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TEXTBOOK OF ANATOMY

THIRD EDITION

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MEDICAL DEPARTMENT
HARPER & ROW, PUBLISHERS
HAGERSTOWN, MARYLAND
NEW YORK, EVANSTON, SAN FRANCISCO AND LONDON

TEXTBOOK OF ANATOMY, Third Edition.
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For information address Medical Department, Har-
per & Row, Publishers, Inc., 2350 Virginia Avenue,
Hagerstown, Maryland 21740

Library of Congress Cataloging in Publication Data

Hollinshead, William Henry, 1906-

Textbook of anatomy.

Includes bibliographies.

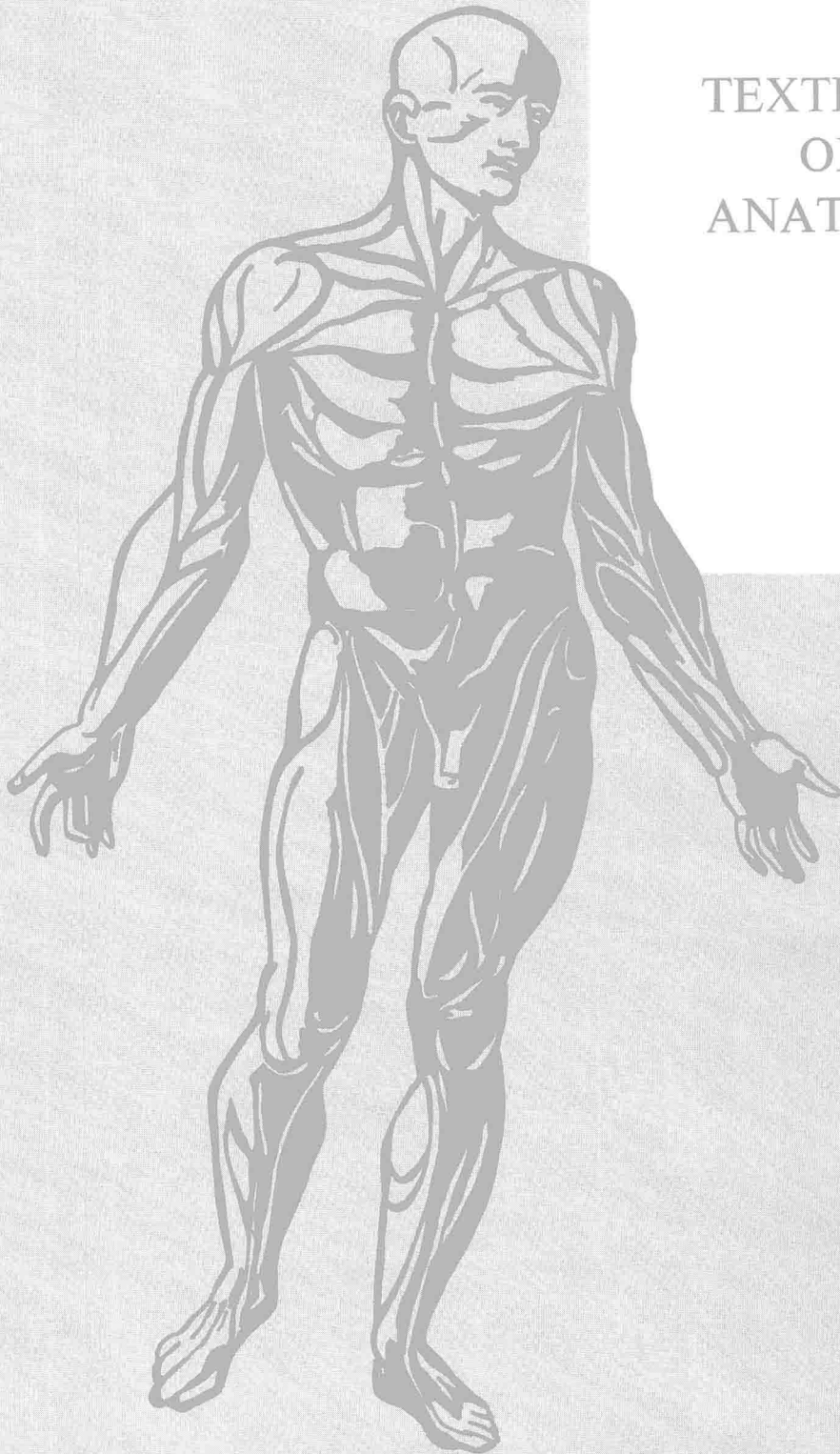
1. Anatomy, Human. I. Title. [DNLM:

