A Man of Many Works

Joseph Priestley. Revolutions of the Eighteenth Century. F. W. GIBBS. Doubleday, Garden City, N.Y., 1967. xii + 258 pp., illus. $6.

This short biography is one in a series entitled British Men of Science, under the general editorship of Sir Gavin de Beer. It appeared first in Britain, in 1965, with the slightly different title *Joseph Priestley: Adventurer in Science and Champion of Truth*. The two subtitles are equally unfortunate, and both fail to give an indication of the contents of the book. The author indicates in his preface that he has departed from the general plan of the series in order to give a broad outline of Priestley's multifarious activities in education, religion, politics, and science. This decision to attempt a comprehensive survey of Priestley's life in such a compact format was an unfortunate one. The result is a superficial biography, crowded with a baffling array of minor figures who are introduced with frequently nothing more than the statement that they were acquaintances or correspondents of Priestley. Even more regrettable is the fact that the aspect of Priestley's life which has suffered most from this treatment is the scientific. Chapters on his contributions to electricity, light, physiology, and chemistry are inserted at appropriate chronological points; but little attempt is made to demonstrate the relation of these contributions to his other interests. And yet, as the author points out, Priestley's science was rooted in his religious and political dissent: it provided him with yet another base from which he could attack usurped authority and pretentious posturing in his search for unencumbered truth and the better welfare of mankind.

Priestley's most notable scientific achievement was his contribution to the chemistry of gases: his isolation and researches on the oxides of nitrogen, ammonia, hydrogen chloride, silicon tetrafluoride, sulfur dioxide, and oxygen displayed considerable manipulative resourcefulness and were in large part dependent on his skillful deployment of the pneumatic trough. This systematic exploitation of a new technique, rather than any planned theoretical objective, seems to provide the unifying theme in Priestley's chemical studies. Gibbs, however, devotes little space to the development of the pneumatic trough—he gives sole credit to William Brownrigg—and does not discuss Priestley's refinement of this very important technique. Nor does the reader derive any estimate of Priestley's overall position and importance in the history of chemistry. In spite of the subtitle of the American edition, hardly any space is devoted to Priestley's contribution to Lavoisier's Chemical Revolution; the combustion question is dismissed in a half-page section entitled "Phlogiston." Interestingly, however, we learn that the French gave Priestley chief credit for their preeminence in the art of ballooning. The author throws some oblique light on the question of why Priestley so combatively adhered to the phlogiston theory until his death in 1804—a seemingly uncomfortable posture for a revolutionary figure. In discussing Priestley's opposition to James Keir's suggestion that the word *gas* be adopted instead of *air* for all elastic fluids, Gibbs suggests that the former's adherence to tradition sprang from his deep historical commitment. This commitment is further reflected in Priestley's grand design to publish a series of "histories" of the various branches of natural philosophy, of which only the volumes on electricity (1767) and light (1772) appeared. Also, as with most would-be religious reformers, Priestley's reformation was not evolutionary but was based on a return to the supposed pristine simplicity of primitive Christianity. Priestley the revolutionary was, in a sense, a man marching forward with his gaze fixed steadily over his left shoulder.

There can be no doubt of the author's sympathy for his subject as a religious and political figure; but, to this reader at least, he has not conveyed the basis of his admiration. Instead, Priestley emerges as a somewhat smug bourgeois who did not know where to draw the line in controversy. The overall impression is that Priestley wrote too much and thought too little. The most pungent and terse commentary on him in the book occurs in a reproduced contemporary cartoon which depicts the dissenting triumvirate of Priestley, Price, and Lindsey haranguing a motley assembly on the Repeal of the Test Act from a pulpit. While Lindsey tears up a copy of the Thirty-Nine Articles and Price addresses sage words to the congregation, Priestley spews volumes of hot air out the window.

Priestley's last years, which he spent in Northumberland, Pennsylvania, were clouded by financial pressures, personal sorrows, intellectual isolation—he found Philadelphia climatically inhospitable and too expensive—and political disillusionment. An ardent supporter of the American cause while in Britain, he now felt that the Adams administration had betrayed the American ideal, and as usual did not hesitate to say so. His own pugnaciousness and the malevolent activities of William Cobbett almost secured his deportation under the aliens and sedition acts of 1798, but Adams demurred with the comment that "his influence is not an atom in the world." Poor Priestley, what a reward for all that writer's cramp.

Any biographer of Priestley is due some sympathy on account of the mass of raw literary material with which he has to deal; but it might fairly have been expected that Gibbs would have distilled a more penetrating essence than this. It is unfortunate that this book should have been Gibbs's last work in the history of science; he was a much better historian than this contribution would indicate.

There is a brief, highly selective bibliography at the back of the book, and footnotes pointing out "the less familiar sources" are included on the appropriate pages. The book is well illustrated with plates and drawings, and there is an index.

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Biochemical Energetics

Energy Changes in Biochemical Reactions. IRVING M. KLOTZ. Academic Press, New York, 1967. x + 108 pp., illus. $5.95.

This is an expanded edition of the earlier book *Energetics in Biochemical Reactions*. The present version covers more ground but has lost some of the bounce of the shorter one. The author's reluctance to adopt the terminology of biochemists has receded in the ten years intervening between the two books, although it still seems necessary to him to introduce high-energy bonds enclosed between quotation marks; these disappear in the later discussion, however, and even the use of phosphate bond energy creeps in rather naturally.

