

# The Human Organism

**Anatomy and Physiology**

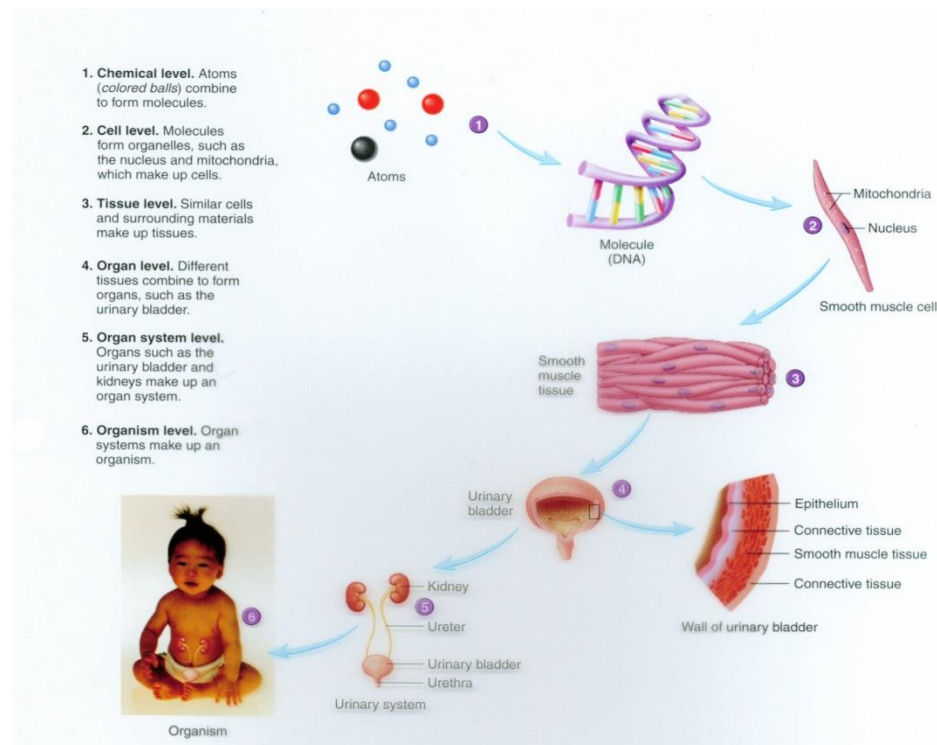
**Unit 1**

**Organization of the Human Body**

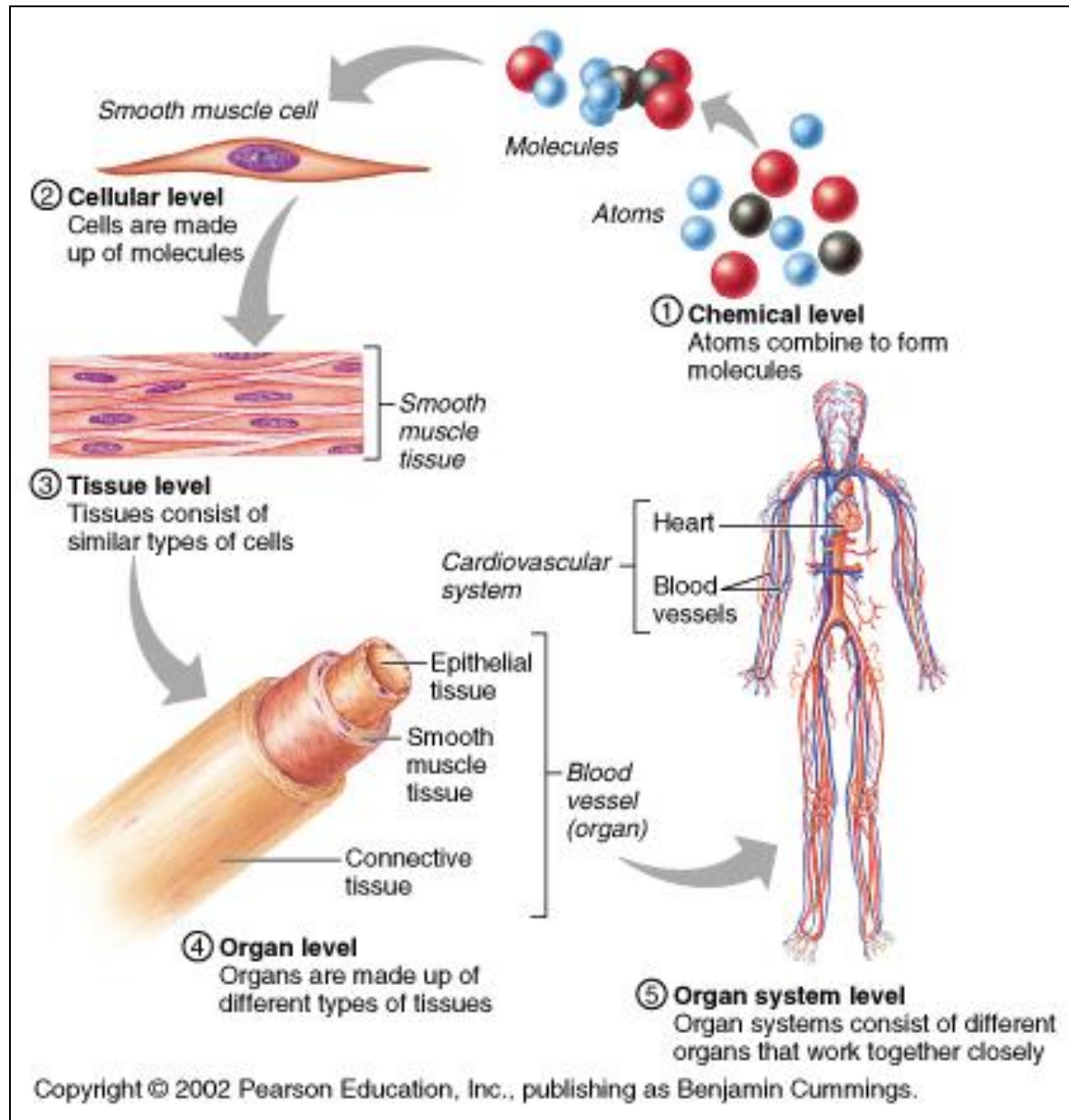
- Anatomy: (The cutting apart or separate) is the science of the structure and relationships among structures.
- Physiology: The Study or the science of the Process or Function of the Body.
- (How it works)

# Levels of Organization

## Atoms to Molecules to cells to Tissues to Organs to Organ systems to Organism



# Levels of Structural Organization



Atoms

Molecule

Organelle

Cell

Tissue

Organ

Organ System

Organism

# 1. Chemical Levels:

- Atoms and Molecules:
- Atoms are the building Blocks of matter. Each atom is sometimes known as an element. Atoms or elements, such as carbon, nitrogen, sulfur, hydrogen, calcium, oxygen, and phosphorous are essential for proper life functions.
- Molecules are two or more elements that are chemically combined.
- Molecules such as ATP, DNA, Oxygen, vitamins, will play a role with this.

## 2. Cells:

- Cells are the basic structural and functional units in our bodies. Each cell works as a tiny furnace burning up food and producing carbon dioxide. (Respiration)
- Plant Cells, Animal Cells, Moneran Cells, Fungal Cells, Protist Cell
- There are 100 trillion cells in the human body and the majority of these cells are located in the blood.

- The two types of blood cells are the Red Blood Cells or hemoglobin, and the White Blood Cells or leukocytes.
- Each cell is made up of tiny structures called organelles. These are the basic organs of each cell.

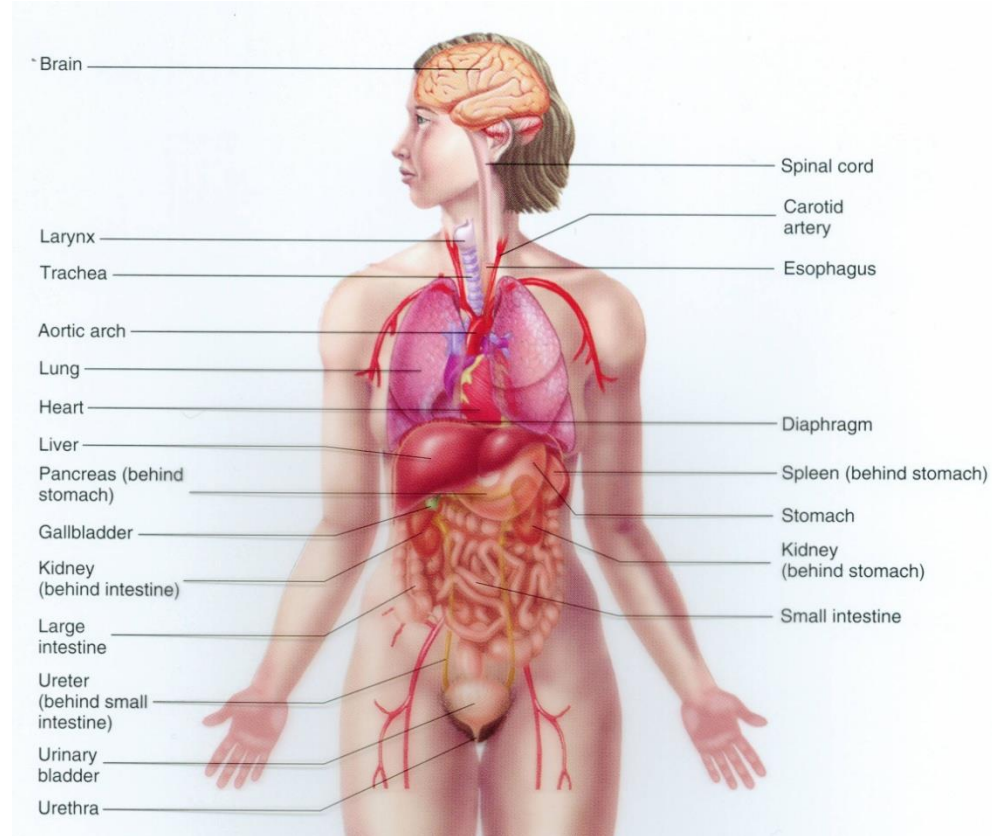
### 3. Tissues

- Tissue is a group of cells that work together to perform a specific function.
- Four types of tissues are: epithelial, connective, muscle, and nervous.



