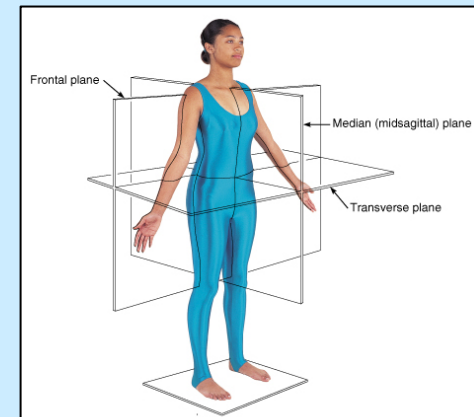
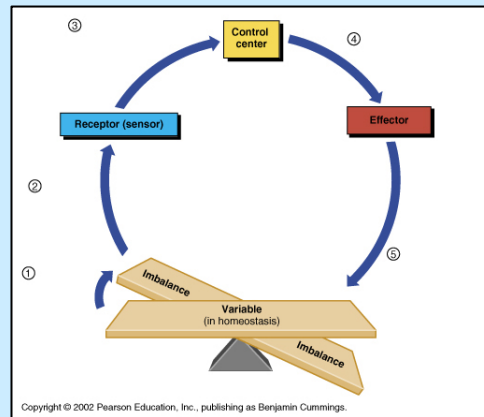


# Anatomy & Physiology

## The Human Body: An Orientation

### Chapter 1



•Nasser-Eddin M., PhD

# Overview of Anatomy and Physiology

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- Anatomy – the study of the *structure* of the body and the relationships of the various parts of the body
  - Gross or macroscopic (visible structures)
  - Microscopic (cytology, histology)
  - Developmental – structural changes over time (embryology)
- Physiology – the study of the *functions* of the parts of the body, includes specific organ systems and molecular and cellular levels (neurophysiology, cardiovascular physiology, electrophysiology)

# Levels of Structural Organization

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Chemical – atoms combine to form molecules

Cellular – molecules interact to make up cells

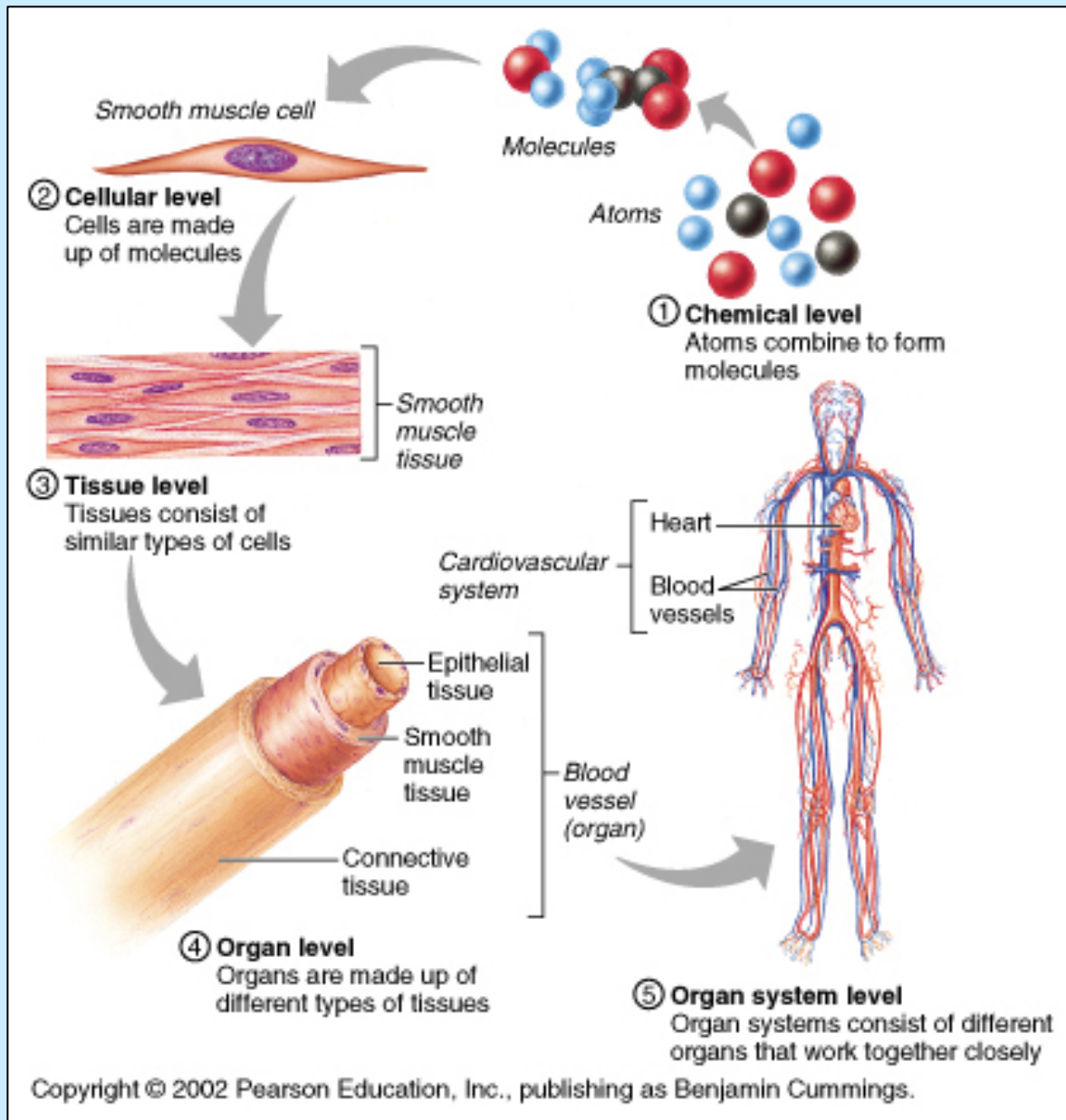
Tissue – cells are grouped into tissue

Organ – tissues compose organs

Organ system – organs function together to form  
organ systems

Organism (individual) – made up of the organ systems

# Levels of Structural Organization



Atoms

Molecule

Organelle

Cell

Tissue

Organ

Organ System

Organism

# Organ Systems

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- Skeletal system
  - Composed of bone, cartilage, and ligaments
  - Protects and supports body organs
  - Provides the framework for muscles
  - Site of blood cell formation
  - Stores minerals

# Organ Systems

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- Muscular system
  - Composed of muscles and tendons
  - Allows manipulation of the environment, locomotion, and facial expression
  - Maintains posture
  - Produces heat

# Organ Systems

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- 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

