dependent on distance as the other passive methods and can be carried out by the use of modest-sized telescopes. The method does require a fortuitous alignment in orbital inclination, but the large number of planetary systems increases the odds for detection. This passive method can then tell us where to beam signals in our search for intelligent extraterrestrial life, although serious minds should question whether we should let the rest of the universe in on our ignorance.

Astronomers as a group are highly in tune with, and sympathetic to, the subject matter of this book. The author has a lot to say and perhaps even tries to cover too much ground, but it is ground that must be covered. If one weeds out the mistakes, the book is worth reading for the vistas that it reveals and the thoughts that it provokes.

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## Plant Products

**Symposium on Phytochemistry**. Proceedings of a meeting held at Hong Kong in September 1961. H. R. Arthur, Ed. Hong Kong University Press, Hong Kong; Oxford University Press, New York, 1964. xiv + 256 pp. Illus. $10.

This volume presents the proceedings of one of six symposia held in September 1961 in conjunction with the Golden Jubilee Congress of the University of Hong Kong. The material is divided into two main sections—(i) Structural and Biosynthetic Relationships in Plant Products and (ii) Isolation, Structure, and Chemistry of Plant Products, with the second section further subdivided into sections dealing with alkaloids, terpenoids, steroids, phenolic and other oxygenated plant products, and flavonoids and related compounds. In addition to short reports on recent work on natural products, eight special lectures on more general aspects of phytochemistry were delivered at the symposium.

With emphasis primarily on reports of investigations carried out in the Far East, as is entirely appropriate for a symposium of this character, it is only natural that substantially all of the short reports were given by investigators from this broad geographical area. The special lectures, however, which were given by A. J. Birch, Carl Djerassi, T. R. Govindachari, C. W. Shoppee, K. Nakanishi, W. A. Bonner, T. R. Seshadri, and E. S. Hiscocks, are representative of worldwide phytochemical investigations. That the short reports, 29 in number, cover a broad spectrum of fields is indicated by the section headings.

Inasmuch as a similar congress was held in Kuala Lumpur in 1957, the investigators in general report on work done between 1957 and 1961. Both the quality and quantity of the work represented by these reports furnish adequate testimony to the interest in studying the host of natural products that are indigenous to the Far East, a fact which reflects due appreciation of the potential economic benefits that may accrue from these products.

Space does not permit detailed treatment of all of the topics discussed but a few reports may be singled out as providing well-documented surveys that will be of value to those interested in particular subjects. Of particular interest are the comprehensive review of the fungicidal components of cedars, by A. B. Anderson, and that of the chemistry of the isoflavonoids, by T. R Seshadri.

The volume concludes with a series of summarizing reports dealing with phytochemical investigations made since 1957 at a number of laboratories —namely those at the Tropical Products Institute, London, and various laboratories in Hong Kong, India, Japan, Korea, the Philippines, Singapore, Taiwan, and Thailand. The extensive bibliographies in several of these reports will prove quite valuable (many of the cited references are in journals not too readily accessible in American libraries). Some 479 references are cited in the Indian report, 75 in the report from Taiwan, and at least 150 in the Japanese report, Furthermore, as an indication of the activity in the countries represented, this section is very impressive.

For a volume of this type, with inevitable delays in publication, the literature citations are remarkably up to date, with several references to 1963 publications. The editor is to be congratulated for this all too rare occurrence.

In this age of modern instrumentation, one question raised by Shoppee in his concluding remarks is especially pertinent. Should *every* research laboratory be equipped with *all* modern instruments, or would it not be more efficient and economical to establish adequately equipped regional centers? There is much to recommend the latter alternative. The problem of efficient servicing is by no means the least important consideration.

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## Chemical Technology

**Infrared Spectroscopy of High Polymers**. Rudolf Zbinden. Academic Press, New York, 1964. xii + 264 pp. Illus. $9.50.

Zbinden's comprehensive *Infrared Spectroscopy of High Polymers* consists of five chapters—"Characteristic features of polymer spectra," "Selection rules for chain molecules," "Numerical calculations of vibrations in chain molecules," "Vibrational interaction in chain molecules," and "Orientation measurements." Literature references to infrared spectra of individual polymers are surveyed in an appendix.

Chapter 1 is a general survey of the subject; the other chapters contain mathematical derivations of the theory required in performing a partial or detailed infrared analysis of a high polymer. In the last chapter the author discusses in detail the effects of molecular orientation on the spectrum of a high polymer. The experimental conditions and auxiliary equipment needed to record these effects are also thoroughly treated. Of the utmost importance is the discussion of the effects that falsify dichroic ratio measurements, since true dichroic ratios are required in order to interpret properly the infrared spectra. Some excellent explanations are offered about why some dichroic ratios are smaller than predicted from theory. Zbinden included some real and hypothetical examples of high polymers to illustrate the theory presented, and his book is well documented. The literature references alone are worth the price of the book.

