Complementation

The message in J. R. S. Fincham's **Genetic Complementation** (Benjamin, New York, 1966. 157 pp. Illus. $8.75) consists of a lucid professional perspective on the biological aspects of complementation. It is a pleasure to find not only that the author has a message to present but also that he has communicated that message clearly. In this regard, the book is outstanding.

The subject of complementation is introduced by a discussion of those organisms that are suitable for investigations of the phenomenon. Genetic systems are described, so that comparisons of the complementation test as it applies to each type of organism can be made. The presentation of the concept of the gene relates current terminology to historical developments in genetics. A discussion of the mechanism of interallelic complementation is followed by an analysis of complementation maps, along with possible ways of interpreting them. The monograph closes on a speculative note, dealing with the evolutionary significance of interallelic complementation and multimeric proteins.

The weakest aspect of the monograph is the discussion of multimer formation and the process of hybridization. A common criticism of biologists whose work extends into the physical and chemical sciences is that their treatment at the molecular level is often superficial. The author appears to be too involved in describing the details of his own experimental work on interallelic complementation to give full consideration to the entire subject. The main theme generated is that multimeric proteins provide a mechanistic explanation for much of the descriptive work on complementation. Yet the subject of quaternary structure is dealt with only superficially. For example, there is no mention of some very significant early developments relating to multimer structure and function. Investigations of muscle phosphorylase [*J. Biol. Chem.* **223**, 1055 (1956)] by Madsen, Cori, and Gurd, and later investigations by Singer and Itano [*Proc. Nat. Acad. Sci. U.S.* **45**, 174 (1959)] on the reversible dissociation of hemoglobin subunits provided the prototype for experiments to reconstruct complementation in vitro [*Quart. Rev. Biol.* **35**, 313 (1960)]. Most of the detailed studies of the subunit structure of proteins [see, for example, *Advan. Protein Chem.* **20** (1965) and *Brookhaven Symp. Biol.* **17**, (1964)] are not even mentioned in this treatise. The physical-chemical approach to the study of quaternary structure [Tanford, *Brookhaven Symp. Biol.* **17**, 154 (1964)] has been completely ignored. Finally, since quaternary structure is proposed as the physical basis for the mechanism of complementation, a general discussion of subunit structure, binding sites, isoenzymes, and allosteric interactions might be expected to appear in such a book. There is one brief paragraph devoted to allosteric interactions as they relate to conformational changes in proteins, but no mention is made of the outstanding work of Gerhart [*Brookhaven Symp. Biol.* **17**, 222 (1964)] and others. The last chapter of the book attempts to relate some of the subjects mentioned to complementation, but fundamental biochemical treatment is not applied.

On the biological side, I noted omissions, but not to the same extent as in the areas mentioned. For example, the subject of nuclear ratios in interallelic heterocaryons of Neurospora was an issue during certain stages of the early work on complementation [Yanofsky and St. Lawrence, *Ann. Rev. Microbiol.* **14**, 311 (1960); Woodward, *Quart. Rev. Biol.* **35**, 313 (1960)]. No reference was made to this or other subjects discussed in these two papers.

In spite of the weaknesses cited above, the author presents a clear exposition of the biological aspects of complementation and has correlated a diverse body of information that needed to be summarized.

DOW O. WOODWARD
Department of Biological Sciences, Stanford University, Stanford, California

Space Science

There has never been a plethora of English-language texts on practical orbit determination. Indeed the number is astonishingly small, though of high quality, and is, on the whole, of pre-Sputnik I vintage. It would therefore seem that a new work, particularly with modern applications, would be very welcome.

The present text, Pedro Ramon Escobal's **Methods of Orbit Determination** (Wiley, New York, 1965. 483 pp., $17.50), whose title might more appropriately read "Methods of Orbit Determination of Artificial Satellites for Engineers" is intended to be a step in this direction. The first half of the book is designed as an introductory course in elliptic motion and astrodynamics, while the second half is billed as an advanced course on the determination of orbits.

The arrangement of material follows the classical pattern except for the inclusion in the first chapter of a discussion on the system of astronomical constants. The introduction, at this early stage, of astronomical constants is unfortunate because terms not yet defined and concepts requiring advanced knowledge of celestial mechanics are used.

Some of the beginning material suffers from imprecision in definition and astronomical fact and improper emphasis. In addition, the reader will have to contend with occasional quaintness of expression, some of which may be a source of confusion—for example, "Discrepancies between geodetic and astronomical latitude are usually quite differential."

It is well to point out again that planetary orbit correction is treated inadequately, almost all the examples dealing with artificial-satellite problems. The last chapter, "Secular perturbations," thus, is concerned primarily with oblateness perturbations and perturbations due to drag. This would not be a shortcoming if the text were devoted principally to artificial-satellite problems. A more serious shortcoming is the wholly inadequate (less than two pages) treatment of numerical integration. Because of its central importance in many practical applications in orbit determination, even an introductory text should contain a discussion of numerical integration, in particular, describing the classical Cowell and Encke methods.

On the credit side is the inclusion of modern material that is of immediate application such as selenographic and areocentric coordinate systems; rising and setting, visibility and eclipse problems of artificial satellites; mixed data determinations; differential correction of orbits. Bearing in mind the applications of computers, each chapter contains summaries of the formulae presented in almost algorithmic form. The appendix contains lists of frequently used formulae and transformations, and satellite data are given for comparison with the students' calculations.

MORRIS S. DAVIS
Computer Center, Yale University, New Haven, Connecticut