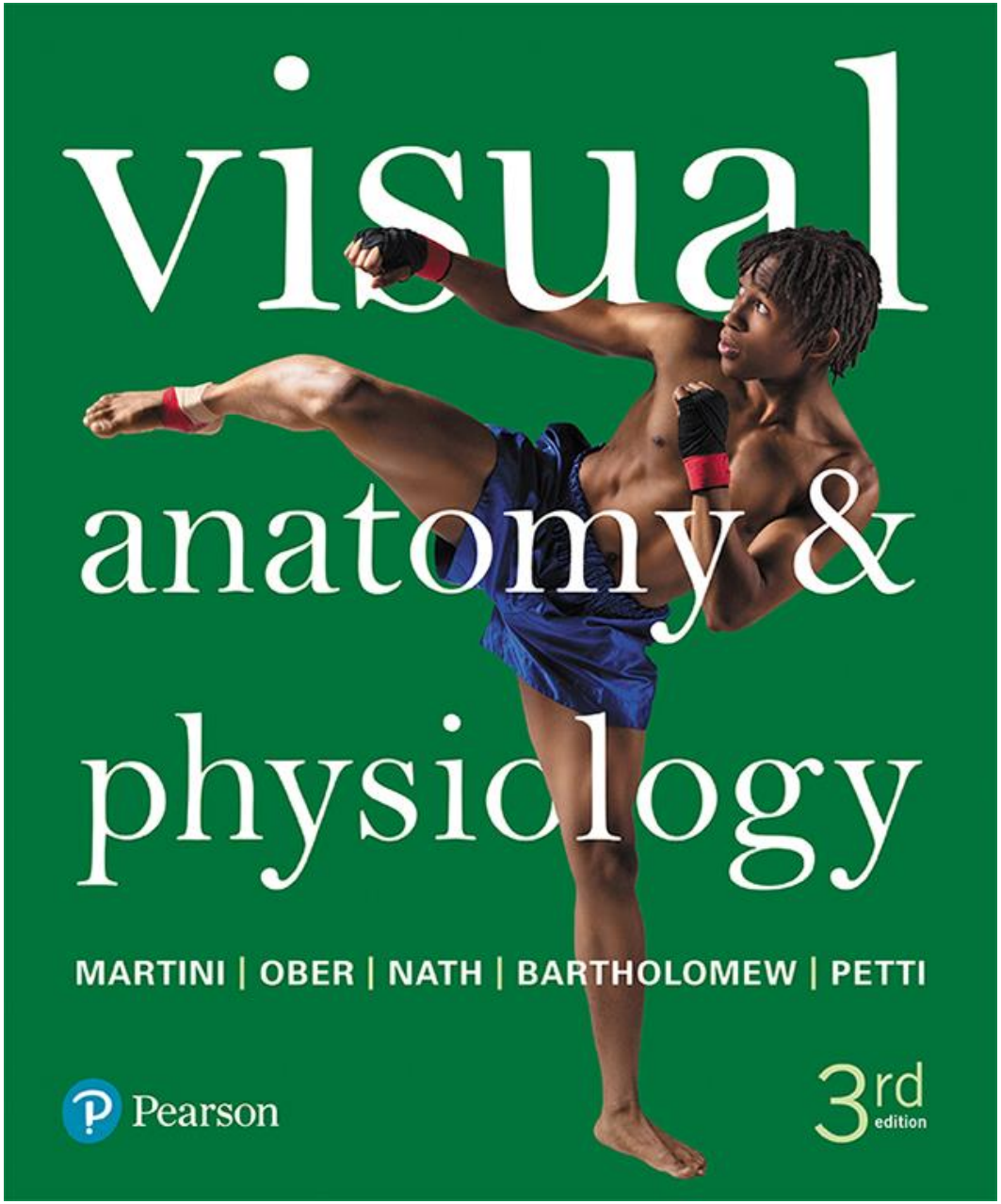


1

An Introduction to Anatomy & Physiology

Lecture Presentation by
Lori Garrett

Section 1: An Introduction to Studying the Human Body

- **Learning Outcomes**

1.1 Briefly describe the difference between anatomy and physiology.

1.2 Describe how to use the text and art together to master learning.

1.3 Explain how to approach complex concepts with multiple parts.

1.4 Describe the anatomical position and how you should view sectional images.

1.5 Explain the significance of learning outcomes in acquiring knowledge and skills.

Module 1.1: Using your textbook effectively is key to your success

- **Anatomy**—structure
- **Physiology**—function
  - Structure determines function
- **Biology**—the study of life
- Illustrations are especially important

Module 1.1: Review

A. What is human A&P?
B. Define the term *biology.*

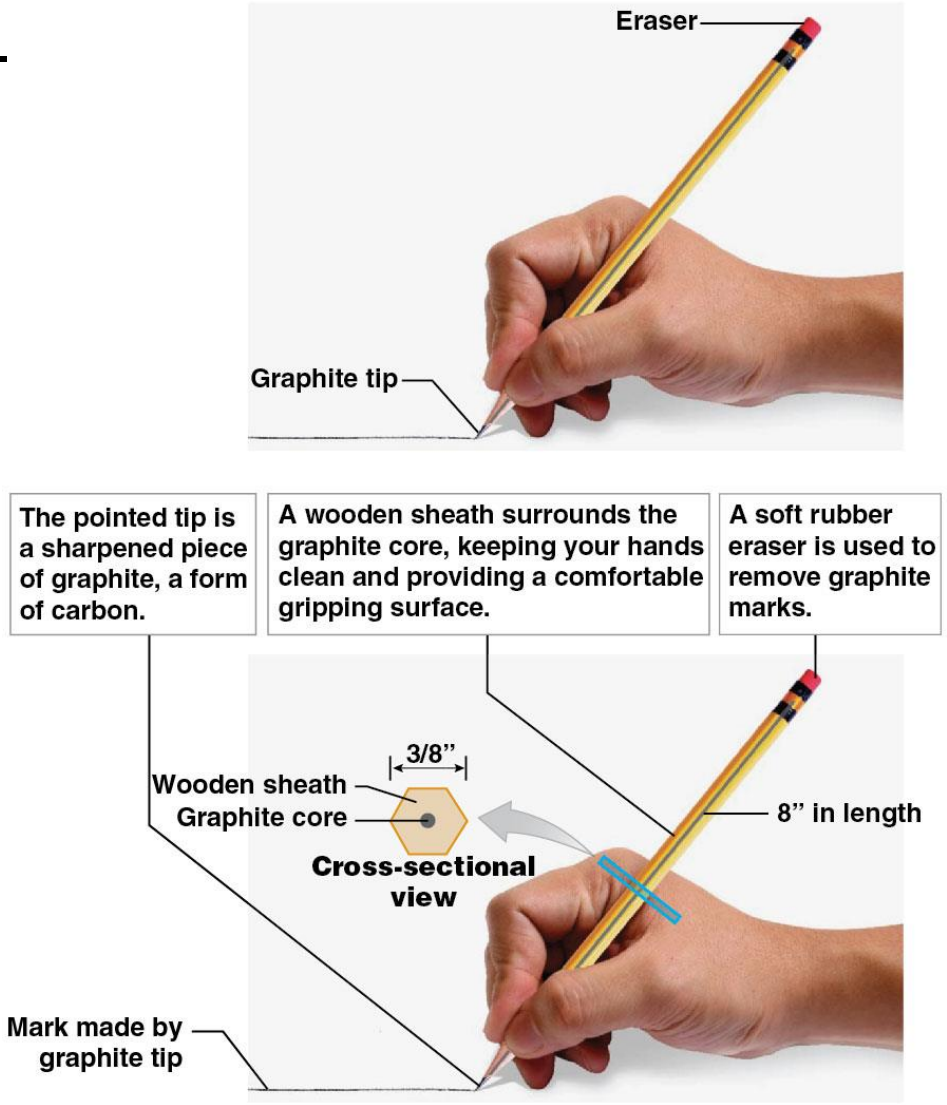
Learning Outcome: Briefly describe the difference between anatomy and physiology.

Module 1.2: Comprehending the art is essential to understanding A&P

- Integrate information in art and words for success
- Research with eye tracking equipment shows that *learning and comprehension levels are greater for students who studied art and text together*
- Art and text go hand in hand

Module 1.2: Comprehending the art is essential

- **Text-art integration**—no page flipping or hunting for illustration associated with text
  - Text and art are combined, with key text in the art itself



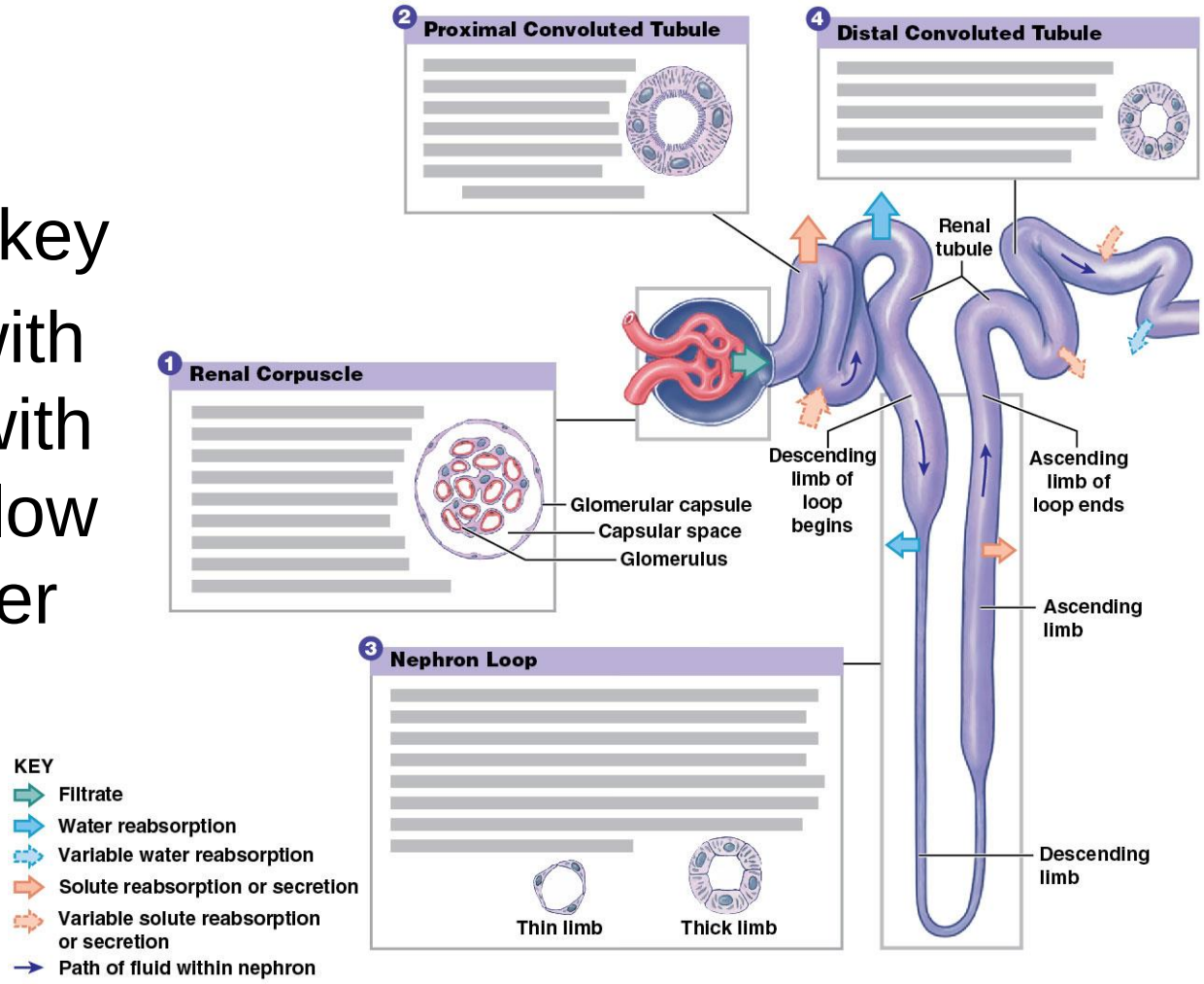
Module 1.2: Review

A. What do eye-tracking studies tell us about the most effective way to learn?
B. Try this experiment. Pick one of the two examples, cover up the text, and focus solely on the art. What did you discover?

Learning Outcome: Describe how to use the text and art together to master learning.

Module 1.3 Break down the art in step-wise fashion to learn the topic

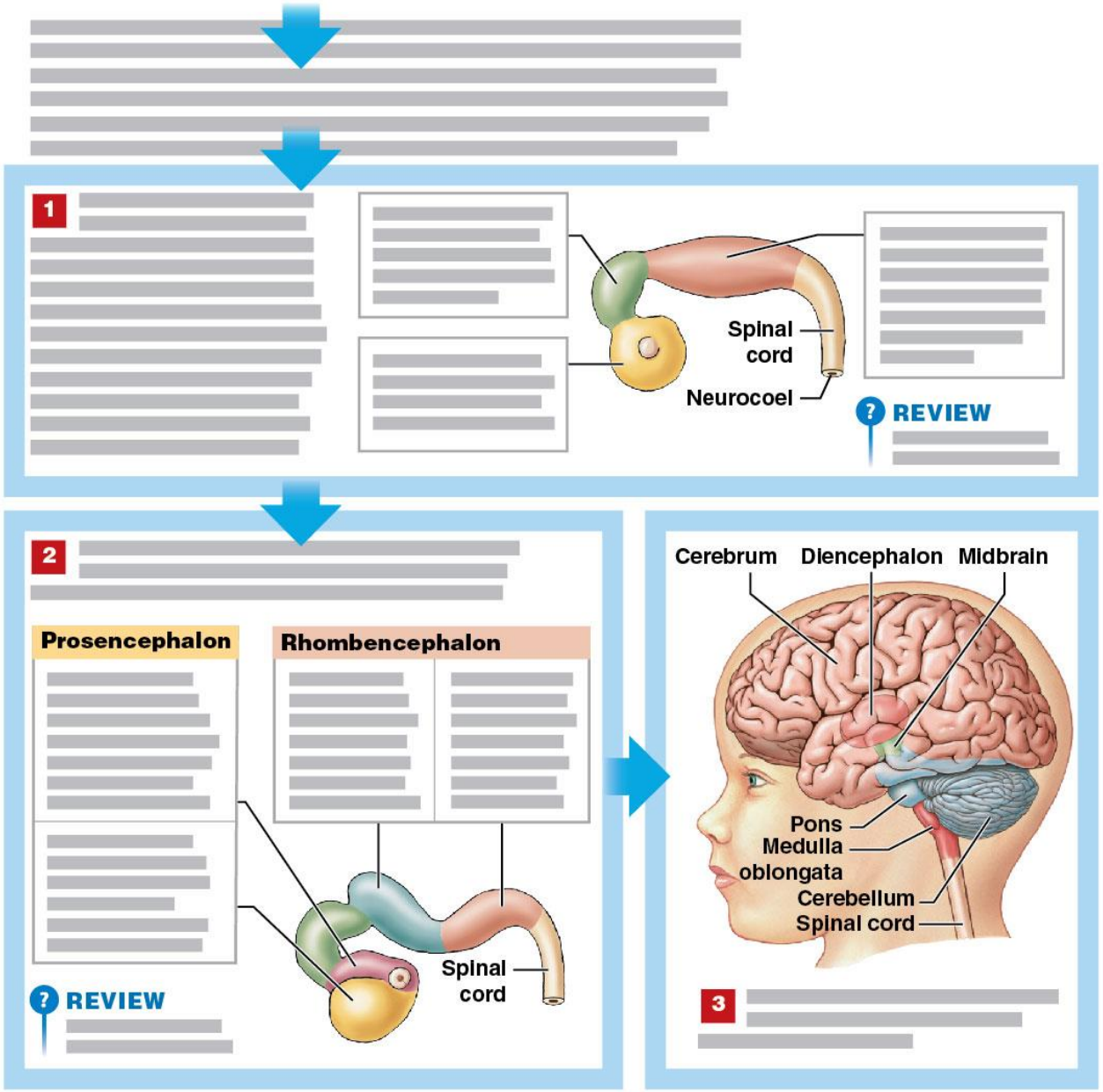
- Tasks become easier when broken down
- Start with the key
- With figures with steps, begin with step 1 and follow numerical order



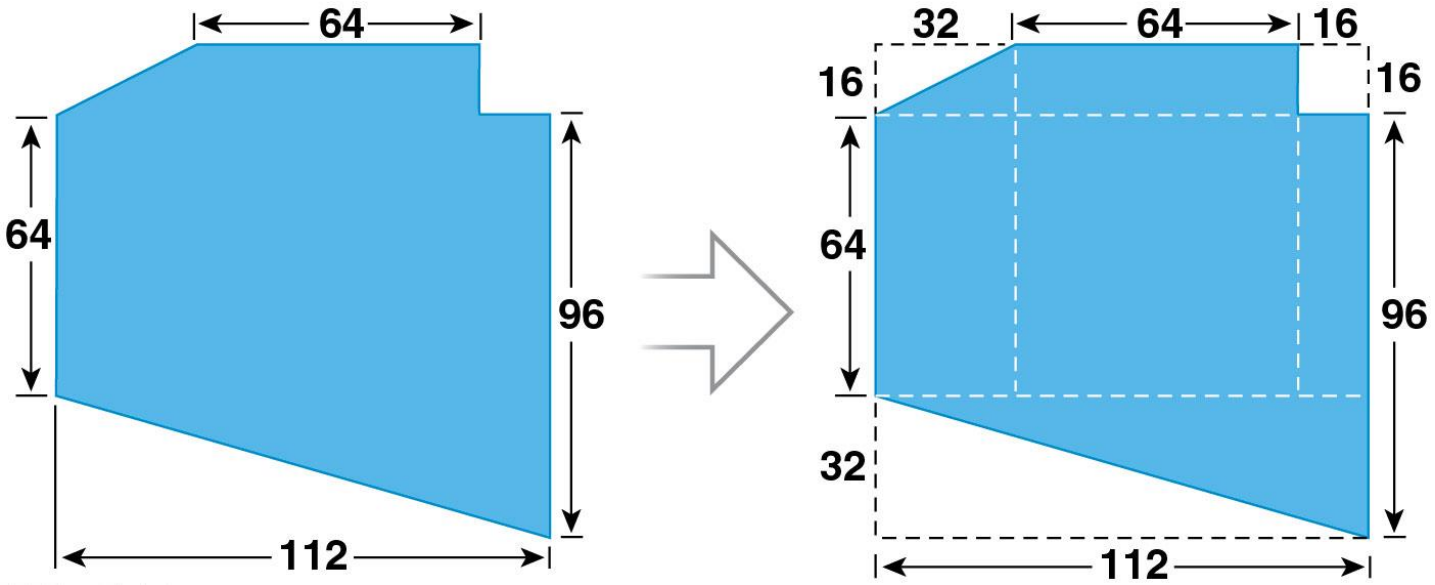
Module 1.3: Break down the art

- Read left-to-right, column-by-column
- Every new one- or two-page module starts with a title
- Look for numbered red blocks
  - Read the text and study the image
  - Answer review questions
  - Move on to next numbered red block
- At completion of the module, answer the integration questions

Break down the art



Module 1.3: Review



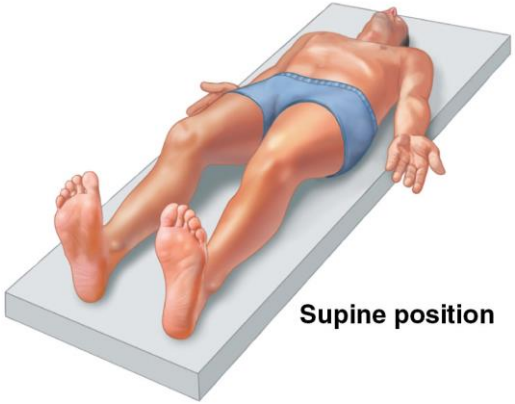
A. Calculate the area in blue. All numbers are in centimeters (cm).

Learning Outcome: Explain how to approach complex concepts with multiple parts.

Module 1.4 Orient yourself to all art in the same way

- Anatomical position
  - Standing erect, face forward (anteriorly), arms at side, palms anterior facing
  - Lying face up in supine position
- Find point of reference and put yourself in position of images

Anatomical position

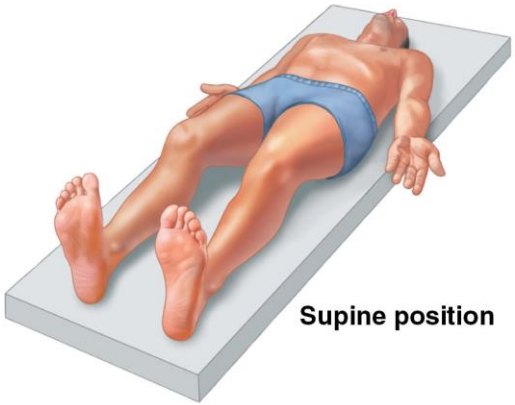


Supine position

Module 1.4 Orient yourself to all art in the same way

- In this text, all body cross sections are from same perspective
  - To read, orient as if standing at feet of person who is in supine position, looking up toward the head

Anatomical position



Supine position

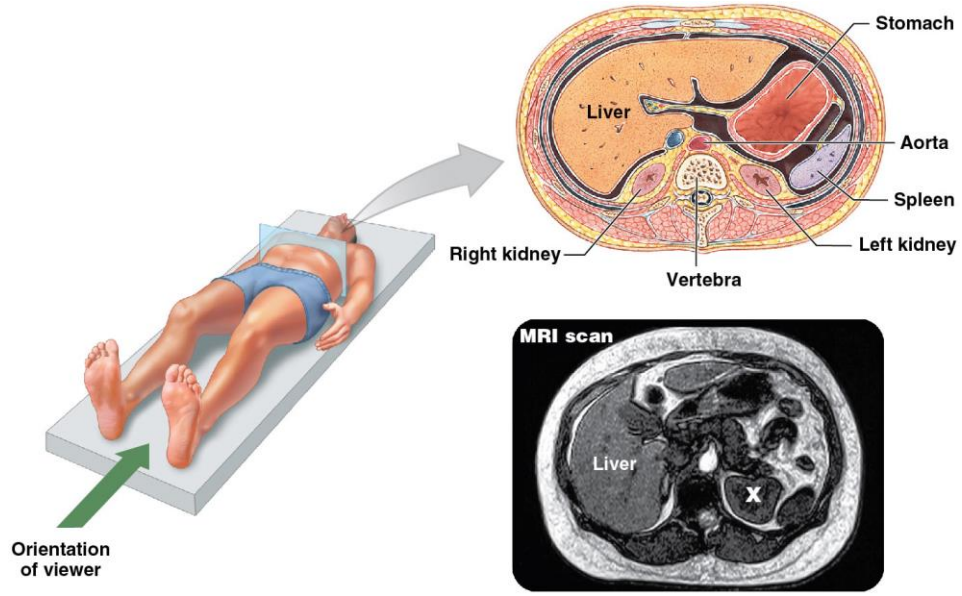
Module 1.4: Review

A. Look at the woman standing. On which wrist is her bracelet found?

Anatomical position

Module 1.4: Review

B. What is the structure marked with an X in the MRI scan?



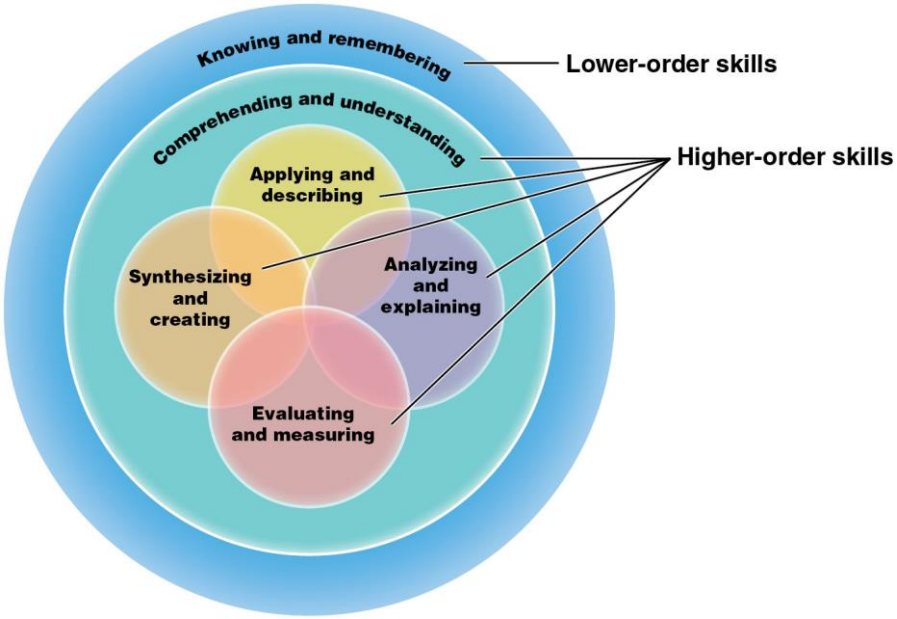
Learning Outcome: Describe the anatomical position and how you should view sectional images.

Module 1.5: Learning Outcomes correspond to modules and what you should be able to do after completing chapter

- **Module**—independent, self-contained unit about a specific topic
- **Section**—set of modules placed in a series that are interdependent
- **Learning Outcomes**—educational objectives that use key verbs to target knowledge, comprehension, and specific skills

Module 1.5: Learning Outcomes correspond to modules

- **Learning classification scheme**—identifies fundamental levels of learning, from lower-order thinking to higher-order skills
- Read the text, study the image, and pay attention to Learning Outcomes for success



Module 1.5: Review

A. Define *module*, and state where the Learning Outcomes appear.
B. Describe *learning classification scheme*.

Learning Outcome: Explain the significance of learning outcomes in acquiring knowledge and skills.

