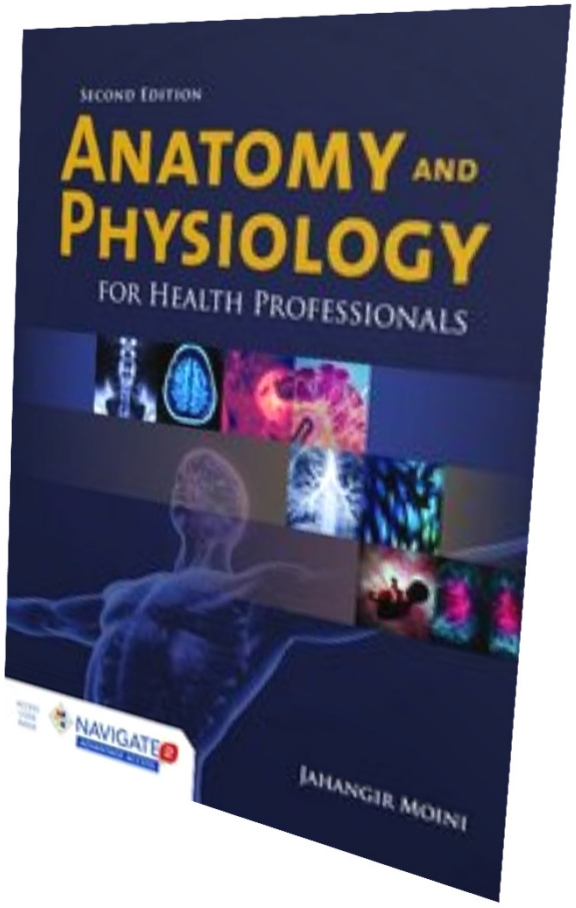
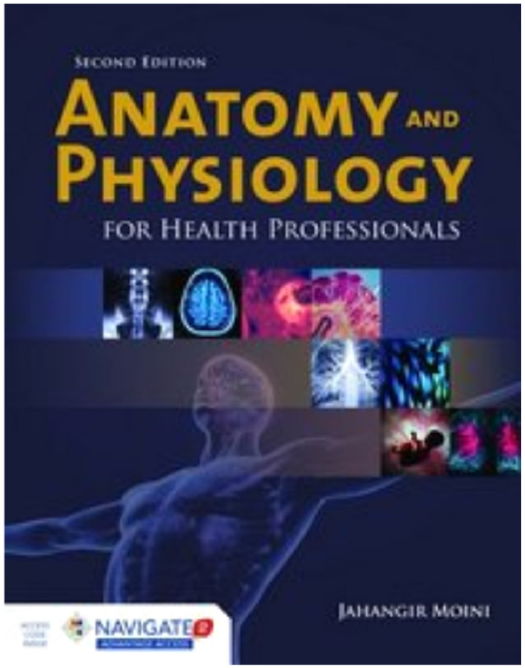
JONES & BARTLETT LEARNING
An Ascend Learning Company

Anatomy and Physiology for Health Professionals, Second Edition



Anatomy and Physiology for Health Professionals, Second Edition



ISBN-13: 978-1-284-03694-7

JUST PUBLISHED 1/27/15

Net price: $57.75

List price: $76.95

Paperback · 698 pages

Includes Navigate 2 Advantage Access

Trim size: 8 1/2" x 11“

© 2016

Author

Jahangir Moini, MD, MPH

Professor of Science and Health

Eastern Florida State College

Palm Bay Campus

About Dr. Jahangir Moini

- Professor of Science and Health at Eastern Florida State College, Palm Bay Campus
- Former Assistant Professor at Tehran University School of Medicine for 9 years teaching medical and allied health students
- Former Professor and Director of Allied Health programs at Everest University for 15 years
- Worked as a health educator consultant for 18 years at Brevard County Health Department

Overview

- Provides an accessible overview of human anatomy and physiology for all health professionals
- Focus on enhanced student understanding and learning
- Offers assessments and interactive learning resources to increase student comprehension and retention
- Provides students with an easily navigable format

New to the Second Edition

- Four additional chapters, including:
  - New chapter on joints, providing an overview of classifications, types, and injuries
  - Expanded presentation of the nervous system, with additional chapters
  - Enhanced discussion of the cardiovascular system
- New *Focus on Pathology* feature connects anatomy and physiology to human disease
- Essay Questions appear at the end of each chapter

Layout of the Material

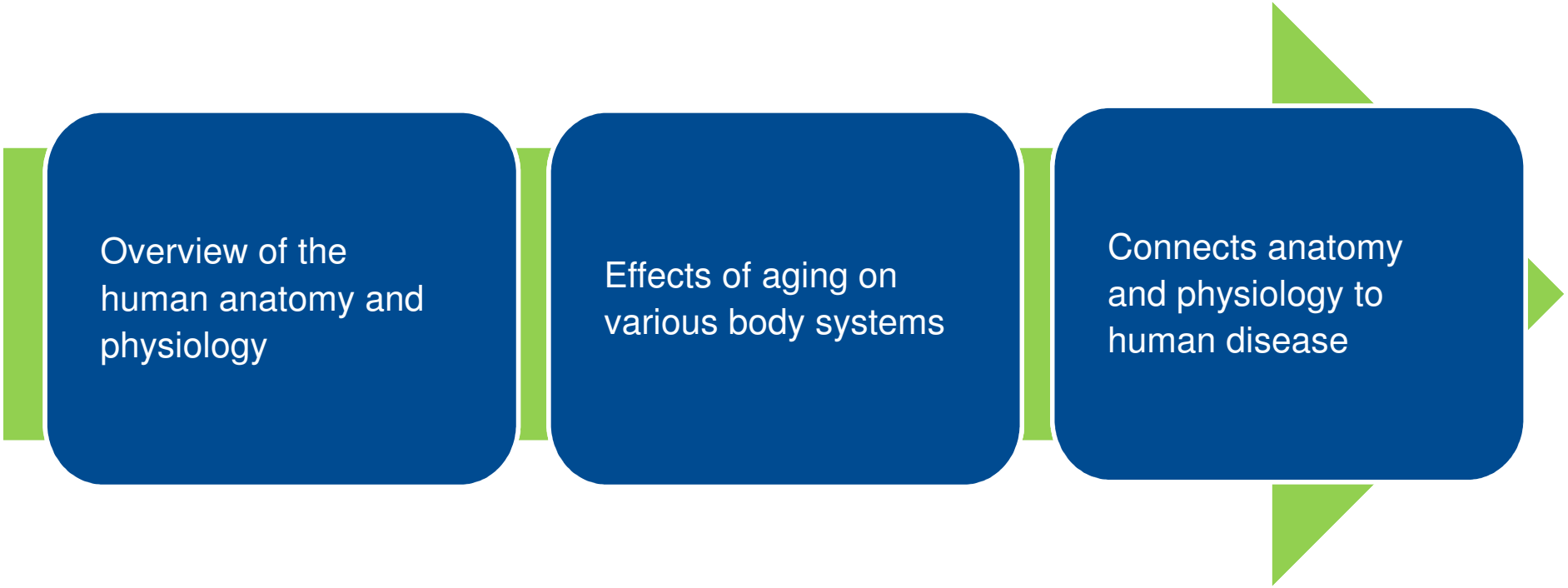


Table of Contents

Levels of Organization

Support & Movement

Control & Coordination

Table of Contents cont'd..