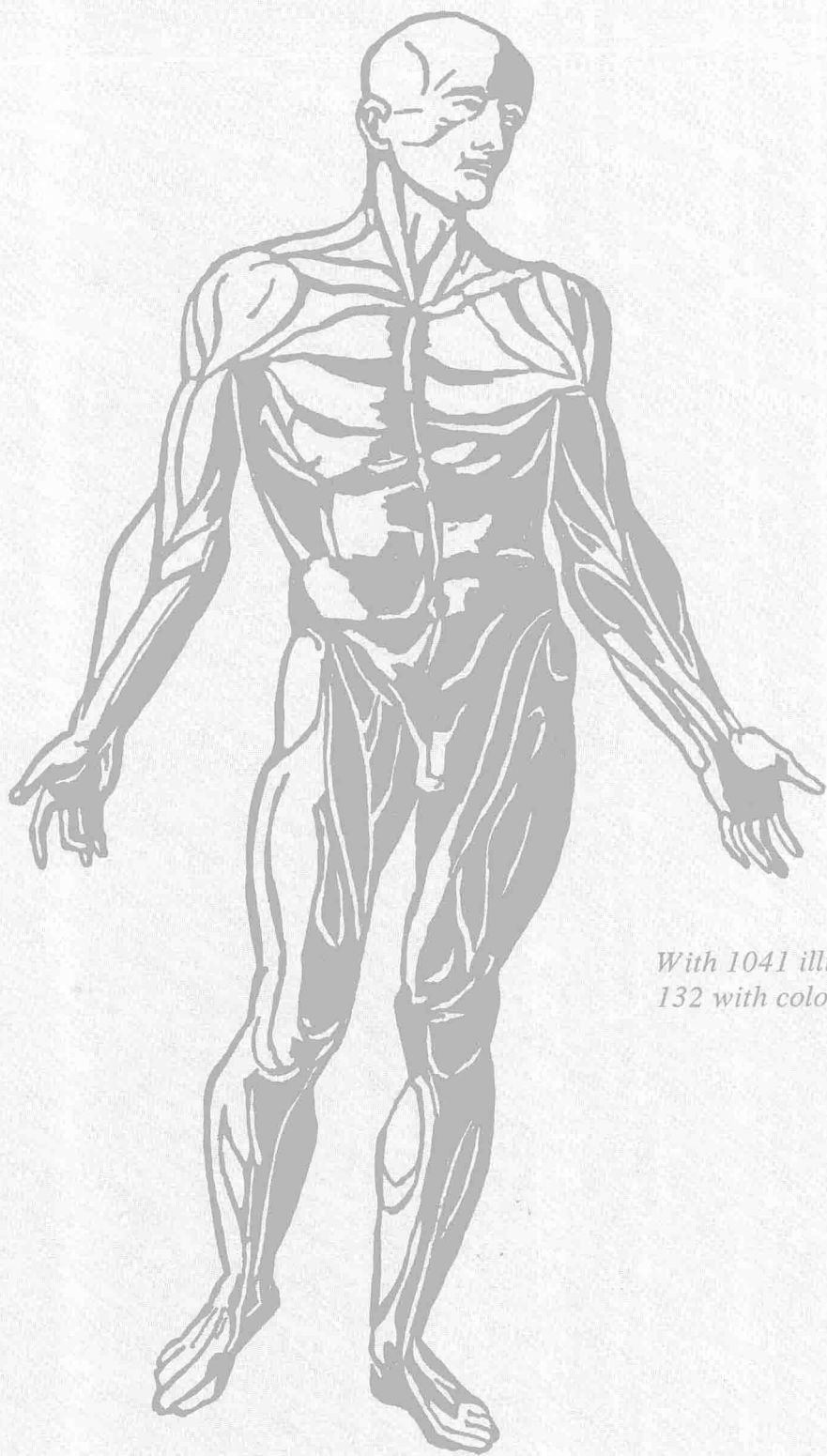
1. Anatomy. QS4 H741t 1974]

QM23.2.H57 1974 611 74-6057

ISBN 0-06-141262-7

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*With 1041 illustrations
132 with color*

PREFACE

The purposes of this third edition of *Text-book of Anatomy* remain unchanged from those of the previous editions. As indicated in the Prefaces for those volumes, this book attempts "to present to the student of medicine or dentistry an account of anatomical facts and concepts that he will need to know, or know where to acquire, during his years of formal study in his chosen profession; to provide a foundation of anatomical knowledge sufficient to build upon when more detailed knowledge becomes necessary; and to help make the study of anatomy more meaningful by emphasizing functional aspects and indicating some of the many ways in which anatomical knowledge influences medical practice."

