between theory and experiment does not necessarily mean that the theory is correct. Similarly, the sequence in which the products are formed does not unambiguously define the reactions by which they are formed. A more critical appraisal of a good deal of the work covered in this book would have been welcome. The recurring suggestion that peroxy radicals can undergo a metal-surface-catalyzed unimolecular decomposition to form an aldehyde or ketone and an alkoxy radical seems unlikely to me. Even at the comparatively low temperatures which are employed the lifetimes of the individual peroxy radicals are too short for any significant fraction of them to come in contact with the surface during a liquid-phase oxidation. The experimental data can be more plausibly explained in terms of the well-documented homogeneous β-scission of alkoxy radicals.

The translation is excellent, but there are several printing errors. The text is clear and liberally supplied with figures and tables. The authors have produced a comprehensive study of the theory, technique, and technology of a rapidly growing field of chemistry, and the book is recommended to all those interested in this field.

K. U. INGOLD
Division of Applied Chemistry, National Research Council, Ottawa, Ontario, Canada

The State of a Science

Changing Identity of Graduate Earth Science Education. Proceedings of a conference held in Atlanta, Ga., January 1965. CHARLES E. WEAVER, Ed. Georgia Institute of Technology, Atlanta, 1967. 184 pp. Paper. Available free from the editor.

Faced with the problem of starting a graduate program in the earth sciences, the administration of the Georgia Institute of Technology sought guidance in a conference. The 31 participants included representatives from large and small, private and state universities and colleges, the U.S. Geological Survey, and the National Science Foundation, which sponsored the meeting. This volume is a partially edited transcript of the proceedings.

I can do no better in summarizing the outcome of the conference than an unidentified participant who concluded: "I have been an observer here for two days. I have heard an analysis of what is wrong with geology rather than a real changing identity of graduate earth science education."

At the risk of taking some remarks out of context, I quote from Charles E. Weaver's foreword, which has many of the characteristics of a postmortem: "In some instances there is little relation between the titles and the actual talks. The discussions ranged far and wide and though few, if any, problems were 'solved,' many were defined and evaluated. . . . Unfortunately, relatively little thought was given to the long-range effects of some of the changes that are taking place. . . . Many will conclude that the ideas and problems presented at this conference are not representative of the whole field of graduate earth science education. This is probably true."

In spite of half a dozen sound and well-prepared presentations, the conference obviously provided a minimum of guidance for an institution about to embark on a program of graduate instruction. I have just initiated a graduate program at the University of Pennsylvania, but I did not discover the dichotomy that several of the conferees stressed between so-called "classical" and "modern" geology or earth science. Geology is still the study of the earth, whether its followers call their specialties geophysics, geochemistry, or paleoecology. The major function of geochronology is that of refining correlation and extending it from the interpretative stratigraphic correlation of sediments to the more precise dating and differentiation of other petrologic types. It is a new and exciting adjunct to historical geology.

The conferees emphasized the need for a great deal of pregraduate training in mathematics, physics, and chemistry, but what is new about this? In 1946, I berated listeners at a meeting of section E of the AAAS with an address pointedly entitled "Geomorphology—The Inexact Science." The need and the potential of mathematics, physics, and chemistry were as evident then as they are now, and had the profession as a whole been alive to the fact 20 years ago, departments of geology (or earth science)—and conferees on graduate education—would not be bemoaning the dearth of undergraduates, or the loss of the best students to other disciplines.

What is new is the instrumentation from the fields of physics, engineering, chemistry, and geology itself that provides opportunities to probe more profoundly into the physics and chemistry of the earth and thereby learn with some precision how our planet fits into the solar system, how it has evolved, and how we can live on it and with it as a dynamic body. If there is a schism, it is between the new methodology and the background training that is being provided for those who will have to comprehend the significance of tools that are still being devised. The embryonic stage in which the profession finds itself is evident from the diametrically opposed views geophysicists draw from the same sets of physical facts—witness heat flow, remanent magnetism, convection, continental drift.

I heartily agree with Weaver that "We are on the threshold of an explosive growth in the Earth Sciences," and the conferees at Atlanta were—and are—enthusiastic participants in the advancement of the field. One of the gems contributed to the meeting came from Julius R. Goldsmith, of the University of Chicago, who observed that there is a marked difference, in graduate programs, between crystallization and petrification. If Georgia Tech manages to avoid the latter, success in its graduate venture will be assured.

HOWARD A. MEYERHOFF
3625 South Florence Place, Tulsa, Oklahoma

Stars and Substances

Nuclear Astrophysics. WILLIAM A. FOWLER. American Philosophical Society, Philadelphia, 1967. 127 pp., illus. $3. Jayne Memorial Lectures, 1965.

In this slender masterpiece, based on a series of four Jayne lectures, Fowler ranges over a wide variety of fascinating topics that include element synthesis in the proto-universe and in the stars, age dating of the universe by nuclear clocks, supermassive stars, and the enigmatic nature of quasars. The presentation is extremely lucid, following in the grand tradition of Eddington, Jeans, and Hoyle. Characterized by vivid and nonmathematical description, this volume will appeal thoroughly to the layman. By the perspective that it affords and by the state-