A point of minor criticism is that the titles—*Uranium Process Metallurgy* and *Uranium Corrosion and Alloys*—do not correctly convey the contents of the volumes, which are far broader than their titles imply. About one-half of the first volume is devoted to the extractive metallurgy of uranium and its purification and reprocessing as a fuel material; the other half is devoted to powder metallurgy, fabrication, and safety practices with uranium. Only the first 100 pages of the second volume's 700 pages cover corrosion; the remainder is devoted primarily to physical properties of uranium alloys. Valuable appendices at the end of the second book include crystallographic data on uranium compounds and 40 binary phase diagrams for uranium alloy systems. There is some duplication between Wilkinson's volumes and Holden's earlier monograph, *Physical Metallurgy of Uranium* (Addison-Wesley, 1958). However, Holden covered, in the main, the properties of pure uranium, whereas Wilkinson places emphasis on the properties of alloys.

The price of the volumes—volume 1 is $18 and volume 2, $16—will prevent a mass buying spree by average scientists, but the books certainly belong in all technical libraries, and they should prove invaluable to those involved in the field of uranium research and technology.

O. D. SHERBY
Department of Materials Science, Stanford University

Comparative Anatomy

Chordate Morphology. Malcolm Jollie. Reinhold, New York; Chapman and Hall, London, 1962. xiv + 478 pp. Illus. $8.75.

Although fighting rearguard actions may be more popular in biology than in certain other scientific disciplines, one seldom sees the task accomplished with such conspicuous gallantry as Malcolm Jollie displays in his new *Chordate Morphology*. At a time when comparative anatomy has already been dropped from the undergraduate curriculum of more than one great university, Jollie has produced a big new book devoted to the factual basis of vertebrate morphology and morphogenesis. The 475 double-columned pages of his handsome new volume carry an almost unrelieved recital of facts, covering everything from the tip of the os carunculae to the end of the gephyrocercal tail.

The book proceeds in the traditional manner from a survey of the vertebrate classes through the several organ systems. About a third of the volume is devoted to the skeleton, with considerable attention being given to extinct forms. Among the extant vertebrates not only the species familiar to comparative anatomy courses but also an impressive array of less well-known species are described in detail. For example, the skulls of more than 40 vertebrates are illustrated from different aspects. The chapters on the soft parts similarly deal with numerous representatives of all vertebrate classes.

Chordate Morphology resembles most recent comparative anatomy texts in that some space is given to developmental considerations. Chapter 7 deals with cleavage, gastrulation, and body formation in frog and chick, but also manages to include matters like the development of *Clavelina, Torpedo,* and *Epatretus*, among others, as well as placentation in the dogfish, lizard, and opossum. Since the chapter is 23 pages long, it is not necessary to say that the topics are treated superficially. Nor is early development presented in a way that provides the student with any basis for understanding the descriptions which are included of the development of organ systems. For example, the derivatives of the visceral arches and pouches are dealt with in several chapters; but the embryonic visceral arch system itself is not even mentioned.

In other respects *Chordate Morphology* represents a reversion from current trends in teaching comparative anatomy. With the exception of the chapter on the integument, there is no treatment of histology. Physiological considerations fare even worse. The respiratory functions of both gills and lungs are covered in 78 words.

The value of Jollie's book will depend entirely on the use that is made of it. Well-illustrated and on the whole carefully and accurately composed, the volume is an excellent source of information on vertebrate structure. As a reference work, or as a text for advanced courses, *Chordate Morphology* will be of real service. But its relentless terminology, its esoteric detail, its avoidance of generalization (except in a brief prologue and epilogue) make it altogether unsuitable for use by innocent sophomores whose initial interest in comparative anatomy arises from the fact that the course is the next item in the curriculum. As an assigned text in the hands of such students, the book is most likely to serve as an instrument for throttling a budding interest in biological science.

FLORENCE MOOG
Department of Zoology, Washington University, St. Louis, Missouri

Applied Kinetics

Chemical Reaction Engineering. An introduction to the design of chemical reactors. Octave Levenspiel. Wiley, New York, 1962. xv + 501 pp. Illus. $10.75.

In recent years the steady improvement in our understanding of the effects of physical conditions on the course of chemical reactions, coupled with a greatly increased knowledge of chemical mechanism and with the availability of high-speed computers to overcome the mathematical difficulties involved, has paved the way for detailed kinetic analysis of almost every chemical reaction now utilized in large-scale production or intended for such use. This new book could play a major rôle in convincing both experienced engineers and neophytes that such analyses should be made and in helping them to know how to proceed.

Levenspiel deals primarily with the physical factors that have been the most neglected in the previously published texts. The book's title is taken from the name of two international symposia (Amsterdam, 1957 and 1960), and their proceedings are reflected in the contents, along with much additional related literature. The topics treated include an introduction to reactor design, holding time and space time, multiple-reactor systems, optimum temperature progression, residence-time distribution of fluid in vessels, axial dispersion, characteristics of a fluidized bed, and contacting patterns for two-phase systems. In the chapters on noncatalytic fluid-solid reactions and heterogeneous fluid-fluid reactions more attention is given to the interrelation between material-transfer rates and chemical kinetics than in previous texts.

