General Biology-total 14/16 classes

- Body organization—1 class
- Material Exchange-respiration-1 class
- Heart-2 classes
- Nutrition-1 class
- Kidney-1class
- Nervous system-2 classes
- Body’s defence-2 classes
- Hormone-2 classes
- Reproduction and development-3 classes

Figure 21.1-s3

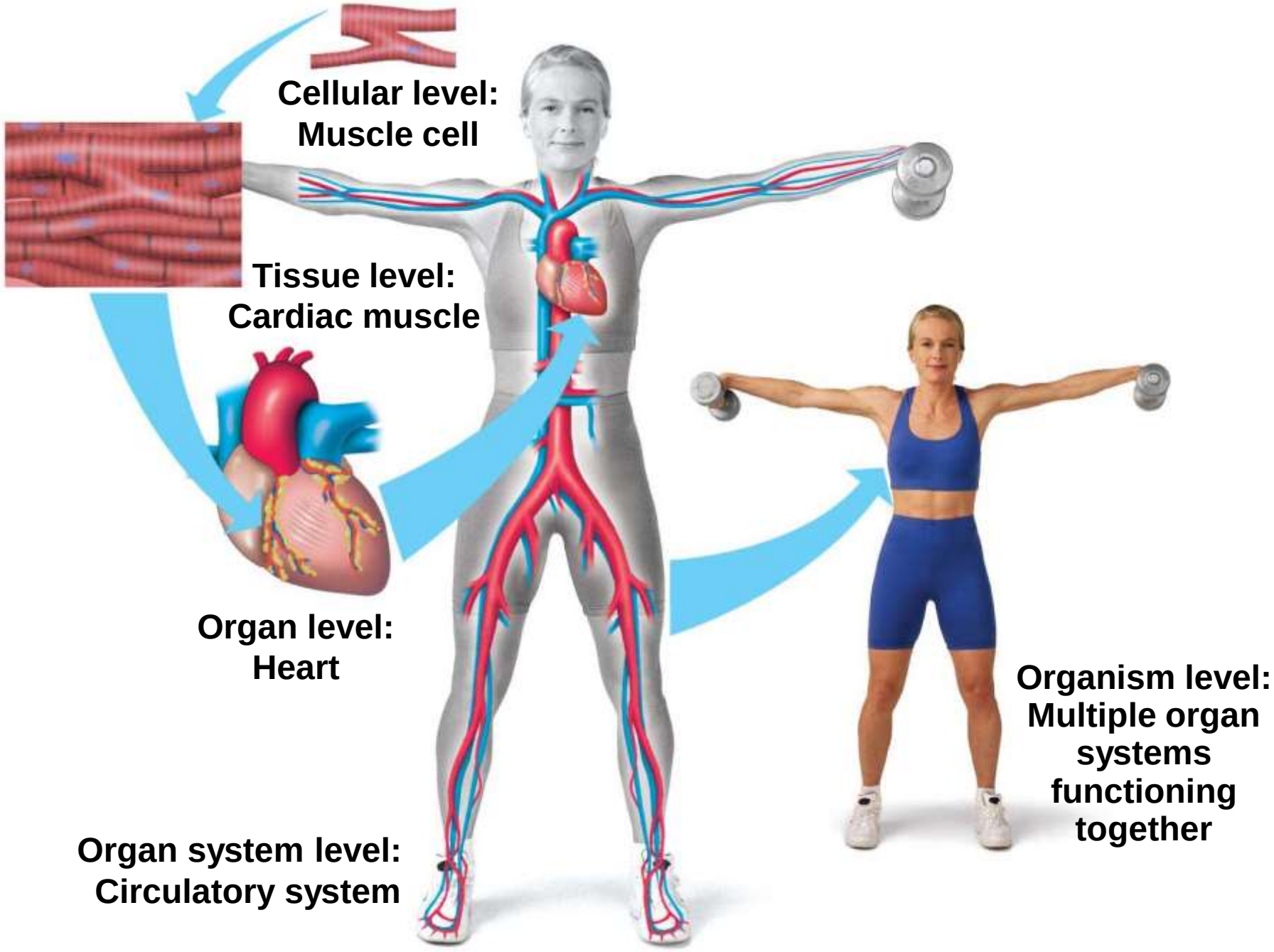
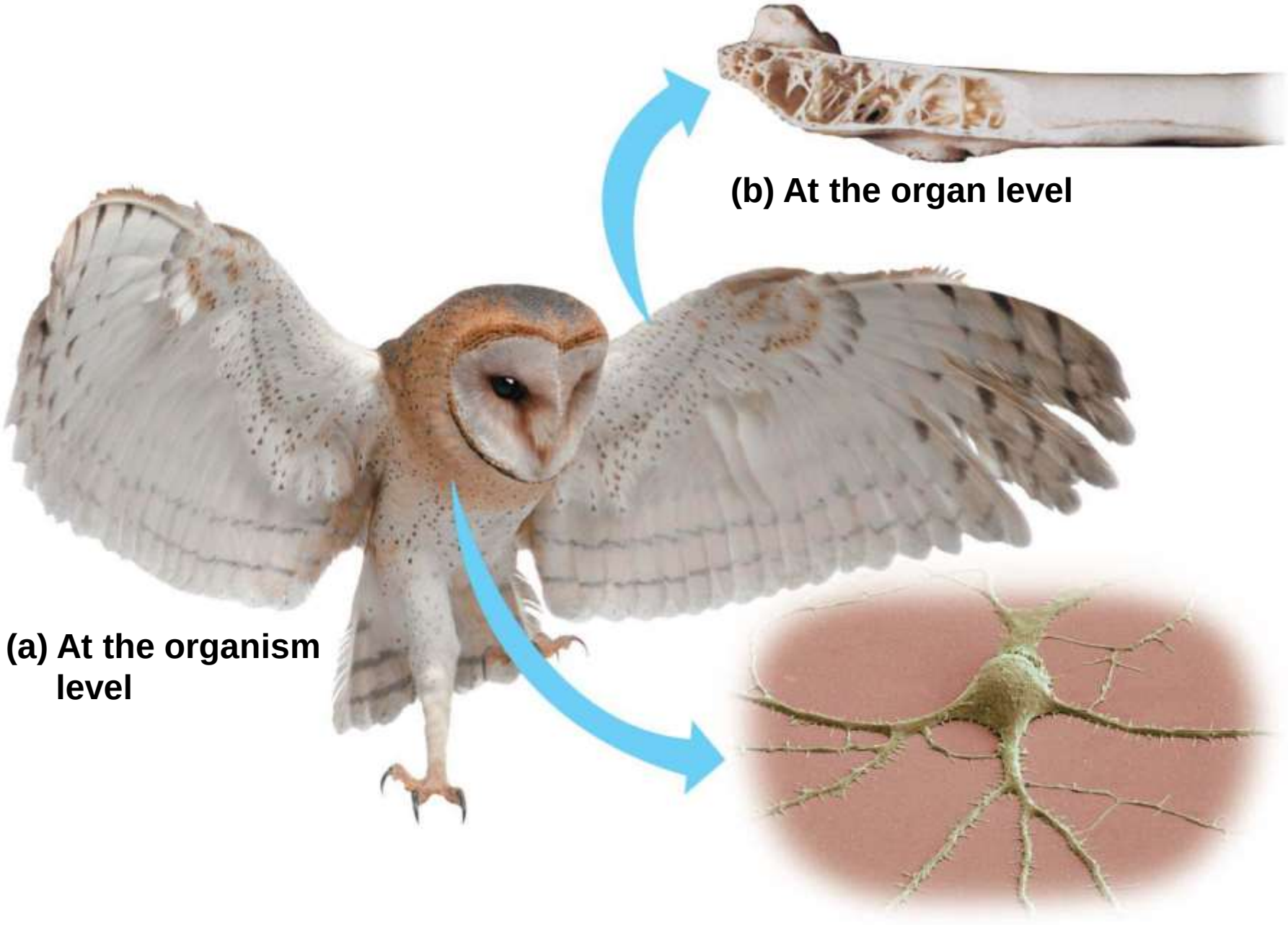


Figure 21.2-s3



Structure/Function: Anatomy and Physiology

- Biologists distinguish anatomy from physiology.
  - **Anatomy** is the study of the structure of an organism's parts.
  - **Physiology** is the study of the function of those parts.
- The correlation of structure and function is a fundamental principle of biology that is evident at all levels of life's hierarchy.