Section 2: A&P in Perspective

Learning Outcomes

1.6 Describe homeostasis, and identify basic study skill strategies to use in this course.

1.7 Describe the common characteristics of life and the basic processes in humans and other animals.

1.8 Define anatomy and physiology, and describe macroscopic and microscopic anatomy.

1.9 Explain the relationship between structure and function.

Module 1.6: Focused study is important for learning anatomy and physiology

- Basic approach in studying A&P: **"What is the structure, and how does it work?"**
- "Black Box"
  - When you know *what* something does but not *how*
- One of the most important concepts to learn:
  - **Homeostasis**
    - A relatively stable internal environment

Tips on How to Succeed in Your A&P Course

- **Approach the information in different ways.**
- **Set up a study schedule** and stick to it.
- **Devote a block of time each day** to your A&P course.
- **Practice memorization.**
- **Avoid shortcuts.**
- **Attend all lectures, labs, and study sessions.**
- **Read your lecture and lab assignments** before coming to class.
- **Do not procrastinate!**
- **Seek assistance as soon as possible if you have a problem understanding the material.**

Module 1.6: Review

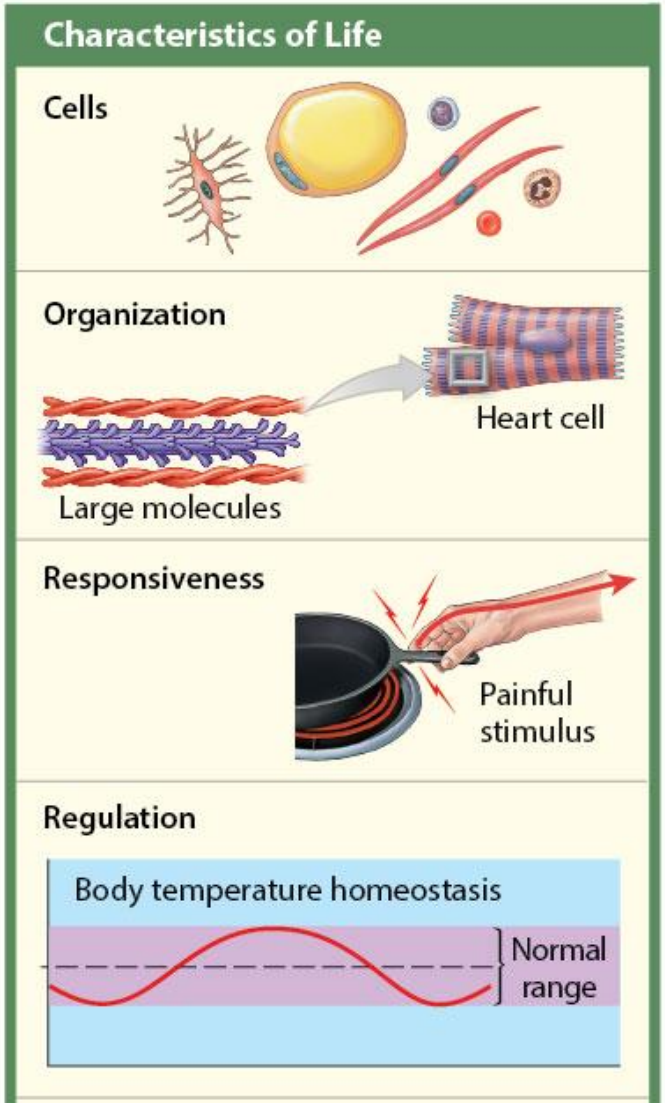
A. What do scientists mean when they use the term “Black Box”?
B. Identify several strategies for success in this course.

Learning Outcome: Describe homeostasis, and identify basic study skill strategies to use in this course.

Module 1.7: Organisms share common characteristics and processes

Characteristics of all living things

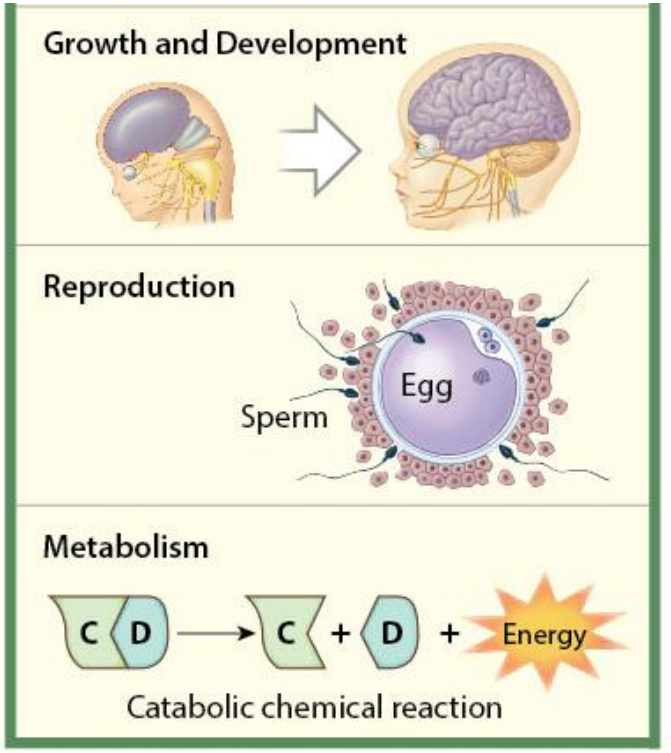
1. Composed of cells
2. Complex structural arrangement
3. Detect and respond to stimuli
4. Maintain a relatively stable internal environment



Module 1.7: Organisms share common characteristics and processes

Characteristics of all living things (continued)

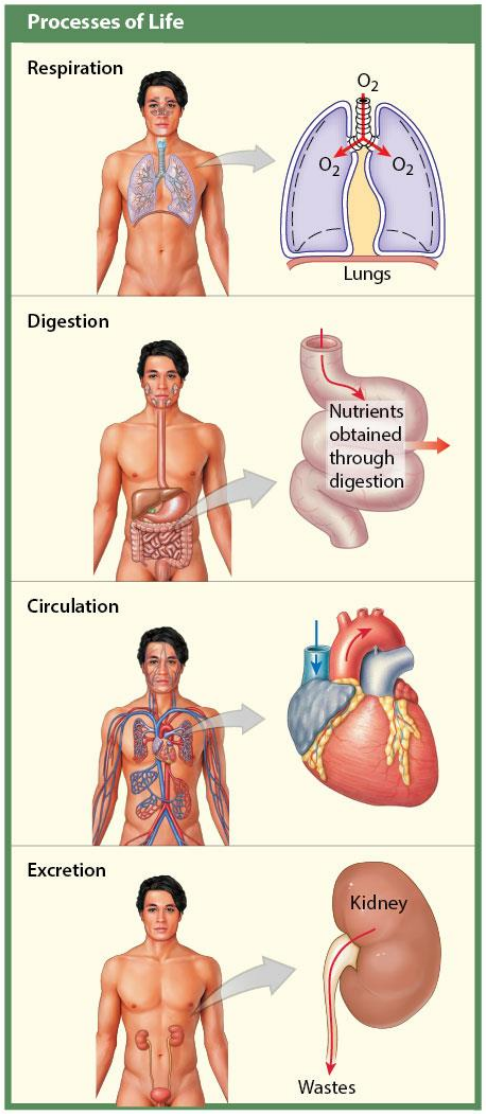
5. Organisms grow (increase in size) and develop (natural progression in physical maturation)
6. Offspring are produced by reproduction
7. Have *metabolism*—all essential chemical processes occurring in cells
   - Anabolic—building up
   - Catabolic—breaking down



Module 1.7: Organisms share common characteristics and processes

Processes of life

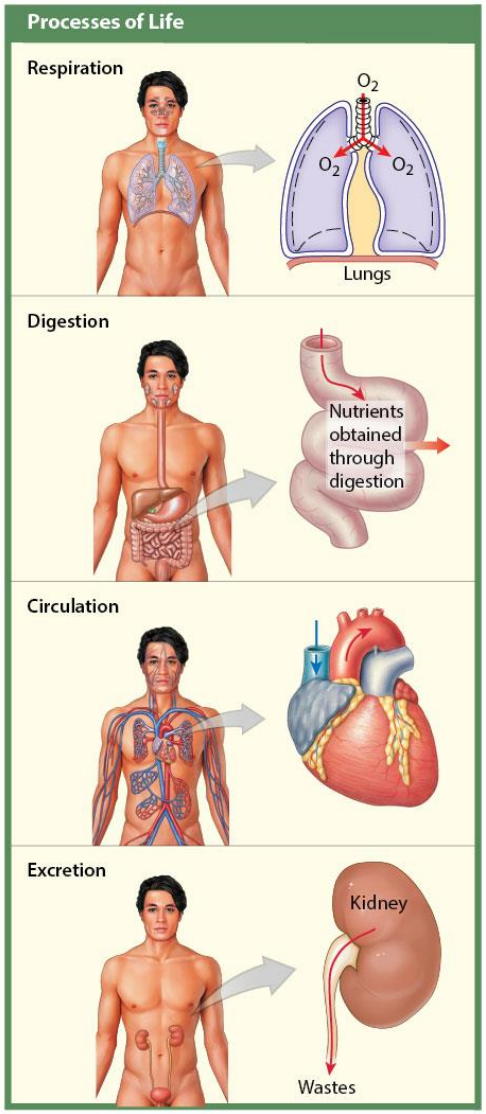
- **Respiration**—oxygen required for chemical processes obtained from atmosphere and delivered to cardiovascular system; carbon dioxide removed by cardiovascular system
- **Digestion**—mechanical and chemical process to convert ingested food into simple absorbable substances



Module 1.7: Organisms share common characteristics and processes

Processes of life (continued)

- **Circulation**—internal movement and distribution of oxygen, wastes, and digestion products
- **Excretion**—undigested food and wastes of metabolism eliminated from body



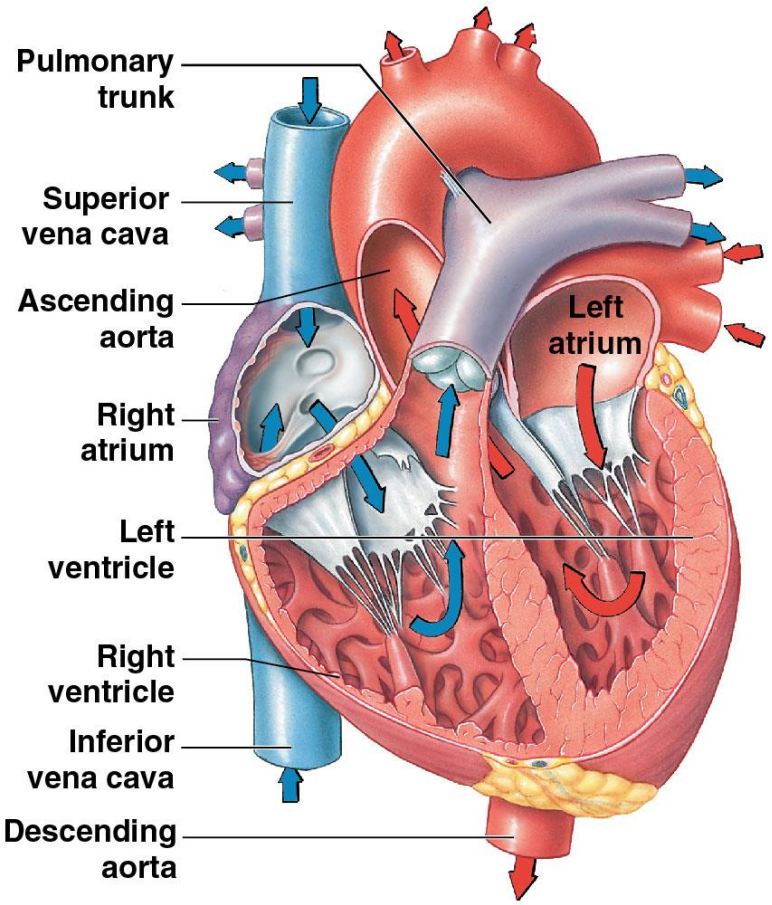
Module 1.7: Review

A. List the common characteristics shared by all living things.
B. Distinguish between growth and development.
C. Describe the basic processes in humans and other animals.

Learning Outcome: Describe the common characteristics of life and the basic processes in humans and other animals.

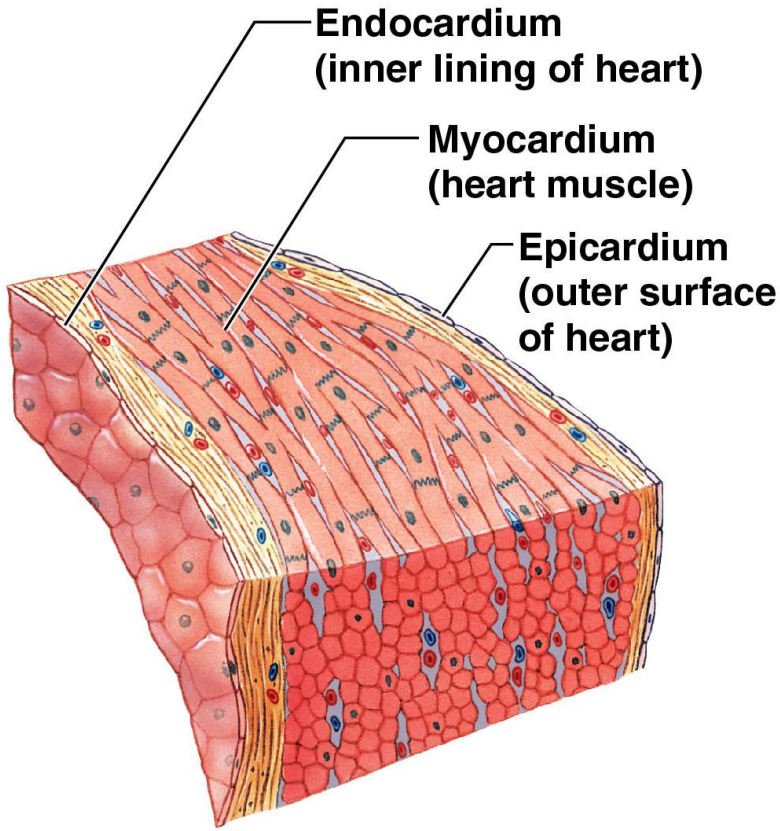
Module 1.8: Anatomy is the study of structure…

- **Anatomy**—means "a cutting open"
  - Study of the structures of the body and physical relationships among body parts
- **Gross (macroscopic) anatomy**—large structures and features usually visible with unaided eye



Module 1.8: Anatomy is the study of structure…

- **Microscopic anatomy**
  - Study of structures that cannot be seen without magnification
    - Dissecting microscope—can see tissues
    - Light microscope—can see basic cell structure
    - Electron microscope—can see individual molecules



Module 1.8: …and physiology is the study of function

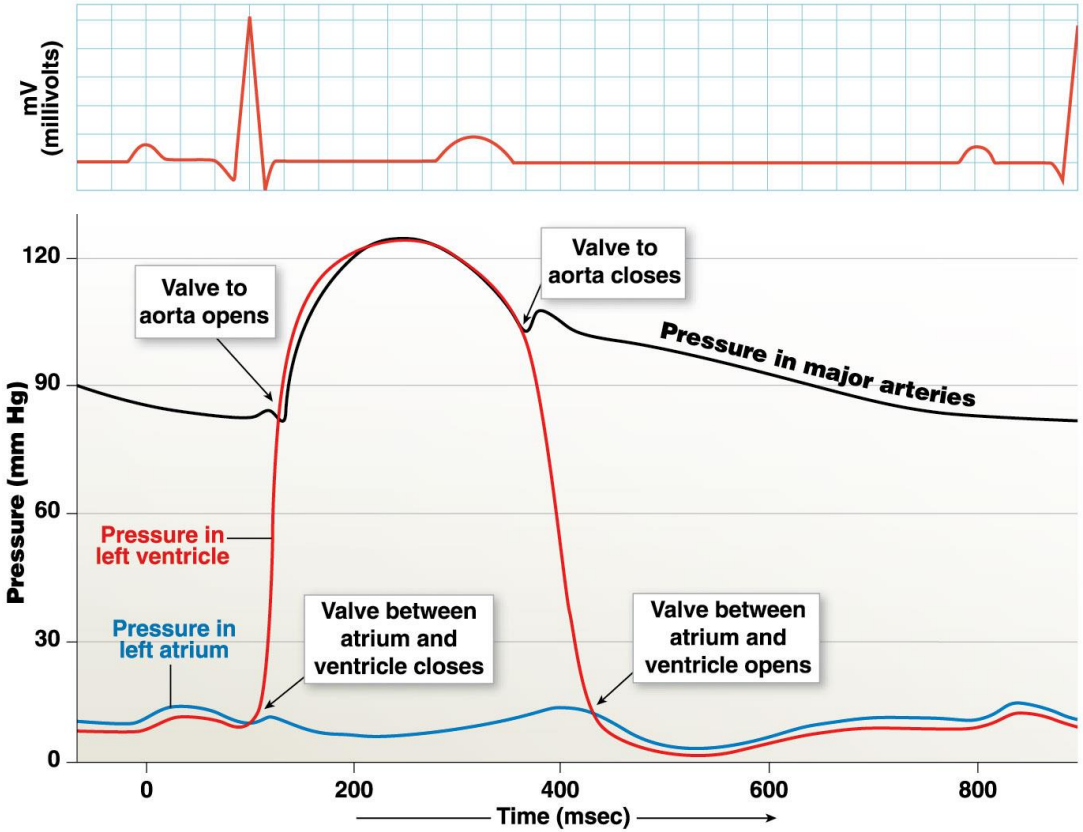
Physiology

- Study of function and how organisms perform vital functions
- Complex and more difficult to examine than anatomical structures
- Focuses on functional properties

Module 1.8: …and physiology is the study of function

Examples of physiology topics

- Electrical events within the heart coordinating the heartbeat and pressure changes



Module 1.8: Review

A. What are the differences between gross anatomy and microscopic anatomy?
B. Explain the link between anatomy and physiology.

Learning Outcome: Define anatomy and physiology, and describe macroscopic and microscopic anatomy.

Module 1.9: Structure and function are interrelated

Physiology and anatomy are closely interrelated in theory and in practice

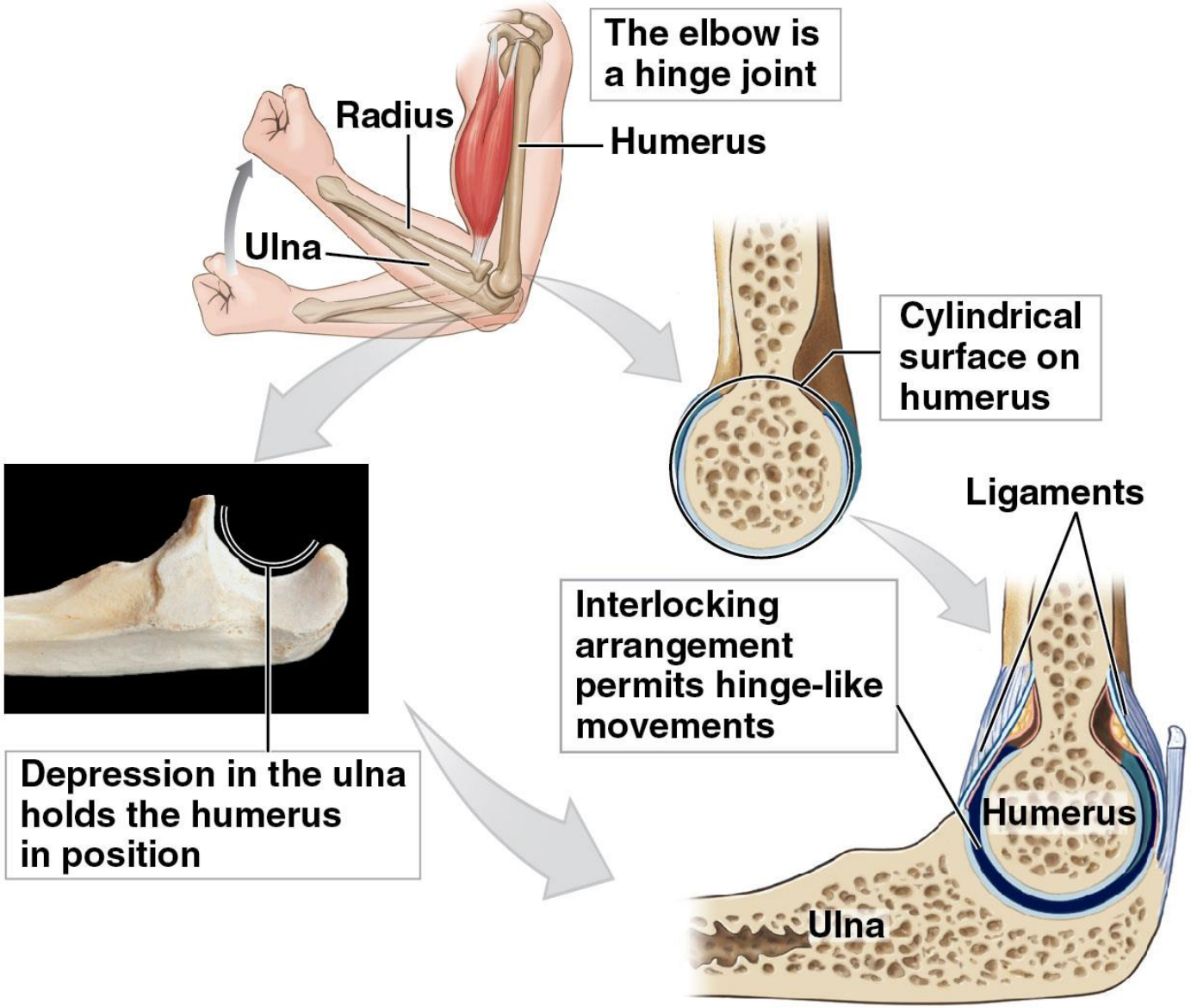
- One cannot be fully understood without the other
  - Anatomical details have an effect on function
  - Physiological mechanisms are understood in terms of underlying structural relationships

Module 1.9: Structure and function are interrelated

Examples

- The elbow joint is an example of interrelationship between structure and function at the gross anatomy level
  - Functions like a hinge
  - Allows movement in one plane
    - Forearm moves toward or away from shoulder, but does not twist
  - Anatomical structures impose functional limits

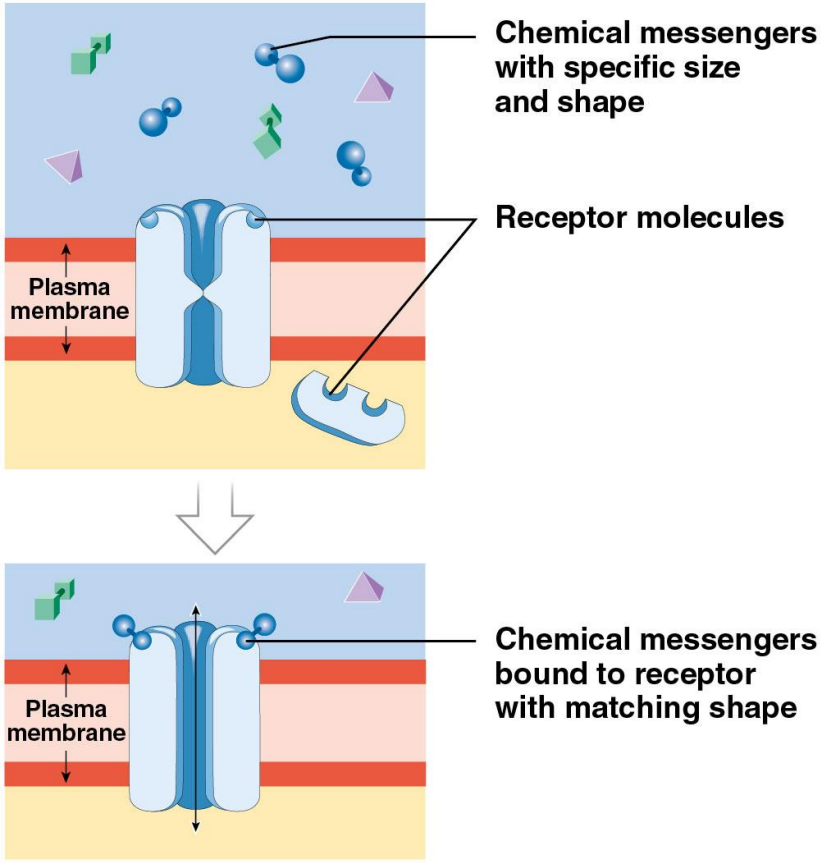
Module 1.9: Structure and function are interrelated



Module 1.9: Structure and function are interrelated

Chemical level example

- Chemical messengers and cellular receptors
- Cells communicate using specifically shaped molecules called chemical messengers
  - Receptors on target cells receive the message only if the messenger molecule fits the shape of receptor



Module 1.9: Structure and function are interrelated

Living systems are subject to laws of physics and chemistry

- Many advances in understanding the human body came after advances in physical or applied sciences
  - William Harvey
    - Demonstrated that heart valves worked on same principles as valves in coal mine water pumps

Module 1.9: Review

A. Compare the functioning of the elbow joint with a door on a hinge.
B. Predict what would happen to the function of a structure if its anatomy were altered.
C. What features are common to forearm movement at an elbow joint and the opening of a cell membrane passageway?

Learning Outcome: Explain the relationship between structure and function.

Section 3: Levels of Organization

Learning Outcomes

1.10 Describe the various levels of organization in the human body.

1.11 Describe various types of cells in the human body, and explain the basic principles of the cell theory.

1.12 Define histology, and explain the interrelationships among the various types of tissues.

1.13 Identify the 11 organ systems of the human body, and describe the major functions of each.

Section 3: Levels of Organization

Learning Outcomes (continued)

1.14 Describe the major organs of the integumentary, skeletal, muscular, and nervous systems, and briefly describe their functions.

1.15 Describe the major organs of the endocrine, cardiovascular, lymphatic, and respiratory systems, and briefly describe their functions.

1.16 Describe the major organs of the digestive, urinary, and reproductive systems, and briefly describe their functions.