Transport

Chapter 15:
Blood
Chapter 16:
The Heart
Chapter 17:
The Vascular System
Chapter 18:
The Lymphatic System and Immunity

Environmental Exchange

Chapter 19:
The Respiratory System
Chapter 20:
The Urinary System
Chapter 21:
Fluid, Electrolyte, & Acid-Base Balance
Chapter 22:
Digestive System

Continuity of Life

Chapter 23:
The Reproductive System
Chapter 24:
Pregnancy and Development

Chapter Features

PEDOGOGY
- Chapter Objectives
- Learning Goals
- Assess Your Learning Questions
- Test Your Knowledge Questions
- Critical Thinking Questions
- Essay Questions

BOXED FEATURES
- Focus on Pathology
- Effects of Aging on Body Systems
- Diagnostic Imaging Tables
- Diagnostic Images: MRI, X-Ray, CT Scans

Benefits for Students

- **Facilitates Student Learning**
  - Provides a comprehensive overview of human anatomy and physiology
  - Presents content in an accessible manner targeted to health professions students
  - Includes clinical images such as X-rays, CT Scans and MRIs
  - Offers access to helpful animations and interactive learning tools
- **Provides Self Assessments**
  - Incorporates robust end of chapter assessments for learners
  - Navigate 2 Advantage Access provides additional activities and questions

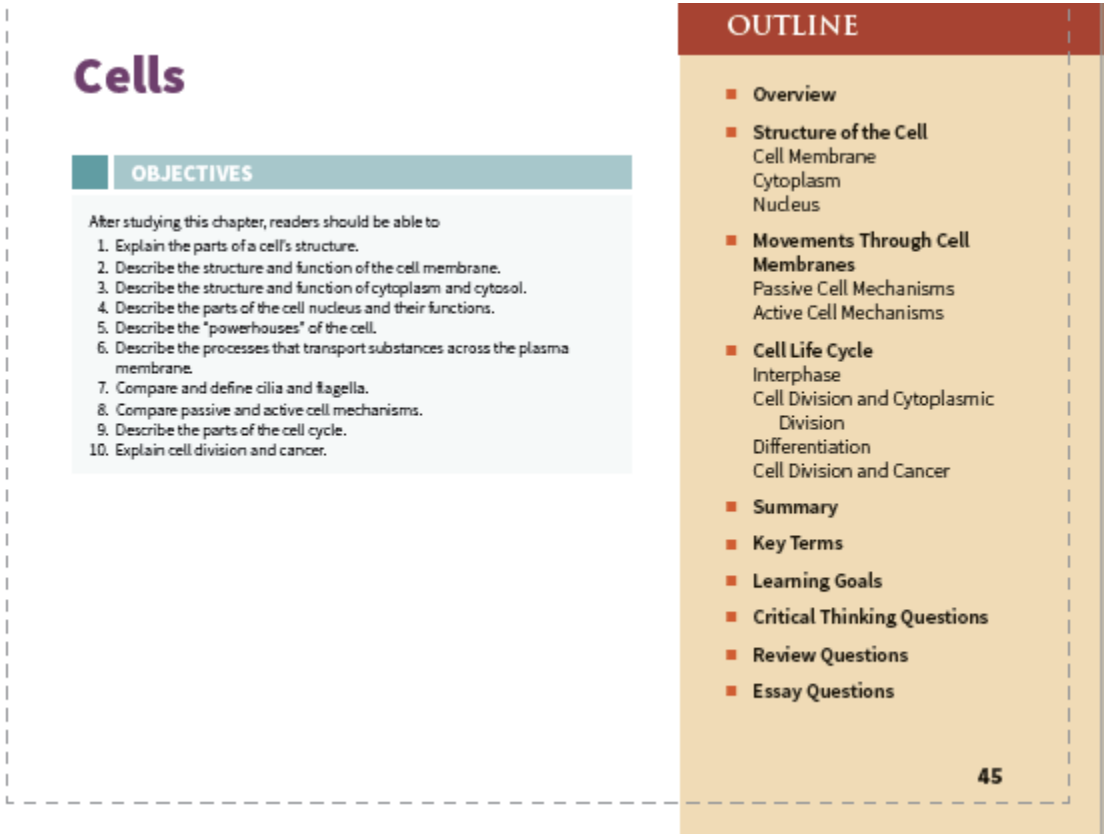
Preview Pages and Examples

Next, let's take a look at some of the features and examples from the text…

Chapter 3

Chapter Objectives

Chapter Outline



Cells

OBJECTIVES

After studying this chapter, readers should be able to

1. Explain the parts of a cell's structure.
2. Describe the structure and function of the cell membrane.
3. Describe the structure and function of cytoplasm and cytosol.
4. Describe the parts of the cell nucleus and their functions.
5. Describe the "powerhouses" of the cell.
6. Describe the processes that transport substances across the plasma membrane.
7. Compare and define cilia and flagella.
8. Compare passive and active cell mechanisms.
9. Describe the parts of the cell cycle.
10. Explain cell division and cancer.

OUTLINE

- **Overview**
- **Structure of the Cell**
  Cell Membrane
  Cytoplasm
  Nucleus
- **Movements Through Cell Membranes**
  Passive Cell Mechanisms
  Active Cell Mechanisms
- **Cell Life Cycle**
  Interphase
  Cell Division and Cytoplasmic Division
  Differentiation
  Cell Division and Cancer
- **Summary**
- **Key Terms**
- **Learning Goals**
- **Critical Thinking Questions**
- **Review Questions**
- **Essay Questions**

45

Full- color Images

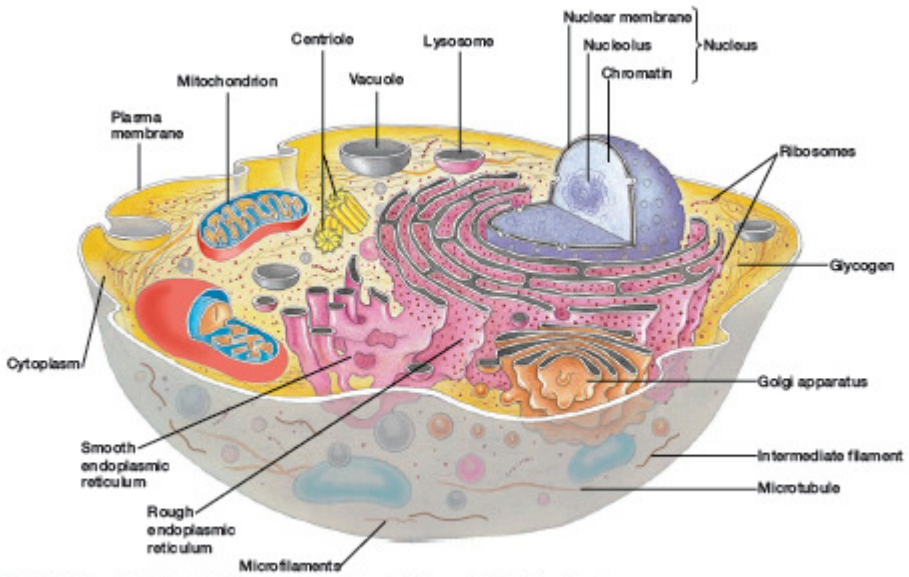


FIGURE 3-1 The cell. (Lewin, B., et al. (2007). Cells. Sudbury, MA: Jones & Bartlett Learning.)

