

for another. For example, in the process discovered by Nicolas Leblanc for making soda, sea salt was made to react with sulfuric acid, yielding sodium sulfate and hydrochloric acid. The sodium sulfate was then changed to sodium carbonate by treatment in a furnace with coke and calcium carbonate. The hydrochloric acid could be dissolved in water and sold as such, or it could be oxidized to chlorine by reaction with manganese dioxide.

Processing and finding of uses for hydrochloric acid were often motivated by the undesirability of venting it into the atmosphere. Smith documents several instances in which local French officials forced a factory to stop polluting or move to a site away from population centers.

Environmental problems were just one of many factors that determined the success or failure of the first chemical factories. As Smith chronicles the fate of these enterprises, one cannot escape noticing their high rate of failure and the restless flux of partnerships, relocations, processes, and products that characterized the industry. Tempestuous political conditions only added to the instability, but a more fundamental destabilizer was the revolutionary growth of chemical science. The variety of known reactions was such that late-18th-century entrepreneurs seeking to manufacture soda had four major processes, each with variations, from which to choose. Only after two decades of hard-earned experience could Leblanc's method be declared the clear winner.

Progress made since Lavoisier in quantifying chemical studies enabled manufacturers to figure the maximum theoretical yield and thereby measure how much further they could go in improving the efficiency of their operations. Among sulfuric acid makers, the quest for higher yields was retarded until the quantitative studies made in 1806 by Nicolas Clément and Charles-Bernard Desormes, who showed that the oxidation of sulfur proceeds first to sulfur dioxide and then to the trioxide provided nitrogen oxide gases, usually released from saltpeter, were present. Theirs was the first catalytic explanation in modern chemistry. It led Gay Lussac to invent a procedure recycling the nitrogen oxide gases, a considerable cost advantage. Meanwhile, further savings were realized by a whole series of clever innovations that made it possible for sulfuric acid to be made by a continuous-flow process. This technical triumph foreshadowed the abandonment by the chemical industry of batch processing wherever possible.

Though Smith is quick to point out trend-setting advances, he is careful not to distort their character and importance within the historic setting in which they occurred. For instance, in his study of bleaching operations he shows precisely how limited were the changes made in the traditional process when treatment with chlorine came to be substituted for exposure to sunlight.

Smith is at his best in describing old processes and the modes of thought that underlay them. He is also good at explaining what is going on in terms of modern chemistry. Though I regret his timidity in reaching general conclusions and in linking his findings to the broader currents of political and business history, his book must rank as an outstanding contribution to the history of chemical technology.

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Alternative Energy Sources

Progress in Biomass Conversion. Vol. 1. KYOSTI V. SARKANEN and DAVID A. TILLMAN, Eds. Academic Press, New York, 1979. xii, 260 pp. \$16.50.

Although biomass in general and wood in particular have been vigorously advocated as viable and appropriate alternative sources of energy and chemicals since the advent of the oil embargo of 1973-1974, this advocacy has been based on the virtues of biomass as an available, renewable, and environmentally compatible resource, more in line with traditional applications and processes than with modern technology and prevailing economic systems.

The foreword and preface of this volume naturally reflect the general enthusiasm about the long-range potential of biomass. The subsequent chapters, however, get down to the business of describing precisely not only how biomass could replace petroleum and natural gas through different processes and under different circumstances, but also at what price and to what extent. The descriptions are thorough and comprehensive, often providing comparison with alternative resources, including coal and petroleum, and taking into consideration such problems as corrosion and erosion.

The question of how additional fuel could be obtained from forest industry or silvicultural energy farms, with related technical details and economics, is discussed in separate chapters by R. L.

Jamison and Jean-Francois Henry. A truly critical assessment of methanol production from wood is presented by R. M. Rowell and A. E. Hokanson. James G. Abert and Harvey Alter have surveyed practices for recovery of energy from municipal waste in the United States and Europe. Some of the efforts to update old, destructive distillation methods by using a vertical bed reactor are described by J. A. Knight, and the fuel values of wood residues are analyzed by Tillman.

