



# Preface

By:

CNX Anatomy and Physiology

Welcome to *Human Anatomy and Physiology*, an OpenStax College resource. We created this textbook with several goals in mind: accessibility, customization, and student engagement—helping students reach high levels of academic scholarship. Instructors and students alike will find that this textbook offers a thorough introduction to the content in an accessible format.

## About OpenStax College

OpenStax College is a nonprofit organization committed to improving student access to quality learning materials. Our free textbooks are developed and peer-reviewed by educators to ensure that they are readable, accurate, and organized in accordance with the scope and sequence requirements of today’s college courses. Unlike traditional textbooks, OpenStax College resources live online and are owned by the community of educators using them. Through partnerships with companies and foundations committed to reducing costs for students, we are working to improve access to higher education for all. OpenStax College is an initiative of Rice University and is made possible through the generous support of several philanthropic foundations.

## About OpenStax College’s Resources

OpenStax College resources provide quality academic instruction. Three key features set our materials apart from others: 1) They can be easily customized by instructors for each class, 2) they are “living” resources that grow online through contributions from science educators, and 3) they are available for free or for a minimal cost.

## Customization

OpenStax College learning resources are conceived and written with flexibility in mind so that they can be customized for each course. Our textbooks provide a solid foundation on which instructors can build their own texts. Instructors can select the sections that are most relevant to their curricula and create a textbook that speaks directly to the needs of their students. Instructors are encouraged to expand on existing examples in the text by adding unique context via geographically localized applications and topical connections.

*Human Anatomy and Physiology* can be easily customized using our online platform (<https://openstaxcollege.org/textbooks/anatomy-and-physiology/adapt>). The text is arranged in a modular chapter format. Simply select the content most relevant to your syllabus and create a textbook that addresses the needs of your class. This customization feature will ensure that your textbook reflects the goals of your course.

## **Curation**

To broaden access and encourage community curation, *Human Anatomy and Physiology* is “open source” under a Creative Commons Attribution (CC BY) license. Members of the scientific community are invited to submit examples, emerging research, and other feedback to enhance and strengthen the material, keeping it current and relevant for today’s students. Submit your suggestions to [info@openstaxcollege.org](mailto:info@openstaxcollege.org), and check in on edition status, alternate versions, errata, and news on the StaxDash at <http://openstaxcollege.org>.

## **Cost**

Our textbooks are available for free online, and in low-cost print and tablet editions.

## **About *Human Anatomy and Physiology***

*Human Anatomy and Physiology* is designed for the two-semester anatomy and physiology course taken by life science and allied health students. It supports effective teaching and learning, and prepares students for further learning and future careers. The text focuses on the most important concepts and aims to minimize distracting students with more minor details.

The development choices for this textbook were made with the guidance of hundreds of faculty who are deeply involved in teaching this course. These choices led to innovations in art, terminology, career orientation, practical applications, and multimedia-based learning, all with a goal of increasing relevance to students. We strove to make the discipline meaningful and memorable to students, so that they can draw from it a working knowledge that will enrich their future studies.

## **Coverage and Scope**

The units of our *Human Anatomy and Physiology* textbook adhere to the scope and sequence followed by most two-semester courses nationwide.

### ***Unit 1: Levels of Organization***

Chapters 1–4 provide students with a basic understanding of human anatomy and physiology, including its language, the levels of organization, and the basics of chemistry and cell biology. These chapters provide a foundation for the further study of the body. They also focus particularly on how the body’s regions, important chemicals, and cells maintain homeostasis.

Chapter 1 An Introduction to the Human Body

Chapter 2 The Chemical Level of Organization

Chapter 3 The Cellular Level of Organization

Chapter 4 The Tissue Level of Organization

### ***Unit 2: Support and Movement***

In Chapters 5–11, students explore the skin, the largest organ of the body, and examine the body’s skeletal and muscular systems, following a traditional sequence of topics. This unit is the first to walk students through specific systems of the body, and as it does so, it maintains a focus on homeostasis as well as those diseases and conditions that can disrupt it.

