be appreciated? There are many fine papers among the 14 contributions assembled here, admirable both as reviews and as stimuli for further research. The laudable trusteeship of Maheshwari, who has fostered many students and many studies, is evident. Additionally, there are workers becoming worthy of recognition for consistently fine production. To mention selected names would only be invidious, for many chapters are excellent. The chapters dealing with so-called descriptive aspects are the best, and demonstrate that, instead of reaching a point of exhaustion, embryology is opening unexpectedly broad vistas for new research. Because recent studies show relationships with physiology, cytology, genetics, and plant breeding, the editor's hope that this book will reach a wider audience is reasonable. The editor has deliberately cultivated a spectrum of interests, and the reader is likely to find much of value in the taxonomic and genetic implications. One brief chapter, which deals with a problem in morphogenesis and offers predictions of what evidence will be needed and prophecies of what will be found, should have been omitted, however.

SHERWIN CARLQUIST
Claremont Graduate School, Claremont, California

Satellite Probes

Space Physics. Donald P. LeGalley and Alan Rosen. Eds. Wiley, New York, 1964. xx + 752 pp. Illus. $25.

This book, which contains 18 "chapters" first presented as lectures in a statewide series sponsored by the University of California in the spring of 1964, answers a need that has been growing during the past few years for an organized, effective presentation of the physics of our space program. The editors and the 19 contributors are outstanding men in their fields and well qualified for their roles as authors; they have correlated their efforts and present an integrated coverage of the subject. The book is divided into four basic parts: Experimental Techniques for Space Physics, Solar and Planetary Physics, Fields and Plasmas in Interplanetary Space, and High Energy Radiation in Space.

For the scientist, the book will provide an excellent review of rocket and satellite experiments as well as the pertinent theory for understanding the results. An advanced background in physics is generally required for complete appreciation of the many topics. However, the beginner in the field can follow the general outlines, and he can refer to the excellent bibliography for further study. In many chapters there are concise theoretical developments of certain topics not previously presented in unified form; thus, the nonspecialist can quickly achieve an insight that will prepare him for original research in the space field. The problem of the solar plasma is an example.

Space engineers will find the book valuable as an aid in the design of spacecraft and instruments for space physics research. Part 1, which is devoted to general problems of this kind, presents knowledge acquired from space experiments to date. Throughout the book, along with the physics of the experiments, the authors make frequent reference to details of specialized instruments and to the basic engineering problems involved.

The technical administrator will welcome the many hints about worthwhile problems for research. Most of the chapters conclude with a summary of the state of progress in a given field and with suggestions for experimental programs. Despite the large number of contributors, the book is basically well written, and the reader can obtain qualitative understanding without appreciating all the mathematical and esoteric details. Naturally, since many of the topics are particularly difficult, there are some exceptions. The excellent introductory chapter is a fine general review of the broad features of the various past and present space programs that have yielded results in scientific missions.

A partial list of the specific topics covered in the book includes radiation spectrum of the sun; physical and chemical aspects of the atmospheres of the planets, including the earth; observational and theoretical results of aurora measurements; micrometeoroids; interaction of the geomagnetic field in the solar plasma; interplanetary magnetic fields, hydromagentic waves; trapped-radiation zones; effects of high-altitude explosions; solar and general cosmic rays in space; and problems of radiation hazards in space.

In most chapters the historical background for the topic is sketched, so that the reader may become quickly familiar with the evolution of the topic during the years before the advent of space measurements (Sydney Chapman's chapter, "Aurora and geomagnetic storms," is a case in point). As one reads further in a given chapter, the enormous contribution of the space age is thus more forcefully apparent. The book will inspire enthusiasm for the importance of the space effort to date, and for its continuation as a necessary component of our search for solutions to many problems in the understanding of our natural environment.

WILLIAM A. RENSE
Laboratory for Atmospheric and Space Physics, University of Colorado

A General Reference Source

The Harper Encyclopedia of Science. vols. 1–4. James R. Newman, Ed. Harper and Row, New York, 1963. 1379 pp. Illus. $35.

There is, no doubt, always room for another well-done general reference work on science, and *The Harper Encyclopedia* fulfills its editor's avowed intention of producing a useful work for the "common reader"—that is, the student, the teacher, and the nonspecialist.

This new work with its four Britannica-sized volumes occupies a middle ground between the one-volume encyclopedias and its longer and considerably more expensive rival in the field, the 15-volume *McGraw-Hill Encyclopedia of Science and Technology*.

Despite its title, articles in the Harper encyclopedia are well divided between science, narrowly defined, and technology. Substantial space is given to articles on medicine, engineering, and photography, for example. And what might be viewed as auxiliary subjects, such as logic and the history and philosophy of science, figure fairly prominently among the 4000 articles.

In general, the editor has adhered to his announced policy of opting for longer and fewer articles, and the reader is seldom compelled to pursue a subject back and forth through the four volumes. The credentials of the 450 authors are impeccable, the prose is clear, and the editor seems to have been quite successful in pruning the articles of nonessentials. Difficult subjects, however, have not been oversimplified or popularized.

