Book Reviews

Chemists in America

A Century of Chemistry. The Role of Chemists and the American Chemical Society. HERMAN SKOLNIK, chairman, board of editors. KENNETH M. REESE, Ed. American Chemical Society, Washington, D.C., 1976. xviii, 468 pp., illus. $14.

This book is a detailed history of the American Chemical Society from its founding in 1876 to the present. It deals with the development of the society, with the chemists who built it, and with the progress of chemistry in America during its existence. More than 50 people contributed to the writing of the book, and Kenneth Reese rewrote the material to give the book a uniform style and to avoid duplication. The first 380 pages of the book tell the story of the development of the society from a small local group to the largest technical society in America. The remainder is a record of the officers of the society, the important committees, the publications and their editors, the division and section officers, the winners of the society's awards, the national meetings, and membership statistics.

An interesting part of the early history is the description of the many difficulties the founders encountered. Chemists were scattered, and travel and communication were difficult. American chemists first got together in 1874 in Northumberland, Pennsylvania, to celebrate the centennial of Priestley's isolation and characterization of oxygen. A group of 75 chemists from 15 states and the District of Columbia, along with one each from Canada and Britain, met on that occasion. The meeting, which was chaired by Charles F. Chandler of Columbia College School of Mines, led to the suggestion that a national chemical society be organized, but little was done until a group of New York chemists met at Chandler's home in New York in January 1876 and decided to form a local chemical society. This group wrote to 100 chemists in New York and received favorable replies from 40. This encouraged them to try to form a national society, so they sent letters to 220 chemists throughout the United States and received 60 favorable replies. With the assurance of 100 founding members, the first meeting of the American Chemical Society was held in April 1876 in the College of Pharmacy of the City of New York. Chandler was elected president.

The society did not prosper at first. Membership fluctuated from 192 at the end of 1876 to 243 in 1881 and back to 167 in 1889. It was difficult to assemble the number of members (15) required for a quorum. In Washington, D.C., in 1884 a Chemical Society of Washington was formed, and by 1887 there were no Washington chemists in the national society. In 1888 the American Association for the Advancement of Science helped get chemists together by forming its section C. In 1889 the suggestion that local sections of the national chemical society should be organized was adopted, and the Washington group accepted that idea and became a local section. Harvey W. Wiley of the U.S. Department of Agriculture became the national president of the society. From that time on the society prospered. By 1896 membership had passed 1000, by the spring of 1902 it had passed 2000, and in 1917 it had passed 10,000. There was a slight drop in membership in 1921, but then there was a steady increase until 1931. For four years the membership slipped, but by 1936 it was up again to more than 18,000. In the next ten years it grew to 48,755. In 1956 it had reached 79,224, and by 1975 it had grown to 110,820. This increase in membership paralleled the increase in the importance of chemistry in America.

Through the active part it has played in chemical education, the society has made an important contribution to the development of the profession. Its most important contribution, however, has been its publications. Its journals are highly regarded all over the world, and its *Chemical Abstracts*, an endeavor in which British, German, and French scientists are cooperating, are now used throughout the world. As chemistry has grown in importance and scope, journals have been added to keep pace.

A major change in the operation of the principal office of the society took place in 1945, when Charles L. Parsons, who had been the secretary of the society for 38 years, retired. Parsons had been primarily responsible for the society's operation and had managed its tremendous growth. On his departure, many changes were made that allowed the members to play a greater part in making important decisions of policy. This arrangement has functioned until the present, but there is once again some feeling among the members that changes in the mode of operation may be desirable.

One of the most important sections of the first part of the book is the description of the various divisions of the society. The dates of their formation and the chemical developments that made them necessary are recorded in good detail. This section also sets forth the contributions chemistry has made to American life. The reviewer believes this section should have been enlarged to emphasize these contributions.

The book will be of interest to all chemists and to those who work in the chemical industry.

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Ichnology

The Study of Trace Fossils. A Synthesis of Principles, Problems, and Procedures in Ichnology. ROBERT W. FREY, Ed. Springer-Verlag, New York, 1975. xiv, 562 pp., illus. $57.80.

As geologists have placed more emphasis on the environmental and biological interpretation of sedimentary rocks and the fossils they enclose, the study of the trails, borings, and other traces made by fossil and recent organisms has become important. This volume is the most comprehensive and coherent treatment of trace fossils to date, a tribute to skillful planning and editing. It also represents the coming of age of the study of trace fossils and their use in solving geological and paleontological problems. It is still burdened with the sort of unfamiliar terms—"stratinomy" and "epichnia," for example—that made its predecessors treasuries of new coinage. Many of the articles are largely anecdotal, with descriptions of singular occurrences. But throughout, there is an attempt to deliver geologically useful generalizations.

The 23 contributions are organized into five parts. The first part is concerned with the history and potentialities of ichnology, the classification and preservation of trace fossils, and false traces. This section is largely review and will be of interest chiefly to those who are unfamiliar with the study of trace fossils. The second part deals with the geological significance of trace fossils. J. D. Howard's chapter on the sedimentological significance of trace fossils is an outstanding contribution. Howard ably demonstrates his assertion that trace fossils "often supply evidence of sedimentological conditions that is superior to information gained only by the study of physical structures." His model of trace fossils as indicators of general depositional processes under continuous and discontinuous deposition should receive wide attention from stratigraphers and paleontologists alike. It is simple, sensible, and useful.

