isolate and describe the chief symptoms of the developing pattern of settlement. But the city is the setting of much of human activity—in the United States seven out of ten persons live in cities. Though Gottmann realizes that the "dynamics of urbanization" are largely economic, there is no economic "dynamics" in his volume. Social and political forces are even more sketchily introduced. The mapping of the extension of settlement and the drift of densities gives us the symptoms, the surface phenomena. The social data developed in the chapter "Living and working together" leads to no particular insight into the social forces of the new megalopolis. In the important task of laying bare the workings of the city, Gottmann's book is inferior to the economic reports of Hoover and Vernon and the political case studies of Banfield and his students. The social dynamics of the suburb and the urban village must be found elsewhere, chiefly in the work of Gans.

As a contribution to the studies of spatial occupancy, however, this is an important, perhaps monumental, compendium crammed with useful, and often suggestive measures of the form of settlement that is coming to dominate the American, and perhaps the world, scene.

Applied Mathematics

Numerical Methods for Scientists and Engineers. Richard W. Hamming. McGraw-Hill, New York, 1962. 411 pp. Illus. $11.

"The purpose of computing is insight, not numbers" is the slogan frequently shouted in this delightful, very readable, intermediate book on numerical methods. Except for a few cases, such as in the computation of engineering design data, few of those experienced in numerical analysis will disagree with the tenet that the vast disgorgements of electronic computers are not ends in themselves. Unfortunately, the computer user, under pressure to deliver early answers, seldom has time for reflection on the choice and careful planning of the computational aspects of a program. Thus, the author does a potentially receptive readership a service by repeating this maxim often.

That the author is concerned with the significance of the numerical output of a computer is most amply illustrated by his presentation of a variety of effective methods for treating errors that arise in many sorts of computations. Round-off errors (or computational pseudonoise), goodness of fits of polynomial approximations for variously spaced data, a method for finding error terms of general formulas, errors in numerical quadrature and in numerical solutions of ordinary differential equations as well as their stability and instability, least squares, Fourier approximations, curve fitting, filtering by numerical "band-limited" functions, and errors in approximation by sums of exponentials are some of the topics ably dealt with. The author also gives several practical heuristic alternatives to the frequently used and frequently pessimistic upper bounding of errors by sums of upper bounds on the component errors.

A certain air of informality that, with the exception of *Practical Analysis* by C. Lanczos, is seldom encountered in books on numerical analysis is exuded by the author's frequent remarks about his experience and by his opinions. Here and there one sees neat tricks of the trade and finds discussions of topics not usually found in texts—for example, the summation of series and the above-mentioned band-limited functions. Simplicity is a guiding principle throughout the text; huge computational examples do not appear, and the use of special operators is kept to a minimum. For greater depth of treatment on a number of topics it is necessary to consult such books as those of Householder, Hildebrand, Kopal, Collatz, Henrici, Forsythe, Durand, and Nörlund and perhaps also to consult journal articles. Hamming's presentation includes many suggestions and allusions, but not quite enough elaboration in many places. He is, however, very careful to call attention to this, and he supplies ample references for further intensive treatment.

A few negative aspects, primarily on the point of emphasis, should be mentioned here. Although the author indicates (on page 8) that old-style interpolation is rarely used, he makes considerable use of the method in chapter 1; some is necessary, but perhaps not all. Space devoted to Stirling numbers and the digamma function could have been used to provide information on continued fractions, a useful tool in modern efficient approximations, and more attention could profitably have been given to other topics—linear algebraic numerical problems, boundary value problems, eigenvalues, and summation of slowly convergent series of positive terms. Moreover, at least something might have been said about partial differential equations. The interaction between word length in a computer and the method chosen for the solution of a problem is not noted. This is a serious omission in a text concerned with methods for use on large-scale digital computers. With the exception of questions related to stability, round-off noise may be overemphasized; in fact, its treatment is a bit inconsistent with the hint (on page 39) that possibly its intensive analysis is a waste of time. Finally, the poor treatment accorded Monte Carlo methods should have been omitted, for extensive literature on this field is available.

This is not a cookbook or a reference book, and it will possibly require amplification (of its depth of treatment and examples) by an instructor if it is to be used as a textbook. However, with such amplification, it would be a very usable and admirable text. It could well be considered a supplement, or more aptly a complement, to other textbooks, and it will be a worthwhile part of a computing man's library.

M. L. JUNCOSA
RAND Corporation,
Santa Monica, California

Intermediate Astronomy

Fundamentals of Celestial Mechanics. J. M. A. Danby. Macmillan, New York, 1962. xiii + 348 pp. Illus. $8.

Good textbooks on intermediate astronomy are in short supply these days. It is a great pleasure, therefore, to find that I can recommend highly Danby's new text on celestial mechanics. This clearly written book covers, in 14 chapters, all the celestial mechanics with which every professional astronomer and senior space scientist should be acquainted. It covers no more because, as the author states in the preface, it aims to be a direct elementary text rather than an encyclopedia.

