final chapter, on cell radiation biology, is somewhat better.

The text is not footnoted, but each chapter has an extensive list of suggested readings from a wide variety of sources.

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Education

BIOLOGY TEACHER'S HANDBOOK, ed by Evelyn Klinckmann. 2nd ed., 1970. John Wiley & Sons, Inc., New York. 692 pp. $8.95.

The first edition (1963) of this excellent book was prepared by a team actively involved in BSCS programs. The second edition lists 12 new contributors whose expertise in the teaching of biology complements that of the contributors to the first edition.

The book has five sections. Section 1 discusses the origin, development, and organization of the BSCS program. Extensive consideration is given to behavioral objectives in applying the inquiry process to the teaching of biology. The inclusion of material developed in 1969 by the McREL–BSCS group enhances the effectiveness of the book. Chapter 3 of section 1 contains updated, succinct descriptions of instructional materials produced by BSCS.

Section 2 is entitled "Invitations to Enquiry." [The spelling "enquiry" has come to denote the editor's point of view.–*Ed.*] This material is essentially the same as that of chapter 4 of the first edition; however, the Invitations have been indexed, which will facilitate their use. According to the contributors the Invitations are "teaching units that bring before the student small samples of the operation of enquiry." They directly involve the student in the operation of the process. The teaching methodology for use of "Invitations to Enquiry" is described in detail. Students and teachers who use the Invitations will share a unique experience.

The teaching of biology is the focus of section 3. The chapter on teaching strategies and styles has been vastly changed from the first edition. Models for structuring learning activities are proposed. Considerable attention is given to strategies of questioning and discussing. Useful checklists to help teachers develop more productive teacher–student interaction are included in chapter 6. Chapter 8, on evaluation, has been improved by the addition of material on students' perception of tests and the purpose of tests. Since evaluation is a difficult task for many teachers, this chapter could have been strengthened by including more information on assessing progress through means other than tests, and more references pertaining to evaluation could have been provided.

Section 4, devoted to the background of biology–physics, chemistry, and statistics–is essentially the same as that of the first edition except for a severe reduction in the chapter on biochemistry. Although it is true that knowledge in this field is growing rapidly, it does not seem reasonable to reduce this chapter to a mere listing of references to be searched out by the teacher: basic concepts and conceptual schemes providing a foundation of information on which the teacher could build through further reading should have been included. The chapter on statistics would have been strengthened by including a consideration of research design.

Section 5 is composed of six appendices: a list of republished research papers in biology, a selected bibliography for teachers, a description of laboratory facilities for BSCS biology, itemization of techniques and materials for the biology laboratory, and lists of sources of films and of information on career opportunities in biology. All appendices, except for the last-mentioned, have undergone complete revision and updating. The appendix on techniques and materials will be especially useful in the preparation of solutions, reagents, and stains. Material on the maintenance and handling of laboratory organisms will be an aid to the teacher who establishes and maintains his own cultures.

Although this book was developed by individuals associated with the BSCS program, it can be used successfully in any high school biology program. It should become a standard tool of biology teachers in stimulating interest in the study of biology. The book should also be considered for use in pre-service biology methods courses.

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TEACHING AS A SUBVERSIVE ACTIVITY, by Neil Postman and Charles Weingardner. 1969. Delacorte Press, New York. 234 pp. $5.95.

The relatively high price of this slim book is more than justified. It is especially relevant for science teachers, since part of science teaching is helping children learn how to learn. The point of view held by the authors and conveyed repeatedly in a variety of contexts is that the primary concerns of educators (the educational establishment) are not the primary concerns of students. Educators are primarily concerned with producing people who will become bureaucratic functionaries and fit well into today's society. The roles envisioned by students are seldom, if ever, the content of education.

Postman and Weingardner favor a new education that would create people who could "be part of their own culture and at the same time be out of it." They envision a person "not completely captivated by the arbitrary abstractions" of his own society. Such a person would be freed from dependency on arbitrary authority, have greater respect for himself as "anti-entropic" agent, and so would be ready to question the entrenched attitudes and beliefs of his society.

