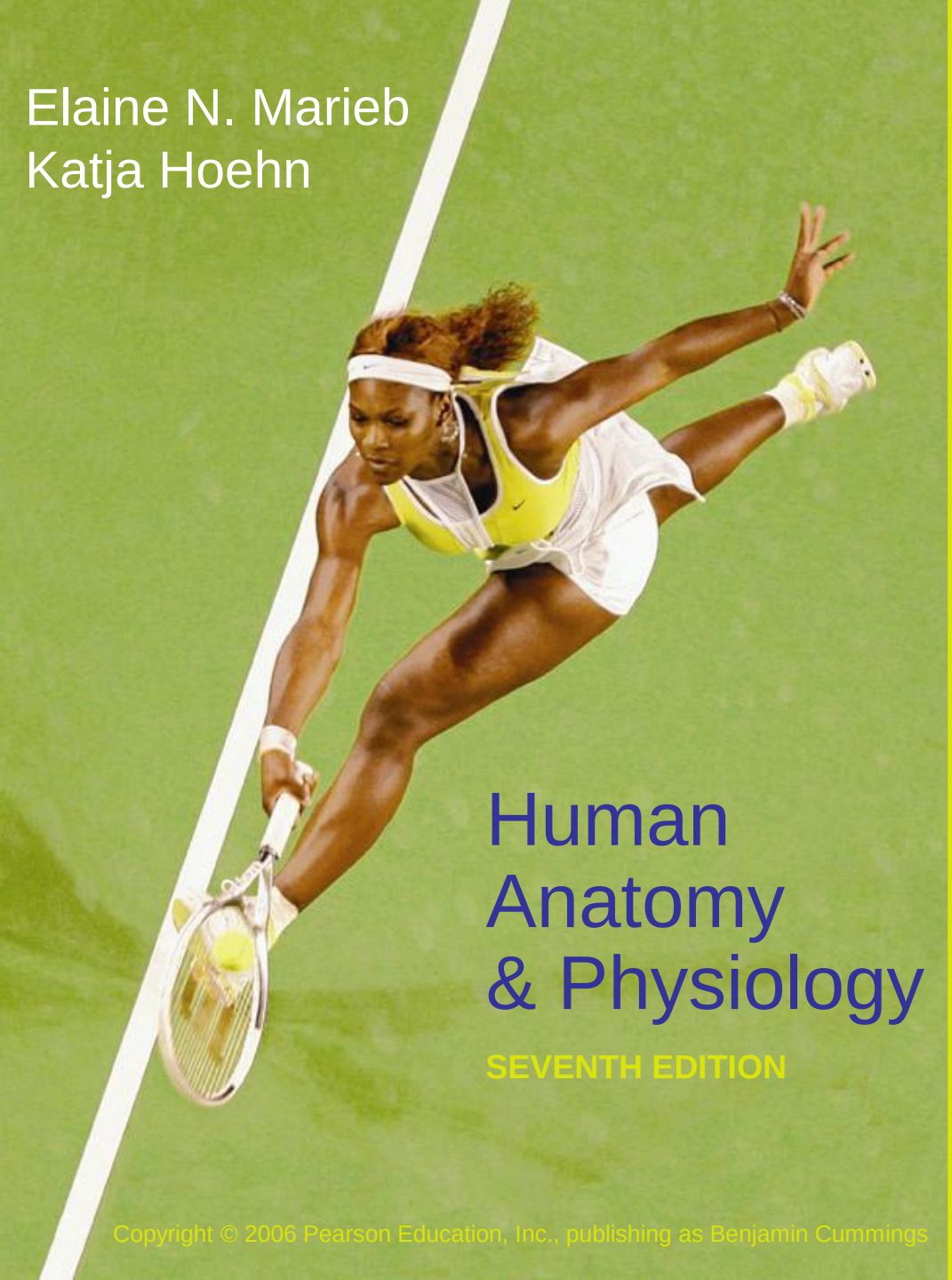


Elaine N. Marieb
Katja Hoehn

Human Anatomy & Physiology

SEVENTH EDITION

PowerPoint® Lecture Slides
prepared by Vince Austin,
Bluegrass Technical
and Community College

CHAPTER 1

The Human Body: An Orientation

Overview of Anatomy and Physiology

- Anatomy – the study of the structure of body parts and their relationships to one another
- Physiology – the study of the function of the body's structural parts

Gross Anatomy

- Studies large body structures
- Regional – all structures in one part of the body (such as the abdomen or leg)
- Systemic – study of a body system

Microscopic Anatomy

- Study of structures too small to see with naked eye
- Histology – study of tissues

Developmental Anatomy

- Traces structural changes throughout life
- Embryology – study of developmental changes of the body before birth

Some Specialized Branches of Anatomy

- Pathological anatomy – study of structural changes caused by disease
- Radiographic anatomy – study of internal structures visualized by X ray

Physiology

- Focuses on the functions/operations of the body and organ systems, often at the cellular or molecular level
- requires a knowledge of physics
  - For example it explains electrical currents, blood pressure, and the way muscle uses bone for movement

The Principle of Complementarity

- Function always reflects structure
- What a structure can do depends on its specific form

Levels of Structural Organization

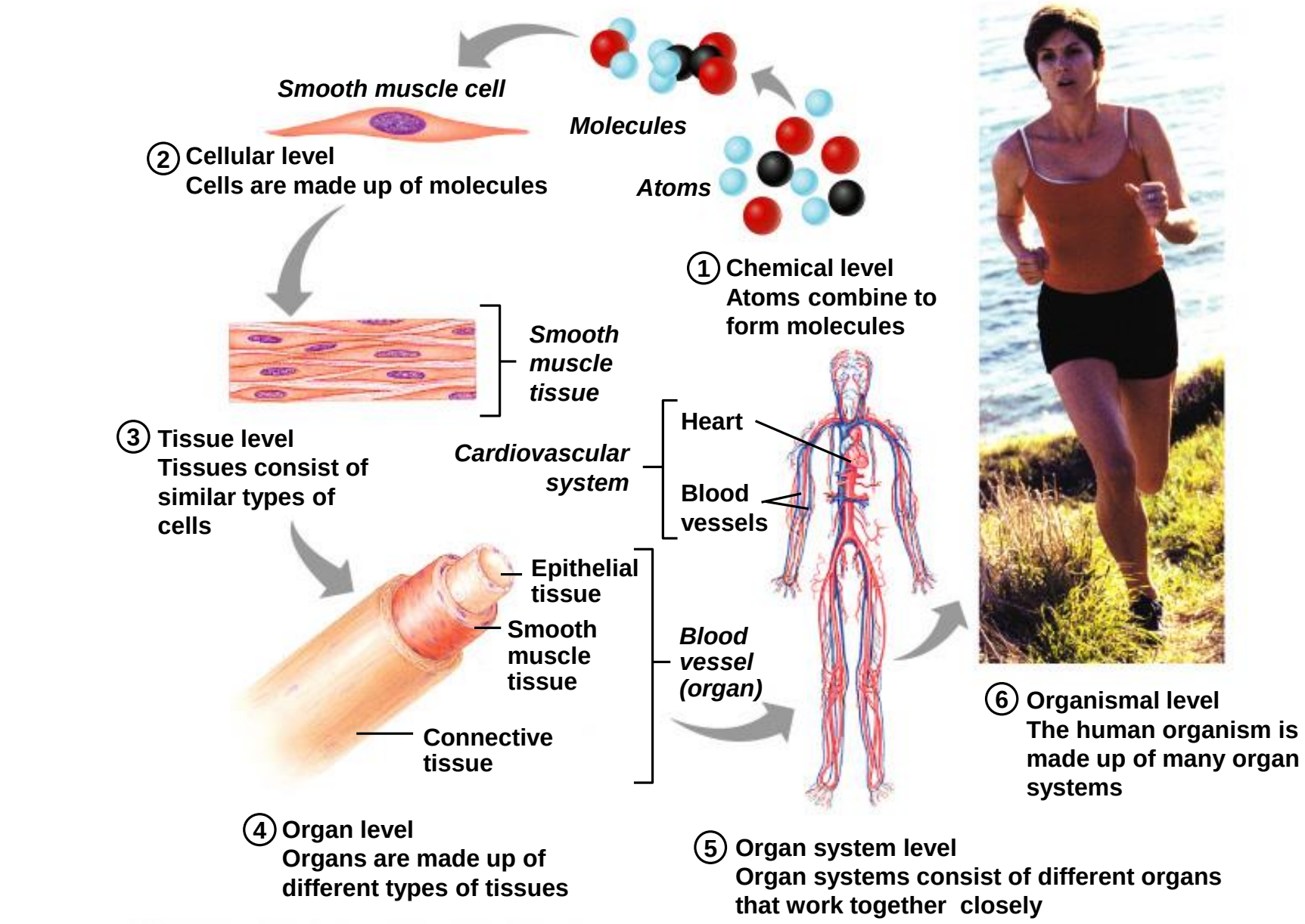


Figure 1.1

Levels of Structural Organization

- We will focus on the following:
- Cellular – cells are made of molecules
  - cells are the basic unit of structure and life
- Tissue – consists of similar types of cells
- Organ – made up of different types of tissues
- Organ system – consists of different organs that work closely together

Levels of Structural Organization

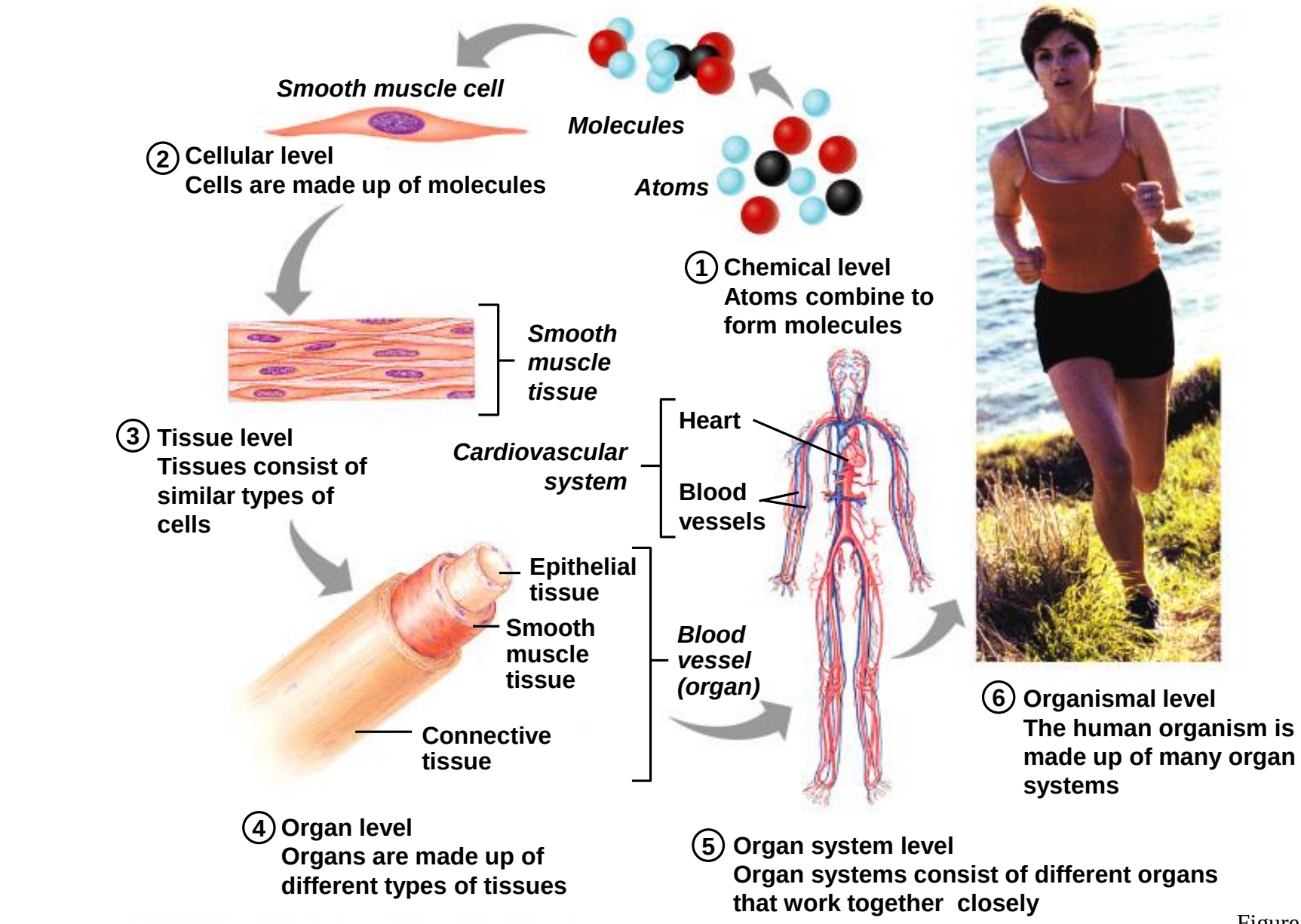


Figure 1.1

Body organ systems (notes page 15 front of diagram)

- There are 11 body organ systems
- There is another system but it is a cellular system that uses organs from other systems
- No body system works in isolation
  - Interrelationships/cooperation- body organ systems working together

Immune system

- The 12th body system is a cellular system only
- Protects the body from infectious foreign substances
- Only system that is a functional system
  - Uses cellular and molecular mechanisms
- It does require the organs of other systems:
  - integumentary, cardiovascular, lymphatic

Your task: Classwork/Homework

- As a pair or group of three complete the following:
- For the each of the remaining 11 organ systems:
  - Match and Name the system with each diagram
  - On the right side opposite each pair of diagrams:
    - Identify the major organs of the system
    - Describe the major function(s) of the system.
- This will be done on pages 16-27

Diagram info

- 1.3: pick a light color and trace over the nerves
- 1.9: color each gland the same color
- 1.10: Color all of the structures for this system the same color
- 1.11: Color all the muscles the same color
- 1.12: Color all the bones the same color

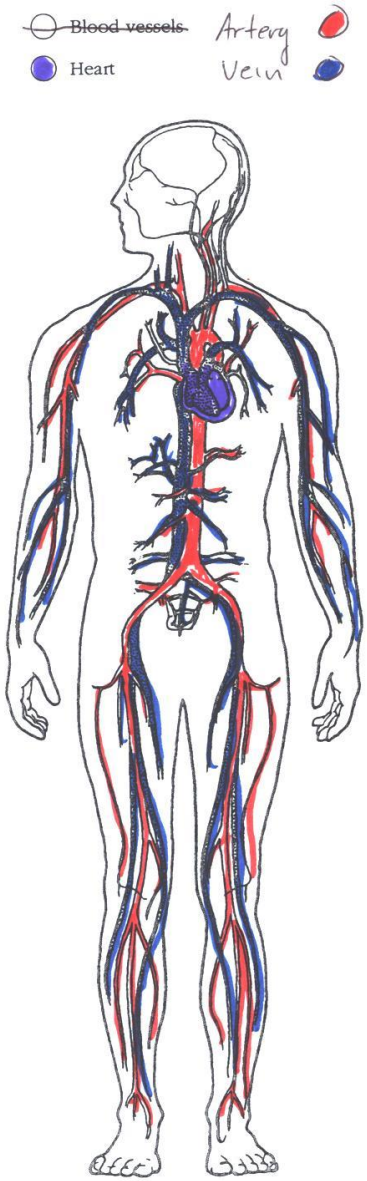


Figure 1.1

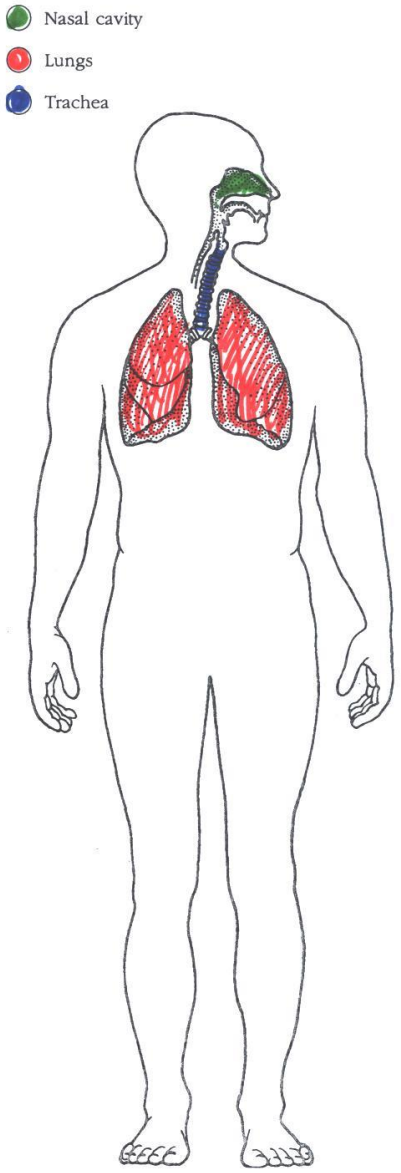
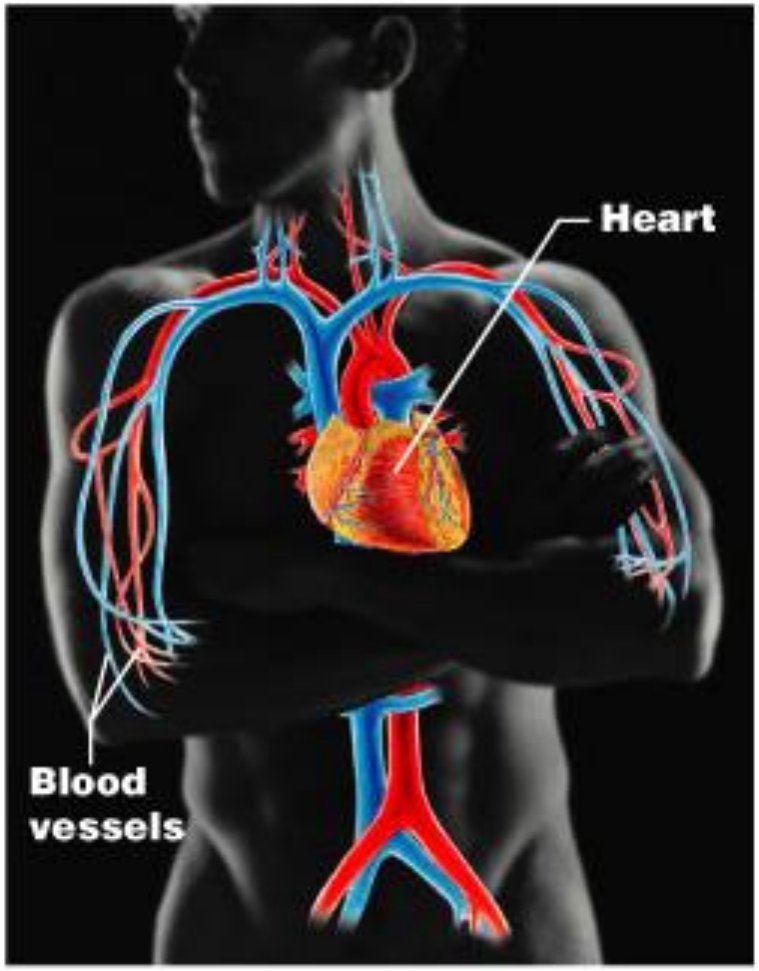