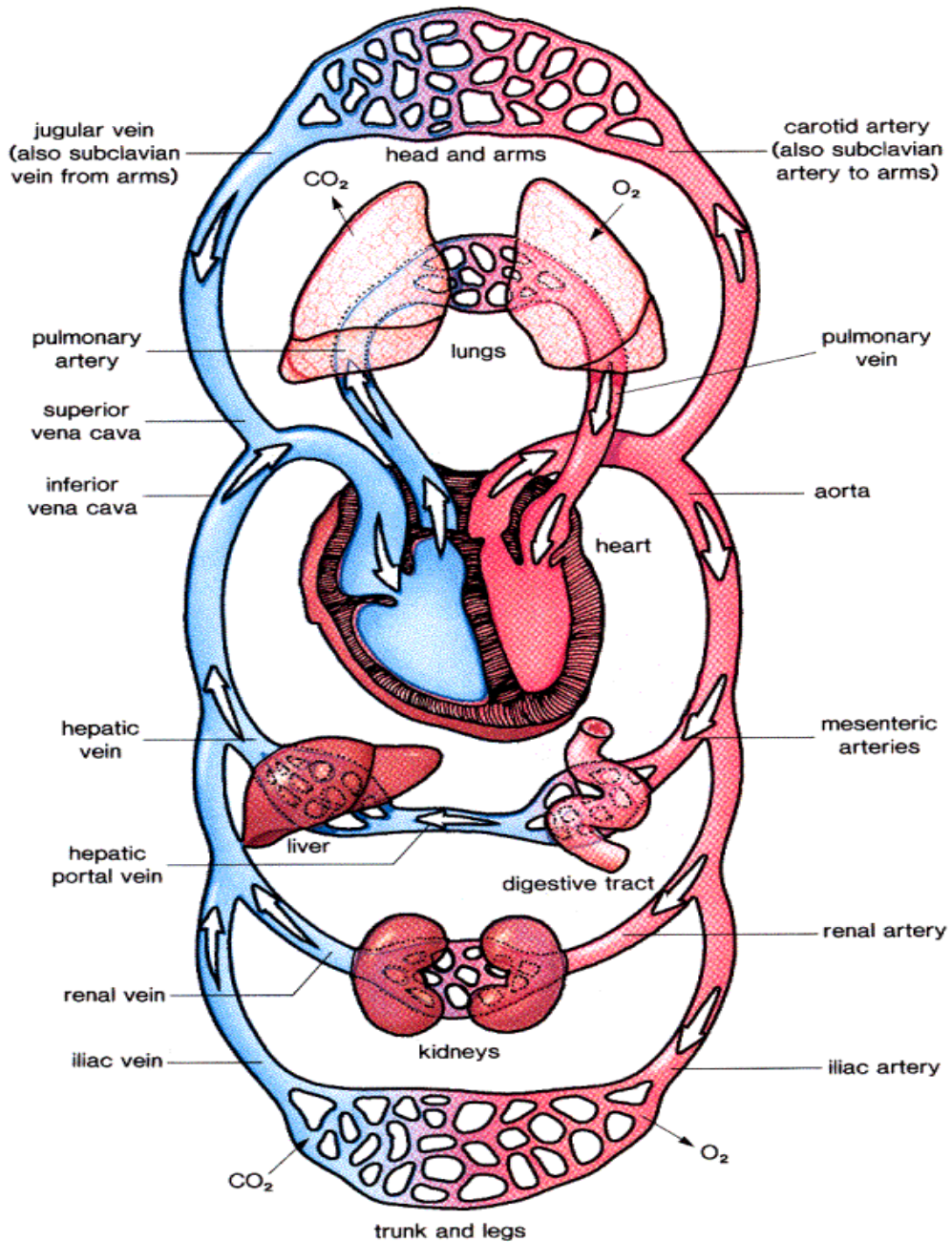
# Organ Systems

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



# CARDIOVASCULAR SYSTEM



# Organ Systems

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

# Organ Systems

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- 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

# Organ Systems

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

# Organ Systems of the Body

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- Male reproductive system
  - Main function is the production of offspring
  - Testes produce sperm and male sex hormones
  - Ducts and glands deliver sperm to the female reproductive tract

# Organ Systems of the Body

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- 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

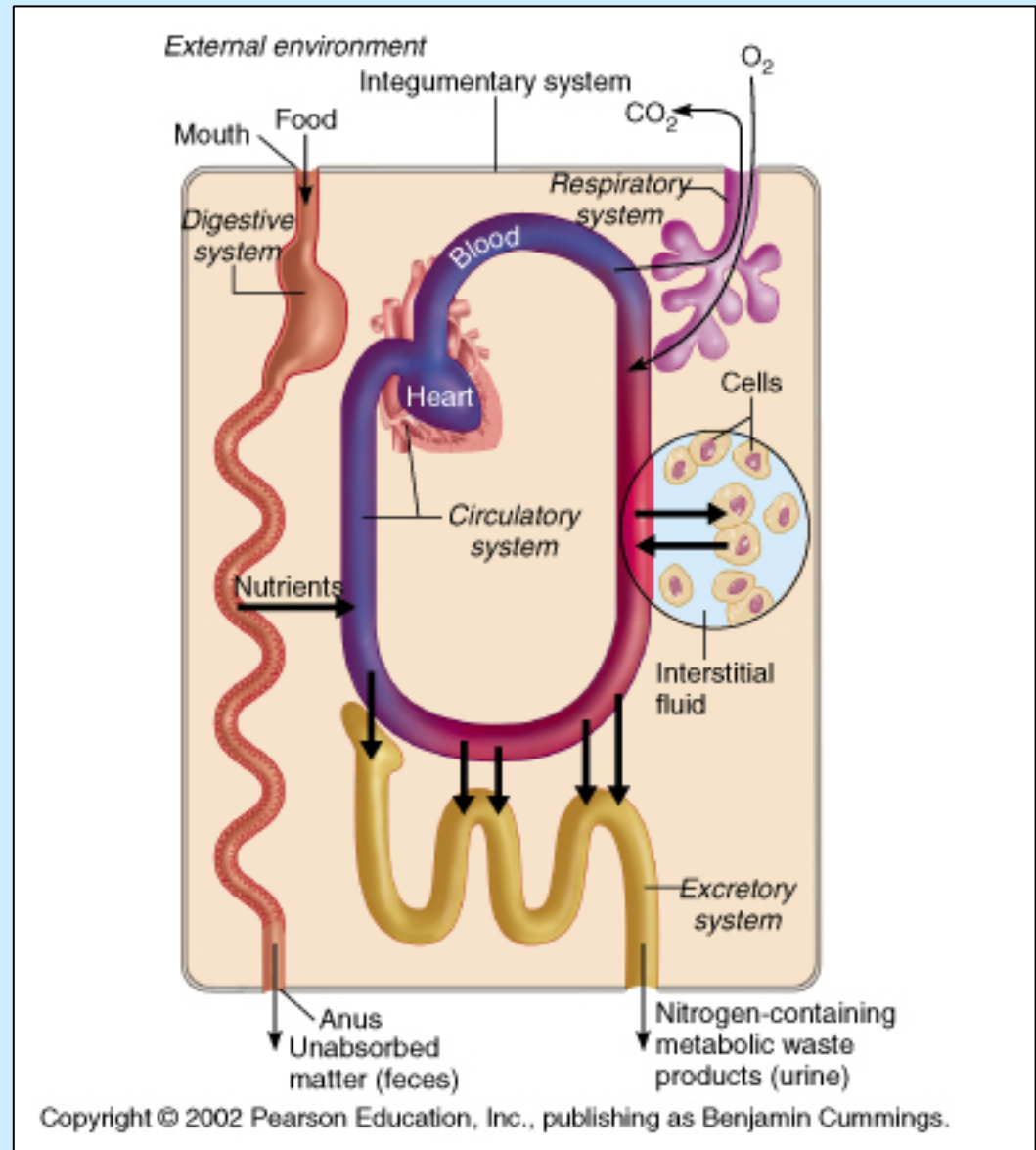
# Organ System Interrelationships

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- The integumentary system protects the body from the external environment
- Digestive and respiratory systems, in contact with the external environment, take in nutrients and oxygen