TEST YOUR UNDERSTANDING QUESTION

TEST YOUR UNDERSTANDING

1. Name the three major parts of a cell and the function of the cell membrane.
2. Explain how a semipermeable cell membrane functions.

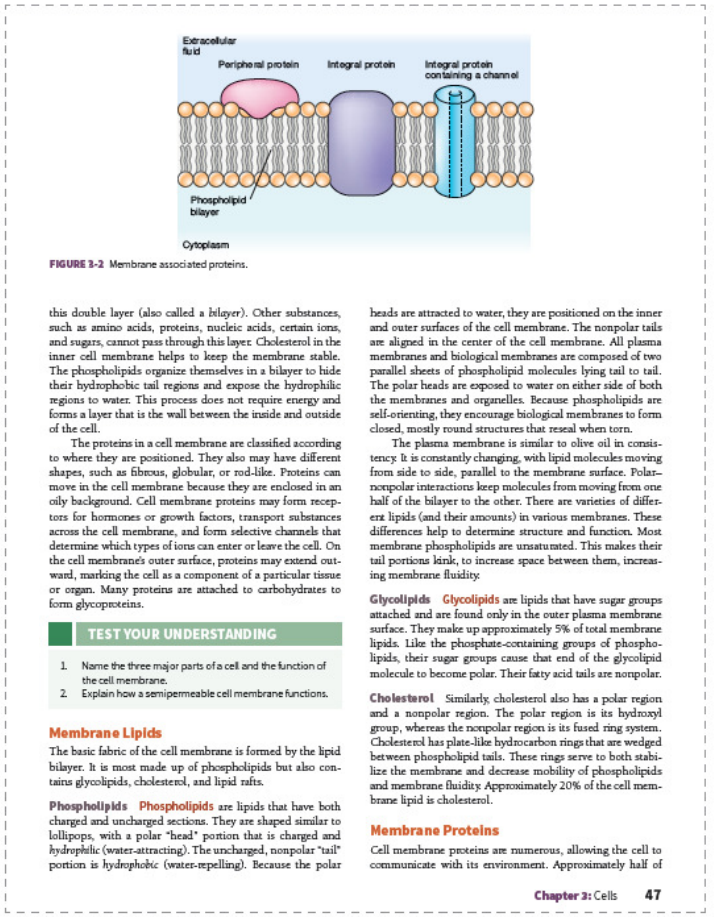


FIGURE 3-2 Membrane associated proteins.

this double layer (also called a *bilayer*). Other substances, such as amino acids, proteins, nucleic acids, certain ions, and sugars, cannot pass through this layer. Cholesterol in the inner cell membrane helps to keep the membrane stable. The phospholipids organize themselves in a bilayer to hide their hydrophobic tail regions and expose the hydrophilic regions to water. This process does not require energy and forms a layer that is the wall between the inside and outside of the cell.

The proteins in a cell membrane are classified according to where they are positioned. They also may have different shapes, such as fibrous, globular, or rod-like. Proteins can move in the cell membrane because they are enclosed in an oily background. Cell membrane proteins may form receptors for hormones or growth factors, transport substances across the cell membrane, and form selective channels that determine which types of ions can enter or leave the cell. On the cell membrane's outer surface, proteins may extend outward, marking the cell as a component of a particular tissue or organ. Many proteins are attached to carbohydrates to form glycoproteins.

TEST YOUR UNDERSTANDING

1. Name the three major parts of a cell and the function of the cell membrane.
2. Explain how a semipermeable cell membrane functions.

Membrane Lipids

The basic fabric of the cell membrane is formed by the lipid bilayer. It is most made up of phospholipids but also contains glycolipids, cholesterol, and lipid rafts.

Phospholipids Phospholipids are lipids that have both charged and uncharged sections. They are shaped similar to lollipops, with a polar "head" portion that is charged and *hydrophilic* (water-attracting). The uncharged, nonpolar "tail" portion is *hydrophobic* (water-repelling). Because the polar heads are attracted to water, they are positioned on the inner and outer surfaces of the cell membrane. The nonpolar tails are aligned in the center of the cell membrane. All plasma membranes and biological membranes are composed of two parallel sheets of phospholipid molecules lying tail to tail. The polar heads are exposed to water on either side of both the membranes and organelles. Because phospholipids are self-orienting, they encourage biological membranes to form closed, mostly round structures that reseal when torn.

The plasma membrane is similar to olive oil in consistency. It is constantly changing, with lipid molecules moving from side to side, parallel to the membrane surface. Polar–nonpolar interactions keep molecules from moving from one half of the bilayer to the other. There are varieties of different lipids (and their amounts) in various membranes. These differences help to determine structure and function. Most membrane phospholipids are unsaturated. This makes their tail portions kink, to increase space between them, increasing membrane fluidity.

Glycolipids Glycolipids are lipids that have sugar groups attached and are found only in the outer plasma membrane surface. They make up approximately 5% of total membrane lipids. Like the phosphate-containing groups of phospholipids, their sugar groups cause that end of the glycolipid molecule to become polar. Their fatty acid tails are nonpolar.

Cholesterol Similarly, cholesterol also has a polar region and a nonpolar region. The polar region is its hydroxyl group, whereas the nonpolar region is its fused ring system. Cholesterol has plate-like hydrocarbon rings that are wedged between phospholipid tails. These rings serve to both stabilize the membrane and decrease mobility of phospholipids and membrane fluidity. Approximately 20% of the cell membrane lipid is cholesterol.

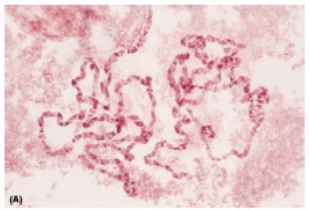
Membrane Proteins

Cell membrane proteins are numerous, allowing the cell to communicate with its environment. Approximately half of

FOCUS ON PATHOLOGY
- Boxed Feature

FOCUS ON PATHOLOGY

As you have learned, cell membranes are selectively permeable. This is a very important property of cell membranes. When damaged, many substances are able to flow in and out of cells freely. For example, in burn victims, vital fluids, ions, and proteins leak out of damaged cells



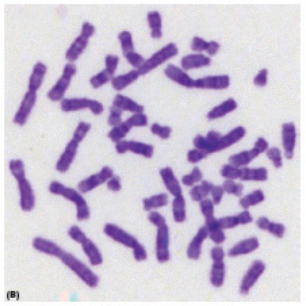


FIGURE 3-10 Chromosomes. (A) The thread-like chromosomes, made of chromatin fibers consisting of protein and DNA, must condense (© Photos.com) (B) before the nucleus can divide. (B) Condensed chromosomes. Can you think of any advantages to this strategy? (© Donna Beer Stolz, PhD, Center for Biologic Imaging, University of Pittsburgh Medical School)

FOCUS ON PATHOLOGY

As you have learned, cell membranes are selectively permeable. This is a very important property of cell membranes. When damaged, many substances are able to flow in and out of cells freely. For example, in burn victims, vital fluids, ions, and proteins leak out of damaged cells

Movements Through Cell Membranes

The cell membrane controls which substances can enter and leave the cell. It does this by using passive and active mechanisms. Passive mechanisms do not require cellular energy, whereas active mechanisms do.