Figure 1.2

Cardiovascular System

- Cardiovascular system
  - Composed of the heart and blood vessels
  - The heart pumps blood
  - The blood vessels transport blood throughout the body

Cardiovascular System

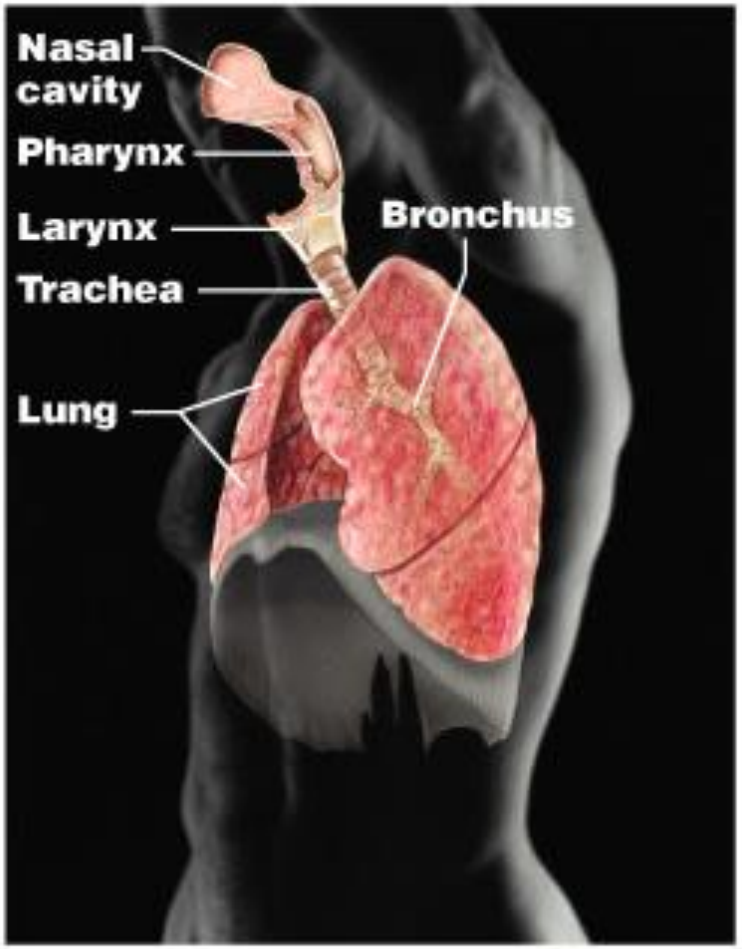


(f) Cardiovascular System
Blood vessels transport blood, which carries oxygen, carbon dioxide, nutrients, wastes, etc.; the heart pumps blood.

Respiratory System

- Respiratory system
  - Composed of the nasal cavity, pharynx, trachea, bronchi, and lungs
  - Keeps blood supplied with oxygen and removes carbon dioxide

Respiratory System



(h) Respiratory System
Keeps blood constantly supplied with oxygen and removes carbon dioxide; the gaseous exchanges occur through the walls of the air sacs of the lungs.

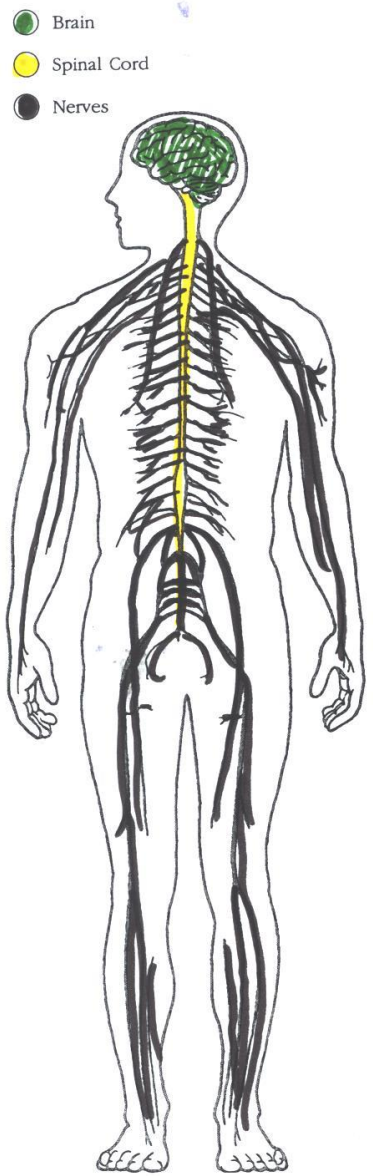


Figure 1.3

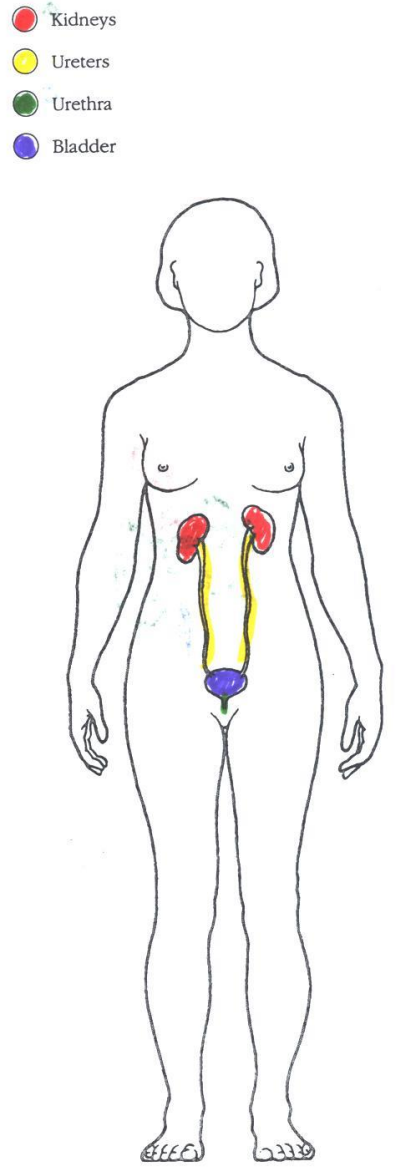
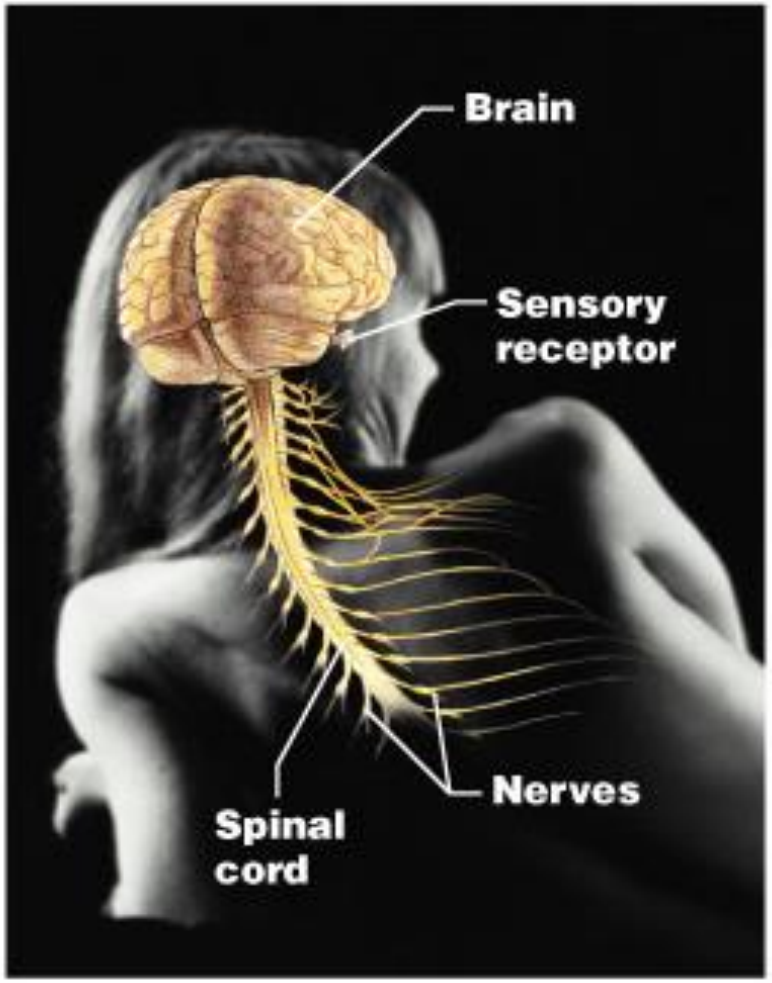


Figure 1.4

Nervous System

- Nervous system
  - Composed of the brain, spinal column, and nerves
  - Is the fast-acting control system of the body
  - Responds to stimuli by activating muscles and glands

Nervous System

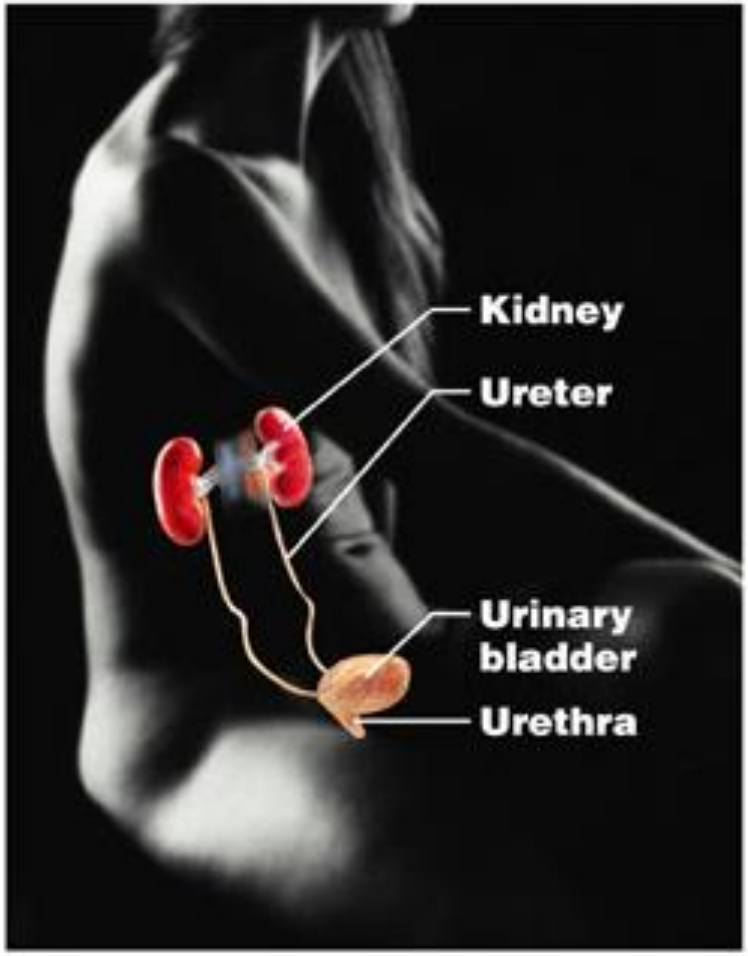


(d) Nervous System
Fast-acting control system of the body; responds to internal and external changes by activating appropriate muscles and glands.

Urinary System

- Urinary system
  - Composed of kidneys, ureters, urinary bladder, and urethra
  - Removes nitrogenous wastes from the body
  - Regulates water, electrolyte, and pH balance of the blood

Urinary System



(j) Urinary System

Eliminates nitrogenous wastes from the body; regulates water, electrolyte and acid-base balance of the blood.

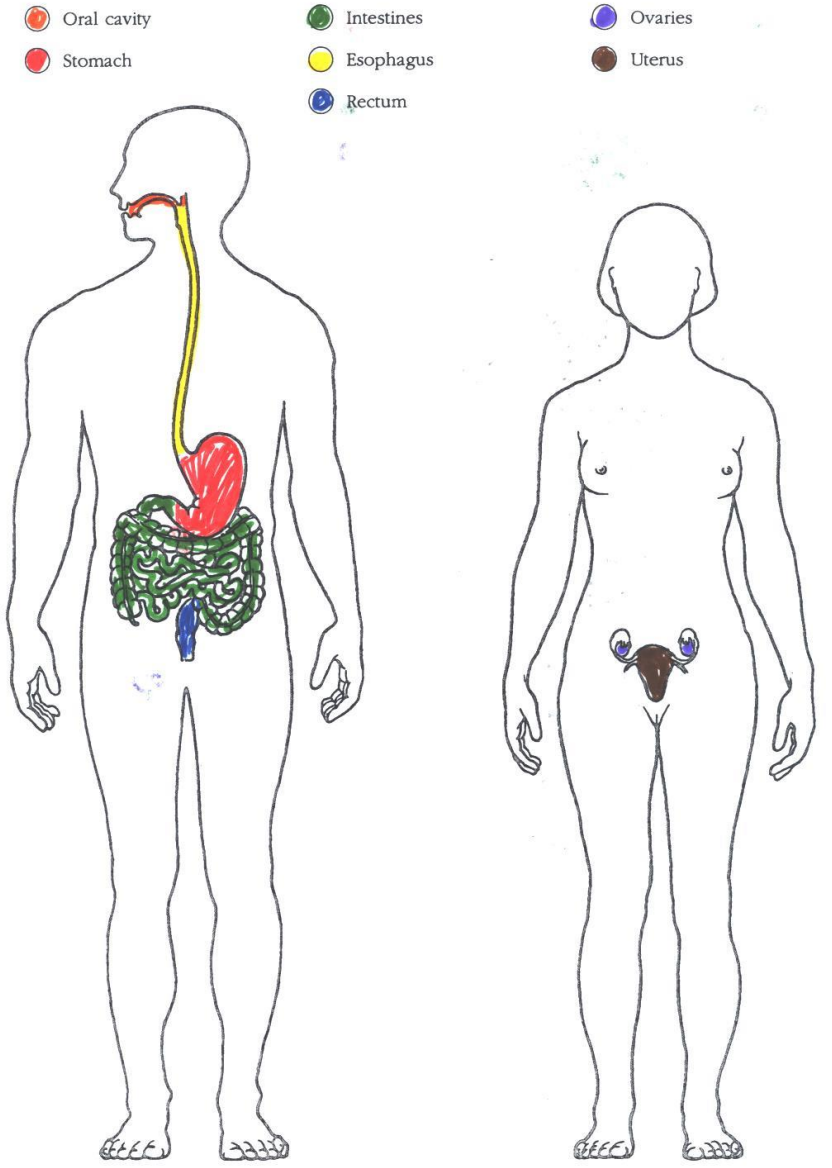


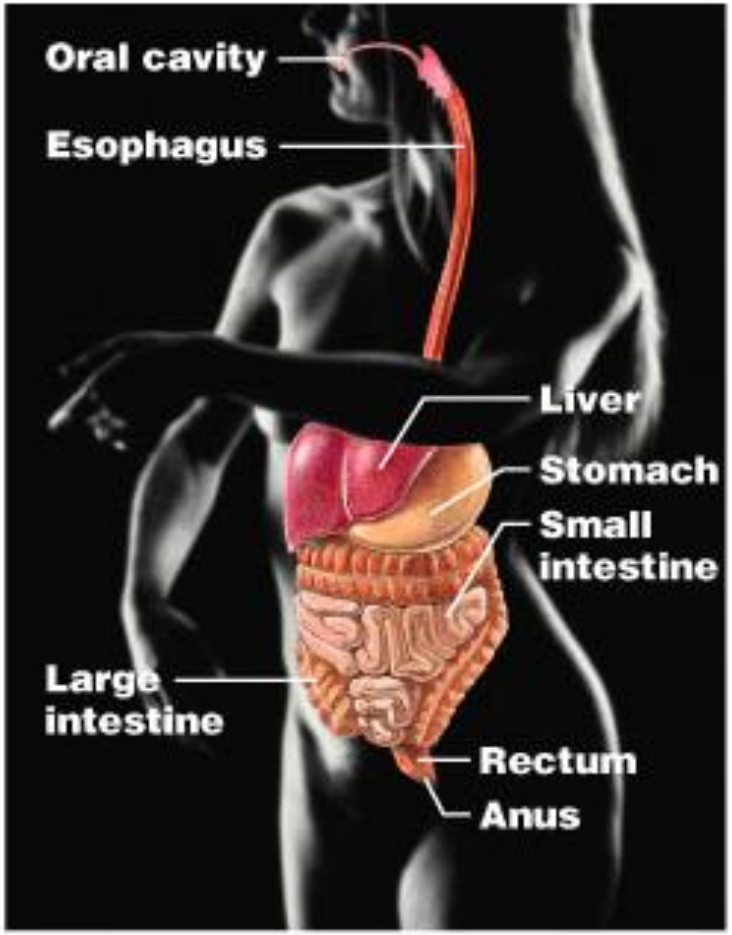
Figure 1.5

Figure 1.6

Digestive System

- Digestive system
  - Composed of the oral cavity, esophagus, stomach, small intestine, large intestine, rectum, anus, and liver
  - Breaks down food into absorbable units that enter the blood
  - Eliminates indigestible foodstuffs as feces