# 4. Organ Level:

- These are structures that are composed of more than one type of tissue, and they come together to perform a specific function.
- Ex. Kidney , Liver, heart,, etc...



# 5. Organ Systems

- Organ systems are a group of organs that come together to perform a common function.
- Ex. Cardiovascular System this includes the heart, arteries, veins, capillaries, et...

## 6. Organism

This is the highest level of organization. All of these components must work together in order to have a healthy organism.

Living organisms have 6 characteristics.

- **1. Differentiation and Made up of cells:** One cell ( unicellular) or many cells (Multicellular) each cell has a specific function.
- **Differentiation** is the change in cell structure and function.
- After fertilization general cells specialize to become specific types of cells, like skin, muscle, nerve, and organs.

- **2. Reproduce:** Make new cells or new offspring.
- **A. Asexual Reproduction.** Cells divide to form new cells.
- **B. Sexual Reproduction:** New Organisms reproduce from two parent organisms.
- \*Both animals and some plants reproduce this way.

- **3. Grow and Develop.**
- **Growth:** This can result in the size of all the parts of the organism.
- Number of cells, size of cells and the substance surrounding the cell.

- **4. Development:** Includes the changes the organism goes through over a period of time.
- **Begins with fertilization and ends with death.**
- The greatest developmental changes occur before birth.
- Many changes occur throughout our life.

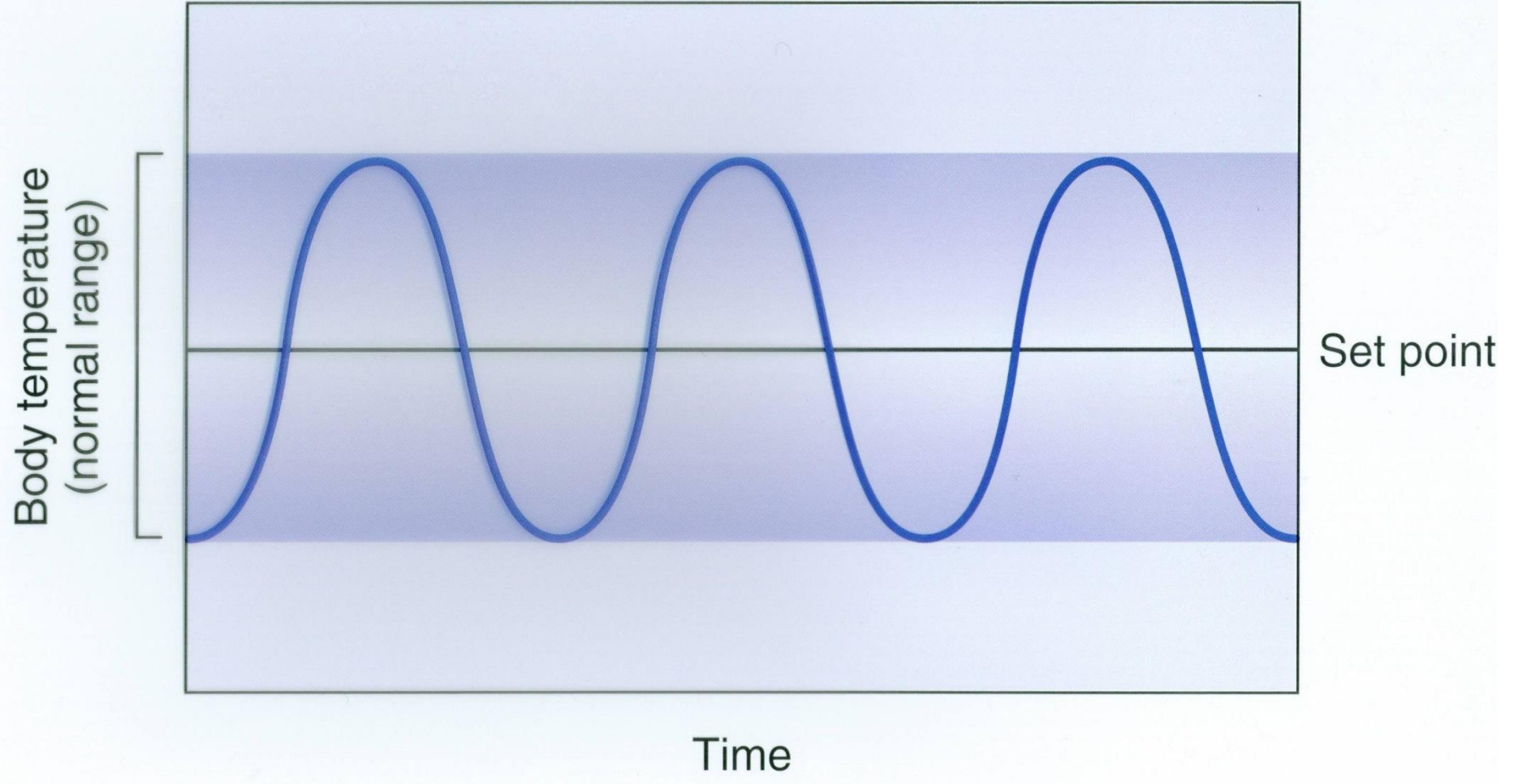
- **5. Metabolism or Obtain and use energy.** The chemical processes that are used to, give off heat, move and allow cells to grow and develop



- **6. Respond to their environment.** To allow the organism to move and interact with other organism in their environment.
- Could be flight, attack, talk or any other gestures.

# Homeostasis

- Homeostasis:
- This is the condition in which the internal environment of the body remains in a stable condition. This condition may have a narrow range.



# Homeostasis continued

- It is the optimal condition for a healthy body and does not change regardless of any changes that occur in or out of the body.
- Interstitial fluid is a large part of the internal environment of the body. It is the fluid that brings the nutrients and oxygen from the blood to the cell.
- It also carries waste products to the blood for removal.

# Homeostasis continued

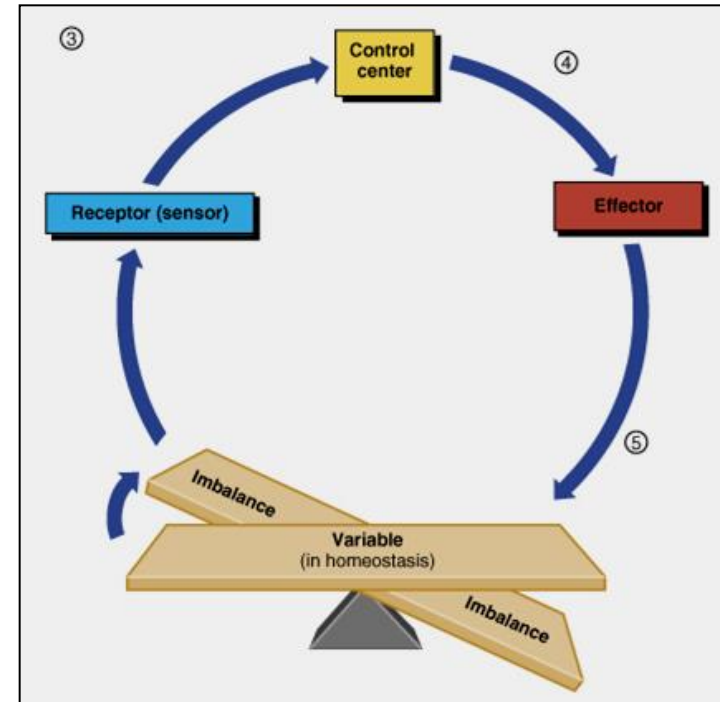
- It regulates the nervous and the endocrine system.
- The nervous system detects changes in the body and sends impulses to help maintain a stable environment. The endocrine system secretes hormones to help maintain and regulate homeostasis.

