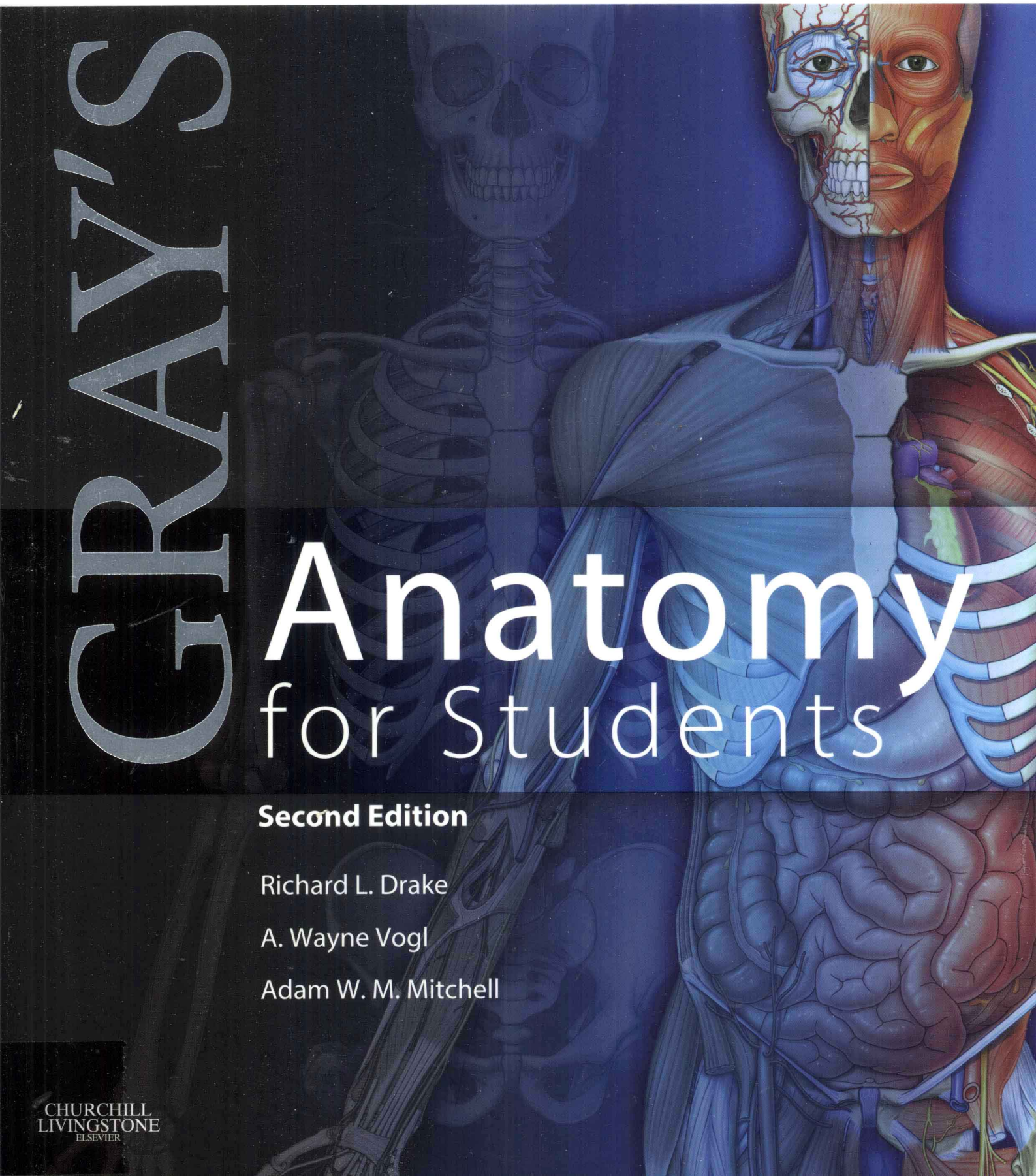

GRAY'S Anatomy for Students

Second Edition

Richard L. Drake

A. Wayne Vogl

Adam W. M. Mitchell

CHURCHILL LIVINGSTONE
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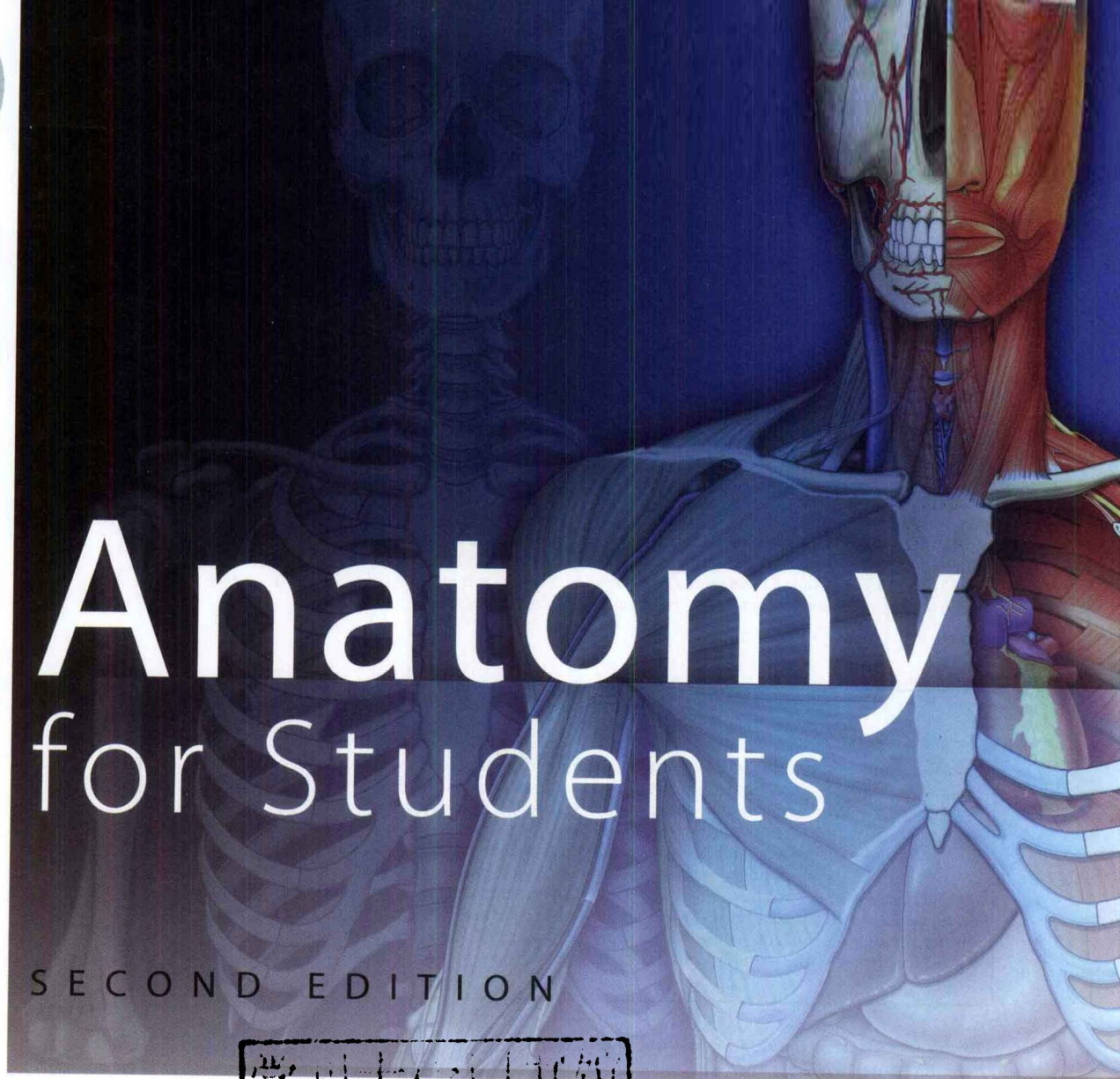
GRAY'S



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Editorial review board

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Adam W. M. Mitchell

Dedications

To my wife, Cheryl,
who has supported me;
and my parents who have guided me.

Richard L. Drake

To my family,
to my professional colleagues
and role models,
and to my students—
this book is for you.

A. Wayne Vogl

To Cathy, Max (Adder),
and Elsa (ZaZa).

Adam W. M. Mitchell

Preface

The first edition of *Gray's Anatomy for Students* accomplished many of the goals we had established for this textbook, including our primary goal of helping students learn anatomy. However, we realized from the many suggestions, comments, and kind advice we received from colleagues and students around the world that there were modifications and changes that would improve this textbook. So keeping in mind the goals and objectives of the first edition, we began work on the second edition by evaluating all of the input from our readers, assessing changes occurring in the educational environment, and doing our best to predict the future direction of anatomy education. The result is the second edition of *Gray's Anatomy for Students*, which builds on the past and looks toward the future.

