simplicity and elegance of these methods have led to a great extension of their use during the past decade, and the book is correspondingly much larger (and unfortunately much more expensive) than the preceding (1950) edition.

The revision is a thorough one; large sections of the book have been completely rewritten in order to bring it abreast of recent developments. Even paragraphs whose content is not appreciably changed have been gone over with meticulous care to improve the clarity and smoothness of the wording. The main body of the text includes discussions of methods published up to 1957, and literature references through 1958 have been added as supplements to most chapters.

The organization of the book remains unchanged. About one-fifth of its thousand pages is devoted to a general discussion of the methods, materials, and apparatus used in trace analysis. The advantages and limitations of colorimetric methods are explained in detail, methods of separating and isolating small amounts of metals are considered, and the various colorimetric reagents are discussed critically. The remaining four-fifths of the book takes up the metals in alphabetical order and for each one describes methods of separation, analytical procedures, and applications of the procedures to various kinds of material. Among the analytical procedures for each element the author selects the one that he considers most generally useful; he explains its merits and demerits and describes the necessary apparatus, reagents, and sequence of operations in great detail. For many elements this sort of detailed treatment is given for several alternative methods.

In the new edition all parts of the book have been expanded in about the same ratio. Sections of the early chapters which are wholly new or of greatly increased length include those on radioactivation analysis, preparation of biological material, chromatographic and ion-exchange separations, extraction of metals by immiscible solvents, indirect colorimetric methods, and fluorimetry. In the chapter on colorimetric reagents the most prominent addition is a long section on the details of dithizone-dithizonate equilibria; an indication of how rapid recent progress has been is the fact that the second edition gave only two approximate equilibrium constants for such reactions (silver and copper), whereas the new edition has a two-page table listing constants for most of the metals that react with dithizone. In the chapters devoted to individual metals, the most conspicuous additions are frequent descriptions of separation procedures involving ion exchange and chromatography and directions for applications of colorimetric procedures to a much greater variety of materials, particularly to metals and alloys. Innovations under particular metals are too numerous for listing, but the following will serve as examples: new methods introduced as the favored ones (persulfate for cerium, phenylfluorone for germanium, rhodamine-B for gallium and thallium, thoron for lithium, alizarinsulfonic acid for scandium); great expansion in the number of methods and the amount of description given for niobium, tantalum, uranium, zirconium, and the platinum metals; a completely new chapter on thorium; great increase in the detail given for methods previously described (especially those of rhodamine-B for antimony, 8-hydroxyquinoline for aluminum, dithiocarbamate for copper, and rhodanine for silver).

The great virtue of this book, in this edition as in the previous ones, is the thoroughness with which Sandell has digested the enormous literature on colorimetric reactions. Here is no mere listing of possible procedures; each method has been looked into carefully, the sensitivity and applicability of these methods under various conditions have been examined, and the advantages and disadvantages relative to other methods have been scrupulously considered. Many of the procedures have been exhaustively tested by Sandell and his students. For several elements the author admits freely that no satisfactory procedure is yet available; he describes the limitations of present methods and suggests leads that analysts might pursue in attempting improvements. The thoroughness of the discussion and the meticulous detail of the descriptions result in an enormous saving of time for analysts seeking to devise methods suitable for particular purposes.

One limitation of the book is the fact that its procedures are designed primarily for use in a completely equipped analytical laboratory. There is little discussion of the more rapid and often less sensitive methods of analysis that can be adapted for use in the field. In the chapter on copper, for example, the biquinoline method is casually dismissed because the reagent is expensive and somewhat less sensitive than others; the specificity of biquinoline and the remarkable stability both of the reagent and of its copper compound—properties that have so endeared it to field workers—are evidently of secondary importance in Sandell's opinion. But this is hardly a valid criticism, since to include a discussion of field methods would increase still further the size of a book that is already straining the limits of a single volume.

The format of the book has been improved by the substitution of italics for bold-face type in many of the side headings, and by the use of larger type for several of the tables. Typographical errors are remarkably few in number for a book that has undergone such thorough revision.

Analysts in many fields owe Sandell a debt of gratitude for bringing together, sifting, and organizing so skillfully the presently available data on colorimetric methods for traces of metals.

KONRAD B. KRAUSKOPF
School of Mineral Sciences,
Stanford University

Polar Atmosphere Symposium. Part 2. Ionospheric section. K. Weeks, Ed. Pergamon Press, New York, 1957. xiii + 212 pp. Illus. $10.50.

The Oslo symposium on the polar atmosphere, which dealt with both meteorology and ionospheric physics, resulted from a suggestion to AGARD (Advisory Group for Aeronautical Research and Development, North Atlantic Treaty Organization) by L. Harang of the Norwegian Defence Research Establishment. The ionospheric section was organized according to three areas of interest: drifts and movements in the ionosphere (10 papers), ionospheric prediction in high latitudes (7 papers), and scattering of radio waves by the ionosphere (4 papers). The proceedings include a record of the discussion which followed each group of papers. The opening address by F. L. Wattendorf (director of AGARD), who explained how AGARD grew out of the suggestion of T. von Kármán (California Institute of Technology) and the introduction speech by H. U. Sverdrup, who drew upon his wealth of personal experience to interpret the objectives of the conference, are included. The record of Sverdrup's speech is especially valuable because of his death only a year later. Sverdrup was an oceanographer and meteorologist of much renown. At his death he was director of the Norsk Polarinstitutt in Oslo and deputy rector and professor of geophysics at the University of Oslo. From 1936 to 1948 he was professor of oceanography and director of the Scripps Institution of Oceanography at the University of California. He organized the highly successful Norwegian-Swedish-British Antarctic Expedition of 1949–52.