# Organ System Interrelationships

- Nutrients and oxygen are distributed by the blood
- Metabolic wastes are eliminated by the urinary and respiratory systems





# Necessary Life Functions I

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- *Maintaining boundaries* – the internal environment remains distinct from the external
  - Cellular level – accomplished by plasma membranes
  - Organism 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 food

# Necessary Life Functions II

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

# Metabolism

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A broad term used for all the chemical reactions that occur within cells of the body

*Catabolism* - breaking down substances into simpler components

*Anabolism* – synthesizing more complex substances or structures from simpler substances

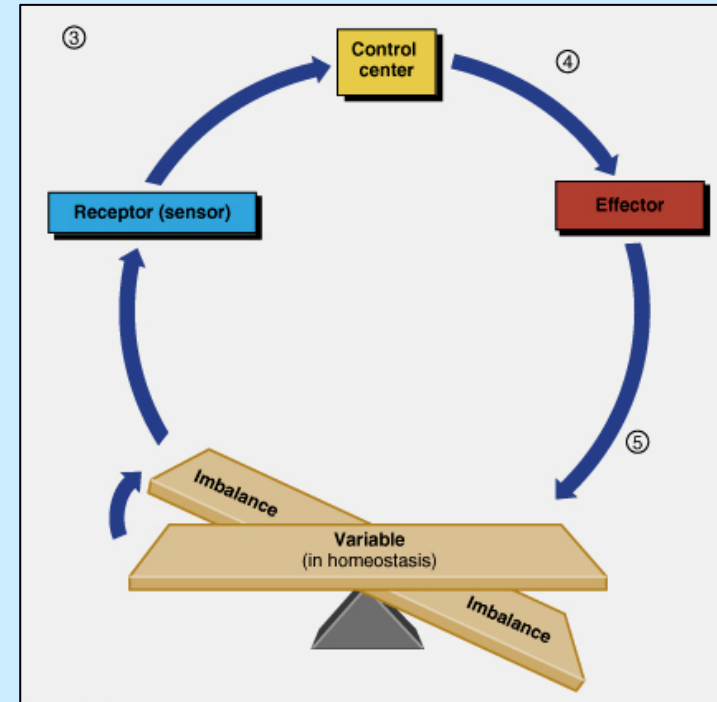
# Homeostasis

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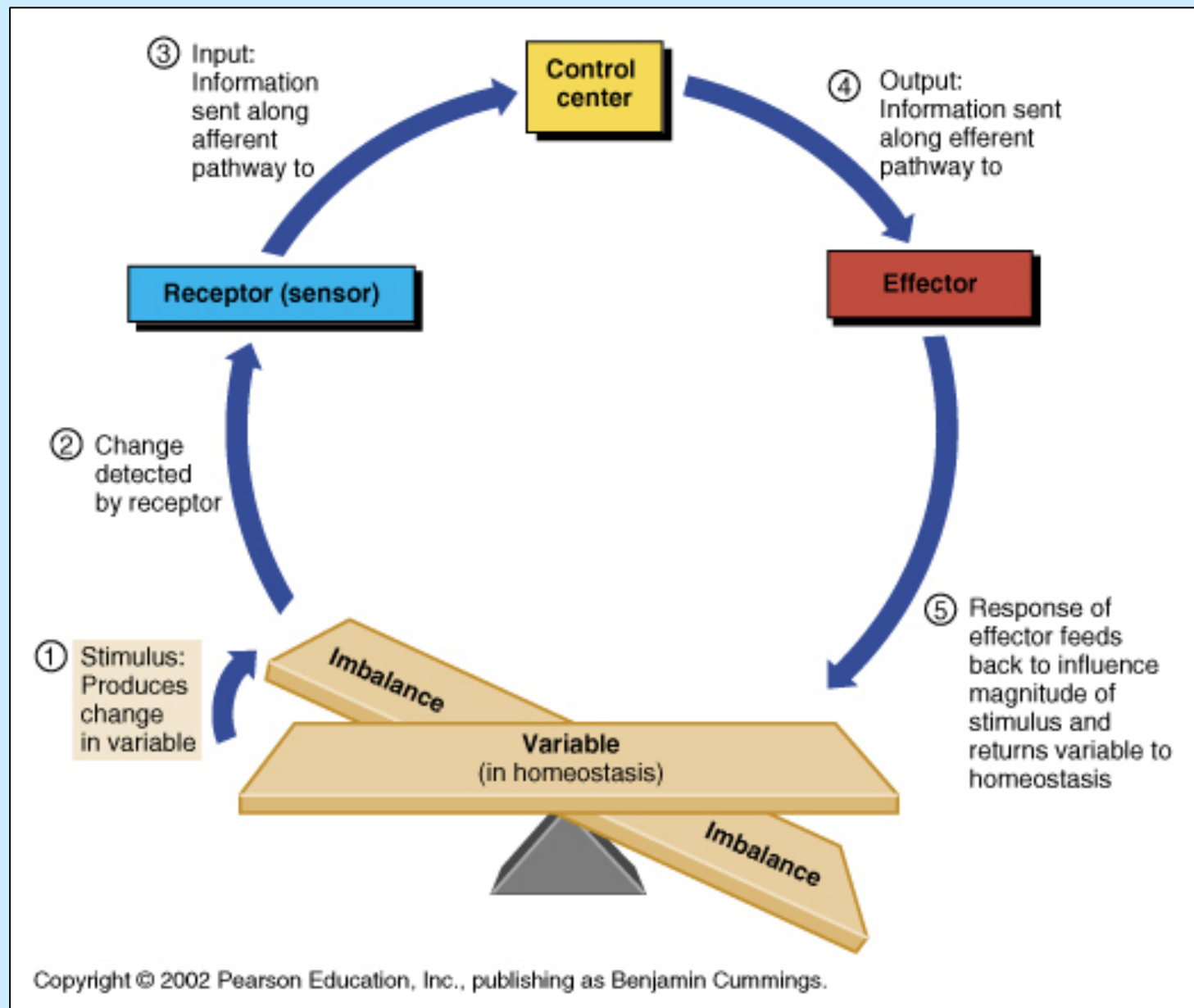
- Homeostasis is the ability of the body to maintain a relatively stable internal environment
- The internal environment of the body is in a dynamic state of equilibrium (internal conditions vary, but within relatively narrow limits)
- A wide variety of chemical, thermal, and neural factors act and interact in complex ways to maintain homeostasis

