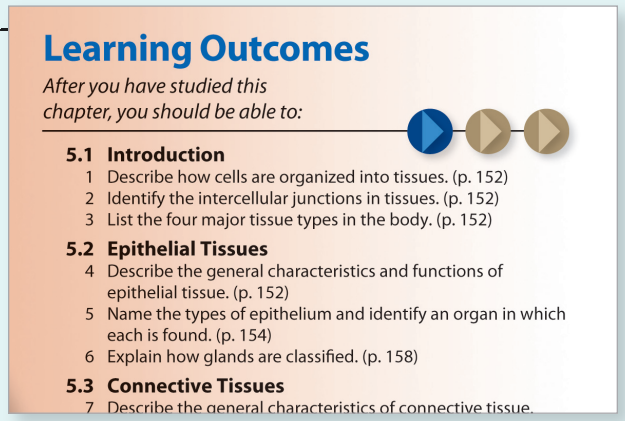
LEARN, PRACTICE, ASSESS

This book is organized with **Learning Outcomes and Assessments.**

LEARN

Learning Outcomes open the chapters, and are closely linked to Chapter Assessments and Integrative Assessments/Critical Thinking questions found at the end of each chapter.

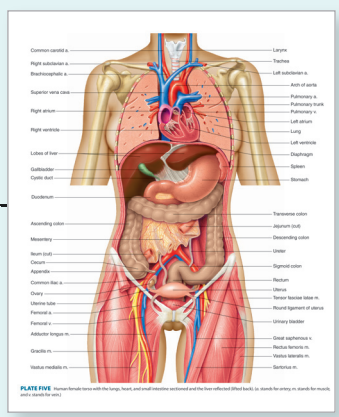


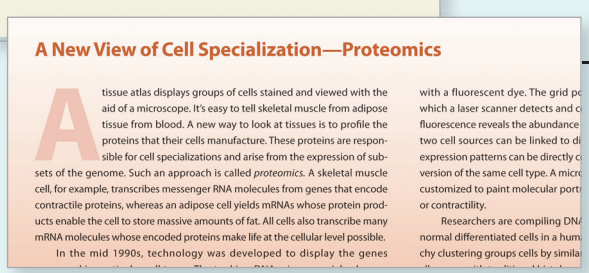
Learning tools to help you succeed...

Check out the **Preview Chapter, Foundations for Success,** on page 1. The Preview Chapter was specifically designed to help students **LEARN** how to study at the collegiate level and efficiently use the tools available to them. It provides helpful study tips.

Understanding Words help you remember scientific word meanings. Examine root words, stems, prefixes, suffixes, and pronunciations to build a solid anatomy and physiology vocabulary.

Reference Plates offer vibrant detail of body structures.





Chapter Opening Vignettes introduce each topic. Taken from headlines and scientific journal reports, they extend the student's view of the chapter content.

LEARN, PRACTICE, ASSESS

PRACTICE

After each major section, a question or series of questions tests the student's understanding of the material. If he or she cannot answer these practice question(s), the student will want to reread that section.

PRACTICE

1 What is a tissue?
2 What are the different types of intercellular junctions?
3 List the four major types of tissue.

Interesting applications help students practice and apply their knowledge...

Cancer cells secrete a substance that dissolves basement membranes, enabling the cells to invade tissue layers. Cancer cells also produce fewer adhesion proteins, or none at all, which allows them to spread into surrounding tissue.

Boxed Information connects chapter ideas to clinical situations, discusses changes in organ structure and function, and introduces new medical technology or experiments.


5.1 FROM SCIENCE TO TECHNOLOGY

Nanotechnology Meets the Blood-Brain Barrier

Nanotechnology is helping drug developers to circumvent a problem in drug delivery based on an anatomical impediment—the close attachments of the cells that form tiny blood vessels in the brain. Like a tight line of police officers keeping out a crowd, the blood-brain barrier is a 400-mile network of capillaries in the brain whose cells are firmly attached by overlapping tight junctions. These cells also lack the scattered vesicles and windowlike clefts in other capillaries. In addition, star-shaped brain cells called astrocytes wrap around the barrier.

The blood-brain barrier shields brain tissue from toxins and biochemical fluctuations that could be overwhelming. It also allows selective drug delivery. Certain antihistamines, for example, do not cause drowsiness because they cannot breach the barrier. But this protection has a trade-off—the brain cannot take up many therapeutic drugs that must penetrate to be effective.