Digestive System

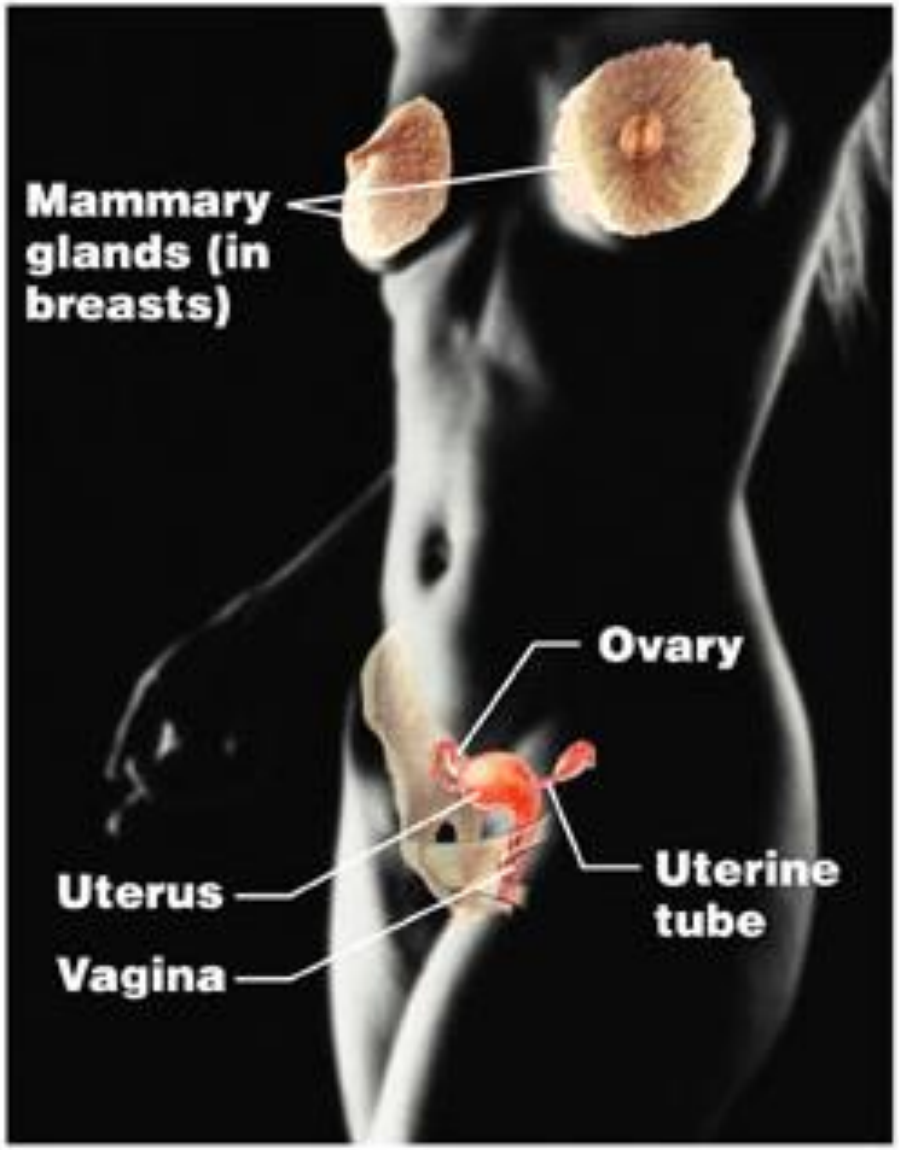


(i) Digestive System
Breaks down food into absorbable units that enter the blood for distribution to body cells; indigestible foodstuffs are eliminated as feces.

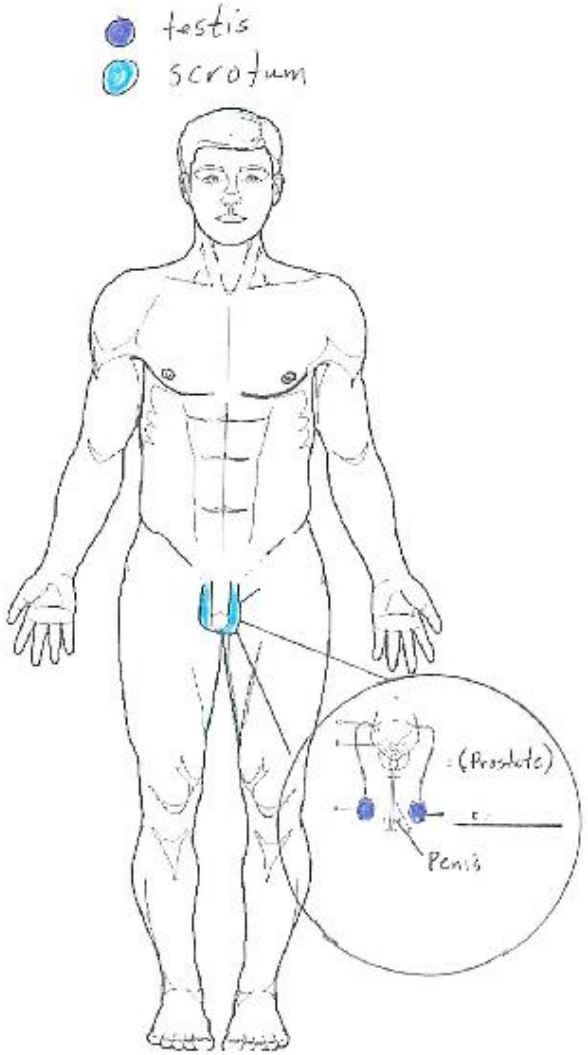
Female reproductive system

- Composed of mammary glands, ovaries, uterine tubes, uterus, and vagina
- Main function is the production of offspring
- Ovaries produce eggs and female sex hormones
- Remaining structures serve as sites for fertilization and development of the fetus
- Mammary glands produce milk to nourish the newborn

Reproductive System

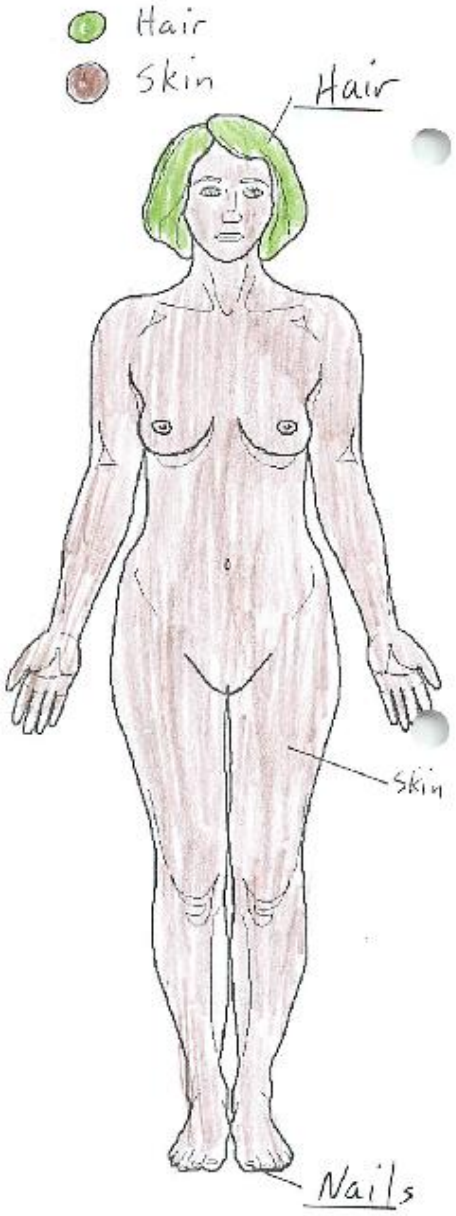


(I) Female Reproductive System



male Reproductive

1.7



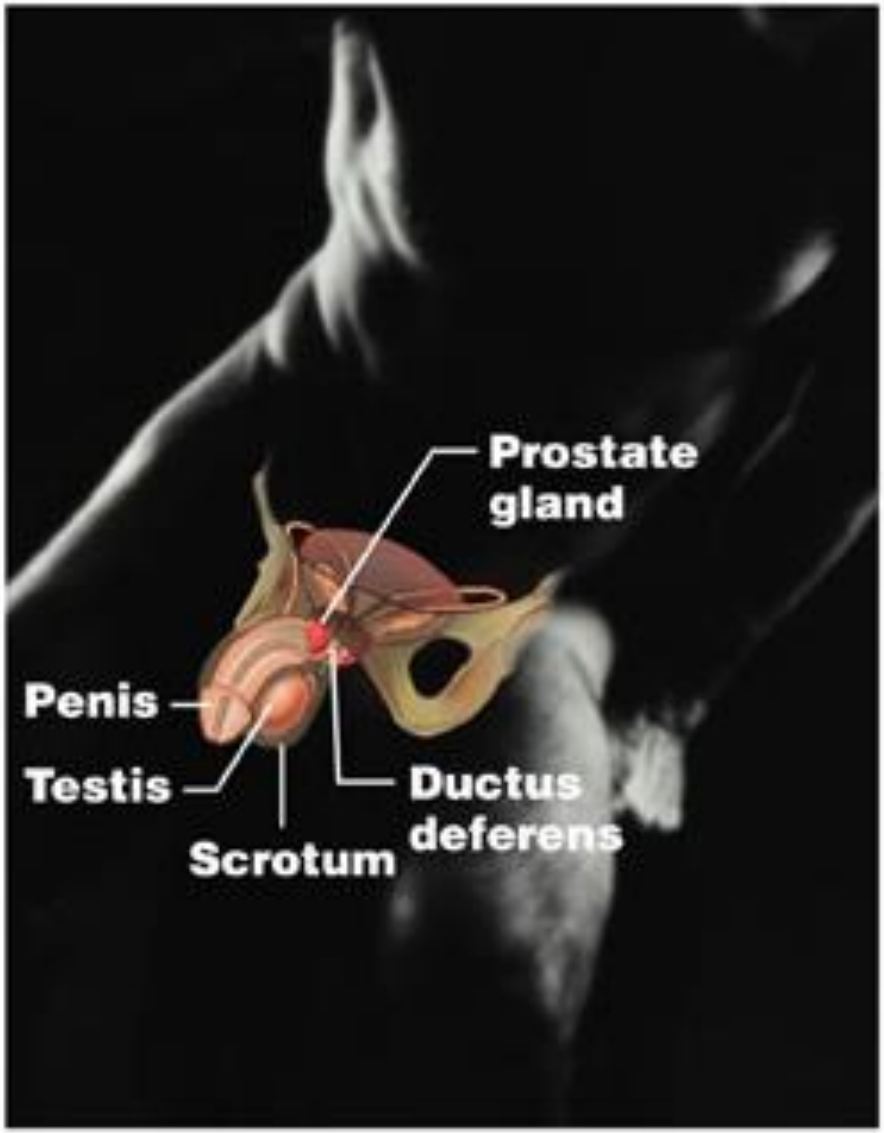
Integumentary

1.8

Reproductive system

- Male reproductive system
  - Composed of prostate gland, penis, testis, scrotum, and ductus deferens
  - Main function is the production of offspring
  - Testis produce sperm and male sex hormones
  - Ducts and glands deliver sperm to the female reproductive tract

Reproductive System

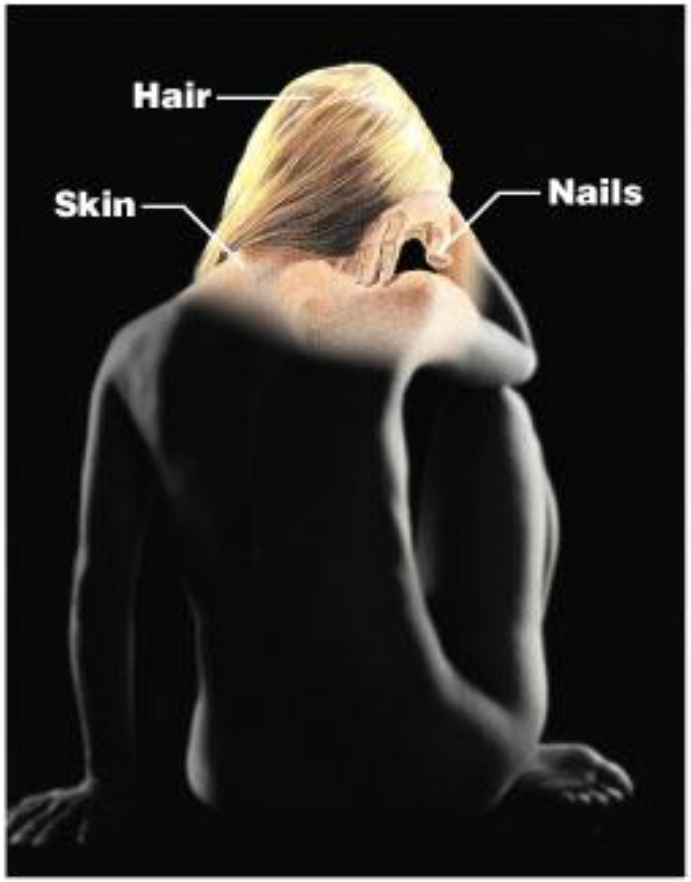


(k) Male Reproductive System

Organ Systems of the Body

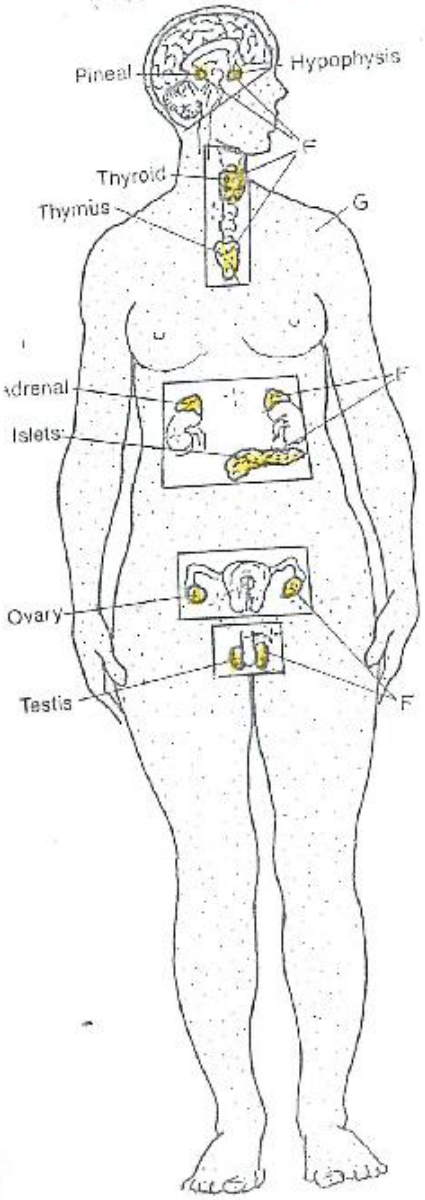
- Integumentary system
  - Forms the external body covering
  - Composed of the skin, sweat glands, oil glands, hair, and nails
  - Protects deep tissues from injury and synthesizes vitamin D