# Homeostatic Control Mechanisms

- Variable – the factor or event being regulated
- Receptor monitors the environment 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 stimulus

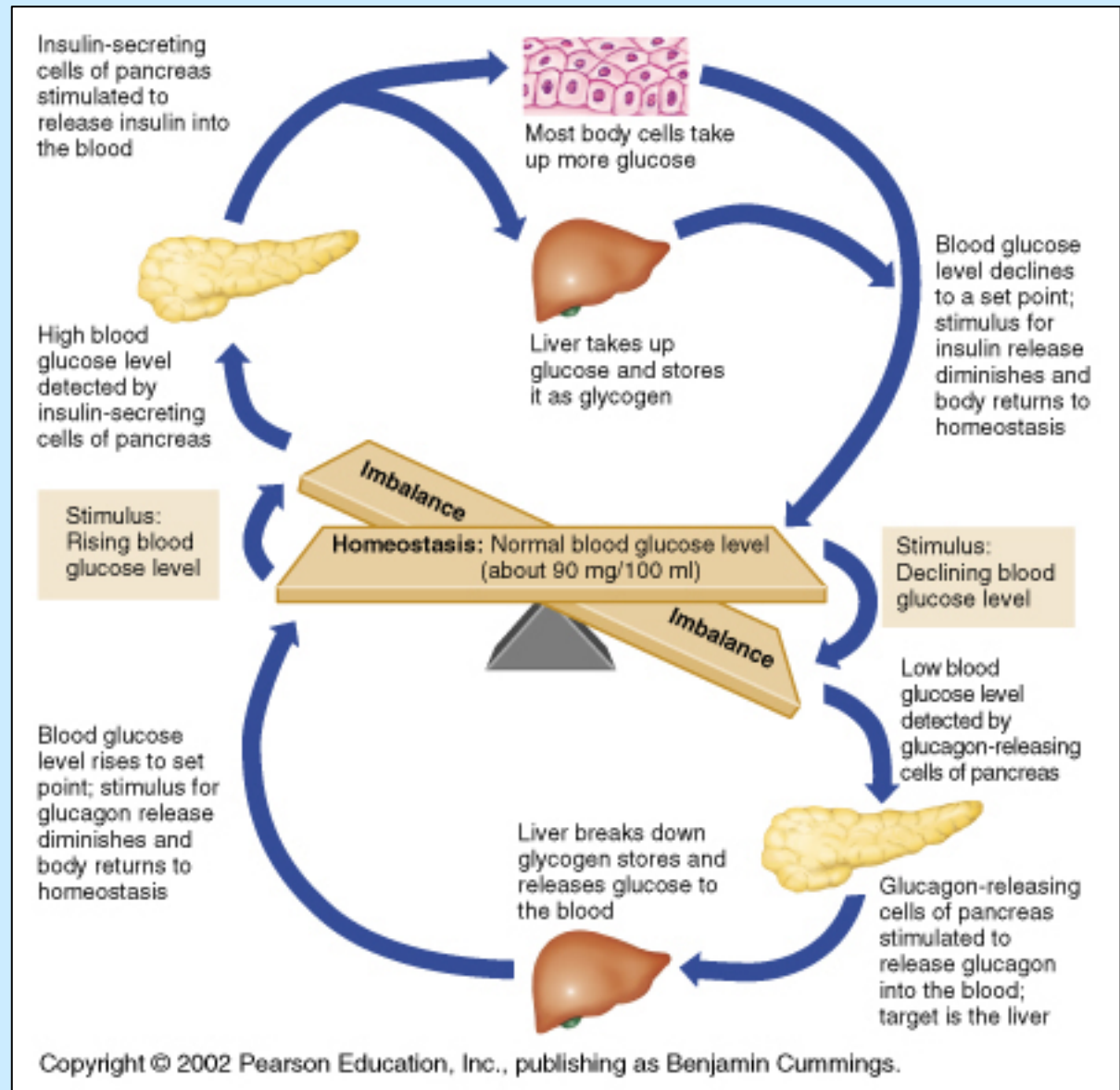


# Homeostatic Control Mechanisms



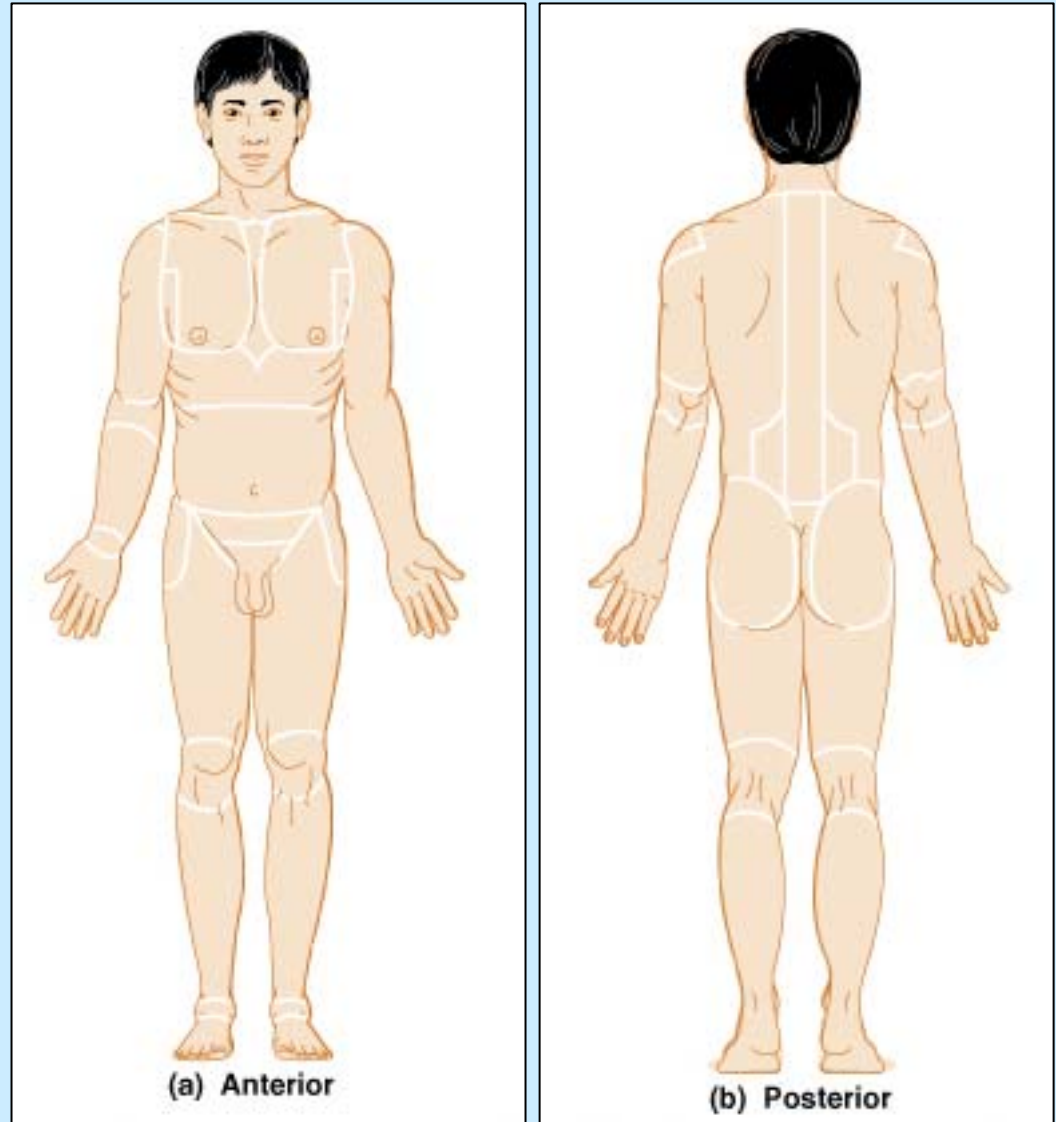
# Negative Feedback

- In negative feedback systems, the output “turns down” or “shuts off” the original stimulus
- Example: Regulation of blood glucose levels