In the reviewer's opinion the crucial chapter is "What's Worth Knowing?" It provides a mirror in which the teacher will see reflected the priorities behind his present teaching practices. Here the definition of inquiry used by the authors acquires a new and exciting perspective. For them, inquiry means inquiring into issues of concern to the learner. And, as most of us know, that is not common practice in most schools. Carl Rogers' belief that "anything that can be taught to another is relatively inconsequential, and has little or no significant influence on behavior" is fundamental to the Postman–Weingardner philosophy.

The authors offer proposals for producing a better learning environment. Some have to do with the training of teachers, others with modifying the school's procedures. The proposals are radical ones–remember the title of the book!–but the authors would ask the teacher to examine his premises for rejecting them. Here are some of the proposals:

1. Prohibit teachers from asking any questions they already know the answers to. (This proposal would not only force teachers to perceive learning from the learner's perspective but would help them to learn how to ask questions to produce knowledge.)
2. Make every class an elective and withhold the teacher's monthly check if the students do not show any interest in going to next month's classes.
3. Require that graffiti in the schools' toilets be reproduced on large sheets of paper and hung in the halls. Graffiti that concerns teachers and administrators should be chiseled in stone at the main entrance of the school.
4. Prohibit the use of the following expressions: teach, syllabus, covering ground, I.Q., disadvantaged, gifted, accelerated, enhancement, human nature, dumb, college material, administrated necessity.

I recommend this book to any teacher who is interested in making his school more humane. The book is especially suited to the teacher who worries about why so many students stare out of windows, cut classes, or see school as separate from "living." For these teachers this book could be the start of a new way of life.

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General Biology

PROGRAMMED BIOLOGY SERIES [booklets], ed. by James Bond. 1967-70. Educational Methods, Inc., Chicago. "Heredity," by Gary Parker, W. Ann Reynolds, and Rex Reynolds (1970;

171 pp., $2.95). "Probability and chi-square," by Sandra F. Cooper and Thomas R. Mertens (1969; 88 pp., $2.95). "Mitosis and meiosis," by Gary Parker, W. Ann Reynolds, and Rex Reynolds (1968; 145 pp., $2.95). "Genes and populations," by Paul Geisert (1968; 145 pp., $2.95). "Energy, organization, and life," by R. Rodrigo Panares (1967; 129 pp., $2.95). "Understanding the microscope," by Paul Geisert. (1967; 30 pp., $1.00).

As the series title indicates, these softbacks are designed for self-learning. Several programmed instructional techniques are utilized, but the usual device is a card the user moves down the page as questions are answered. The publishers quite frankly indicate that these are efforts to have students make up work missed, as supplements to regular classroom work, and as homework. The authors are practicing teachers.

Each booklet is prefaced with a list of the objectives the authors hope the student will accomplish after working through the book. There is also a "Teacher's Manual" (1969; 64 pp., 75¢).

As pedagogic tools, the booklets come off well. The obvious criticism is that they probably promote rote memory, but there is abundant evidence that the authors try to avoid this charge by using a variety of questioning techniques. Furthermore, a book embodying chemistry ("Energy, Organization, and Life") must inevitably use memorization: this process of learning is preliminarily essential to an inquiry approach.

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BASIC BIOLOGY, by Alfred M. Elliott and Bruce R. Voeller. 1970. Appleton-Century-Crofts, New York. 663 pp. $8.95.

LABORATORY GUIDE FOR BIOLOGY, by Alfred M. Elliott. 1970. [Same publisher.] 330 pp. $4.95.

INSTRUCTOR'S MANUAL TO ACCOMPANY "BASIC BIOLOGY," by Alfred M. Elliott and Bruce R. Voeller. 1970. [Same publisher.] 275 pp. 95¢.