For decades researchers have attempted to deliver drugs across the barrier by tagging compounds to substances that can cross, and injecting substances that temporarily relax the tight junctions. More recently, researchers have applied nanotechnology to the problem of circumventing the blood-brain barrier. Nanotechnology is the application of structures smaller than 100 billionths of a meter (100 nanometers) in at least one dimension.

Nanoparticles that can cross the blood-brain barrier are made of combinations of oils and polymers, with a neutral or slightly negative charge (positively charged particles are toxic). In one application, anesthetics or chemotherapeutics are loaded into fatty bubbles (liposomes) that are in turn placed in nanoparticles. This delivery system masks the part of the drug that cannot cross the barrier and slows release of the drug, which diminishes side effects.

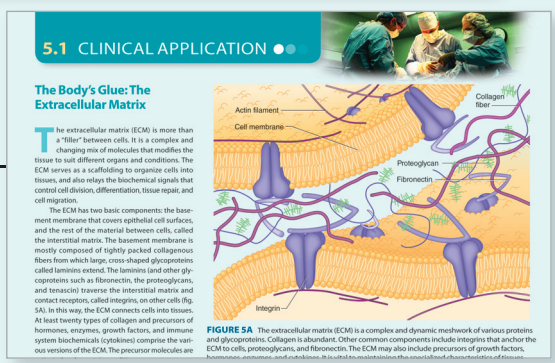
In another application, insulin is delivered in inhaled nanoparticles 10 to 50 nanometers in diameter. Originally developed to provide insulin to people with diabetes instead of injecting it, clinical trials are showing that nanoparticle delivery of insulin is also helpful in maintaining memory in people who have mild cognitive impairment or Alzheimer disease. ■

From Science to Technology previews the technological applications of knowledge in anatomy and physiology that students are likely to encounter in the future and explains how and why the technology was developed.

NEW! A Glimpse Ahead icon prompts the student to look ahead to learn more about the topic.

A GLIMPSE AHEAD | To Chapter 9

Dense irregular connective tissue surrounds individual skeletal muscles *(fascia)*, and separates each muscle into


5.1 CLINICAL APPLICATION

The Body's Glue: The Extracellular Matrix

The extracellular matrix (ECM) is more than a "filler" between cells. It is a complex and changing mix of molecules that modifies the tissue to suit different organs and conditions. The ECM serves as a scaffolding to organize cells into tissues, and also relays the biochemical signals that control cell division, differentiation, tissue repair, and cell migration.

The ECM has two basic components: the basement membrane that covers epithelial cell surfaces, and the rest of the material between cells, called the interstitial matrix. The basement membrane is mostly composed of tightly packed collagenous fibers from which large, cross-shaped glycoproteins called laminins extend. The laminins (and other glycoproteins such as fibronectin, the proteoglycans, and tenascin) traverse the interstitial matrix and contact receptors, called integrins, on other cells (fig. 5A). In this way, the ECM connects cells into tissues. At least twenty types of collagen and precursors of hormones, enzymes, growth factors, and immune system biochemicals (cytokines) comprise the various versions of the ECM. The precursor molecules are

FIGURE 5A The extracellular matrix (ECM) is a complex and dynamic meshwork of various proteins and glycoproteins. Collagen is abundant. Other common components include integrins that anchor the ECM to cells, proteoglycans, and fibronectin. The ECM may also include precursors of growth factors, hormones, enzymes, and cytokines. It is vital to maintaining the specialized characteristics of tissues.

Reconnect Icon prompts the student to review key concepts found in previous chapters that will assist in their understanding of new information.

RECONNECT

To Chapter 3, Movements Into and Out of the Cell, page 106.

Clinical Applications encourage students to explore information on related pathology, historical insights, and clinical examples that they are likely to encounter in their careers.

AP|R **NEW! Anatomy and Physiology Revealed icons** found in figure legends. These icons indicate that there is a direct link to APR available in the eBook provided with ConnectPLUS for this title!