# Homeostasis continued

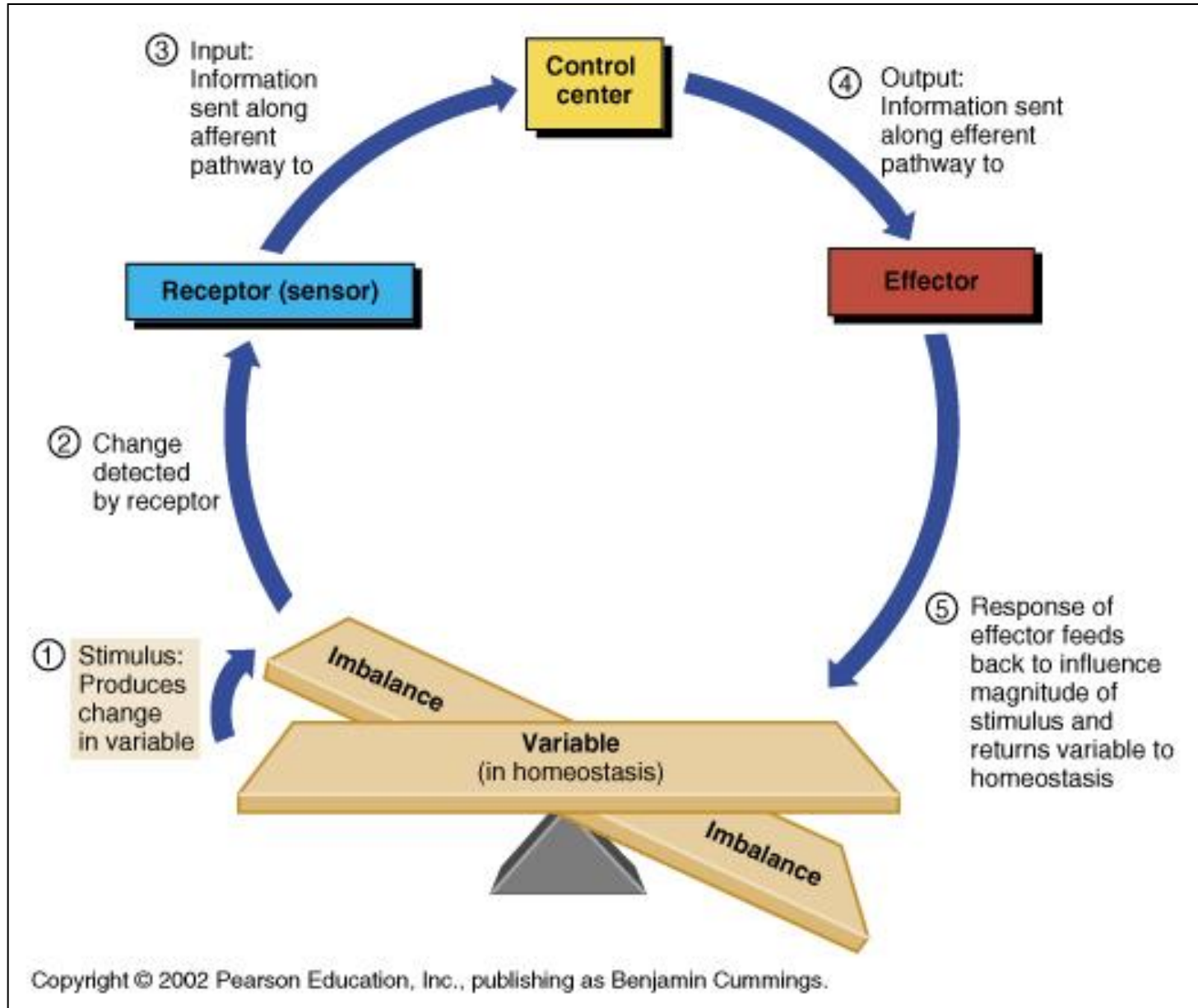
- Disruption may cause a mild or a quick response by the body. If the disturbance is severe it could cause an entire system to run into failure.