Tissues

- The cell is the basic unit of all living organisms.
- In almost all animals, including humans, cells are grouped into tissues.
  - A **tissue** is an integrated group of similar cells that performs a specific function.
  - Animals have four main categories of tissue:
    1. epithelial tissue,
    2. connective tissue,
    3. muscle tissue, and
    4. nervous tissue.

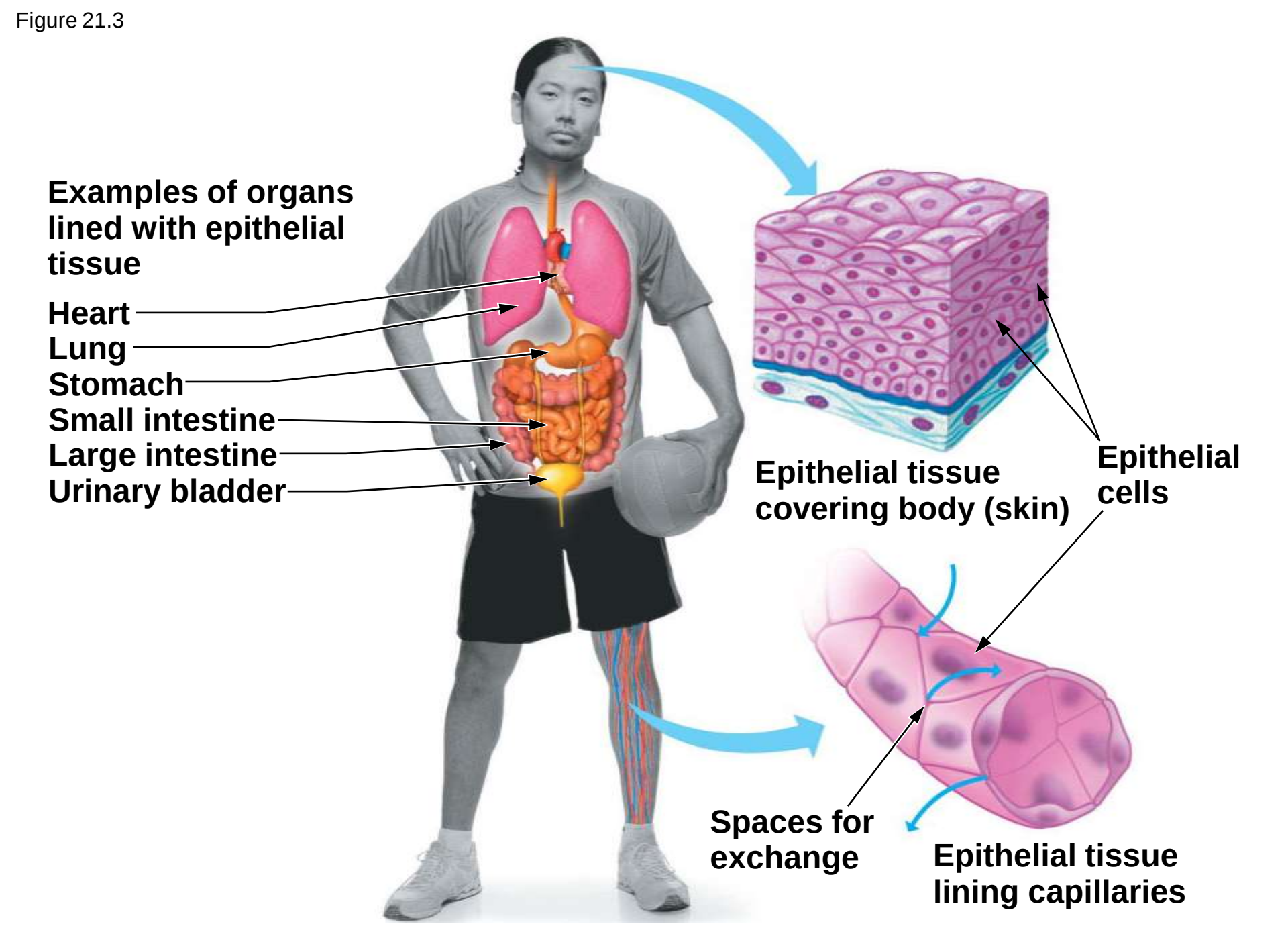
Epithelial Tissue

- **Epithelial tissue**, also known as **epithelium**,
  - covers the surface of the body and
  - lines organs.
- The architecture of an epithelium illustrates how structure fits function at the tissue level.
  - Your skin contains many layers of tightly bound epithelial cells, forming a protective, waterproof barrier that surrounds your body and keeps it safe from external threats.
  - In contrast, a single thin and leaky layer of epithelial tissue lines capillaries, where it is well suited for the role it plays of exchanging substances with the circulatory system.

Epithelial Tissue

- The body continuously renews the cells of many epithelial tissues.
- Such turnover requires cells to divide rapidly, which increases the risk of an error in cell division, a mistake that can lead to cancer.
- Carcinoma is a type of cancer that develops from epithelial cells.
- Carcinomas occur when the DNA of a cell is damaged or altered and the cell begins to grow uncontrollably and become malignant.

Figure 21.3



Connective Tissue

- **Connective tissue** contains cells scattered throughout a material called the **extracellular matrix**.
- The structure of the matrix varies and matches the function of each tissue.
- Two major functions of the connective tissue are to support and join other tissues.

Connective Tissue

- Figure illustrates six of the major types of connective tissue.
- Loose connective tissue
  - is the most widespread connective tissue in the body of vertebrates and
  - binds epithelia to underlying tissues.

Connective Tissue: extracellular matrix

- Extracellular network of macromolecules
- Components secreted locally; organized by cells associated with the matrix