# Anatomical Position

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

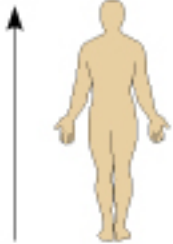
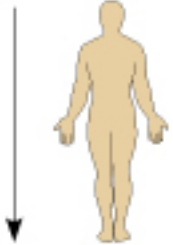
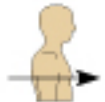




# Directional Terms

**TABLE 1.1**

**Orientation and Directional Terms**

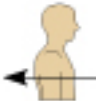
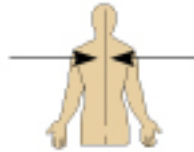
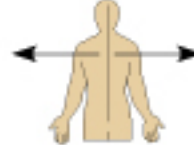

<i>Term</i>	<i>Definition</i>	<i>Example</i>
Superior (cranial)	Toward the head end or upper part of a structure or the body; above	 The head is superior to the abdomen
Inferior (caudal)	Away from the head end or toward the lower part of a structure or the body; below	 The navel is inferior to the chin
Anterior (ventral)*	Toward or at the front of the body; in front of	 The breastbone is anterior to the spine

\*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
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
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 breastbone and shoulder

\*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

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- Proximal and Distal – closer to and farther from the origin of the body part or the point of attachment of a limb
- Superficial (External) and Deep (Internal) – toward and away from the body surface

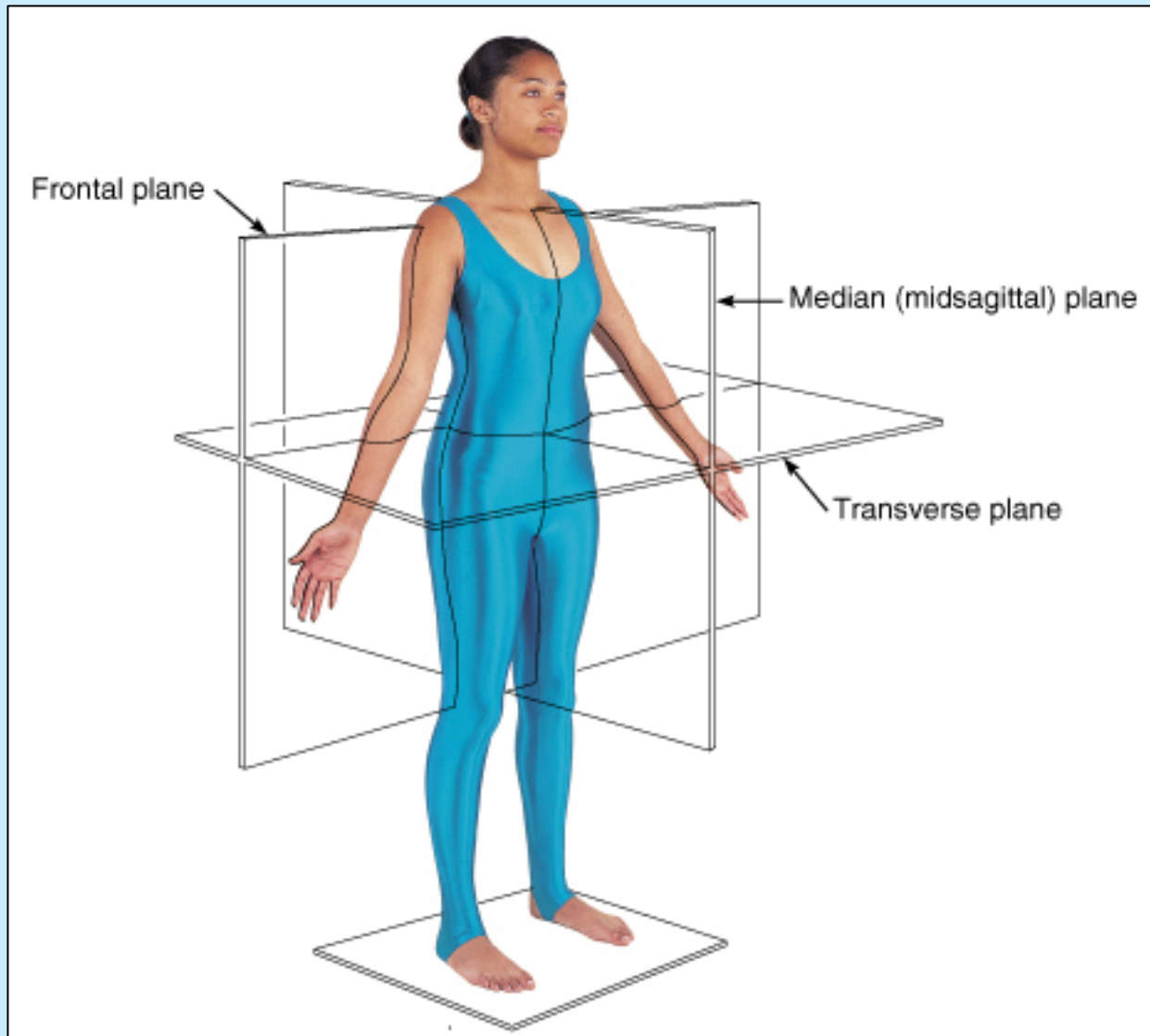
# Directional Terms

**TABLE 1.1** Orientation and Directional Terms

<i>Term</i>	<i>Definition</i>	<i>Example</i>
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

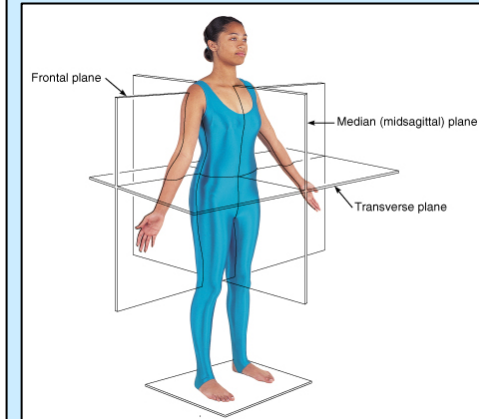
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# Body Planes