On the chemical side, Levenspiel presents a survey of introductory kinetics that is somewhat more complete than

the treatment usually found in elementary textbooks on physical chemistry. In a chapter on the design of multiple reactions, he considers certain typical situations and introduces the student to general approaches for handling such systems. His treatment of solid-catalyzed fluid reactions is relatively concise. A wealth of problem material is provided, but very few of the problems relate to experimental data on true-to-life systems. The majority of the problems deal with the old friends A + B; inkahol and googliox are also represented.

In order to provide adequately rounded instruction for chemical engineering students, supplementary material on chemistry must be used with Levenspiel's text. For example, catalysis is presented as an insoluble mystery, and he gives no indication that a catalyst must provide a new reaction path in which it enters molecularly.

Despite certain shortcomings, this text appears to accomplish its objectives more successfully than any other available for chemical engineers. One major virtue is that it does not use the case method of instruction. The numerous illustrative examples are just that, and the principles that they embody are explained carefully in the preceding text.

THEODORE VERMEULEN
Department of Chemical Engineering, University of California, Berkeley

Multidisciplinary Forum

Physical Sciences: Some Recent Advances in France and the United States. Hartmut P. Kallmann, Serge A. Korff, and Sidney G. Roth, Eds. New York University Press, New York, 1962. ix + 243 pp. Illus. $7.50.

Much is said these days about the economic miracle that has occurred in Western Europe since World War II. Coupled with this is the new level of international cooperation among the European countries, symbolized by the Common Market and the North Atlantic Treaty Organization. While it is true that the structure is threatened by what may be called de Gaulleism and related *isms*, such as that which caused the United Kingdom to resist the formation of the Common Market in the first place, one feels that this story will have a happy ending once those who grew to maturity in the atmosphere of nationalism which prevailed before 1914 leave the scene and a younger generation takes its place on the stage.

Parallel to the emergence of a new spirit in Europe has been a renaissance of science in France on a scale that is truly remarkable. Historically speaking, no one need apologize for French science, as one well might for science in the United States prior to 1900. Names such as Descarte, Fermat, Lagrange, Laplace, Fresnel, Pasteur, and de Broglie speak for its vitality since the time the Western world first turned to science. Nevertheless, a sequence of events did make French science more stagnant than the opportunities of recent decades merited. This book is a modest tribute to the new spirit that promises to provide France, and the rest of the world, with all of the scientific productivity of which the French people are capable. The volume is based on a conference, held in New York City 2 years ago and sponsored by New York University with the financial backing of the Sloan Foundation, at which a dozen French and American scientists addressed themselves to a number of subjects of mutual interest. Some of the topics were general, such as those concerning the organization of support for science, including government financing and education; others were specialized, such as those devoted to radio astronomy, solid state physics, magnetic resonance, geology, and hydraulics. The treatment is by no means encyclopedic. Rather it seems to have generated an atmosphere in which the traditional amity between France and the United States shines alongside some accounts of the successful struggle going on in France to enhance the support of science.

The opening chapter, by Pierre Piganiol, to whom de Gaulle in 1958 gave the task of leading a study of science and technology in France (Piganiol served as delegate general of scientific and technical research and reported directly to the prime minister), gives a vivid and detailed account of the governmental apparatus designed to support and stimulate all aspects of science. It should be added that Piganiol has since left this arduous post after bringing about very great and productive reforms. I had the good fortune to live in Paris at the height of Piganiol's tenure in office and to witness first-hand both the operation of his group and the widespread, intelligent discussion of his work which was held throughout the country in all channels of public communication. Those who are interested in such matters will find the book worth reading for this chapter alone.

Both Richard T. Arnold and George D. Stoddard contributed essays on general aspects of research and education; Arnold's essay is entitled "Trends in academic and industrial research," and Stoddard's, "Education for science."

The remaining chapters deal with special fields of science; individuals from the two countries described progress in research in the special areas mentioned earlier. As is often the case with a symposium volume, the different contributions are uneven, since the angle of vision of the different authors is different. Each reader must determine the extent to which he is interested in any particular contribution. The American contributors are Serge A. Korff, Fred Haddock, N. Bloembergen, J. H. Van Vleck, J. Joseph Lynch, and Hunter Rouse; the French are Jean Denisse, J. C. Pebay-Peyroula, Louis Néel, Georges Millot, and L. Escande.

FREDERICK SEITZ
National Academy of Sciences, Washington, D.C.

Bibliographed Syllabus

Biological Transport. Halvor N. Christensen. Benjamin, New York, 1962. viii + 133 pp. Illus. $6.50.

This modest volume is a welcome addition to the growing literature on biological transport processes. Halvor Christensen, who has made valuable contributions to this field over a period of many years, is well qualified to write on the subject. He has succeeded admirably in his intention to write a book which "should be interpreted more as a bibliographed syllabus" for the instruction of graduate students in the biological sciences "than as a review." The monograph contains chapters on the scope of the problem, concepts and terms, the kinetic approach to transport, the specificity of transport, site isolation-membrane separation, clues from associated events, nutritional and genetic approaches, and the endocrinology of transport; there is a general summary which includes some cogent specula-