Passive Cell Mechanisms

Passive cell mechanisms include diffusion, osmosis, and filtration. Diffusion (also known as *simple diffusion*) is the process by which substances spontaneously move from regions of higher concentration to regions of lower concentration (the *concentration gradient*). Molecules and ions in various substances move very quickly, colliding with many other types of particles. These collisions occur at the rate of a million times per second. The speed of diffusion is influenced by kinetic energy, molecular size, and temperature. Once particles have diffused to be evenly distributed throughout a substance such as water, they have achieved a state of **equilibrium**. Examples of diffusion include ion movement across cell membranes, and neurotransmitter movement between nerve cells.

Cells allow substances to diffuse into or out of them only if the cell membrane is permeable to the substance and if the concentration of a substance is higher on one side of the membrane than the other (**FIGURE 3-11**). A molecule or ion will diffuse through the cell membrane if it is lipid soluble, assisted by a carrier molecule, or small enough to pass through membrane channels. *Simple diffusion* is further defined as unassisted diffusion of very small or lipid-soluble particles. Nonpolar and lipid-soluble substances are diffused through the lipid bilayer. These substances include carbon dioxide, fat-soluble vitamins, and oxygen. Oxygen continuously diffuses from the blood into the cells because its concentration is always higher in the blood than in tissue cells. Oppositely, because carbon dioxide is in higher concentration within the cells, it diffuses from tissue cells into the blood.

Some substances cannot pass through the lipid bilayer of a cell membrane, requiring proteins in the membrane to assist them. This process is known as **facilitated diffusion**, which is also known as *assisted diffusion*. It is similar to simple diffusion

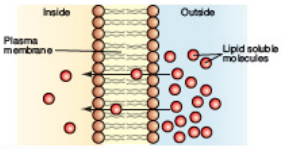


FIGURE 3-11 Diffusion.

Example: Helpful Table

TABLE 3-1

Structures and Functions of Organelles

Organelles	Structure	Function
Centrioles	Paired cylindrical bodies that are each made up of nine triplets of microtubules.	During mitosis (cell division), they organize a microtubule network to form the spindle and asters. They form the bases of cilia and flagella.
RER	A membranous system that encloses a cavity (cistern). It coils through the cytoplasm, and is externally studded with ribosomes.	Within the cisterns, sugar groups are attached to proteins. The proteins are bound in vesicles so they can be transported to the Golgi apparatus and other sites. Their external faces synthesize phospholipids.
SER	A membranous system of sacs and tubules that lack ribosomes.	The site of steroid (cholesterol) and lipid synthesis, lipid metabolism, and drug detoxification.
Golgi apparatus	Located close to the nucleus, it is a stack of flattened membranes and associated vesicles.	It packages, changes, and separates proteins for secretion from the cell, to be included in lysosomes, and to be incorporated into the plasma membrane.
Lysosomes	Membranous sacs that contain acid hydrolases.	The sites of intracellular digestion.
Microfilaments	Fine filaments composed of actin, a protein.	Aid in muscle contraction and other intracellular movement and help to form the cell's cytoskeleton.
Intermediate filaments	Protein fibers of various composition.	They are stable cytoskeletal elements that resist mechanical forces acting upon the cell.
Microtubules	Cylindrically shaped structures made of tubulin proteins.	They support the cell, giving it shape, and are involved in intracellular and cellular movements. Microtubules form centrioles and, if present, cilia and flagella. They form the mitotic spindles during cell division, binding to the chromosomes and separating the two strands.
Mitochondria	Double-membrane structures that are rod-like in appearance; they are folded into projections (cristae).	The site of ATP synthesis. The mitochondria are the powerhouses of cells.
Peroxisomes	Membranous sacs of the enzymes catalase and oxidase.	Their enzymes detoxify many substances. Catalase is the most important enzyme, which breaks down hydrogen peroxide.
Ribosomes	Dense particles made up of two subunits that are each composed of ribosomal RNA and protein. They may be free, or attached to the RER.	The sites of protein synthesis.

Chapter 3 Summary

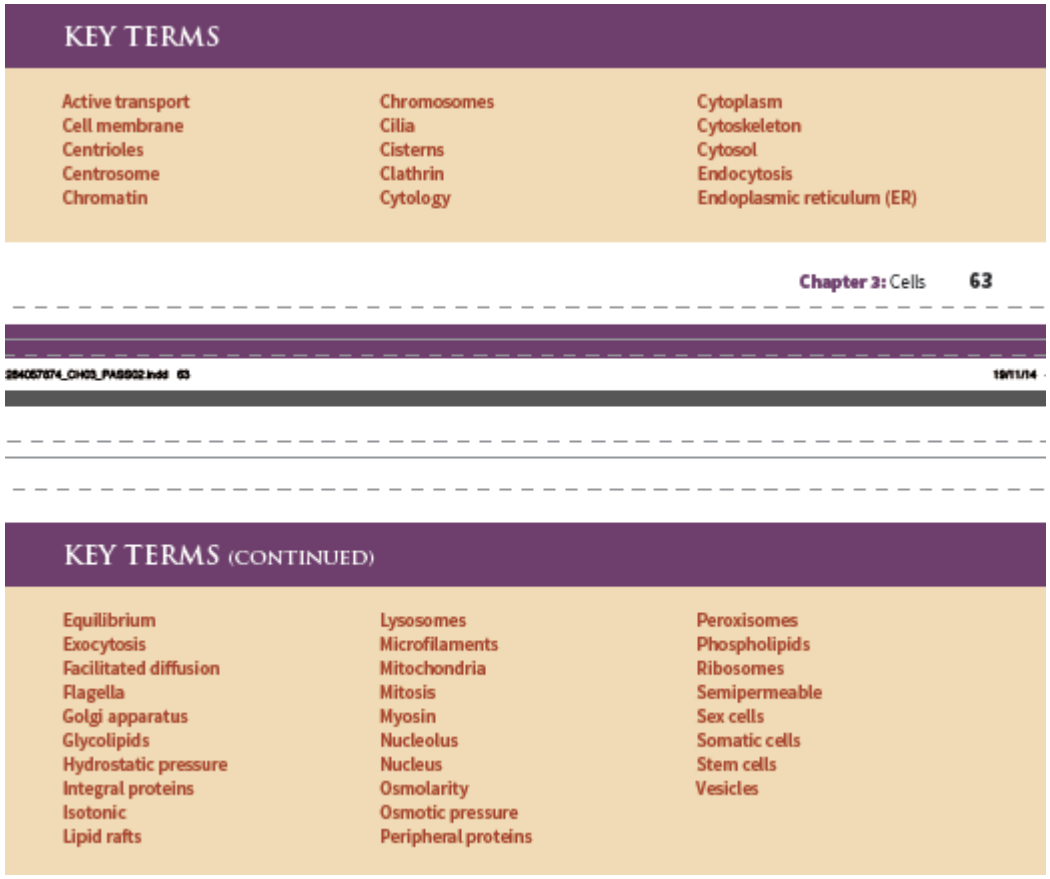
SUMMARY

The cell is the basic unit that performs all the vital physiologic functions in the body. The three parts of the cell are the semipermeable cell membrane, the cytoplasm, and the nucleus. The cell membrane is mostly made up of lipids and proteins, usually in a double layer of phospholipid molecules. The cytoplasm is a gel-like material suspending the cell's organelles. The organelles in the cytoplasm each have specific actions that help to carry out the cell's activities. They are vital to the life of the cell, tissue, and organism.