Module 1.10: The human body has multiple interdependent levels of organization

Levels of organization

- The human body is complex, representing multiple **levels of organization**
  - Each level more complex than underlying one
  - All can be broken down to similar chemical and cellular components

Module 1.10: Interdependent levels of organization

Chemical level (Chapter 2)

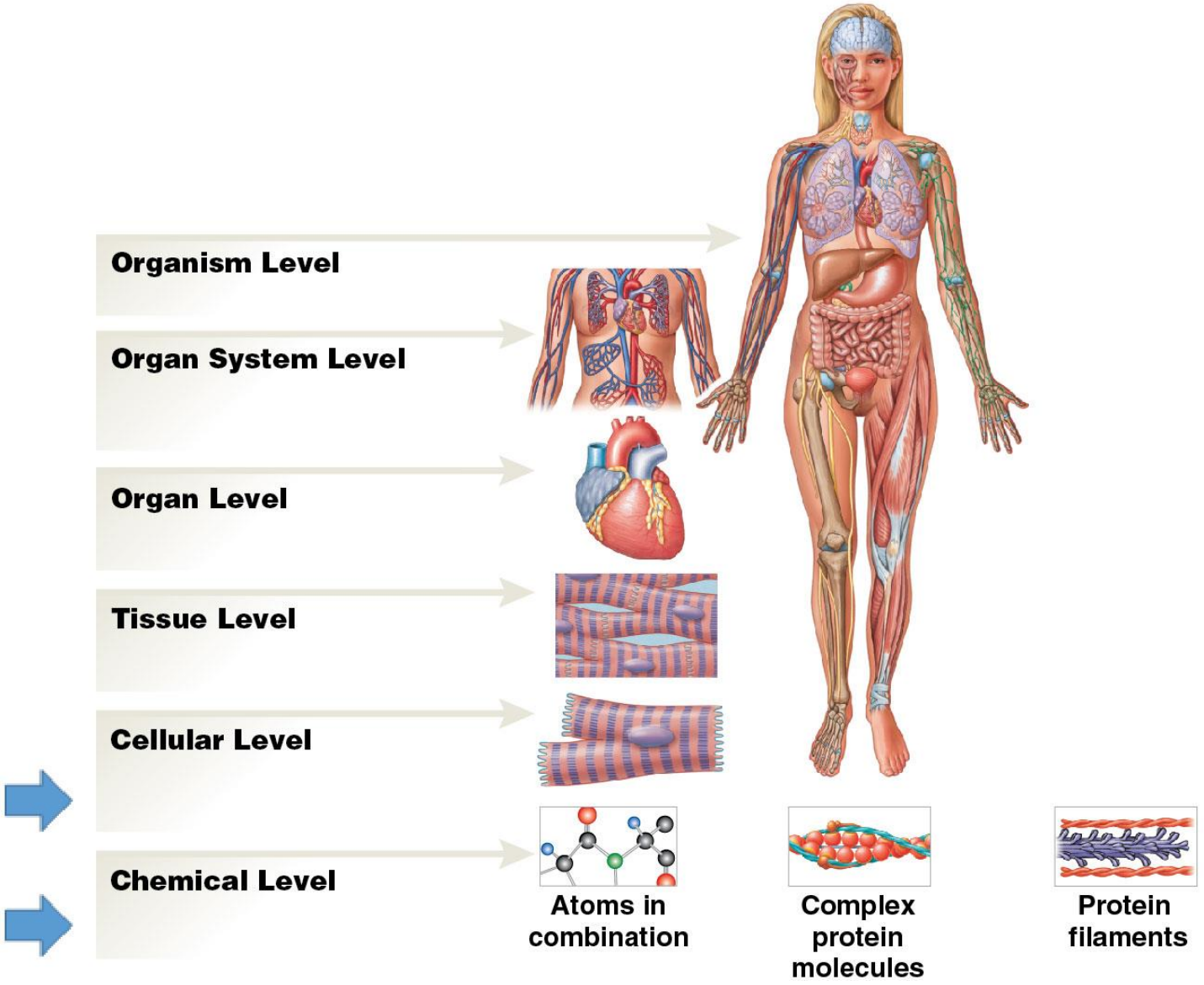
- **Atoms** (smallest stable units of matter) combine to form **molecules**
- Functional properties of molecule determined by shape and atomic components

Module 1.10: Interdependent levels of organization

Cellular level (Chapter 3)

- **Cells** are the smallest living units in the body
- Functions depend on *organelles* (composed of molecules)
- Each organelle has a specific function
  - *Example*: a mitochondrion provides energy for heart muscle cell contraction

Chemical and cellular levels of organization



Module 1.10: Interdependent levels of organization

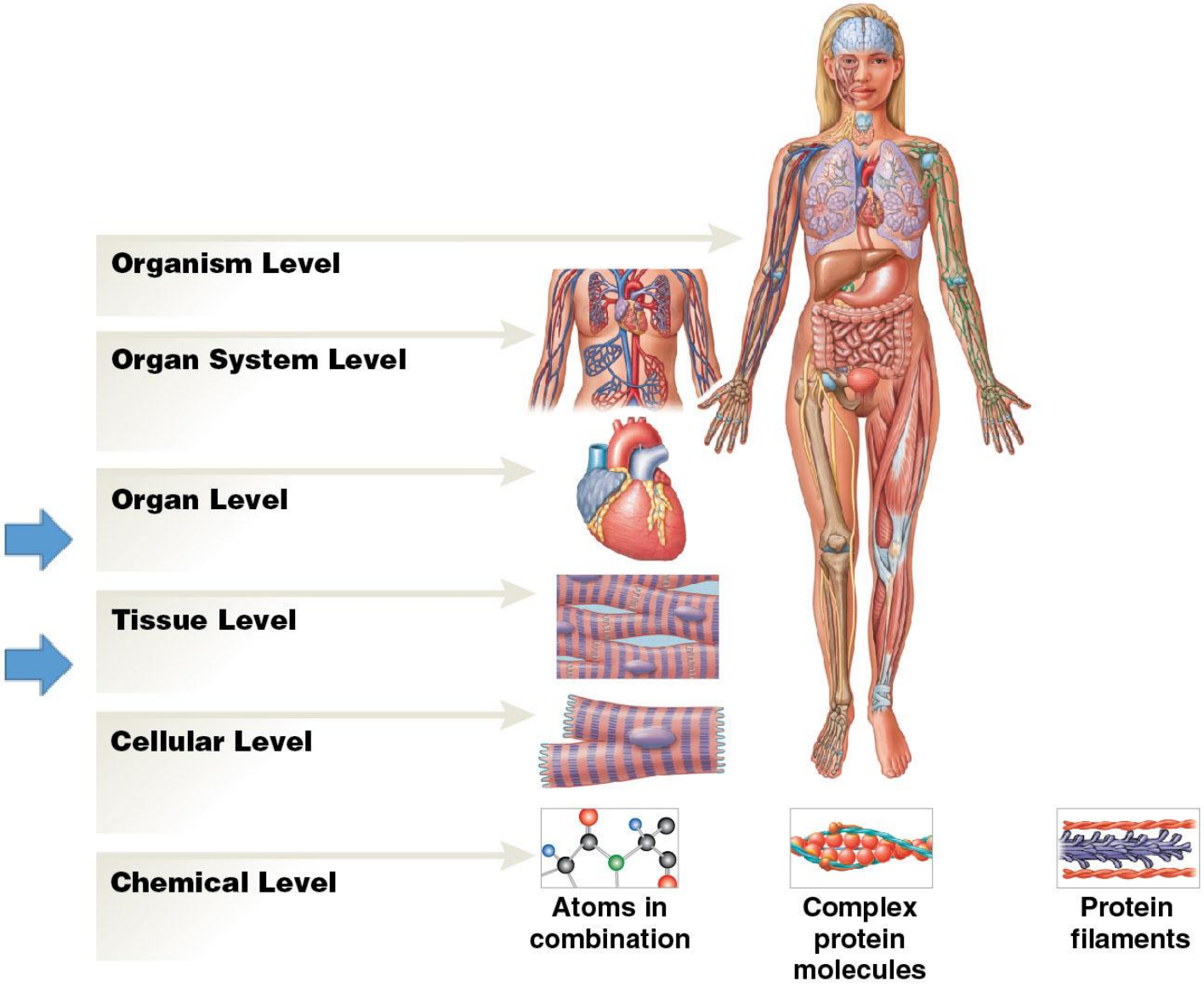
Tissue level (Chapter 4)

- A **tissue** is a group of cells working together to perform specific functions
  - *Example*: heart muscle cells form cardiac muscle tissue

Organ level

- An **organ** is composed of two or more tissues working together to perform specific functions
  - *Example*: layers of cardiac muscle tissue along with connective tissue form the heart

Tissue and organ levels of organization



Module 1.10: Interdependent levels of organization

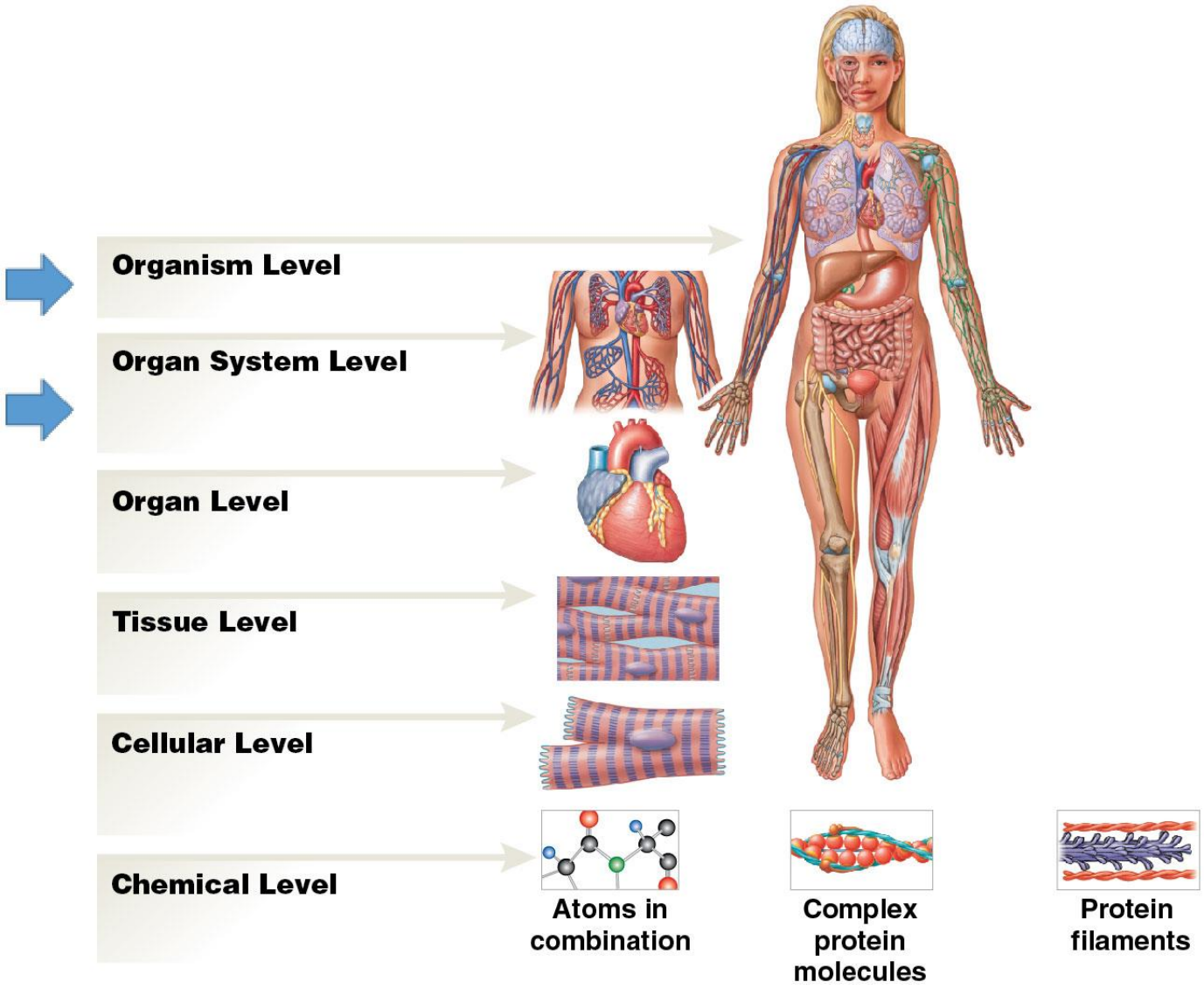
Organ system level (Chapters 5–27)

- **Organ systems** consist of interacting organs
  - *Example*: the heart works with blood vessels and blood to form the cardiovascular system

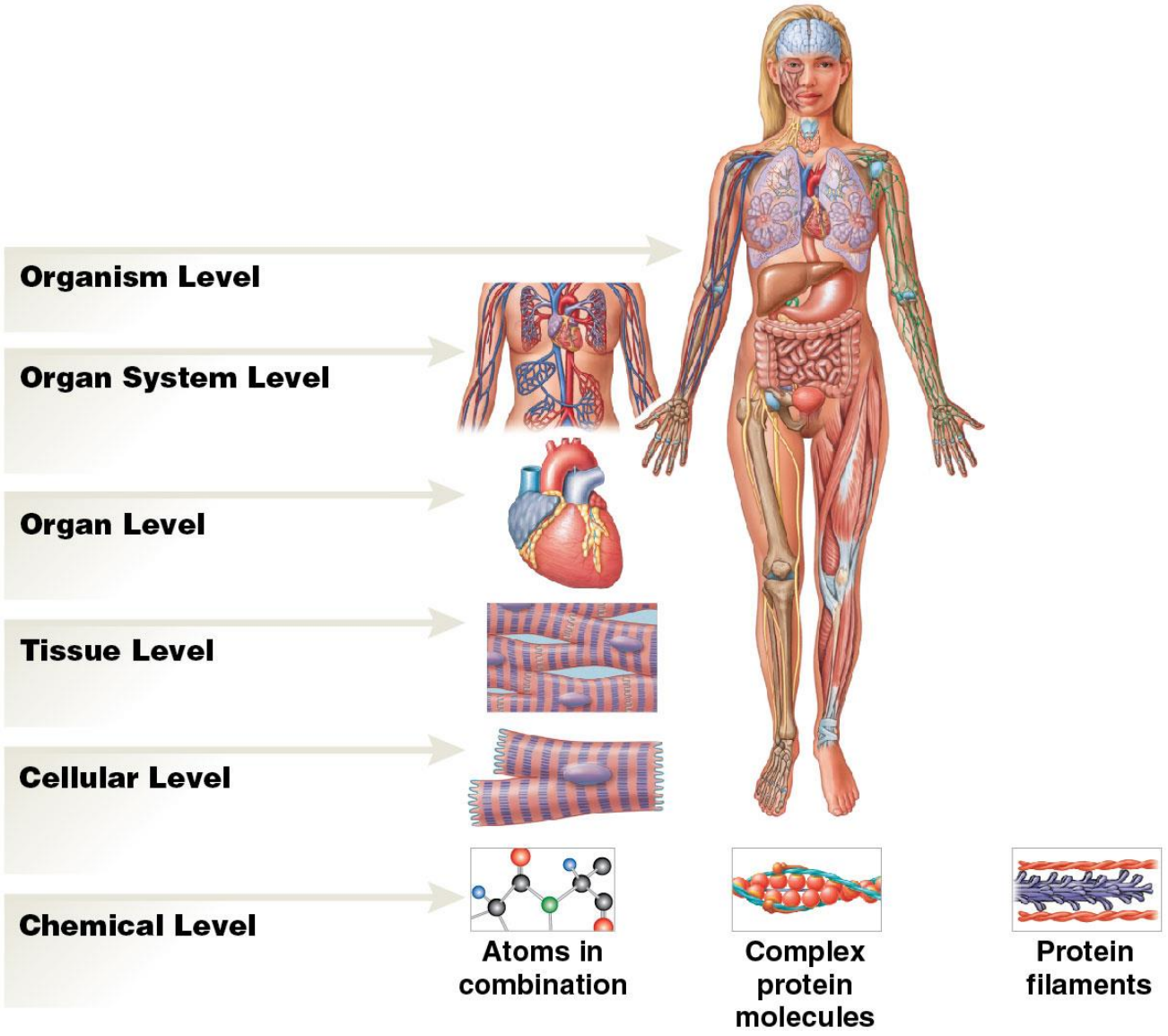
Organism level

- An **organism** is the highest level of organization
- Collection of organ systems working together to maintain life and health

Organ system and organism levels of organization



Module 1.10: Interdependent levels of organization



Module 1.10: Review

A. Name the simplest level of organization that includes the smallest living units in the body.
B. Define organ.
C. Our understanding of how the human body works is based on a knowledge of which level(s) of organization?

Learning Outcome: Describe the various levels of organization in the human body.

Module 1.11: Cells are the smallest units of life

Free-living cells

- Smallest living structures

Most plants and animals are multicellular

- Containing thousands to billions of cells

Cells in the human body

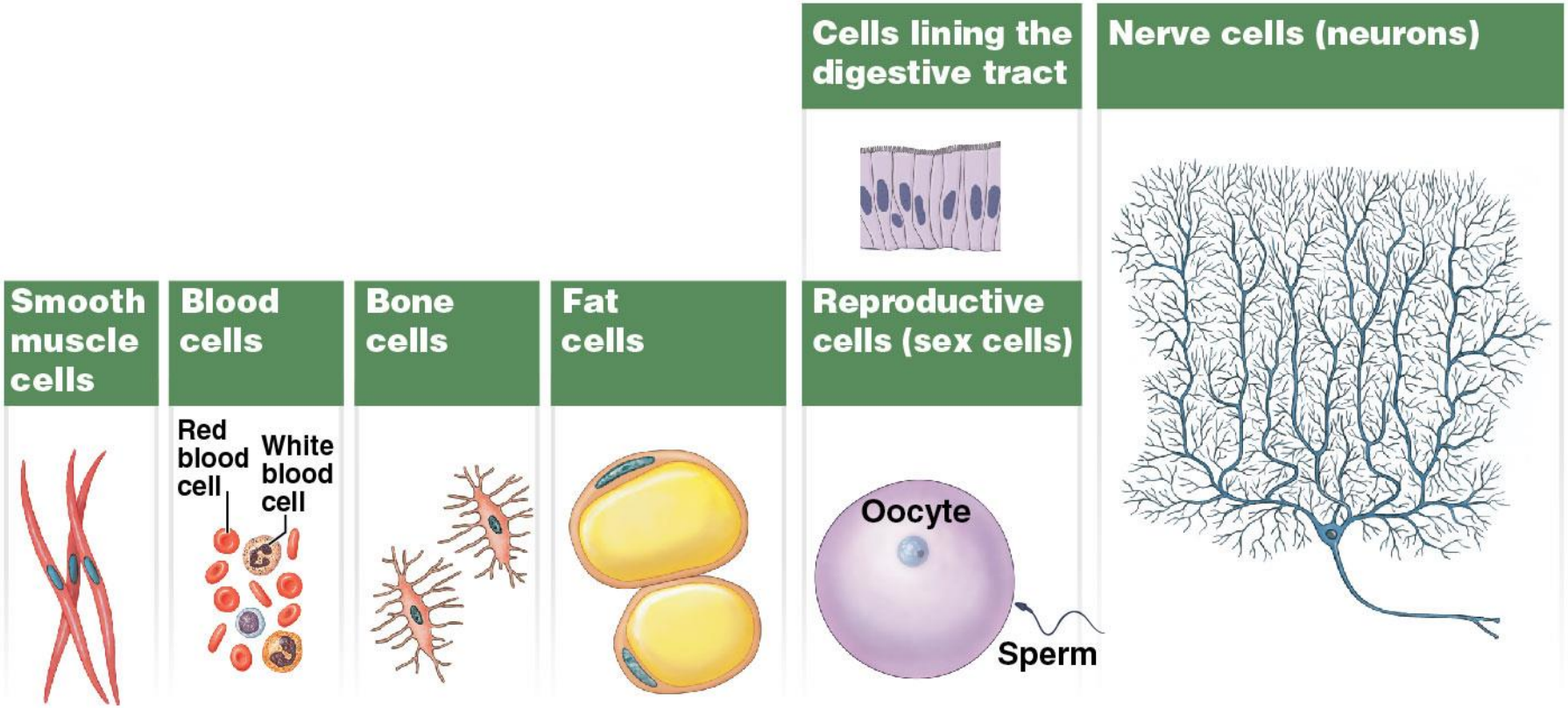
- Contains trillions of cells
- Only an estimated 200 different types of cells
- Measured in micrometers
- Vary greatly in size

Module 1.11: Cells are the smallest units of life

Cell function is related to its structure

- Smooth muscle cells—long and slender for contraction
- Red blood cells—flattened discs to transport oxygen and carbon dioxide
- Bone cells—maintain bone
- Fat cells—spherical for fat storage
- Cells lining digestive tract—shaped for absorption
- Reproductive—few large oocytes; numerous sperm
- Nerve cells—some have extensive branching providing huge surface area for communication

Module 1.11: Cells are the smallest units of life



Module 1.11: Cells are the smallest units of life

Cell theory—foundation of modern biology

Basic Principles of the Cell Theory

- Cells are the structural building blocks of all plants and animals.
- Cells are produced by the divisions of pre-existing cells.
- Cells are the smallest structural units that perform all vital functions.

Module 1.11: Cells

Cells work together

- Human life depends on cells working together
- Each cell responds to its local environment independently
- Cells in different parts of the body are coordinated and controlled

Module 1.11: Review

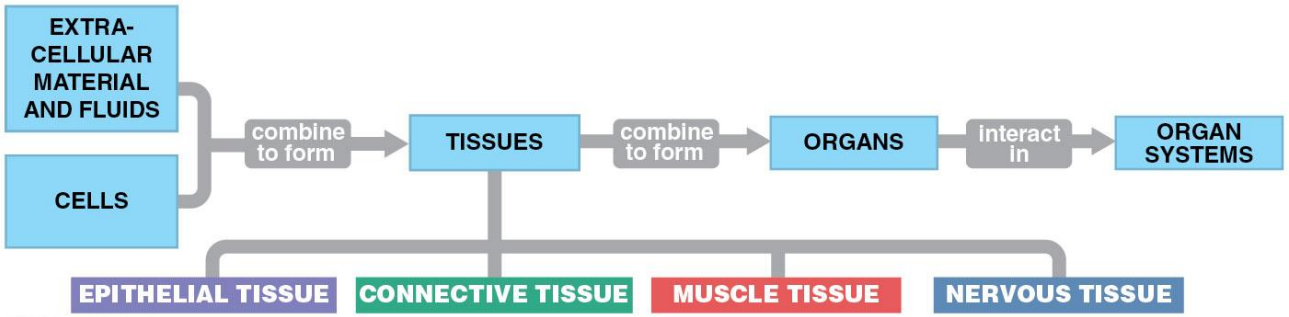
A. Name and define the unit used to measure cell size.
B. List the three basic principles of the cell theory.
C. A red blood cell has a diameter of about 8 µm. Use that information to estimate the diameter of the oocyte in micrometers (µm) and millimeters (mm). (1 mm = 1000 µm)

Learning Outcome: Describe various types of cells in the human body, and explain the basic principles of the cell theory.

Module 1.12: Tissues are specialized groups of cells and cell products

Tissues are collections of similar cells and cell products that perform specific functions

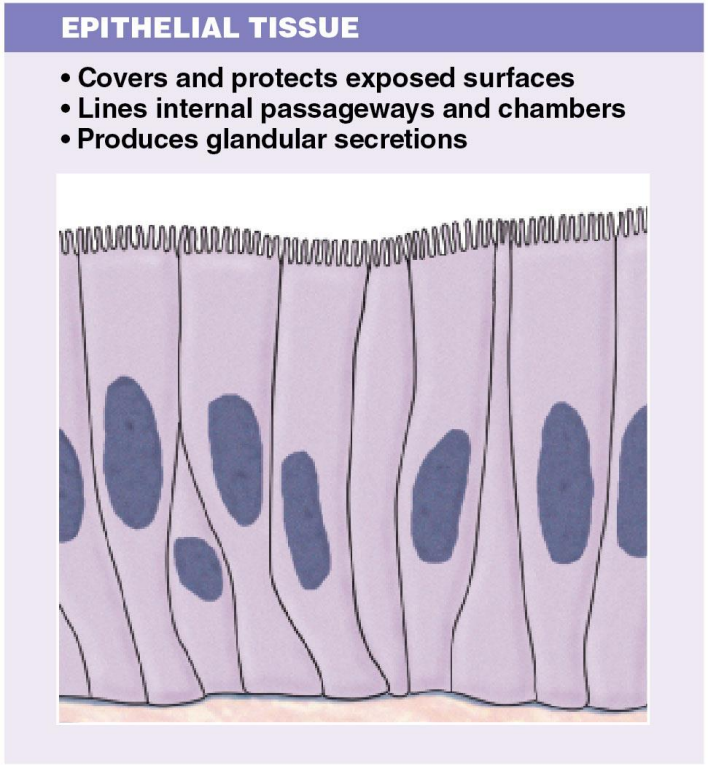
- **Histology** (*histos*, tissue) is the study of tissues.
- Four **primary tissue types**
  1. Epithelial tissue
  2. Connective tissue
  3. Muscle tissue
  4. Nervous tissue



Module 1.12: Tissues

Epithelial tissue

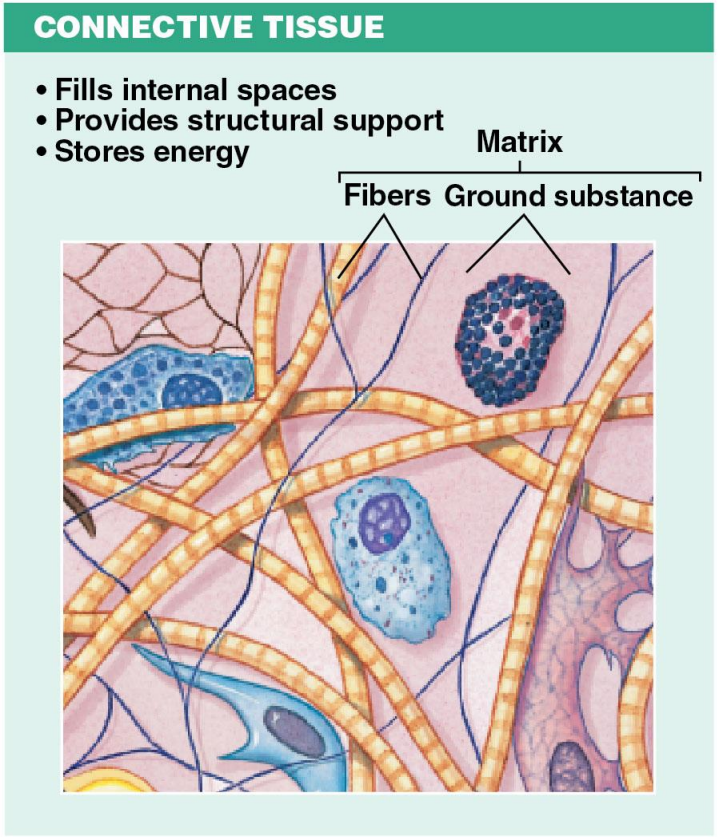
- Most common
- Forms a barrier with specific properties
- Covers every exposed body surface
- Lines digestive, respiratory, reproductive, and urinary tracts
- Surrounds internal cavities (e.g., chest cavity)
- Lines inner surfaces of blood vessels and heart
- Produces glandular secretions



Module 1.12: Tissues

Connective tissue

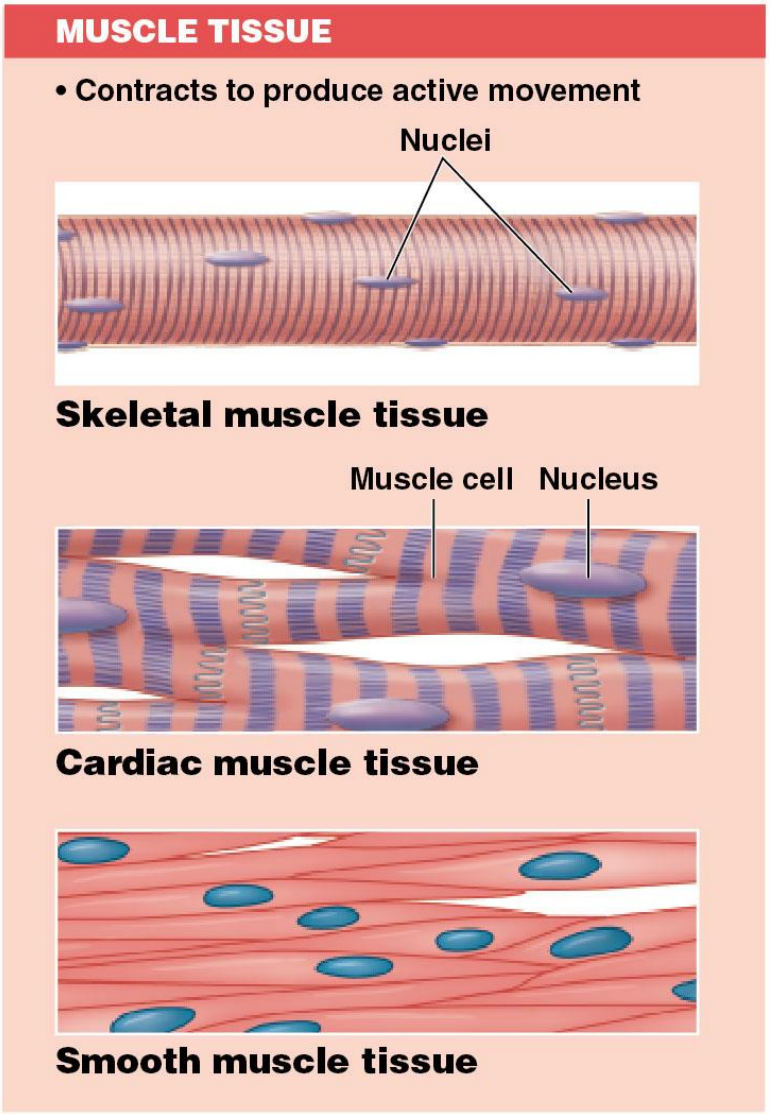
- Diverse in appearance but all forms contain cells surrounded by extracellular **matrix**
  - Matrix composed of:
    - Protein fibers
    - Ground substance (liquid)
  - Amount and consistency of matrix varies by the particular connective tissue type
    - Blood—watery matrix
    - Bone—crystallized matrix with little ground substance



Module 1.12: Tissues

Muscle tissue

- Has the ability to contract forcefully
- Major functions
  - Skeletal movement
  - Soft tissue support
  - Maintenance of blood flow
  - Movement of materials internally
  - Stabilization of body temperature



Module 1.12: Tissues

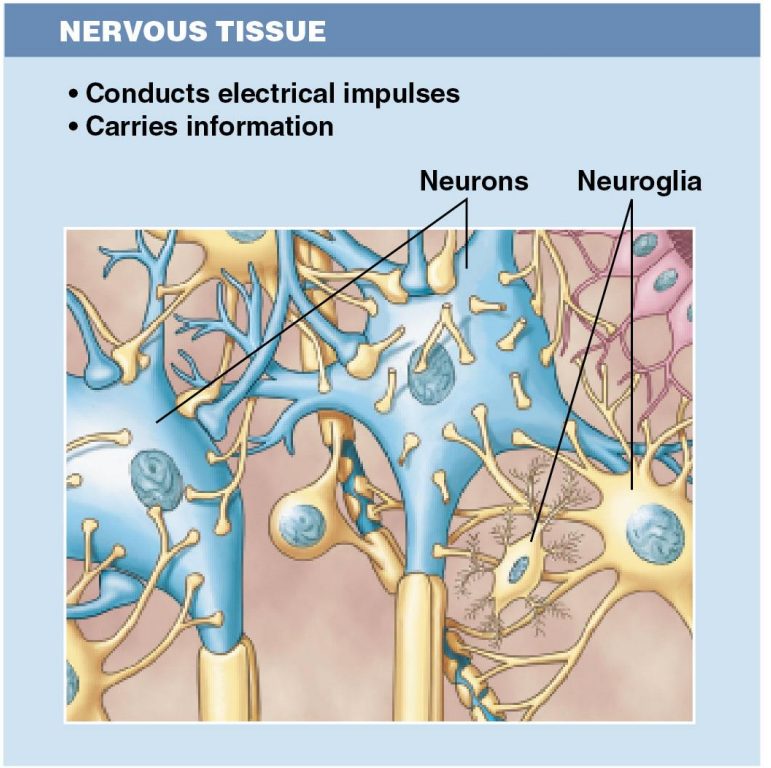
Muscle tissue (continued)

- Three types
  1. **Skeletal**
     - Usually attached to the skeleton
     - Moves or stabilizes position of skeleton or internal organs
  2. **Cardiac**
     - Found only in the heart
     - Propels blood through blood vessels
  3. **Smooth**
     - Found in blood vessel walls, within glands, along respiratory, circulatory, digestive, and reproductive tracts

Module 1.12: Tissues

Nervous tissue

- Specialized to carry information or instructions within the body
- Two basic types of cells
  1. **Neurons** (nerve cells)
     - Transmit information in form of electrical impulses
  2. **Neuroglia** (supporting cells)
     - Isolate and support neurons
     - Form supporting framework



Module 1.12: Tissues

Neural tissue locations within the body

1. **Central nervous system**
   - Brain and spinal cord
2. **Peripheral nervous system**
   - Nerves connecting central nervous system with other tissues and organs

Module 1.12: Review

A. Describe the general roles of the different types of muscle tissue.
B. Identify the four primary tissue types, and explain the functions of each.

