

HOWELL'S TEXTBOOK OF PHYSIOLOGY

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PREFACE TO THE FIFTEENTH EDITION

In revising Howell's *Textbook of physiology* it proved essential to prepare many new chapters and to rewrite others in their entirety. It was felt that the text would gain in clarity if the newer developments in physiology were presented *de novo* rather than worked into the older text.

Editors were appointed for each of the ten sections (nine originally), and they were authorized to obtain such help as they needed for the revision of individual chapters. Dr. Lloyd's section on muscle and nerve has been rewritten completely, and the chapters on the central nervous system have been largely recast save for the passages on the labyrinth and the cranial nerves. Dr. Ruch has presented sensory physiology in clinical language, and has attempted to coordinate the large clinical literature on sensory problems in terms that will be understood by both the clinician and the physiologist. Dr. Hitchcock has brought his broad knowledge of physical and protein chemistry to bear in revising the section on the formed elements of the blood and the blood plasma proteins. The section on the cardiovascular system, which has been jointly edited by Drs. Barron, Lampion and myself, has been presented on somewhat novel lines, and we have been fortunate in securing the contributions of Dr. H. E. Hoff who interprets the problem of excitability and conductivity of cardiac muscle in the light of modern electrophysiology—making it, incidentally, quite clear that the membrane theory as applied to muscle and nerve is directly applicable to the problem of the interpretation of the electrocardiogram.

In the section on respiration, the newer concepts of high altitude physiology which have emanated from the war have been incorporated, and Dr. Nims has included much else that is new in the broad field of aviation medicine. Drs. Clarke and Elkinton have entirely rewritten the section on water metabolism and the kidney, and have brought it into line with current teachings concerning renal clearance. The section on gastro-intestinal physiology follows the outline of previous editions, but Dr. Cowgill has incorporated new work in the field. Dr. Brobeck has reorganized the section on basal metabolism, adding recent disclosures on the part played by the endocrines and the central nervous system in the integration of metabolic processes. The physiology of sex has become a precise science since Dr. Howell's last revision, and Dr. Gardner has rewritten the entire section, summarizing the present status of this rapidly unfolding branch of experimental medicine.

In preparing the revision we have attempted to keep the text within reasonable limits and at the same time preserve its general character, realizing, however, that the fluent prose style of the original will be difficult to equal. Early in his career Dr. Howell had taken a leaf from Sir Michael Foster, and it is doubtful whether any American writer on physiology other than he has approached Foster's eloquent use of language. So we offer the new edition with misgivings, but also with a sense of pride that a work of such importance has been committed to our hands.

The Editors wish to express their gratitude to the large number of authors and publishers who have generously permitted reproduction of figures and the use of certain quoted passages from monographs and journal articles. Full acknowledgment is given in the legends and text, and written authorization has been obtained in each case. Thanks are also due Mr. Carl P. Rollins, Printer to Yale University, for advice concerning typographical design. To the W. B. Saunders Company we are grateful for unfailing courtesy and cooperation. Mr. Bertram G. Bruestle is responsible for the majority of the new line drawings. We thank him, and also Miss Mary P. Wheeler, who has not only prepared all copy for press but has been responsible for conducting correspondence and for reading both galley and page proof.

J. F. FULTON

YALE UNIVERSITY

PREFACE

In the preparation of this book the author has endeavored to keep in mind two guiding principles: first, the importance of simplicity and lucidity in the presentation of facts and theories; and, second, the need of a judicious limitation of the material selected. In regard to the second point every specialist is aware of the bewildering number of researches that have been and are being published in physiology and the closely related sciences, and the difficulty of justly estimating the value of conflicting results. He who seeks for the truth in any matter under discussion is oftentimes forced to be satisfied with a suspension of judgment, and the writer who attempts to formulate our present knowledge upon almost any part of the subject is in many instances obliged to present the literature as it exists and let the reader make his own deductions. This latter method is doubtless the most satisfactory and the most suitable for large treatises prepared for the use of the specialist or advanced student, but for beginners it is absolutely necessary to follow a different plan. The amount of material and the discussion of details of controversies must be brought within reasonable limits. The author must assume the responsibility of sifting the evidence and emphasizing those conclusions that seem to be most justified by experiment and observation. As far as material is concerned, it is evident that the selection of what to give and what to omit is a matter of judgment and experience upon the part of the writer, but the present author is convinced that the necessary reduction in material should be made by a process of elimination rather than by condensation. The latter method is suitable for the specialist with his background of knowledge and experience, but it is entirely unfitted for the elementary student. For the latter, brief comprehensive statements are oftentimes misleading, or fail at least to make a clear impression. Those subjects that are presented to him must be given with a certain degree of fullness if he is expected to obtain a serviceable conception of the facts, and it follows that a treatment of the wide subject of physiology is possible, when undertaken with this intention, only by the adoption of a system of selection and elimination.

