celerations (p. 22) be understood? Vector sum is used on pages 23 and 35 and then defined on page 64. Scalar multiplication of matrices is used (pp. 32, 34) before it is formally introduced. The coefficients for quadratic forms—A_{11}, A_{12}, and so on—are used (p. 116) but never explained.

Motivation is sometimes missing. Advanced ideas are assumed and fundamental ones proved. Here are a number of examples: why is distance invariant on page 25; does one example for transformation of coordinates suffice on page 26; why do the decimals appear as they do on page 36; why is the magnitude of the matrix not zero on page 45; why is cT substituted for T on page 52; why is the unit vector dimensionless on page 66; and why do the asymptotes of hyperbolas follow from the discussion on page 119?

Without trying to spot all errors in printing, I noted some on pages 10, 46, 49, 57, 176, and 182.

In the hands of a skillful teacher this book could come to life and be the basis for a fascinating course, but it does not stand on its own feet. It is too condensed to be useful and too vague with respect to the audience it expects and the background it assumes.

HENRY W. SYER

Kent School,
Kent, Connecticut

Photosynthesis

Primary Processes in Photosynthesis. Martin D. Kamen. Academic Press, New York, 1963. xii + 183 pp. Illus. $5.50.

The author has defined his task as that of writing a book which will introduce both students and veteran researchers to the newly developing studies of the fundamental physics and physical chemistry of the primary events in photosynthesis. Following the course of events initiated by the arrival of a light quantum at the photosynthetic apparatus, he divides the subsequent processes into "eras"—the era of radiation physics (10^{-15} to 10^{-9} second), the era of photochemistry (10^{-9} to 10^{-4} second), the era of biochemistry (10^{-4} to 10 second), and the era of physiology and ecology (after 10 seconds). His book is restricted to the first two eras.

Those whose backgrounds are in biology and biochemistry will find this an excellent guide to understanding the importance, the language, the methodology, the instrumentation, and the preliminary successes of the more physically oriented approaches to photobiology. Among the topics covered are the light absorption act itself, energy migration, lifetimes and quenching processes of excited states, charge transfer processes, polarization of absorbed and emitted light, resonance phenomena, and difference spectroscopy. Wherever possible, the physical concepts are discussed first with reference to simple monoelectronic, monatomic, or diatomic systems, and the additional features are sketched out for extending studies to the macromolecular systems of the living cell.

Those who approach photosynthesis from the more physical disciplines will find in the book a balanced perspective of the biological setting of the problem. Bacterial and green plant photosyntheses are viewed as similar situations, whose differences should be exploited for the unraveling of some of the complexities of the primary photochemical events.

The problem of photosynthesis, as defined in the first chapter, is to "pump up" electrons from a region of high electron affinity, water, to one of low electron affinity, a primary electron acceptor that mediates between the pigments and the carbon dioxide to be assimilated. Emphasis is placed on the possible role played by important constituents of the chloroplast and the chromatophores, especially by the various forms of chlorophyll, by the other photosynthetic pigments, and by the heme proteins. A thorough review is given of the structural organization of the photosynthetic apparatus. Special attention is given to the experimental and theoretical bases for energy migration and trapping at special reactive sites and for charge separation within pigment aggregates or within a pigment-heme protein complex. The possible role of atom, as opposed to electron, transfer, in primary photochemical events has perhaps been underestimated.

This book should help to bridge the communication gap between the various fields that are contributing to the current activity in photosynthesis. Since a reader who wants more detailed information may be directed to original sources by the excellent bibliography, the author may be forgiven for the occasional use of the same term for two different things, for some contradictory descriptions of certain proposed models, and for the errors introduced in the attempt to simplify spectroscopic concepts.

Kamen wisely did not attempt to synthesize a complete picture of photosynthesis, noting that many important problems are now in a very active stage of research. In fact, very few references are taken from publications after 1960. He has given us an authoritative statement of the current problems, a guide to a critical evaluation of the growing literature, and a renewed enthusiasm for approaching photosynthesis as a whole life process rather than as a collection of isolated steps.

J. L. ROSENBERG

Department of Chemistry,
University of Pittsburgh

College Calculus

College Calculus with Analytic Geometry. Murray H. Protter and Charles B. Morrey, Jr. Addison-Wesley, Reading, Mass., 1964. xiv + 897 pp. Illus. $11.50.

In the preface the authors make the following statement: "This text, together with *University Calculus* by Charles B. Morrey, Jr., is designed to solve the problem described above." The problem is that of shifting students between the regular course in calculus and the honors course, after perhaps a semester. Regardless of the direction of the transfer, the student is usually penalized by the incongruence of content in the two courses. After comparing the content of these companion texts, one must agree that this disparity of content will not be a problem if these texts are used. It is also fair to say the texts are written at sufficiently different levels of sophistication to justify their use in courses taught at such different levels as the regular and the honors course. In *College Calculus* the student is frequently referred to *University Calculus* for proofs of theorems stated without proof or for more complete details of proofs.

Otherwise *College Calculus* is largely traditional in content and approach. One noteworthy exception is the treatment of the differential, which is in-