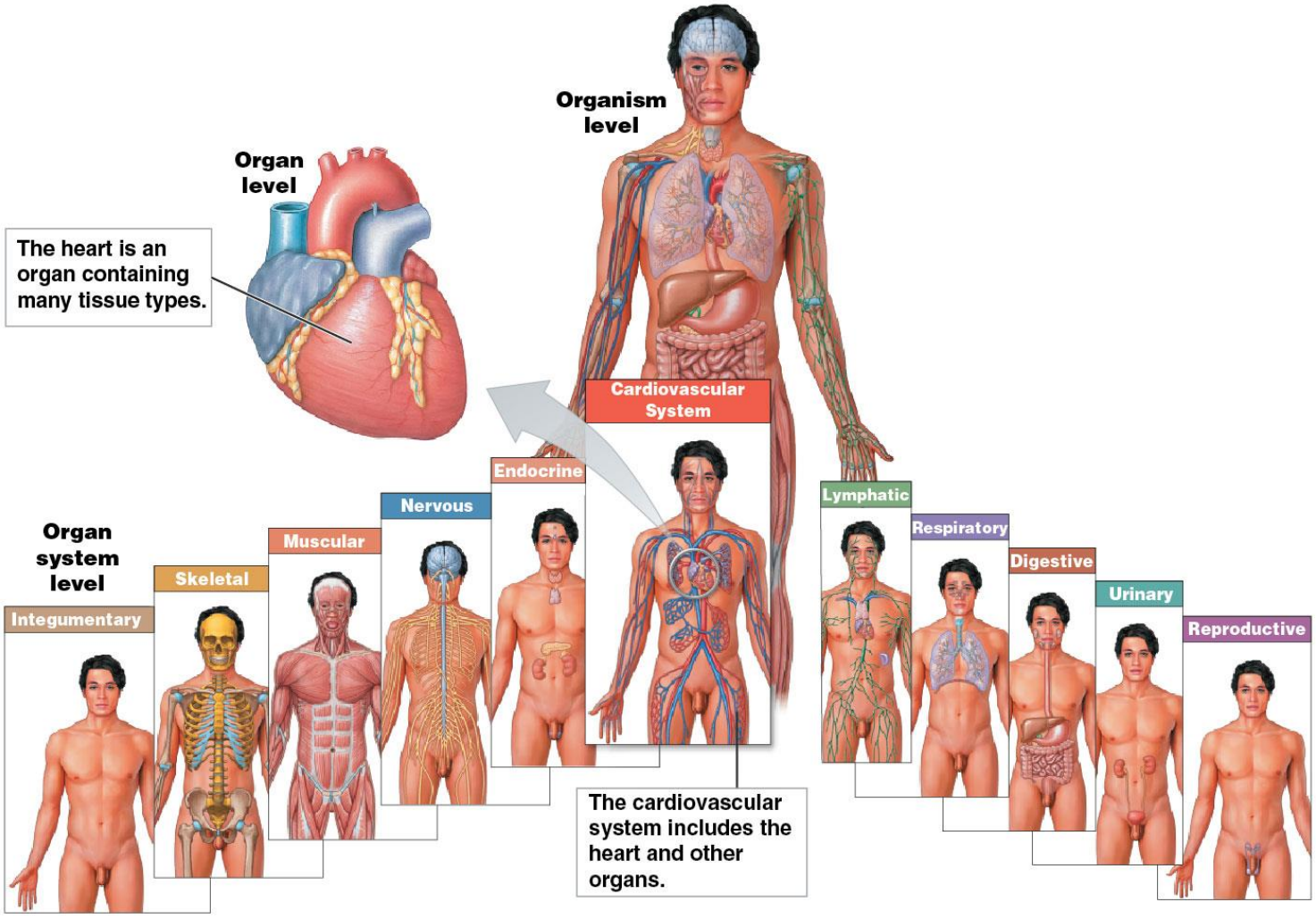
Learning Outcome: Define histology and explain the interrelationships among the various types of tissues.

Module 1.13: Organs and organ systems perform vital functions

Organ

- Functional unit composed of more than one tissue type
- Function determined and limited by specific combination and organization of tissues within it
  - For example:
    - Organ with flattened shape could function well in protection (skin)
    - Organ with three-dimensional shape could house other structures (liver)

Module 1.13: Organs and organ systems



The heart has cardiac muscle, epithelial tissue, connective tissue, and neural tissue, which all work together as a pump.

Module 1.13: Organs and organ systems

Organ system—Consists of organs that interact to perform a specific range of functions, often in coordinated fashion

- Eleven organ systems in the human body
  - None of these systems function in isolation
  - All are interdependent on each other

Organ Systems	Major Functions
Integumentary system	Protects against environmental hazards; helps control body temperature
Skeletal system	Provides support; protects tissues; stores minerals; forms blood cells
Muscular system	Produces movement; provides support; generates heat
Nervous system	Directs immediate responses to stimuli, usually by coordinating the activities of other organ systems
Endocrine system	Directs long-term changes in other organ systems
Cardiovascular system	Transports cells and dissolved materials in the bloodstream, including nutrients, wastes, and gases
Lymphatic system	Defends against infection and disease; returns tissue fluid to the bloodstream
Respiratory system	Delivers air to sites where gas exchange occurs between the air and circulating blood; produces sound
Digestive system	Processes food and absorbs nutrients (carbohydrates, fats, proteins, vitamins, minerals, and water)
Urinary system	Eliminates excess water, salts, and wastes; controls pH
Reproductive system	Produces sex cells and hormones; supports embryonic development from fertilization to birth (female)

Module 1.13: Review

A. Which two organ systems are involved with circulation within the body?
B. Using the table as a reference, describe how falling down a flight of stairs could affect at least six of the organ systems.

Learning Outcome: Identify the 11 organ systems of the human body, and describe the major functions of each.

Module 1.14: Organs of the integumentary, skeletal, and muscular systems support and move the body …

Integumentary system

- Protects the body from environmental hazards
- Helps control body temperature

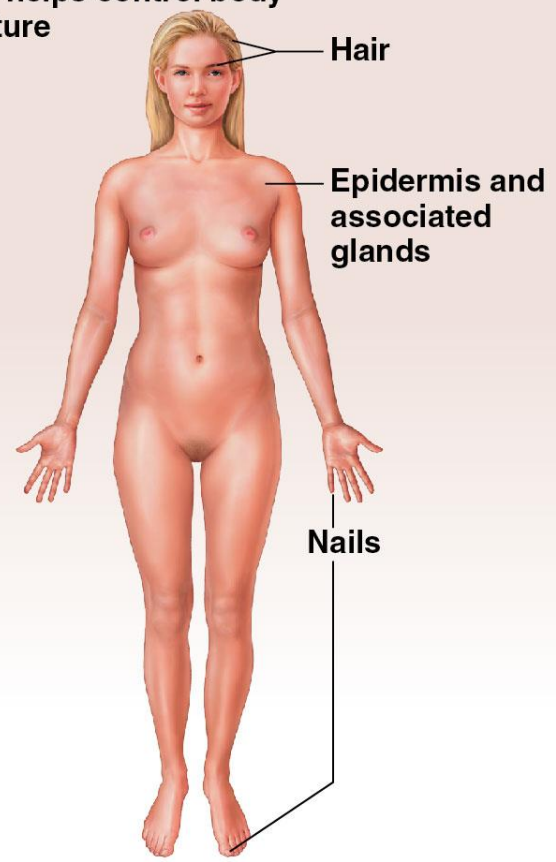
Skeletal system

- Provides support
- Protects tissues
- Stores minerals
- Forms blood cells

Integumentary system

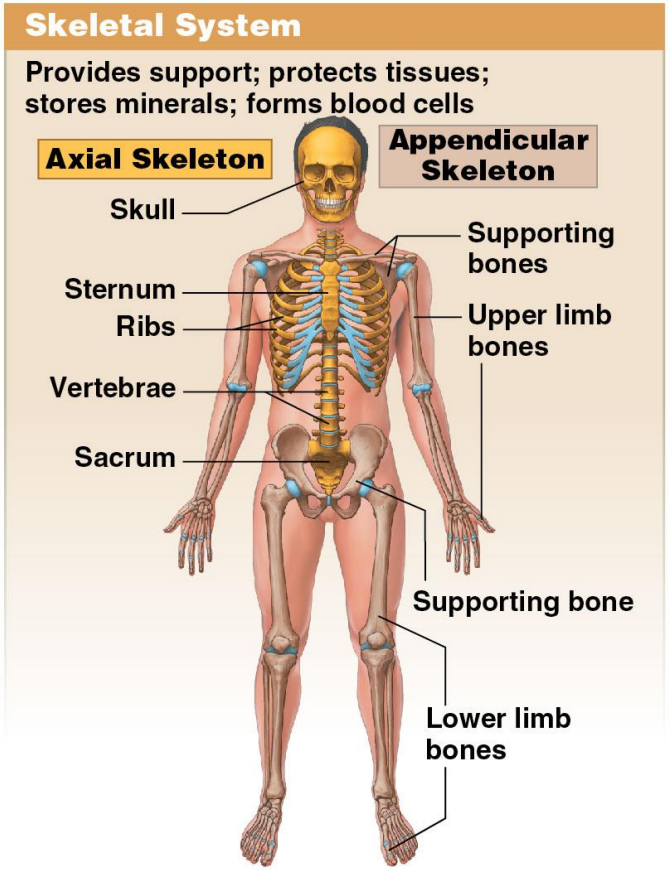
Integumentary System

Protects against environmental hazards; helps control body temperature



Organ/Structure	Primary Function
Cutaneous Membrane	
Epidermis	Covers surface; protects deeper tissues
Dermis	Nourishes epidermis; provides strength; contains glands
Hair Follicles	Produce hair; innervation provides sensation
Hairs	Provide protection for head
Sebaceous glands	Secrete lipid coating that lubricates hair shaft and epidermis
Sweat Glands	Produce perspiration for evaporative cooling
Nails	Protect and stiffen distal tips of digits
Sensory Receptors	Provide sensations of touch, pressure, temperature, pain
Hypodermis	Stores lipids; attaches skin to deeper structures

Skeletal system



Organ/Structure	Primary Function
Bones, Cartilages, and Joints	Support, protect soft tissues; bones store minerals
Axial skeleton (skull, vertebrae, sacrum, coccyx, sternum, supporting cartilages and ligaments)	Protects brain, spinal cord, sense organs, and soft tissues of thoracic cavity; supports the body weight over lower limbs
Appendicular skeleton: limbs and supporting bones and ligaments	Provides internal support and positioning of the limbs; supports and moves axial skeleton
Bone Marrow	Primary site of blood cell production (red marrow); stores of energy in fat cells (yellow marrow)

Module 1.14: Organ systems (part 1)

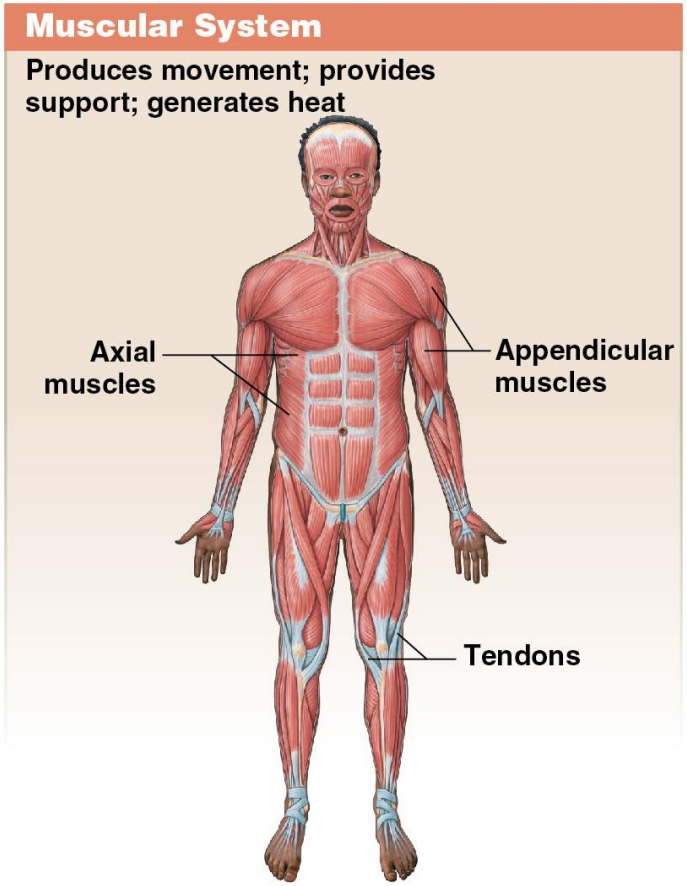
Muscular system

- Produces movement
- Provides support
- Generates heat

Nervous system

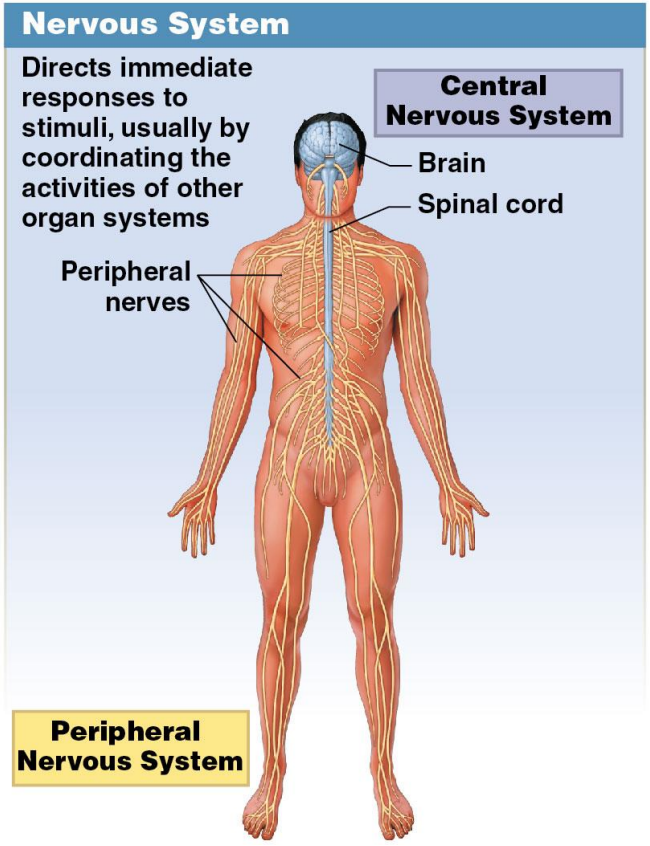
- Provides rapid control and regulation
- Coordinates activities of other organ systems

Muscular system



Organ/Structure	Primary Functions
Skeletal Muscles	Provide skeletal movement; control entrances to digestive and respiratory tracts and exits from digestive and urinary tracts; produce heat; support skeleton; protect soft tissues
Axial muscles	Support and position axial skeleton
Appendicular muscles	Support, move, and brace limbs
Tendons, Aponeuroses	Use forces of contraction to perform specific tasks

Nervous system



Organ/Structure	Primary Function
Central Nervous System (CNS)	Acts as control center for nervous system; processes information; provides short-term control over activities of other systems
Brain	Performs complex integrative functions; controls both voluntary and involuntary activities
Spinal cord	Relays information to and from brain; performs less complex integrative activities
Special senses	Provide sensory input to the brain relating to sight, hearing, smell, taste, and equilibrium
Peripheral Nervous System (PNS)	Links CNS with other systems and with sense organs

Module 1.14: Review

A. How would a nervous system disorder affect the muscular system?

Learning Outcome: Describe the major organs of the integumentary, skeletal, muscular, and nervous systems, and briefly describe their functions.

Module 1.15: Organ systems (part 2)

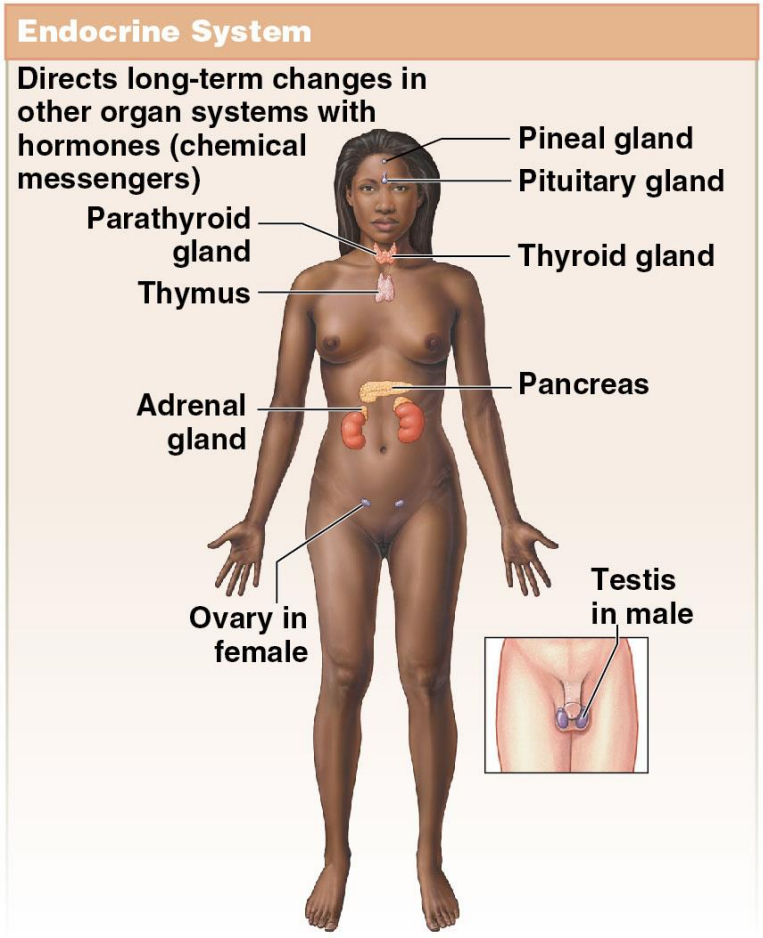
Endocrine system

- Secretes chemical messengers
- Directs long-term changes in other systems

Cardiovascular system

- Transports cells and dissolved materials, including nutrients, hormones, wastes, and gases to all parts of the body

Endocrine system

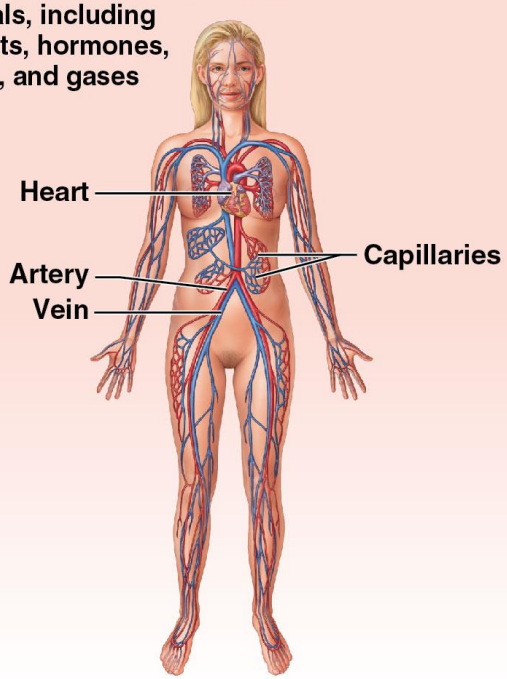


Organ/Structure	Primary Function
Pineal Gland	May control timing of reproduction and set day-night rhythms
Pituitary Gland	Controls other endocrine glands; regulates growth and fluid balance
Thyroid Gland	Controls tissue metabolic rate; regulates calcium levels
Parathyroid Glands	Regulate calcium levels (with thyroid gland)
Thymus	Controls maturation of lymphocytes
Adrenal Glands	Adjust water balance, tissue metabolism, cardiovascular and respiratory activity
Kidneys	Control red blood cell production, elevate blood pressure, and assist in calcium homeostasis
Pancreas	Regulates blood glucose levels
Gonads	
Testes	Support male sexual characteristics and reproductive functions (see Module 1.16)
Ovaries	Support female sexual characteristics and reproductive functions (see Module 1.16)

Cardiovascular system

Cardiovascular System

Transports cells and dissolved materials, including nutrients, hormones, wastes, and gases



Organ/Structure	Primary Function
Heart	Propels blood; maintains blood pressure
Blood Vessels	Distribute blood around the body
Arteries	Carry blood from the heart to capillaries
Capillaries	Permit diffusion between blood and interstitial fluids
Veins	Return blood from capillaries to the heart
Blood	Transports oxygen, carbon dioxide, and blood cells; delivers nutrients and hormones; removes wastes; assists in temperature regulation and defense against disease

Module 1.15: Organ systems (part 2)

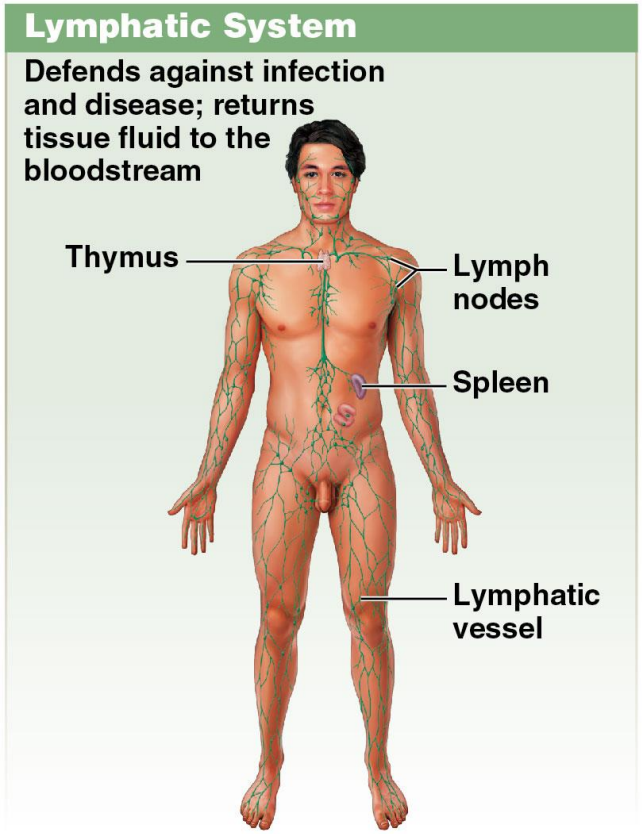
Lymphatic system

- Defends the body against infection and disease
- Returns tissue fluid to bloodstream

Respiratory system

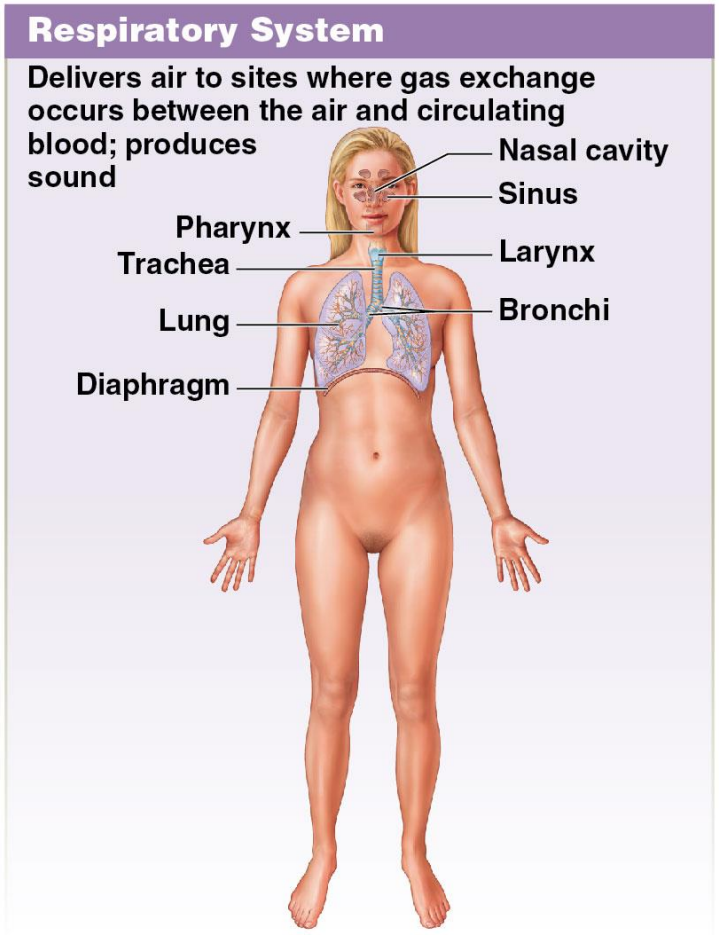
- Delivers air to gas exchange sites in lungs
- Produces sound

Lymphatic system



Organ/Structure	Primary Function
Lymphatic Vessels	Carry lymph (water and proteins) and lymphocytes from peripheral tissues to veins of the cardiovascular system
Lymph Nodes	Monitor the composition of lymph; engulf pathogens; stimulate immune response
Spleen	Monitors circulating blood; engulfs pathogens and recycles red blood cells; stimulates immune response
Thymus	Controls development and maintenance of one class of lymphocytes (T cells)

Respiratory system



Organ/Structure	Primary Function
Nasal Cavities and Paranasal Sinuses	Filter, warm, humidify air; detect smells
Pharynx	Conducts air to larynx; a chamber shared with the digestive tract
Larynx	Protects opening to trachea and contains vocal cords
Trachea	Filters air; cartilages keep airway open
Bronchi	Conducts air between trachea and lungs
Lungs	Responsible for air movement; alveoli within the lungs are sites of gas exchange between air and blood

Module 1.15: Review

A. How would a respiratory system disease affect the cardiovascular system?

Learning Outcome: Describe the major organs of the endocrine, cardiovascular, lymphatic, and respiratory systems, and briefly describe their functions.

