

# BIOLOGY OF THE VERTEBRATES

A COMPARATIVE STUDY OF  
MAN AND HIS ANIMAL ALLIES

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REVISED EDITION

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# **BIOLOGY OF THE VERTEBRATES**

*These pages, which he would have perused sympathetically,  
are dedicated to the memory of my father, who  
left me a teacher's torch to carry on.*

## PREFACE TO THE REVISED EDITION

THE writing of this book originally involved the tandem arrangement of the twenty-six letters of our alphabet, in varying sequence along printed lines which, if placed end to end, would actually extend nearly two miles. It was to be expected that observant travelers up and down this printed highway would discover that some of the letters were out of alignment. As a result many of the minor suggestions that have come from persons who have explored these pages have been duly incorporated in the text during the course of the eleven reprintings that have been made, but it is felt that now, after more than a decade, the time has come for more drastic changes and the addition of new material.

The story of the vertebrates, who by the way are our nearest of kin, is by no means finished, for countless unfolding episodes dealing with the perennial charm of living things still await the telling.

The present revision involves the addition of ninety-three pages and more than eighty new illustrations, while the entire text has been painstakingly rewritten with due regard to helpful suggestions from many friends. My wife, Alice Hall Walter, and my niece, Dorothy C. Walter, have faithfully helped throughout the making of the book, and Dr. W. D. Sargent with his clever pen has contributed a considerable number of new pictures.

It is hopefully believed that the premedical student who mulls over the facts compiled herein will find himself better able to undertake the more advanced studies which are indispensable today for a successful medical career. The writer would be particularly gratified and amply rewarded, moreover, if in looking through these pages the general reader also, who is not immediately concerned with the practical application of biology to medicine and surgery, should catch some glimpse of the vision of creation that unrolls before the eyes of the comparative anatomist.

H. E. W.

PROVIDENCE, R. I.  
April, 1939

## PREFACE TO THE FIRST EDITION

THE following pages are the outcome of over twenty years of teaching *Comparative Anatomy of Vertebrates* to premedical students and others. The "others" have crowded more and more into the picture, for while it is universally granted as essential that medical students should lay a firm biological foundation, it is not so generally realized that it may not be amiss for Everyman to gain some inside information about the "fearfully and wonderfully made" human mechanism, and how it came to be.

The book is divided into three parts.

Part One furnishes a necessary setting or introduction for the other two by emphasizing some of the outstanding features of various sister biological sciences most intimately related to Comparative Anatomy. They are Taxonomy, Chorology, Palaeontology, Anthropology, Cytology, Histology, Embryology, and Pathology. The reason that Physiology is not specifically included in this review of cognate fields of study, is because it was found to be neither desirable nor possible satisfactorily to consider the function or physiology of the animal mechanism apart from its structure or anatomy. Hence the more general term of *Comparative Biology*, which includes somewhat more than the bare morphological aspect of the matter, appears upon the title page in preference to *Comparative Anatomy*, since it more nearly expresses the point of view employed.

In Part Two are grouped chapters dealing with the *mechanisms of metabolism and reproduction*, including the integument, systems of digestion, circulation, respiration, excretion, and reproduction, together with the glands of internal secretion.

Part Three is concerned with the *mechanisms of motion and sensation*, which may be regarded as particularly characterizing animal organisms.

It is expected that practical laboratory work upon various typical vertebrates will accompany the theoretical presentation of matter in the book. There has been no attempt to combine the two, since numerous excellent manuals and guides for dissection are now available. The author has found that the dogfish,

mud puppy, turtle, and white rat are the most useful and available forms to employ in these essential confirmatory exercises. At Brown University the students entering the course in Comparative Anatomy of the Vertebrates have already had a laboratory initiation with various invertebrates, the frog, and embryo pig.

There has been no determined attempt to avoid scientific names or technical terms in the text, whenever they are useful, and furthermore, that lazy man's device, a "glossary," as well as an extended bibliography of source materials, which would pad pages already corpulent, has purposely been omitted. A glossary has been omitted as it is assumed that the reader has access to a dictionary and is not indolent. As all technical terms are usually defined whenever first introduced, the index in most cases of doubt should satisfactorily guide the inquiring student to desired information. In the bibliography only a few outstanding books are mentioned and no attempt is made to cite the very many original papers involved. The student who has occasion to go back to such sources will find excellent lists in several of the books named, and will no doubt be advanced and resourceful enough to obtain whatever he wants without gratuitous assistance of this kind. The author confesses a fellow feeling in this matter of unasked for student aid for one Mr. George Baker, a contemporary of Shakespeare, who retained the ponderous Latin names of the herbs described in a foreign medical book which he translated into English, holding that it would do his readers good to look up the English equivalents, for, as he naively wrote in his preface: "I would not have every ignorant asse be made a chirurgeon by my booke." In any case it is the pursuit of knowledge rather than the final possession of it that is the chief delight of the scholar. If it were not for this fact there would be little excuse for, or satisfaction in attempting to make a book of this kind, which at best represents only a passing and incomplete picture of a changing body of knowledge.

The numerous illustrations, which the generosity of the publishers has made possible, have been gathered together from many sources. For the most part they have been redrawn or adapted from other pictures already published, in which case the source is indicated and for which grateful acknowledgment is hereby made. Many of the cuts from *The Human Skeleton* and *Genetics* by the author, as well as three figures from Hegner's *College Zoölogy*,

through the courtesy of The Macmillan Company, are used here again.

In preparing the pictures, aid was furnished by Miss Martha Whitmarsh, Miss Dorothy Walter, Mr. Harold Meyers, Mr. Joseph Kostecki, Professor J. Walter Wilson, and particularly by Miss Dorcas Hager. Professor Wilson has also critically read the entire manuscript, and Professor A. D. Mead some parts of it. The sympathetic insight and friendly suggestions of these two colleagues of many years has been a constant stimulus and support throughout the whole undertaking. Professor W. W. Swingle has cast a helpful eye over Chapter XVI. My niece, Miss Dorothy Walter, has given much expert assistance at all points in preparing the manuscript and reading the proofs, while the literary debt of long standing and increasing magnitude which I owe to my wife, Alice Hall Walter, is so great that there is no hope of ever discharging it.

If all the suggestions and criticisms from these various quarters, together with those of several other unnamed but appreciated contributing friends had been faithfully followed, this would no doubt be a better book. The responsibility for the volume as it stands, however, with its inevitable shortcomings, rests entirely upon my own shoulders.

To all the immediate helpers mentioned, as well as to the long line of biological workers, both obscure and famous, whose discoveries and ideas are our intellectual heritage today, I wish to acknowledge my great indebtedness. Last, but by no means least, I hereby express my sincere thanks to the stimulating young men and women, who for so many years have allowed themselves to be practiced upon in my classes.

H. E. W.

BROWN UNIVERSITY  
November, 1927

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