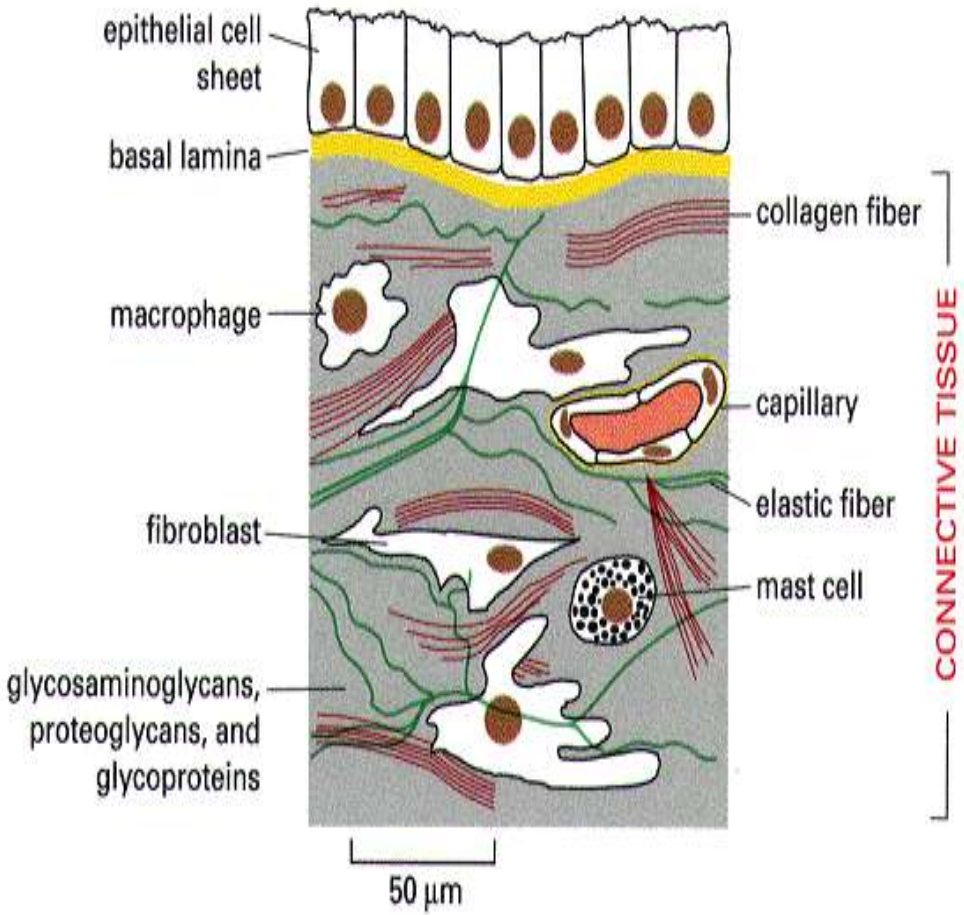