This third edition follows the previous two in general format. A relatively brief section presents a general account of the systems of the body, with emphasis particularly on

continuities of the various systems from one part of the body to another, and on anatomy and function which pertain to each system as a whole rather than specifically to its regional parts. The major part of the book is regional, with material presented as much as possible in the order in which it is likely to be observed in the dissecting room.

The illustrations and text of this edition have been carefully revised. A few figures were found to need slight corrections, others have been replaced by better versions, and about 40 new figures have been added.

Information not available at the time the Second Edition was written has necessitated rewriting some discussions, such as the innervation of the urinary bladder and ureter, the lymphatic drainage of the lungs, and the actions of various muscles. Otherwise, the emphasis in revising the text has been on shortening it by revising the sentence struc-

ture or rephrasing various descriptions and discussions so as to present the same material in briefer form, while maintaining or improving clarity. Some descriptions and anatomic terms that seem unlikely to be useful to the student have been eliminated. In view of the fact that our "new" Nomina Anatomica terminology will be 20 years old shortly after this book appears, it seemed unnecessary to cite the former B.N.A. names in many cases; important ones that the student is most likely to hear during his clinical training, such as "internal mammary" and the "descending" branches of the coronary arteries, remain in the text; others have been eliminated from

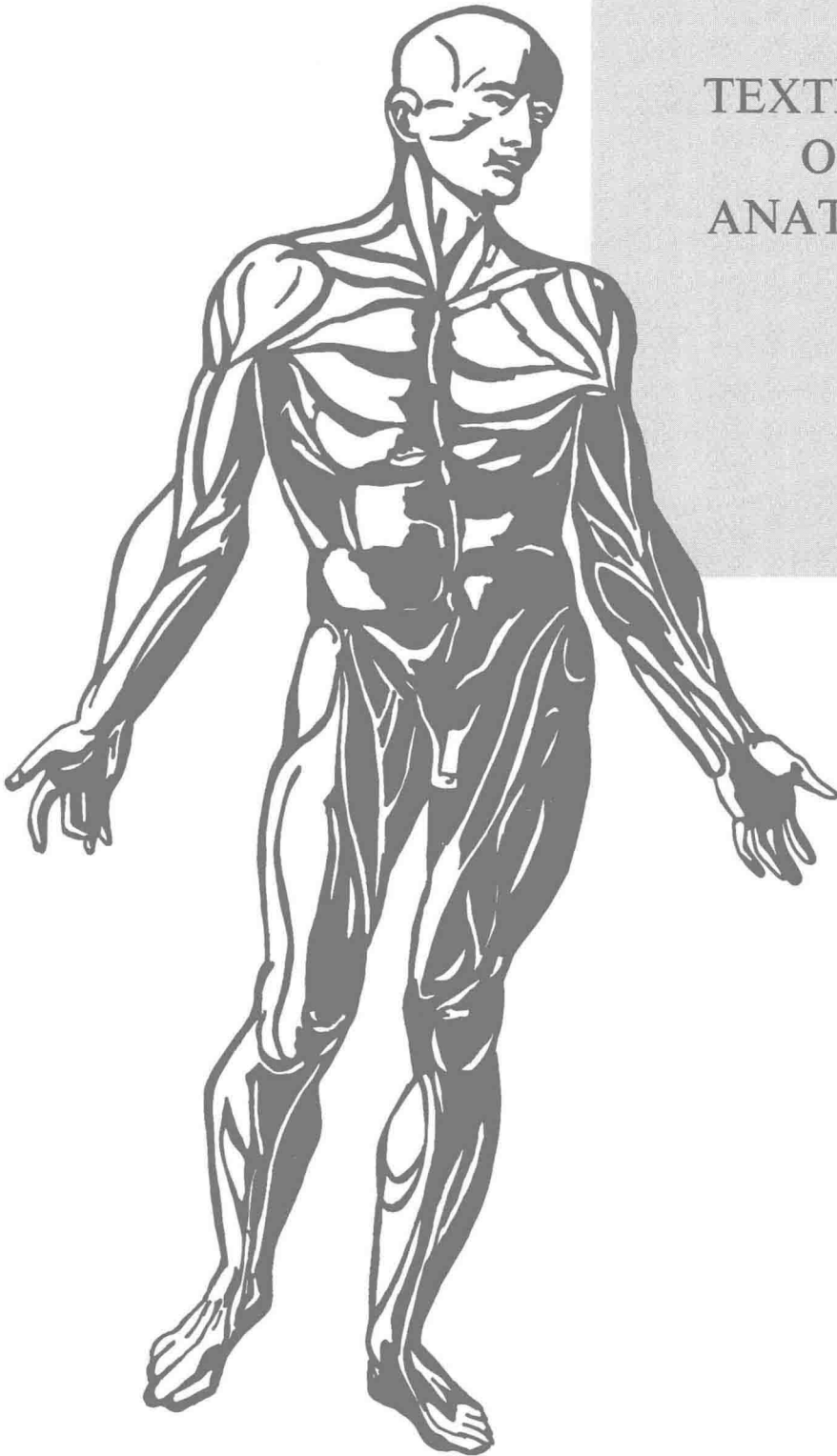
the text, but remain in the Glossary of Synonyms and Eponyms.