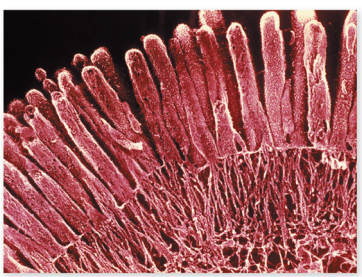
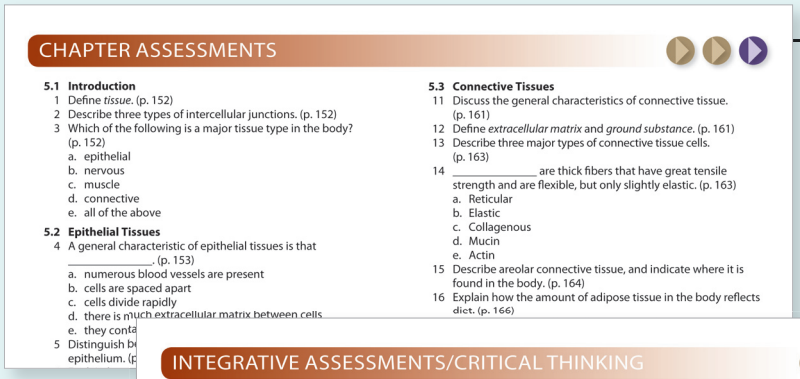


FIGURE 5.5 AP|R A scanning electron micrograph of microvilli, which fringe the free surfaces of some columnar epithelial cells (33,000×).

ASSESS

Tools to help students make the connection and master anatomy & physiology!



CHAPTER ASSESSMENTS

5.1 Introduction

1 Define *tissue*. (p. 152)
2 Describe three types of intercellular junctions. (p. 152)
3 Which of the following is a major tissue type in the body? (p. 152)
a. epithelial
b. nervous
c. muscle
d. connective
e. all of the above

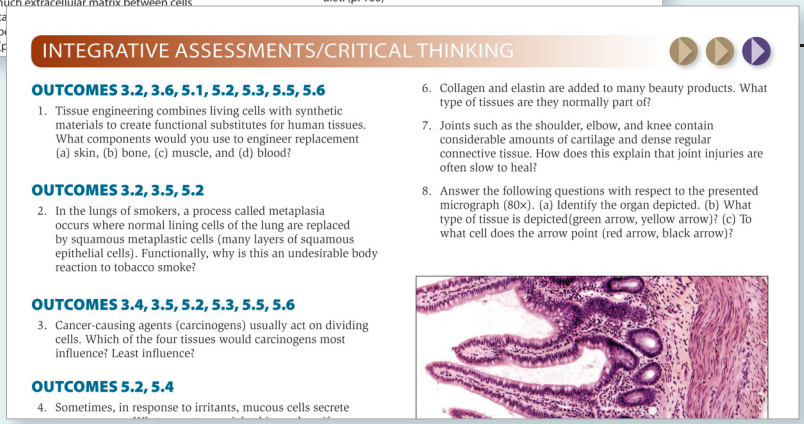
5.2 Epithelial Tissues

4 A general characteristic of epithelial tissues is that _____. (p. 153)
a. numerous blood vessels are present
b. cells are spaced apart
c. cells divide rapidly
d. there is much extracellular matrix between cells
e. they conta
5 Distinguish b
epithelium. (p

5.3 Connective Tissues

11 Discuss the general characteristics of connective tissue. (p. 161)
12 Define *extracellular matrix* and *ground substance*. (p. 161)
13 Describe three major types of connective tissue cells. (p. 163)
14 _____ are thick fibers that have great tensile strength and are flexible, but only slightly elastic. (p. 163)
a. Reticular
b. Elastic
c. Collagenous
d. Mucin
e. Actin
15 Describe areolar connective tissue, and indicate where it is found in the body. (p. 164)
16 Explain how the amount of adipose tissue in the body reflects diet. (p. 166)

Chapter Assessments found at the end of each chapter check student's understanding of the chapter's Learning Outcomes. The Chapter Assessment numbers correspond directly to the Learning Outcomes.



INTEGRATIVE ASSESSMENTS/CRITICAL THINKING

OUTCOMES 3.2, 3.6, 5.1, 5.2, 5.3, 5.5, 5.6

1. Tissue engineering combines living cells with synthetic materials to create functional substitutes for human tissues. What components would you use to engineer replacement (a) skin, (b) bone, (c) muscle, and (d) blood?

OUTCOMES 3.2, 3.5, 5.2

2. In the lungs of smokers, a process called metaplasia occurs where normal lining cells of the lung are replaced by squamous metaplastic cells (many layers of squamous epithelial cells). Functionally, why is this an undesirable body reaction to tobacco smoke?