Chapter 5 The Integumentary System

Chapter 6 Bone and Skeletal Tissue

Chapter 7 The Axial Skeleton

Chapter 8 The Appendicular Skeleton

Chapter 9 Joints

Chapter 10 Muscle Tissue

Chapter 11 The Muscular System

### ***Unit 3: Regulation, Integration, and Control***

Chapters 12–17 help students answer questions about nervous and endocrine system control and regulation. In a break with the traditional sequence of topics, the special senses are integrated into the chapter on the somatic nervous system. The chapter on the neurological examination offers students a unique approach to understanding nervous system function using five simple but powerful diagnostic tests.

Chapter 12 Introduction to the Nervous System

Chapter 13 The Anatomy of the Nervous System

Chapter 14 The Somatic Nervous System

Chapter 15 The Autonomic Nervous System

Chapter 16 The Neurological Exam

Chapter 17 The Endocrine System

### ***Unit 5: Energy, Maintenance, and Environmental Exchange***

In Chapters 22–26, students discover the interaction between body systems and the outside environment for the exchange of materials, the capture of energy, the release of waste, and the overall maintenance of the internal systems that regulate the exchange. The explanations and illustrations are particularly focused on how structure relates to function.

Chapter 22 The Respiratory System

Chapter 23 The Digestive System

Chapter 24 Nutrition and Metabolism

Chapter 25 The Urinary System

Chapter 26 Fluid, Electrolyte, and Acid–Base Balance

### ***Unit 6: Human Development and the Continuity of Life***

The closing chapters examine the male and female reproductive systems, describe the process of human development and the different stages of pregnancy, and end with a review of the mechanisms of inheritance.

Chapter 27 The Reproductive System

Chapter 28 Development and Genetic Inheritance

### **Pedagogical Foundation and Features**

*Human Anatomy and Physiology* is designed to promote scientific literacy. Throughout the text, you will find features that engage the students by taking selected topics a step further.

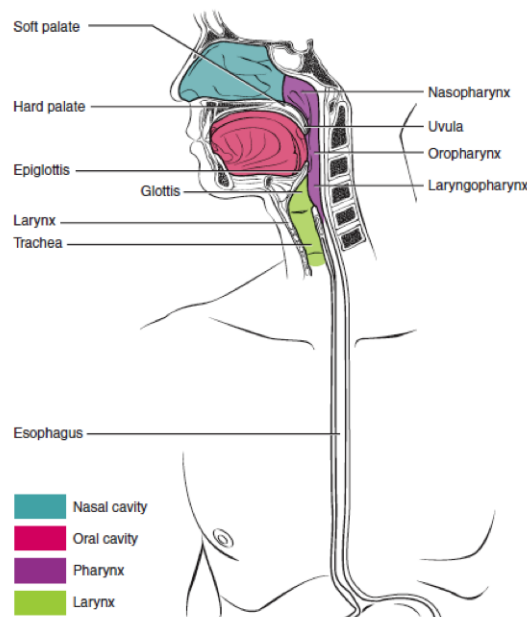
- **Homeostatic Imbalances** discusses the effects and results of imbalances in the body.
- **Disorders** showcases a disorder that is relevant to the body system at hand. This feature may focus on a specific disorder, or a set of related disorders.
- **Diseases** showcases a disease that is relevant to the body system at hand.
- **Aging** explores the effect aging has on a body’s system and specific disorders that manifest over time.
- **Career Connections** presents information on the various careers often pursued by allied health students, such as medical technician, medical examiner, and neurophysiologist. Students are introduced to the educational requirements for and day-to-day responsibilities in these careers.
- **Everyday Connections** tie anatomical and physiological concepts to emerging issues and discuss these in terms of everyday life. Topics include “Anabolic Steroids” and “The Effect of Second-Hand Tobacco Smoke.”
- **Interactive Links** direct students to online exercises, simulations, animations, and videos to add a fuller context to core content and help improve

understanding of the material. Many features include links to the University of Michigan's interactive WebScopes, which allow students to zoom in on micrographs in the collection. These resources were vetted by reviewers and other subject matter experts to ensure that they are effective and accurate. We strongly urge students to explore these links, whether viewing a video or inputting data into a simulation, to gain the fullest experience and to learn how to search for information independently.