The cell nucleus is the control center for cellular operations. Inside the nucleus, a fluid called nucleoplasm suspends the nucleolus and chromatin. The nucleus also contains chromosomes. The DNA controls protein synthesis in the nucleus.

The cell membrane uses passive and active mechanisms to allow various substances to enter or leave the cell. Passive cell mechanisms include diffusion, osmosis, and filtration. Active cell mechanisms require energy and specific carrier molecules and include active transport, endocytosis, and exocytosis. A neoplasm is a mass of tissue produced by abnormal cell growth and division. The two types of tumors are benign or malignant. Tumors that are malignant spread into surrounding tissues in a process known as metastasis.

Ch 3
Key Terms



KEY TERMS

Active transport
Cell membrane
Centrioles
Centrosome
Chromatin
Chromosomes
Cilia
Cisterns
Clathrin
Cytology
Cytoplasm
Cytoskeleton
Cytosol
Endocytosis
Endoplasmic reticulum (ER)

KEY TERMS (CONTINUED)

Equilibrium
Exocytosis
Facilitated diffusion
Flagella
Golgi apparatus
Glycolipids
Hydrostatic pressure
Integral proteins
Isotonic
Lipid rafts
Lysosomes
Microfilaments
Mitochondria
Mitosis
Myosin
Nucleolus
Nucleus
Osmolarity
Osmotic pressure
Peripheral proteins
Peroxisomes
Phospholipids
Ribosomes
Semipermeable
Sex cells
Somatic cells
Stem cells
Vesicles

Ch 3 Learning Goals

LEARNING GOALS

The following learning goals correspond to the objectives at the beginning of this chapter:

1. There are three major parts to a cell: the cell membrane, the nucleus, and the cytoplasm. The cell membrane encloses the cell, its nucleus, and its cytoplasm. The nucleus contains the cell's genetic material and controls its activities. The cytoplasm fills out the cell and its shape.
2. The cell (plasma) membrane controls movement of substances both into and out of the cell. It is also where much of the cell's biologic activities are conducted. Molecules in the cell membrane form pathways that allow the detection of signals from outside the cell to be transmitted inside. Each cell's membrane is thin, delicate, and able to stretch. There are usually tiny folds on the surface, which help to increase its surface area. Cell membranes can be differentially permeable or semipermeable.
3. Cytoplasm is a substance that contains all the cellular contents between the plasma membrane and the nucleus. It makes up most of each cell's volume and is a gel-like material suspending the cell's organelles. Cytoplasm consists of cytosol and a cytoskeleton. Cytosol is the fluid portion of cytoplasm.
4. The cell nucleus serves as the control center for cellular operations. Inside the nucleus is a fluid called nucleoplasm that suspends the following structures:
   - *Nucleolus:* A mini-nucleus made up of mostly RNA and protein, with no surrounding membrane
   - *Chromatin:* Loosely coiled DNA and protein fibers that condense, forming chromosomes
5. The mitochondria are the "powerhouses" of each cell. They are organelles with double membranes that play a central role in the production of ATP. There may be hundreds or thousands of mitochondria in each cell. Cells that use more ATP have more mitochondria (such as liver, kidney, and muscle cells).
6. Passive cell mechanisms include diffusion, osmosis, and filtration. Active cell mechanisms include active transport, endocytosis, and exocytosis.
   - Diffusion is the process by which substances spontaneously move from regions of higher concentration to regions of lower concentration.
   - Osmosis is a special type of diffusion that occurs when water molecules diffuse from an area of higher water concentration to an area of lower water concentration.
   - Filtration forces molecules through membranes.
   - Active transport is the movement of particles through membranes from regions of lower concentration to regions of higher concentration.
   - Endocytosis involves a secretion from the cell membrane moving particles too large to enter the cell by other processes within a vesicle of the cell.
   - Exocytosis is the opposite process of endocytosis, in which a substance stored in a vesicle is secreted from the cell.
7. Cilia and flagella extend from certain cell surfaces. Cilia are hair-like, moving in a coordinated sweeping motion to move fluids over the surface of tissues. Flagella are longer than cilia and often exist as only a single flagellum, such as the tail of a sperm cell.
8. Passive cell mechanisms do not require energy, whereas active cell mechanisms do.

Ch 3 Review Questions

CRITICAL THINKING QUESTIONS

A 63-year-old woman was diagnosed with carcinoma of the thyroid. Unfortunately, it had metastasized to her vertebral bones.

1. Explain the cell division in relation to cancer.
2. Describe the term *metastasis* and the most common cause of cancer.

REVIEW QUESTIONS

1. Which of the following is the control center for cellular operations?
   A. cell membrane
   B. lysosomes
   C. nucleus
   D. mitochondria
2. Which of the following organelles is involved in the digestion of foreign material?
   A. ribosomes
   B. lysosomes
   C. mitochondria
   D. Golgi apparatus
3. Where is most of the ATP required to power cellular operations produced?
   A. mitochondria
   B. nucleoli
   C. Golgi apparatus
   D. centrioles
4. Where does synthesis of lipids take place?
   A. lysosomes
   B. nucleoli
   C. rough endoplasmic reticulum
   D. smooth endoplasmic reticulum
5. A solution that contains a higher solute concentration than the cytoplasm of a cell is referred to as
   A. hypertonic
   B. isotonic
   C. hypotonic
   D. semitonic
6. Which of the following is true about cell membranes?
   A. They are impermeable.
   B. They are freely permeable.
   C. They are differentially permeable or semipermeable.
   D. They are actively permeable.
7. The movement of oxygen from an area of high concentration to an area of low concentration is an example of
   A. filtration
   B. diffusion
   C. osmosis
   D. active transport
8. The fluid-filled cavity within mitochondria is called the
   A. matrix
   B. cristae
   C. vesicle
   D. anticodon

Ch 3 Essay Questions

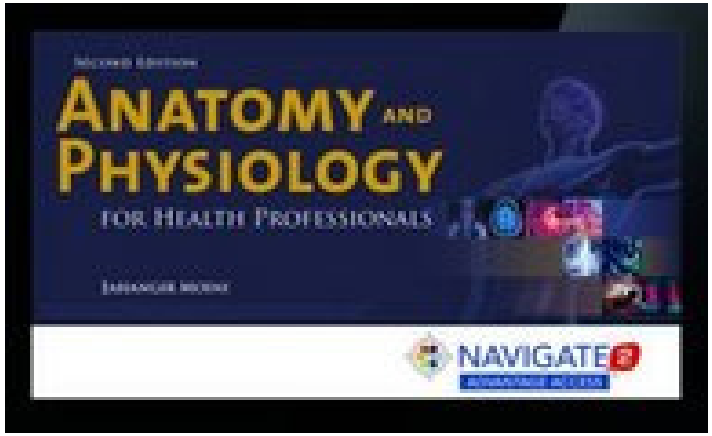
ESSAY QUESTIONS

1. What are the lipid and protein membranes of a cell?
2. Compare hydrophilic and hydrophobic lipids.
3. How many membrane proteins are found in the cell membrane? Describe them.
4. What are lipid rafts? Give two examples.
5. Compare cilia with flagella.
6. Contrast the roles of the ER-bound ribosomes with those that are free in the cytosol.
7. Compare and contrast active and passive cell membranes.
8. Name the cell life cycle and its four phases.
9. Explain the structure and functions of the Golgi apparatus and the microtubules.
10. Define the structures of DNA and RNA, and identify their locations.