One of the most significant changes in the second edition of our textbook occurs in Chapter 1. This chapter has been retitled "The Body" and not only includes the material from Chapter 1 of the first edition, such as "What is anatomy?" and "Imaging" but also has a new section, entitled "Body systems." This new section provides students with an overview of the skeletal system, skin and fascias, the muscular system, the cardiovascular system, the lymphatic system (material moved from Chapter 4 of the previous edition), and the nervous system (material moved from Chapter 2 of the first edition). The information is concise in its presentation, and its clinical significance is emphasized by the addition of numerous examples of common clinical problems.

Another significant change in this edition involves the presentation of clinical material. While "In the Clinic" boxes are still presented throughout the textbook, usually at the end of a section of material so as not to destroy the readability of the textbook, we have also highlighted clinically relevant information throughout the textual material. This technique, while maintaining the book's readability, provides the student with a rapid locator of clinical "pearls of wisdom." Thus, throughout the textbook, material in "pastel green," whether in boxes or text, signals clinical information—pay particular attention.

Finally, the index has been completely restructured and provides the reader with a more convenient and useful tool for finding information. We have also added a concise table of contents at the beginning of each chapter to further assist the reader in the location of specific topics. Additionally, a large number of the clinical images and pictures used in the first edition have been upgraded. Many of them have been replaced with higher quality examples and imaging from newly emerging technologies. Smaller changes in this second edition include modifying some of the artwork, adding some new artwork, and moving the 10 short questions at the end of each chapter to Student Consult online.

We feel that with these changes the second edition of *Gray's Anatomy for Students* is a much improved version of the first edition, and we hope that the book will continue to be a valuable learning resource for students.

Richard L. Drake
A. Wayne Vogl
Adam W. M. Mitchell
January 2009

About the book

The idea

In the past 20 years or so, there have been many changes that have shaped how students learn human anatomy in medical and dental schools and in allied health programs, with curricula becoming either more integrated or more systems based. In addition, instructional methods focus on the use of small group activities with the goals of increasing the amount of self-directed learning, and acquiring the skills for the life-long acquisition of knowledge. An explosion of information in every discipline has also been a force in driving curricular change as it increases the amount to be learned without necessarily increasing the time available. With these changes, we felt it was time for a new text to be written that would allow students to learn anatomy within the context of many different curricular designs, and within ever-increasing time constraints.

We began in the fall of 2001 by considering the various approaches and formats that we might adopt, eventually deciding upon a regional approach to anatomy with each chapter having four sections. From the beginning, we wanted the book to be designed with multiple entry points, to be targeted at introductory level students in a broad spectrum of fields, and to be a student-oriented companion text for *Gray's Anatomy*, which is aimed at a more professional audience. We wrote the text first and subsequently constructed all the artwork and illustrations to complement and augment the words. Preliminary drafts of chapters, when complete, were distributed to an international editorial board of anatomists, educators, and anatomy students for review. Their comments were then considered carefully in the preparation of the final book.

The text is not meant to be exhaustive in coverage, but to present enough anatomy to provide students with a structural and functional context in which to add further detail as they progress through their careers. *Gray's Anatomy* was used as the major reference, both for the text and for the illustrations, during the preparation of this book, and it is the recommended source for acquiring additional detail.

The book

Gray's Anatomy for Students is a clinically oriented, student-friendly textbook of human anatomy. It has been prepared primarily for students in a variety of professional programs (e.g., medical, dental, chiropractic, and physical therapy programs). It can be used by students in traditional, systemic, combined traditional/systemic, and problem-based curricula and will be particularly useful to students when lectures and laboratories in gross anatomy are minimal.

Organization

Using a regional approach, *Gray's Anatomy for Students* progresses through the body in a logical fashion, building on the body's complexities as the reader becomes more comfortable with the subject matter. Each chapter can be used as an independent learning module, and varying the sequence will not affect the quality of the educational experience. The sequence we have chosen to follow is back, thorax, abdomen, pelvis and perineum, lower limb, upper limb and head and neck.

We begin with the back because it is often the initial area dissected by students. The thorax is next because of its central location and its contents (i.e., the heart, the great vessels, and the lungs). This also begins a progression through the body's cavities. The abdomen and pelvis and perineum follow logically in sequence from the thorax. Continuing downward toward the feet, the lower limb is next, followed by the upper limb. The last region discussed is the head and neck. This region contains some of the most difficult anatomy in the body. Covering all other regions first gives the student the opportunity to build a strong foundation from which to understand this complex region.

Content

Each regional anatomy chapter consists of four consecutive sections: conceptual overview, regional anatomy, surface anatomy, and clinical cases.

The conceptual overview provides the basis on which information in the later sections is built. This section can be read independently of the rest of the text by students who require only a basic level of understanding and can also be read as a summary of important concepts after the regional anatomy has been mastered.