Integumentary System



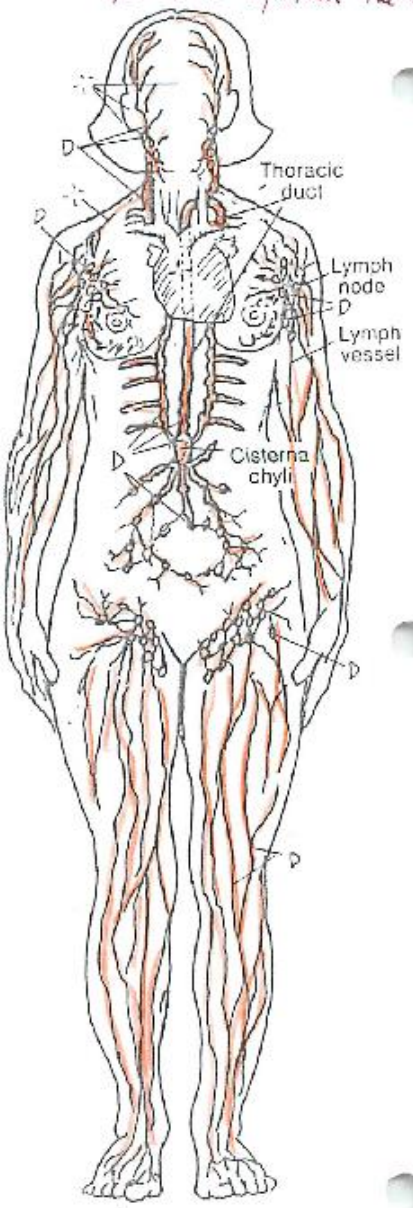
(a) Integumentary System
Forms the external body covering; protects deeper tissues from injury; synthesizes vitamin D; site of cutaneous (pain, pressure, etc.) receptors, and sweat and oil glands.

color each gland same color



Endocrine

Color all structures for this system the same

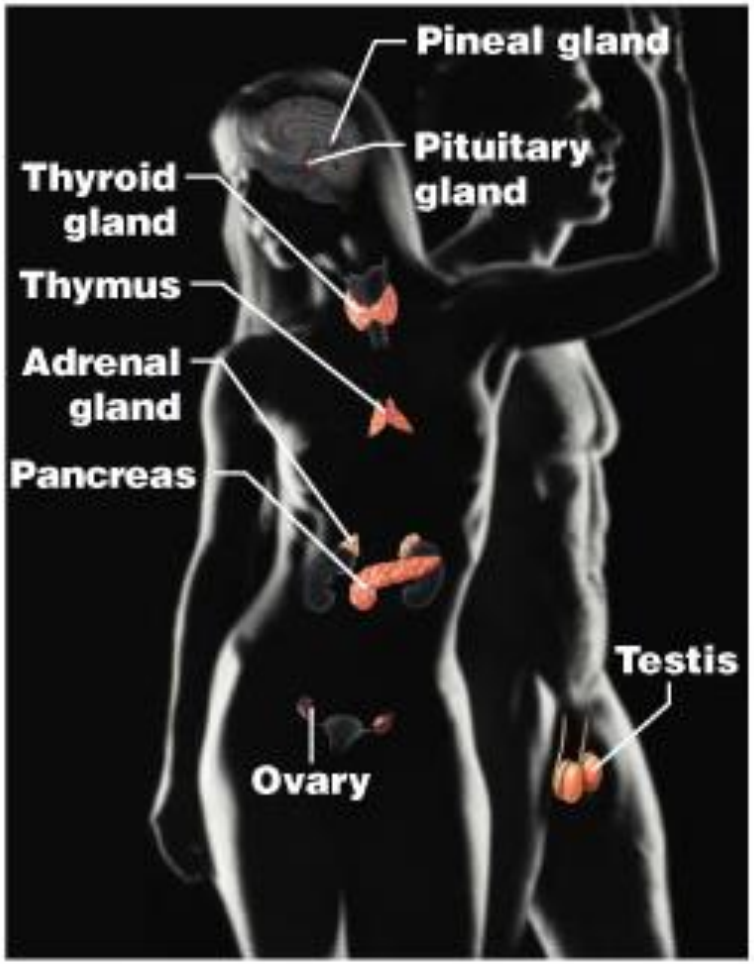


Lymphatic

Endocrine System

- Made of glands (organs)
- secrete chemical messengers into the blood called hormones
- Controls growth, reproduction and metabolism

Endocrine System

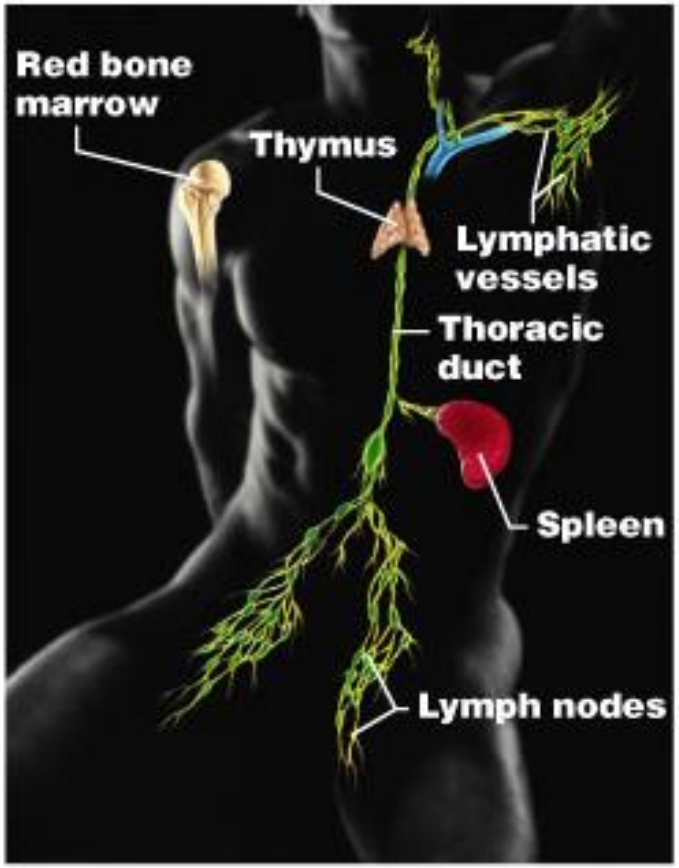


(e) Endocrine System
Glands secrete hormones that regulate processes such as growth, reproduction and nutrient use (metabolism) by body cells.

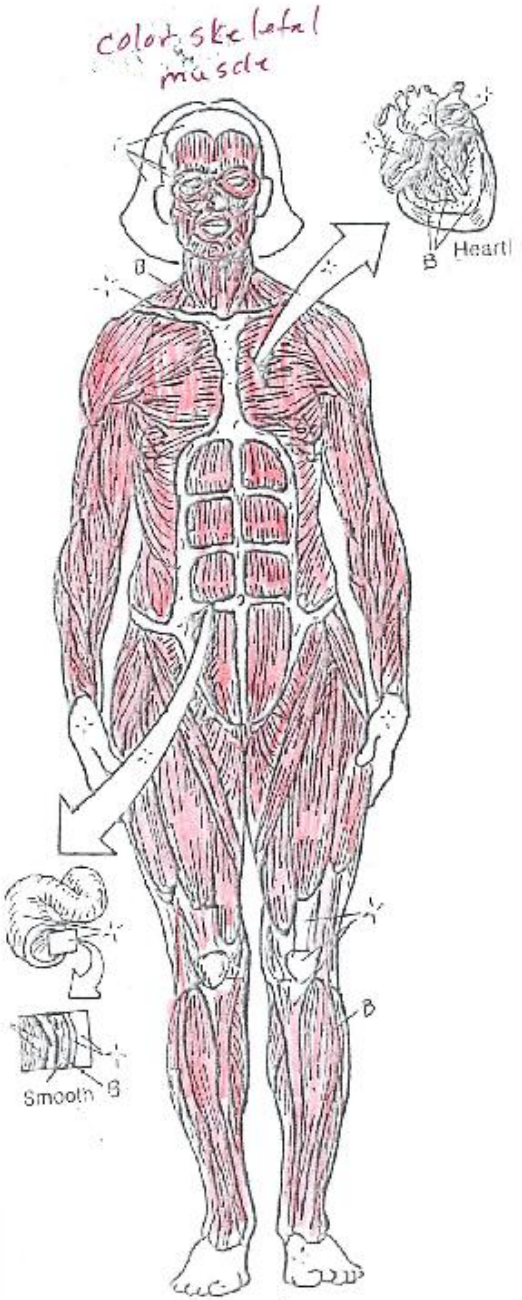
Lymphatic System

- Composed of red bone marrow, thymus, spleen, lymph nodes, and lymphatic vessels
- Picks up fluid that leaks from blood vessels and returns it to blood
- Disposes of cellular debris
- Houses white blood cells involved with immunity

Lymphatic System



(g) Lymphatic System/Immunity
Picks up fluid leaked from blood vessels and returns it to blood; disposes of debris in the lymphatic stream; houses white blood cells (lymphocytes) involved in immunity. The immune response mounts the attack against foreign substances within the body.



Muscular

1.11

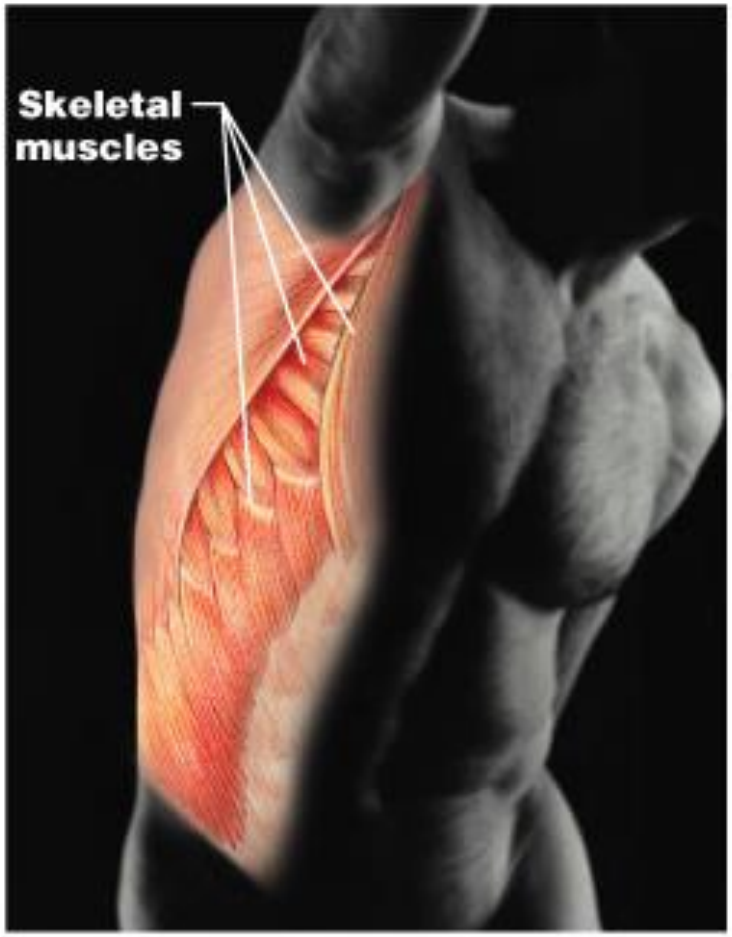
Skeletal

1.12

Muscular system

- Composed of muscles and tendons
- Allows manipulation of the environment, locomotion, and facial expression (movement)
- Maintains posture
- Produces heat

Muscular System

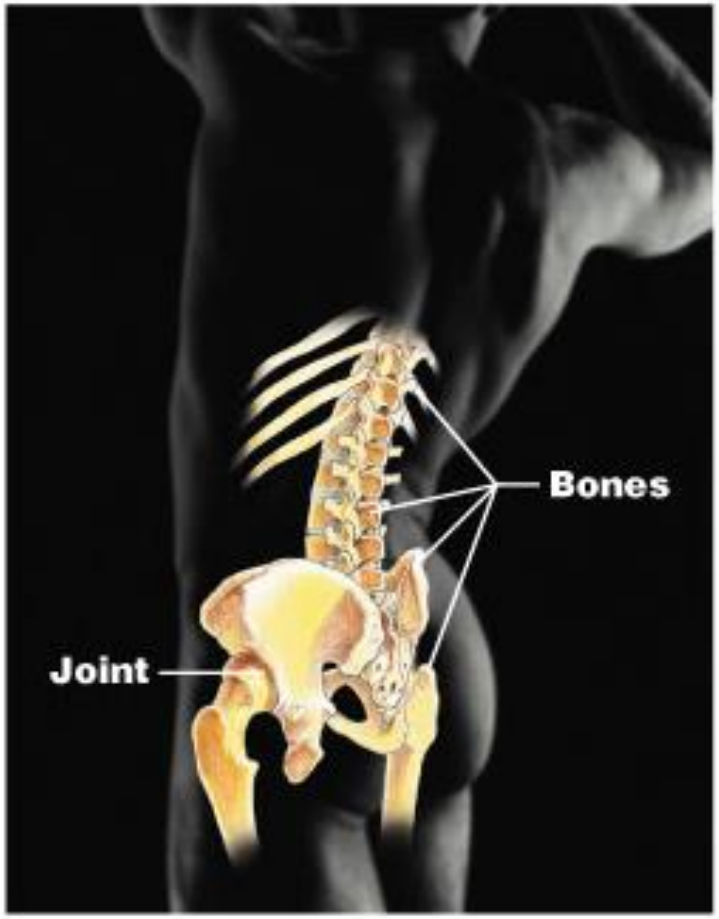


(c) Muscular System
Allows manipulation of the environment, locomotion, and facial expression; maintains posture; produces heat.

Skeletal system

- Composed of bone, cartilage, and ligaments
- Protects and supports body organs
- Provides the framework for muscles
- Produces blood cells
- Stores minerals

Skeletal System



(b) Skeletal System
Protects and supports body organs; provides a framework the muscles use to cause movement; blood cells are formed within bones; stores minerals.

Classwork/homework for 8/15

- In your notebook on page 29 (new page), complete the following:
  - List and define the 8 necessary life functions of the human body
  - List and define the survival needs of the human body.
- You have 25 minutes to complete this. We will go over them today in the second half of the class.

Necessary Life Functions (8 total)

Processes the body must do to keep us alive

- **Maintaining boundaries** – the internal environment remains distinct from the external
  - Cellular level – accomplished by plasma membranes
  - Organismal level – accomplished by the skin
- **Movement** – locomotion, propulsion (peristalsis), and contractility
- **Responsiveness** – ability to sense changes in the environment and respond to them
- **Digestion** – breakdown of ingested foodstuffs

Continued on next slide

Necessary Life Functions

- **Metabolism** – all the chemical reactions that occur in the body
- **Excretion** – removal of wastes from the body
- **Reproduction** – creating new life on the cellular and organismal levels
  - Cellular – an original cell divides and produces two identical daughter cells
  - Organismal – sperm and egg unite to make a whole new person
- **Growth** – increase in size of a body part or of the organism

Survival Needs:

- **The following are needed for humans to survive. All must be in appropriate amounts**
- Nutrients – chemical substances used for energy and cell building
- Oxygen – needed for metabolic reactions
- Water – provides the necessary environment for chemical reactions
- Maintaining normal body temperature – necessary for chemical reactions to occur at life-sustaining rates
- Atmospheric pressure – the appropriate pressure required for proper breathing and gas exchange in the lungs

Homeostasis (new notes: page 31)

- Homeostasis is the ability to maintain a relatively stable internal environment
  - a dynamic state of equilibrium
- Chemical, thermal (temperature), and neural (nerve) factors maintain homeostasis

Homeostatic Control Mechanisms

- A variable or stimulus produces a change in the body
- The three components of control mechanisms are:
  - Receptor – monitors the environments and responds to changes (stimuli)
  - Control center – determines the set point at which the variable is maintained
  - Effector – provides the means to respond to the stimuli

Homeostatic Control Mechanisms

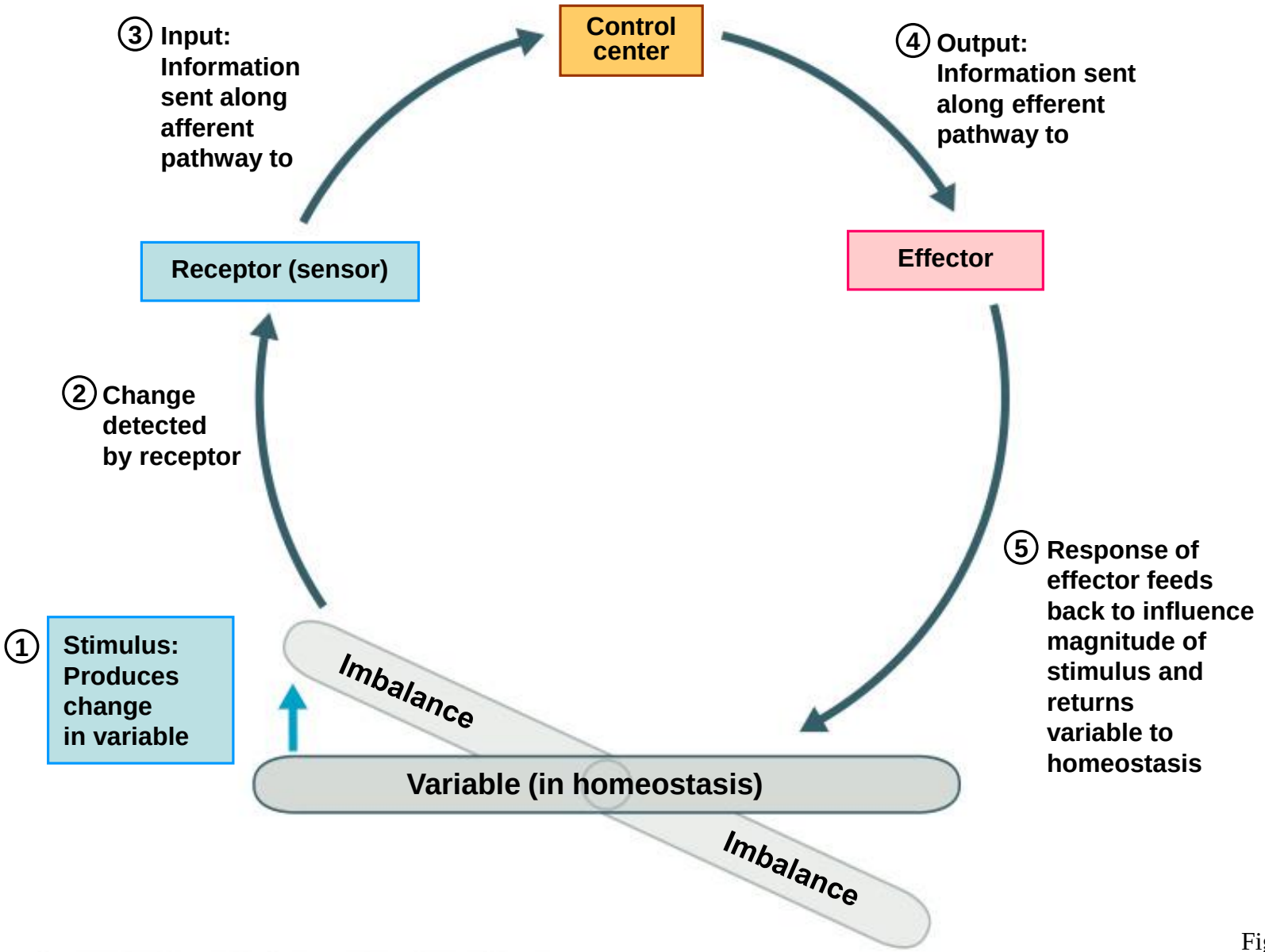


Figure 1.4

Feedback loops or mechanisms

- The body monitors itself
- It turns on and off mechanisms as needed
- They either increase or decrease an effect