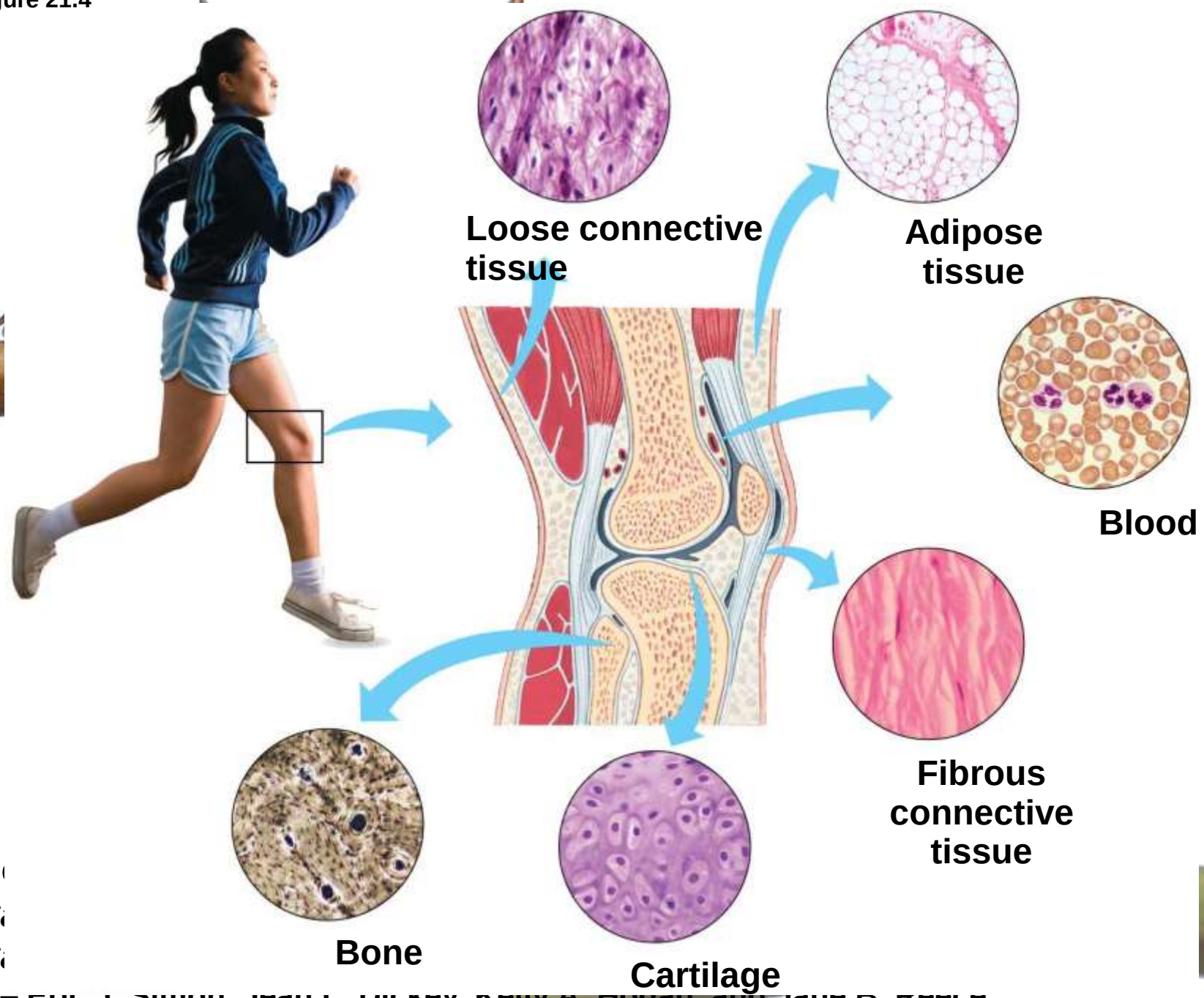


