matched. So is his organizational skill. A work of over 200,000 words, giving thousands of new facts about scores of projects and hundreds of "projectors," could all too easily degenerate into anecdotage. Instead, in Webster's treatment detail is always subordinated to his general argument: the predominant forms of scientific activity during England's Puritan decades can be shown to be a direct outgrowth of a Puritan ideology. The argument is a stunningly convincing one.

Yet I must register not disagreement, but some disappointment. Webster has sought out the science he sees as flowing from Puritan programmatics; to my mind, some of it turns out to be less-than-interesting science. The decades from 1625 to 1660 were exciting times for English science, even if not as productive in "accomplishments" as the post-Restoration era. Harvey announced his discovery of the circulation of the blood; Ent defended it; Wharton and Glisson wrote on the anatomy of glands and of the liver. In mathematics, Briggs worked on logarithms; Oughtred clarified mathematical notation; Wren and Brouncker wrote on the theory of equations; Wallis's *Arithmetica infinitorum* laid the conceptual foundations of the calculus. Gascoigne, Horrocks, Wren, and Ward developed both observational and mathematical astronomy. Atomism was introduced into England by Charleton during the 1650's, and the same decade saw Boyle work out the experimental bases of his corpuscular philosophy. Hooke and Boyle collaborated in carrying out their famous air-pump experiments on the properties of gases.

Little of this finds a place in Webster's narrative. He argues (correctly, in my view) that such lines of inquiry were pursued by a relatively small and socially isolated elite. The sciences of broader appeal and concern were practical mathematics, the technology of trades, chemistry, and husbandry. These were the kinds of subjects that were linked organically to Puritan-dominated culture.

One must be careful not to misinterpret Webster. He would certainly not say that the "elite" sciences were, or are, unimportant. Indeed, he has himself written influential articles on topics in the history of chemistry, physiology, and medicine. But in this, his most recent and certainly his most ambitious work, he is both pleading for and exemplifying an approach to the understanding of the world view of a particular society in terms of its own inner logic, rather than according to its contribution to the "progress towards our present intellectual condition." He even goes so far as to assert that "the worldview of any cultural group merits attention in its own terms."

Many historians of science, I would venture to guess, would not follow Webster that far. Context, yes; total relativity, no. The particular interest western European science holds derives from the way in which it has increasingly focused upon a relatively few problem areas and submitted them to progressively more rigorous and experimental treatment. If a historian of science does not confine himself to the relatively broad historical path delimited by such criteria, his work wanders perilously close to the realm of a cultural anthropology in which the scholar does not even have the advantage of interviewing his subjects. An extreme contextualist position renders moot all the criteria by which a historian of science chooses his objects of investigation.

Such "positivist" criteria even provide the justification for the importance Webster's book will doubtless assume in the historiography of science. Seventeenth-century England is an important historical laboratory for exploring the relationships between social values and scientific concepts, precisely because it recorded some significant "progress." Webster has solved this important historical problem by showing that the set of dominant social values that we label Puritanism gave rise to *certain kinds* of scientific activity, only a few of which were central to the main lines of scientific ideas which were the raison d'être for examining 17th-century England in the first place. But without this index of "progress," Webster could have with equal justification studied the world views of 15th-century Catalonia or 18th-century Turkey.

But I suspect that Webster would not push his historiographic principles to such a point of caricature. He aims to hold up a model of the history of science which places science in the context of the larger society. He would reform history of science by having its practitioners exercise their craft with much greater respect for the intellectual environment from which the sciences emerge. But unlike that of many reformers—including the 17th-century ones whose ideals he chronicles—his practice is as good as his principles. He has written a definitive work whose breadth and substance are commensurate with its aspirations.