Module 1.16: Organ systems (part 3)

Digestive system

- Processes food and absorbs nutrients

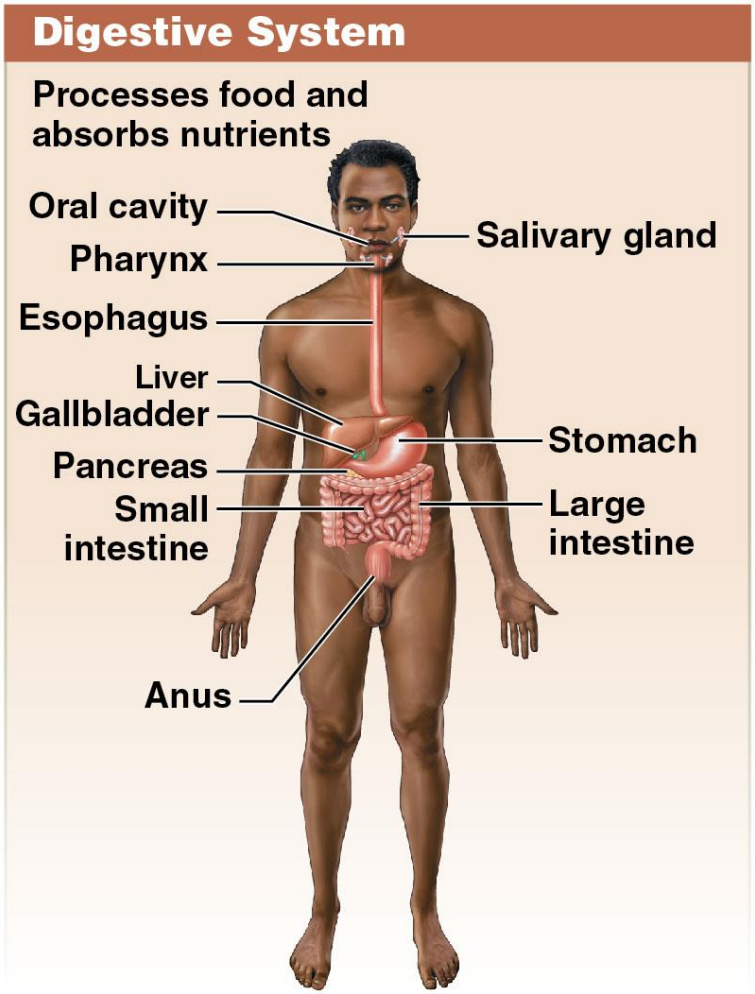
Urinary system

- Eliminates excess water, salts, and wastes

Reproductive system

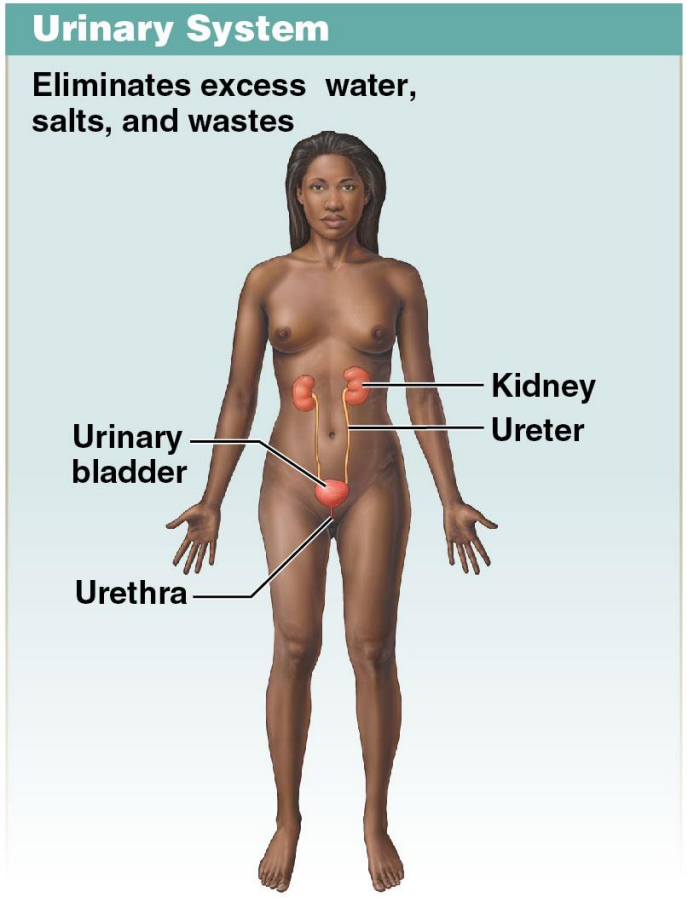
- Produces sex cells and hormones (male and female)
- Supports embryonic development from fertilization to birth (female only)

Digestive system



Organ/Structure	Primary Function
Oral Cavity (Mouth)	Cavity for food; works with associated structures (teeth, tongue) to break up food and pass food and liquids to pharynx
Salivary Glands	Provide buffers and lubrication; produce enzymes that begin digestion
Pharynx	Conducts solid food and liquids to esophagus; chamber shared with respiratory tract
Esophagus	Delivers food to stomach
Stomach	Secretes acids, enzymes, and hormones
Small Intestine	Secretes digestive enzymes, buffers, and hormones; absorbs nutrients
Liver	Secretes bile; regulates nutrient composition of blood
Gallbladder	Stores and concentrates bile for release into small intestine
Pancreas	Secretes digestive enzymes and buffers; contains endocrine cells
Large Intestine	Removes water from feces; stores wastes

Urinary system

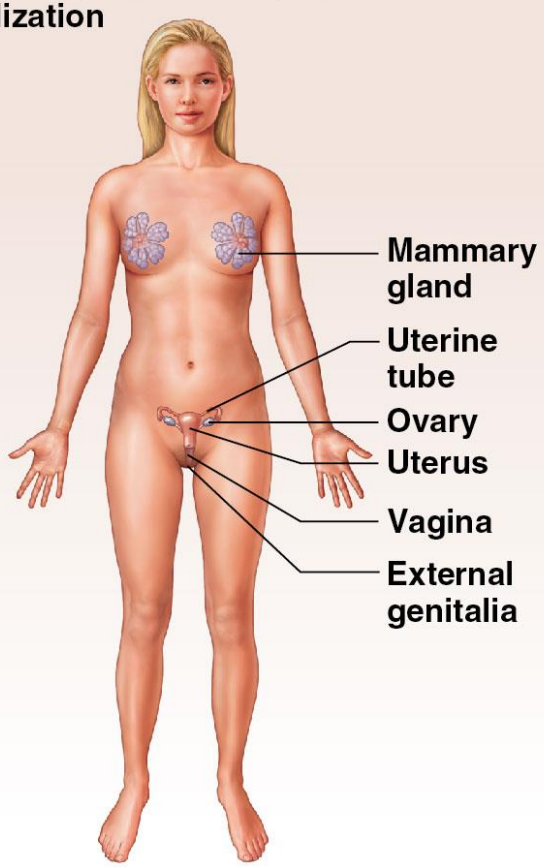


Organ/Structure	Primary Function
Kidneys	Form and concentrate urine; regulate blood pH and ion concentrations; perform endocrine functions
Ureters	Conduct urine from kidneys to urinary bladder
Urinary Bladder	Stores urine for eventual elimination
Urethra	Conducts urine to exterior

Female reproductive system

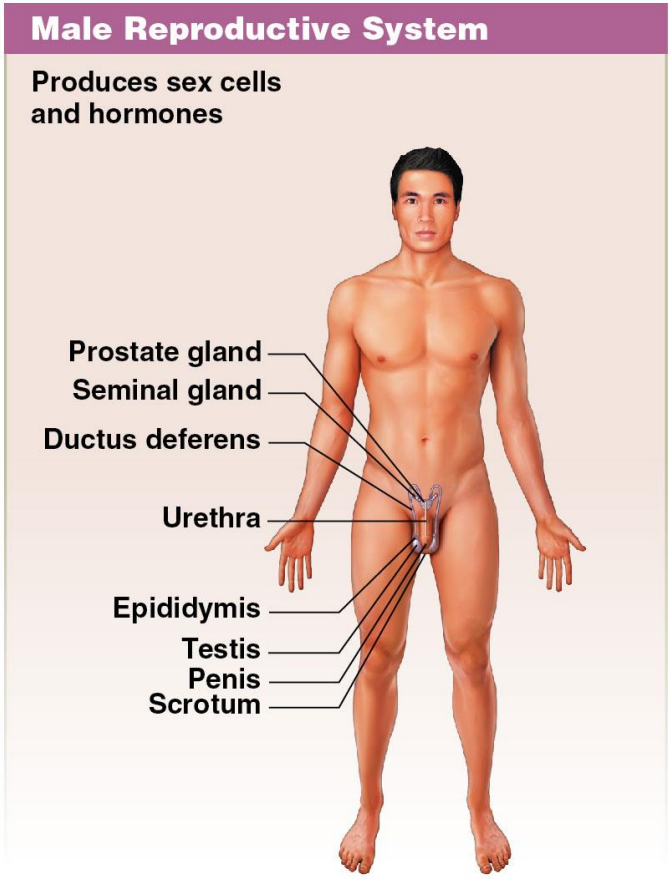
Female Reproductive System

Produces sex cells and hormones; supports embryonic development from fertilization to birth



Organ/Structure	Primary Function
Ovaries	Produce oocytes and hormones
Uterine Tubes	Deliver oocyte or embryo to uterus; normal site of fertilization
Uterus	Site of embryonic development and exchange between maternal and fetal bloodstreams; sheds lining during menstruation
Vagina	Site of sperm deposition; acts as a birth canal during delivery; provides passageway for fluids during menstruation
External Genitalia	
Clitoris	Contains erectile tissue; provides pleasurable sensations during sexual activities
Labia	Contain glands that lubricate entrance to vagina
Mammary Glands	Produce milk that nourishes newborn infant

Male reproductive system



Organ/Structure	Primary Function
Testes	Produce sperm and hormones
Accessory Organs	
Epididymis	Acts as site of sperm maturation in each testis
Ductus deferens	Conducts sperm from the epididymis
Seminal glands	Secrete fluid that contributes to semen
Prostate gland	Secretes fluid and enzymes
Urethra	Conducts semen to exterior
External Genitalia	
Penis	Deposits sperm in vagina of female
Scrotum	Surrounds the testes and controls their temperature

Module 1.16: Review

A. How would a reproductive system disorder affect the urinary system?

Learning Objective: Describe the major organs of the digestive, urinary, and reproductive systems, and briefly describe their functions.

Section 4: Homeostasis

Learning Outcomes

1.17 Describe the mechanisms of homeostatic regulation.

1.18 Discuss the roles of negative feedback and positive feedback in maintaining homeostasis.

Module 1.17: Homeostatic regulation relies on a receptor, a control center, and an effector

Homeostasis (*homeo*, unchanging + *stasis*, standing)

- Presence of stable internal environment
- Failure to maintain homeostasis leads to illness or death

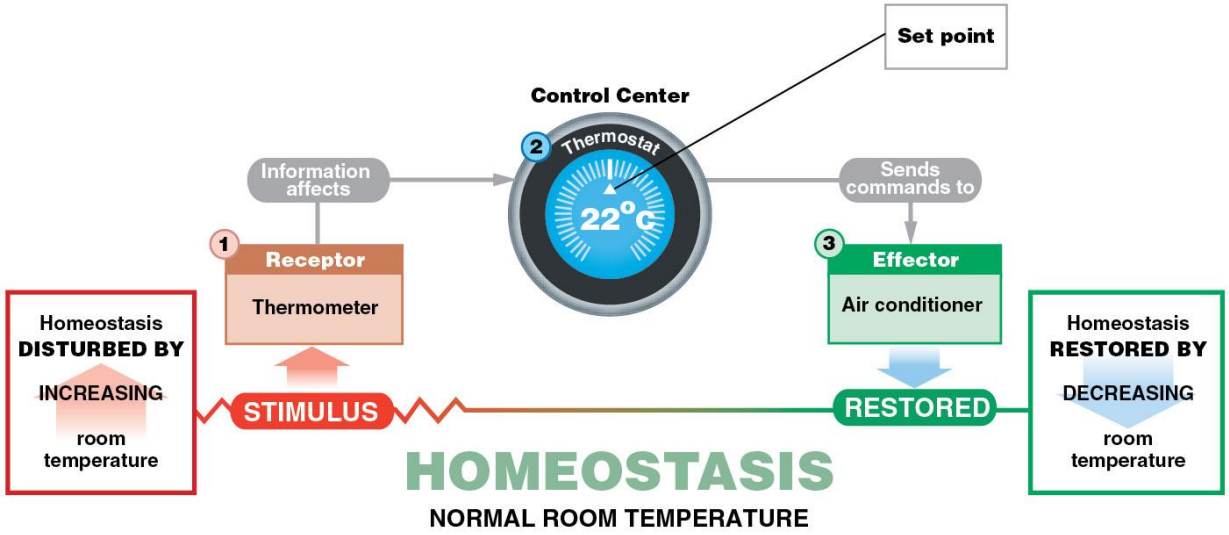
Homeostatic regulation

- Physiological adjustment to preserve homeostasis in variable environments

Module 1.17: Homeostatic regulation

Components of a homeostatic regulatory mechanism

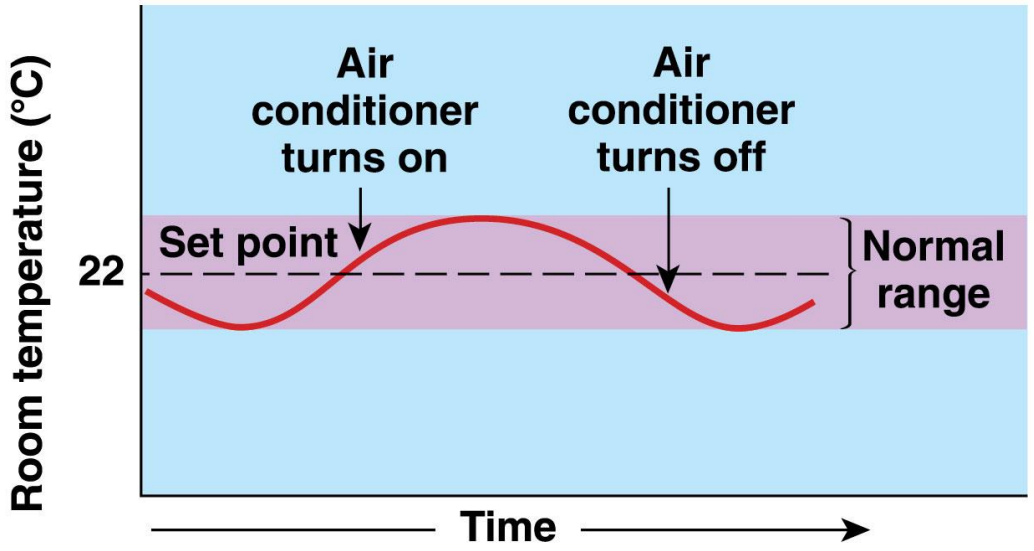
- **Receptor** (sensor)
  - Sensitive to environmental change
- **Control center** (integration center)
  - Processes information from the receptor and sends out commands
- **Effector**
  - Responds to commands opposing stimulus



Module 1.17: Homeostatic regulation

Homeostatic control is not precise

- Maintains a normal range around the **set point**
- Actual value oscillates
  - For example:
    - House thermostat set at 72ºF
    - Actual temperature in the house ranges a few degrees above and below that set point



Module 1.17: Review

A. Why is homeostatic regulation important to an organism?
B. Describe the three parts necessary for homeostatic regulation.
C. The Appendix contains tables of the normal physiological values regarding dissolved materials in various body fluids. Most of these values are listed as ranges, rather than averages. Why?

Learning Outcome: Describe the mechanisms of homeostatic regulation.

Module 1.18: Negative feedback provides stability …

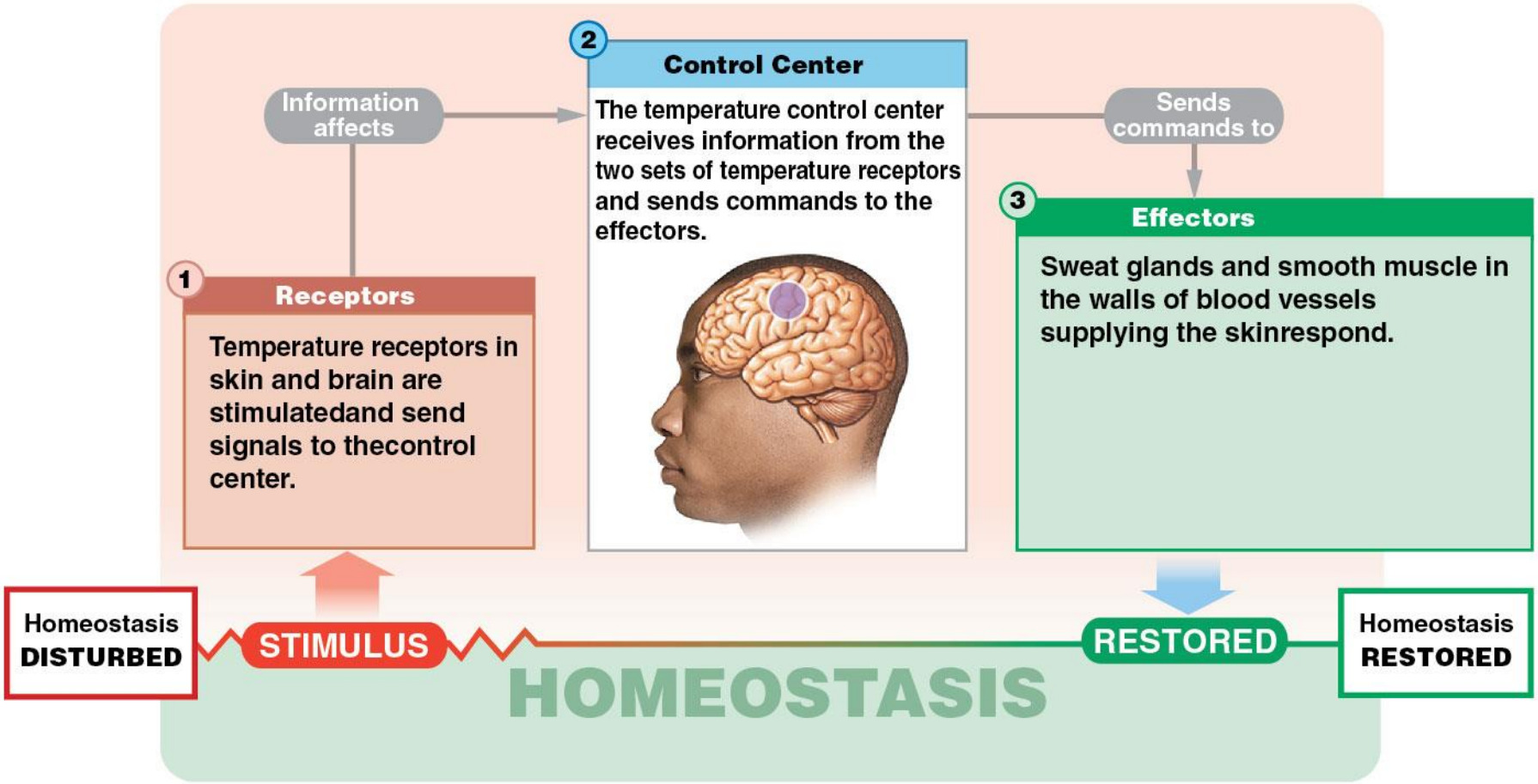
Feedback

- Stimulation of a receptor triggers response that changes environment at that receptor

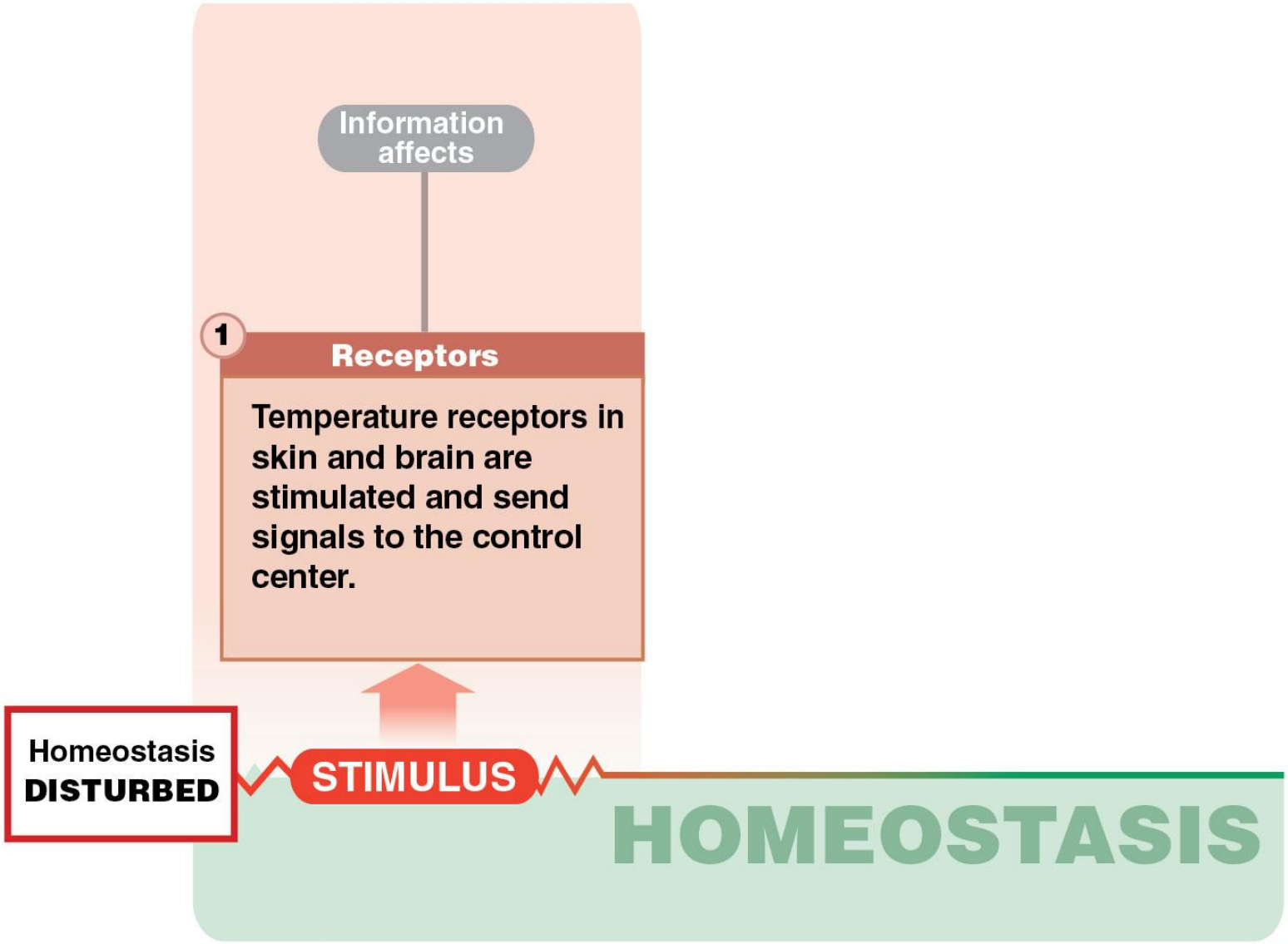
Negative feedback

- Effector opposes or negates the original stimulus
- Minimizes change
- Primary mechanism of homeostatic regulation in the body
- Dynamic process
  - Set point varies with varying environments and activity levels