Figure 21.4

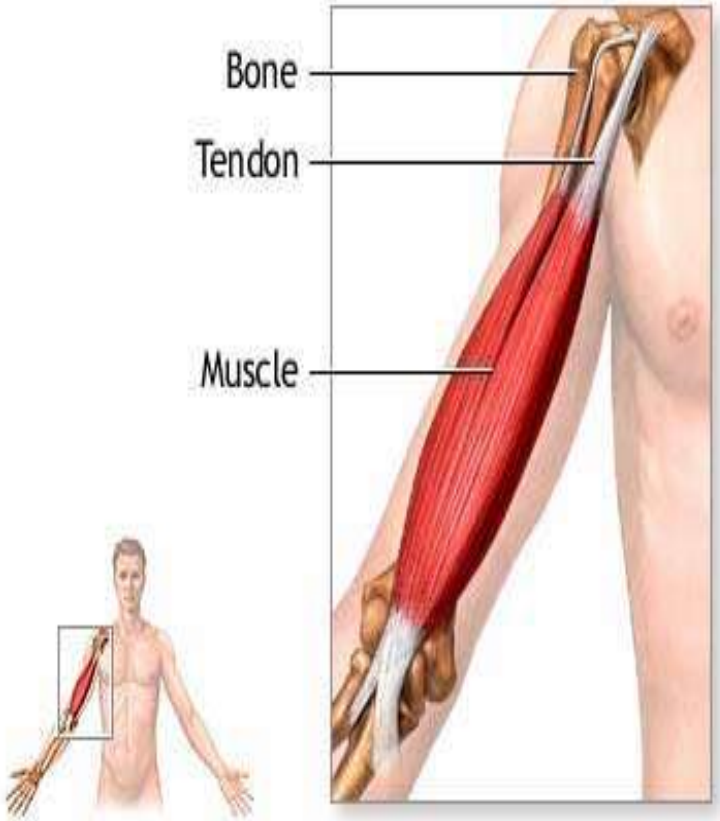


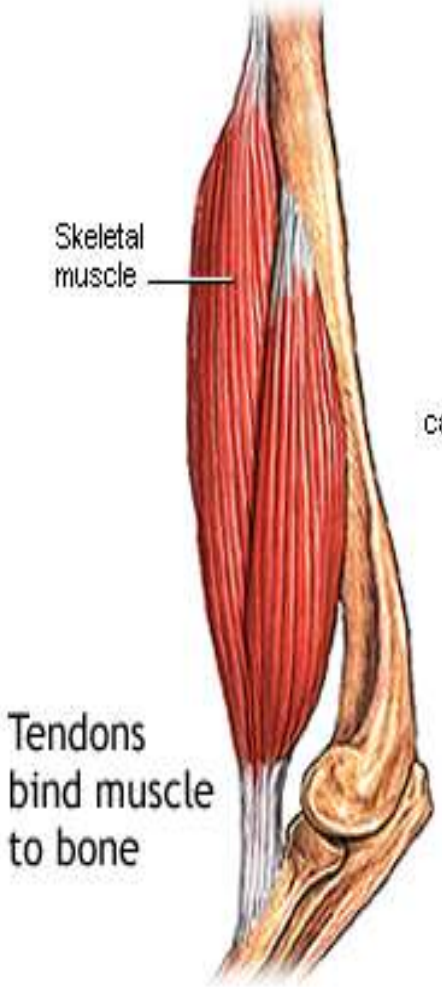
– Eric J. Simon, Jean L. Dickey, Kelly A. Hogan, and Jane B. Reece