Instructor Resources

- **Lecture Outlines** in PowerPoint format, featuring more than 100 slides per chapter
- **Instructor's Manual**, featuring Sample Syllabus , Teaching Strategies, Lecture Outlines, Discussion Topics, Image Bank and Answer Key
- **Test Bank**, containing 70-100 questions per chapter; variety of question types (multiple choice, matching, true/false, figure matching, etc.)

Student Resources



Navigate 2 Advantage Access

Digital Only

Online Access Code

ISBN-13: 9781284057423

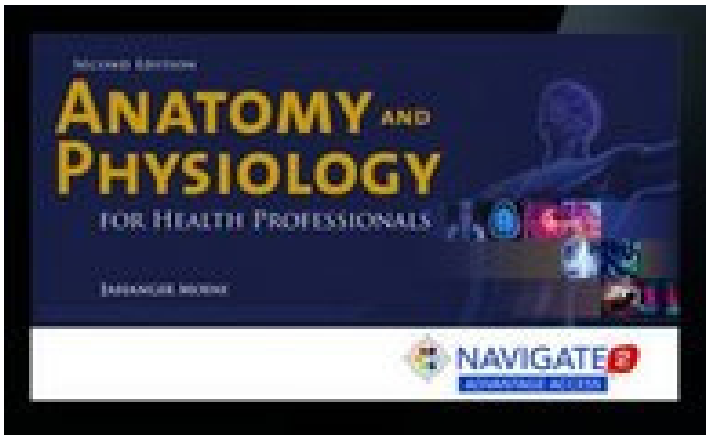
$38.95* List Price © 2016

Available Late March 2015

Half the cost of the textbook/eBook package

Navigate 2 Advantage Access

JONES & BARTLETT LEARNING
NAVIGATE™ 2



Whether you teach an online, hybrid, or traditional classroom-based course, Navigate 2 delivers unbeatable value. Navigate 2 provides access to mobile-ready course materials:

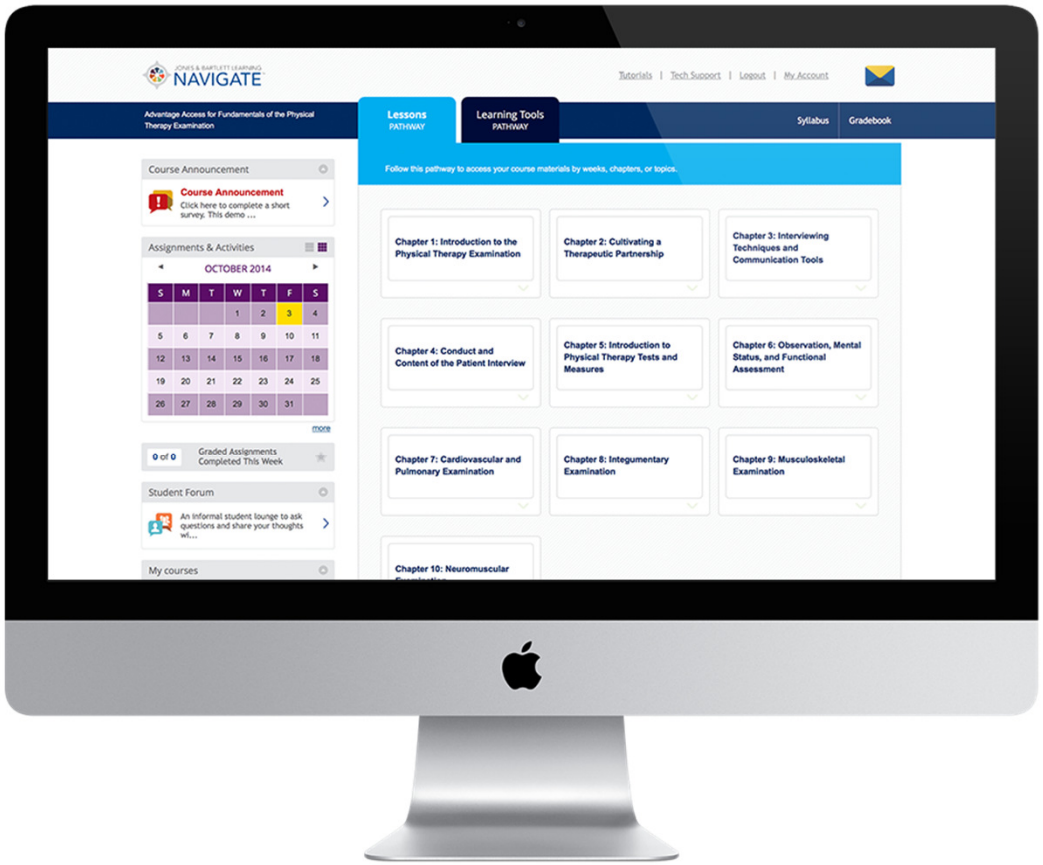
- Learn: A complete eBook with interactive tools
- Practice: A virtual Study Center with robust practice activities and flashcards
- Assess: A homework and testing Assessment center with prepopulated quizzes and examinations
- Analyze: A dashboard that reports actionable data

Navigate 2 Learning Management System

- **eBook**
  - Animations Library
  - Knowledge Checks
  - End-of-Chapter Graded Quizzes
- **Study Tools**
  - Learning Objectives
  - Flashcards
  - Practice Activities
  - Chapter Overview Presentation Slides in PowerPoint format
- **Assessments**
  - Lesson Quizzes
  - Midterm
  - Final

Instructor Tools:

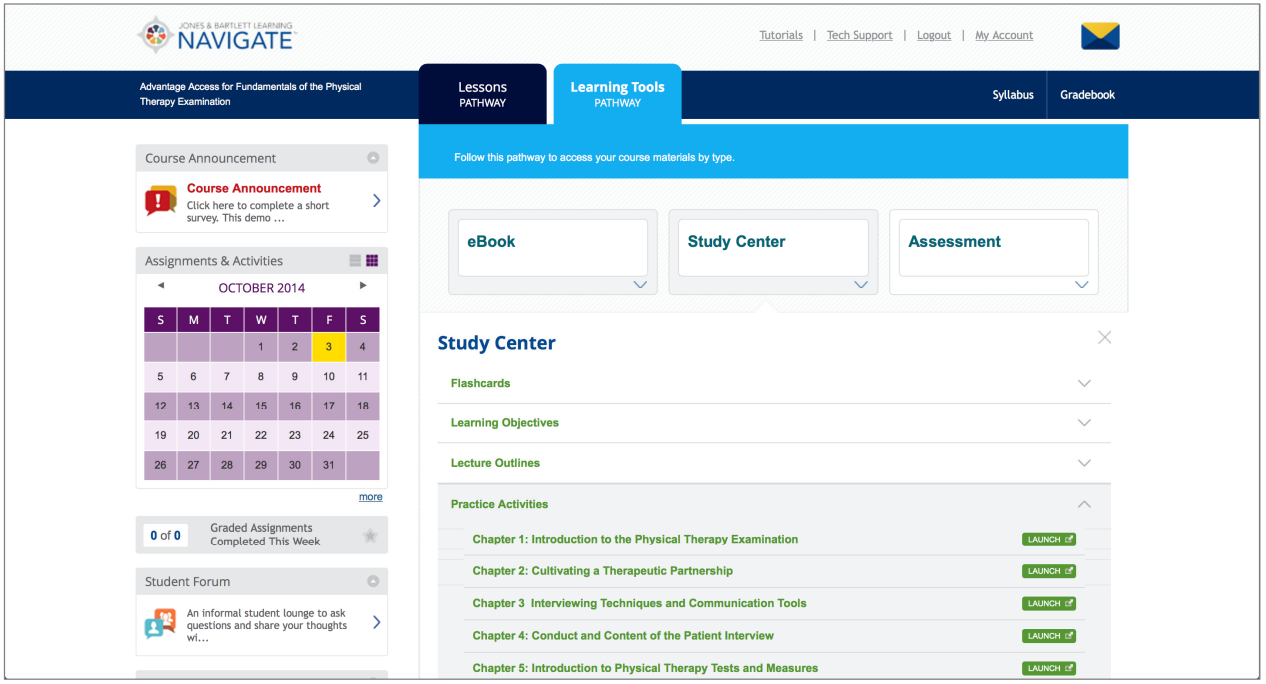
- Preloaded Assignments
- Automatic Grading
- Student Reporting