# 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



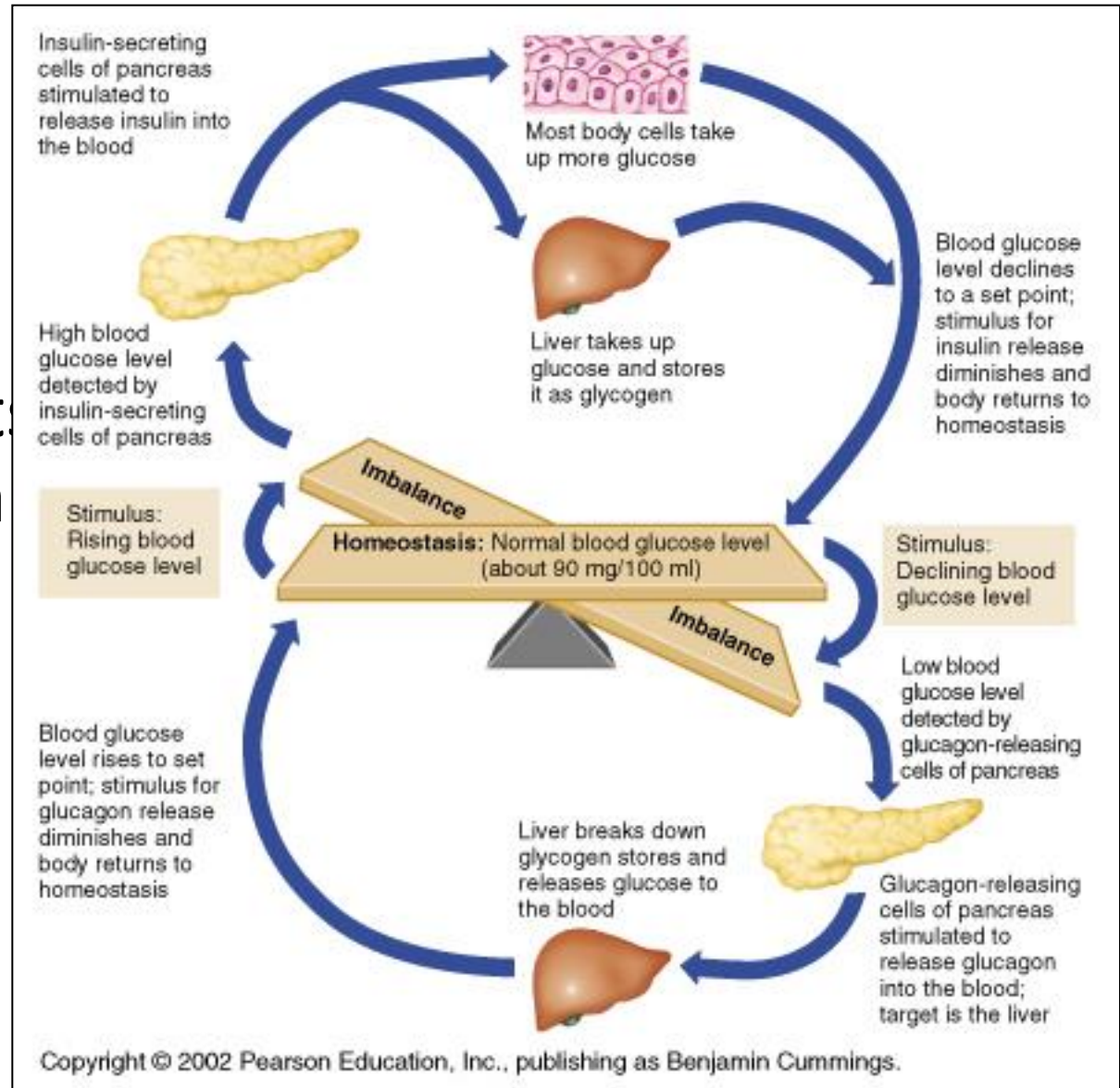
# Homeostatic Control Mechanisms





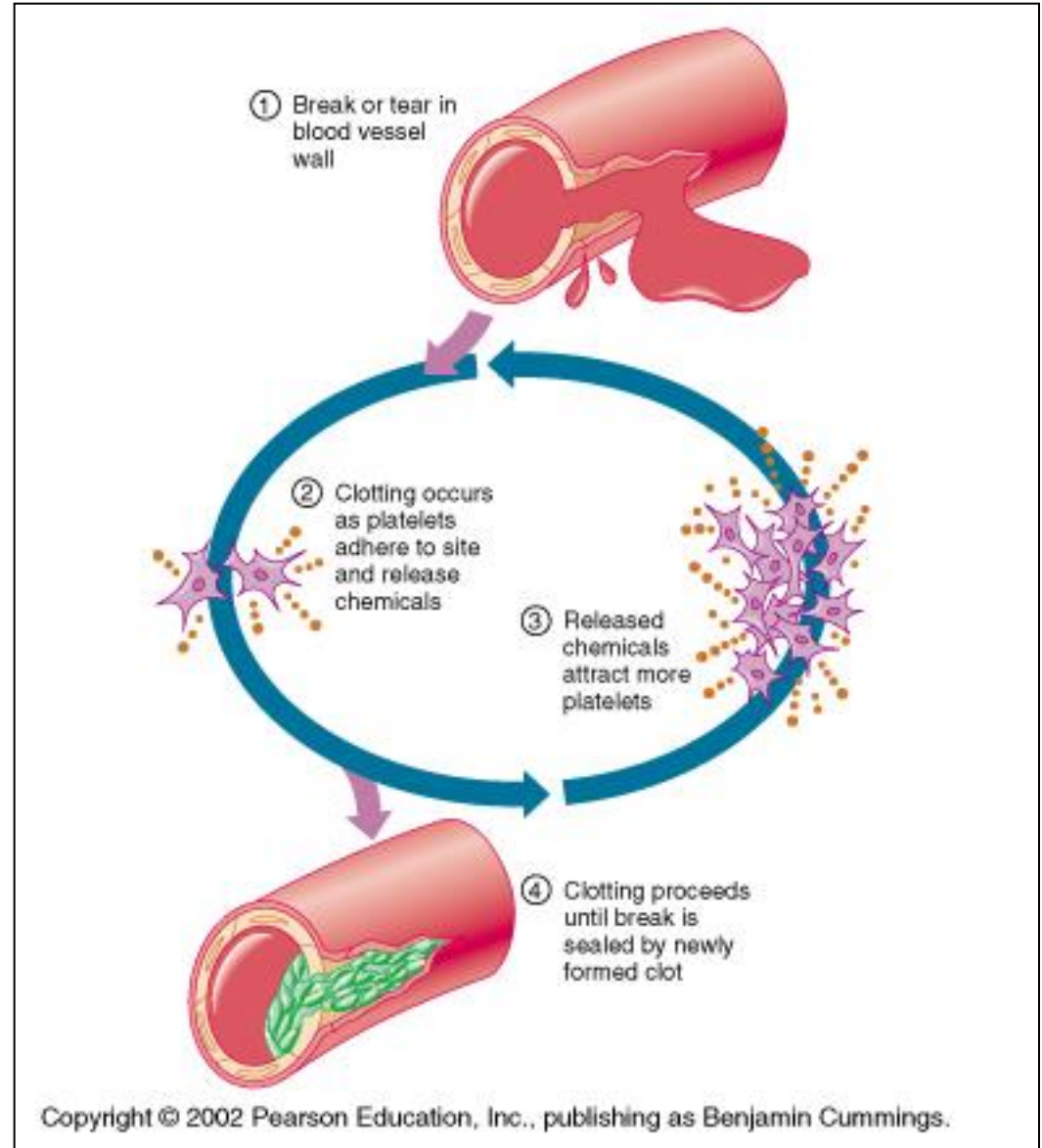
# Negative Feedback

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



# Positive Feedback

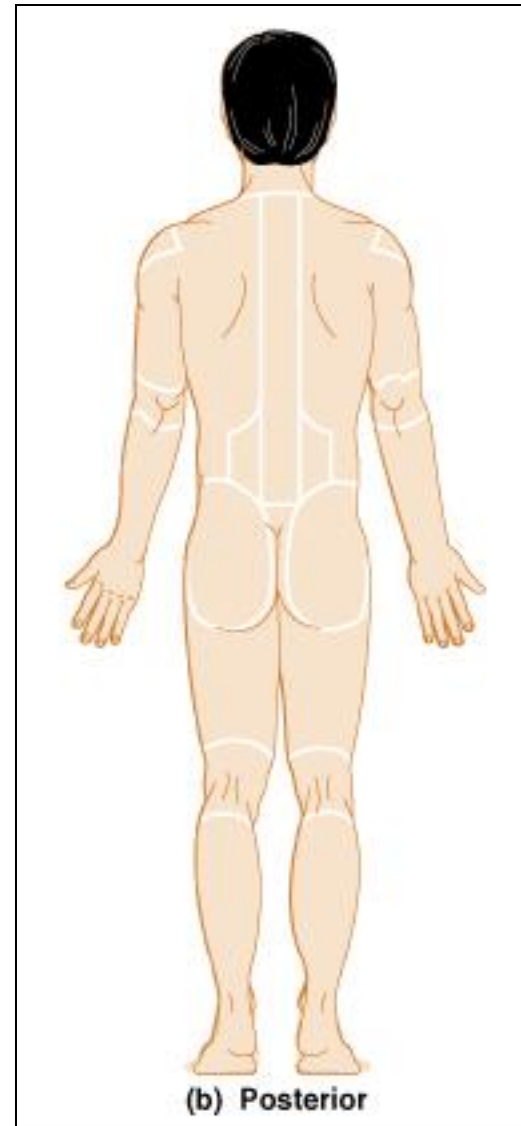
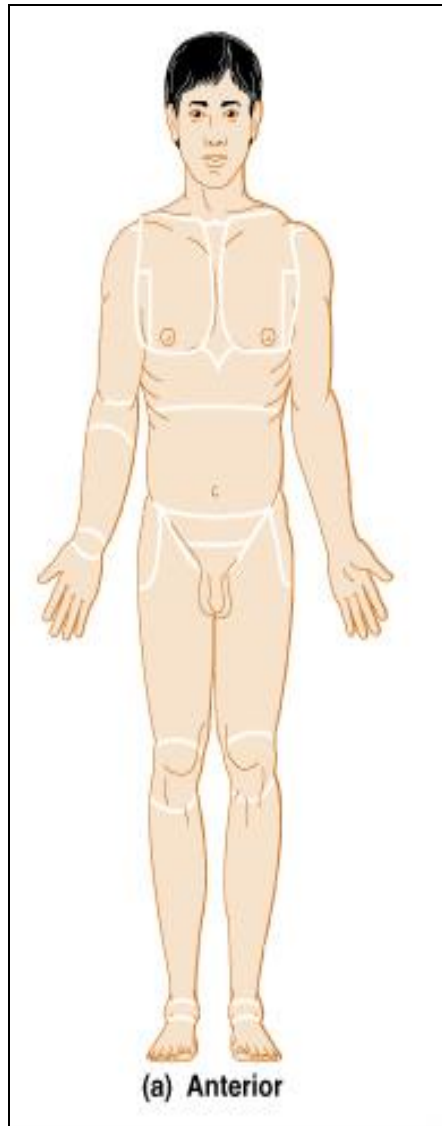
- In positive feedback systems, the output enhances or “turns up” the original stimulus
- Examples: Regulation of blood clotting, Uterine contractions during labor.



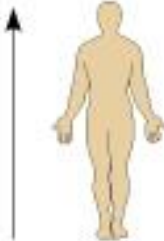
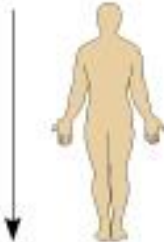
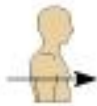
# Ch 1 Directional Terms

- These are given so that we can find the location of different body structures and that there will be a lower chance of confusion when treating a specific area.
- We all understand the names of the Body regions and what they include..
- Skull, neck, trunk, upper limb, lower limb but we need to understand some specific terms that are used.

- **Anterior**= front
- **Posterior**= back
- **Superior** = toward the head
- **Inferior**= away from the head or lower portion
- **Medial**= Nearer the midline or middle of the structure.
- **Lateral**= Away from the middle or midline
- **Proximal**= nearer to the attachment of the limb or the origin.


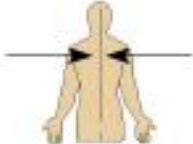
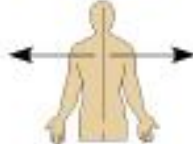



**TABLE 1.1****Orientation and Directional Terms**

<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.

**TABLE 1.1****Orientation and Directional Terms**

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



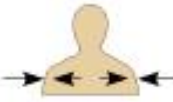

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- **Distal**= farther away from the attachment or origin.
- **Superficial**= Nearer the surface.
- **Deep**= away from the surface.
- **Dorsal**= at or on the back.
- **Ventral**= the front section or pertaining to the front.
- **Supine** = the back or pertaining to the back.



