could have confused the Paliau movement with a cargo cult. Much of the effort of the Paliau movement was devoted to ideological combat with a cargo cult which, for a time, competed with Paliau's movement for adherents. The Paliau movement is, in fact, the best documented single case of a Melanesian revitalization movement in the anthropological literature: yet it receives only 11 inaccurate lines in a 39-page chapter devoted to "messianic movements in Melanesia."

It is distressing to see the scientific significance of this subject matter diminished by the sloppiness of some of the work devoted to it. Let us hope that future comparative works in this area emulate the studies by Schwartz and Wilson, not the one by Lanternari.

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Plant Taxonomy

Biochemical Systematics. Ralph E. Alston and B. L. Turner. Prentice-Hall, Englewood Cliffs, N.J., 1963. xii + 404 pp. Illus. $13.25.

The more we learn about biology the more we find out that all creatures contain the same basic components. This is bad for biochemical systematics. However, we have also learned that there are special compounds, de luxe equipment, nonessential to the welfare of the plant, which are peculiar and unique to an individual species, a group, a genus, or a family. It is these nonubiquitous materials, these compounds produced at the plant's whim rather than for its essential well-being, that constitute the subject matter of plant biochemical systematics. Among these nonessential and nonubiquitous compounds are numerous very interesting materials: amino acid derivatives not contained in protein, the alkaloids, the cyanogenic glycosides, phenols of various kinds including the anthocyanins and anthoxanthins, quinones, terpenes, carotenoids of various kinds, tannins, isothiocyanates, and various odd organic acids. It is with these groups that Alston and Turner are primarily concerned in this pioneer volume. Overall, the reader must conclude that biochemistry is not yet a powerful tool for the systematician. It is true that biochemical diagnosis can distinguish *Pinus jeffreyi* (heptane) from *Pinus ponderosa* (pinene and limonene), a classical case of biochemical systematics which we owe to Mirov, and one can distinguish the algae, which contain no anthocyanins, from any plant which contains an anthocyanin, of which there are many. In general, however, the present volume provides an orientation, rather than a key. The authors guide the systematic botanist toward the groups of compounds and the groups of plants in which biochemical diagnoses may be useful.

The first five chapters constitute an introduction to the subject (regrettably on an elementary level), apologetics for taxonomy, the history of plant taxonomy, the history of biochemistry, some discussion of the evolution of metabolic pathways, and some discussion of the history of the application of immunochemistry to plant systematic problems. The next nine chapters are concerned sequentially with the nonprotein amino acids, fatty acids, sugars, alkaloids, cyanogenic glucosides, phenols, quinones, terpenes, and miscellaneous compounds such as carotenoids, the betacyanins, tannins, lignins, isothiocyanates, and the organic acids. Of these groups of compounds, the phenols, including the anthocyanins and anthoxanthins, the terpenes, the betacyanins (nitrogen containing cyanine-type colored compounds), and the isothiocyanates appear to have the most power for taxonomic purposes, have received the most attention in past investigation, and deserve the most future investigation. In the cases of the anthoxyanins and of the terpenes, not only can one distinguish between species by chemical analysis alone, but one can also determine whether a putative hybrid is in fact a hybrid, since the hybrid in general contains the chemical components characteristic of both parent species.

Chapter 15 includes an overall summary of Turner and Alston's work on the biochemical taxonomy of the species of *Baptisia* and their hybrids. The method adopted in this study is that of fingerprinting; a whole cytoplasmic extract is subjected to paper chromatography, two dimensional, and we determine what compounds are not common to two individuals or species. By the same method, we determine which individuals are hybrids of which parents; all of this is accomplished without any chemical identification of the compounds involved. As an interim method, in the absence of biochemical sophistication, the fingerprint technique may well prove to be a valuable tool in the service of plant taxonomy. Chapter 16, evaluation, brings out a few of the broad generalizations of biochemical genetics. For example, it would be surprising to find an anthocyanin in a member of the Chenopodiaceae. This family contains betacyanin, and betacyanin and anthocyanin appear to be mutually exclusive.

The present volume brings together in a systematic fashion the facts of the distribution in plants of nonessential metabolites, and it lays the groundwork for the application of biochemical analysis to plant taxonomy. It is not an evaluation of a finished topic. Rather, in praiseworthy fashion, it lays the groundwork for the intensive application of classic tools of chemistry in the service of plant taxonomy.

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Descriptive Astronomy

Pictorial Astronomy. Dinsmore Alter, Clarence H. Cleminshaw, and John G. Phillips. Crowell, New York, ed. 2, 1963. viii + 312 pp. Illus. $6.95.

Extensively revised since its first appearance 15 years ago, and with a new and third author, *Pictorial Astronomy* offers a brightly written and reasonably comprehensive story of the skies, a wealth of carefully selected and fresh photographs, and a glossary that leads the reader from aberration to zodiac. The book aims essentially at the interested lay reader, and it seems to me that the aim is fairly true. What is more, the book covers the field completely enough to serve as a good companion for one who is taking a first descriptive course in astronomy. There is neither extended mathematical analysis nor elaborate discussion of physical concepts, but one finds a number of tables crammed with useful numerical data.