The book begins with a chapter that defines the astronomical terminology to be used later; the next two chapters

cover vectors and vector mechanics; and the remainder of the text deals with the subjects that are now quite standard in a beginning course on celestial mechanics: the two-, three-, and n-body problems, properties of solid and fluid bodies, perturbations, the motion of the moon, and the determination of orbits. In addition, there is a worthwhile chapter on numerical procedures and errors, which students, subjected to the rigors of lengthy calculation for the first time, should find most valuable.

Danby has a very lucid and entertaining style of writing which should soon make this text a favorite of astronomy instructors in many universities and colleges. Throughout the book there are numerous problems and examples and at its end there are handy appendices and an adequate index.

Although this text is not intended to be the successor to Moulton's classic, it undoubtedly will, in future years, be seen on many reference shelves. After comparing it with Moulton's book, I find *Fundamentals of Celestial Mechanics* a more practical, more humanely written treatise that will serve as a valuable text in many courses.

WILLIAM LILLER
Department of Astronomy, Harvard University

Surveys of Pharmacology

Progress in Medicinal Chemistry. vol. 1. G. P. Ellis and G. B. West, Eds. Butterworth, Washington, D.C., 1961. ix + 262 pp. Illus. $11.25.

Advances in Pharmacology. vol. 1. Silvio Garattini and Parkhurst A. Shore, Eds. Academic Press, New York, 1962. xi + 474 pp. Illus. $13.

For many years a serious shortage existed in the literature pertaining to pharmacology, but suddenly the void is being filled at an exceedingly rapid rate. New books, journals, and compendia appear so frequently that it now becomes necessary to consider whether each new progress, advance, or whatever, actually has anything new to offer or is merely a duplication. Each of the books reviewed here is the first volume of a new series. I do not believe either has a counterpart in the existing literature.

Progress in Medicinal Chemistry is written for organic chemists and biochemists whose interests center on the pharmacological testing of compounds. Pharmacologists may be interested in the techniques by which new compounds are tested as potential drugs. Six topics are covered in some detail: pharmacological screening tests, hypotensive agents, tranquilizers, diuretic drugs, oral hypoglycemic drugs, and antifungal agents. In each instance the need for a particular type of therapy is discussed first, and this is followed by a brief description of the physiology of the organ under consideration and how its function may be modified by a drug. Although this section is, at times, too brief, it still may help the chemist understand the apparent mechanism of the drug's action. Some chapters are enhanced by biochemical explanations of the mechanism of action.

Each chapter includes excellent coverage of the drugs that have been found clinically useful. The side effects of some of the drugs are noted; in view of the present-day concern, this section could well be expanded in future volumes. An extensive bibliography completes each chapter.

Medicinal chemists are quite often concerned with the synthesis of new compounds as potential drugs, but authoritative references describing the biological tests to which these compounds must be subjected are scattered in various journals and, thus, are hard to find. This need is well answered in the *Progress* series.

Advances in Pharmacology, produced under the guidance of an international board of editors (a virtual "who's who" in the field) is written for advanced students and active workers alike. Of its eight chapters, four deal with drugs as related to hyperlipidemia, hypertension, mental illness, and anticoagulation; three, with general topics—drug metabolism, the binding of amines to tissues, and the effect of naturally occurring amines on the gastrointestinal tract—and the introductory chapter, with a new interpretation of the adrenergic nerve fiber. Each is a complete unit, with adequate charts, formulas, and tables. Particularly useful are the excellent outlines preceding each discussion and the remarkably up-to-date references.

The appearance of *Advances* will at once raise the question, "How does this series compare with the *Annual Review of Pharmacology?*" [reviewed in *Science* **137**, 663 (1962)]. They are different types of series, and can certainly supplement one another. *Annual Reviews* covers a topic over a finite span of years. *Advances* covers a single topic in depth. That the two series are in no way in competition can be seen from a detailed comparison of their tables of contents: *Advances* overlaps the first two volumes of the *Reviews* in only two short sections. A comparison of the references cited again shows that the overlap is slight. In fact, the editor of one is writing a review for the other.

Both *Progress in Medicinal Chemistry* and *Advances in Pharmacology* are well printed and quite free of typographical errors. The formulas are easy to read, and no blurred tracings confuse the issue. I recommend both highly for the pharmacologist, and the former especially for the chemist.

ARTHUR FURST
Institute of Chemical Biology, University of San Francisco

Personality and Perception

Psychological Differentiation. Studies of development. Herman A. Witkin *et al.* Wiley, New York, 1962. xii + 418 pp. Illus. $7.95.

Ten years ago, Witkin and his colleagues hypothesized that the extent to which an individual can separate conflicting perceptual cues in laboratory test situations is pervasively related to a variety of personality characteristics. The two extremes of this broad dimension were called field-dependence and field-independence. Field-dependent persons were those who could not tell which way was straight up in orientation tests with misleading cues. Although the broad outline of Witkin's general theory was well supported by the empirical evidence presented in his first book, *Personality Through Perception*, the specific claims of high correlations between field dependence and personality traits proved sufficiently controversial to generate prolonged debate and scores of new investigations. Highly cognizant of the criticisms leveled at his earlier work, Witkin has now done a masterful job of mustering support for a slightly altered thesis, which he presents in this book.

Witkin places major emphasis on what he calls the differentiation hypoth-