
PHYSIOLOGY

MAIN AND RICHARDSON

SECOND EDITION

PHYSIOLOGY

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By

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PREFACE TO THE SECOND EDITION

A thorough revision of the first edition has been prepared, with no chapter left untouched. With the rapid advances in physiological research during the past few years, such procedure was necessary to make a place for the recent findings and concepts. The newer construction of the book has been considerably influenced by the critical evaluations of the readers. An attempt has been made to preserve the features which have been reported to be of merit, and to include the suggested alterations found to be feasible. Such an endeavor entailed a certain degree of compromise to preserve the original purpose of the book, that it deal with the abstracted fundamental concepts of advanced physiology, not uncommonly referred to as an intermediate approach. Physiologic material about which there has been conflicting evidence, lack of confirmation, existing controversy, and lack of import may not have been included. Decisions based on these criteria have required deliberate judgment, not necessarily spiced with wisdom.

For the purpose of better integration for the reader, the book has been reorganized into body systems. Entirely new chapters have been written on the subjects of metabolism, renal physiology, and the autonomic nervous system. Substantial additions have been made on the subjects of reflexes, respiration, body fluids and their dynamics, and endocrinology, and the modern accent on the importance of the role of the hypothalamus has been acknowledged. The book now presents in order, basic physiologic systems, metabolic systems, homeostatic mechanisms, fluid systems, and the integrative systems of the body. To aid in the assimilation of the material, 26 original illustrations have been added, the type has been reset for improved readability, and the book itself has been redesigned.

The accent on human physiology has been maintained, reference to comparative physiology appearing only where inductively pertinent. This was not because of any lack of appreciation for the important role of animal experimentation, obviously vital to accurate and reliable physiological research, but because of an awareness of the readers for whom

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the book is intended, and the necessity for brevity where possible. Likewise absent are references, experimental details, and historical comments. These may be found in the more detailed textbooks of physiology. An attempt has been made to integrate the material where possible, since it is believed that this is necessary for an understanding of the principles of physiology.

I am considerably indebted to Jack G. Bishop for his assistance in the examination of literature, and to Betty Muncee for her efforts in the preparation of the manuscript.

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PREFACE TO THE FIRST EDITION

Physicians and senior medical students often ask me to recommend a physiology text for review purposes, or to learn what has been added to our knowledge of physiology since they studied the subject. When, with yearly increasing exertion, I lift a standard text from my desk, they recoil in horror at its size, stating emphatically that they want a *little* book which hits the high spots. So here is a small book which attempts to cover the essentials.

Since the reader for whom this book is designed is not handicapped by a lack of some knowledge of physiology and clinical medicine, as are elementary students, I have tried to organize the material in a more logical order than is possible for beginners, to indicate, for instance, that what the student considers "goosing frog muscle," is actually the study of fundamental characteristics of all cells. In addition, I have restricted the data to man wherever possible; I see no reason for giving the pH of pancreatic juice of dogs when human data are available, or even of mentioning the interesting fact that the dog's esophagus is composed entirely of striated muscle. Some texts impress one as fast becoming encyclopedias of comparative physiology, thereby incurring the danger of producing misconceptions in the mind of the student, as to the conditions in man. Our increasing knowledge of human physiology cannot be handled by a mere expansion of texts and acceleration of speech by the lecturer; something must be omitted. I am, however, opposed to the omission of certain human functions, as of phonation, on the basis that, "they'll get all that in their clinical years." I believe that the human body should be discussed as a whole.

Brief mention of some physiologic disturbances in disease is made, since the normal can be best appreciated and clearly understood only by comparison to the abnormal. The relative space devoted to various subjects has been determined by various factors, not always by innate importance. These factors include complexity, clinical interest or importance, recency and that material which, in my experience, is often poorly understood by practitioners.

To obtain the necessary brevity I have been shockingly dogmatic; let the reader beware. Illustrations are restricted for lack of space to such

as are often inadequate or absent in the average text, or which are necessary for comprehension. They are merely typical blackboard sketches which I have found helpful to students. References are not included since these may be readily found in the standard texts. I have omitted proper names associated with various diseases and phenomena, since I consider that nonexplanatory, monumental terminology is a useless mental burden. Repetition, the soul of pedagogy, has not been avoided when it seemed advisable in discussion of different topics.

The following abbreviations are used: *Hb* for hemoglobin, *HbO₂* for oxygenated hemoglobin, *HbCO₂* for carbaminohemoglobin, *ECG* for electrocardiograph, *EEG* for electroencephalograph, *hypocorticalism* for hypoadrenocorticalism, *cortical hormone* for adrenocortical hormone, *A-V* to indicate arteriovenous or atrio-ventricular, *S-A* for sino-atrial. I have restricted the term *proprioceptors* to include only those sensory endings in muscles, tendons, and ligaments stimulated by tension or pressure, and not those as of the vestibule. The terms *acidosis* and *alkalosis* are replaced by *acidemia* and *alkalemia*, which refer to corresponding changes in pH, without indicating whether a change in blood bicarbonate has occurred; hence the term *uncompensated acidosis* becomes *acidemia with low blood bicarbonate*; *compensated alkalosis* becomes *alkalemia with compensatory lowering of blood bicarbonate*. The term *alkaline metal salts* includes those of Na, Ca, K, and Mg. *Epinephrine* indicates the adrenomedullary hormone, and *sympathin*, the hormone liberated by adrenergic nerve endings. The word *hyperoxia* is used to indicate the effects of excess oxygen, and *asphyxia* means both hypercapnia and anoxia. I have found it so annoying to myself and students to remember the varied spelling of such words as proprioceptor and interoceptor, but pressoreceptor and chemoreceptor, that I have arbitrarily used the unhyphenated suffix *oceptor* for all.

I am deeply indebted to several colleagues—to Ernst Fischer, Harvey B. Haag, Edwin L. Smith and Robert W. Ramsey for suggestions and criticism of various parts of the manuscript; and to Hans Jelinek for the illustrations which incorporate many of his suggestions.

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