### **Dynamic, Learner-Centered Art**

Our unique approach to visuals is designed to emphasize only the components most important in any given illustration. The art style is particularly aimed at focusing student learning through a powerful blend of traditional depictions and instructional innovations.

Much of the art in this book consists of black line illustrations. The strongest line is used to highlight the most important structures, and shading is used to show dimension and shape. Color is used sparingly to highlight and clarify the primary anatomical or functional point of the illustration. This technique is intended to draw students' attention to the critical learning point in the illustration, without distraction from excessive gradients, shadows, and highlights. Full color is used when the structure or process requires it (for example, muscle diagrams and cardiovascular system illustrations).



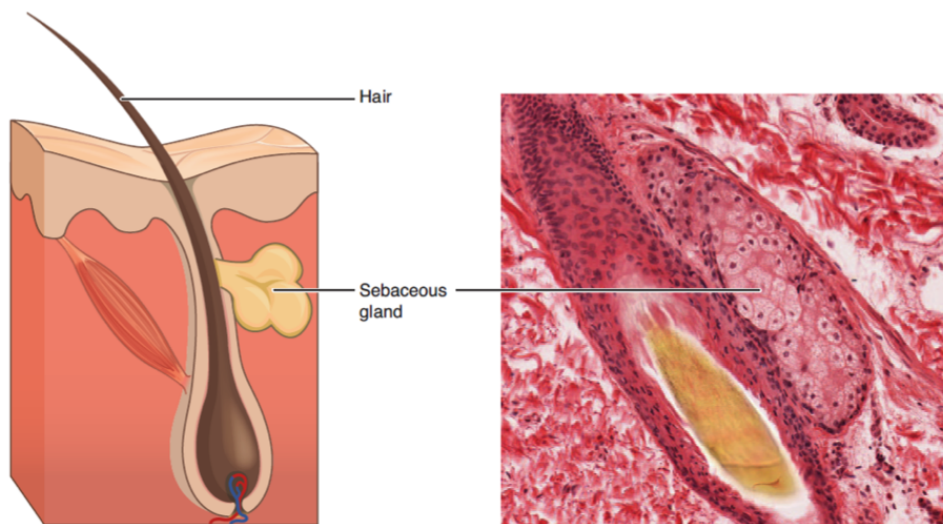
*The Pharynx*

*By highlighting the most important portions of the illustration, the artwork helps students focus on the most important points, without overwhelming them.*

## ***Micrographs***

Micrograph magnifications have been calculated based on the objective provided with the image. If a micrograph was recorded at 40 $\times$ , and the image was magnified an additional 2 $\times$ , we calculated the final magnification of the micrograph to be 80 $\times$ .

Please note that, when viewing the textbook electronically, the micrograph magnification provided in the text does not take into account the size and magnification of the screen on your electronic device. There may be some variation.



### *Sebaceous Glands*

*These glands secrete oils that lubricate and protect the skin. LM  $\times$  400. (Micrograph provided by the Regents of University of Michigan Medical School  $\copyright$  2012)*

## ***Learning Resources***

The following resources are (or will be) available in addition to main text:

- PowerPoint slides: For each chapter, the illustrations are presented, one per slide, with their respective captions.
- Pronunciation guide: A subset of the text's key terms are presented with easy-to-follow phonetic transcriptions. For example, blastocyst is rendered as "blas'to-sist"

## **About Our Team**

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### **Special Thanks**

OpenStax College wishes to thank the Regents of University of Michigan Medical School for the use of their extensive micrograph collection. Many of the UM micrographs that appear in *Human Anatomy and Physiology* are interactive WebScopes, which students can explore by zooming in and out.

We also wish to thank the Open Learning Initiative at Carnegie Mellon University, with whom we shared and exchanged resources during the development of *Human Anatomy and Physiology*.