The major subject headings are sun, earth, moon, eclipses, planets, comets and meteors, and stars and nebulae—an organization that is identical with that of the first edition. Following these

seven blocks is a section that deals with such miscellaneous subjects as measuring astronomical distance, radio astronomy, and life in the universe. I suspect that a number of astronomers, particularly those with extragalactic tastes, will be disappointed that the greatest realm in the hierarchy—the universe of galaxies—does not rate a separate major section and that cosmology receives little attention. I would contend that a major and current research theme like stellar evolution is accessible to most readers and that today it also merits strong emphasis.

Viewed as a whole, however, *Pictorial Astronomy* is a generally fine account. And it contains some highly original writing that is downright fun. Especially provocative are several chapters such as the one on the visit of Arcturus to the earth, where we watch that star come into view a half million years ago, serve as a pretty fair pole star several times, make its closest approach in the "near" future, and another half million years hence move, dimmer and dimmer, far into the southern celestial hemisphere. Things afar make us impatient with their apparent pokiness, and it is always good to get a feel for the real spatial and temporal picture over the millions of years. The authors succeed admirably in that endeavor.

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Chemical Analysis

Standard Methods of Chemical Analysis. vol. 2, *Industrial and Natural Products and Noninstrumental Methods*. Pts. A and B. Frank J. Welchner, Ed. Van Nostrand, Princeton, N.J., ed. 6, 1963. 2637 pp. Illus. $50.

This sixth edition of the second volume of *Standard Methods of Chemical Analysis* is the work of some 67 contributors. Only four of these authors contributed chapters to the fifth edition; thus, although many of the chapter titles are the same in both editions, the contents and the treatment are often quite different. In addition, 23 new chapters have been included; consequently volume 2 has doubled in size and has had to be bound in two parts.

Roughly one-fifth of volume 2 is devoted to discussion of noninstrumental methods. This section includes chapters that deal with laboratory apparatus, sampling, the detection of cations and anions by spot tests and by a systematic qualitative analysis scheme, and the statistical treatment of data. Various methods for performing separations are treated in chapters on mechanical separations, precipitation separations, electrolysis, solvent extraction, distillation and evaporation, chromatography, and ion exchange. Finally, noninstrumental methods for completion of the analysis are covered in chapters devoted to final gravimetric treatment, titration methods, acid-base titrations in nonaqueous solvents, colorimetric *p*H methods, electrometric *p*H measurement, the use of the microscope, quantitative microchemical analysis, organic functional group analysis, solubility measurements, and the determination of water.

Eighty percent of volume 2 is devoted to standard methods for the analysis of industrial and special substances. This section contains 11 new chapters: "Air pollutants," "Amino acid analysis of protein hydrolyzates: chemical analysis in clinical medicine," "Fertilizers," "Gas analysis—vacuum techniques," "Pesticides," "Plastics," "Silicates," "Glasses, rocks, and ferrous slags," "Soils," and "Vitamins."

The parts of this volume that are devoted to noninstrumental methods provide much general information which will be useful to the practicing analytical chemist. The chapters on microchemical analysis, organic analysis, and titration methods are particularly good, and they offer sufficiently detailed instructions to make the volume useful as a primary source of information for those who work in these fields. Other sections are so brief that they provide only outlines of their subject and, thus, are useful only for their literature references—for example, the sections devoted to homogeneous precipitations, the determination of water, and separations by electrolysis.

The bulk of volume 2 is a compilation of selected standard procedures for the analysis of a variety of common materials; enough detail is given so that, in many instances, reference to the literature is not necessary. Thus, the volume should serve as a useful source book for the analyst, and it deserves a place in most technical libraries.

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Mathematics

Retracing Elementary Mathematics. Leon Henkin, W. Norman Smith, Verne J. Varineau, and Michael J. Walsh. Macmillan, New York, 1962. xviii + 418 pp. Illus. $6.50.

Principles of Modern Mathematics. vol. 1. William E. Harnett. Harper and Row, New York, 1963. xvi + 416 pp. Illus. $7.75.

Although these books are quite different in most respects, they have one important aspect in common. Both attempt, and in general the attempts should meet with success, to draw the reader into the discussion, to make him cognizant of desirable goals and of why certain steps are taken to reach these goals. For too long mathematics books have presented "well-polished" results with little indication of "why."

Henkin and his coauthors give a well-constructed development of the real number system. They start with a modification of the Peano postulates for the positive integers and progress through the several subsystems of the real numbers in such a fashion that each system is *actually contained* in the following system. This contrasts with more usual developments where each system is contained in the following only up to isomorphism. This gain is obtained at the cost of added abstraction at each stage. The transition from rationals to reals is obtained by a modification of the Dedekind Cut concept.

Early in the book the authors devote considerable attention to the idea of proof. The reader who works his way through the book will gain comprehension about the nature of proof and, equally important, about when he has a proof. Those for whom this book is intended cannot rush through the early chapters, but certain sections can be omitted. This, coupled with the complexity of later chapters, limits the book's usefulness in the classroom on a one-semester basis; for a two-semester course on foundations, this book is excellent.

Hartnett does not seem to have a theme, unless it be a discussion of various basic concepts of present-day mathematics. The real number system is discussed, not developed; this discussion is intended as a base for future examples and developments. The author proceeds with sets, relations, and functions; then with groups, rings, fields, and vector spaces; and then with