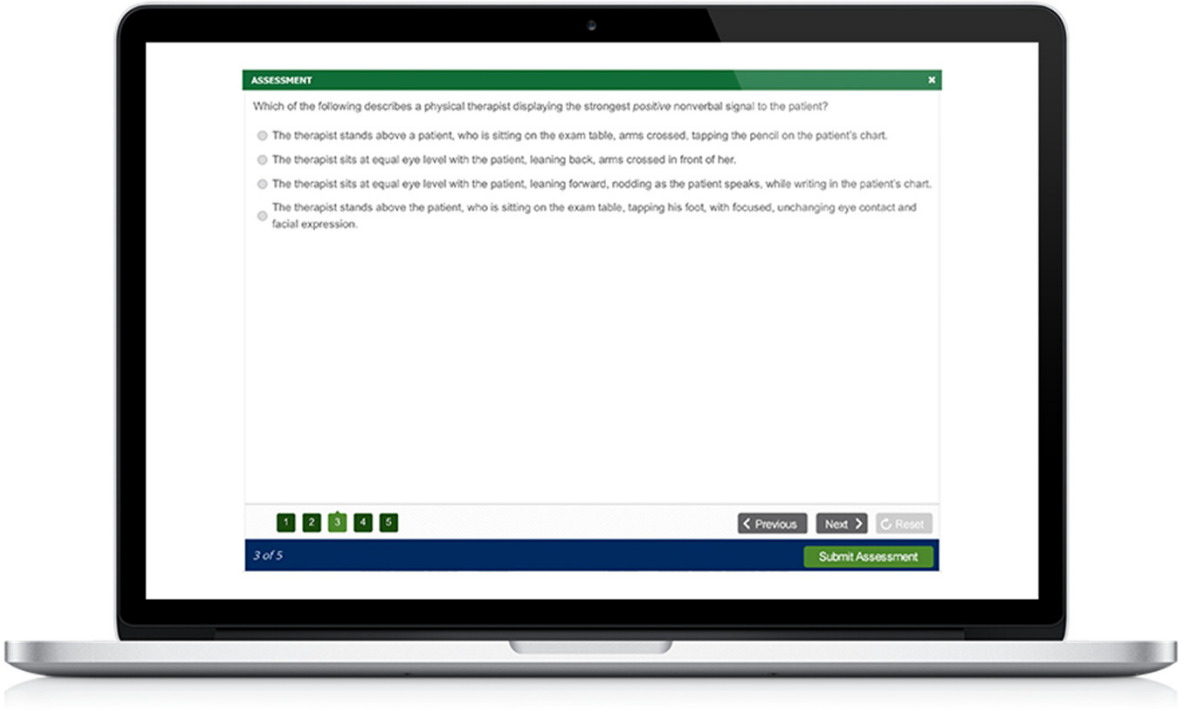
Navigate 2 Homepage

eBook Sample View

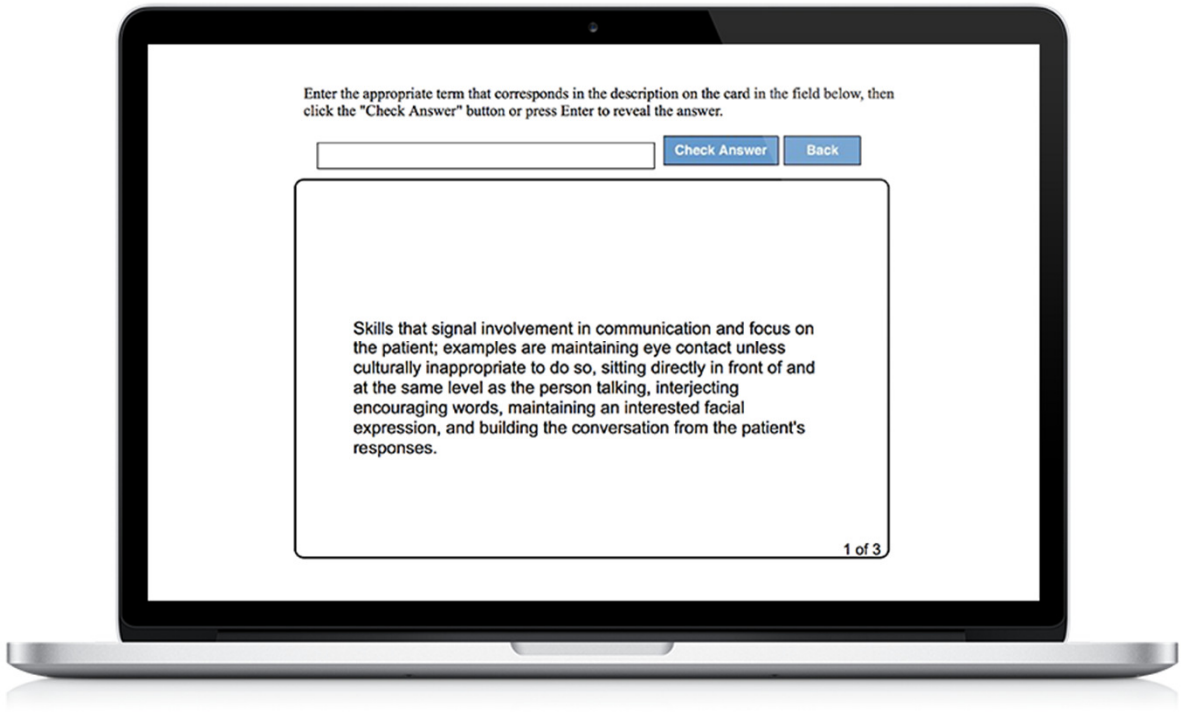
Study Center



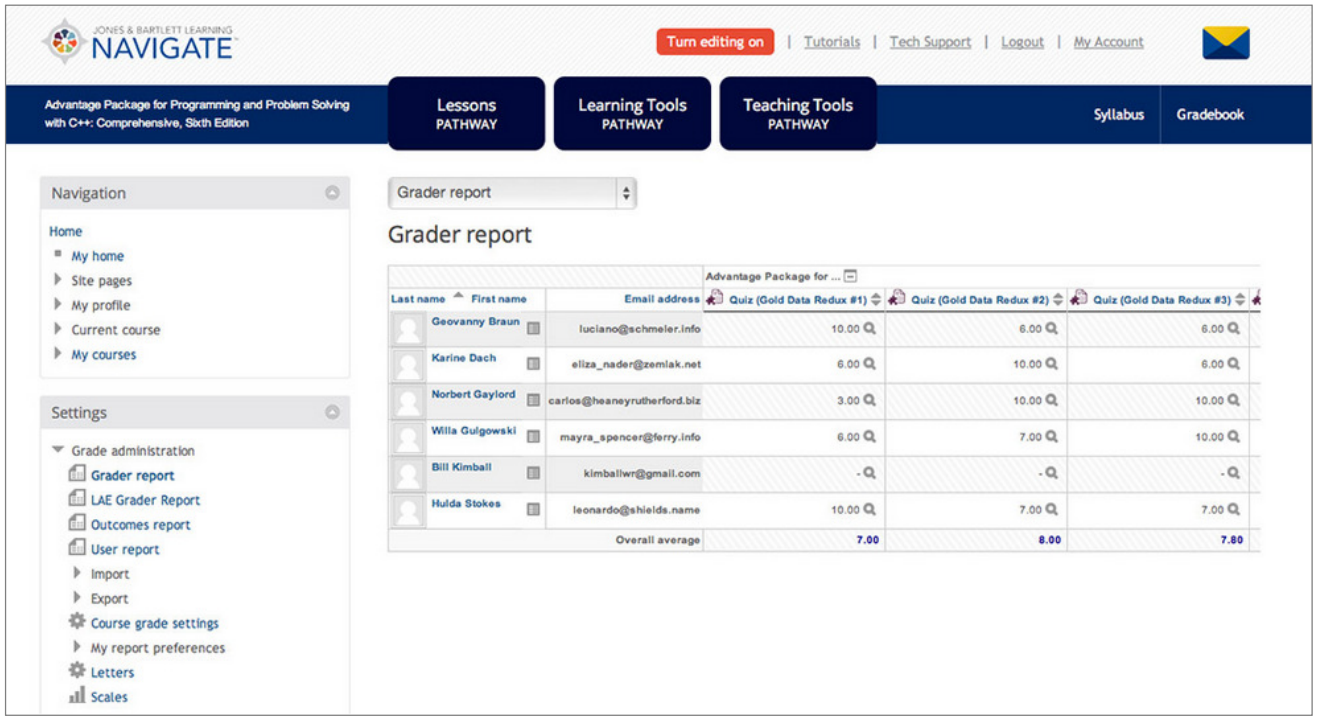
Knowledge Check Questions within eBook



Flashcards

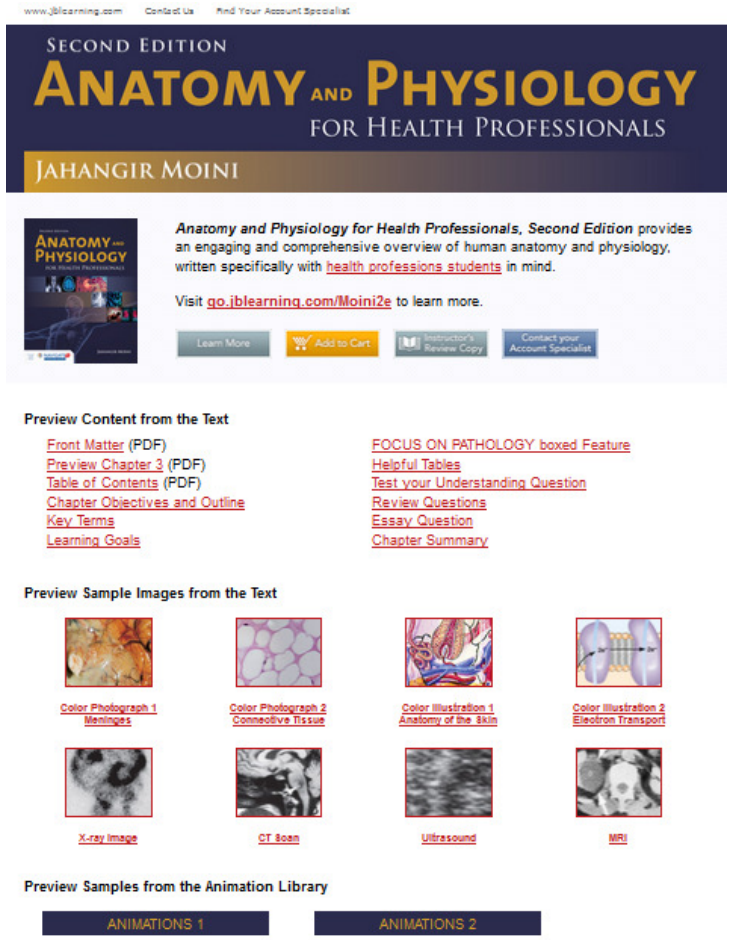


Grade Book



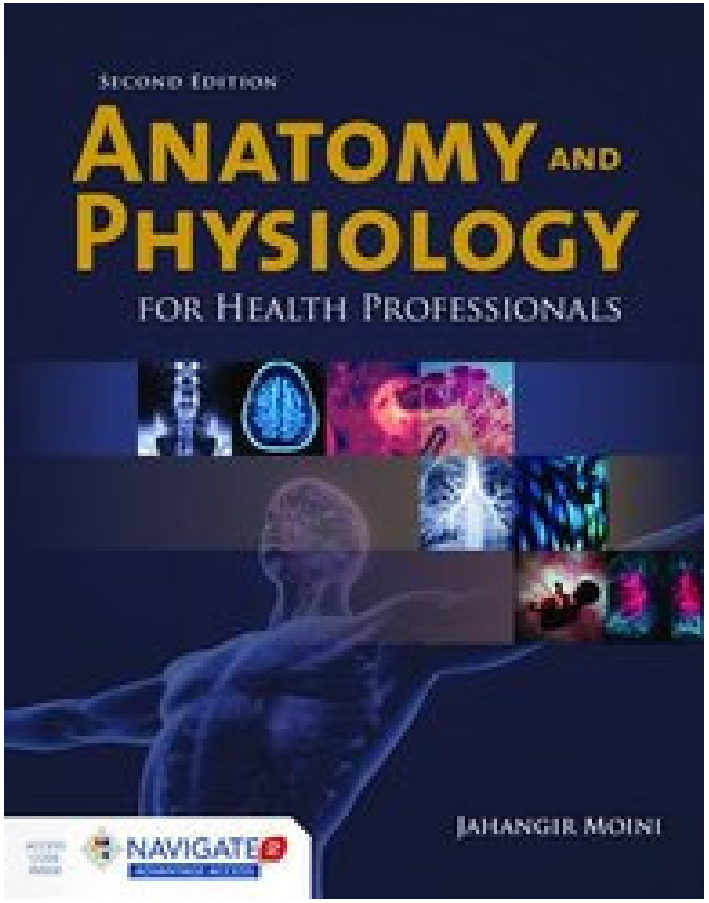
Visit the Microsite for more Previews

http://go.jblearning.com/MoiniAP2



Thank you for joining us today to learn more about ***Anatomy and Physiology for Health Professionals, Second Edition***

We hope you will enjoy using this fabulous resource in your course.



Thank You!

For more information, visit: http://go.jblearning.com/MoiniAP2

- Request a review copy
- Instructor resources

To order, or for more information, **contact your Health Professions Account Specialist** via email: http://go.jblearning.com/findarep or call 1-800-832-0034

Browse our website for additional resources: www.jblearning.com