The record reflects the fact that the meeting was strictly scientific in character. Only by listing and commenting on each of the 21 papers would it be possible to summarize the scientific progress made and give suitable credit to the contributors. However, most of those who are interested in this field regularly see the *Journal of Atmospheric and Terrestrial Physics,* and this same record of the symposium was published as a special supplement to that journal in 1957 as well as in this hard-cover edition.

Part I, recording the proceedings of the meteorological section of the meeting, was also published in 1957 as a special supplement to the same journal as well as in the hard-cover edition.

M. G. MORGAN
Thayer School of Engineering, Dartmouth College

The College Influence on Student Character. An exploratory study in selected colleges and universities. Edward D. Eddy, Jr. American Council on Education, Washington, D.C., 1959. xii + 185 pp. $3.

In this study the provost of the University of New Hampshire and two recent college graduates (Mary L. Parkhurst and James S. Yakovakis) have contributed a most sensitive understanding of influences in college which have a lasting effect on students. The study was prepared for the American Council on Education because the council felt an "urgent necessity to develop in oncoming generations the strength of character to match the responsibilities that will be heaped upon the educated leader."

The purposeful search of the investigators for experiences inside and outside the formal educational process which touch the intangible phenomenon called "character" was conducted in a way which gives the findings unusual authenticity. Extended, on-the-spot observation at a diverse group of colleges, was coupled with incisive discussions with students, faculty, and counselors to produce fresh, lively, and strikingly candid testimony about what actually happens to students, in a personal sense, as they go through college.

The accent of the findings is impressively positive, but not complacent. Students respond when they are given responsibility, but it must be real, not fictitious, responsibility. They rise to a high level of performance, moral as well as intellectual, when a high level of expectancy on the part of the college community challenges them. They do build upon the insights of the teacher who has integrity and vision, but he must be a genuine article, for students quickly detect a "phony."

The central conclusion is that the dual goals of intellectual excellence and force of character are inextricably interwoven in the truly educated man. So the elements in the campus community which encourage character are those which also encourage learning. "The college," these observers believe, "finds its greatest contribution to the student in the Socratic theme that the unexamined life is not worth human living." Excellence of character will emerge as students are prodded to a more searching and strenuous intellectual development.

This vindication of the academic vocation in terms of its moral potential does not agree with the profile drawn of contemporary college experience in several other recent studies. Many students today can apparently refine their intellect without a corresponding enrichment of character. They seal off their moral control tower—the mechanism by which they reach value judgments—from the influx of intellectual communications. On many an American campus, a hiatus splits the educational process from the real life of students and the student's learning from the values he holds. An educated but morally *irresponsible* college graduate probably emerges far more frequently from the academic assembly line than does Eddy's intellectual of "Socratic-character."

What makes this inquiry so significant, however, is that it may have hit upon some of the vital influences which make the difference in the human outcome of the educational process. The Eddy report might well have been subtitled "A guidebook on how to avoid futility in liberal education." To educators concerned with the growth of the person as well as the mind of their students it will furnish encouragement and direction as they struggle against sweeping automation in the college industry.

PHILIP E. JACOB
Professor of Political Science, University of Pennsylvania

Free Radicals as Studied by Electron Spin Resonance. D. J. E. Ingram. Academic Press, New York; Butterworths, London, 1958. 274 pp. Illus. $9.50.

The development of paramagnetic resonance spectroscopy has opened new avenues in free radical research. Information and knowledge in this field have increased rapidly in recent years, and considerable future advances have to be anticipated. In this situation the monograph by Ingram fills an urgent need: it gives an excellent introduction to the field and a critical, systematic evaluation of the available experimental data.

The first four chapters of the book deal with the "unchangeable" facts: basic ideas, well-established experimental designs and methods, and basic molecular theory. The following five chapters discuss and summarize applications and achievements—physical, organic and biochemical, biological, and medical—in the physics of the field where many new facts have been discovered and existing theories could be confirmed. Of special interest are the applications of the method to radiobiological problems, where the existence of long-lived, radiation-produced radicals could be demonstrated and where the method is soon to be applied for the measurement of the life span of short-lived radicals produced in biological systems during irradiation.

Thus, the book will be more than a reliable source book of information and knowledge; it will also be a guide to further research in this steadily-growing important field. It is one of the standard works on free radical research which should be available in every laboratory.

A. T. KREBS
Radiobiology Division, U.S. Army Medical Research Laboratory and *Biology Department, University of Louisville*

The Gulf Stream. A physical and dynamical description. Henry Stommel. University of California Press, Berkeley; Cambridge University Press, London, 1958. xiii + 202 pp. Illus. $6.

This well-written and stimulating book is a noteworthy contribution to the literature of oceanography and geophysics. The author summarizes the distribution in the northwestern Atlantic of temperature, salinity, other properties that characterize certain features of the Gulf Stream. However, he is careful to point out that although the name of this great ocean current is a familiar one, it is no easy matter to describe it accurately. The observational data can be interpreted in a variety of ways, depending upon the preconceived ideas of the compiler and the geographic pattern of the observations available to him. The computed values of current velocity and volume transport depend upon the selection of the level of no motion; even direct measurements of current are subject to these same uncertainties. In part these problems reflect the lack of adequate theories that should provide a model that could then be tested by properly planned field measurements. However, the theoretical oceanographer has been handicapped by the lack of an adequate description of the phenomenon he attempts to explain. This has led to what Stommel calls "the peculiar dreamlike qualities" that have characterized many of the descriptions and discussions of ocean currents. Stommel has made great contributions in recent years to a more rational attack on the problem of oceanic circulation.

The greater part of the book is devoted to a review of the theories of ocean currents. Stommel has broad theoretical interests, and he has also made many original observations on the Gulf Stream. Because of his background and interests he is uniquely qualified to write this book. Since its establishment in 1931,