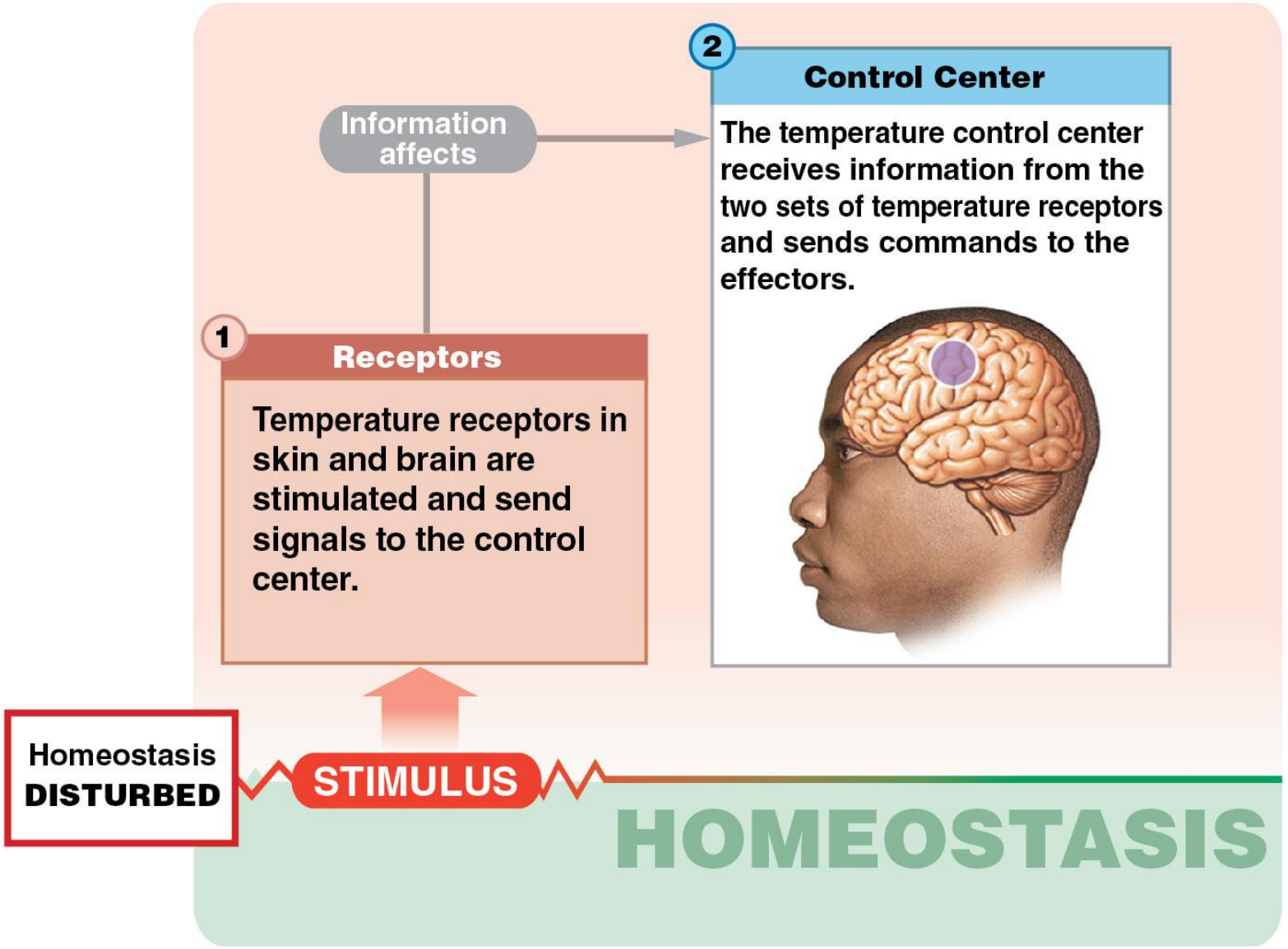
Negative feedback of temperature regulation



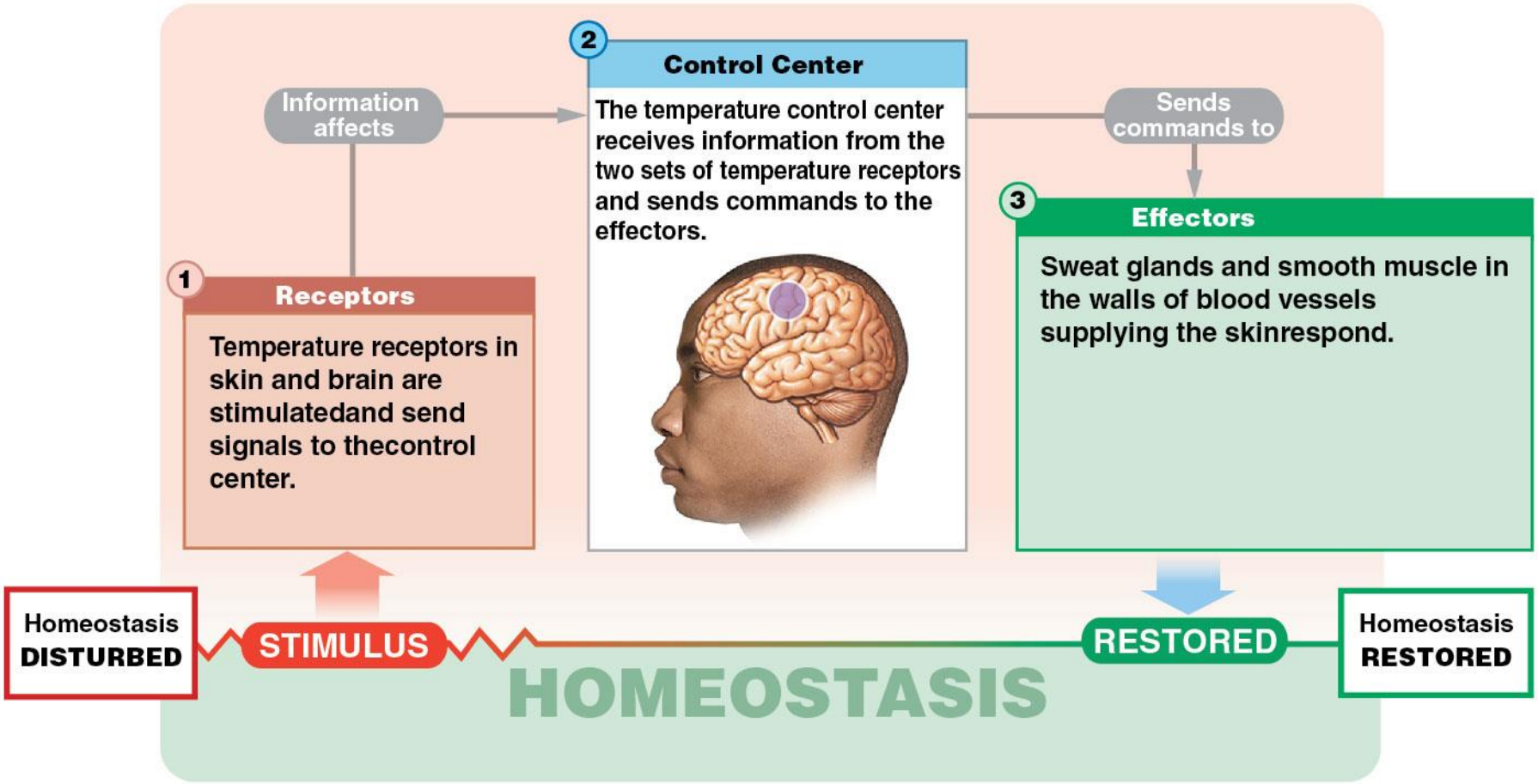
Negative feedback of temperature regulation



Negative feedback of temperature regulation

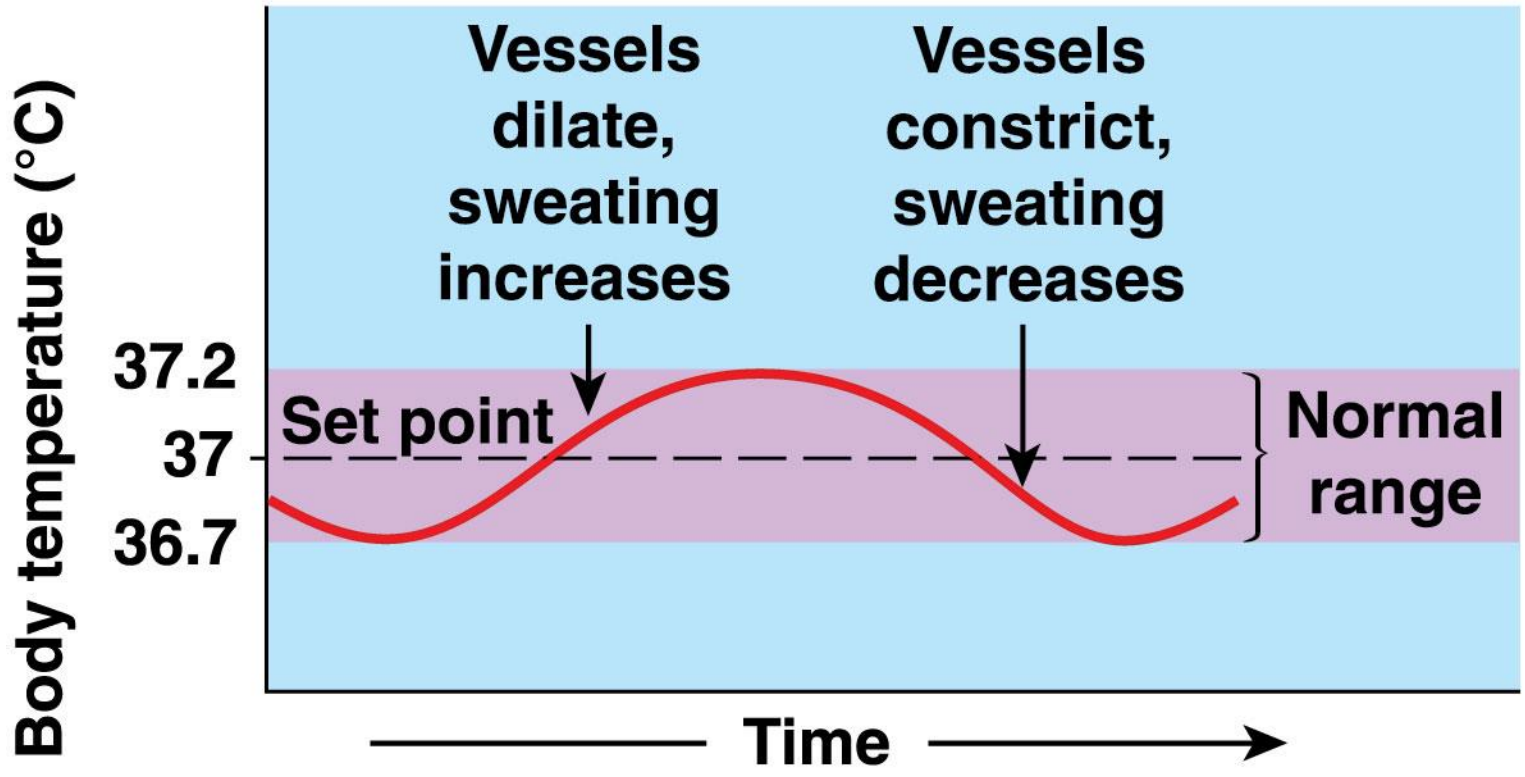


Negative feedback of temperature regulation



Module 1.18: Negative versus positive feedback

Over time in a warm environment, the body temperature can decline past the set point, due to sweat that has been secreted evaporating.



Module 1.18: … and positive feedback accelerates a process to completion

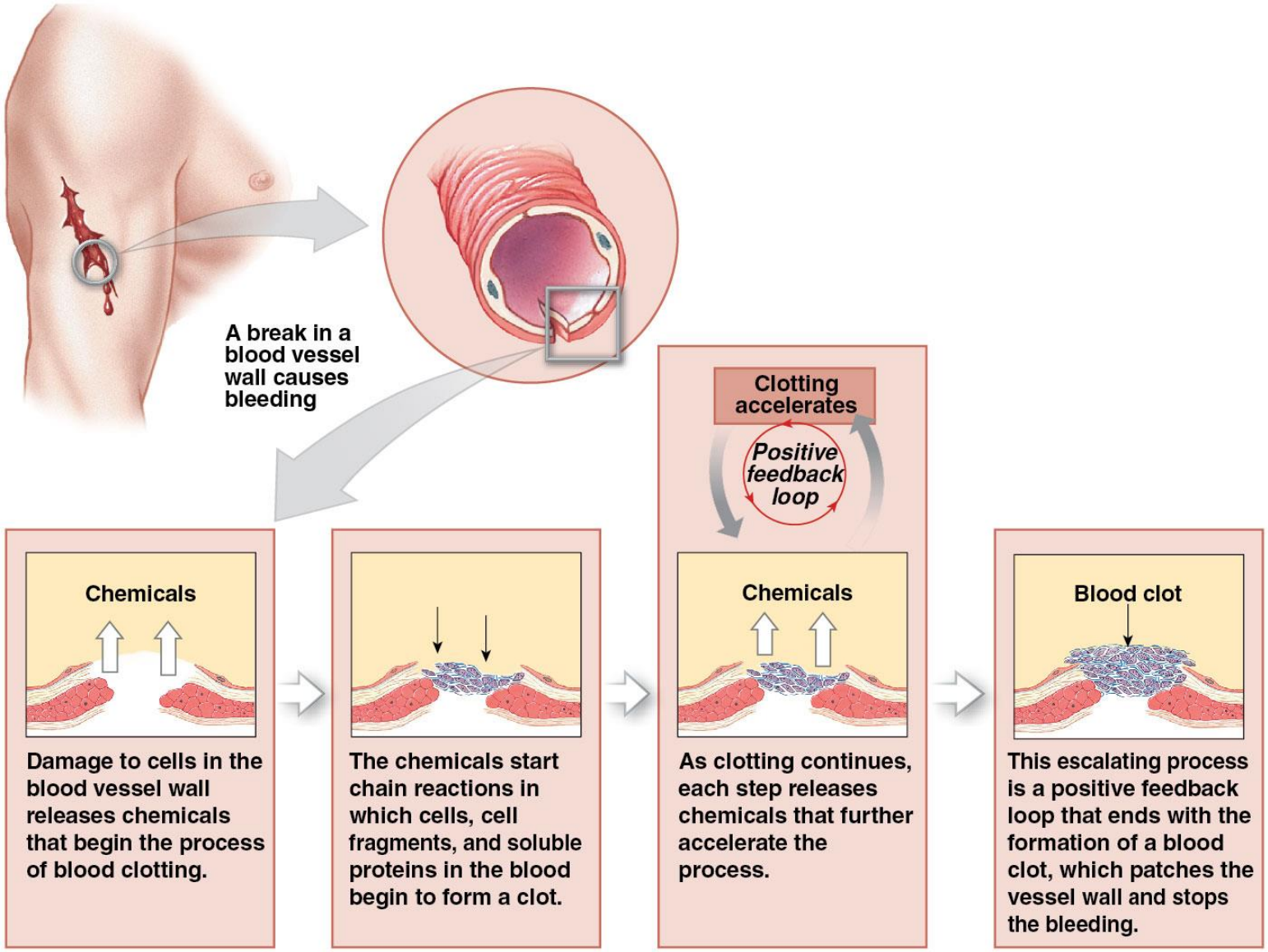
Positive feedback

- Stimulus produces a response that exaggerates or enhances the original change (rather than opposing it)
- Tends to produce extreme responses
- Does not restore homeostasis

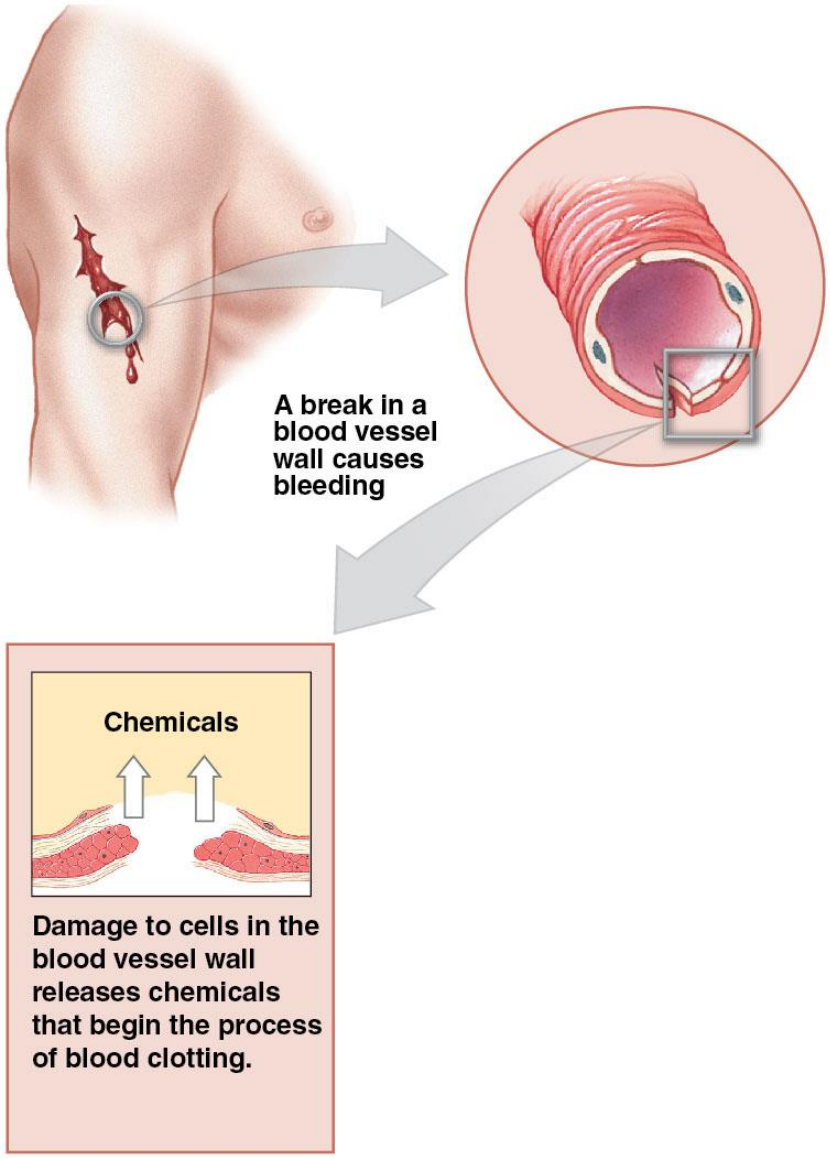
Positive feedback loop

- Escalating cycle
- Typically occurs when a potentially dangerous or stressful process must be completed quickly before the body can restore homeostasis

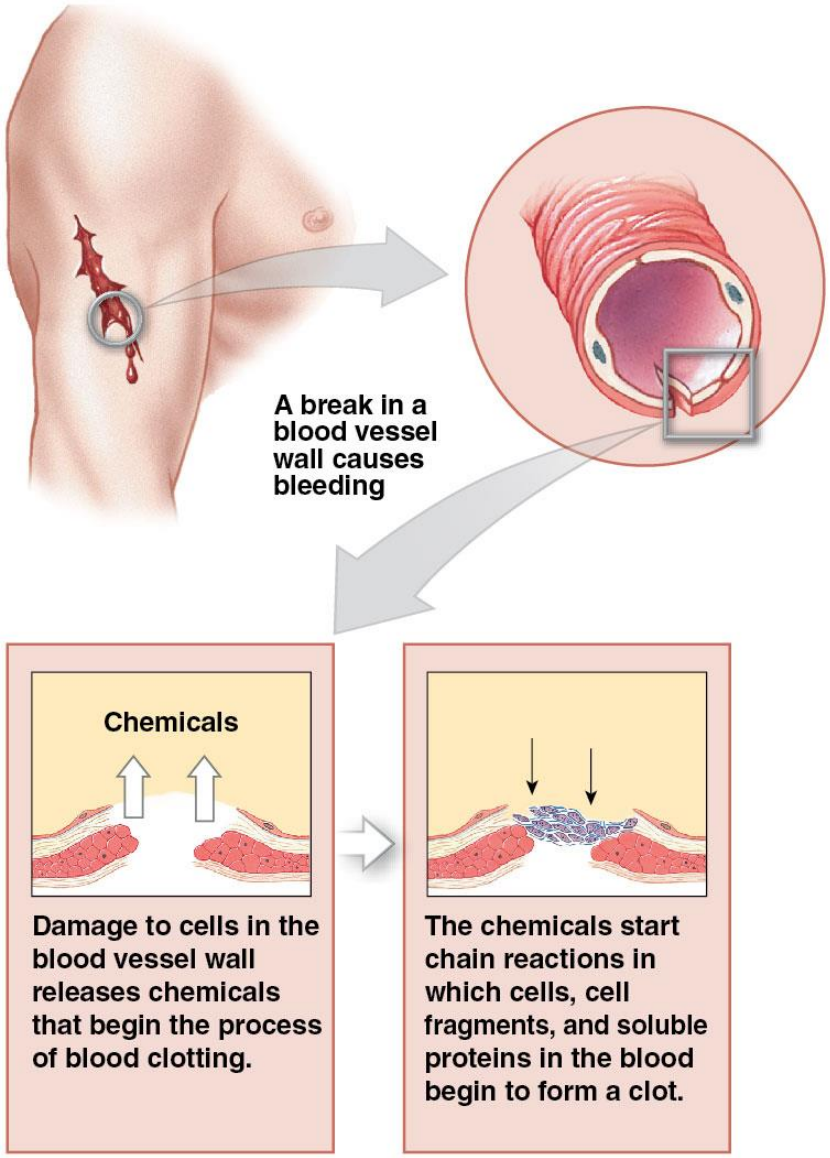
Blood clotting is positive feedback



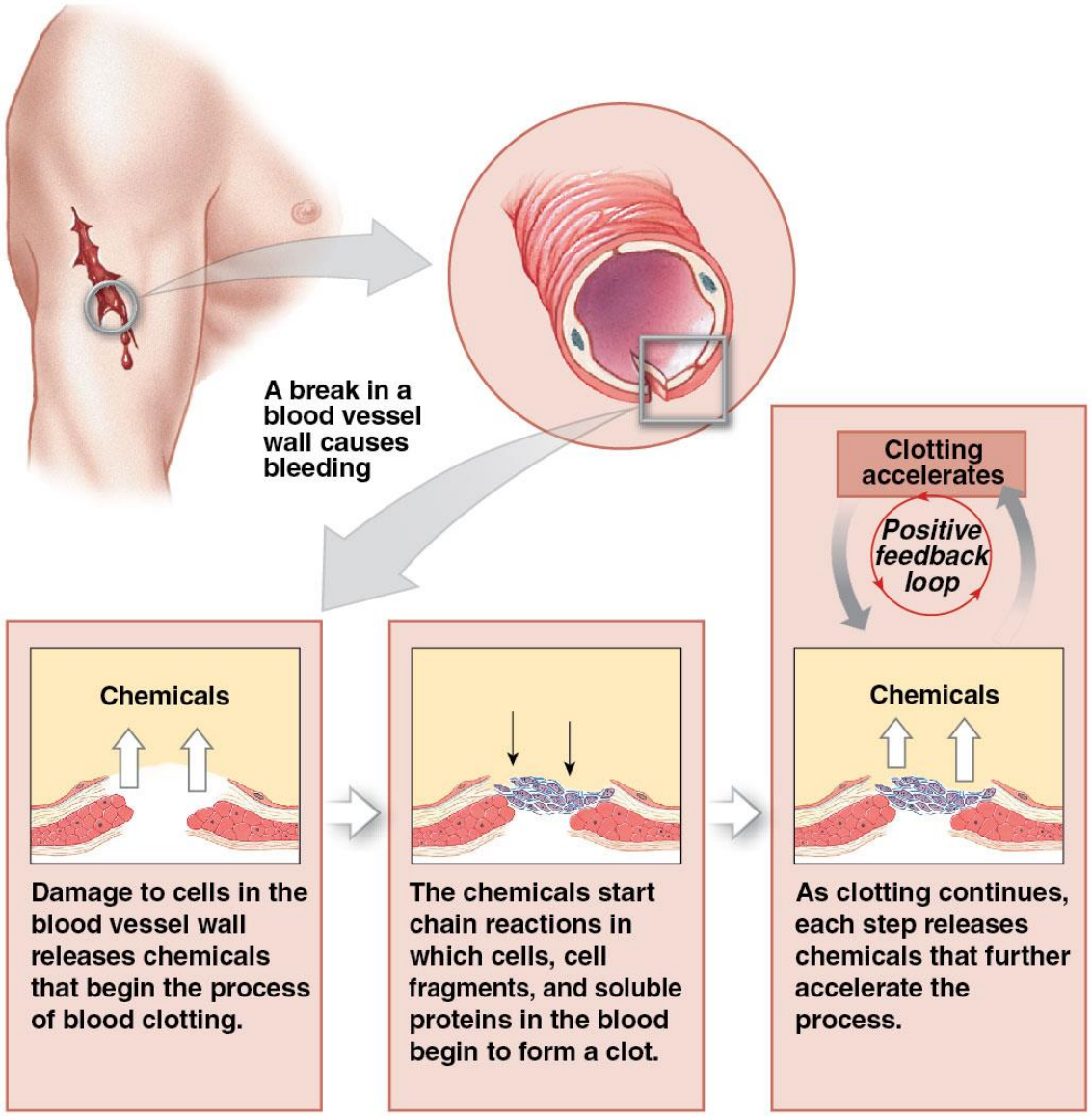
Blood clotting is positive feedback



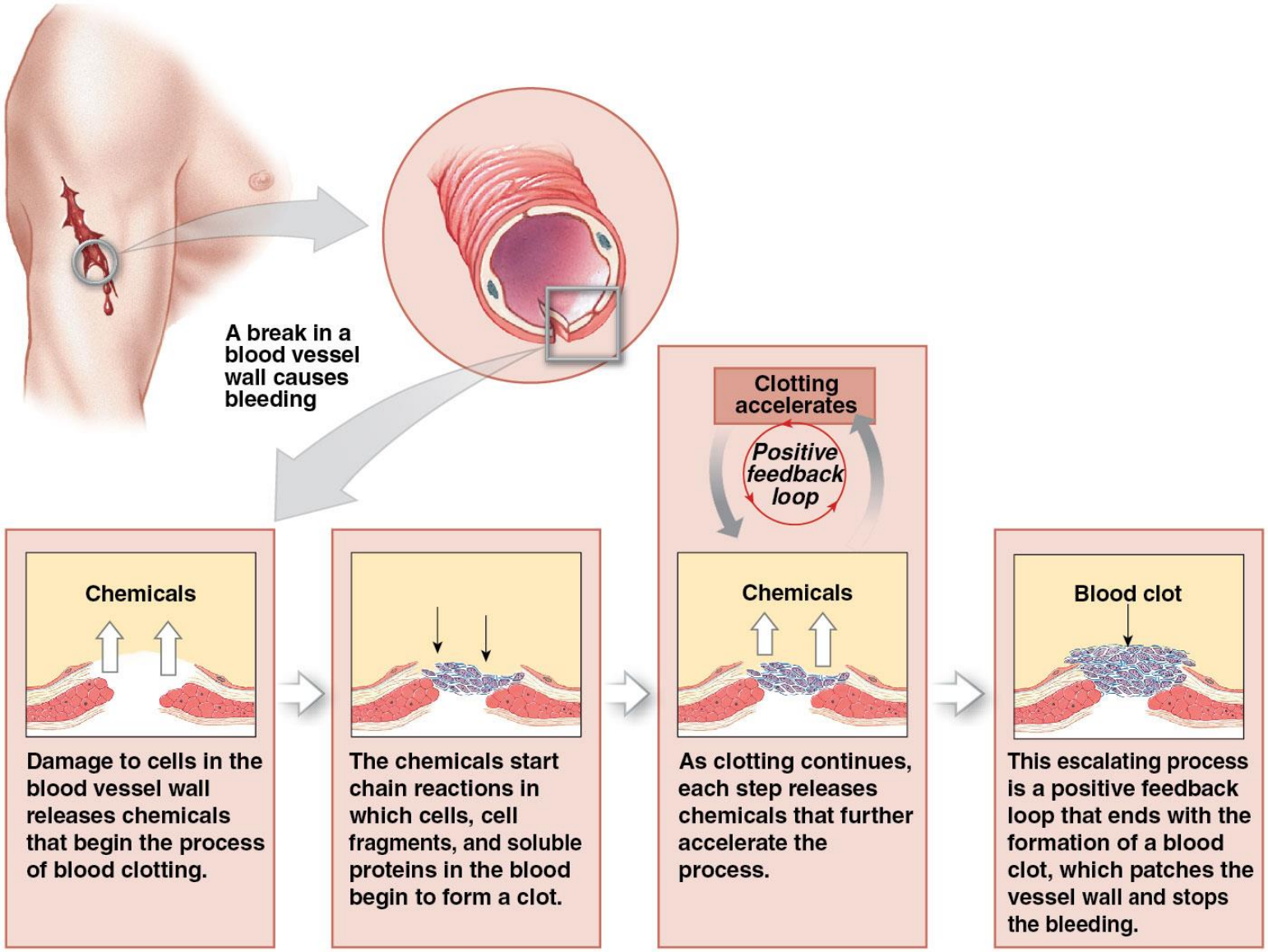
Blood clotting is positive feedback



Blood clotting is positive feedback



Blood clotting is positive feedback



Module 1.18: Review

A. Explain the function of negative feedback systems, and give an example of homeostatic regulation by negative feedback in the body.
B. Why is positive feedback helpful in blood clotting but unsuitable for regulating body temperature?

