fied will only be apparent to the readers of *Science* another generation hence. For the present, *The Emergence of Science in Western Europe* expertly encapsulates our historical knowledge even as it also reasonably reflects our societal concerns.

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Molecular Virology

Negative Strand Viruses. Papers from a symposium, Cambridge, England, July 1973. B. W. J. MAHY and R. D. BARRY, Eds. Academic Press, New York, 1975. Two volumes. Vol. 1. xx + pp. 1–554 + index, illus. $38.25. Vol. 2. xxviii + pp. 555–928 + index, illus. $27.75.

Evolution keeps trying to produce the perfect virus, and its continuing efforts have generated a startling variety of solutions to the problem of transporting genetic information from cell to cell and getting it to do something useful (or reprehensible, depending on the point of view) when it arrives. One of the more unusual solutions is exemplified in the "negative strand" viruses. Here we have the agents of measles, rabies, and influenza and their close relatives, all with genes encoded in RNA of the single-strand type, but not in the translatable form of messenger RNA. Instead, the genomes of these viruses are the complement of message, "negative" by the convention that messenger RNA molecules are "positive" strands. And because cells have no interest in using RNA as a template for RNA synthesis, these viruses have had to devote a large fraction of the small amount of genetic information they contain to specifying their own transcriptional machinery, which they carry around together with their "negative strand" genomes.

These things and more about the molecular biology of these agents can be learned from *Negative Strand Viruses*, a collection of 65 papers by more than 100 investigators, including most of the leading contributors to the field. Each of the major groups of negative strand viruses is well covered, with about equal space devoted to paramyxoviruses, influenza viruses, and rhabdoviruses. Volume 1 is thicker than volume 2, and it is possibly the better choice for one whose interests lie in the realm of genetic information transfer. It includes sections on virus structure, the architecture of viral genomes, RNA transcription and translation, and RNA replication, with some insights provided by several papers on biochemical genetics. Volume 2 covers additional aspects of viral genetics, virus protein synthesis, and biochemical and biological studies on the outermost part of these viruses, the envelope, a hybrid structure containing virus-specified proteins and cell membrane lipids.

Although almost everything in these volumes has already found its way into print elsewhere, it is convenient to have the information together in this format. Despite some recent developments such as the cell-free translation of influenza virus messenger RNA and the discovery of 5′-terminal modification in rhabdovirus and paramyxovirus messenger RNA molecules, most of the papers in these volumes are still accurate representations of the state of the art. But the prospective reader must be warned that he cannot approach this work unprepared. These are raw scientific papers, unconnected by explanatory text. He who is unfamiliar with the field would do well to consult a recent review on the molecular biology of one of these virus groups before plunging in.

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Origins of Metabolic Systems

The Evolution of the Bioenergetic Processes. E. BRODA. Pergamon, New York, 1975. x, 212 pp., illus. $20.

Although there are many books at many levels on bioenergetic processes and on their chemical mechanisms this is the first to present such material in an evolutionary framework. Not until very recently has such an effort even been possible, for the original literature is being generated now. The virtue of this book is its value as an organized source of entry to this new literature, which is scattered in geophysical, microbiological, paleontological, and biochemical books and journals. The book is at an introductory level, and instructors concerned with a balanced, lucid, and broad account of the evolution of metabolic systems may find themselves reorienting their courses as a result of this treatment. The bibliography (though unfortunately without titles) is so extensive that the teacher of biochemical evolution can easily upgrade the level by sending the student to the original work.

The orientation is chronological: after a brief introduction to energy in the biosphere and the relation of energetics to evolution one proceeds from the early conditions on the earth and the origins of life through fermentation, photosynthesis, and other prokaryote metabolic virtuosities. The book has an emphasis that is unusual in the evolutionary literature, but probably appropriate to the subject matter, in that 17 of the 25 chapters deal with Precambrian prokaryote evolution. Only four chapters deal directly with eukaryotes, their organelles, their microbial representatives, and bioenergetic processes in multicellular plants, animals, and fungi. Two chapters deal with paleontological and geological evidence for the sequence developed in the book, and the book ends with a discussion of the history of the increase in atmospheric oxygen.

The account is straightforward. Some controversial matters (such as the origin of some eukaryotic organelles by symbiosis, the details of the increase of oxygen to its present value, monophyly of the peroxisome, a detailed phylogeny for the prokaryotes) are labeled as such. In most cases justification for the straightforward statements is given. Other potentially controversial matters are either presented as settled (for example, the time of the first appearance of fossil eukaryotes) or omitted (for example, carbon and sulfur isotope fractionation effects and their use in the interpretation of the past).

The book is clearly an original collection and synthesis of the literature of a new field. It is a fund of easily understood and appreciated information. The details of the author's attempted answer to the question in what organisms at what time under what conditions did such phenomena as fermentation, photosynthesis, carbon dioxide assimilation, and respiration evolve may be disputed by those close to the literature, but I suspect everyone will agree that he has provided us with a fine summary of the literature through 1975. Although much of the factual material will be found in any elementary biochemistry or comprehensive biology textbook, nearly none will be found in books on evolution. Broda's work represents an important step toward the integration of microbiology, biochemistry, and cell physiology into the evolutionary thinking of the neo-Darwinian synthesis.

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