Negative Feedback

- In negative feedback systems, the output shuts off the original stimulus
- Example: Regulation of blood glucose levels

Negative Feedback

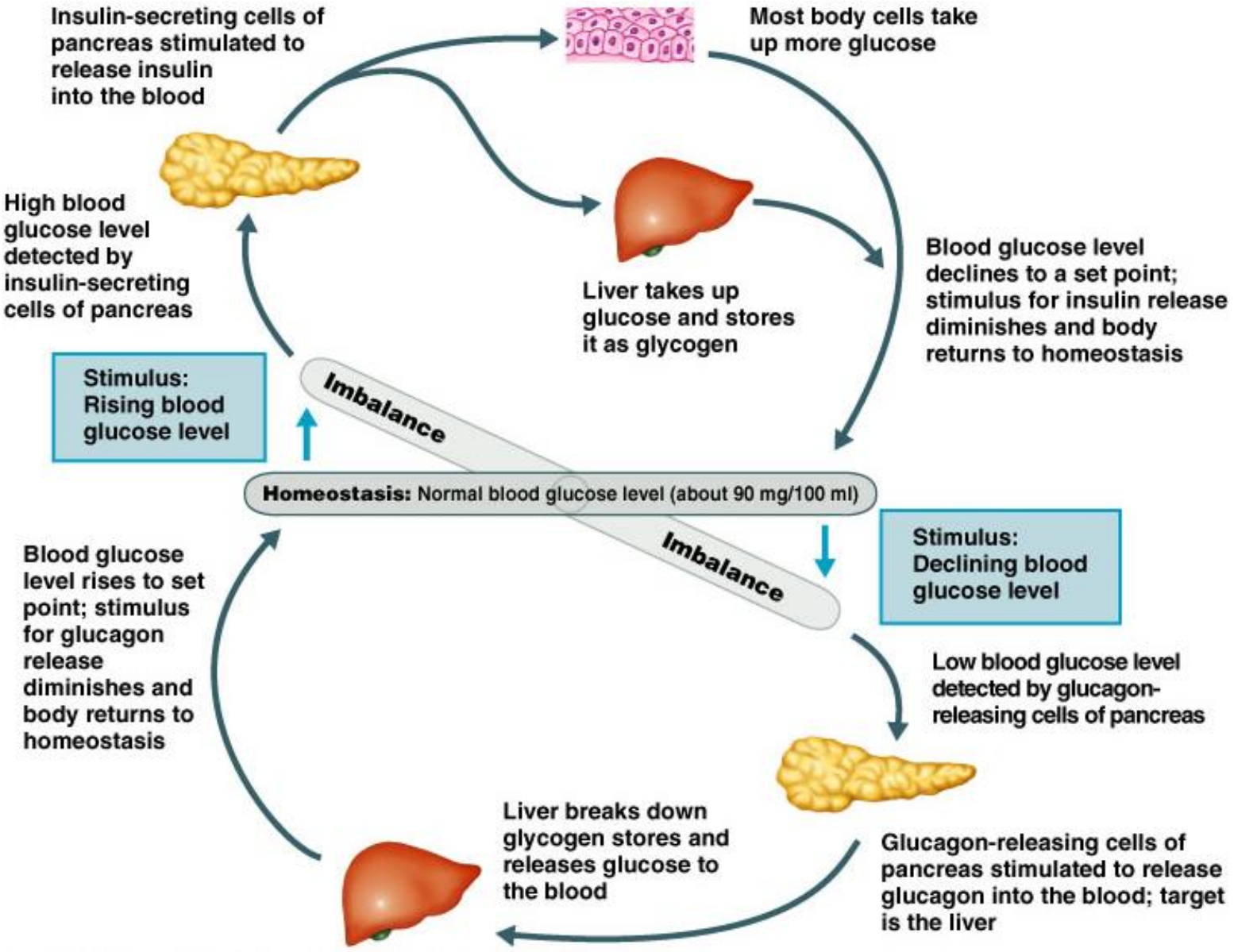


Figure 1.5

Positive Feedback

- In positive feedback systems, the output enhances or exaggerates the original stimulus
- Example: Regulation of blood clotting

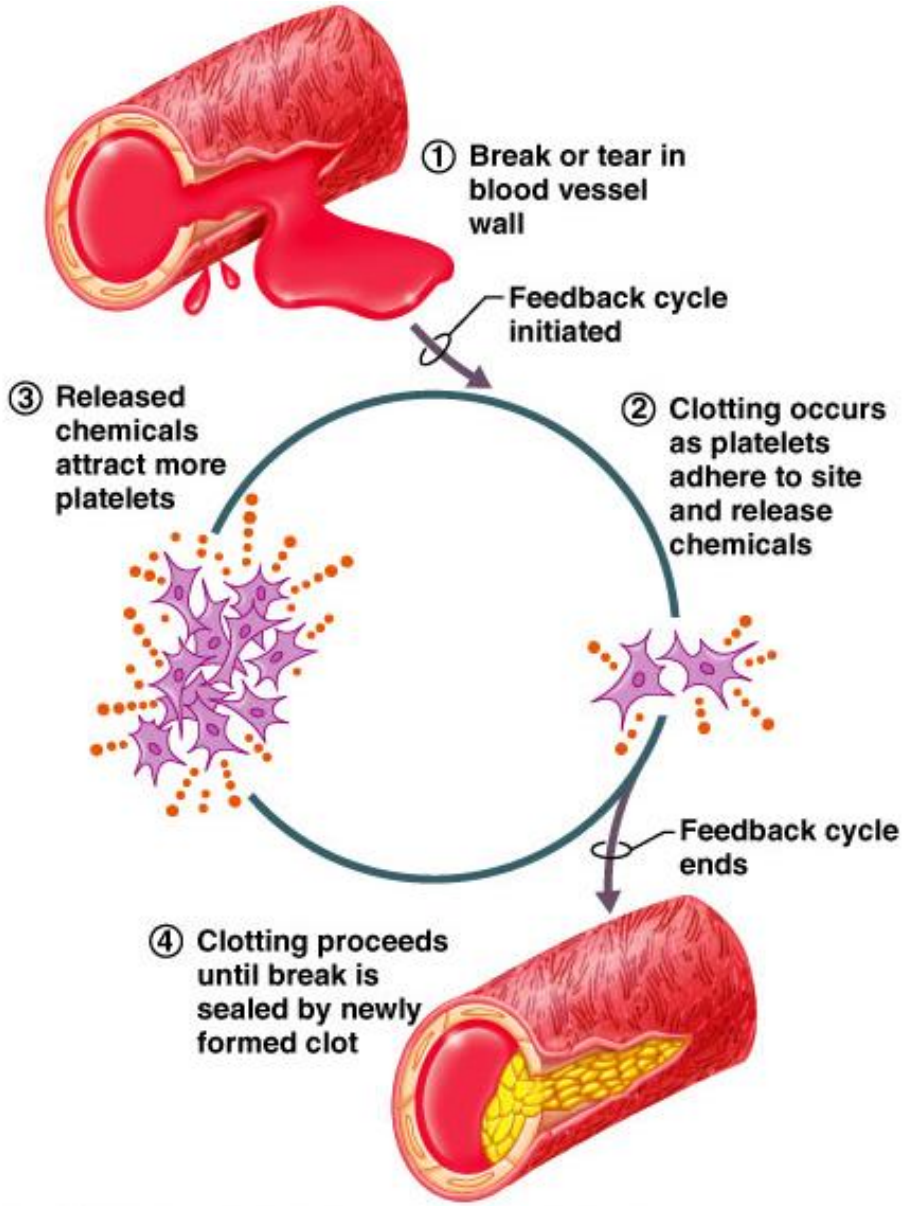


Figure 1.6

Homeostatic Imbalance

- Disturbance of homeostasis or the body's normal equilibrium
- Overwhelming of negative feedback mechanisms allows destructive positive feedback mechanisms to take over

Take out the notes from yesterday

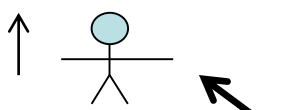
- Chunk the notes if not done
- Write only questions for the notes
  - **Don’t write a summary**

Classwork:

- On the blank side of the diagram at your seat:
- Define the following directional terms:

Inferior Superior Anterior Posterior Medial Lateral Superficial Deep

Also draw a stick figure and arrow(s) showing the direction



Example

PowerPoint® Lecture Slides prepared by Vince Austin, University of Kentucky

The Human Body: An Orientation

1

Human Anatomy & Physiology, *Sixth Edition*

Elaine N. Marieb

Anatomical Position

Don’t copy

- Body erect, feet slightly apart, palms facing forward, thumbs point away from body

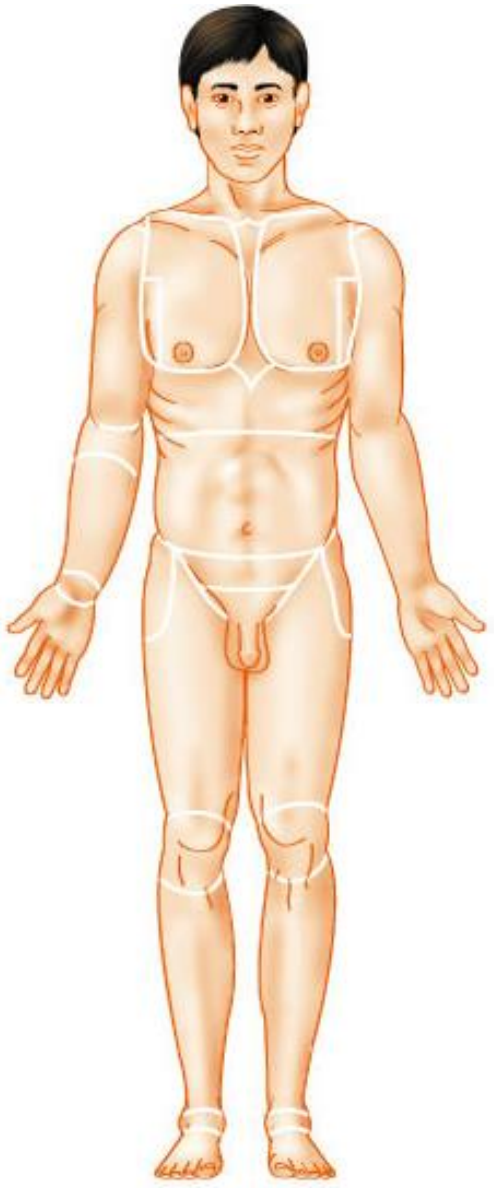


Figure 1.7a

Directional Terms

- Superior –toward the head
- inferior –away from the head
- Anterior -toward the front of the body
- posterior –toward the back of the body
- Medial -toward the midline,
- Lateral - away from the midline
- intermediate –between a more medial and lateral structure

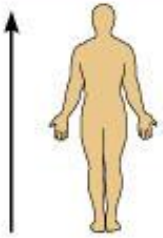
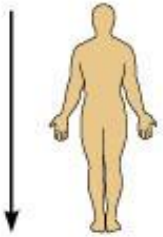
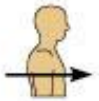
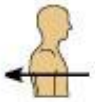
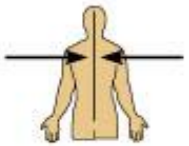
Continued on next slide

Directional Terms

- Proximal -closer to the origin of the body
- distal –farther from the origin of the body
- Superficial -toward the body surface
- deep –away from the body surface

Directional Terms

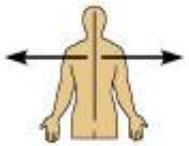
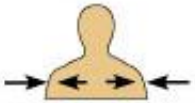
TABLE 1.1 Orientation and Directional Terms

Term	Definition	Example	
Superior (cranial)	Toward the head end or upper part of a structure or the body; above		The head is superior to the abdomen
Inferior (caudal)	Away from the head end or toward the lower part of a structure or the body; below		The navel is inferior to the chin
Anterior (ventral)*	Toward or at the front of the body; in front of		The breastbone is anterior to the spine
Posterior (dorsal)*	Toward or at the back of the body; behind		The heart is posterior to the breastbone
Medial	Toward or at the midline of the body; on the inner side of		The heart is medial to the arm

*Whereas the terms *ventral* and *anterior* are synonymous in humans, this is not the case in four-legged animals. *Ventral* specifically refers to the "belly" of a vertebrate animal and thus is the inferior surface of four-legged animals. Likewise, although the dorsal and posterior surfaces are the same in humans, the term *dorsal* specifically refers to an animal's back. Thus, the dorsal surface of four-legged animals is their superior surface.

Directional Terms

TABLE 1.1 Orientation and Directional Terms

Term	Definition	Example	
Lateral	Away from the midline of the body; on the outer side of		The arms are lateral to the chest
Intermediate	Between a more medial and a more lateral structure		The collarbone is intermediate between the beastbone and shoulder
Proximal	Closer to the origin of the body part or the point of attachment of a limb to the body trunk		The elbow is proximal to the wrist
Distal	Farther from the origin of a body part or the point of attachment of a limb to the body trunk		The knee is distal to the thigh
Superficial (external)	Toward or at the body surface		The skin is superficial to the skeletal muscles
Deep (internal)	Away from the body surface; more internal		The lungs are deep to the skin