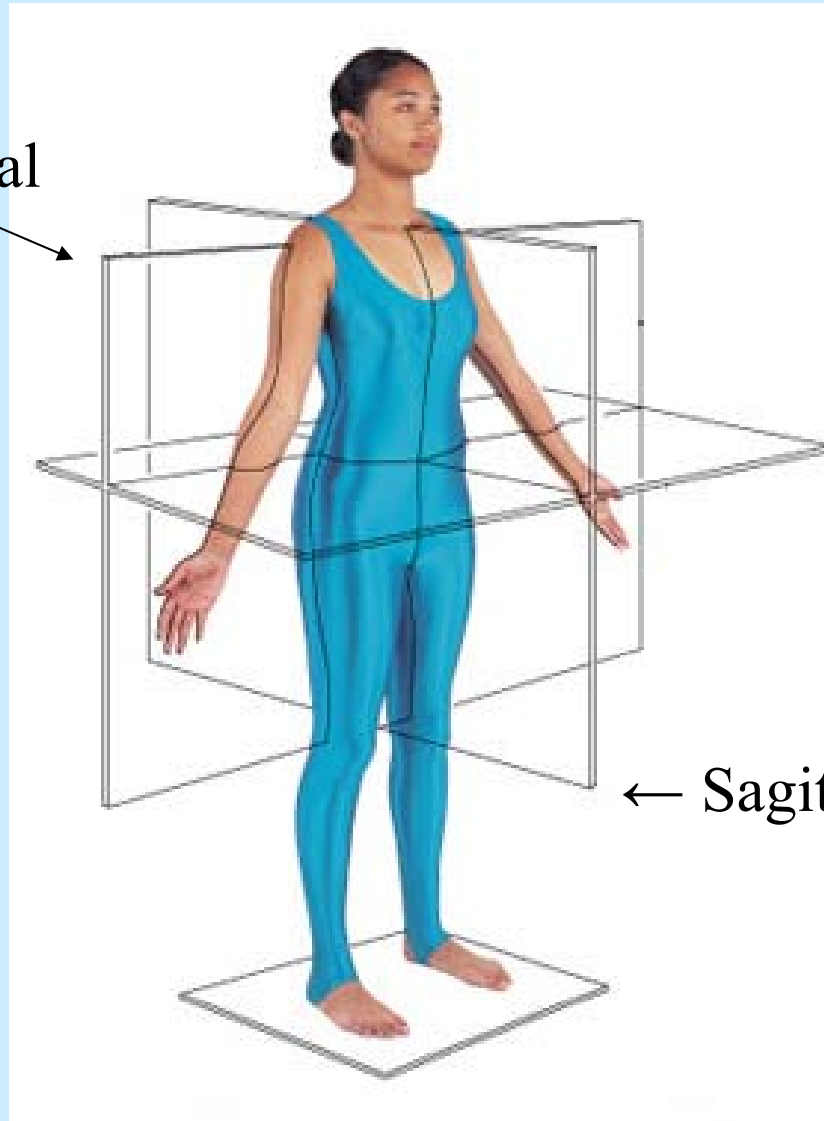
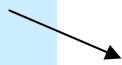
# Body Planes

- Sagittal and Medial – divides the body into right and left parts
- Midsagittal – 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

Frontal or Coronal  
Plane



← Transverse Plane

← Sagittal Plane

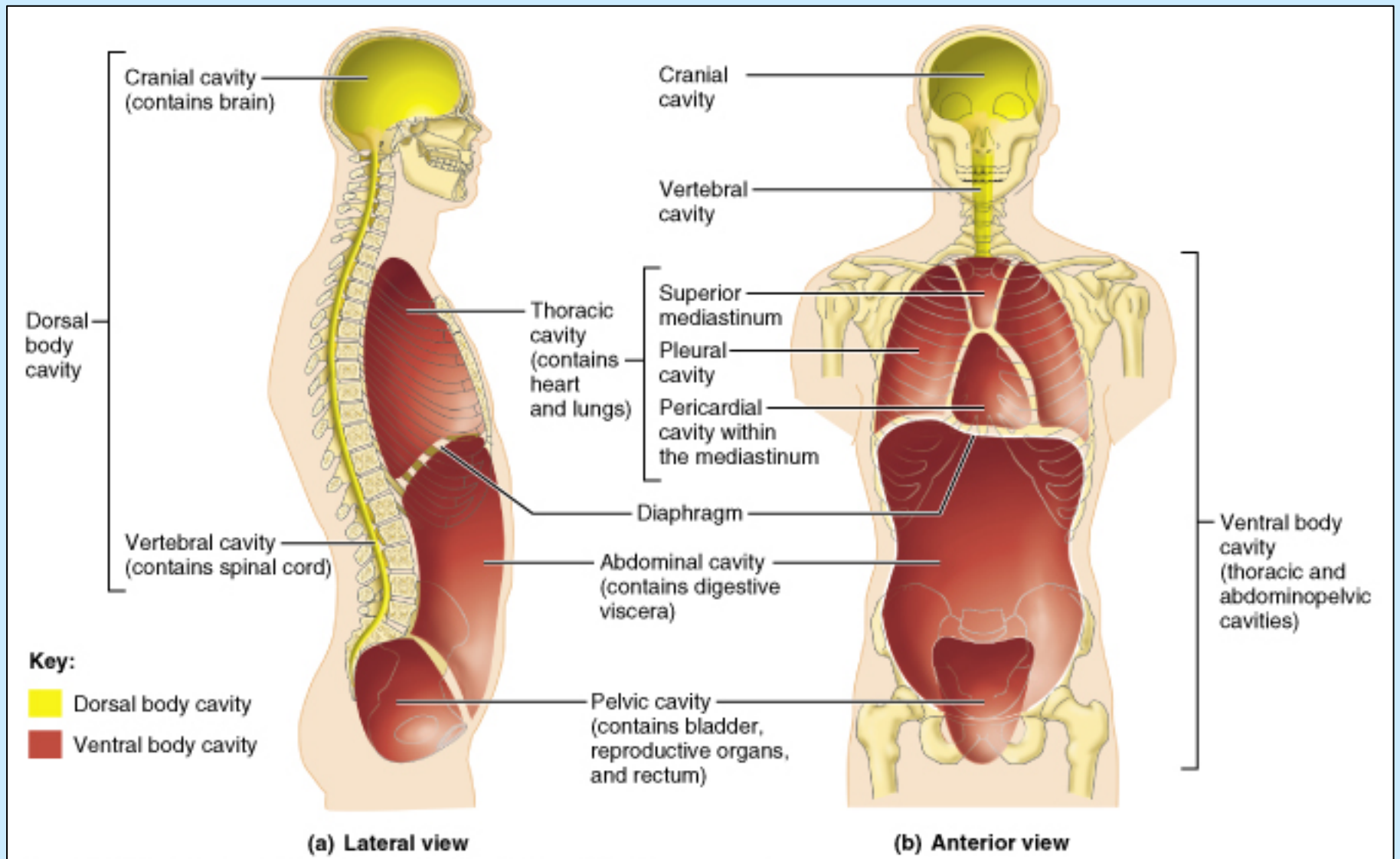
# Body Cavities

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- Dorsal cavity protects the nervous system, and is divided into two subdivisions
  - Cranial cavity is within the skull and encases the brain
  - Vertebral cavity runs within the vertebral column and encases the spinal cord
- Ventral cavity houses the internal organs (viscera), and is divided into two subdivisions: thoracic and abdominopelvic