A welcome addition is a comparative discussion of proton, electron, and group transfer, followed by a para-

graph on coupled reactions. But I am not too happy about the treatment of a simple phosphate transfer reaction such as that from adenosine triphosphate to arginine as a coupled reaction. Biochemists prefer to reserve the term *coupling* for transmission of potential between different groups, and in particular from electron transfer to group potential, to which *coupling* and *uncoupling* refer almost specifically.

The book contains ingenious applications of thermodynamics. For example, tre ΔG for hydrophobic bonding is deduced from a comparison of solubilities of a series of amino acids in ethanol with glycine. It appears that to shift a mole of isoleucine from alcohol to water, 3 kilocalories have to be expended. This kind of treatment offers a background for evaluating the much-talked-about functioning of clusters of hydrophobic side chains in enzyme proteins.

I like most the last section, on the relationship between energetics and molecular statistics. It deals in a commonsense manner with problems that are often submerged by high-powered formalism. It makes one realize one is in the presence of a person who is enviably familiar with his tools and able to use them ingeniously.

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Sites of Photosynthesis

Biochemistry of Chloroplasts. Proceedings of a NATO Advanced Study Institute, Aberystwyth, Wales, Aug. 1965. T. W. GOODWIN, Ed. Academic Press, New York. Vol. 1, 1966, xvi + 476 pp., illus., $18; vol. 2, 1965, xviii + 776 pp., illus., $29.

These two volumes provide a striking demonstration of the proliferation of studies on chloroplast biochemistry that has occurred since the announcement in 1954 of photosynthesis by isolated chloroplasts. Before this time the study of chloroplasts was not generally regarded as a branch of biochemistry. Goodwin was fortunate in being able to assemble at the conference of which these volumes are the published record a large proportion of the workers who have contributed to this field in recent years, so that the books represent a summary of current results and thinking on chloroplast structure and function which should be useful both to the student entering the field and to the researcher who is trying to keep up with the flood of papers which now appear on chloroplasts and their activities.

The first volume is concerned with the structure and composition of chloroplasts. The first seven papers, dealing with studies of the ultrastructure of chloroplasts, done mostly by electron microscopy, but also with the use of x-ray scattering, fluorescence properties, and other physical methods, illustrate vividly the variations on a basic structural theme which can be derived by different investigators from quite similar data. Most current work on the ultrastructure of chloroplasts is concerned with attempts to make models of the chloroplast lamellae, regarding whose organization there is not as yet general agreement, at least not in detail. The fact that the method of isolation of the chloroplasts may have a great influence on the structure observed is being increasingly recognized.

Studies of the chemical composition of chloroplasts, including the lipids, the proteins and nucleoproteins, the nucleic acids, and the pigments, comprise the remainder of the first volume. Since most of the investigators are interested in the localization of these components in the chloroplast structure, these studies often merge closely with the more strictly structural investigations described in the first few chapters, and, on the other hand, lead into the studies on the biochemical activities of chloroplasts to which the second volume is devoted. Subjects of papers in this section include elucidation of the unusual types of lipids found in chloroplasts; the organization of these with proteins and lipoproteins in the lamellae; description of a distinctive DNA in chloroplasts, providing support for earlier suggestions from genetic experiments that at least some chloroplast syntheses and functions may be independent of nuclear control; the observation of RNA, ribosome-like particles, and protein synthesis in chloroplasts; and last, but by no means least, continuation of studies on one of the most important types of chloroplast components, the photosynthetic pigments.

Anyone familiar with the photosynthesis literature of a few years ago who had not followed the field since would probably be surprised at the small amount of space in the second volume devoted to the subject of carbon dioxide fixation, although the papers in this section, like most of the others, are careful and detailed. The greatest portion of this volume is concerned with the biosynthesis of the various chloroplast components, including the carbohydrates (some of this is closely related to CO_2 fixation), lipids, proteins, and amino acids. These subjects are treated in considerable detail from many points of view, and, like the chemical studies of volume 1, are often related to ultrastructure. The biochemistry of photosynthetic phosphorylation, which provides the energy to drive the biosynthetic mechanisms in the light, receives considerable attention, with particular emphasis on naturally occurring cofactors of the reactions involved and on a possible relation between cyclic (only ADP formed, no oxygen liberated) and noncyclic (ATP and NADPH both formed, oxygen liberated) photosynthetic phosphorylation and the two light reactions of photosynthesis. The work finally comes full circle with a consideration of biosynthetic mechanisms in relation to morphogenesis.

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Quantum Substances

The Properties of Liquid and Solid Helium. J. WILKS. Oxford University Press, New York, 1967. xii + 703 pp., illus. $24.

Experimental and theoretical investigations of the quantum liquids, liquid helium-3 and liquid helium-4, have a long history of rich accomplishment. Intensive study of the quantum solids, solid helium-3 and solid helium-4, which is relatively more recent, promises to be very fruitful for basic solid-state research. Most of this monumental book by John Wilks is devoted to quantum liquids (chapters 1–19, 560 pages); the last three chapters deal with quantum solids. Wilks, a major contributor to the experimental literature on both liquid and solid helium, approaches the exposition of the properties of these substances as an experi-