The third part consists of papers dealing with selected groups of trace fossils, including plants, borers, and vertebrate tracks and burrows. W. J. Kennedy discusses trace fossils in carbonate rocks, a subject that has received little attention in the past although all trace fossil suites occur in carbonates and are as important for environmental interpretation, in carbonates as they are in other rocks. In another important chapter, R. G. Bromley describes distinct trace fossil assemblages associated with omission surfaces. If it wasn't before, it is clear from this paper that trace fossils will become increasingly important in assessment of the temporal continuity of any local stratigraphic sequence.

The fourth part is concerned with the traces of recent animals in aquatic, shallow marine, and deep-sea environments. J. Dörjes and G. Hertweck compare the living communities and trace assemblages at three places in the modern ocean, but with limited success. The only clear relation is no surprise—the highest degree of bioturbation coincides with the peak density of the biocoenoses. C. D. Hollister, B. C. Heezen, and K. E. Nafe describe animal traces on the deep-sea floor and illustrate them with new photographs. This area of research has become increasingly important as we recognize more and more deep-sea sediments in the fossil record. Trace fossils are often the only evidence of life preserved in these sediments.

The last part of the book deals with techniques in the study of traces. C. A. Elders's chapter is entitled "Experimental approaches in neoichnology" but is chiefly a systematic review of the method and mechanisms of burrowing. Perhaps this best illustrates the need for truly experimental research on the production and preservation of trace fossils.

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Bioenergetics

Electron Transfer Chains and Oxidative Phosphorylation. Proceedings of a symposium, Selva di Fasano, Italy, Sept. 1975. E. QUAGLIARIELLO, S. PAPA, F. PALMIERI, E. C. SLATER, and N. SILIPRANDI, Eds. North-Holland, Amsterdam, and Elsevier, New York, 1975. x, 452 pp., illus. $35.95.

At the descriptive level, there is no question that this proceedings volume provides an excellent, all-inclusive account of our present knowledge about the components of the complexes of the electron transfer chain and of the adenosine triphosphatase complex and about the pathways of electrons in the various complexes. It contains 56 articles, ranging in length from 2 to 16 pages. Some have the character of reviews or progress reports; quite a few present new material.

It might be useful to point up some decisive experimental developments to be found among the articles. H. Weiss *et al.* provide compelling evidence that cytochrome b in complex III is a dimeric unit of molecular weight 50,000 and not, as was previously thought, a monomeric unit of 25,000. The polypeptide chains of the unit are similar, but there are significant differences. The two spectral species of cytochrome b can now be satisfactorily rationalized in terms of a dimeric unit, the hemoprotein components of which are distinguishable spectroscopically. G. v. Jagow provides evidence that the interaction of antimycin with cytochrome b converts the cytochrome into a relatively inactive form that scarcely can exchange electrons with Q, durohydroquinone, and cytochrome c_1. In the form of its antimycin complex, cytochrome b behaves like a hydrogen carrier, that is, it accepts two protons and two electrons. W. A. Cramer *et al.* demonstrate that cytochrome b-559, which is intimately associated with photosystem I, exists in a high-potential form at neutral *p*H and in a low-potential form in acid. The oxidation-reduction potential of the protonated form is sufficiently low to permit it to be readily oxidized by photosystem I.

H. Beinert and F. Ruzicka give an incisive account of the role and function of the multiplicity of iron sulfur centers found in the various electron transfer complexes. They point out that the number of iron sulfur proteins counted now exceeds the number of cytochromes. This has become a source of embarrassment because no one has any idea why there should be three to four iron sulfur centers in a single complex such as complex I. The discovery that the flavoprotein that links the fatty acid oxidation system to the electron transfer chain is associated with an iron sulfur center is particularly noteworthy. H. Penefsky *et al.* have mastered the art of clearing F_1 of all bound nucleotides, and this has made it possible to determine how many binding sites for nucleotides there are in F_1 and which of the five polypeptides is concerned in the binding. In by far the most elegant article in the volume, S. J. Ferguson *et al.* trace the consequences of inactivating F_1 with a reagent that ties up one tyrosine group, inactivates adenosine triphosphatase, and eliminates the fluorescence induced by 1-anilino-naphthalene-8-sulfonate on addition of adenosine triphosphate (ATP). They conclude that the rate of probe response is not a bulk property of the membrane but is due to local causes, in line with the position of H. Baum *et al.* This result, Ferguson *et al.* emphasize, is hardly concordant with any of the current dogmas about the nature of the energized state. R. Bachofen *et al.*, from their studies of photosynthetic energy transduction, conclude that the energy-dependent release of bound ATP may be a side reaction with little relation to phosphorylation. It is this release that is the cornerstone of the Slater-Boyer conformational hypothesis.

A. Tzagoloff has initiated the construction of the first map of the structural and regulatory genes in mitochondrial DNA. From studies of mutants deficient in some facet of coupled ATP synthesis, he has been able to deduce the arrangement and role of some of the markers in the gene map. Y. Hatefi *et al.* have defined how one complex (complex I) can oxidize two substrates (reduced nicotinamide adenine dinucleotide and its phosphate) by similar yet not identical pathways and thus may have solved one of the long-standing puzzles of the mitochondrial electron transfer chain. A. Lehninger *et al.* have systematically tackled the problem of the number of protons formed during the passage of two electrons and two Ca^{2+} ions across the membrane. The number is four. It should be pointed out that if it were not, the prin-