My thanks are due to my colleagues and students who have called attention to various small errors appearing in the previous edition; to Mr. Vincent P. Destro of the Section of Medical Graphics, Mayo Clinic, for his cooperation; to the W. B. Saunders Company for permitting me to use figures from my *Functional Anatomy of the Limbs and Back*; and to the publishers of this volume who have, as always, been most co-operative.

W. H. H.

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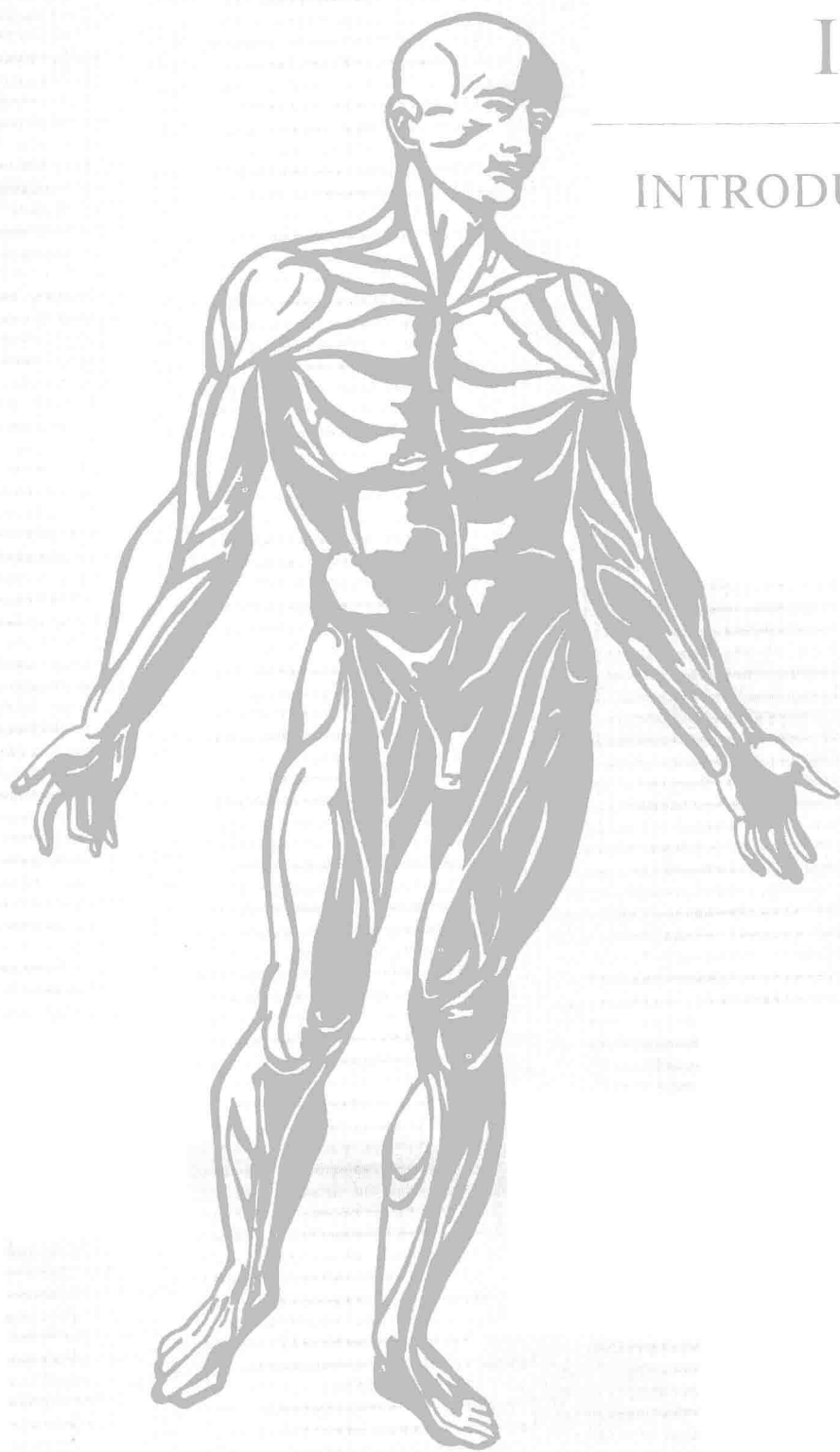
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PART I