ROBERT G. FRANK, JR.
Medical History Division,
Department of Anatomy, and
Department of History,
University of California, Los Angeles

Meeting a Pollution Challenge

Biological Control of Water Pollution. Papers from a conference, Philadelphia, Pa. JOACHIM TOURBIER and ROBERT W. PIERSON, JR., Eds. University of Pennsylvania Press, Philadelphia, 1976. x, 340 pp., illus. Paper, $20.

Not many years ago water pollution control measures were confined to the construction of conventional sewage treatment plants. Today our natural waters are being bombarded with a bewildering assortment of stresses. Each day our cities produce enormous quantities of nutrients, toxic chemicals, and waste heat. Conventional sewage treatment facilities are totally inadequate to neutralize these contaminants, and they continue to pollute rivers, lakes, and estuaries. There is an urgent need for new and economical processes to control water pollution. Biological control holds the dual promise of an efficient and inexpensive means of detoxifying water combined with the utilization of the nutrients in the water for food production.

Biological Control of Water Pollution is a collection of 39 papers presented at an international conference with the title "Biological Water Quality Improvement Alternatives" held at the University of Pennsylvania in 1974. The book describes biological approaches to waste treatment. Emphasis is placed on methods for reclamation of drinking water as well as effective utilization of nutrients in the wastes.

The first part is devoted to general overviews. It includes discussions of legislative problems by Senator Muskie and former Environmental Protection Agency administrator Ruckelshaus. Limnological problems are perceptively analyzed by Ruth Patrick. A subsequent section addresses the problem of chemical pollution of drinking water. Excellent chapters by Robert Harris and Samuel Epstein describe the dangers of contamination of drinking water with carcinogens.

The major portion of the book is devoted to biological treatment methods. Treatment is discussed from a variety of viewpoints. There are chapters on the use of algae, macrophytes, vascular plants, mollusks, brine shrimp, *Daphnia*, and fish. De Jong's description of a Dutch project in which sewage is treated in ponds containing rushes and reeds is of particular interest. A paper from Romania describes the use of sawgrass for the manufacture of paper products and suggests the possibility of harvesting sawgrass from the nutrient-rich waters of Florida. The organizers have not ignored the expertise of less-developed nations in natural methods of purification. A paper from the Sudan describes methods in which local clays or vascular plants are used as flocculants to purify Nile water for drinking purposes.

The chapter by Goldman and Ryther describing their work on waste reclamation through the use of an integrated food chain exemplifies the difficulties inherent in biological control of water pollution. Despite Ryther's wide experience in marine biology, he and his group have had serious technical difficulties to overcome, particularly the concentration of toxic chemicals and enteric viruses in the biota. These constraints are discussed by a number of contributors.

I am impressed by this book. It provides a new perspective on water pollution control. Ultimately we will have to conserve our water and material resources, and the integration of recycling with waste treatment will be a long, uphill struggle. The contributors to this conference are to be commended for facing the challenge.

RALPH MITCHELL
Laboratory of Applied Biology, Division of Engineering and Applied Physics, Harvard University, Cambridge, Massachusetts

Evolutionary Phytochemistry

Biochemical Interaction between Plants and Insects. Proceedings of a meeting, Tampa, Fla., Aug. 1975. JAMES W. WALLACE and RICHARD L. MANSELL, Eds. Plenum, New York, 1976. xii, 426 pp. $35. Recent Advances in Phytochemistry, vol. 10.

This volume will be of particular importance to the field of phytochemistry because of two papers, that of Feeny and that of Rhoades and Cates. Taken together these papers provide a sound evolutionary foundation for the development of testable hypotheses in fields that have been essentially descriptive (phytochemistry) or have been concerned primarily with proximate mechanisms of plant-insect chemical interaction (insect physiology and behavior).

The correspondence between the basic theories outlined in these two papers is remarkable given their conceptually different points of origin and their independent development. Feeny's theory originated from his empirical studies of widely different categories of plant and phytophagous insect. On the basis of observed differences in the kinds of chemical defenses employed by oak trees and mustard plants and striking differences in the digestive strategies of phytophagous insects, he developed (in *Coevolution of Animals and Plants*, L. E. Gilbert and P. R. Raven, Eds., University of Texas Press, 1975) the basic aspects of the theory that is extended and elaborated in this volume as the theory of plant apparency.