The fundamental facts of physiology, its principles and modes of reasoning, are not difficult to understand. The obstacle that is most frequently encountered by the student lies in the complexity of the subject—the large number of more or less disconnected facts and theories which must be considered in a discussion of the structure, physics, and chemistry of such an intricate organism as the human body. But once a selection has been made of those facts and principles which it is most desirable that the student should know, there is no intrinsic difficulty to prevent them from being stated so clearly that they may be comprehended by anyone who possesses an elementary knowledge of anatomy, physics, and chemistry. It is doubtless the art of presentation that makes a textbook successful or unsuccessful. It must be admitted, however, that certain parts of physiology, at this particular period in its development, offer peculiar difficulties to the writers of textbooks. During recent years chemical work in the fields of digestion and nutrition has been very full, and as a result theories hitherto generally accepted have been subjected to criticism and alteration, particularly as

the important advances in theoretical chemistry and physics have greatly modified the attitude and point of view of the investigators in physiology. Some former views have been unsettled and much information has been collected which at present it is difficult to formulate and apply to the explanation of the normal processes of the animal body. It would seem that in some of the fundamental problems of metabolism physiological investigation has pushed its experimental results to a point at which, for further progress, a deeper knowledge of the chemistry of the body is especially needed. Certainly the amount of work of a chemical character that bears directly or indirectly on the problems of physiology has shown a remarkable increase within the last decade. Amid the conflicting results of this literature it is difficult or impossible to follow always the true trend of development. The best that the textbook can hope to accomplish in such cases is to give as clear a picture as possible of the tendencies of the time.

Some critics have contended that only those facts or conclusions about which there is no difference of opinion should be presented to medical students. Those who are acquainted with the subject, however, understand that books written from this standpoint contain much that represents the uncertain compromises of past generations, and that the need of revision is felt as frequently for such books as for those constructed on more liberal principles. There does not seem to be any sound reason why a textbook for medical students should aim to present only those conclusions that have crystallized out of the controversies of other times, and ignore entirely the live issues of the day which are of so much interest and importance not only to physiology, but to all branches of medicine. With this idea in mind the author has endeavored to make the student realize that physiology is a growing subject, continually widening its knowledge and readjusting its theories. It is important that the student should grasp this conception, because, in the first place, it is true; and, in the second place, it may save him later from disappointment and distrust in science if he recognizes that many of our conclusions are not the final truth, but provisional only, representing the best that can be done with the knowledge at our command. To emphasize this fact as well as to add somewhat to the interest of the reader short historical *résumés* have been introduced from time to time, although the question of space alone has prevented any extensive use of such material. It is a feature, however, that a teacher might develop with profit. Some knowledge of the gradual evolution of our present beliefs is useful in demonstrating the enduring value of experimental work as compared with mere theorizing, and also in engendering a certain appreciation and respect for knowledge that has been gained so slowly by the exertions of successive generations of able investigators.

A word may be said regarding the references to literature inserted in the book. It is perfectly obvious that a complete or approximately complete bibliography is neither appropriate nor useful, however agreeable it may be to give every worker full recognition of the results of his labors. But for the sake of those who may for any reason wish to follow any particular subject more in detail some references have been given, and these have been selected usually with the idea of citing those works which themselves contain a more or less extensive discussion and literature. Occasionally also references have been made to works of historical importance or to separate papers that contain the experimental evidence for some special view.

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