

MICROBIOLOGY

A WORLD IN A DROP OF WATER, by Alvin and Virginia Silverstein. 1969. Atheneum, New York. 58 pp. \$3.75.

The young reader is introduced to a variety of microscopic organisms commonly encountered in a pond. Well illustrated with photographs and line drawings, the volume is a fascinating account of a diverse assortment of invertebrates, and it includes a brief discussion of some algae. My criticisms are relatively minor. The authors might have included more projects and activities for the interested student to pursue—though they do make some suggestions about collecting and observing. The use of quotation marks to set off words used in a special way, such as “portholes” and “guns” to describe the trichocysts of a paramecium, is certainly better than no designation. Some statements appear close to erroneous over-simplification; for example, “The paramecium is not very smart” and “Rotifers have toes with sticky ends.” The book, which includes an excellent index, promises to be a helpful addition to the school library and should be a handy reference for the budding elementary microscopist.

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LABORATORY INSTRUCTIONS IN BIOLOGY OF MICROORGANISMS, by Majorie S. Sharp and Sanders T. Lyles. 1969. C. V. Mosby Co., St. Louis. 279 pp. \$4.95.

This is a reasonably complete laboratory manual evidently designed for a rigorous course in general microbiology including applications. A student completing these experiments should have adequate technical skills to be a reasonably competent worker. These are quite standard experiments; there is nothing especially new or original about them, but they are well written and the discussion is brief and to the point. If anything, the program provided is a little too structured; there seems to be little room or time for individual initiative. This is a competent, reasonable, useful work which could be used by any of a wide array of introductory courses.

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PRINCIPLES OF MICROBIOLOGY, by Alice Lorraine Smith. 6th ed., 1969. C. V. Mosby Co., St. Louis. 669 pp. \$9.75.

MICROBIOLOGY [laboratory manual and workbook], by Alice Lorraine Smith. 2nd ed., 1969. C. V. Mosby Co., St. Louis. 166 pp. \$3.95.

After a brief introduction, the author gives a concise historical presentation of the development of microbiology from the middle of the 16th century to the present decade. Micro-

biologic techniques are presented in a manner that the neophyte can readily comprehend. Pathogenic microbial organisms are stressed, but the usefulness of other forms is also indicated. Charts, tables, and illustrations help to clarify the subject matter. Control of microorganisms is given ample space. The immune mechanisms of man are discussed. Parasites other than microbial forms are given some consideration. Finally, there is a discussion of the microbiology of water, milk, and foods, together with methods of study and control.

The teacher may find this book a handy reference for various courses in biology. The laboratory manual, which accompanies the text, offers a workable set of projects for the beginning student.

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SCIENCE EDUCATION

SCIENCE EDUCATION AS IT RELATES TO TECHNICAL EDUCATION, ed. by Jerry S. Dobrovolsky. 1968. American Association for the Advancement of Science, Washington, D.C. 55 pp. Single copy free.

This pamphlet incorporates the papers of a symposium held at the AAAS meeting in Dallas in December 1968. It is one of the very few publications addressed to the problems arising within a rapidly expanding educational field. This one does not concern biology directly, but the implications for all science teachers are clear. The discussants are knowledgeable and come straight to the point. The increase in the numbers of students in technical curricula and the *ad hoc* character of science instruction in these curricula should be enough to compel biologists to do some serious thinking about their role. Highly recommended for teachers of teachers and curriculum specialists.

Paul Klinge
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THE TECHNOLOGY OF TEACHING, by B. F. Skinner. 1968. Meredith Corp., New York. 271 pp. \$2.95.

Research bases and educational applications of teaching machines and programmed instruction constitute the theme of this volume. The book is not light reading, partly because of the liberal use of psychologic and educational terms (which are not always clearly defined) and also perhaps because of the manner in which the chapters were compiled: some of them have been published before or were originally presented as papers. In any event, the reader should plan to spend considerable time on the first several chapters before proceeding.

Skinner obviously favors the use of a technology of teaching, so the reader should not expect him to present an objective appraisal of the matter. Even so, the scientist or science teacher may be somewhat annoyed, as this reviewer was, by the prevalence of rather strong assertions of the potential of a technology of teaching and the relative weakness of support or rationale given for the assertions. Similarly vexing is the tendency to assert technological solutions without being clear as to the nature or “how” of these solutions. The reader should also be alerted to the need to evaluate critically whether or not the full range of human capabilities for which we want to educate can be achieved by the methods Skinner has proposed. Granted that if the end behavior is specified, an organism can be trained to accomplish it; but has the individual been taught to evaluate and make decisions, for example, or has he been trained to exhibit a certain behavior?

There are numerous positive contributions. A wide array of abilities that can be taught by means of a technology of teaching are discussed. In addition, a number of more abstract or complex goals, such as problem-solving, are broken down into components that appear to be more teachable. Skinner indicates that the components of such goals can be achieved through a technology of teaching.

In large part, the thesis seems to be this: Once a desired behavior has been adequately defined, the organism (human or otherwise) can be trained to perform it by the proper arrangement of behaviors and the consequences of behaviors. Skinner suggests that teachers generally do not have ample opportunity to provide reinforcement in the proper increments or with adequate frequency. Thus, teaching machines and programmed learning are needed. In spite of this emphasis, a reading of this volume by a biology teacher will remind him of numerous instances in which certain aspects of instruction can be improved. For example, he may be reminded of the need for repetition when students are expected to learn a skill, and of the need to define and teach the components of a complex skill.

Biology-curriculum developers and teachers at all educational levels would do well to read this book for ideas concerning areas of instruction in which they would like to train students in the performance of particular behaviors with maximum efficiency. But they should be prepared to encounter a wide range of suggestions and assertions that fail to answer their procedural and philosophical questions.

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