about 2000 pages. Because assignments must be reasonable, the book (or the series) presents a length problem which has several aspects, most of which are easily understood and readily solved:

Nearly one-third of the volume is direct quotations. The text commonly introduces each quotation by a succinct statement that places its message in historical perspective; the original author then speaks for himself. This plan of presentation involves a certain amount of space-consuming repetition, but space as such is inconsequential—the device actually saves time. The reader can grasp the development of concepts that are peripheral to his interests from the text alone, but is provided with well-selected samples of source material in matters with which he may be concerned.

About one-quarter of the book deals with geologic topics that have no direct bearing on the evolution of the study of landforms; the Neptunist-Plutonist controversy, for example, and the discussions of early developments in cosmology and stratigraphic and structural geology, per se, are in this category. These matters are treated much more fully in several standard histories of geology, and they are (or should be) familiar to geomorphologists at the graduate student and professional levels in this country, where geomorphology is a branch of geology. The reason for their inclusion is probably that the book is directed primarily to students in Great Britain and on the Continent, where geomorphology is commonly treated as a branch of geography—all three authors teach in geography departments in England. There is no question but that the geologic background material given is essential to any understanding of the development of geomorphology and is, therefore, quite in order in a geographically oriented book.

Representative of a third category of material which is not strictly relevant to the business at hand is a 31-page chapter on the life of John Wesley Powell, chiefly on his boat trip through the gorges of the Colorado River. Powell's scientific work is treated elsewhere in the text. The canyon trip is high adventure, and the chapter is exciting reading; it is simply not the kind of reading suggested by the title of the book.

The value of the book as a reference work is greatly enhanced by the "Informative Index" which includes an estimated 3000 items. The remarkably complete topical references provide a convenient means of following the development of thought regarding specific landforms, processes, and ideas prior to 1890; for example, there are 12 references to river terraces, 15 to marine planation, and 23 to uniformitarianism. This means that there is no longer any excuse for publishing as new discoveries matters that were first stated prior to 1890, or for the venial sin of crediting points to people who had failed to give credit to the original author. Many geomorphologists are apt to be embarrassed, as I was, on one or both of these scores in the course of reading the book.

The authors seem to be of two or three minds regarding W. M. Davis. In the index he is "an American geomorphic genius" and on page 4 "a great figure . . . worthy of a place with Hutton." But on the same page we learn that "it would be hard to imagine a more stultifying situation" for a young science than that brought about by the Davisian generalizations; these generalizations are said to have "lulled the geomorphological world into a . . . slumber" from which it is only now awakening. On page 621 Davis' work is regarded as "the mainspring of half a century of research" but that research was, in the authors' view, kept at the level of a "pseudo-science" (p. xi) chiefly because the importance of the quantitative approach was obscured by a qualitative veil which he "threw over geomorphology" (p. 603). In the comments (p. 624) on his near-dismissal from Harvard (at age 32) for poor teaching, the denigration reaches a fervor and rhetorical quality that is almost Russian:

> If Davis was criticized for his poor lecturing ability, this was certainly a gross miscalculation of his ultimate potential; however, if he had been threatened with dismissal because of his lack of fundamental research, some unkind geomorphologists might credit the Harvard President with greater insight than was to be vouchsafed to students of geomorphology for at least another half century!

Perhaps because I happen to be the present chairman of the Davis Protective Association, this seems a little harsh, but before taking up my cudgel I will await the more complete evaluation of his work which is promised for volume 2. In the meantime volume 1 is the most useful and, in one way or another, the most stimulating book on my shelf.

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Intelligent Extraterrestrial Life

We Are Not Alone: The Search for Intelligent Life on Other Worlds. Walter Sullivan. McGraw-Hill, New York, 1964. xii + 325 pp. Illus. $6.95.

This serious attempt to treat a most challenging and interesting subject, the search for intelligent life on other worlds, is marred by the use of some very sloppy physics and astronomy. Extrapolation to chemistry and biology, subjects in which I am not particularly versed, would leave very little to recommend this book. And just those people who should not be given erroneous science are the ones who will read *We Are Not Alone*, mainly because it does not rely on an elaborate physical superstructure and its attendant mathematical tools. It is a pity, because with a little additional work the author could have cleared up the mistakes and still have avoided the use of mathematics. The use of ambiguous and trite words may be fashionable, but to say that a planet "flys" its orbit definitely does not appeal to me. A very large part of the book is devoted to discussion of all aspects of Mars, but E. C. Slipher's monumental life work is not mentioned, although many lesser studies are cited.

In the first part of the book the author thoroughly confuses focal length and focal ratio. One gets the impression that the focal length of the 200-inch Hale telescope is less than that of the Sproul 24-inch refractor, whereas in fact, even at the prime focus, it is already 50 percent larger than the Sproul telescope. Later on there is a completely incorrect statement about the origin of the 1420MHz (21-cm) line of hydrogen. There is also the implication that Bode's relation is a physical law.

In discussing the detection of extrasolar-system planets, much emphasis is placed on the use of nonlinear proper motions. But Sullivan fails to point out that the detectibility of "wiggles" is inversely proportional to the distance, and thus the method fails at those distances where he seems convinced that another civilization is most likely to be found. He does find the occulting disk technique of merit, but does not mention the simpler apodized mirror techniques. The photoelectric method is mentioned in one sentence.

The photoelectric method really deserves more attention, for it is not as

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