TABLE 1.1

## Orientation and Directional Terms

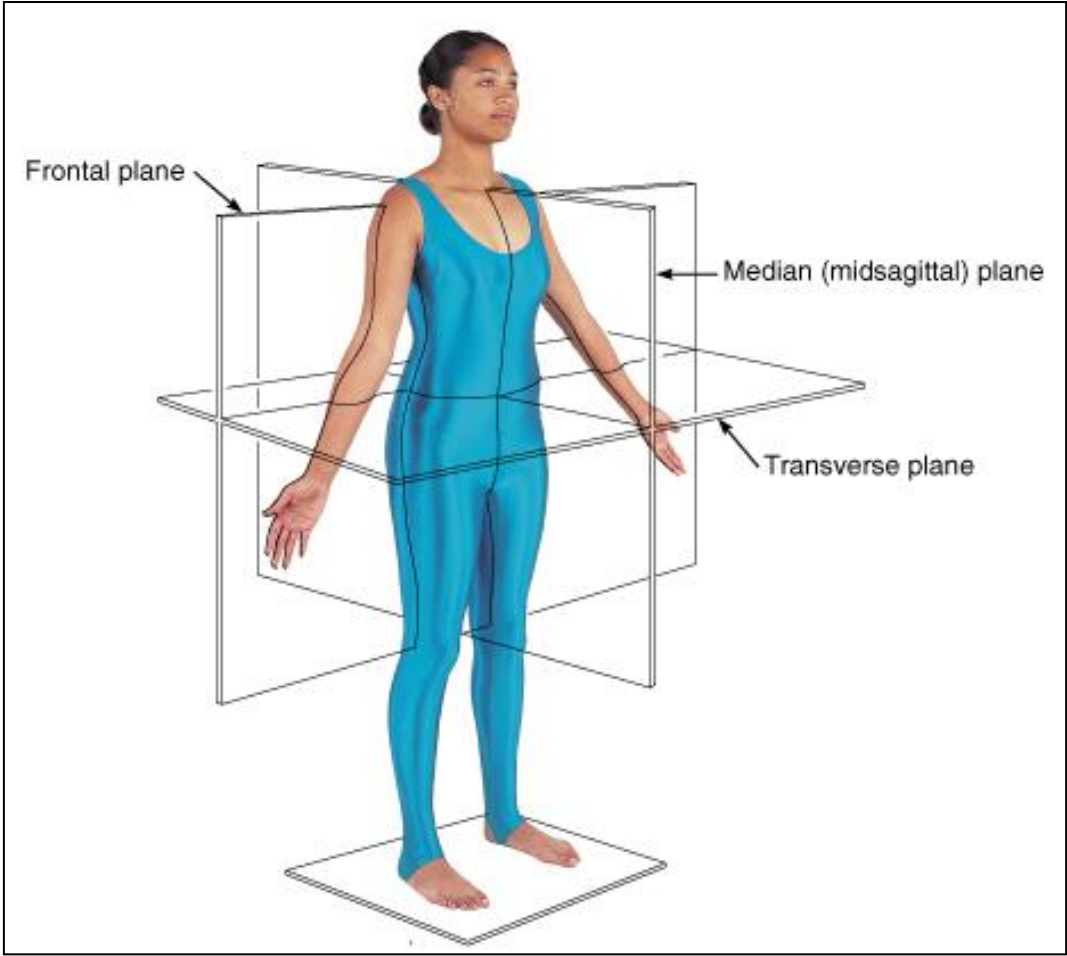
<i>Term</i>	<i>Definition</i>	<i>Example</i>
Proximal	Closer to the origin of the body part or the point of attachment of a limb to the body trunk	 <p>The elbow is proximal to the wrist</p>
Distal	Farther from the origin of a body part or the point of attachment of a limb to the body trunk	 <p>The knee is distal to the thigh</p>
Superficial (external)	Toward or at the body surface	 <p>The skin is superficial to the skeletal muscles</p>
Deep (internal)	Away from the body surface; more internal	 <p>The lungs are deep to the skin</p>

\*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.

# Planes and Sections:

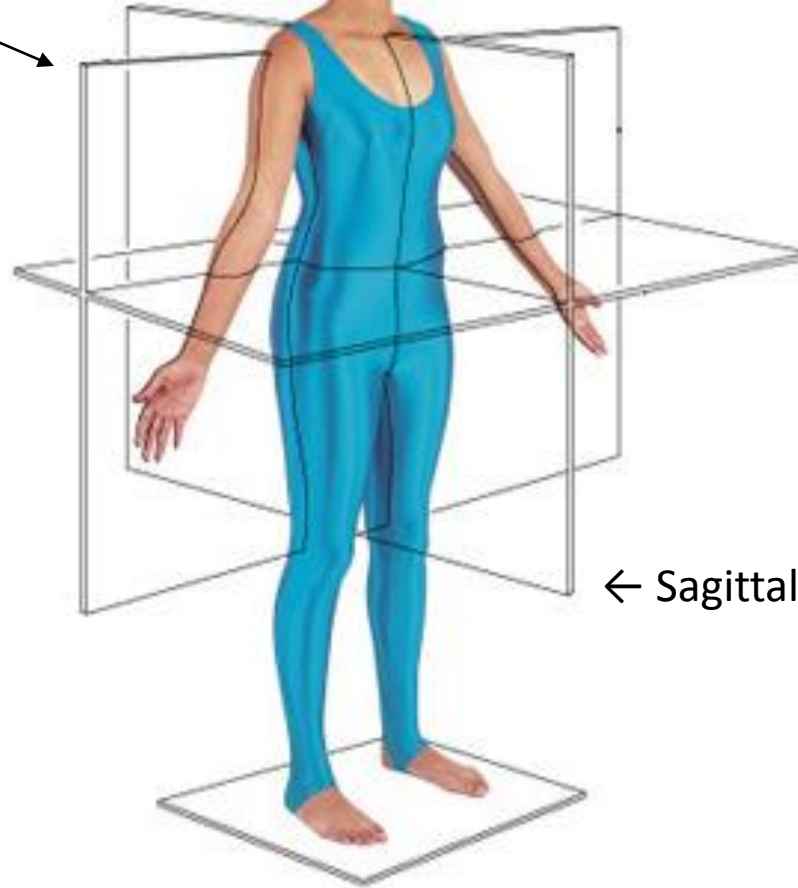
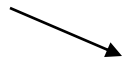
- **Frontal Plane:** Divides the body into Posterior and Anterior sections
- 
- **Transverse Plane:** Divides the body into Inferior and Superior portions.
- 
- **Sagittal Plane:** Divides the body into right and left sides.





# Body Planes

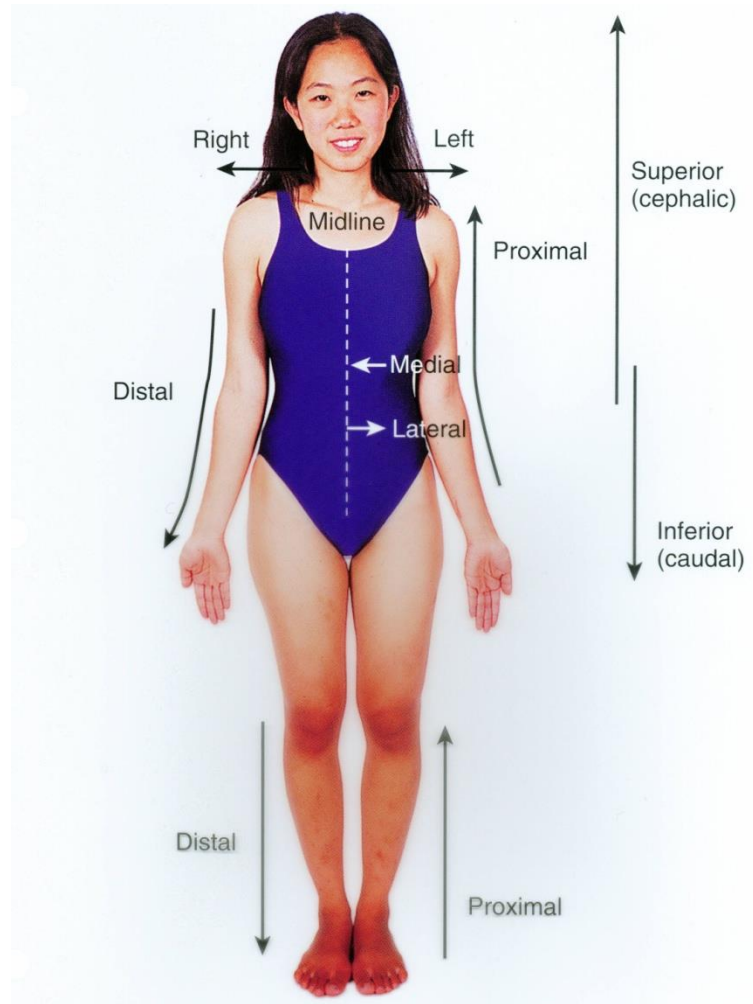
Frontal or Coronal Plane



← Transverse Plane

← Sagittal Plane

- **Midsagittal Plane:** Divides the body into Equal left and Right portions.
- 
- **Parasagittal Plane:** Divides the body into unequal left and Right portions.
- 
- **Oblique Plane:** Passes through the body or structure at an angle.