These papers provide a valuable demonstration of how technical feasibility can be distinct from economic viability and how changes in one can affect the other. A case in point is the utilization of forest residuals as fuel, which is becoming more and more attractive economically as prices of petroleum increase and as combustion technology develops. However, it is interesting to note that tax incentives and lowering of institutional barriers (governmental regulations) are recommended as a more effective short-term approach to increasing economic viability than technological developments, on the grounds that the latter have already made energy systems more complex and costly. Whether or not this approach can be justified, the technical complexity of the proposed energy systems and the costs and problems involved are defined well and presented clearly. Consequently, the volume provides a source of authoritative and specific information for all those who are concerned with energy, economy, and biomass utilization.

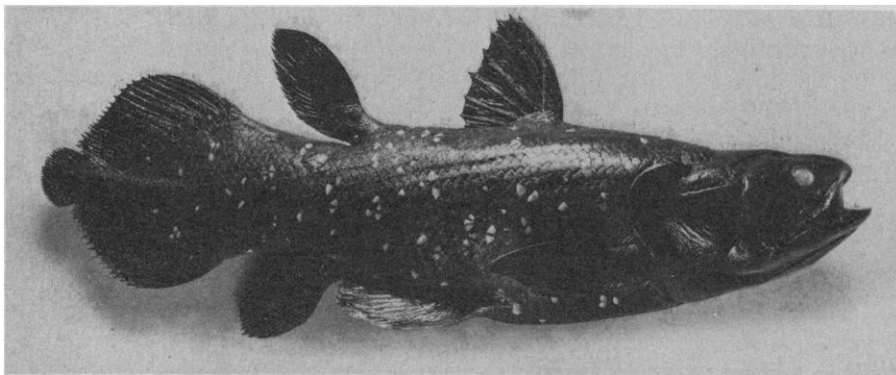
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Latimeria

The Biology and Physiology of the Living Coelacanth. Papers from a symposium, June 1977. JOHN E. MCCOSKER and MICHAEL D. LAGIOS, Eds. California Academy of Sciences, San Francisco, 1979. vi, 176 pp., illus. Paper, \$10. Occasional Papers of the California Academy of Sciences, No. 134.

This volume contains the supplemented proceedings of a AAAS symposium. Included are an introduction by the editors and 11 papers on various aspects of the living coelacanth (*Latimeria*), ranging from natural history through anatomy to physiology and biochemistry. Featured in addition are historical accounts by M. Courtenay-Latimer, who found the first specimen and



The coelacanth, *Latimeria chalumnae*. [From *The Biology and Physiology of the Living Coelacanth*]

brought it to the attention of an ichthyologist, and M. M. Smith, the spouse and co-worker of that fortunate investigator (J. L. B. Smith).

The focus of most of the articles is the systematic relationship of the coelacanth. M. D. Lagios plays the devil's advocate and argues that *Latimeria* is related more closely to elasmobranchs than to bony fishes (tetrapods and actinopterygians). His arguments cite the pituitary, rectal gland, and urea. Refutations are offered by L. J. V. Compagno (skeleton), E. O. Wiley (muscles), R. W. Griffith and P. K. T. Pang (osmoregulation), and G. Dingerkus (chromosomes). Interspersed are noncommittal articles by W. A. Miller (hard tissues), L. E. Rasmussen (biochemistry of brain fluid), T. Hayashida (bioassay of pituitary), S. E. Fisher and G. S. Whitt (creatine kinase isozymes), and J. B. Lombardini *et al.* (amino acids and taurine). Included is an article on "inferred natural history" (J. E. McCosker). The volume ends with transcribed excerpts of the discussion at the close of the symposium, where one learns that the participants were later to feast upon fillets of their study material (rumored to have been small ones).