Those who are familiar with *Biology* (Elliott and Ray) or *Zoology* (Elliott) will find *Basic Biology* quite similar in style, content, and approach but drastically different in the presentation of illustrative materials. Instead of continuing to use the bold, diagrammatic black-and-white illustrations that characterized Elliott's other textbooks, the authors have chosen to use halftones. Some of the figures that were clearly portrayed in the earlier books are, as halftones, difficult to discern. However, electronmicrographs and some excellent drawings, especially of insects, add to the attractiveness of the book.

Although the authors contend that organic evolution is the central theme, it appears that this point of orientation serves only for the first four chapters: the 13 chapters that follow are arranged phylogenetically but include little on evolution. The next six chapters deal with the human systems and are followed by units on genetics and evolution. The book closes with a chapter on ecology, which seems to have been "added." Except for a brief discussion of the ecosphere, the chapter does not deal with contemporary ecologic problems. The lists of supplementary readings that follow each chapter represent a good selection of materials that should be available in most college libraries. The extensive glossary and the classification outline should be helpful to the student.

The college teacher looking for a traditional textbook that integrates the recent findings in molecular biology will want to take a second look at *Basic Biology*. By omitting the typical Elliott illustrations, however, the book has no distinctiveness to separate it from most other general-biology books on the market. The high school teacher would probably want to have a copy in the library for reference use by his students.

The *Instructor's Manual* (Elliott and Voeller) falls short in helping the instructor to obtain full use of the text. The first part of the manual contains a good listing of films and film-loops for each chapter. The chapter questions, mainly of the essay and multiple-choice kinds, require only a low level of understanding.

The *Laboratory Guide for Biology* (Elliott) has a large selection of exercises from which the teacher can choose those that complement his particular course. A number of partial and complete drawings have been included to save the student some time. Most of the exercises, however, do require some drawing or labeling. There are few inquiry investigations but a good assortment concerning descriptive studies. Except for a lack of exercises on ecology and evolution, the lab guide nicely complements the text in arrangement, approach, and supportive exercises.

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INTRODUCTION TO NATURAL SCIENCE, PART 2: THE LIFE SCIENCES, by Lawrence Parsegian, Paul R. Shilling, Floyd V. Monoghan, and Abraham S. Luchins. 1970. Academic Press, New York. 727 pp. $10.95.

This is a college textbook for students who have completed a year of physical sciences. Part 1, subtitled *The Physical Sciences*, would be the prefered prerequisite but is not a necessary one: the present book seems to contain the physical-science information needed for understanding the courses.

I made the mistake of reading the

WHAT A PIECE OF WORK IS MAN!

how noble in reason! how infinite in faculties!

teacher's guide before reading the student's text. Some of the suggestions to the teacher are upsetting; for example, "When the lecturer mentions such terms as covalent bond, he pauses to ask students to give the definition of each. This keeps them on their toes and helps students who require this repetition for the concept to sink in." Another example is a comment about testing: "We have given a few yes–no quizzes successfully along with the very few trick questions against which students are warned in advance." Objectives stated for the chapters would curl the hair of an advocate of Mager-type objectives; for instance, an objective for chapter 9 is to "introduce the ADP–ATP energy exchange reaction." Except for suggested time schedules and supplementary aids, the teacher's guide is a waste of effort.

The text is designed primarily for students in a lecture situation. It is heavily biochemical in approach—so heavily, in fact, that a student may ask where the biology is. The first one-third of the book is devoted to the physical basis of life. In reading the chapters, I felt that I was back at the encyclopedic stage of textbook evolution.

There is a good deal of useful information in the book. The material is up-to-date and the transition from one chapter to another is smoothly made. Sections explaining buffer systems, oxidation–reduction reactions, mole concepts, and so forth will be easily read by a teacher who has little background in chemistry.

Traditional-appearing chapters are here—biological systems, surveys of kingdoms—but some surprises occur; for example, computers are compared and contrasted with the human brain. Social problems are given space but unfortunately seem added to a content course instead of being integrated into the total program.