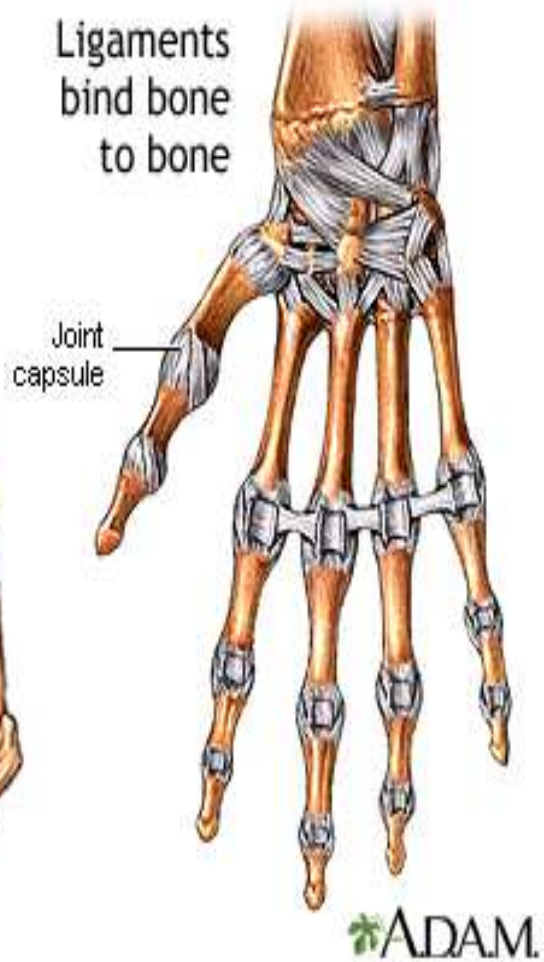
Connective Tissue

2. **Fibrous connective tissue** has a dense matrix of collagen. It forms
   - **tendons**, which attach muscles to bones
   - Tendons are tough band of fibrous connective tissue that connects muscle to bone and is able to withstand tension.
   - Tendons and muscles work together.

- **ligaments**, which strongly join bones together at joints.
- Ligaments are similar to tendons, but they connect bone to bone and help to stabilize joints.



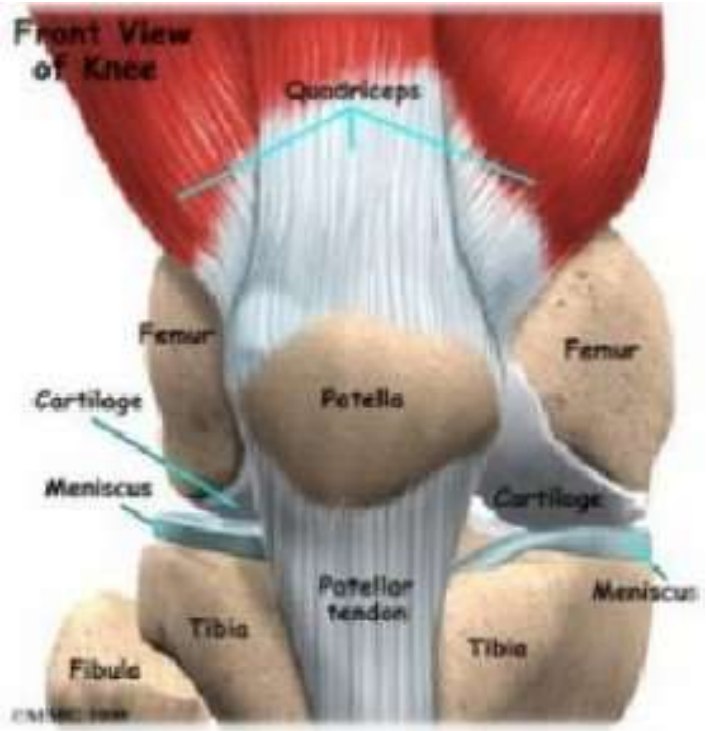




Connective Tissue

3. Cartilage

- is strong but flexible,
- has no blood vessels, so it heals very slowly, and
- functions as a flexible, boneless skeleton.
- structure of cartilage tissue



Connective Tissue

4. Bone

- is a rigid connective tissue with a matrix of collagen fibers hardened with deposits of calcium salts.
- This combination makes bone hard without being brittle.

Connective Tissue

6. Blood

- consists of cells suspended in a liquid matrix called plasma
- transports substances in the plasma from one part of the body to another,
- plays major roles in immunity, and
- seals broken blood vessels.