INTRODUCTION



CHAPTER

1

THE STUDY OF ANATOMY

Content and Subdivisions of the Subject

The word "anatomy" is derived from Greek roots that mean "to cut up" or, as we say now, "to dissect." The field of study of human anatomy in its early stages was adequately defined by this term, for anatomy dealt only with structures that could be displayed by dissection and that were visible to the naked eye—what we now call "gross anatomy." But, although essentially a morphological science, anatomy was never purely that; even in the earliest writings there are speculations, some of them well founded and some now seeming to us ridiculous, as to the importance of the various parts and how they worked. Thus, a consideration of the use to which a part is put and how it fulfills its functions has always been a part of anatomy. Anatomical study that did not consider function would be

somewhat analogous to learning the names and arrangement of all the parts of an automobile engine but having no concept of what the engine does or how it works.

Only as methods of investigating function became increasingly complex and, with use of the microscope, special stains, etc., the investigation of morphology also became more complex, was physiology separated from anatomy as a science in its own right. The division between the two subjects, however, can never be as sharp a one as intimated by the separate names and the different methods and places of study, for structures in the body necessarily have or have had some function, and function is necessarily based upon structure: gross, microscopic, and molecular.

Just as anatomy and physiology overlap, the distinction depending primarily upon where the greatest emphasis is placed, so do

the various subdivisions of anatomy overlap. Again because of the different methods and places of study, anatomy is conveniently subdivided into four general spheres: gross anatomy, microscopic anatomy or histology, neuroanatomy (usually the central nervous system), and developmental anatomy or embryology. These subdivisions are purely arbitrary and for convenience of instruction only, for no one of them is really understandable without some knowledge of the others.

In short, although the study of anatomy is concerned primarily with structure, this runs the gamut from ultramicroscopic structure to that of large organs and organ systems, and anatomic study properly includes, as well, a consideration of the formation and the functional importance of parts. Human anatomy, therefore, is a sector of special interest within the field of human biology. Just as it is often said of medicine that one must remember that he is treating a patient and not a disease, so it is true of anatomy that one should remember that he is studying the makeup of the living human body from as many aspects as possible. It follows that the field of anatomy is no neatly circumscribed body of knowledge that one can master as one can the contents of a high-school course. It is an enormous, expanding area which no one ever completely masters but which has innumerable facets that aid in the understanding and practice of medicine.

Gross anatomy itself is sometimes subdivided according to the method of approach: for instance, into systemic anatomy, regional anatomy, or, especially in texts for more advanced students, into what is called either "practical" or "surgical" anatomy. The first approach attempts to treat the body according to systems: skeletal, vascular, etc.; the second, according to parts of the body; and the third, to emphasize certain features that are believed to be of particular importance to the practitioner of medicine and surgery. All three of these "subdivisions" of gross anatomy necessarily deal with the same basic subject matter and rep-

resent not fields of study but different approaches to gross anatomy. Actually, the student of gross anatomy needs to combine all three of these approaches: a general understanding of the systems of the body is necessary for an appreciation of the more detailed regional anatomy and of the interrelationships of parts and the continuities between regions; the regional approach is both the one commonly used in the dissecting room and the one that is generally most useful to the physician and surgeon; and consideration of functional and simple clinical aspects not only provides a better anatomic background upon which to build clinical knowledge but aids learning and retention by emphasizing the importance of what may seem otherwise to be a mass of unrelated and unimportant minutiae.

