

EDUCATIONAL BIOLOGY

THE CONTRIBUTIONS OF BIOLOGY
TO EDUCATION

A Textbook for Teachers' Colleges and University
Schools and Colleges of Education

BY

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PREFACE

This book is the outgrowth of a course called Educational Biology, given fifty-two times by the writer during the past eighteen years at the State Teachers' College at West Chester, Pennsylvania, at the Western State College of Colorado (a state teachers' college), at Gunnison, and at the State Teachers' College of Colorado at Greeley. Indeed, since 1911, in both of the latter institutions educational biology has been required as a "core subject" for all students graduating from the two-year curriculum with the teacher's life certificate and also for those graduating from the four-year curriculum with the bachelor's degree which carried with it the teacher's life certificate for the secondary schools of Colorado. Since 1926, a similar course has been required in the Pennsylvania state teachers' colleges.

It has long been recognized by educators and biologists that certain well-established biological facts, principles, and laws may serve as a background for the understanding of the child and as a basis for the solution of many teaching problems. Until very recently, however, no one has attempted to collect, select, interpret, and organize these facts and laws in book form.

It is the hope of the writer that this book will influence other teachers' colleges and schools or colleges of education to put into their curricula a course (or courses) in educational biology. This course should be placed early in the curriculum of the prospective teacher, preferably in the first year of study. It should serve as a basis for the intelligent study of principles of education, educational psychology, educational sociology, philosophy of education, and similar courses. It should also form a substantial basis for the more specific courses in nature study, elementary science, and health education.

The book is intended as a text for one semester or quarter of work. It is not intended as a laboratory course, although

demonstrations should accompany the recitations and lectures whenever possible. Since there are few instructors highly trained in both education and biology, it is hoped that this work may serve as a convenient text for teachers whose major training has been in either field, until such time as a sufficient number of specialists in educational biology are available.

Because the subject-matter for this course has been drawn from many different divisions of biology, it is obvious that certain imperfections may occur. To avoid these as far as possible, care has been taken to have each chapter read critically by a specialist in the field which it concerns. It is hoped that in each field both the latest knowledge on the factual side and the best judgment on the side of hypothesis and interpretation will be adequately presented.

The writer takes upon himself full responsibility for all errors that may occur, and invites further criticism from specialists in any of the fields treated.

It is almost presumptuous to attempt to cull from the many divisions of biology the facts that have the most important bearing on education. The writer dares to do so only because he has been attempting this very thing in teacher-training institutions for nearly eighteen years. In this connection it may be permissible for him to say that he holds degrees in the fields of both biology and education. To apply biological facts and principles to education, wherever possible, has been a chief interest for many years.

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January, 1930.

EDITORS' INTRODUCTION

An acquaintance with the basic principles of biology may be regarded as an indispensable background for an adequate understanding of the larger problems of education. Indeed, modern educational theory rests at basis upon the distinction between organic evolution and social evolution. To appreciate the significance of this distinction and to appreciate the place of education as a primary factor of social evolution, one must know something of the laws that govern organic life as a whole and something of the forces that brought mankind to the plane of physical development from which the distinctively human advances have been made.

The study of biology should serve, too, as a preparation and background for the study of psychology. Modern psychology, like modern educational theory, makes large use of biological principles and postulates. For example, a chapter of educational psychology that has come sharply into the foreground during the past twenty years is that which deals with individual differences, their significance and their measurement; and individual differences hark back to fundamental biological laws.

Nor do we lack more direct and specific applications of biology to the problems of teaching. Among the studies and activities of the elementary and secondary schools none transcend in importance those that are now commonly grouped under the general head, "health education." To teach the health studies well and to direct health activities successfully one should understand the fundamental laws of health and appreciate their significance. At basis these are biological laws.

Finally it is generally agreed that every teacher, whatever his own specialized field of instruction, should have at least a speaking acquaintance with all of the major fields of human knowledge. He should know the outstanding facts and princi-

ples and postulates of each of these fields; and he should know something of the methods through which the facts have been accumulated and the principles established; he should know something about the men and women who have made the most substantial contributions to human progress. The desideratum last named gives a peculiar significance to biology as a foundation course for teachers. For the inspiration of youth, the heroes of science may well be catalogued with heroes in other fields of human achievement and the development of the biological sciences has been a series of real adventures in which some very interesting men and women have played a dramatic part.

The term "Educational Biology" should not carry with it, then, a narrow interpretation. It simply means that the facts and principles of biology that are of greatest significance to the theory of education and the practice of teaching are given major attention. These facts and principles, however, certainly include those that are important from the broadest human point of view.

The editors are very fortunate in the fact that Dr. Johnson consented to prepare this text. For many years Dr. Johnson has conducted a course in educational biology for prospective teachers. He knows intimately the needs of such students. He is, too, a competent biologist. As evidence of his keen desire to make his book thoroughly trustworthy, he spent a sabbatical year in advanced study and in conferences with outstanding authorities in the various biological fields, and he has had each chapter read and criticized by one or more specialists in the field that the chapter represents.

