The publication is marred by its format so that it is difficult to find the precise idea the reader wants to trace. There is an extensive bibliography. Should be useful in the project-centered course and for student reading in project work.

P. K.

MICROSCOPE EXPERIMENTS FOR ELEMENTARY AND HIGH SCHOOL, 60 pp., $1.00, Testa Manufacturing Company, El Monte, California, 1960.

Every biology teacher seems to be anxiously looking for suggestions and helps for laboratory work and projects. This is another attempt to help in the field of microscopy. A small book but well written, it is full of information about simple microscope exercises divided into those concerning form, plants, animals, insects, and inorganic substances. The introduction is lucid and well done. A handy little booklet for the beginner.

P. K.

Science Teaching Aids

THE EFFECTIVENESS OF FILMED SCIENCE COURSES IN PUBLIC SECONDARY SCHOOLS, W. James Popham and Joseph M. Sadnavitch, 64 pp., Department of Education and Psychology, Kansas State College of Pittsburg, 1960.

This publication describes an experiment designed to evaluate the filmed physics course consisting of a series of 162 lectures and demonstrations by Professor Harvey White, and the filmed chemistry course of 160 lectures and demonstrations by Professor John Baxter. Briefly, the results indicated that (1) in *subject matter achievement*, the chemistry films were as effective as conventional methods but the physics films were not; (2) the film and non-film approaches fostered comparable *student interest* in physical science, and (3) the film approaches fostered *attitudes* more unfavorable toward physics and chemistry as school subjects than the conventional approach did.

This is one of several research reports which will help science teachers and others to reach decisions concerning the best ways of upgrading and achieving their teaching objectives in the face of ever increasing enrollments. It is the fifth reported research evaluating the filmed physics course and the first evaluating the filmed chemistry course. This publication briefly reviews these previous researches.

The filmed course approach has had an increasing emphasis in recent years and most science educators will want to keep up to date on researches such as this. However, as with all researches, the results of this experiment must be interpreted within its limitations; that is, such variables as the sample used, the validity of the measuring instruments, teacher competency, and utilization procedures must be considered.

This experiment by itself does not provide sufficient evidence to reach a decision concerning the effectiveness of these two filmed courses but is a valuable contribution to the growing fund of knowledge concerning them.

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Education

SCIENCE AS THOUGHT, Howard E. Gruber, 30 pp., University of Colorado Behavior Research Laboratory Report No. 16, Boulder, Colorado, 1961.

News stories of the implications of this study for the expenditure of federal money for the training of science teachers appeared widely throughout the country. The author concludes after a survey of the participants of nine academic Year Institutes that only a negligible percent of these people teach science as a way of thought and that, if this is one of the purposes of AYI, the program is failing miserably. While one must agree, by the simple process of observation, with many but not all of the author's

conclusions, one may raise quite serious objections as to the validity of the instruments chosen to establish these results. For instance, many science teachers conceive of the laboratory as a quite appropriate place to teach scientific method, more appropriate in fact than the classroom lecture. Yet the author relies almost entirely on many aspects of teaching *except* the laboratory to discover his data. Stated purposes of teachers as to their important motives in attending AYI programs are probably given in the light of what they believe to be the purpose of AYI—usually given as subject matter. It is an interesting report, meticulous in detail and care, but, in this reviewer's opinion, laboring under invalid assumptions.

P. K.

BIOLOGICAL EDUCATION IN AMERICAN SECONDARY SCHOOLS 1890-1960, Paul DeHart Hurd, 263 pp., $4.75, Biological Sciences Curriculum Study Bulletin No. 1. American Institute of Biological Sciences, Washington, 1961.

In this book Professor Hurd has carefully summarized the history of biology teaching in the United States from the period 1890-1960. By collecting references and studies and synthesizing them into one concise volume, Hurd has provided a reference useful to educational historians, science curriculum workers, textbook writers and publishers, and the teacher who seeks a broad background on the history and current status of his profession. All of these will be indebted to Professor Hurd for this publication.

The first section deals with reports of curriculum committees and other groups interested in science teaching. Some of the early committee recommendations are cited, and it is alarming to note the similarity of these recommendations to the extant curricula in many high schools and colleges. It is alarming in that most biologists would agree that very substantive and significant advances have been made in biology in the past few decades which were not included in the 1890 curriculum! The curriculum of the 1890's was focused on the structure and taxonomy of plants and animals almost exclusively. While "modern" biology textbooks contain topics on heredity (usually with little reference to chromosomal structure or the nature of "gene" action) and some general physiology, the preoccupation in most popular books remains on the structure and taxonomy of plants and animals. If we define biology as that science in which biologists are engaged, the current textbooks resemble more closely the activities o fthe biology of 1890 than that of 1920 or 1940 to say nothing of the activities which characterize biology today! Since the textbook *defines* the curriculum in most biology classes, the aroused concern of practicing biologists as to what is taught in secondary schools (albeit, in colleges, too!) is not without foundation.

In Part II, Professor Hurd reports some of the more significant research studies in the area of biological education. Unfortunately, such shortcomings of these studies as poor sampling technique, lack of appropriate "controls" in "experiments," poor or inappropriate tests, and interpretive transgressions of the "research workers" were not pointed out. Admittedly, some of the "research workers" have been so naive that it is impossible to identify what the specific design, sample, or test was. In summary, as Hurd suggests, we have a vast frontier of research in biological education which is virtually untouched.

Many readers of *ABT* have been or will be engaged in curriculum planning, textbook selection, school plant and laboratory planning, and related activities. I would strongly recommend that this book be obtained and carefully read with "markers" in the many appropriate sections.

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THE PROCESS OF EDUCATION, Jerome S. Bruner, 97 pp., $2.75, Harvard University Press, Cambridge, 1961.

This book reports on a conference of scientists, scholars, and educators that was conducted under the sponsorship of the National Academy of Sciences at Woods Hole, Massachusetts, for the purpose of examining fundamental issues in the teaching of science and mathematics.

The central idea of *The Process of Education* is that teaching at all levels should be primarily concerned with what is termed the structure of a subject. This structure, as seen by Bruner, consists of the basic principles and concepts that tie together and relate various ideas, facts, and techniques. Bruner believes that the structure or foundations of a subject may be taught in some form to children at any age. He claims "that any idea can be represented honestly and usefully in the thought forms of children of school age, and that these first representations can later be made more powerful and precise the more easily by virtue of this early learning." For example, fourth-grade children can become absorbed in games governed by principles of topology and set theory, even discovering new "moves" or theorems.

Teaching the structure and foundations of science and mathematics as a central purpose of education suggests many things. For one, it would appear that it is of special importance for the teacher to have a thorough understanding of the structure of his subject as well as a knowledge of factual specifics. Ideally, the science and mathe-