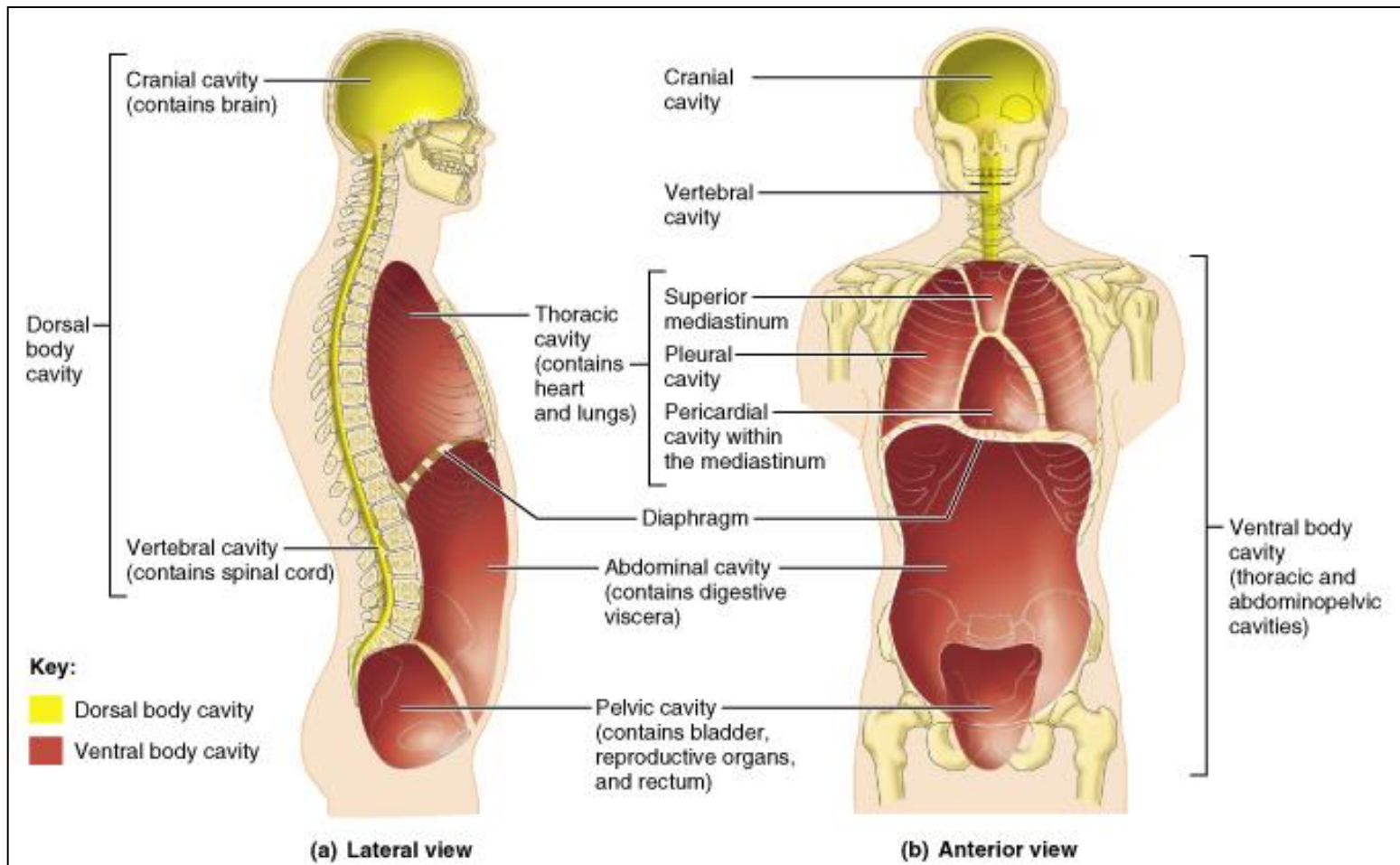


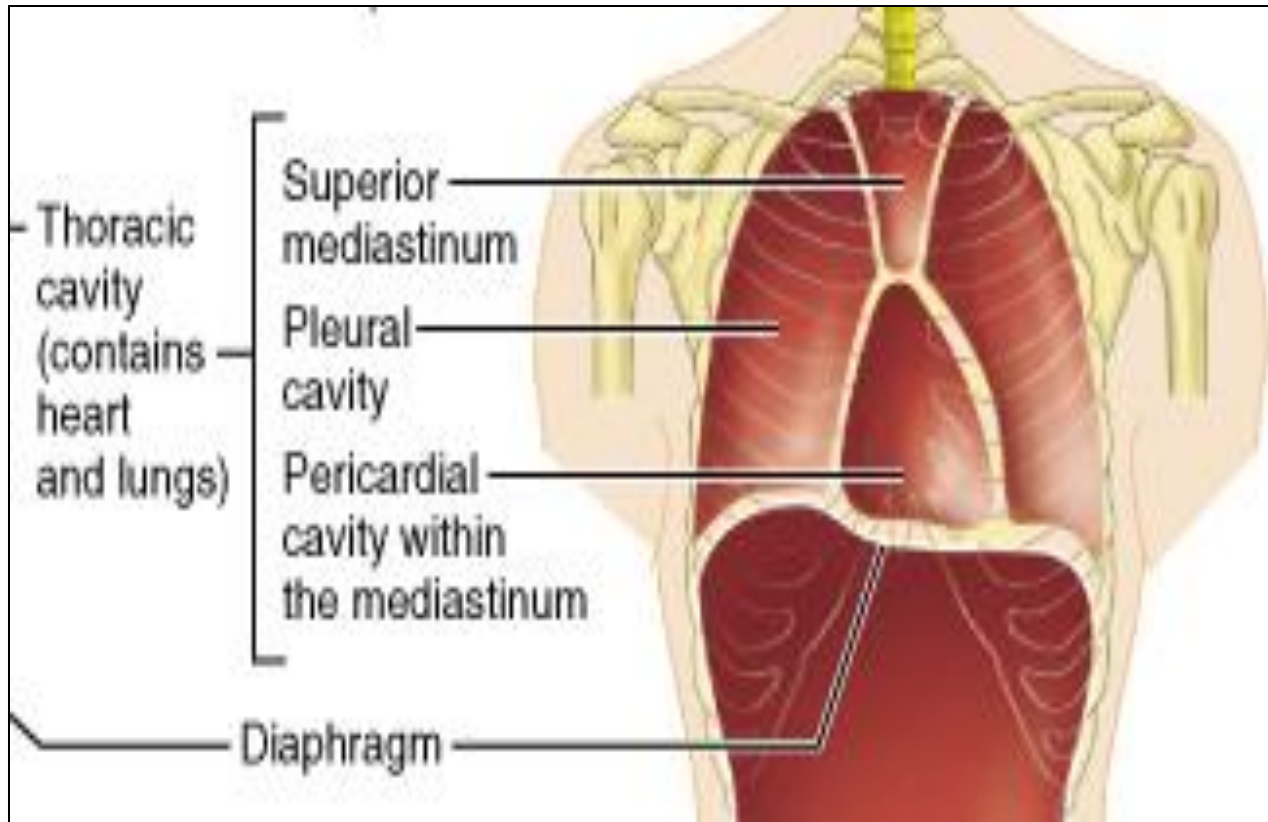
# Body Cavities:

- Dorsal Cavities
- 
- Cranial: The area formed by the bones of the skull, and contains as well as its coverings.
- 
- Vertebral: The area formed by the vertebral column, and contains the spinal cord and the beginnings of the spinal nerves.



- **Ventral Cavities**: (Visceral space)
- **Thoracic**: The chest cavity formed by the ribs, sternum and the diaphragm.
- Contains smaller cavities or spaces such as the
- **Pericardial**: heart
- **Pleural**: lung
- **Mediastinum** area that has the esophagus, thymus, heart, lungs, aorta, Superior and Inferior vena cava and lymphatic vessels.





- **Abdominopelvic**: Both the abdominal and pelvic regions.
- 
- **Abdominal**: contains the Spleen, Liver, Gallbladder, Kidney, Small Intestine, and most of the Large Intestine.
- 
- **Pelvic**: This space is created by the pelvic girdle contains the urinary bladder a small portion of the large intestine and the internal reproductive organs.
-

Abdominopelvic Cavity is broken down into regions.

- Right and Left Hypochondriac, Epigastrio, Right and left lumbar, umbilical,
- Right and left iliac, and hypogastric Regions.