In contrast, many of the empirical data in the paper by Rhoades and Cates were collected to test hypotheses initially developed by Orians (see Orians and Cates in *Unifying Concepts in Ecology*, W. H. van Dobben and B. H. Lowe-McConnell, Eds., Junk, 1975). The original predictions were that early-successional plants (because they escape in time and space) would not be toxic and that late-successional plants (because of their predictability to insects) would be toxic. Thus, the prediction was made that insects that feed on early-successional plants would be generalists and those that feed on late-successional plants would be specialists. Except in the case of a few herbivores (for example, banana slugs) empirical data tend to run counter to this prediction. Feeny's dichotomy of qualitative and quantitative defenses helps resolve the false paradox.

It is both reassuring and a tribute to careful selectionist thinking that the same basic theory of plant defensive chemistry would have been developed even had Feeny been a classical phytochemist. Although the theory is undoubtedly simplistic, I share Feeny's optimism that its broad framework is secure, and I believe it will organize much of phytochemical research in the near future.

While the remaining papers in this volume are more traditional offerings, two deserve special mention. The paper by Beck and Reese is an important contribution to the understanding of insect nutritional physiology in the context of allelochemics and should be consulted by researchers conducting feeding experiments with herbivorous insects. The paper by Roeske *et al.* is a lengthy summary of the authors' work on the processing of cardenolides by monarch butterflies. Of particular interest to ecologists is their technique for revealing the host plants used by larvae on the basis of the cardenolide content of adult tissue.

Two papers deal with the parallel occurrence of similar chemicals in plants and insects. The review by Rodriguez and Levin is a useful summary but the theoretical discussion is shallow. The paper by Hendry *et al.* would not be acceptable in a refereed journal as it is. The authors are confused about how natural selection operates and just what constitutes a scientific theory.

In the final paper Mothes provides a review of the classic work by himself and his colleagues on intraspecific genetic variation in the alkaloids of the opium poppy. Some of his evolutionary-philosophical remarks are almost mystical. I hope this is a problem of translation.

In summary, this volume is very spotty in terms of the quality and importance of its component papers. While I am pleased to have a copy (and feel most specialists in insect-plant research should have one), I do not feel that it is worth its price to a nonspecialist or to a graduate student.

LAWRENCE E. GILBERT
Department of Zoology, University of Texas, Austin

Phagocytic Cells

Immunobiology of the Macrophage. DAVID S. NELSON, Ed. Academic Press, New York, 1976. xviii, 634 pp., illus. $39.

Much credit should go to David Nelson for editing this timely, useful, and nicely produced collection of 23 articles concerned with many different aspects of the physiology and function of macrophages. Although these phagocytic cells do not possess an antigen-specific recognition system, they express on their surface several types of receptors for complement and antibody and do play a major role in the regulation of both humoral and cell-mediated immune responses; the importance of macrophages has been well established in cell-cell interactions, in inflammatory processes, in chemotaxis, and in defense against microbial infections, and they are implicated in the killing of tumor cells. All these topics are discussed in this volume.

The book suffers from the usual defects associated with multiple authorship: there is considerable overlap in material covered by different chapters, whereas some relevant matters receive relatively little attention. For example, at least four full chapters deal with the role of macrophages in vitro in antibody production, T-cell activation, and T- and B-cell collaboration; yet evaluation of controversial results is missing. Each group of workers uses its pet tissue culture system; presumably minor changes in culture, animal colonies, and source of antigen, as well as the difficulties associated with fractionation of macrophages or their complete removal from a lymphoid cell population, account for variability in the results. In contrast to the extensiveness of coverage of the in vitro exper-