dicate that the presently favored model for the earth's magnetic field as an axial dipole may require review.

The final chapters of this volume are "Paleontology and climate" and "Problems of sediments and soils." In the former, Teichert interjects a timely note of warning by suggesting that distribution patterns of fossils and of sediments can as well represent the circumstances of control as any real pattern. And in the latter, red beds are subjected to yet another review in which Van Houten seems to find little real promise that these sediments can provide unequivocal indications of any special climatic regimen.

Problems in Paleoclimatology suggests that the principal problems of the field are occasioned by emergence from uncomfortable adolescence. This is an emergence in which the whole scientific community may take heart, for it will lead to substantial advances. Certainly, as human population increases, the importance of long range planning will increase and the significance of learning enough to predict and possibly someday to modify the intensity, direction, and rate of climatic change is evident. *Problems in Paleoclimatology* tells us of the ground that we have so far traversed, of the chaos in which we are presently ensnared, and occasionally points hopefully to a direction we may take in order to achieve real advances in our knowledge of climate and climatic change.

FRANCIS G. STEHLI
Department of Geology,
Western Reserve University

Techniques in Organic Chemistry

Applications of NMR Spectroscopy in Organic Chemistry: Illustrations from the Steroid Field. Norman S. Bhacca and Dudley H. Williams. Holden-Day, San Francisco, 1964. x + 198 pp. Illus. $7.95.

A major reason for the recent rapid development in organic chemistry has been the availability of instrumental techniques for structure determination, analysis, and similar purposes. Twenty years ago commercial ultraviolet spectrometers completely changed the way in which chemists studied unsaturated compounds. Fifteen years ago infrared spectroscopy changed the approach to qualitative functional group analysis, and 10 years ago nuclear magnetic resonance (NMR) spectroscopy made it possible to study the chemical environment of protons in organic compounds.

Several books dealing with NMR spectroscopy have appeared during the last 10 years, but none of them are really satisfactory in guiding the chemist to make maximum use of this technique or in illustrating the wealth of information that may be obtained from a detailed consideration of the spectrum of a given compound. The present volume is successful on both scores, and is recommended for all but the most experienced among NMR spectroscopists.

The authors have chosen to use the spectra of steroids to illustrate the approach that may be used. At first, this may seem strange because the spectra of these compounds are often very complex. However, as the authors point out, the steroids have relatively fixed conformations, permit functional groups to be placed in a variety of positions with respect to a given proton, and are readily available with a variety of substituents. The authors begin with a discussion of the relatively simple bands that result from angular methyl groups and illustrations of the effect of the environment of the methyl groups on its chemical shift. Methylene and olefinic protons, which add the complexity of spin-spin coupling between protons, are considered. The treatment of extra complications that arise from long-range spin-spin coupling precedes an excellent discussion on the use of NMR spectroscopy on the determination of configuration and conformation. The last chapter is concerned with solvent effects.

Throughout, the book contains useful illustrative spectra and many tables that summarize important data concerning chemical shifts, coupling constants, and their relation to structure. This appears to be a very useful, well-organized, and well-written book. It cannot illustrate all of the potential applications of NMR spectroscopy to organic chemistry, but it does well in covering those related to structure determination.

KENNETH B. WIBERG
Department of Chemistry,
Yale University

General Relativity

Introduction to General Relativity. Ronald Adler, Maurice Bazin, and Menahem Schiffer. McGraw-Hill, New York, 1965. xvi + 451 pp. Illus. $12.50.

The Theoretical Significance of Experimental Relativity. R. H. Dicke. Gordon and Breach, New York, 1964. xii + 153 pp. Illus. Paper, $1.95; cloth, $4.95.

For more than 20 years, Bergmann's textbook has remained (in my opinion) the most readable and balanced introduction to general relativity. This has been true partly because the foundations of the subject have changed so little, partly because Bergmann's breadth of view could accommodate the shift of areas of research since 1942. Most recent books have seemed too personal, or too advanced, to be useful as beginner's textbooks for senior or graduate physics students. Owing to its catholic content and its attention to pedagogical details, *Introduction to General Relativity*, by Adler, Bazin, and Schiffer, is, I feel, the likeliest to supersede Bergmann. It is based upon a lecture course given at Stanford University by Schiffer. In addition to standard treatments of Riemannian geometry, the field equations, the Schwarzschild solution, gravitational fields in hydrodynamic and electromagnetic media, and implications for cosmology, there are excellent accounts of recent work on the Cauchy problem and Rainich theory. I should also mention the admirably clear chapters on conservation laws and the linearized equations.

It is a pity that the authors were reluctant to use 20th-century mathematics. It would be helpful to be told just what tangent spaces or differential forms are, because such terms are occasionally used here. Curiously, they offer as explanation their desire not to prejudge future theoretical developments. The authors also confess misgivings (and well they might!) about the inclusion of the old Lenz derivation of the Schwarzschild solution out of flat space and the equivalence principle. Apart from these minor objections, I found this book a pleasure to read, and one that can be recommended as a textbook for use in a lecture course or by those who wish to study on their own.

The Theoretical Significance of Ex-