Regional Terms: Anterior View

Do not copy

- Axial – head, neck, and trunk
- Appendicular – appendages or limbs

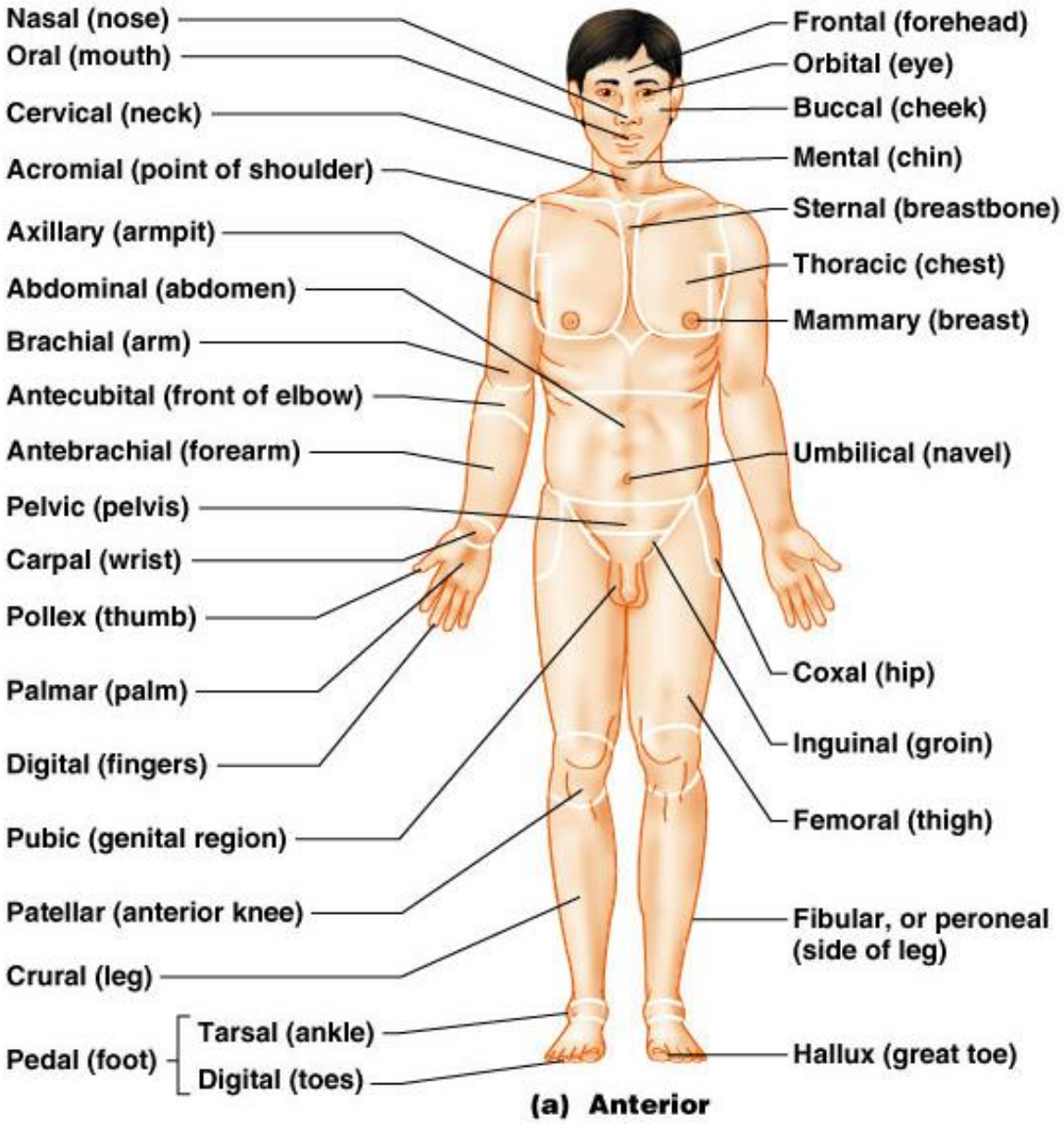


Figure 1.7a

Regional Terms: Posterior View

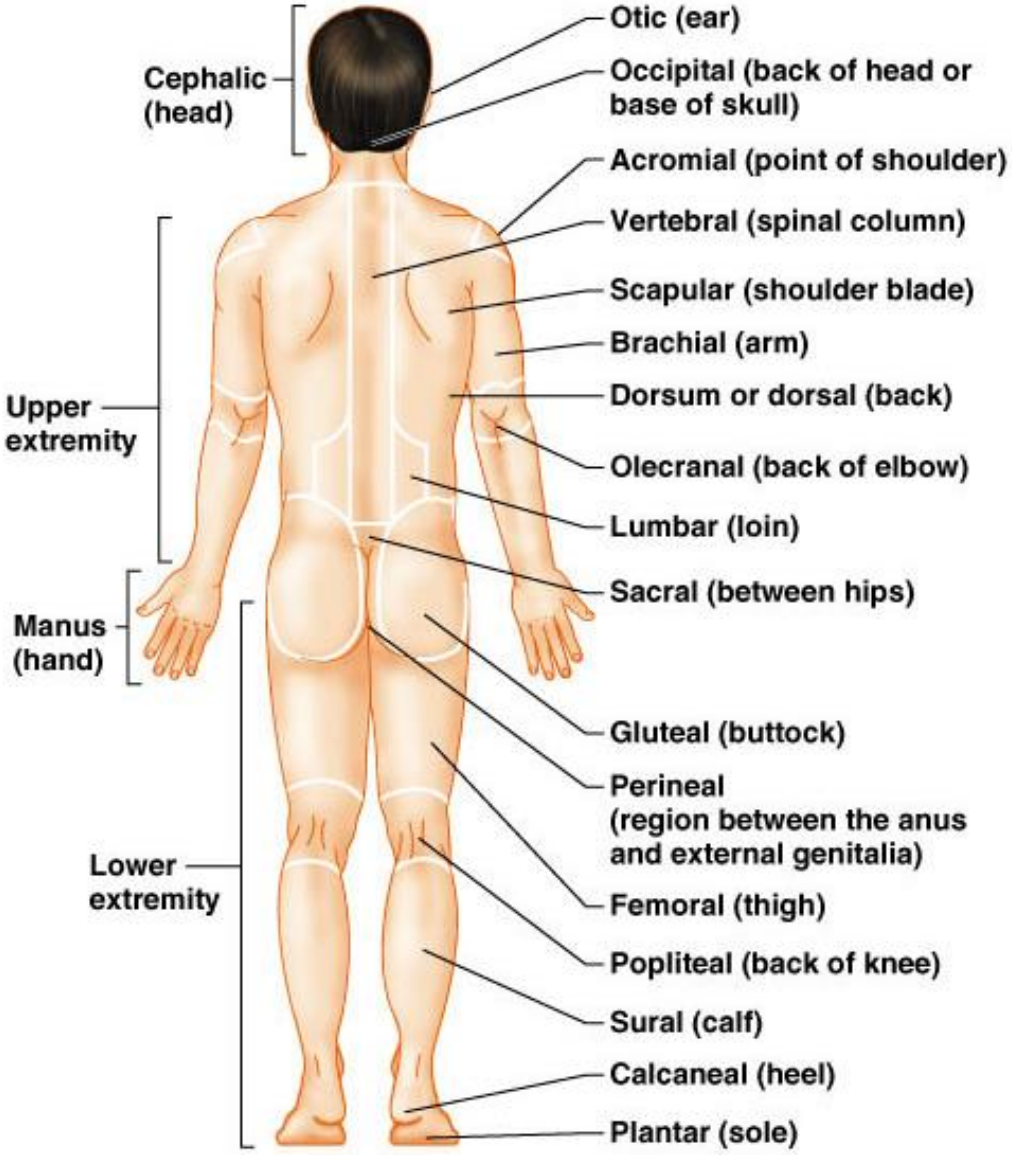


Figure 1.7b

Body Planes (not on test!!)

- The body is divided/sectioned into imaginary sections (cuts)
- Sagittal – divides the body into right and left parts
- Midsagittal or medial – sagittal plane that lies on the midline
- Frontal or coronal – divides the body into anterior and posterior parts
- Transverse or horizontal (cross section) – divides the body into superior and inferior parts
- Oblique section – cuts made diagonally

Body Planes

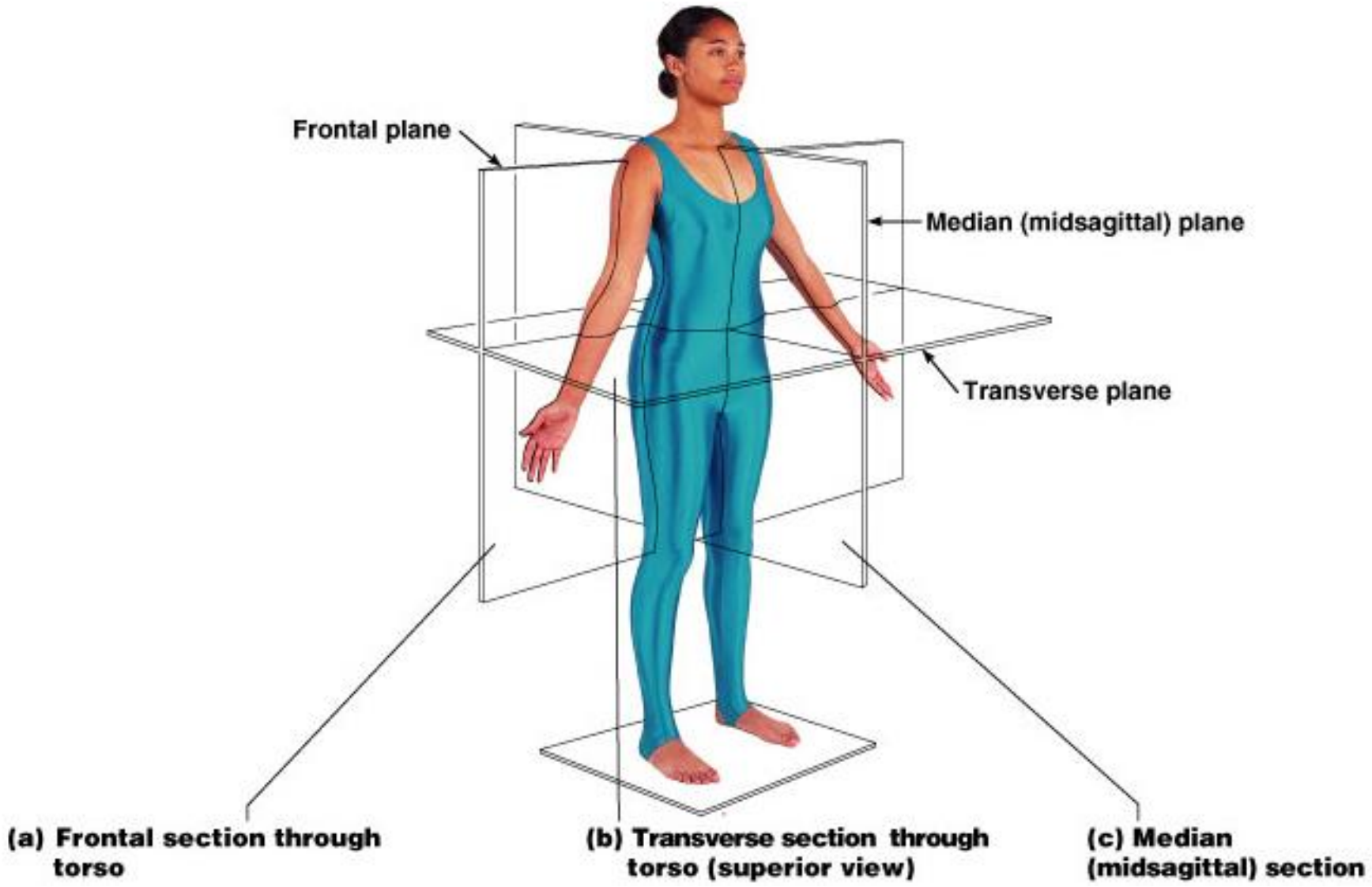


Figure 1.8

Anatomical Variability

Do not copy

- Humans vary slightly in both external and internal anatomy
- Over 90% of all anatomical structures match textbook descriptions, but:
  - Nerves or blood vessels may be somewhat out of place
  - Small muscles may be missing
- Extreme anatomical variations are seldom seen

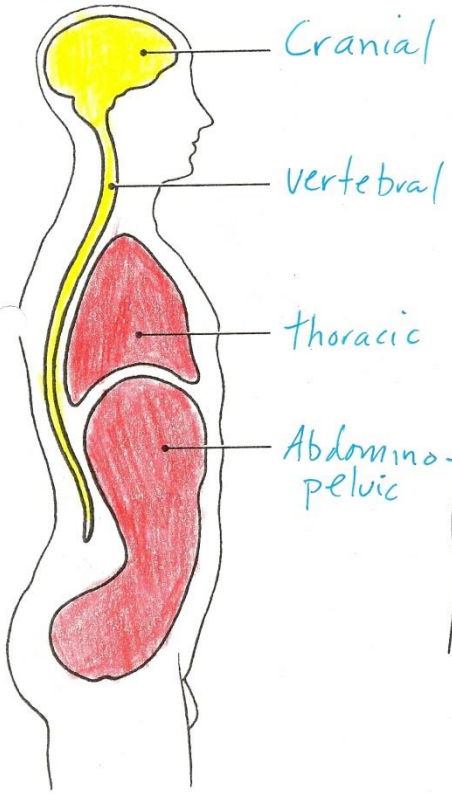
Body Cavities

- Hollow spaces that
  - Contain and protect organs
  - Closed to the outside

Select different colors for the *dorsal* and *ventral* body cavities. Color the coding circles below and the corresponding cavities in part A of Figure 1–7. Complete the figure by labeling those body cavity subdivisions that have a leader line.

Dorsal body cavity

Ventral body cavity



1-7 A

Choose different colors for the cavities listed with color coding circles. Color the coding circles and the corresponding cavities in Figure 1.9. Complete this exercise by identifying the structure provided with a leader line.

Pleural cavities

Pericardial cavity

Abdominal cavity

Pelvic cavity

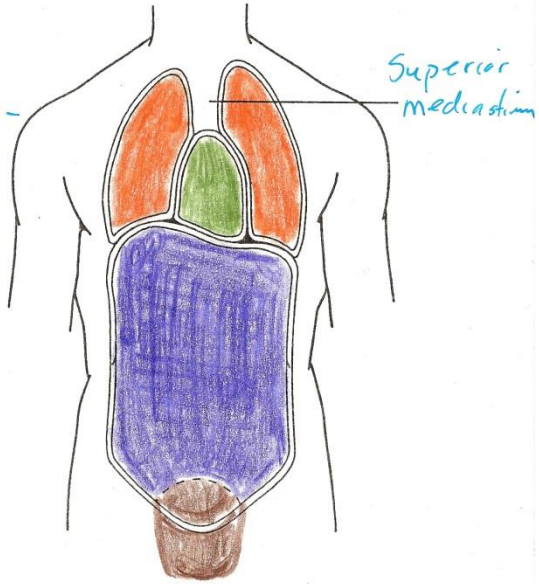


Figure 1.9

Body Cavities

- **Dorsal cavity** protects the nervous system
  - divided into two subdivisions
    1. Cranial cavity is within the skull and encases the brain
    2. Vertebral cavity runs within the vertebral column and encases the spinal cord

(Some anatomists do not think this a cavity)

Body Cavities

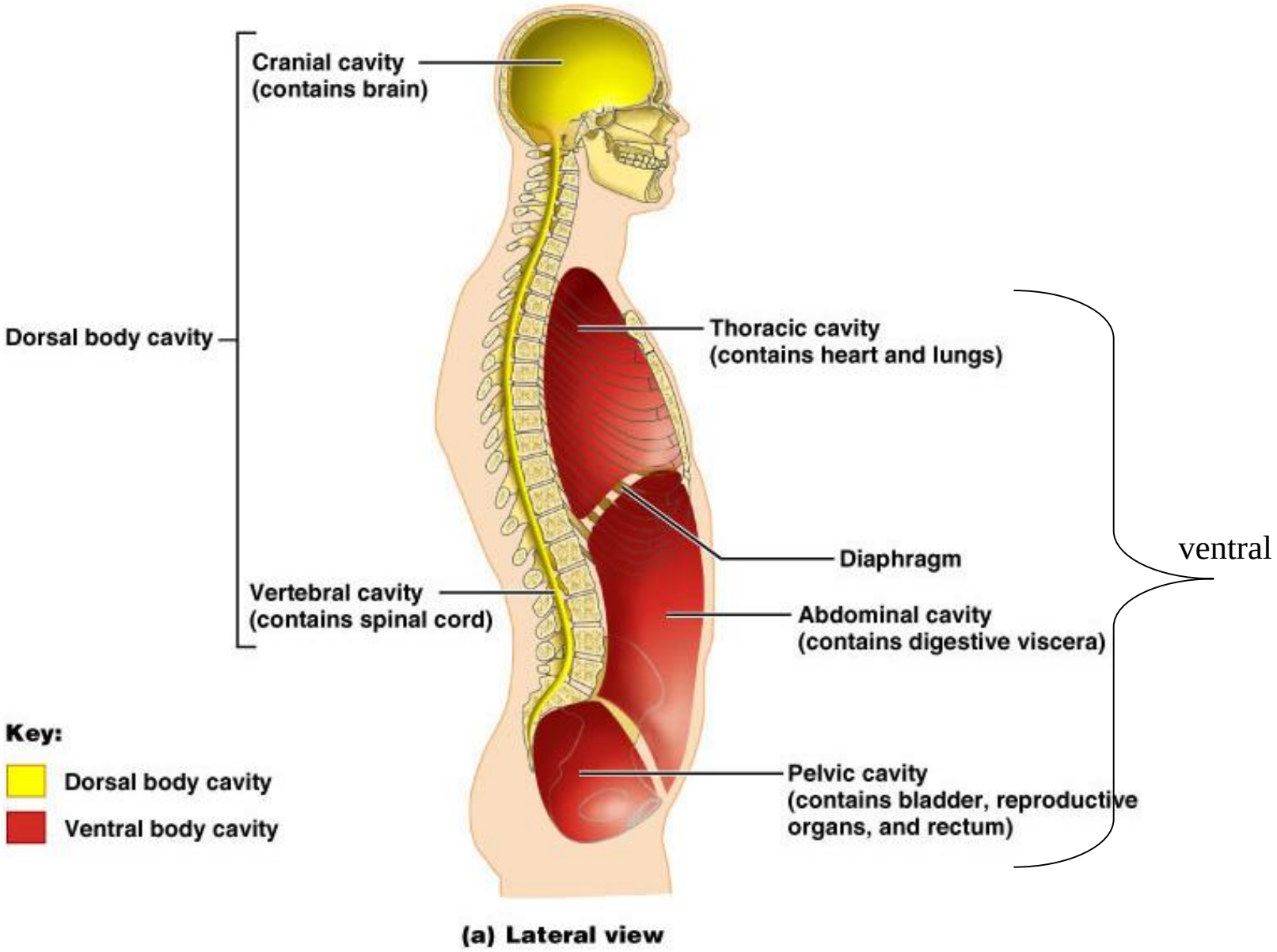


Figure 1.9a

Body Cavitiies

- **Ventral cavity** houses the internal organs
  - Also called the visceral organs (viscera)
- divided into two subdivisions:
  1. thoracic -chest
  2. abdominopelvic -abdominal and Pelvic combined