OUTCOMES 3.4, 3.5, 5.2, 5.3, 5.5, 5.6

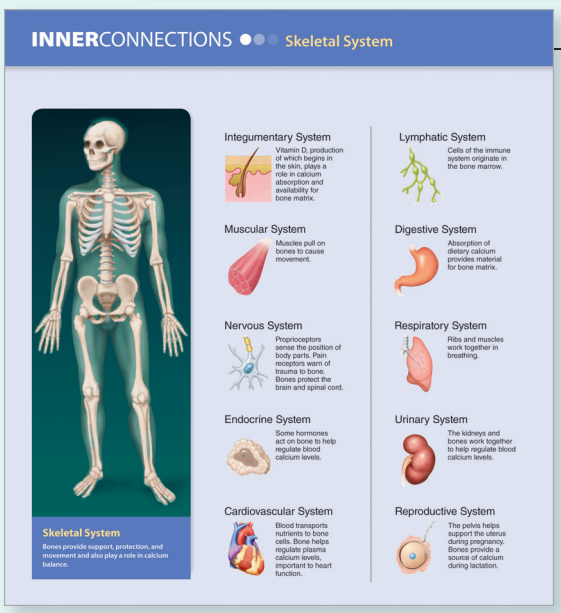
3. Cancer-causing agents (carcinogens) usually act on dividing cells. Which of the four tissues would carcinogens most influence? Least influence?

OUTCOMES 5.2, 5.4

4. Sometimes, in response to irritants, mucous cells secrete

6. Collagen and elastin are added to many beauty products. What type of tissues are they normally part of?
7. Joints such as the shoulder, elbow, and knee contain considerable amounts of cartilage and dense regular connective tissue. How does this explain that joint injuries are often slow to heal?
8. Answer the following questions with respect to the presented micrograph (80×). (a) Identify the organ depicted. (b) What type of tissue is depicted(green arrow, yellow arrow)? (c) To what cell does the arrow point (red arrow, black arrow)?

Integrative Assessments/Critical Thinking questions relate information from various Learning Outcomes within a chapter (and frequently from previous chapters) and apply that information.



INNERCONNECTIONS Skeletal System

Skeletal System
Bones provide support, protection, and movement and also play a role in calcium balance.

Integumentary System
Vitamin D, production of which begins in the skin, plays a role in calcium absorption and availability for bone matrix.

Lymphatic System
Cells of the immune system originate in the bone marrow.

Muscular System
Muscles pull on bones to cause movement.

Digestive System
Absorption of dietary calcium provides material for bone matrix.

Nervous System
Proprioceptors sense the position of body parts. Pain receptors warn of trauma to bone. Bones protect the brain and spinal cord.

Respiratory System
Ribs and muscles work together in breathing.

Endocrine System
Some hormones act on bone to help regulate blood calcium levels.

Urinary System
The kidneys and bones work together to help regulate blood calcium levels.

Cardiovascular System
Blood transports nutrients to bone cells. Bone helps regulate plasma calcium levels, important to heart function.

Reproductive System
The pelvis helps support the uterus during pregnancy. Bones provide a source of calcium during lactation.

InnerConnections conceptually link the highlighted body system to every other system. These graphic representations review chapter concepts, make connections, and stress the "big picture" in learning and applying the concepts and facts of anatomy and physiology.

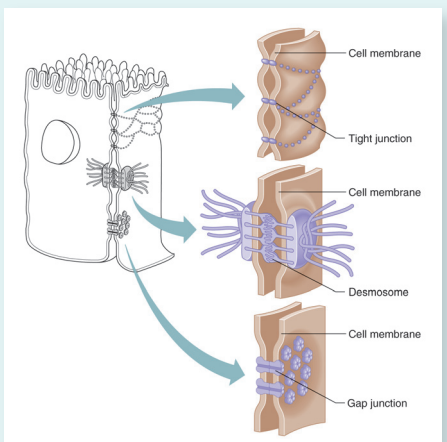


FIGURE 5.1 Intercellular junctions. Tight junctions fuse cell membranes, desmosomes are "spot welds," and gap junctions form channels linking the cytoplasm of adjacent cells.

Q: *Which intercellular junction is the most likely to allow substances to move from one cell to another?*

Answer can be found in Appendix G on page 938.

Q: NEW! Figure Questions allow an additional assessment. These are found on key figures throughout the chapter.