# Abdominopelvic Regions

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

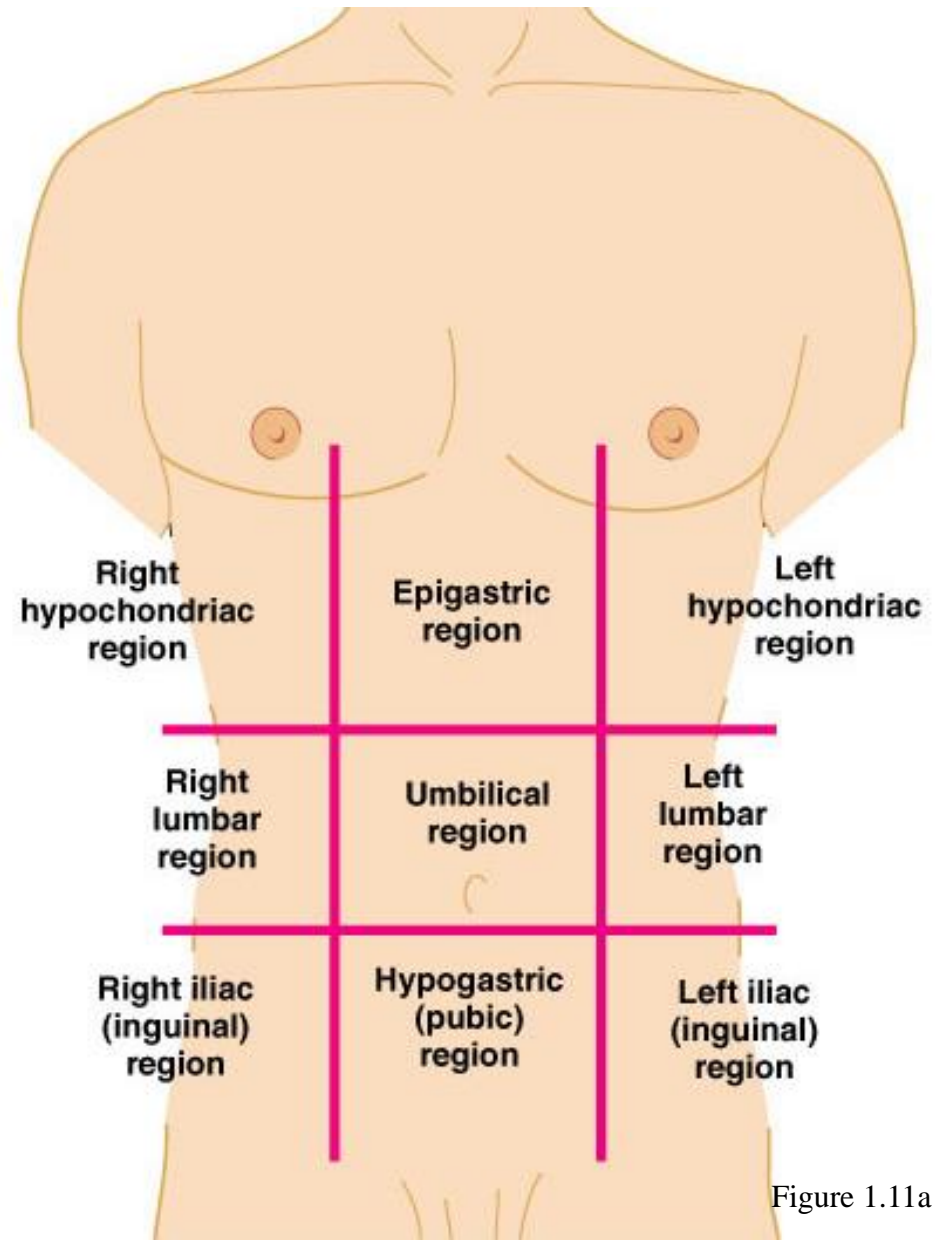


Figure 1.11a

# Abdominopelvic Quadrants

- Right upper (RUQ)
- Left upper (LUQ)
- Right lower (RLQ)
- Left lower (LLQ)

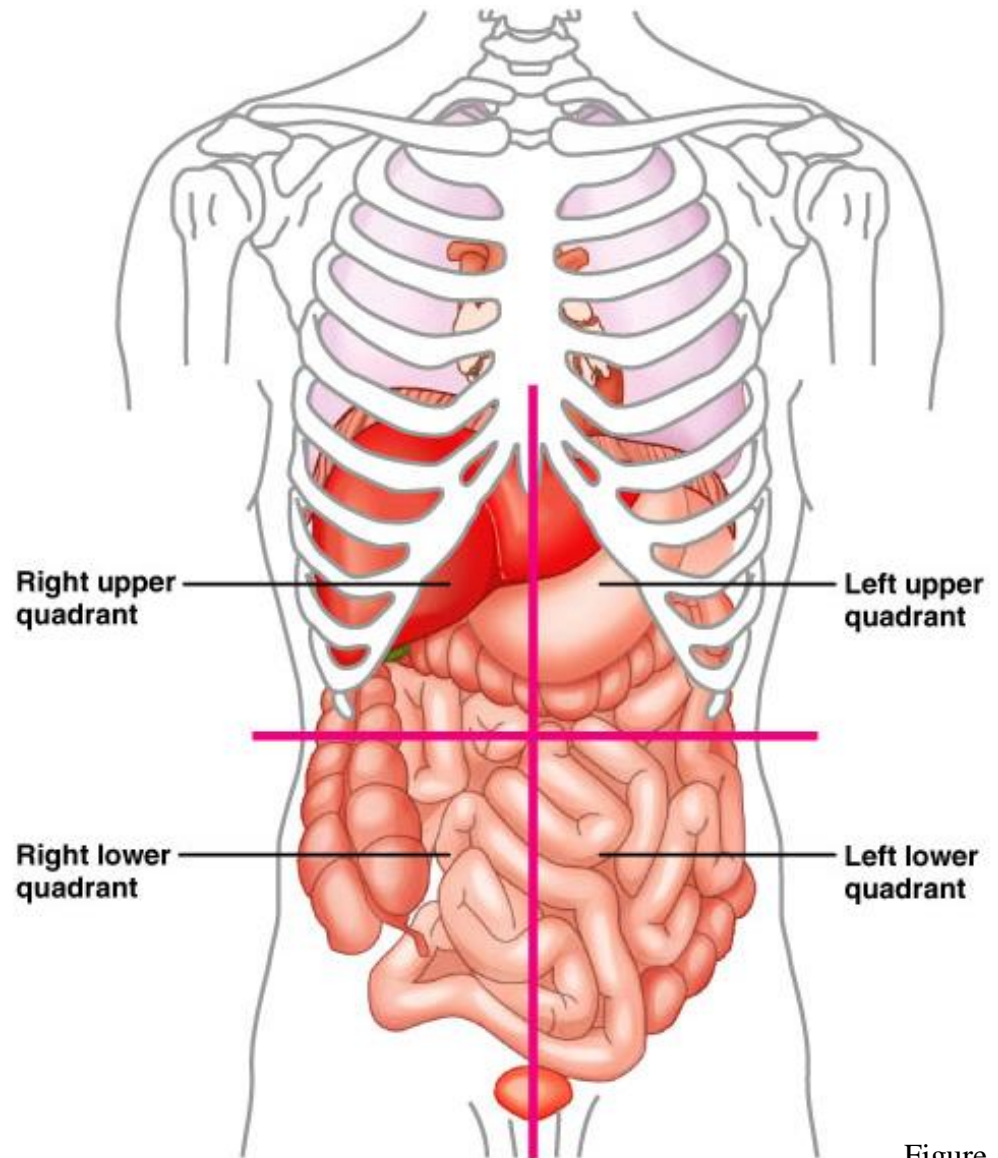


Figure 1.12

- The abdominopelvic cavity can also be divided into Quadrants.
- This is used more by Health care professionals to describe the specific location of pain or other abnormalities.



- Parietal serosa covering the body walls
- Visceral serosa covering the internal organs
- Serous fluid separates the serosae

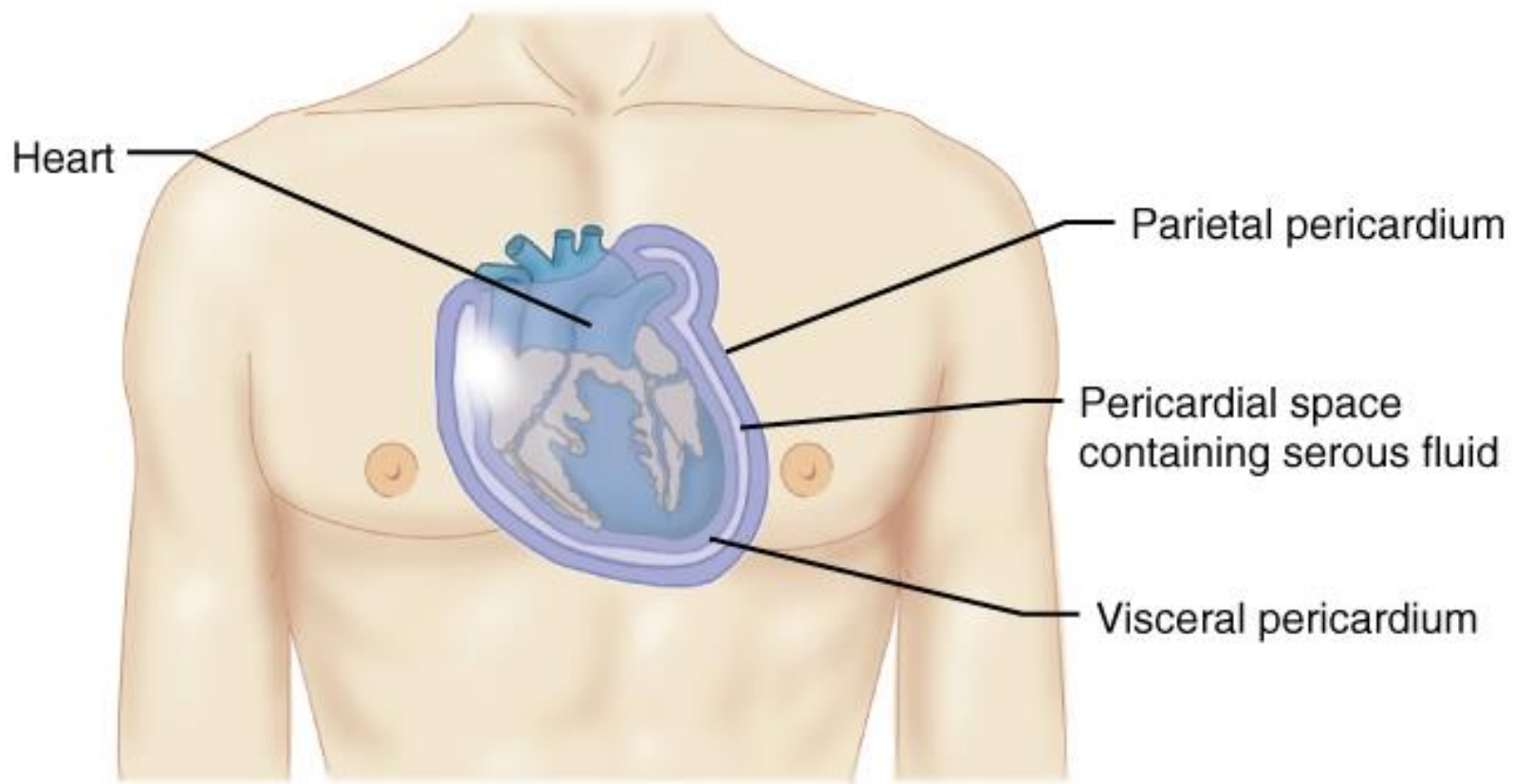


Outer balloon wall  
(comparable to parietal serosa)