Body Cavities

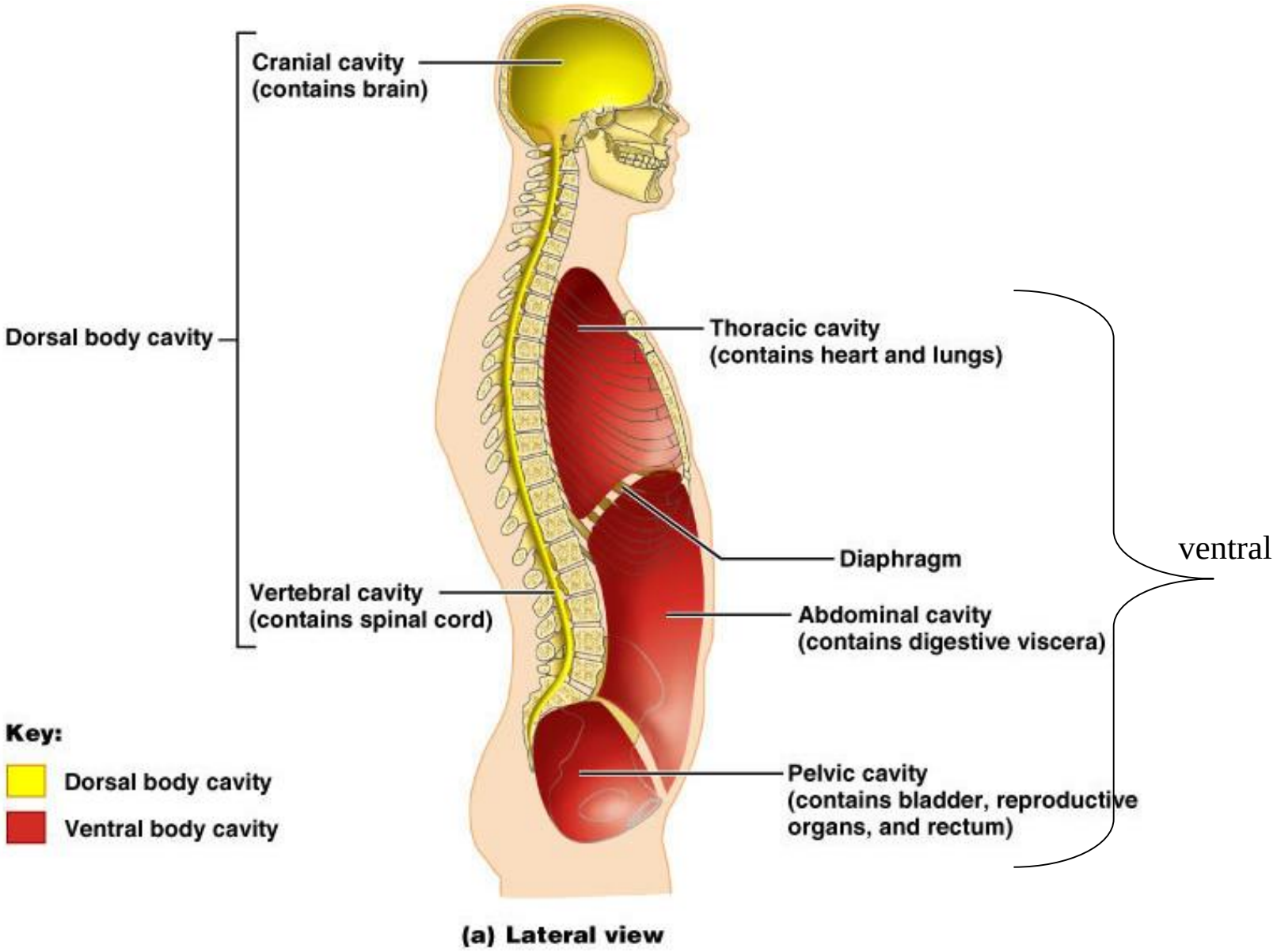


Figure 1.9a

Body Cavities

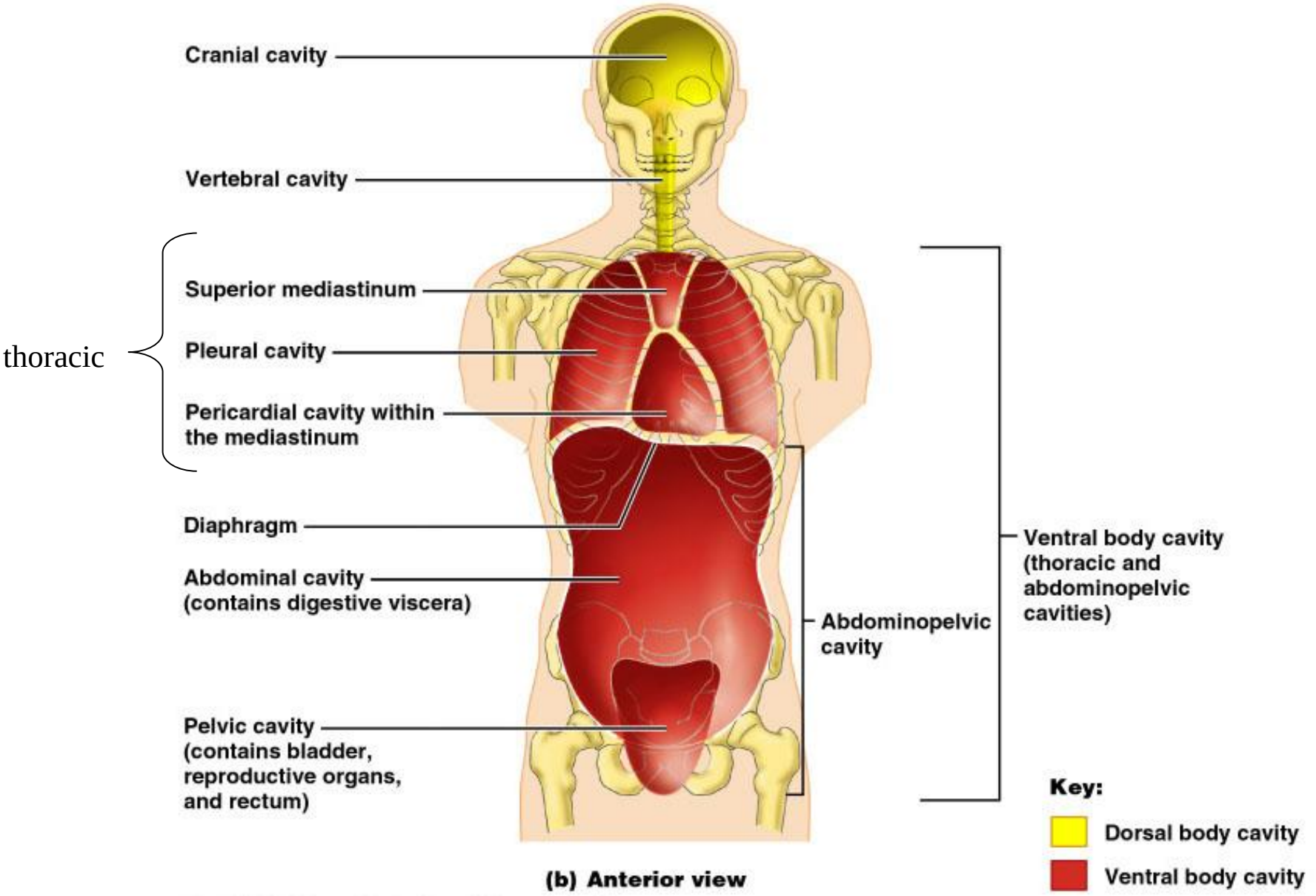


Figure 1.9b

Body Cavities

- Thoracic cavity is subdivided into
  - Pleural cavities – each houses a lung
  - Mediastinum – contains the pericardial cavity, and surrounds the remaining thoracic organs
    - Pericardial cavity – encloses the heart

Body Cavities

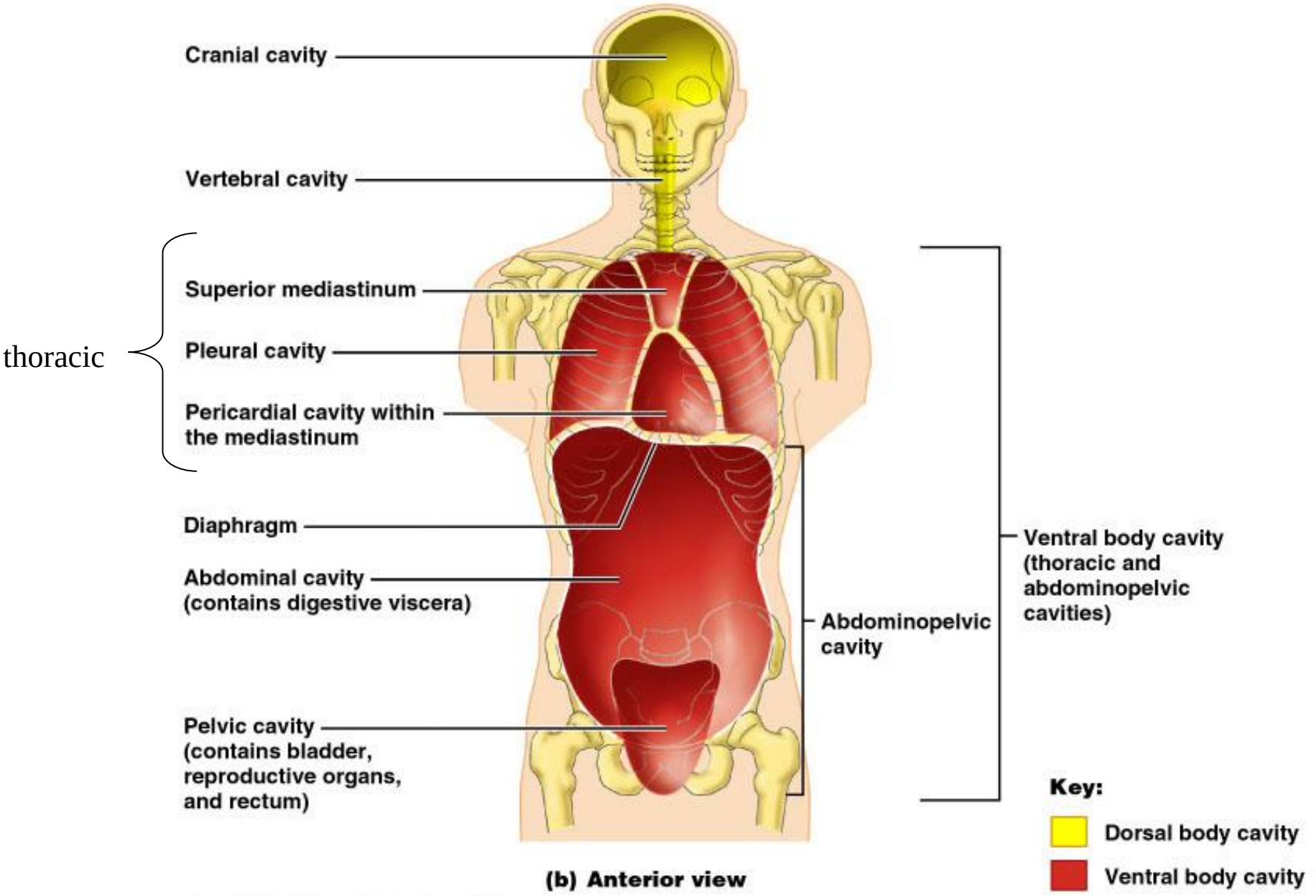


Figure 1.9b

- Please take your notes out from yesterday.
- You will need a second sheet of paper
  - This will be 35A

Body Cavities

- The abdominopelvic cavity is separated from the superior thoracic cavity by the dome-shaped diaphragm
- It is composed of two subdivisions

1. Abdominal cavity – contains the stomach, intestines, spleen, liver, and other organs
2. Pelvic cavity – lies within the pelvis and contains the bladder, reproductive organs, and rectum

Body Cavities

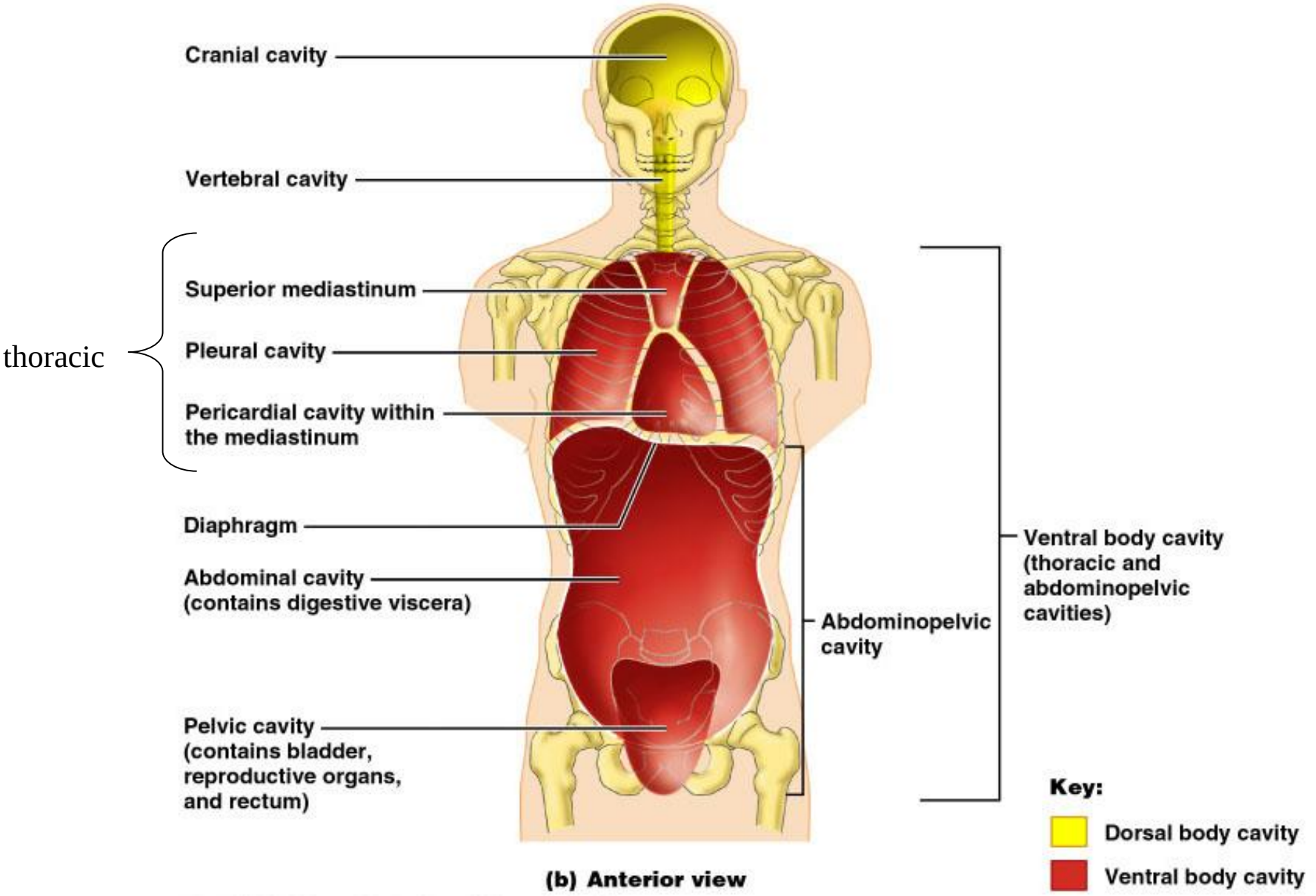


Figure 1.9b

Ventral Body Cavity Membranes

- Thin membranes line the ventral cavities and cover the surface of the organs
  - Called serosa or serous membranes
- Parietal serosa lines the cavity walls
- Visceral serosa covers the organs
- Serous fluid separates the serosae