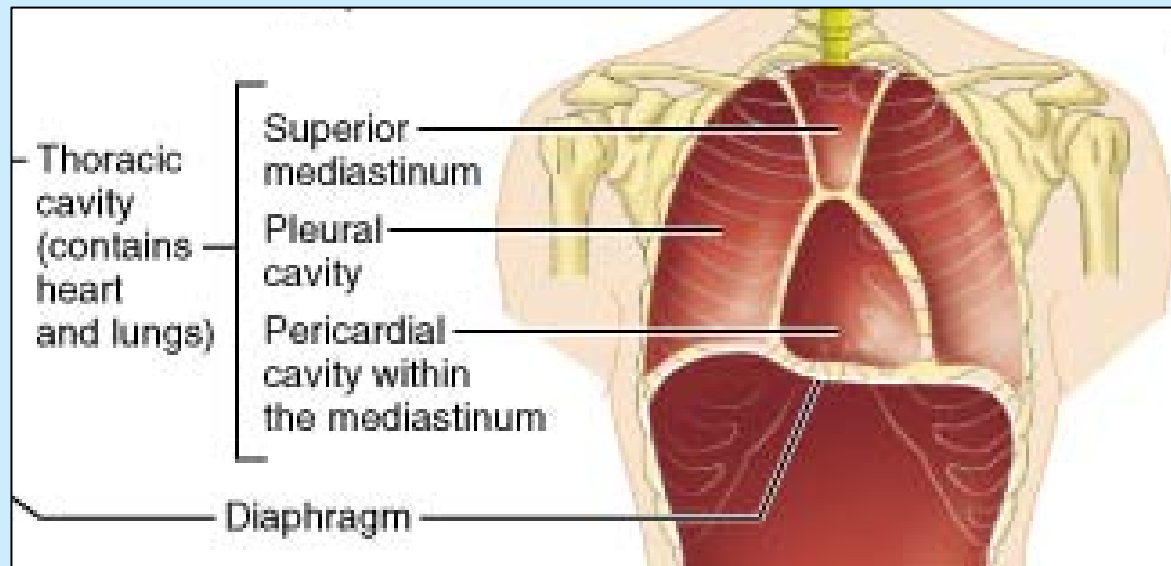


# Body Cavities



# Body Cavities

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

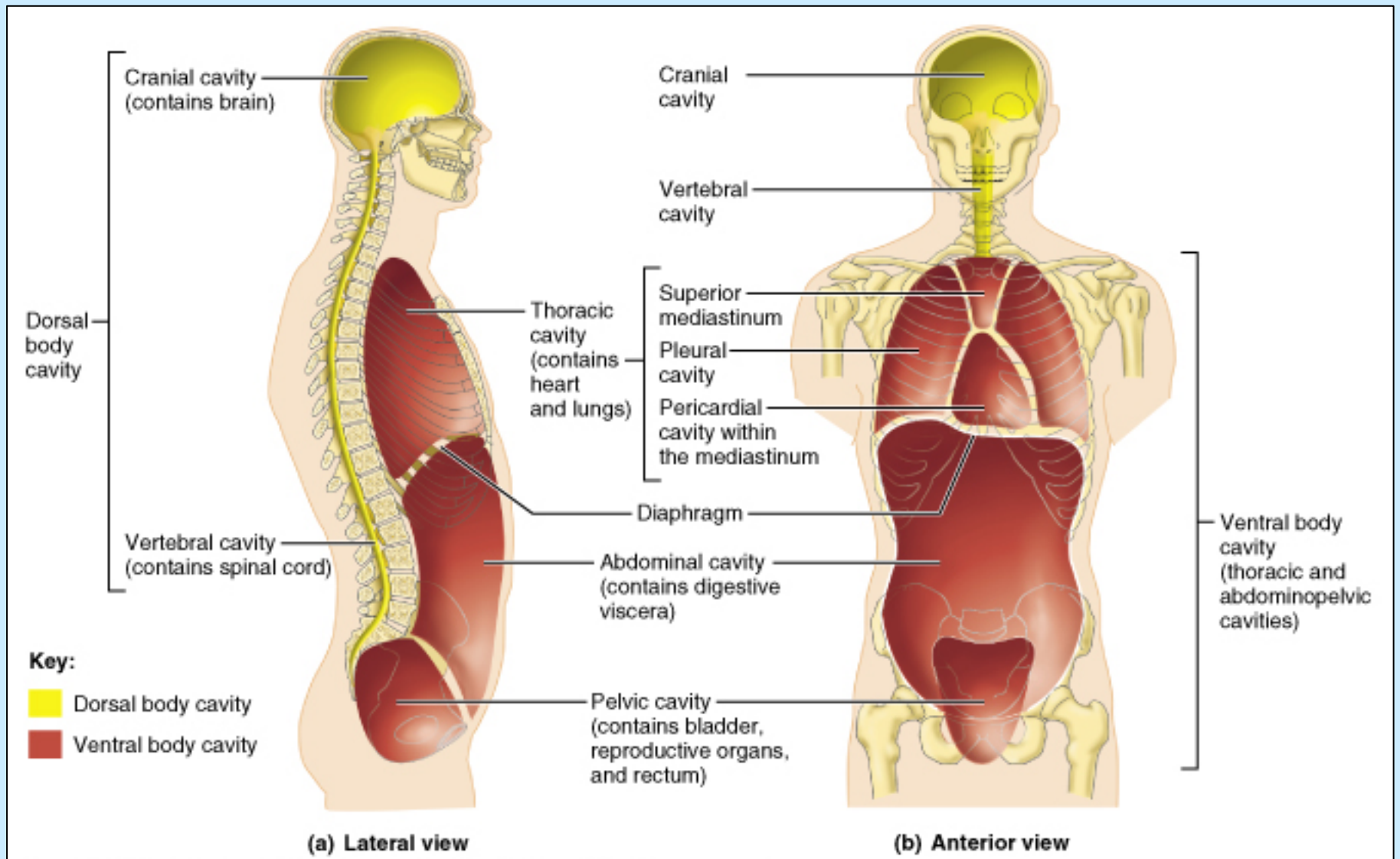


# Body Cavities

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- The abdominopelvic cavity is separated from the superior thoracic cavity by the dome-shaped diaphragm
- It is composed of two subdivisions
  - Abdominal cavity – contains the stomach, intestines, spleen, liver, and other organs
  - Pelvic cavity – lies within the pelvis and contains the bladder, reproductive organs, and rectum