J. A. H. K.
W. C. B.

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EDUCATIONAL BIOLOGY

CHAPTER I

INTRODUCTION

"It is necessary for us as teachers to take the biological point of view in all our thinking and to seek our educational philosophy in the laws of growth."—LEWIS M. TERMAN.

The science of education had scarcely made a beginning before psychology was called upon to offer its contributions and to solve some of the many problems arising, with the result that at least one course in educational psychology or in general psychology, is now "required" by practically every teacher-training institution in the United States. This is as it should be, since only the psychologist is sufficiently well informed to give accurate and expert advice in certain important fields of education.

Likewise it has been recognized that sociology has important contributions to make to the science of education, and there are few professional schools for teachers that do not offer a course in educational sociology or in general sociology. Almost every educational problem is social as well as individual in nature and the social aspects of education are being increasingly emphasized.

For at least a generation many students of education and many students of biology have believed that biology has much to contribute to the growing science of education and to the art of teaching. In fact, many professional schools for teachers have had at one time or another a course devoted in part, at least, to some of the biological aspects of education. These courses have been called by a variety of names and often com-

bined with subject-matter other than biology. Perhaps the most common names for such courses have been: "Biological aspects of education," "Biology as applied to education," "Bionomics," and "Educational biology." The last name seems the best, since it is a brief and accurate description of the content and purpose of the course, and is in keeping with recent developments in the fields of psychology and sociology as applied to education.

Just as educational psychology and educational sociology are not new kinds of psychology and sociology but only the significant parts of their respective fields that contribute most to education, so educational biology is not a new kind of biology but rather a selection of the important facts, principles, and laws of biology that have a bearing on education.

Wherever possible, applications both direct and indirect will be made to the science of education and to the practical work of teaching. However, many facts and laws must necessarily be stated and demonstrated before the proper foundation is laid for the establishment of a principle in the field of education or in the art and science of teaching. This course is in-

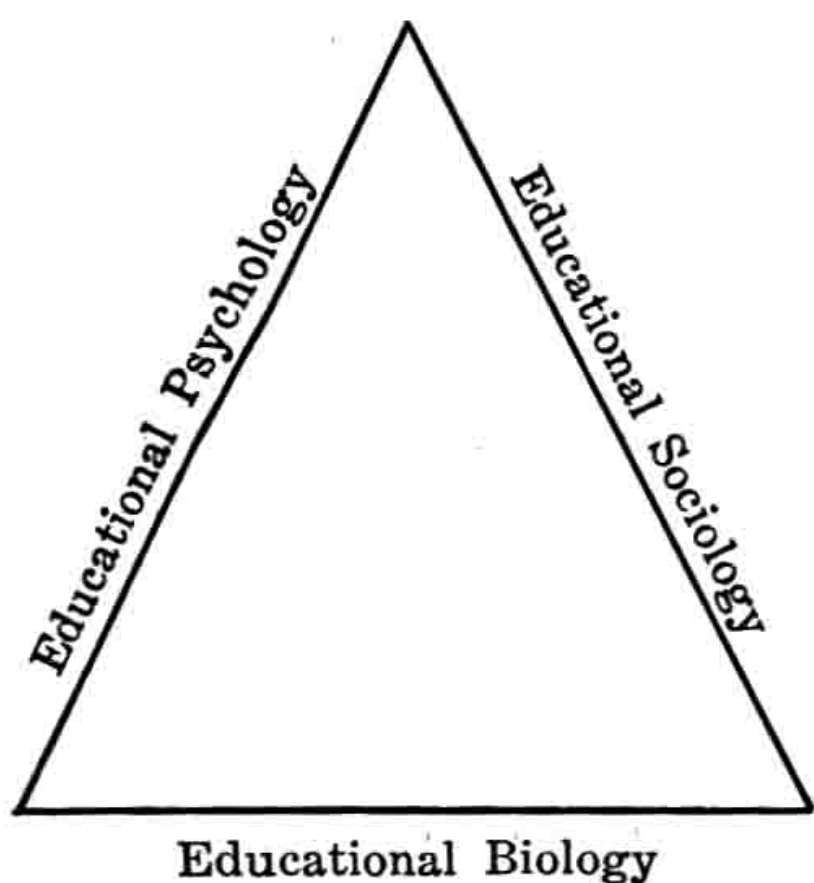


FIG. 1.—Three foundational courses for educational theory and practice.

tended neither as a "methods" course nor as an "academic" course; rather it seeks to provide a general biological basis for the better understanding of the child and of the various problems involved in the teacher's work.

It is the writer's belief that an adequate background for the work of teaching and the science of education must include an understanding of educational biology, educational psychology, and educational sociology. Upon this

threefold basis sound educational thinking may be developed and a correct educational philosophy projected. With such a