is a marvel of efficiency. It is no wonder that photosynthesis and other processes carried out by the leaf have engaged the attention of numerous investigators. What is surprising is that, since the appearance of Avery's classical paper on tobacco leaf development in 1933, relatively little research has been carried out with intact leaves following an undisturbed course of development.

The splendid little book by Roman Maksymowych, the result of over ten years of research, deals with the day-to-day activity of leaf development. The book begins with a description and discussion of the leaf plastochron index (LPI), a quantitative indicator of leaf development, then proceeds to describe both the morphological and the accompanying physiological changes in terms of the LPI. It is puzzling that the leaf has not elicited more attention from developmental biologists: In dicotyledonous plants leaf morphogenesis follows a pattern much more characteristic of animal than of plant growth. The leaf attains a fixed size and has a finite life span. Its development is tightly programmed: cell division, enlargement, differentiation, functioning, and finally senescence. The descriptions should be helpful not only to developmental biologists but also to any investigators whose research involves leaves, such as physiologists working on photosynthesis, photoperiodism, or other effects of light, or horticulturists applying chemical sprays to leaves—the book will help such workers understand better the material they are working with. In addition, considering the fact that leaf development provides a model, and that leaves during various stages of development synthesize a variety of esoteric compounds from hormones to complex phenolics, other scientists would profit by glancing through this book. This reviewer was enlightened by the brief chapter on respiration, which describes the increase in oxygen consumption with cell maturation, a phenomenon of interest to those devel-

opmental biologists who consider shifts in redox potential to be associated with corresponding shifts from the juvenile to the mature state. Other chapters proved similarly useful. If the reviewer's interests constitute a representative sample, then it is clear that Maksymowych's small, concise volume should serve as a standard reference work for a wide spectrum of biological scientists.

TOM STONIER
Laboratory of Plant Morphogenesis, Manhattan College, Bronx, New York

Organophosphorus Chemistry

Organic Phosphorus Compounds. G. M. KOSOLAPOFF and L. MAIER, Eds. Wiley-Interscience, New York, 1972. Four volumes. Vol. 1, xiv, 546 pp., illus. Vol. 2, viii, 508 pp., illus. Vol. 3, viii, 500 pp., illus. Vol. 4, viii, 532 pp., illus. Each volume, $29.95. Second edition of *Organophosphorus Compounds.*

This treatise is an attempt to review much of the chemistry of organophosphorus compounds, primarily as it has developed since the publication of Kosolapoff's *Organophosphorus Compounds* in 1950. Not all topics of current active research are included, for individual authors have primarily addressed themselves to subjects of their own immediate interest. However, in my opinion, the editors have succeeded well in selecting authoritative authors and, by choosing subjects that cross many disciplines, they have made the volumes widely useful. The general style employed in Kosolapoff's earlier volume has been utilized, with syntheses, reactions, and structure-properties relationships as the primary concerns. Lists (referenced) of all reasonably well-identified compounds, and properties thereof, are included at the ends of the chapters. Particularly appealing is the inclusion, along with common physical properties, of infrared, ultraviolet, nuclear magnetic resonance, and gas liquid chromatography data, with references where available, for specified compounds. Such information was not available in 1950.

The literature coverage appears to be comprehensive up to 1970. The chapter on phosphines (vol. 1) is followed by a rather complete bibliography of monographs and review articles which could well be appropriate for most of the other chapters.

In view of the limited commercial availability of organophosphorus compounds, the chapter on phosphines and the two on phosphorus halides (vol. 4) seem especially valuable, since the methods of preparation they describe are often simple and these classes of compounds serve well as precursors of many other organophosphorus chemicals of theoretical, biological, and pharmaceutical interest.

Catalytic properties of metal complexes of several phosphorus compounds are discussed lucidly in several chapters (vols. 1 and 2). In view of the importance of homogeneous catalysis by transition metal-phosphine complexes, for example, for nitrogen fixation models, the chapter (vol. 1) on these complexes is welcome. It is likely somewhat outdated as a result of the three-year publication lag, but it is the most inclusive in the area through 1969.

In summary, this reviewer has found this set of four volumes to be well written and well referenced, and the information on the various compounds easy to locate. Scientists working directly in the field, and others who employ phosphorus reagents in their research, will find these books invaluable.

K. D. BERLIN
Department of Chemistry, Oklahoma State University, Stillwater

Insect Embryology

Developmental Systems: Insects. S. J. COUNCE and C. H. WADDINGTON, Eds. Two volumes. Vol. 1, xiv, 304 pp., illus. $18. Vol. 2, xiv, 616 pp., illus. $27.50. Academic Press, New York, 1972–73.

These two volumes are the beginning of a projected series dealing with different developmental systems. Many students of insect development have been waiting impatiently for their appearance, since for over a year papers have been published referring to them. The delay in publication has made it necessary for several contributors to add appendices updating their articles. It is hoped that the publisher will be able to expedite publication of subsequent volumes.

The first volume describes the normal processes of oogenesis and embryogenesis in different insect groups and concludes with a chapter on polyembryony. The coverage of morphology does not extend into postembryonic development.

A. P. Mahowald discusses in a clear and masterly way cytological and biochemical events during oogenesis in different insects. The development of the primitive insects (Apterygota) is covered by C. Jura in a purely descriptive manner. Most of the work on this subject was published in the last century, and Jura's chapter clearly demonstrates that even though many interesting observations were made they have not stimulated much recent investigation. A descriptive analysis of embryonic development in holo- and hemimetabolic insects is given by D. T. Anderson. He presents a clear and comprehensive picture of the complex and diverse material. The eccentric reproductive mechanism of polyembryony is covered by O. M. Ivanova-Kasas. Unfortunately, new findings are scarce in this area and many of the hypotheses (for example, the formation of asexual larvae) need further clarification.

The second volume emphasizes experimental studies and covers topics that have again become subjects of major research efforts during the last two decades. S. J. Counce brings together an abundance of experimental data in her causal analysis of insect development. Early embryogenesis is under the control of different centers, the cleavage center, the activation center, and the differentiation centers; however, the molecular nature of these centers and the applicability of this concept to all species remain unresolved.

The integument of insects is an excellent system for studying the development of spatial patterns. P. A. Lawrence presents clearly the concept of the gradient model and the many experiments which have led to it.

The imaginal disks of *Drosophila melanogaster*, a system used to analyze a variety of problems in developmental biology, are reviewed by W. J. Gehring and R. Nöthiger. The authors discuss superbly the state of determination, its stability and alterability. They also describe mutants which have been used to analyze the control of disk development.

The literature on insect hormones is highly contradictory in many aspects. This is obvious, for example, with regard to the nature of the "brain hormone" (ecdysiotropin) and the activation of the corpora allata in adults. W. W. Doane here clarifies and evaluates many of the data after carefully considering the conflicting literature.

These volumes are of great value in many respects. Even though a variety