# Body Cavities

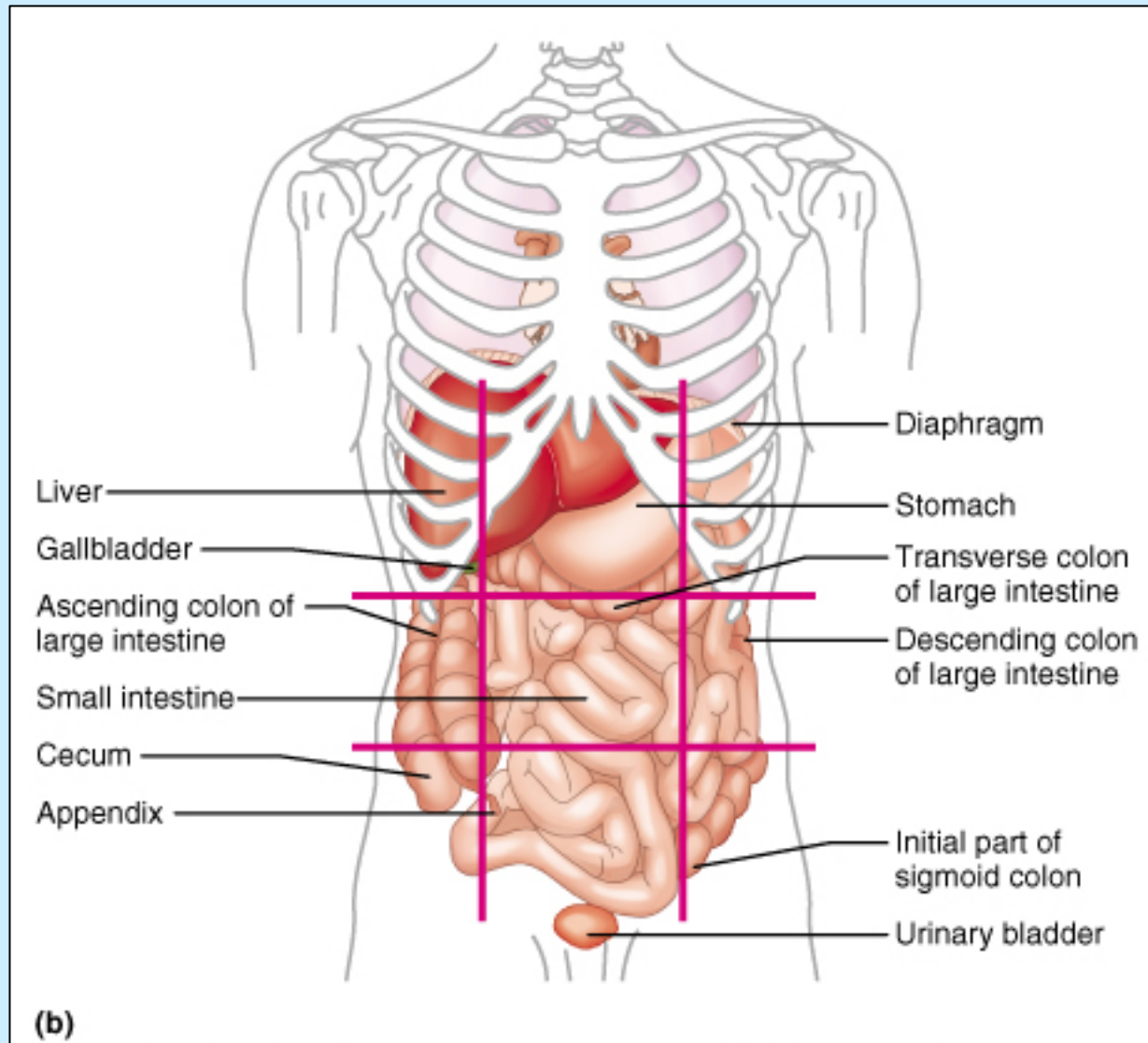


# Other Body Cavities

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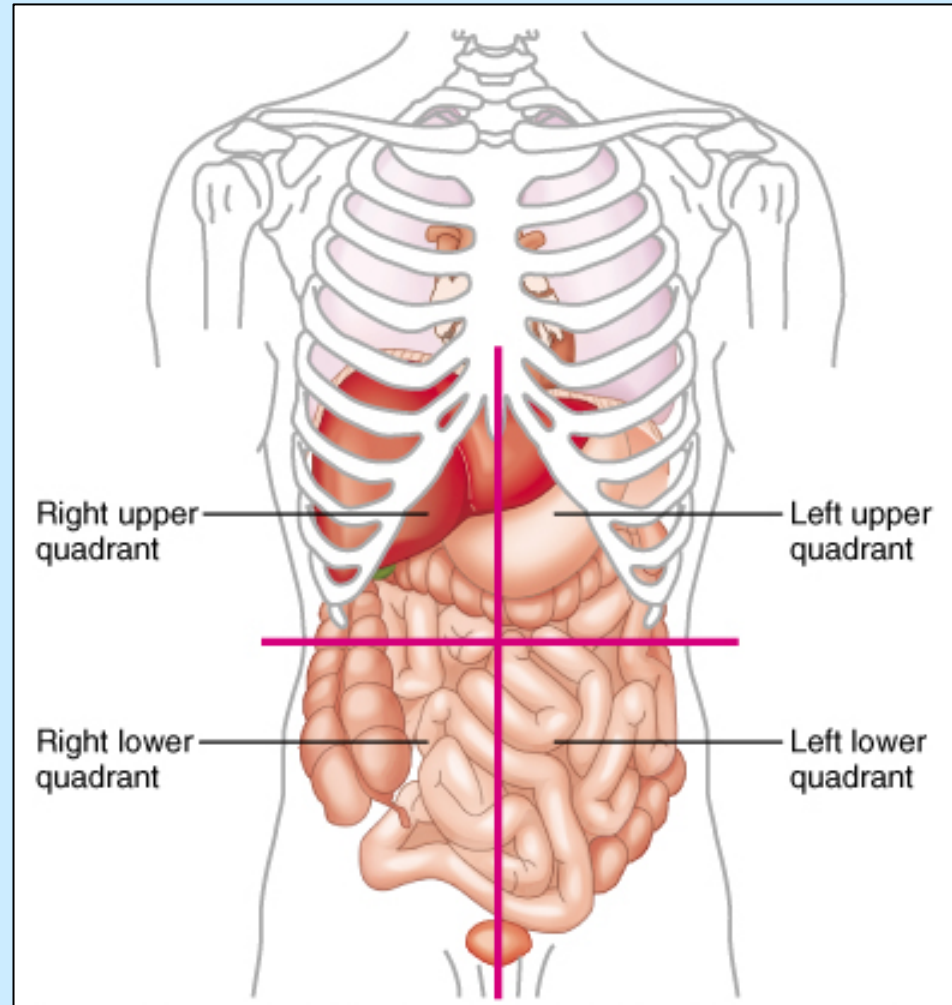
- Oral and digestive – mouth and cavities of the digestive organs
- Nasal –located within and posterior to the nose
- Orbital – house the eyes
- Middle ear – contain bones (ossicles) that transmit sound vibrations
- Synovial – joint cavities

# Abdominopelvic Regions



# Abdominopelvic Quadrants

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



# Anatomy & Physiology

## The Human Body: An Orientation

### Chapter 1

