stantial, sometimes severe, debilitation in its victims. The main object of this book is to describe a serious investigation into the quantitative effects of this miserable disease on the economy of the small West Indian island of St. Lucia. The chief result the investigators report is, in effect, that they were unable to find any measurably nonzero consequences at all.

How is one to take these findings? First, it is possible that they were mistaken, that significant quantitative effects of bilharzia do exist but that the team's techniques of measurement were not refined enough to detect them. Second, even if the disease is demographically and economically insignificant for St. Lucia, that does not mean that similarly negative conclusions would apply to areas of higher endemicity, especially if the intensity of infection (as possibly measured by the number of the parasite's eggs per gram of stool) is also higher. In this respect the choice of St. Lucia as a parade ground for the group's methodological exercises was in some degree unfortunate, although understandable. The smallness of the area and the relatively low degree of endemicity make it difficult to obtain that amount of variation in the data which seems to be necessary for relatively clear-cut results. One would have thought that an area such as northeast Brazil, while in many ways much more difficult to investigate, would have yielded correspondingly more rewarding results.

Although the authors, and especially the writer of the dust-jacket blurb, are not unduly modest about either the novelty or the power of the research methods they used, in fact these methods were straightforward, and appropriate for the problems they faced. Many of the data used were obtained by sample surveys, the rest from government and business records; considerable efforts were made to check on the reliability of these data. They were analyzed by various techniques of regression analysis, including probit analysis, in an effort to control for other possibly varying factors and thus to isolate those effects that really were due to the variable under study, the degree of schistosomiasis. Although the results were not unambiguous in every case, essentially the authors found that schistosomiasis had no effects on fertility, or mortality, or academic performance of school children, or rural labor productivity (the ambiguity here is especially marked), or urban labor productivity.

A most interesting by-product of these analyses, and not readily explicable, is the apparently marked negative effect of the parasite *Strongyloides* on both fertility and rural labor productivity of females. This preliminary finding clearly warrants future research.

The book suffers from its multiple authorship. There are general chapters on the economic and cultural impacts of disease, on the economic and social background of St. Lucia, and on epidemiological aspects of schistosomiasis, but these are rather pedestrian and the whole of part 1 could have been omitted, or severely compressed, without serious loss. The reader is advised to begin with chapter 5, if only because the style noticeably improves once there is something concrete to discuss.

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The Lower Eukaryotes

Lipids and Biomembranes of Eukaryotic Microorganisms. JOSEPH A. ERWIN, Ed. Academic Press, New York, 1973. xvi, 354 pp., illus. $19. Cell Biology.

The Protista, or unicellular eukaryotes, are a natural scientific resource that has not yet been exploited to maximum profit. Sometimes usefully and sometimes misleadingly divided into plants, animals, algae, yeasts, and molds, these organisms are a potential source of invaluable evolutionary and phylogenetic information and are useful experimental models of higher plants and animals. They can be grown in the laboratory and manipulated genetically with an ease approaching that of the culture of bacteria, and, since they share many of the biochemical and morphological properties of higher organisms, data derived from them are more directly applicable to multicellular organisms.

Lipids and membranes provide perfect illustrations. All higher organisms contain similar saturated fatty acids, monounsaturated fatty acids, and the diunsaturated fatty acid linoleic acid (although man, for example, is unable to synthesize linoleic acid). Otherwise higher plants and animals differ markedly, the former containing high concentrations of the triunsaturated fatty acid α-linolenic acid and the latter containing polyunsaturated fatty acids (the tetraunsaturated arachidonic acid is typical) derived from its isomer γ-linolenic acid, which has a different arrangement of double bonds. These fatty acid compositions are, of course, reflections of the enzymatic (genetic) competence of the organism. Among the Protista are examples of the animal type (amebae), of the plant type (yeasts), and of many other patterns (euglenoids, for example, which contain approximately 60 fatty acids including those typical of higher plants and animals as well as others generally restricted to algae). These fatty acid patterns provide the basis for a phylogenetic classification that agrees with and extends the arrangement derived by more traditional criteria. Approximately 30 percent of this volume consists of an able presentation of such material. Perhaps this chapter will stimulate research into the adaptive advantage conferred on each eukaryote by its particular fatty acid composition.

Similarly, cholesterol is the major sterol of higher animals. The major phytosterols, sitosterol and stigmasterol, contain the same ring structure but differ in their side chains. These three sterols and many others appear among the eukaryotic microorganisms, including in particular sterols related to ergosterol which contain a second double bond in the B-ring. The occurrences of the sterols are described reasonably well in this book, but I would have preferred a presentation (as with the fatty acids) that tried to group and interpret the data in a meaningful way.

Fatty acids function in cells primarily as components of phospholipids, which molecules, together with sterols, are exclusively components of membranes. It is in the study of membrane structure and function that Protista may find their greatest application, for, unlike bacteria, they share all the complex intracellular membrane systems and organelles of higher plants and animals. The ability to control genetically, nutritionally, and by other manipulations (of *p*H, temperature, and the like) the lipid composition of the eukaryotic microorganisms provides an excellent experimental approach to understanding the role of lipids in membranes. This receives relatively little attention in the book, possibly more because of a lack of available knowledge than because of a failure of

the authors. The role of lipids in membranes is implicit in the chapters describing the phospholipid, sulfolipid, and halosulfolipid compositions of Protista and the nature of chloroplast lipids, but the relationship between lipid composition and membrane structure and function is treated explicitly only in the one chapter which deals with fatty acid mutants of yeast and *Neurospora*.

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