the physics literature. Certainly in teaching quantum mechanics a number of articles in this collection are good references to give students desirous of some outside reading material on philosophy.

Having been entirely positive up to this point I would offer some criticism of the format of the present collection. There is no advice to the reader on how he might best read the seven articles collected. Certainly the first article presented is, by its length, the least palatable. I would have preferred an introduction and a different arrangement of the articles. In fact a textbook on the subject of the collection might be in order.

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Plant Biochemistry

Phytochemistry. LAWRENCE P. MILLER, Ed. Van Nostrand Reinhold, New York, 1973. Three volumes. Vol. 1, The Process and Products of Photosynthesis. xiv, 410 pp., illus. $22.50. Vol. 2, Organic Metabolites. xvi, 446 pp., illus. $24.50. Vol. 3, Inorganic Elements and Special Groups of Chemicals. xiv, 448 pp., illus. $24.50.

Despite the metabolic versatility of plants (over 1000 new compounds are reported yearly) broad-scale treatments of plant biochemistry are rare. This three-volume set is particularly welcome because its editor is knowledgeable, critical, and skillful as a writer. In the 36 chapters one finds some unevenness, but the editor has tried hard to keep differences in literary styles from causing the usual distractions. Differences in depth of coverage, however, cannot be glossed over.

While both primary and secondary biochemical activities are covered, most of the treatise is devoted to secondary plant compounds. Such compounds attract and hold interest for a number of reasons. There has been a marked increase in interest in compounds in plants from the vantage point of pure science. Perhaps it should have been expected that studies of the biogenesis of many "secondary" constituents would implicate them as intermediates in the biogenesis of metabolites of known importance. This is indeed coming to pass. Some of these compounds are also turning out to be important to the chemical taxonomist. A chapter is devoted to this rapidly growing aspect of systematics.

Most of the chapters are arranged in logical order except for the final volume. This volume has had to accommodate the late arrivals, and we find, for example, the chapter on respiration sandwiched between chapters on vitamins and endogenous plant growth regulators.

Volume 1 is about essentially what its subtitle leads one to expect: the process and products of photosynthesis. The chapter on the chloroplast in photosynthesis is somewhat restricted and seriously deficient in references since the mid-1960's. As a result important evidence of the nature of the two photosystems is missing. A modern treatment of the chloroplast membrane system is also lacking. There is a similar lack of use of concepts that came to the fore in the late 1960's in the chapter on photosynthesis. Thus one finds no mention of the inhibition of photosynthesis by oxygen—an old observation but one that is being reemphasized today.

A thoughtful treatment of the chlorophylls and their biosynthesis is provided. The pitfalls of measurement in solutions are pointed out, but there is no evaluation of Stacy French's important work on species of chlorophyll a. Techniques for the measurement of the chlorophylls in vivo now in use in several laboratories are not discussed. In the treatment of the control of chlorophyll biosynthesis no mention is made of the role of light. This is an important oversight. References after 1968 are sparse, and none appear beyond 1971.

The overview of the carotenoids is very compact but highly readable. An orderly and lucid though undetailed treatment has been provided for the mono- and oligosaccharides, though the sugar alcohols have been given only three pages. Because of the intensity of work on cell wall constituents, it is gratifying to see the much-needed treatment of hemicelluloses and gums. It is disappointing, however, to find no account of what is known of the biosynthesis of cellulose.

Volume 2 is devoted to organic metabolites. This is a big order. Once again the treatments are short and readable but often severely reduced in detail. This is true for the chapters on amino acids, proteins, purines and pyrimidines, alkaloids, steroids, terpenes, and rubber. The chapter on flavonoids is especially well done but lacking in findings of the current decade. The chapter on volatile plant products is encyclopedic to the point of being readable for reference only. One of the most important of the volatiles, ethylene, is not mentioned at all.

Volume 3 is devoted to the inorganic elements and special groups of chemicals. The chapter on the role of minerals in phytochemistry is almost exclusively devoted to the minor elements. The treatment of the halogens is perhaps the best available. A full chapter on the physiology of sulfur compounds is provided. But little is said about their biosynthesis. The treatment of organic acids is restricted to those known to be most active metabolically plus oxalic and tartaric acids. The latter compounds are considered because they are the most prominent acids found in plants. It is a genuine service to have the acetylenes introduced because this is a new area for biochemical exploration. Possibly these highly reactive compounds serve as primary precursors for substances of physiological significance. Some of them are antimicrobial and others are of pharmacological significance.

Lignin is inadequately treated. In view of their importance in the water relations of plants it is surprising that cutin, suberin, and surface waxes have been allotted so little space. The vitamins are treated in encyclopedic style with emphasis on animals. A thoughtful analysis and prediction of things to come appear at the end of the chapter on mitochondria and plant respiration. An overview of the naturally occurring plant growth regulators is followed by one of the most detailed treatments available on the chemistry and biochemistry of the gibberellins.

The treatise ends with a potpourri of chapters on molecular taxonomy, plant-derived drugs, and economically important plant products.

Although almost all the information in these volumes is available in other reviews, a distinct service has been performed for the discipline of plant biochemistry. This is a field with a steadily increasing number of practitioners and their need for a source book has been served.

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