The Nature of Blood

- Consists of
  - Several types of cells
    - Called the formed elements
  - Plasma
    - Contains different kinds of dissolved molecules

Formed Elements

- Red blood cells
  - Lack a nucleus
  - Contain hemoglobin
  - Transport oxygen and carbon dioxide
  - Carbonic anhydrase converts carbon dioxide to bicarbonate that can be dissolved in the blood.
  - Anemia is a lack of oxygen resulting from a lack of red blood cells.

Formed Elements

- White blood cells
  - Also called leukocytes
  - Lack hemoglobin
  - Have a nucleus
  - Include basophils, eosinophils, neutrophils, lymphocytes, and monocytes
  - Defend the body against microorganisms, damaging chemicals, and cancer

Formed Elements

- Platelets
  - Not whole cells
  - Fragments of white blood cells
  - Important in blood clotting
    - Collect at the site of a wound
    - Release clotting factors
      - Initiate a sequence of reactions that trap blood cells to form a clot
      - Eventually the clots (scabs) are replaced by healthy, living tissue.

Plasma

- Liquid part of the blood
- Contains
  - Salts that serve to
    - Buffer and maintain blood pH
    - Maintain osmotic balance
      - Keeps the tissue fluid between cells at the right solute concentration so that it flows into the capillaries, maintaining blood pressure

Plasma

- Proteins
  - Antibodies and other immune proteins
  - Albumin to maintain osmotic balance
    - Transports bilirubin from degraded RBCs to the liver
    - Accumulated bilirubin can cause jaundice
- Nutrients
  - Amino acids
  - Sugars
  - Lipoproteins carry fats and cholesterol
- Hormones

Composition of Blood

TABLE 24.1

Components of Blood

Formed Elements	Function and Description	Source
Red blood cells (erythrocytes)  4 million–6 million per mm^3 blood	Transport O_2 and help transport CO_2 7–8 μm in diameter Bright red to dark purple, biconcave disks without nuclei	Red bone marrow
White blood cells (leukocytes) 4,000–11,000 per mm^3 blood	Fight infection	Red bone marrow
Granular leukocytes		
• Basophil  20–50 per mm^3 blood	10–12 μm in diameter Spherical cells with lobed nuclei; large, irregularly shaped, deep blue granules in cytoplasm	
• Eosinophil  100–400 per mm^3 blood	10–14 μm in diameter Spherical cells with bilobed nuclei; coarse, deep red, uniformly sized granules in cytoplasm	
• Neutrophil  3,000–7,000 per mm^3 blood	10–14 μm in diameter Spherical cells with multilobed nuclei; fine, pink granules in cytoplasm	
Agranular leukocytes		
• Lymphocyte  1,500–3,000 per mm^3 blood	5–17 μm in diameter (average 9–10 μm) Spherical cells with large, round nuclei	
• Monocyte  100–700 per mm^3 blood	10–24 μm in diameter Large, spherical cells with kidney-shaped, round, or lobed nuclei	
Platelets (thrombocytes)  150,000–300,000 per mm^3 blood	Aid clotting 2–4 μm in diameter Disk-shaped cell fragments with no nuclei; purple granules in cytoplasm	Red bone marrow

Plasma	Function	Source
Water (90–92% of plasma)	Maintains blood volume; transports molecules	Absorbed from intestine
Plasma proteins (7–8% of plasma)	Maintain blood osmotic pressure and pH	Liver
Albumin	Maintains blood volume and pressure	
Globulins	Transport; fight infection	
Fibrinogen	Clotting	
Salts (less than 1% of plasma)	Maintain blood osmotic pressure and pH; aid metabolism	Absorbed from intestine
Gases		
Oxygen	Cellular respiration	Lungs
Carbon dioxide	End product of metabolism	Tissues
Nutrients	Food for cells	Absorbed from intestine
Fats		
Glucose		
Amino acids		
Nitrogenous waste	Excretion by kidneys	Liver
Urea		
Uric acid		
Other		
Hormones, vitamins, etc.	Aid metabolism	Varied

Functions of Blood

- Transports molecules, cells
  - Oxygen, carbon dioxide
  - Nutrients
  - Waste products
  - Immune cells and antibodies
  - Hormones
- Regulates temperature
  - If body temperature is too high, blood will be shunted to the body surface to radiate heat.
  - If body temperature is too low, blood will be shunted to the body core to conserve heat.