The volumes are attractively de-

signed. The charts and diagrams are good, and it is only occasionally with the color photographs, which are liberally used, that visual rather than illustrative values appear to have influenced the choice of a picture.

The encyclopedia's machinery is serviceable. Indexing is adequate, cross-referencing is not irksome, topics usually are found where the reader expects them, and a 16-page bibliography points the way for those whose appetite has been whetted for more information.

An encyclopedia must ultimately be judged on the basis of its usefulness, and the experience of using the Harper encyclopedia for several months has led this nonspecialist to expect to find what he needs.

JOHN WALSH
American Association for the Advancement of Science

Chemical Engineering

The Theory of Recycle Processes in Chemical Engineering. M. F. Nagiev. Translated from the Russian edition (Moscow, 1958) by R. Hardbottle. R. M. Nedderman, Ed. Pergamon, London; Macmillan, New York, 1964. xiv + 278 pp. Illus. $15.

Fundamental concepts of the recycle processes used in chemical engineering are discussed in this book. In the petroleum and chemical industries it is common practice to separate the reaction products from the unconverted fresh feed by distillation, extraction, and crystallization when equilibrium limits the degree of conversion or prolonged exposure of the products in the reactor causes undesirable side reactions. These basic principles are developed in considerable detail in the text.

Apparently the author is more mathematician than chemist because many of the minor but important interactions that occur in recycle processes are not mentioned, but when he deals with a single straightforward reaction, such as light hydrocarbon isomerization, where no by-products are formed, the mathematical derivations are especially useful. However, important parameters in olefin alkylation by isobutane, for example, inlet olefin concentration, emulsion stability, and product quality, which are altered by degree of isobutane recycle, are not considered. In other processes, portions of the reactor effluent—hydrogen in destructive hydrogenation processes, for example—are recycled to control the temperature, to alter viscosity of oil, to maintain catalyst activity, and to improve the contact between the feed and the catalyst. For similar reasons in other processes, the value and effect of recycling are far beyond the elementary weight balance considerations expounded by the author.

Unfortunately thermal recycle cracking of light and heavy petroleum fractions is used as an illustrative example in several chapters; this obsolete process is no longer used in modern petroleum refineries. Other factors also make it a poor choice—the interactions that occur and the change in quality of the recycle feed with operating variables, conversion per pass, and efficiency of separation of products. Consequently, the operating conditions and yields must be established by experiments and cannot be predicted from general principles.

As the author notes, mathematical studies of this type are necessary to facilitate automatic control of processes and optimization of operating conditions with competitors. Of course, when many parameters are involved, laboratory data are necessary for confirmation, or only a small portion of the process would be subjected to analysis or control.

The translation is excellent. The English is easily read, and industrial terms are used. One exception is the "round" cracking process, which is merely recycle thermal cracking.

C. E. HEMMINGER
Esso Research and Engineering Company, Linden, New Jersey

Pharmaceutical Chemistry

Modern Inorganic Pharmaceutical Chemistry. Clarence A. Discher. Wiley, New York, 1964. xii + 636 pp. Illus. $12.

With the major emphasis in the pharmaceutical field on synthetic organic chemicals, or natural products, it is easy to forget that a whole area of science is concerned with the pharmaceutical applications of inorganic compounds. Discher's book is intended to vitalize the teaching of inorganic pharmaceutical chemistry, and he presents a different approach to the subjcet, because, as he states in the preface ". . . too often [the course on] inorganic medicinals has become just another chemistry course with some pharmaceutical overtures. . . ." In the main, the author has succeeded in presenting a new approach; students should enjoy using this text.

The book is divided into three parts, consisting of five, six, and nine chapters, respectively. The first, and by far the best section, begins with some elementary statements and soon leads into an elegant review of modern concepts of inorganic chemistry. Structure of molecules, their properties, and the background for reactions are well described. The fourth chapter, which includes acids and bases, is especially well done. Only the fifth chapter, on inorganic nomenclature, needs improvement; this discussion should have been presented much sooner.

Part 2 is concerned with "inorganic chemistry in the practice of pharmacy." Water as a solvent and as a unique chemical is adequately covered. Owing to the review of acids and bases in part 1, the concept of buffers is easily followed. The material on solubilities of pharmaceuticals is well written. An unusually long, drawn-out section on silicates concludes part 2.

In the third section acids and bases are again considered in the material on *p*H control. Basically this section, however, is concerned with inorganic therapeutics, trace elements, and electrolytes.

The author has certainly met his objectives in presenting a readable and well-organized book. He has provided basic chapter outlines, review questions, and some bibliography. The criticisms of the book are minor in comparison to its good points. Some will disagree with the choice, on page 78, of chromium rather than ferrocene, which is a better example. Also, the cyclopentadienes are not positioned correctly. But perhaps the most annoying feature is the use of arrows, pointing up or down, to show gases or precipitates. Wrong impressions can easily be given with this archaic system of notation—for example, on page 339, the implication is that hydrochloric acid gas will be liberated when sodium chloride is treated with *dilute* sulfuric acid. It should not be necessary to represent easily dissociable electrolytes as charged molecules—for example, Na^+Cl^-.

ARTHUR FURST
Institute of Chemical Biology, University of San Francisco