Contents of This Text

Any one-volume textbook of anatomy necessarily omits many details, for there is enough available information to fill volumes. The student should therefore appreciate that this book does not contain enough detail to answer all possible requirements of his present and future interests, and that he will almost certainly at some time have to seek greater detail from various other sources. Fortunately, however, it is possible to recognize a fairly large body of information as being essential to any thorough study of gross anatomy (for this is an old and fairly stable science), even though any two anatomists would not necessarily agree as to the relative importance of any large number of details. This book therefore attempts to present a basic account of useful anatomy.

Even though gross anatomy is an old science, interpretations of anatomic facts sometimes change rapidly, and there are some points about which there are long-standing differences of opinion among anatomists. Ideally, the student should be made aware of such differences of opinion. However, divergent views can properly be presented only in detail, and this is not possible in a short text. Occasionally, therefore,

views presented in this book will not agree with those of the student's instructors, for some necessarily represent only one man's opinion of what is the most reasonable or most nearly correct interpretation.

Certain aspects of gross anatomy are understandable only when there is a background of knowledge in neuroanatomy, histology, or embryology, yet the student is rarely well versed in these fields at the time he is studying gross anatomy. For this reason, certain fundamentals that belong more properly to another field, such as a discussion of the histology of a nerve or a short explanation of the development of a part, are introduced at appropriate places in this text. The aim is to elucidate the gross anatomy, not to give a well-rounded picture of any other field; it is assumed that the student has texts in those fields and will turn to them as necessary for further information.

Finally, although this is a text on regional anatomy, some knowledge concerning the systems of the body is necessary for an understanding of regional anatomy, and therefore a discussion of the major systems precedes the regional parts.

Hints on Studying

There is no pat or entirely satisfactory answer to the student's question: "How shall I study?" Learning anatomy is often regarded by medical students as a feat of pure memory, yet many persons who are generally considered good anatomists would not claim to have a particularly good memory. In truth, the study of anatomy should be aimed at acquiring an understanding of the subject rather than at total recall of a mass of facts. Any clinician can assure you that the anatomic details he remembers are pretty well limited to those that he uses fairly constantly; the advantages of having once known more facts are primarily in the general knowledge that this acquisition has led to, the ability to understand the fundamental rather than the detailed anatomy involved in particular clinical problems, and in relative ease of relearning and of expand-

ing one's knowledge in a particular field if that becomes necessary.

Since anatomy is a visual science, in which verbal descriptions are always inadequate, learning it requires careful observation, preferably repeatedly. In gross anatomy, therefore, the major studying must take place in the dissecting room where repeated handling and review of parts of the body is possible. Except for purposes of communication, whether in taking an examination or among fellow physicians, useful anatomy is visual anatomy: the picture of structures and relationships that can be seen in the mind, not the words that are used to describe it. Probably any instructor with an appreciable teaching experience can recall an occasional student who could quote almost verbatim from some text or from notes but who, upon further query, was unable to recognize the structure he was purporting to describe. Such "knowledge," which is pure memory, is obviously not knowledge at all.

Textbooks and atlases are useful in the dissecting room because they are aids in the identification and understanding of the structures to be observed, but they should be used in the laboratory as adjuncts to learning from the cadaver, never to replace study of the actual structures. Textbooks also have other functions, and therefore often can be read profitably outside the laboratory. One obviously can observe with more efficiency if one has, before the period of observation, some foreknowledge of what one should look for and some understanding of the functional implications of those structures; similarly, after a period of observation, one can review the knowledge acquired, and place it in perspective, by reading texts and examining pictures while one recalls the laboratory observations. Thus, a good way to study might be to skim through the text on the area to be dissected, before going to the laboratory; do no more than the necessary amount of reading in the laboratory; then read more thoroughly following the laboratory experience, noting things that are not understood or recalled and that can be in-