Ventral Body Cavity Membranes

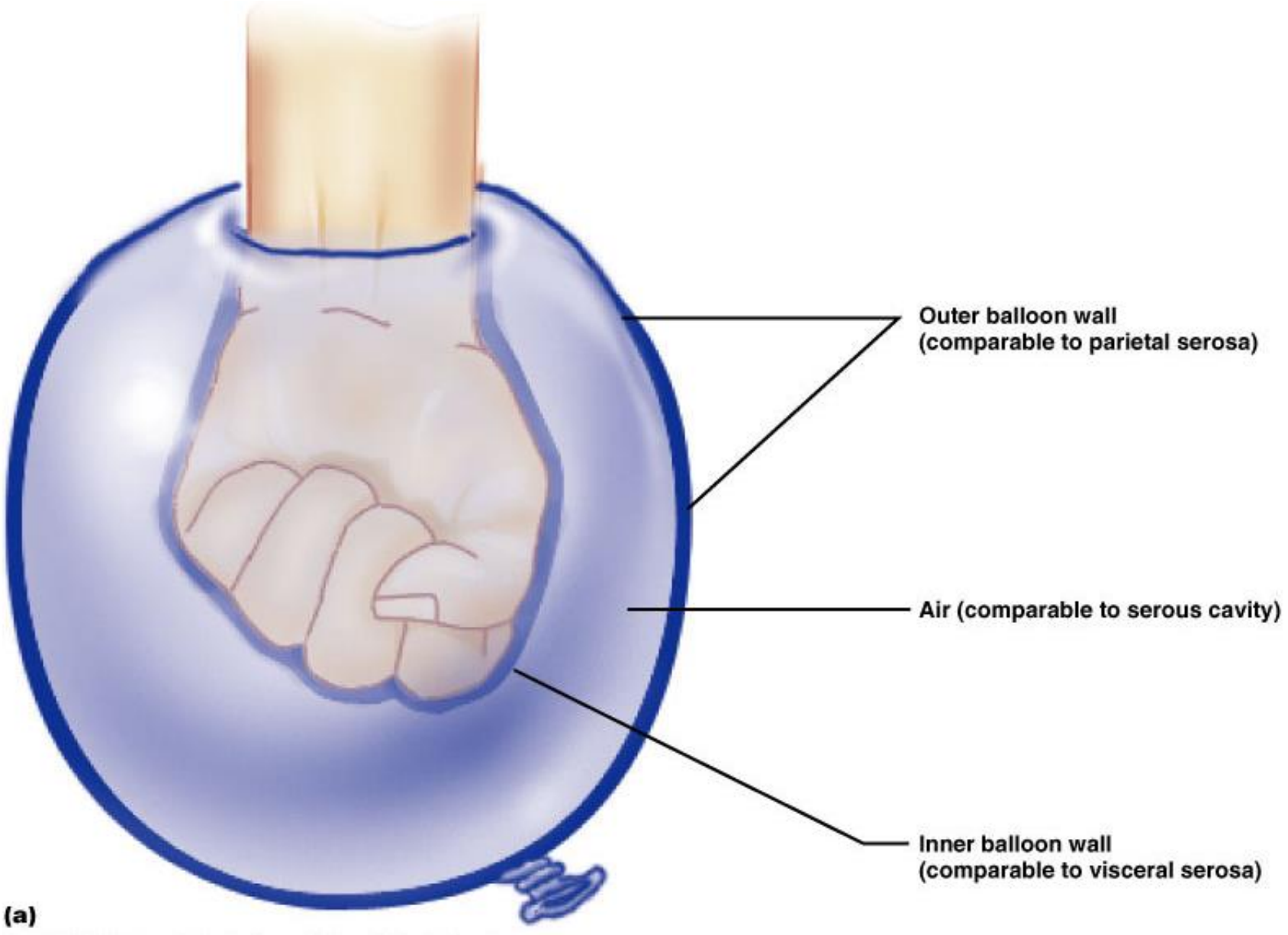


Figure 1.10a

Ventral Body Cavity Membranes

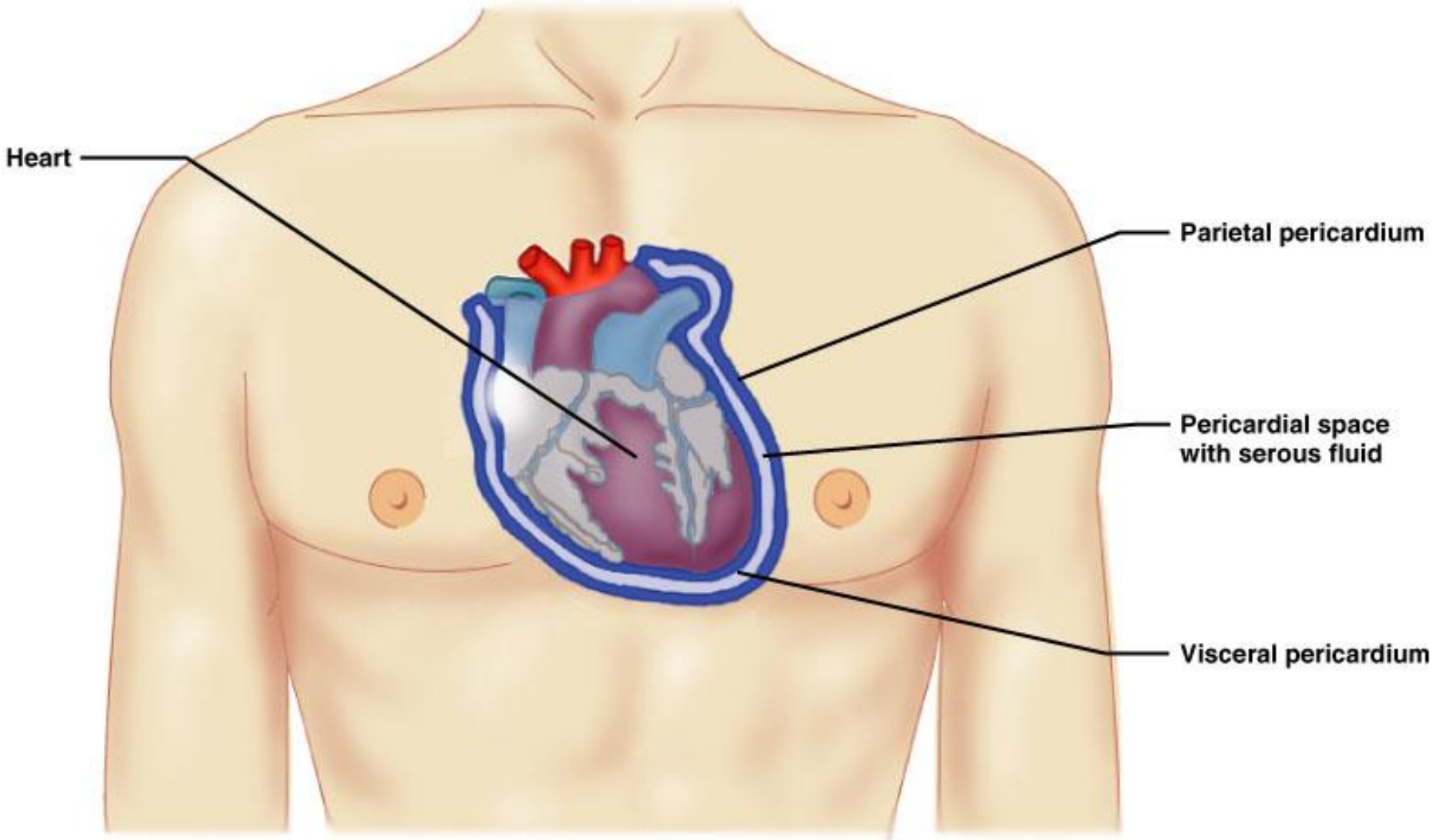


Figure 1.10b

Other Body Cavities

- Oral and digestive – mouth and cavities of the digestive organs
- Nasal –located within and posterior to the nose
- Orbital – house the eyes
- Middle ear – contain bones (ossicles) that transmit sound vibrations
- Synovial – joint cavities

Abdominopelvic Regions

Do not copy

- Umbilical
- Epigastric
- Hypogastric
- Right and left iliac or inguinal
- Right and left lumbar
- Right and left hypochondriac

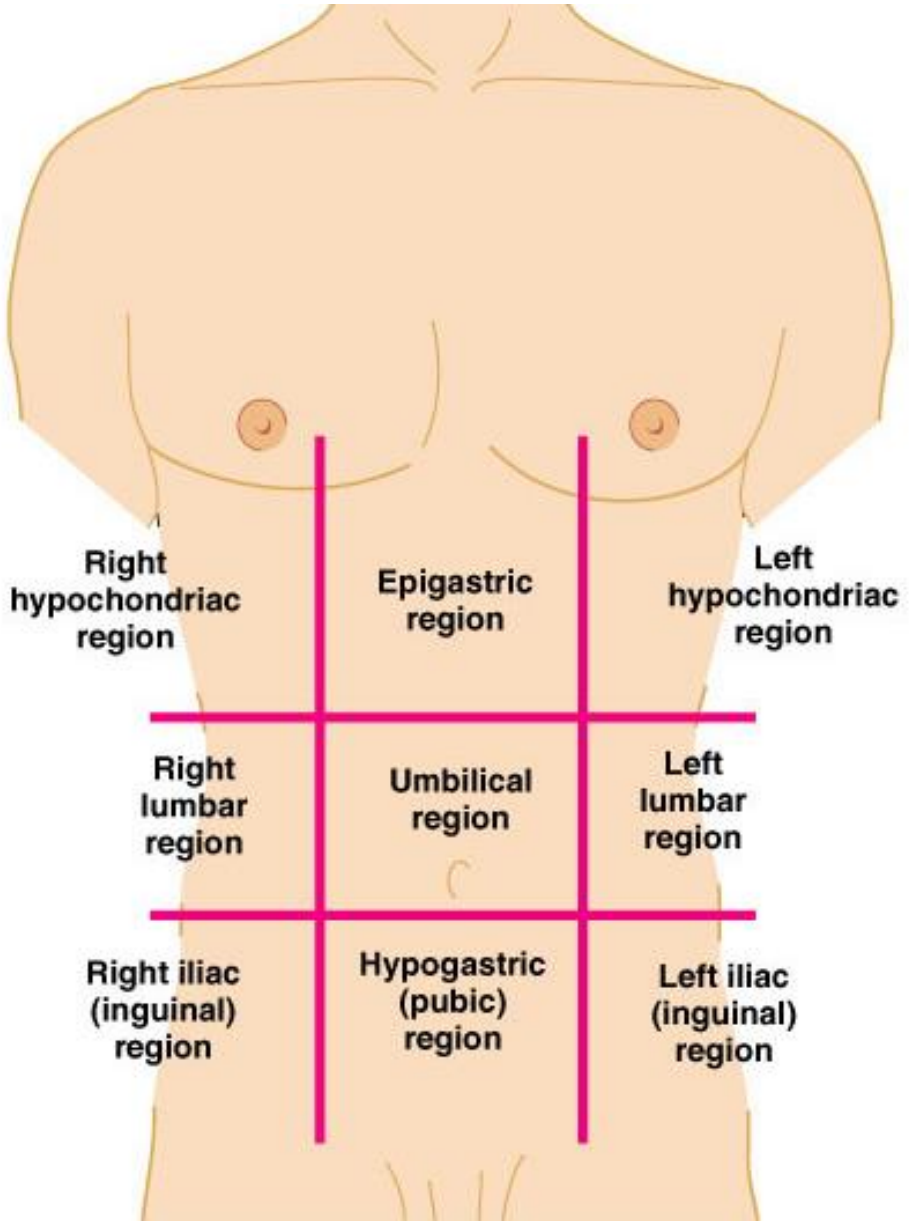


Figure 1.11a

Organs of the Abdominopelvic Regions

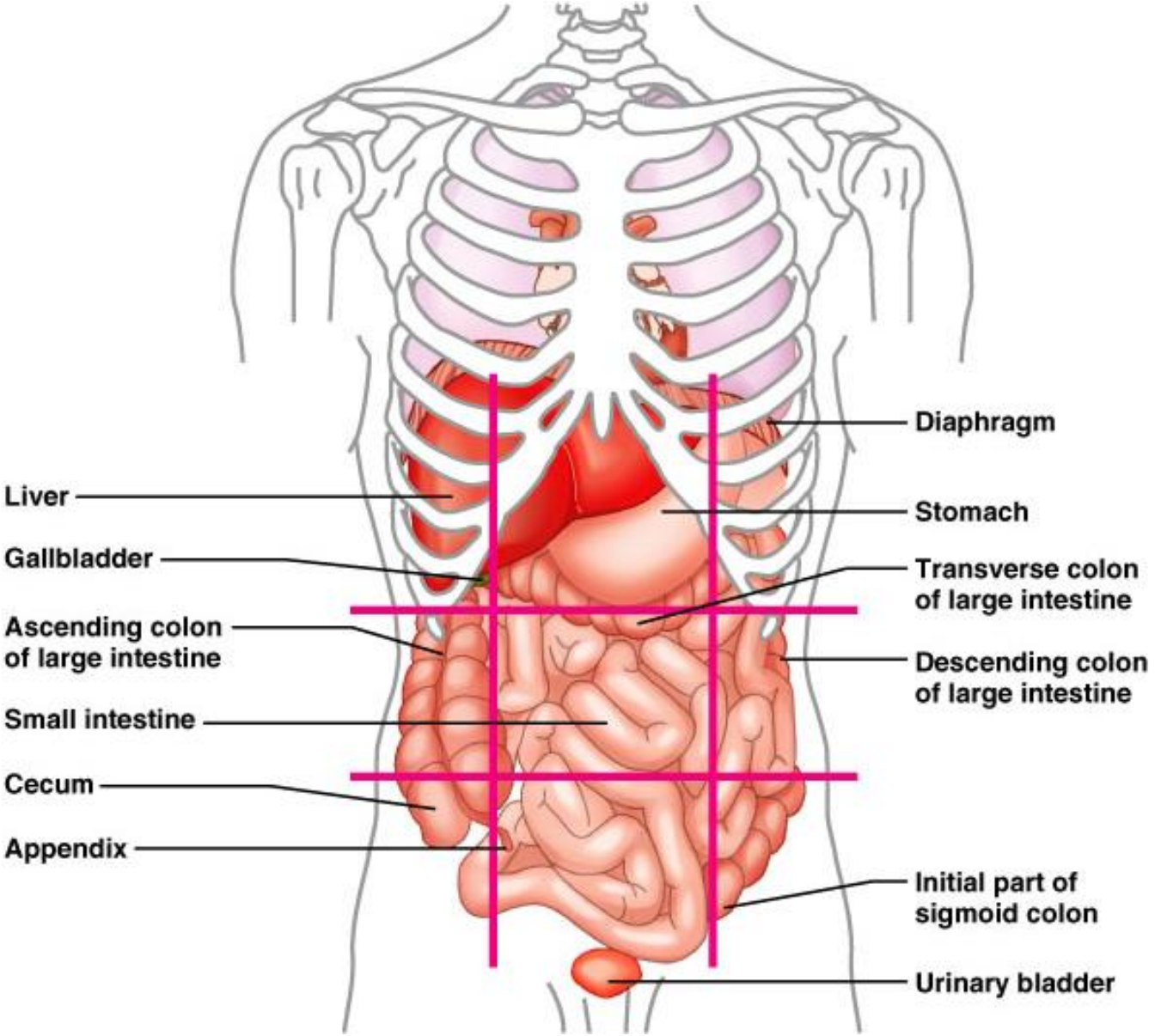


Figure 1.11b

Abdominopelvic Quadrants

- Right upper
- Left upper
- Right lower
- Left lower

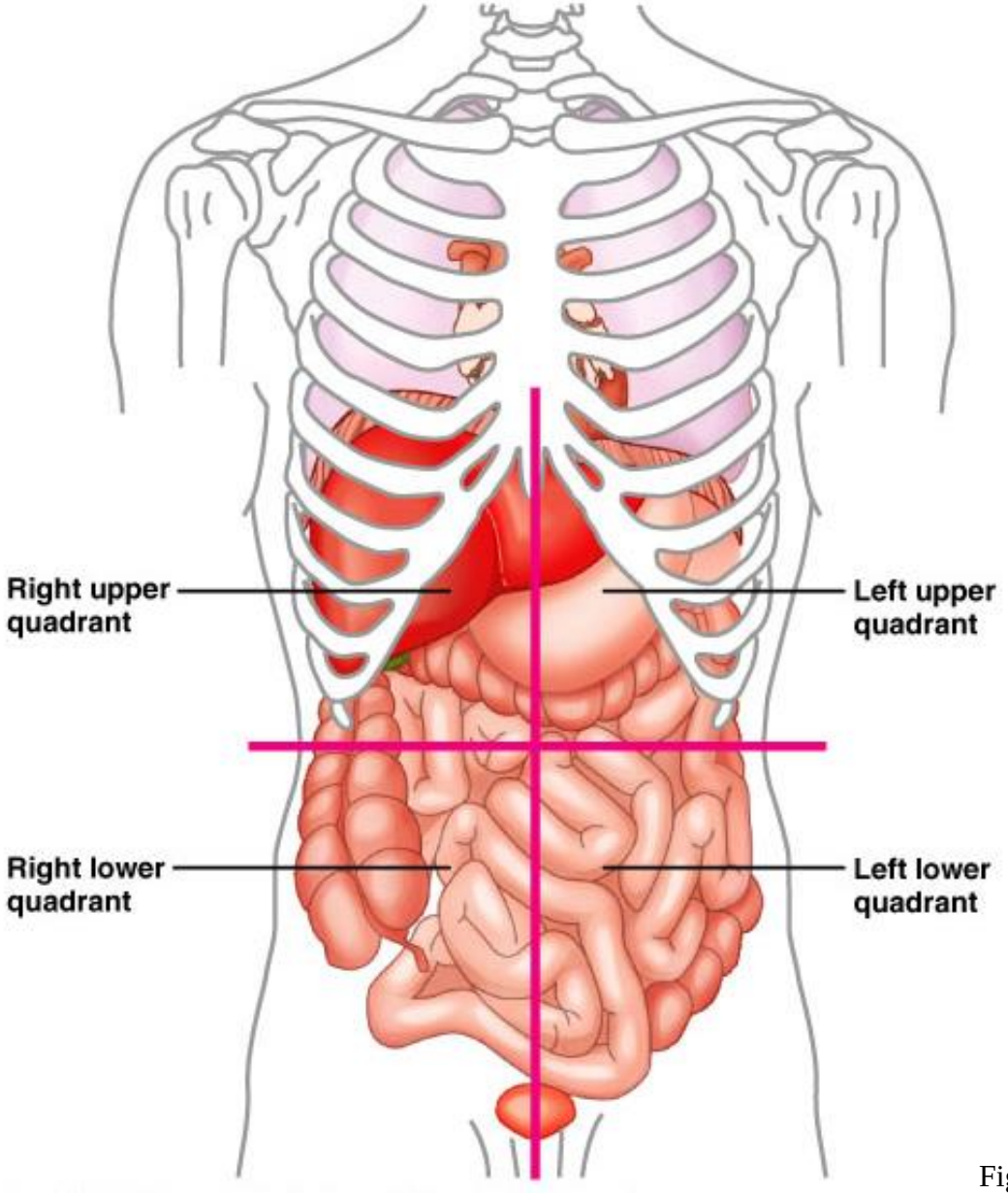


Figure 1.12