In my opinion, infrared spectroscopists who are interested in the theoretical investigation of high polymers will find that this book is a significant contribution to their field, but the polymer chemist will find here only that which a thorough infrared investigation can reveal about his polymeric substance. It is surprising that no mention is made of the fact that

many copolymers consist of long segments of homopolymer, and their infrared spectra are often superpositions of the two homopolymers.

Some highly significant contributions have been made in the field of infrared spectroscopy of high polymers in the last couple of years; unfortunately this book only covers the subject effectively through 1961. However, its coverage up to that point is excellent.

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## Mathematics for Teachers

**Elementary Contemporary Mathematics.** Merlin M. Ohmer, Clayton V. Aucoin, and Marion J. Cortez. Blaisdell (Ginn), New York, 1964. xiv + 382 pp. Illus. $7.50.

In 1960 a committee of the Mathematical Association of America published recommendations on the undergraduate training of teachers of mathematics. Part of the suggested program for prospective elementary teachers was a two-course sequence on the structure of the real number system and its subsystems. At that time little text material was available for such a sequence. *Elementary Contemporary Mathematics*, based on courses at the University of Southwestern Louisiana, tries to meet this need, and its contents closely mirror the outline given by the committee. The topics included are elementary logic, set theory, the counting numbers, numeration systems, the integers, elementary number theory, the rationals, decimals and the reals, and finite number systems.

Since approximately these same elements can be found in texts designed for one-term courses, the authors might have explored related topics as well. But they have instead chosen to treat the same items with greater attention to detail than is customary. The book abounds in carefully analyzed examples. This feature combined with the extensive lists of exercises, many with answers, and with the clear proofs of most theorems should make large portions of the book accessible to the general reader. The authors' efforts to achieve clarity are, indeed, sometimes almost self-defeating. In places the exposition is highly repetitious, and, at times, unusual symbolism is introduced only to be discarded a few pages later. However, the interrelationships of the various topics are well developed. The logical symbolism of the first chapter, for instance, is used effectively but not to excess throughout the book.

Unfortunately, the chapter on decimals and the reals falls short of the standards set in the rest of the book. The proofs of two of the theorems contain flaws. Furthermore, the sequence concept and the idea of convergence are used without definition or even the acknowledgement that new ideas are being introduced. A lack of rigor in dealing with the reals is inevitable in a book at this level, but it is inappropriate to give the impression that no new problems exist. Finally, even the misprints in this chapter seem more likely to cause confusion than do those found in other chapters.

No serious attempt is made in this book to clarify the relation between the mathematics under discussion and the "real" world. A few gestures are made in this direction, but the reader will have to look elsewhere for any systematic treatment.

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## Lecture Notes

**Strong Interactions and High Energy Physics.** Scottish Universities' Summer School, held at Edinburgh in July and August 1963. R. G. Moorhouse, Ed. Plenum Press, New York, 1964. xvi + 475 pp. Illus. $22.50.

The number of summer schools in physics has increased to the point where there are almost as many schools as there are physicists. One of the effects of these schools is the production of an unbelievable quantity of lecture notes. The quality of the notes is naturally not uniform; in too many cases they consist of material that would otherwise, and for good reason, be thrown directly into the waste basket. It is consequently gratifying to see this volume, which consists of lectures given at the 1963 Scottish Universities Summer School. One reason why the book is, on the whole, good is that the lecturers are all very active physicists who are enthusiastic about their subject.

The lead-off article in *Strong Interactions and High Energy Physics* is an introduction to relativistic S-matrix theory, by Euan Squires (University of Edinburgh) who curiously is not listed among the lecturers. After reviewing the Mandelstam representation for potential scattering and the general properties of partial wave amplitudes in nonrelativistic theory, Squires invites the reader to consider, in seven pages, the following topics in what is called relativistic S-matrix theory: Lorentz invariance, crossing symmetry, CPT and the connection between spin and statistics, maximal analyticity, and extended unitarity. These rather difficult ideas are not discussed with religious zeal, and Squires is quite frank about the tentative and uncertain aspects of the "axiomatization" of S-matrix theory. The remainder of his article is devoted to the singularities of the S-matrix and their relation to the unitarity condition and to attempts at dynamical calculations for two-particle scattering processes based on the Mandelstam representation.

A. O. Barut (University of Colorado) discusses the application of group theoretical methods to study the structure of S-matrix elements for reactions involving arbitrary numbers of particles with arbitrary spins. It is a rather highbrow treatment, and it is frequently difficult to tell what is being proved and what has been assumed about the analytic properties of the S-matrix. The methods introduced seem very general and powerful, but in one of the few parts that I could understand they lead to wrong results: The number of scalar amplitudes in photon-spin zero scattering is 2, not 4, and in photon-spin one-half scattering the number is 6, not 12.

In a rather short article, A. Martin (CERN) shows how, by extremely clever use of unitarity and analyticity, one can deduce interesting statements about high-energy scattering amplitudes and the extent to which a knowledge of the scattering amplitude in the elastic region determines it everywhere.

The relation between the singularities of scattering amplitudes regarded as functions of complex angular momenta and high-energy scattering processes is discussed exhaustively by R. Oehme (University of Chicago). This is a very complete and careful treatment of Regge poles in the relativistic