The volume as a whole is interesting in a way entirely different from the appeal of its varied fare and its emphasis on the evolutionary byways of vertebrate osmoregulation. It represents the effort of a public aquarium to do more than exhibit living fishes to the gape and goggle of the curious onlooker. The expedition of the California Academy of Sciences to the Comoro Islands in 1975, while unsuccessful in obtaining a living coelacanth for exhibit at the Steinhart Aquarium, nevertheless returned with two frozen specimens, which served as the research material for many of the articles of this volume. Without the imaginative efforts of J. E. McCosker, director of the aquar-

ium, the research would not have been performed, and the volume would never have appeared.

As a spirited review of the systematic position of *Latimeria*, the volume as a whole reinforces the view, while giving the devil his due, that the coelacanth is a primitive bony fish, not an elasmobranch. The articles on osmoregulation, chromosomes, and creatine kinase, in particular, extend beyond *Latimeria* itself and far into comparative vertebrate zoology. The volume thus has interest for zoologists other than those who enthuse, with appetites barely whetted, over "old four-legs" and its affairs.

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Membrane Pathobiology

Plasma Membranes and Disease. DONALD F. H. WALLACH. Academic Press, New York, 1979. xii, 356 pp., illus. \$44.50.

In *Plasma Membranes and Disease*, Wallach attempts a codification of human diseases that involve, or might involve, plasma membranes. The diverse array of diseases that may involve a membrane defect, at some etiological level, gives some indication of the functional repertoire of the plasma membrane. The book contains seven chapters, of which the first is a brief review of the composition, organization, and dynamics of the plasma membrane. The chapter is strong in its treatment of microviscosity and fluidity and gives a terse description of each of the nine classes of well-characterized proteins that are associated with surface membranes. It is less informative on the complex carbohydrates.

The second chapter is devoted to the role of membranes in neoplastic diseases. It does not purport to span the entire scope of the relationship between plasma membranes and cancer but focuses on some specific alterations caused in membranes by the small DNA viruses and by carcinogens. Wallach has studied the role of membranes in cancer for years, and his expertise makes the chapter a pleasure to read.

Diseases that affect erythrocytes and platelets are described in the third chapter. Some of the diseases discussed are quite rare, and some of the links to a plasma membrane component in the diseases are not direct. For example, red cells from patients with paroxysmal nocturnal hemoglobinuria are abnormally sensitive to complement. Granulocytes from these patients are relatively poor at chemotaxis. The primary lesion is not known, however, and it may not involve the plasma membrane *per se*.

The fourth chapter is, to me, the best. It deals with diseases of membrane receptors, and here the link to the plasma membrane is unequivocal. Wallach discusses the acetylcholine receptor and myasthenia gravis, thyrotropin receptors and Graves' disease, the insulin-receptor and insulin-insensitive forms of diabetes, the low-density lipoprotein receptor and familial hypercholesterolemia, and the immunoglobulin E receptor and allergic disease. The discussions are objective, and controversial issues are dealt with honestly and constructively.

Diseases caused by intracellular parasites are covered in the fifth chapter. The author concentrates on the mechanisms and selectivities that the parasites use to detect and then to penetrate the plasma membranes that surround the cells to be infected. The parasites discussed are viruses, bacteria, and protozoans, but by no means are all the known parasites in each of these categories described or even listed. There is no explanation for including influenza virus and the bacterium that causes leprosy, for example, and excluding polio virus and the bacterium that causes syphilis.

Diseases with unknown etiologies, like multiple sclerosis and Huntington's chorea, are discussed next. Wallach's speculations that tie the disease symptoms and characteristics to the plasma membrane are often fascinating and always presented fairly. Transport defects are covered in this chapter, and Wallach includes brush-border diseases and cystic fibrosis in this category. Like many others, Wallach focuses on the hyperosmolar sweat that is one of the defining