The regional anatomy section provides more detailed anatomy along with a substantial amount of relevant clinical correlations. It is not an exhaustive discussion

but instead provides information to a level that we feel is necessary for understanding the organization of the region. Throughout this section, two levels of clinical material are provided. Clinical hooks are fully integrated with the main anatomical text and function to relate ("hook") the anatomy discussed directly to a clinical application without taking students out of their train of thought and without disrupting the flow of the text. Although fully integrated with the anatomical text, these passages are differentiated from it by the use of green highlighting. "In the Clinic" summaries provide students with useful and relevant clinical information demonstrating how applying anatomical knowledge facilitates the solving of clinical problems. These are spread throughout the text close to the most relevant anatomical discussion.

Surface anatomy assists students in visualizing the relationship between anatomical structures and surface landmarks. This section also provides students with practical applications of the anatomical information, combining visual inspection with functional assessment, as occurs during any type of patient examination.

The final section of each chapter consists of clinical cases. These cases represent the third level of clinical material in the book. In these cases the clinical problem is described, and a step-by-step process of questions and answers leads the reader to the resolution of the case. The inclusion of these cases in each chapter provides students with the opportunity to apply an understanding of anatomy to the resolution of a clinical problem.

Illustrations are an integral part of any anatomy text. They must present the reader with a visual image that brings the text to life and presents views that will assist in the understanding and comprehension of the anatomy. The artwork in this text accomplishes all of these goals. The illustrations are original and vibrant, and many views are unique. They have been designed to integrate with the text, present the anatomy in new ways, deal with the issues that students find particularly difficult, and provide a conceptual framework for building further understanding. To ensure that the illustrations of the book work together and to enable students to cross-refer from one illustration to another, we have used standard colors throughout the book, except where indicated otherwise.


artery


vein


nerve


lymphatic


sympathetic fiber


parasympathetic fiber


preganglionic fiber (solid)


postganglionic fiber (dotted)

The position and size of the artwork was one of the parameters considered in the overall design of each page of the book.

Clinical images are also an important tool in understanding anatomy and are abundant throughout the text. Examples of state-of-the-art medical imaging, including MRIs, CTs, PETs, and ultrasound as well as high-quality radiographs, provide students with additional tools to increase their ability to visualize anatomy in vivo and, thus, increase their understanding.

What the book does not contain

Gray's Anatomy for Students focuses on gross anatomy. While many curricula around the world are being presented in a more integrated format combining anatomy, physiology, histology, and embryology, we have focused this textbook on understanding only the anatomy and its application to clinical problems. Except for some brief references to embryology where necessary for a better understanding of the anatomy, material from other disciplines is not included. We felt that there are many outstanding textbooks covering these subject areas, and that trying to cover everything in a single book would produce a text of questionable quality and usefulness, not to mention enormous size!

Terminology

In any anatomical text or atlas, terminology is always an interesting issue. In 1989, the Federative Committee on Anatomical Terminology (FCAT) was formed and was charged with developing the official terminology of

the anatomical sciences. The *Terminologia Anatomica* (Thieme, Stuttgart/New York, 1998) was a joint publication by this group and the 56 member associations of the International Federation of Associations of Anatomists (IFAA). We have chosen to use the terminology presented in this publication in the interest of uniformity. Other terminology is not incorrect; we just felt that using terminology from this single, internationally recognized source would be the most logical and straightforward approach.

Although we use anatomical terms for orientation as much as possible, we also use terms such as "behind" or "in front of" occasionally to make the text more readable. In these cases, the context clarifies the meaning.

Anatomical use of adverbs

During the writing of this book, we had many long discussions about how we were going to describe anatomical relationships as clearly as possible, but maintain the readability of the text. One issue that arose continually in our discussions was the correct use of the "-ly" adverb form of anatomical orientation terms, such as anterior, posterior, superior, inferior, lateral, and medial. We reached the following consensus:

-ly adverbs *e.g., anteriorly, posteriorly,* have been used to modify (describe) verbs in passages where an action or direction is mentioned. For example, "The trachea passes inferiorly through the thorax."

circumstantial adverbs, *e.g., anterior, posterior,* have been used to indicate the fixed location of an anatomical feature. For example, "The trachea is anterior to the esophagus."

Furthermore, both usages may occur in the same passage. For example, "The trachea passes inferiorly through the thorax, anterior to the esophagus."

We have very much enjoyed the process of putting this book together. We hope that you enjoy using it to the same degree.

Richard L. Drake
A. Wayne Vogl
Adam W. M. Mitchell
January 2009

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