Learning Outcome: Discuss the roles of negative feedback and positive feedback in maintaining homeostasis.

Section 4: Anatomical Terms

Learning Outcomes

1.19 Describe the history of anatomical terminology.

1.20 Use correct anatomical terms to describe superficial and regional anatomy.

1.21 Use correct directional terms and sectional planes to describe relative positions and relationships among body parts.

1.22 Identify the major body cavities of the trunk and the subdivisions of each.

Module 1.19: Anatomical terms have a long and varied history

Orientation to the body

- Landmarks around the body create a map for orientation
- Anatomy uses a special language, with many terms based on Latin or Greek words used by ancient anatomists
- Vocabulary continues to expand

Module 1.19: Anatomical terms

Some **eponyms** (things named after the discoverer or most famous victim of a disease) persist; many replaced by more precise terms

Eponym	Equivalent Term
Achilles tendon	Calcaneal tendon
Broca's area	Speech center
Eustachian tube	Auditory tube
Krebs cycle	Citric acid cycle

Module 1.19: Anatomical terms

History of anatomical studies

- Anatomical studies by medical professionals in a European university can be traced to University of Bologna in Italy
  - *Anatomia* text written by Mondino dei Liuzzi
- Anatomical study improved at University of Padua
  - *De Humani Corporis Fabrica* by Andreas Vesalius published in 1543
  - Served as early model for modern anatomy education

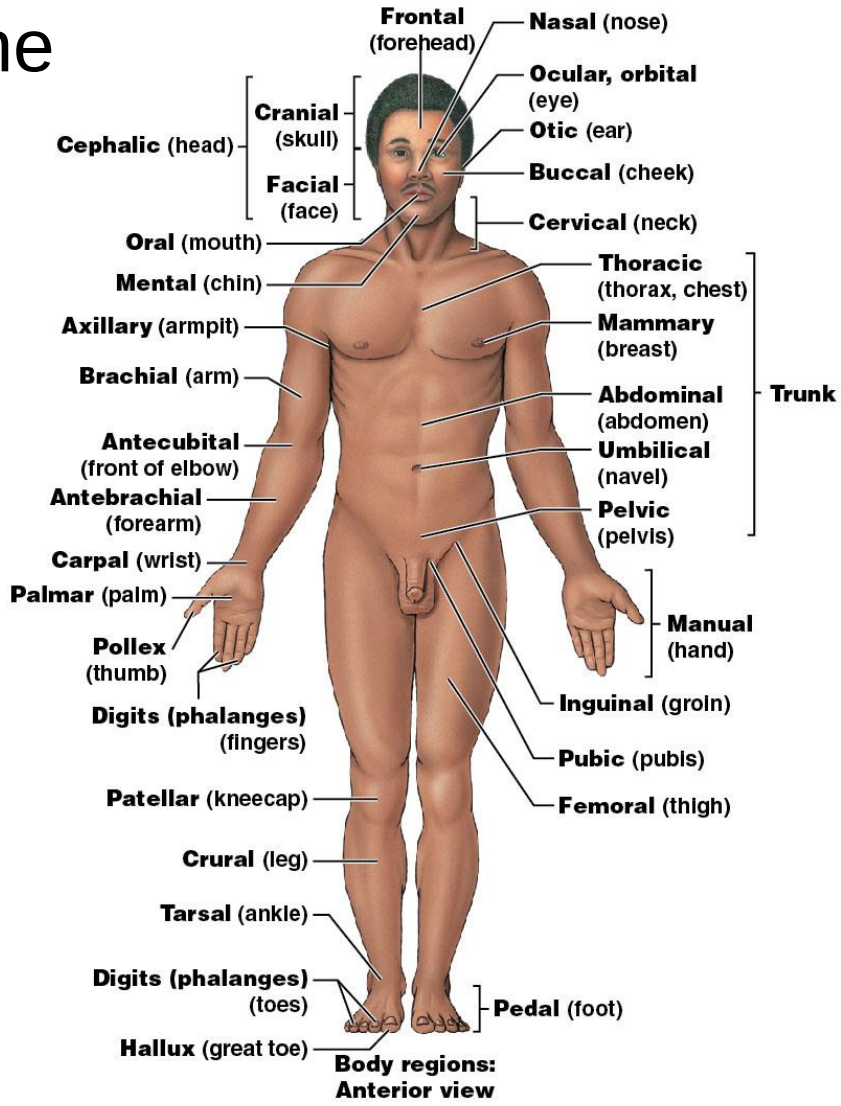
Module 1.19: Review

A. Which languages are the source of many modern anatomical terms?
B. Define the word *eponym*.
C. In what country was cadaver-based anatomy established as a discipline studied by medical professionals?

Learning Outcome: Describe the history of anatomical terminology.

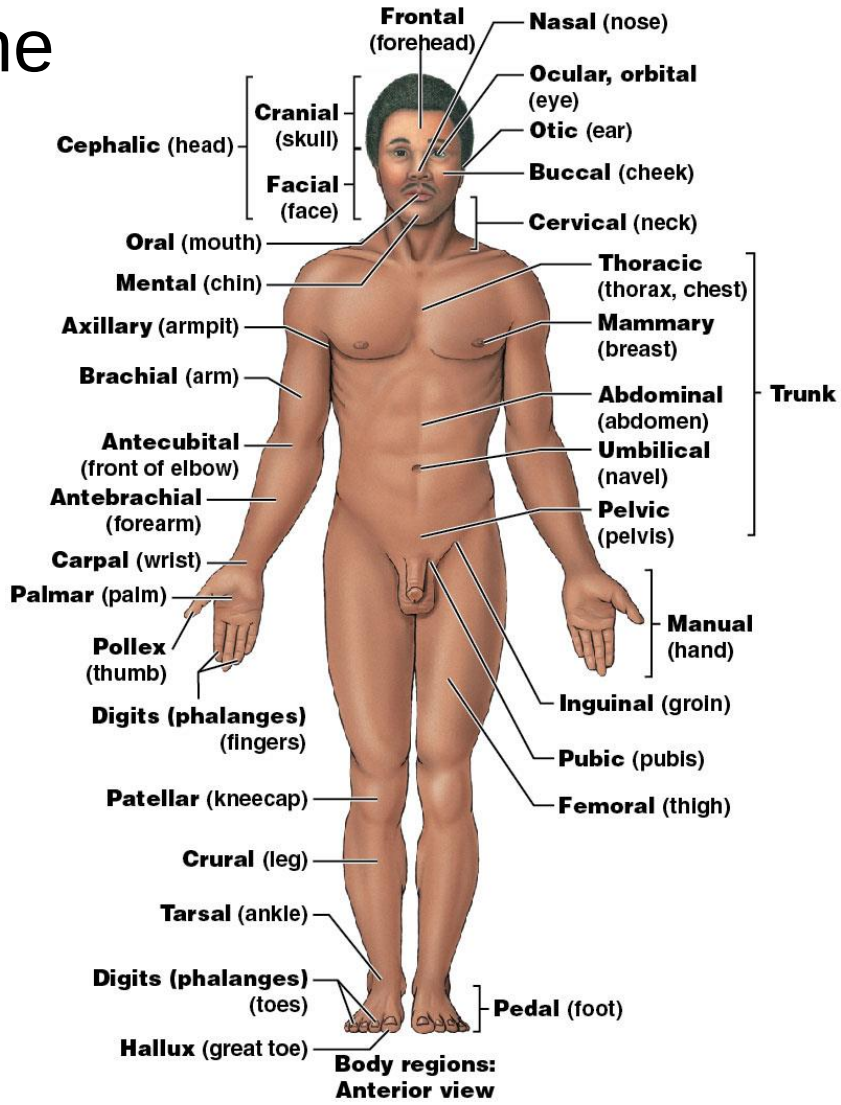
Module 1.20: Superficial anatomy and regional anatomy indicate locations on or in the body

- **Anatomical position** is the body:
  - Standing up
  - Hands at the sides
  - Palms facing forward
  - Feet together and facing forward

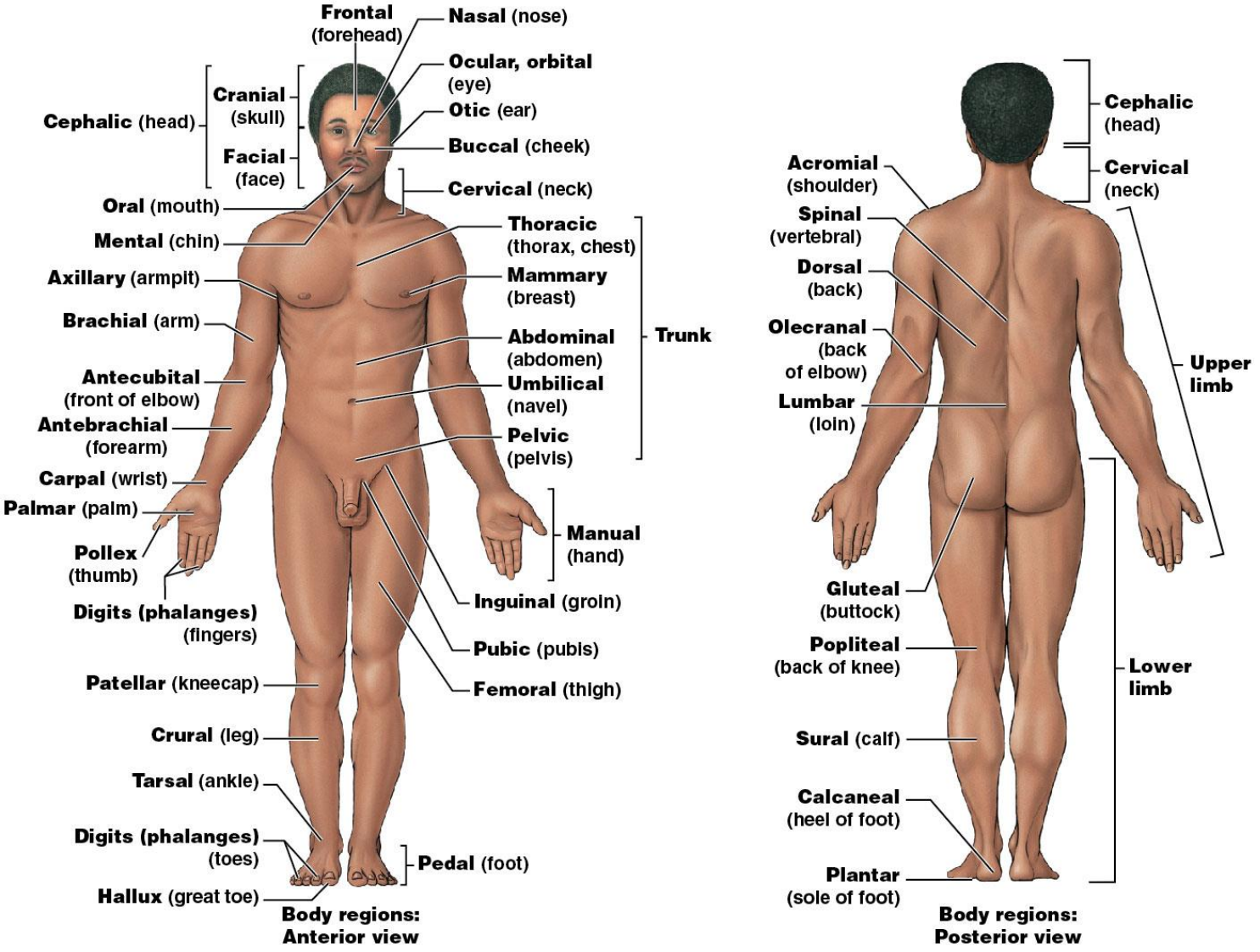


Module 1.20: Superficial anatomy and regional anatomy indicate locations on or in the body

- **Anatomical position** is the body (continued):
  - Eyes facing forward
  - Lying down in anatomical position
    - **Supine** when face up
    - **Prone** when face down



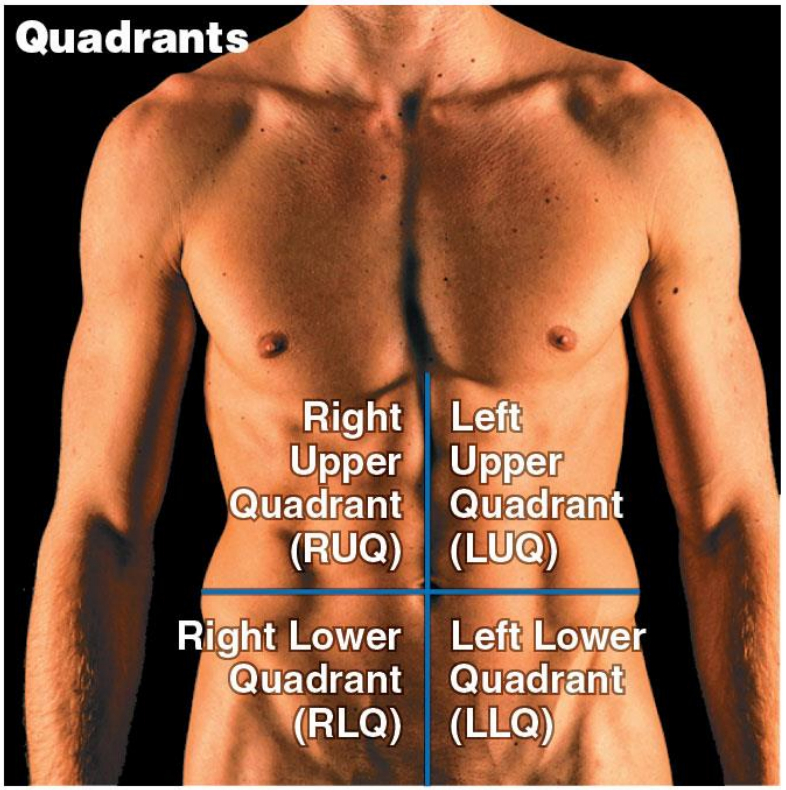
Common anatomical terms aid in effective communication



Module 1.20: Superficial and regional anatomy

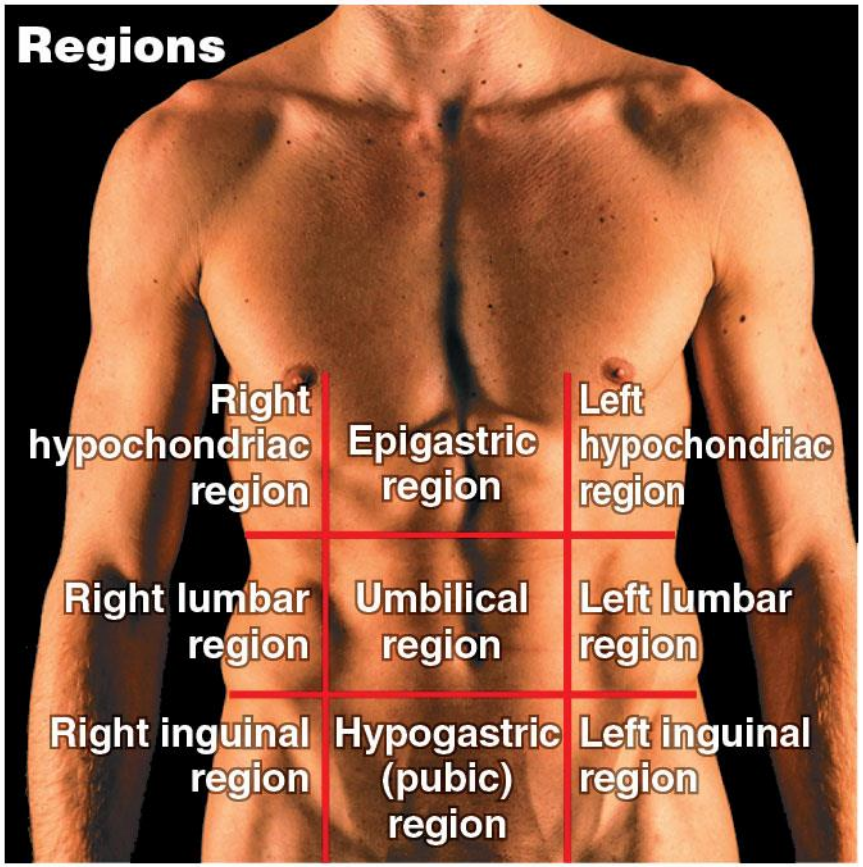
There are four **abdominopelvic quadrants**

- Formed by pair of imaginary perpendicular lines that intersect at navel
- Used by clinicians to describe locations of patient pains, aches, or injuries
- Location can help physicians determine possible cause of pain



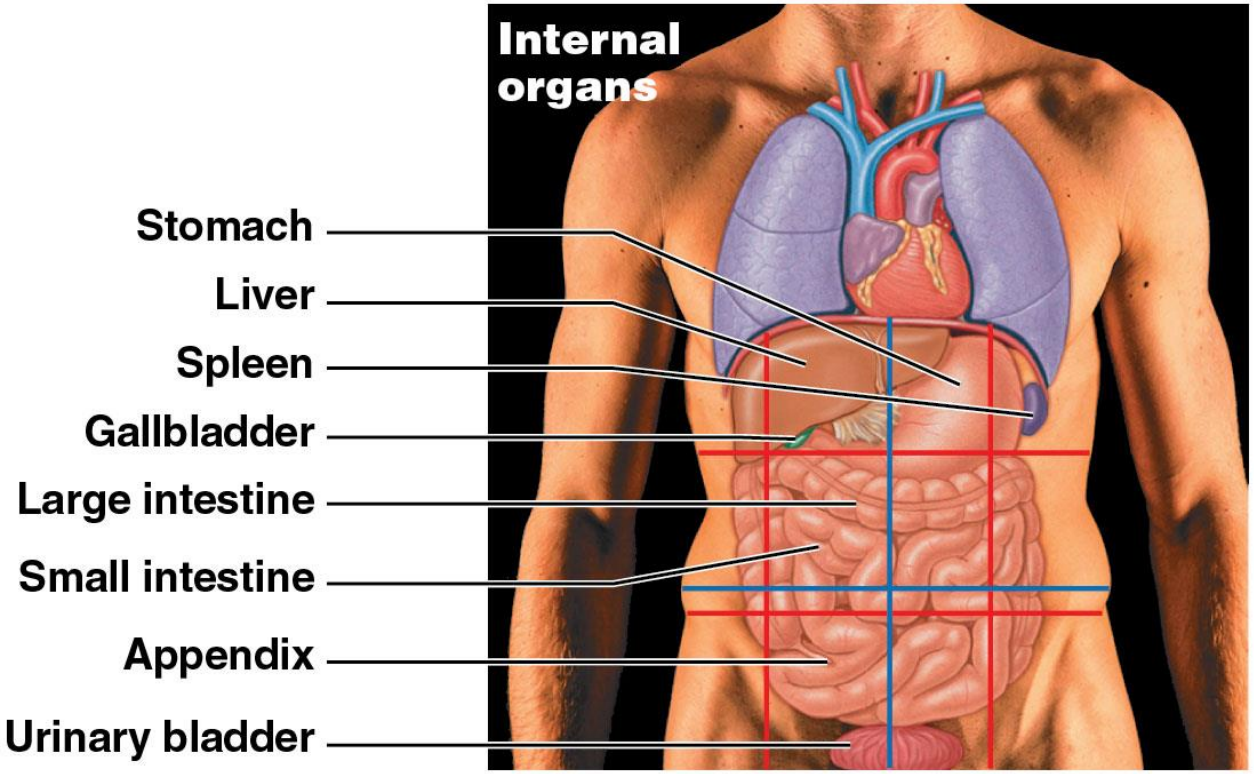
Module 1.20: Superficial and regional anatomy

- There are nine **abdominopelvic regions**
  - Used by anatomists to describe precise location and orientation of internal organs
  - More precise than abdominopelvic quadrants



Module 1.20: Superficial and regional anatomy

Taken together, the abdominopelvic regions and quadrants are able to help identify organ locations in the body



Module 1.20: Review

A. Describe a person in the anatomical position.
B. A massage therapist often begins a massage by asking clients to lie face down with their arms at their sides. Which anatomical term describes that position?
C. Contrast the descriptions used by clinicians and anatomists when referring to the positions of injuries or internal organs of the abdomen and pelvis.
D. What is the purpose of anatomical terms?

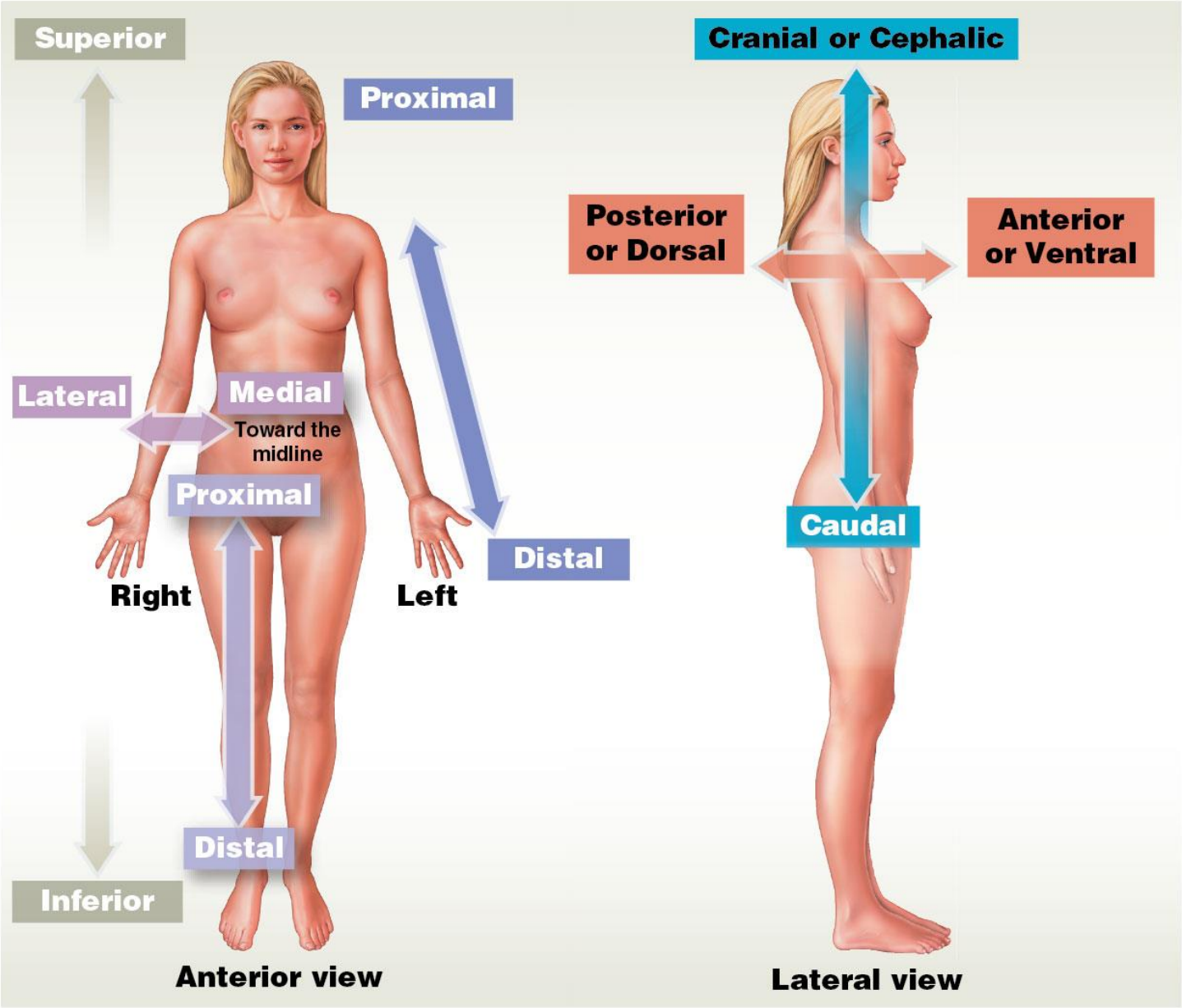
Learning Outcome: Use correct anatomical terms to describe superficial and regional anatomy.

Module 1.21: Directional terms and sectional planes describe specific points of reference

Directional terms

- Used to describe specific points of reference
- All directions utilize anatomical position as standard point of reference
- Many different terms, often interchangeable
  - **Anterior** or **ventral**
  - **Posterior** or **dorsal**
- Other directional terms:
  - **Superficial**—near the surface
  - **Deep**—toward interior of body

Module 1.21: Directional and sectional terms



Module 1.21: Directional and sectional terms

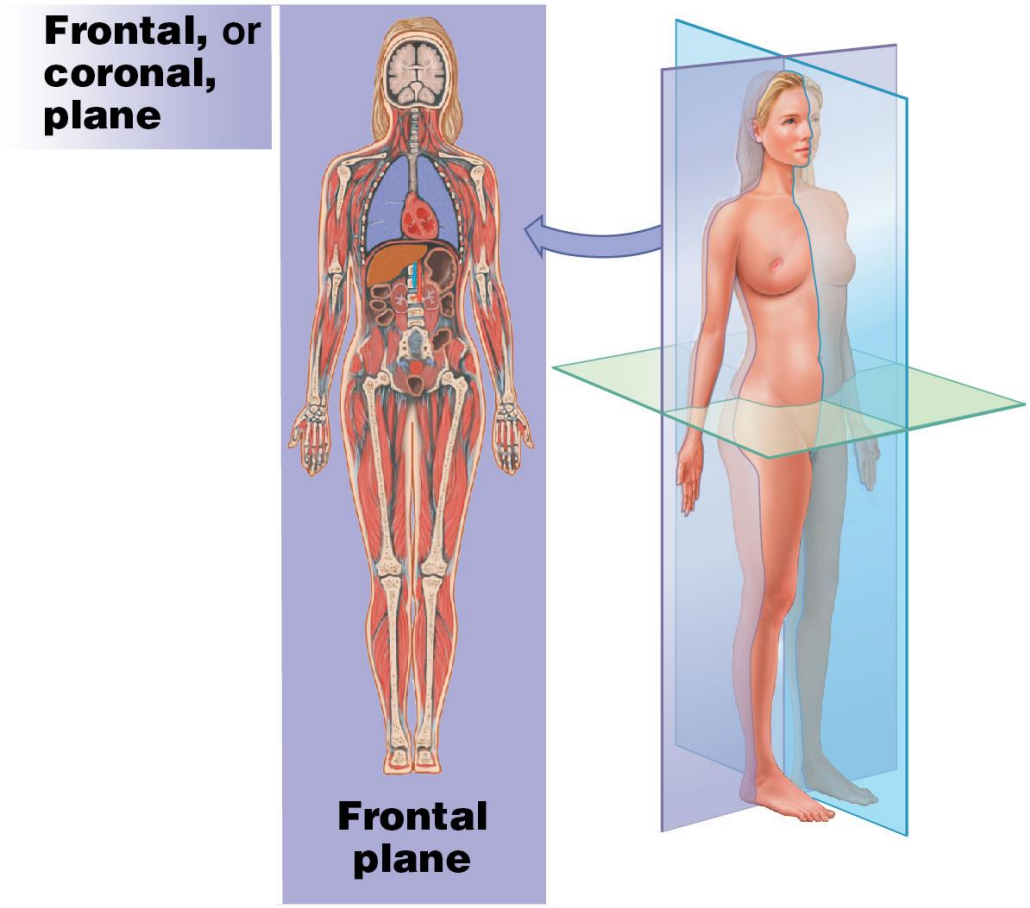
Sectional views

- Sometimes the only way to show the relationship between parts of a three-dimensional body
- Medical imaging techniques utilize sectional views
- Used for visualization purposes
- Important to consider when looking at microscope slides and CT or MRI scans
- Views change throughout structure

Module 1.21: Directional and sectional terms

Frontal or **coronal plane**

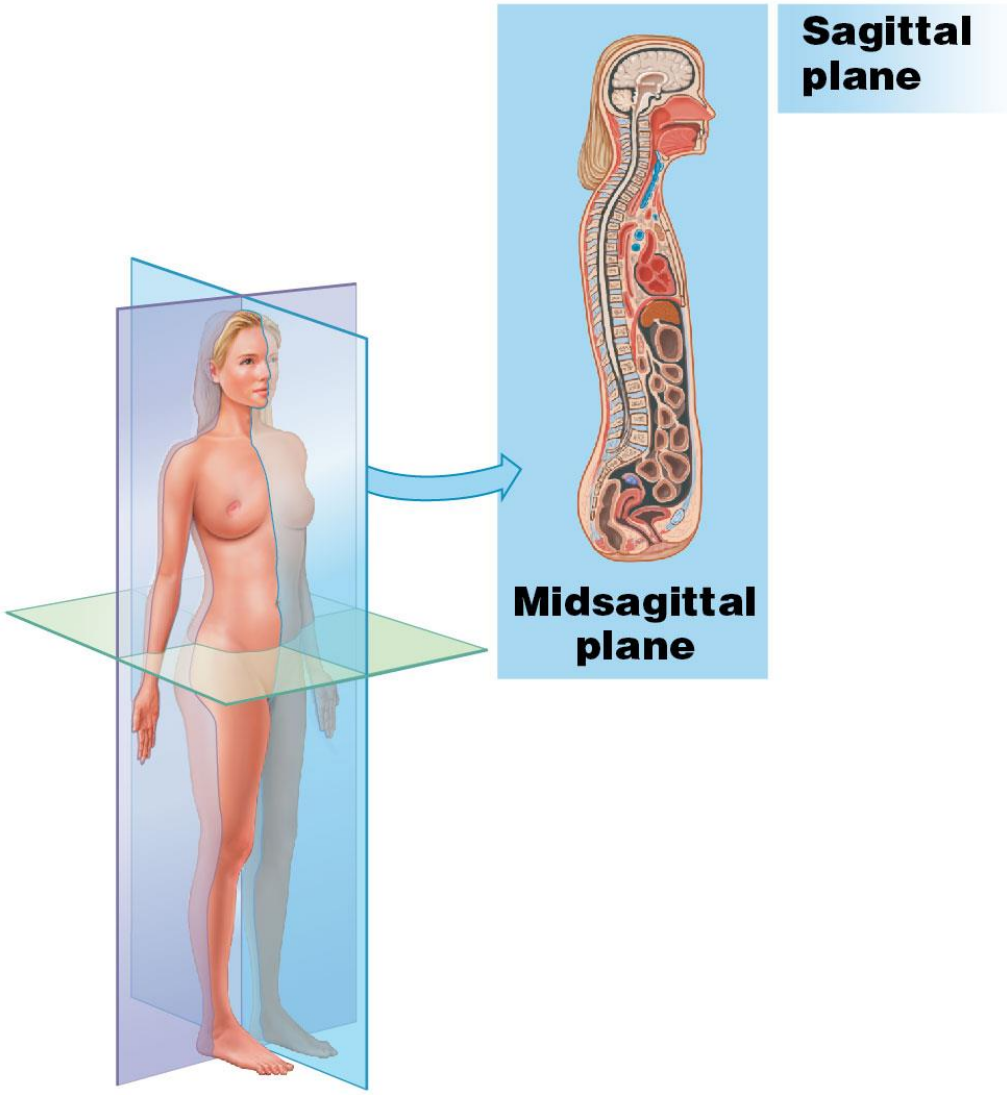
- Oriented parallel to long axis
- Divides anterior from posterior



Module 1.21: Directional and sectional terms

Sagittal plane

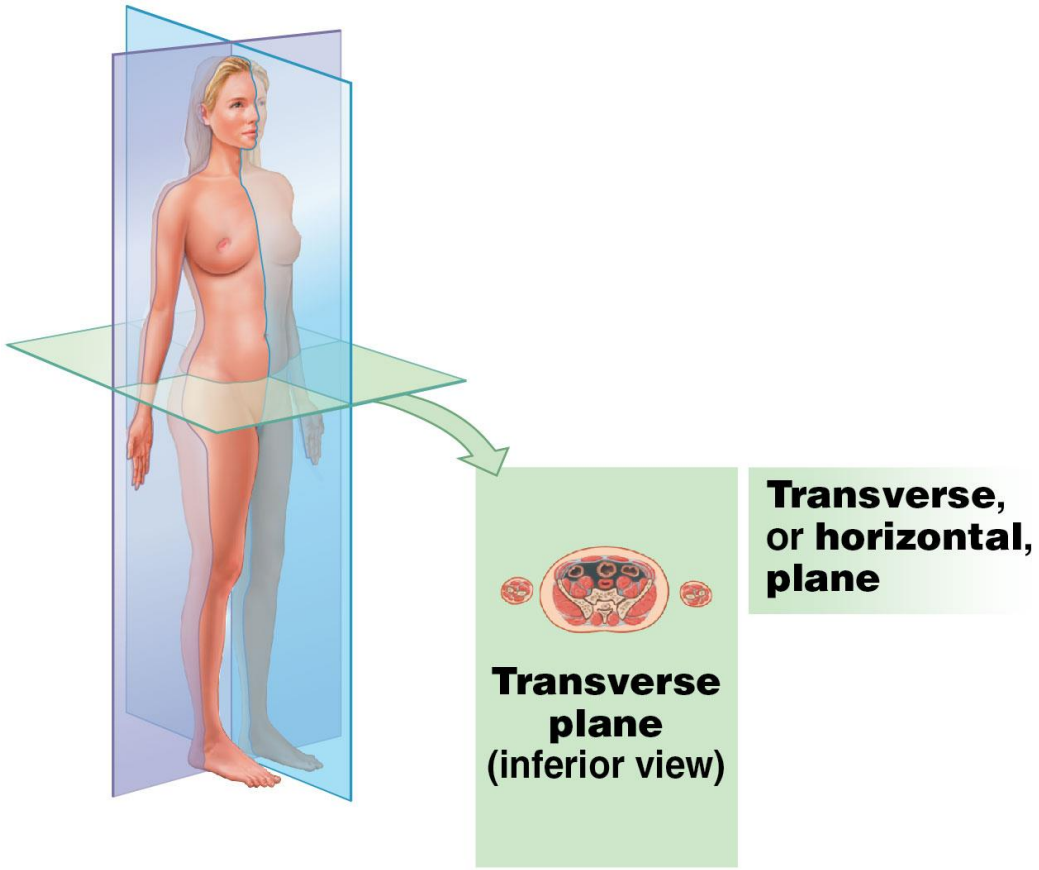
- Parallel to long axis
- Divides right from left
- Midsagittal (midline) and parasagittal (off midline)



Module 1.21: Directional and sectional terms

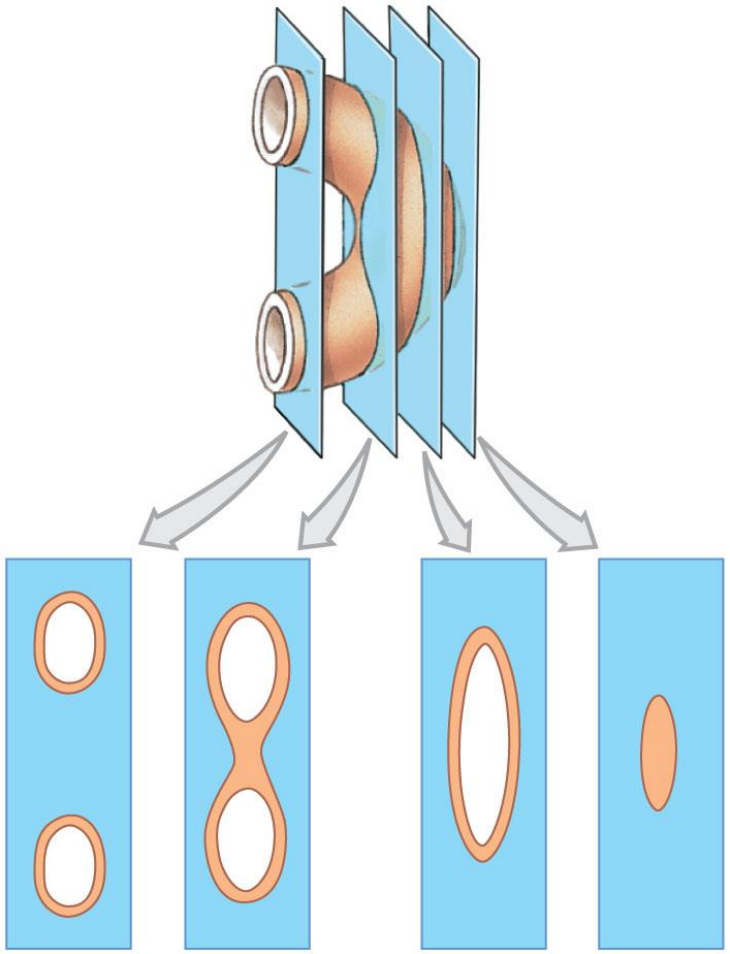
Transverse or horizontal plane

- Perpendicular to long axis
- Divides superior from inferior
- **Cross section**



Module 1.21: Directional and sectional terms

- Sectional planes are used for visualization
- Location of section can alter appearance of structure



Module 1.21: Review

A. In the anatomical position, describe an anterior view and a posterior view.
B. What type of section would separate
    1. the two eyes?
    2. the nose and two ears?
    3. the neck and navel?
C. What is the purpose of directional and sectional terms?

Learning Outcome: Use correct directional terms and sectional planes to describe relative positions and relationships among body parts.

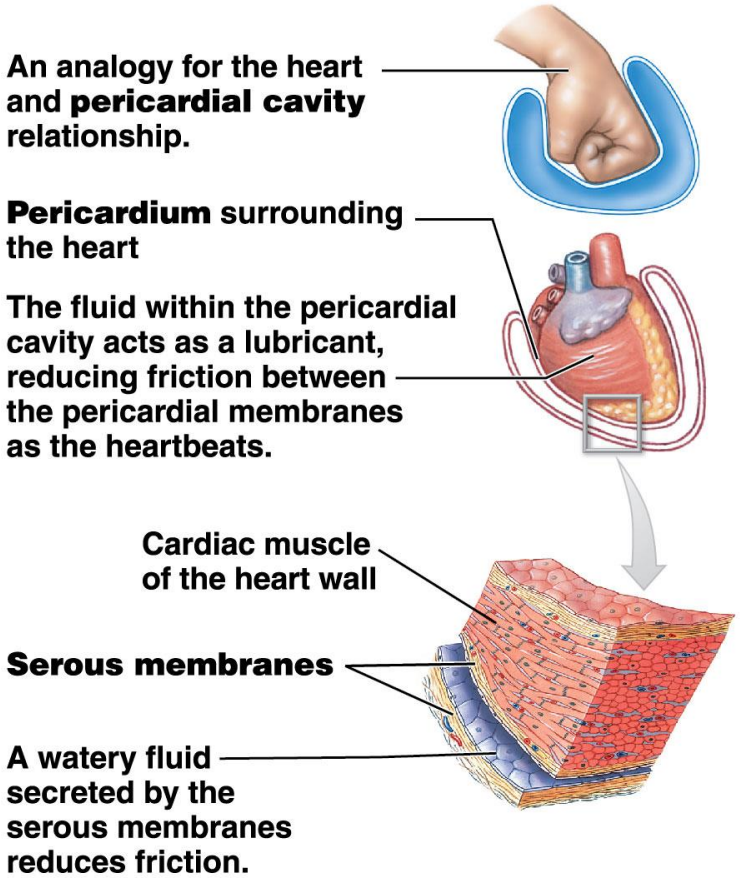
Module 1.22: Body cavities protect internal organs and allow them to change shape

Interior of the body is subdivided into regions established by the body wall

- Many organs within these regions suspended in closed fluid-filled chambers called **body cavities**
  - From common embryological origin
  - Covered by **serous membrane**
  - Two essential functions
    1. Protect organs from shocks and impacts
    2. Permit changes in size and shape of organs

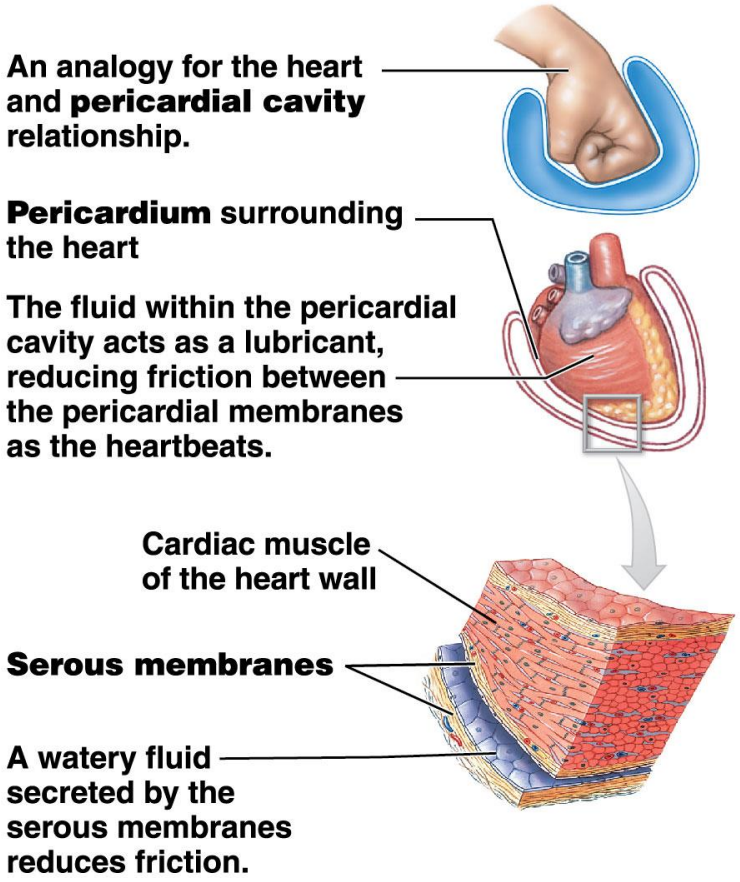
Module 1.22: Body cavities

- **Viscera**
  - Internal organs partially or totally enclosed by body cavities
  - Connected to rest of body



Module 1.22: Body cavities

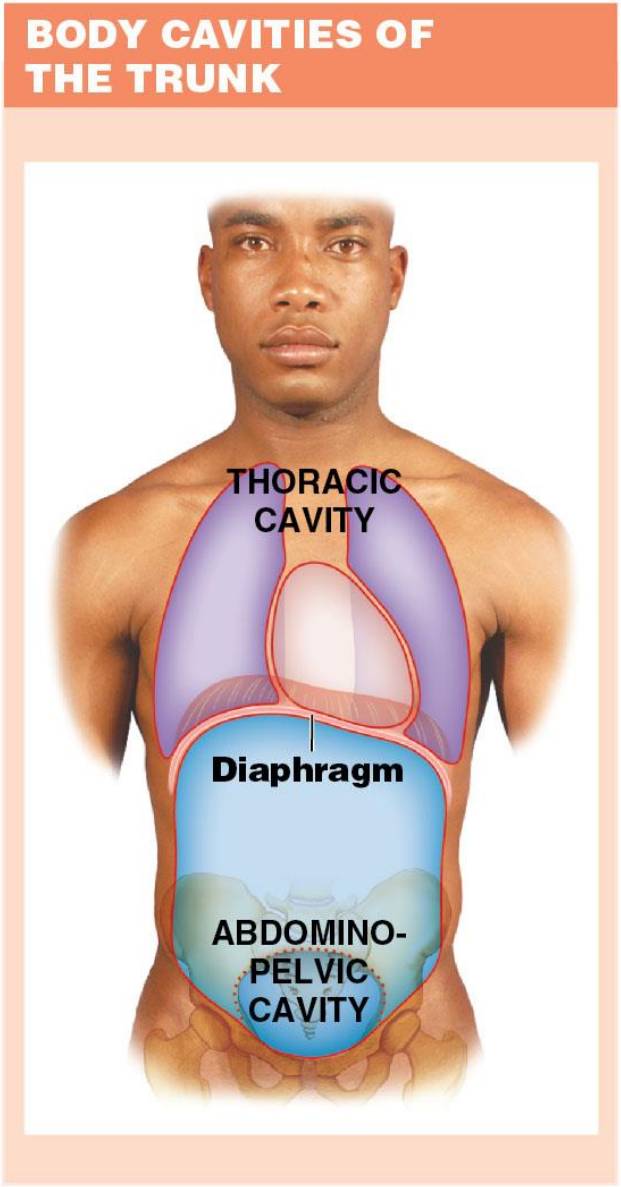
- **Viscera** (continued)
  - For example: the heart is surrounded by the **pericardial cavity**
    - **Pericardium** (*peri-*, around + *cardium*, heart)
      - Delicate **serous membrane** lining the pericardial cavity
      - Secretes watery fluid that keeps surfaces moist and reduces friction
    - Permits heart to change size and shape when beating



Module 1.22: Body cavities

Body cavities of the trunk

- Subdivided into two major cavities
- **Thoracic cavity**—everything deep to the chest
- **Abdominopelvic cavity**—all structures deep to abdominal and pelvic walls
  - These two cavities are separated by the diaphragm



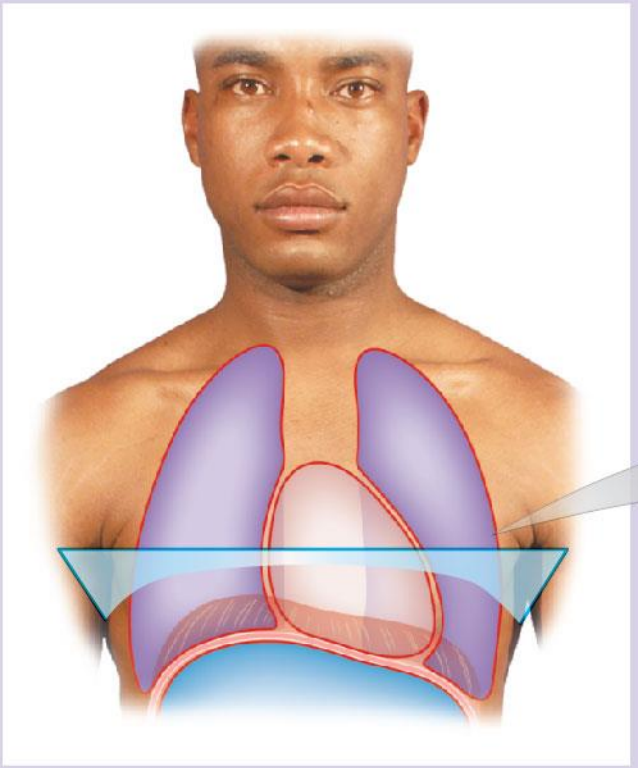
Module 1.22: Body cavities

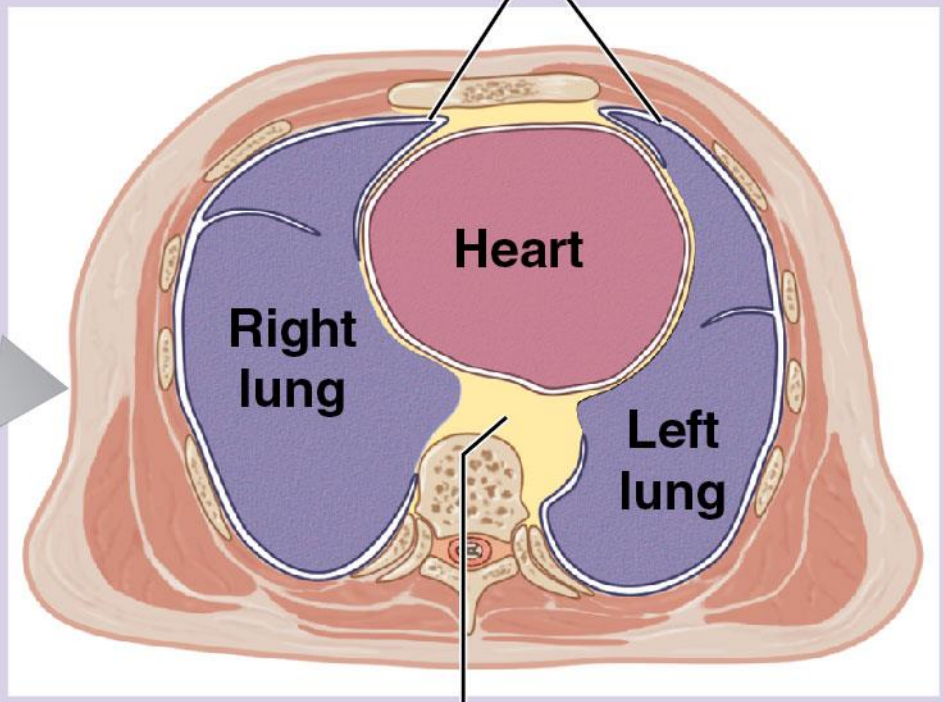
Thoracic cavity

- Everything deep to the chest wall
- Three subdivisions
  - Two **pleural cavities**
    - Lined by **pleura**
    - Contain the lungs
  - **Mediastinum**
    - Contains connective tissue and the **pericardial cavity** containing the heart

Module 1.22: Body cavities

THORACIC CAVITY





Module 1.22: Body cavities

Abdominopelvic cavity

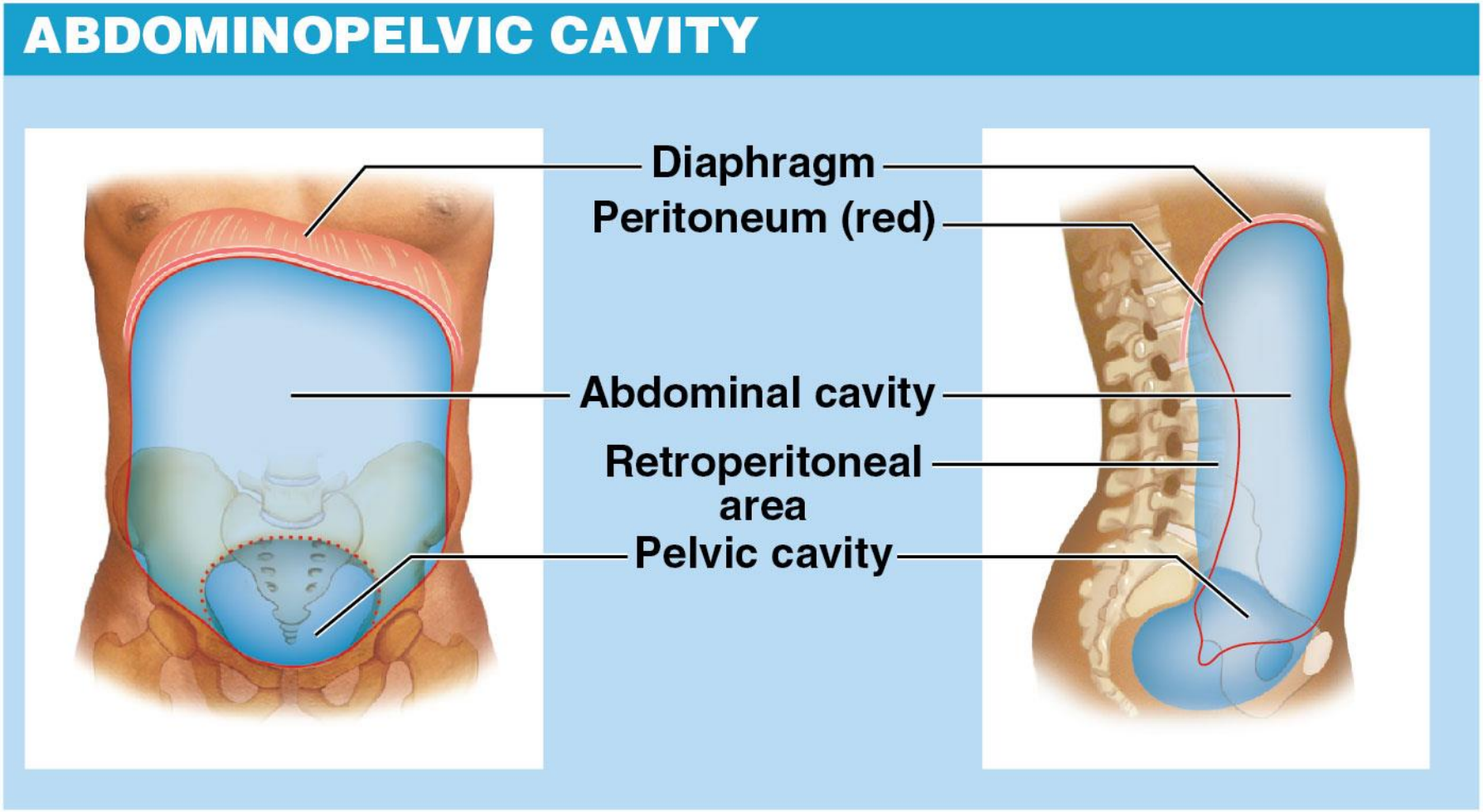
- Everything deep to abdominal and pelvic walls
- Divided into two portions
  1. **Abdominal cavity**
     - Contains many digestive glands and organs
  2. **Pelvic cavity**
     - Contains urinary bladder, reproductive organs, and last portion of the digestive tract

Module 1.22: Body cavities

Abdominopelvic cavity (continued)

- Within the abdominal cavity is the **peritoneal cavity** lined by a serous membrane called **peritoneum**
  - Some organs (e.g., kidneys) lie posterior to the peritoneal membrane
    - Position is called **retroperitoneal**
  - Some organs (e.g., urinary bladder) extend inferior to the peritoneal cavity
    - Position is called **infraperitoneal**

Module 1.22: Body cavities



Module 1.22: Review

A. Describe two distinctive features and two essential functions of true body cavities.
B. Identify the body cavities of the trunk.
C. If a surgeon makes an incision just inferior to the diaphragm, what body cavity will be opened?

Learning Outcome: Identify the major body cavities of the trunk and the subdivisions of each.