Air (comparable to serous fluid)

Inner balloon wall  
(comparable to visceral serosa)

**(a)**



(b)

# Feedback system

- Feedback system: This is the means of monitoring and regulating a system.
- Controlled Condition: the monitored system such as blood pressure or temperature.
- 
- Stimulus: Any type of disruption that causes a change in the control.

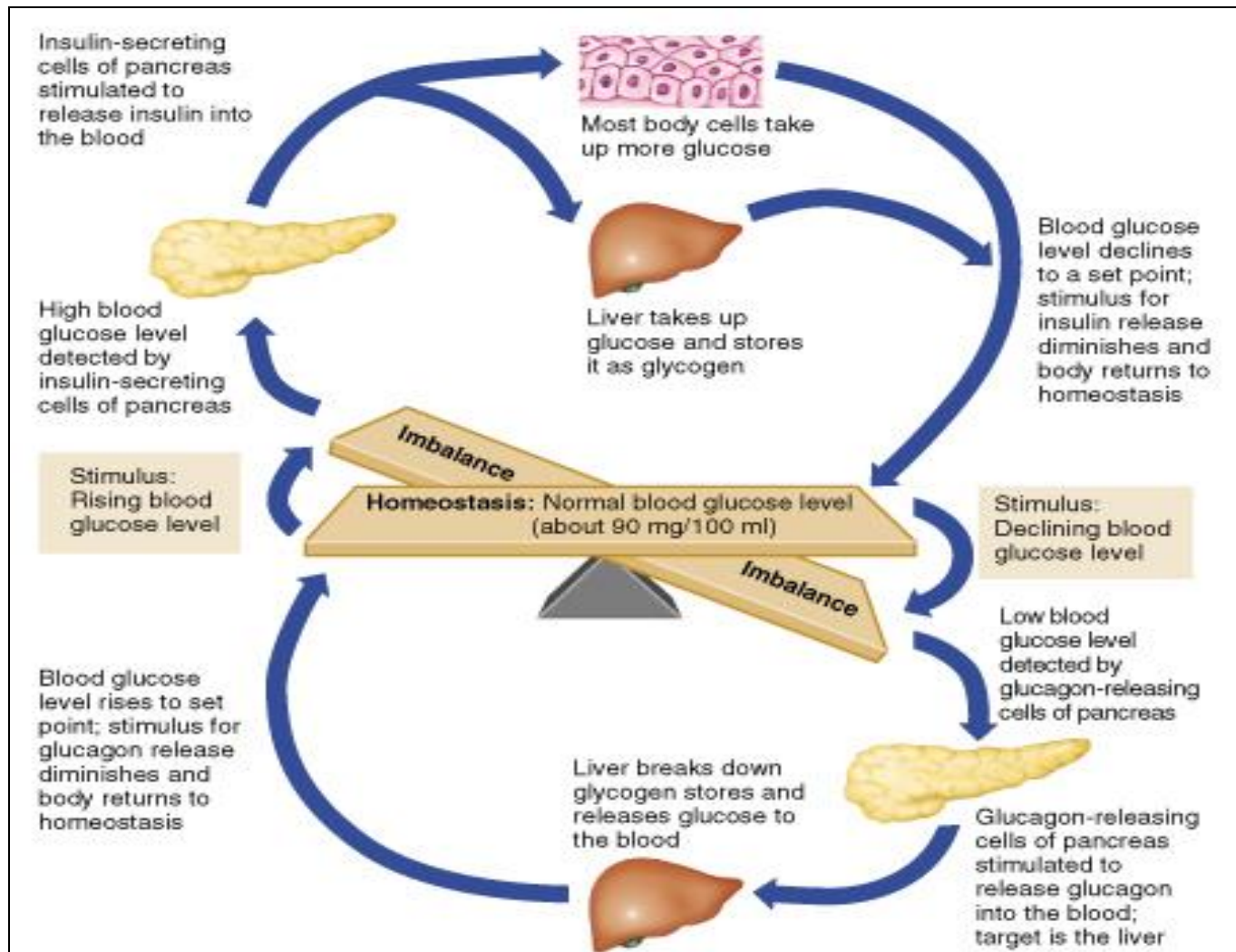
- Three basic components of the Feedback System.
- **Stimulus:** Any type of disruption that causes a change in the control.

- 1. Receptor: This is the structure that monitors the changes and sends out information to the control center.
  - Input or information that is set out. Chemical and nervous impulses.
- 2. Control Center : It is a set range or condition that is set by the body so as to keep it healthy.
  - Receives input and generates output commands
  -
- 3. Effector: Receives output from the control center and produces a response.
  - This response will change the controlled condition.

# Negative Feedback

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

# Negative Feedback





# Negative Feedback

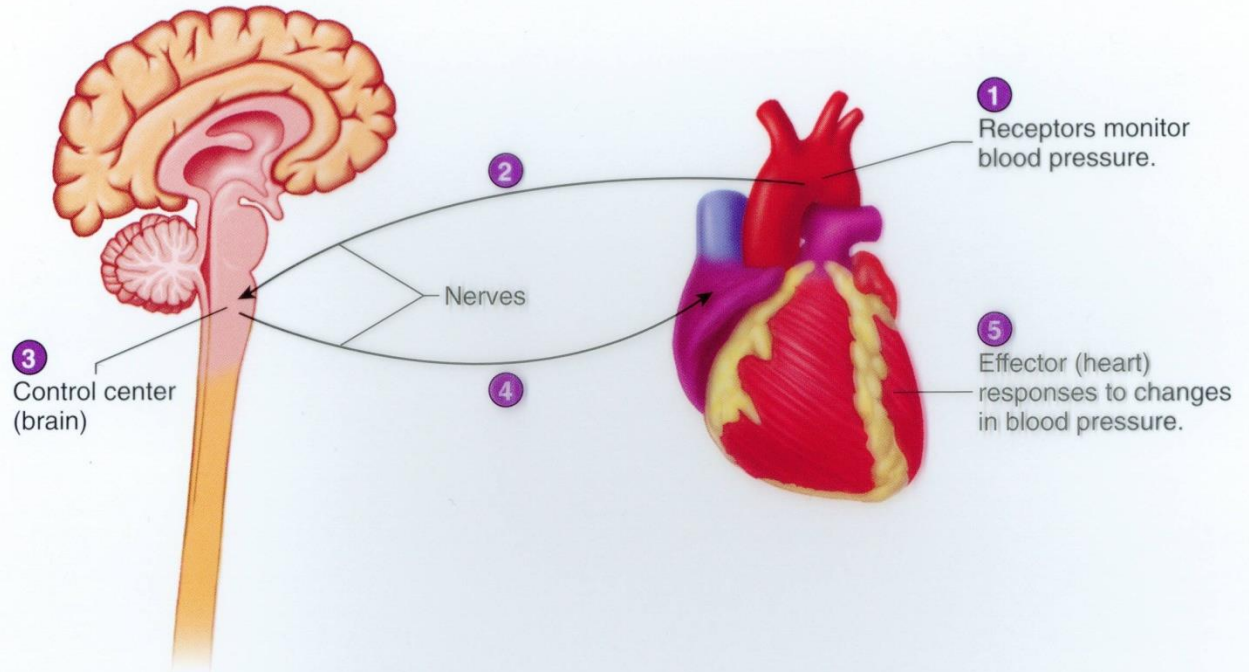
1. Receptors monitor the value of a variable—in this case, receptors in the wall of a blood vessel monitor blood pressure.

2. Information about the value of the variable is sent to a control center. In this case, information is sent by nerves to the part of the brain responsible for regulating blood pressure.

3. The control center compares the value of the variable against the set point.

4. If a response is necessary to maintain homeostasis, the control center causes an effector to respond. In this case, information is sent by nerves to the heart.

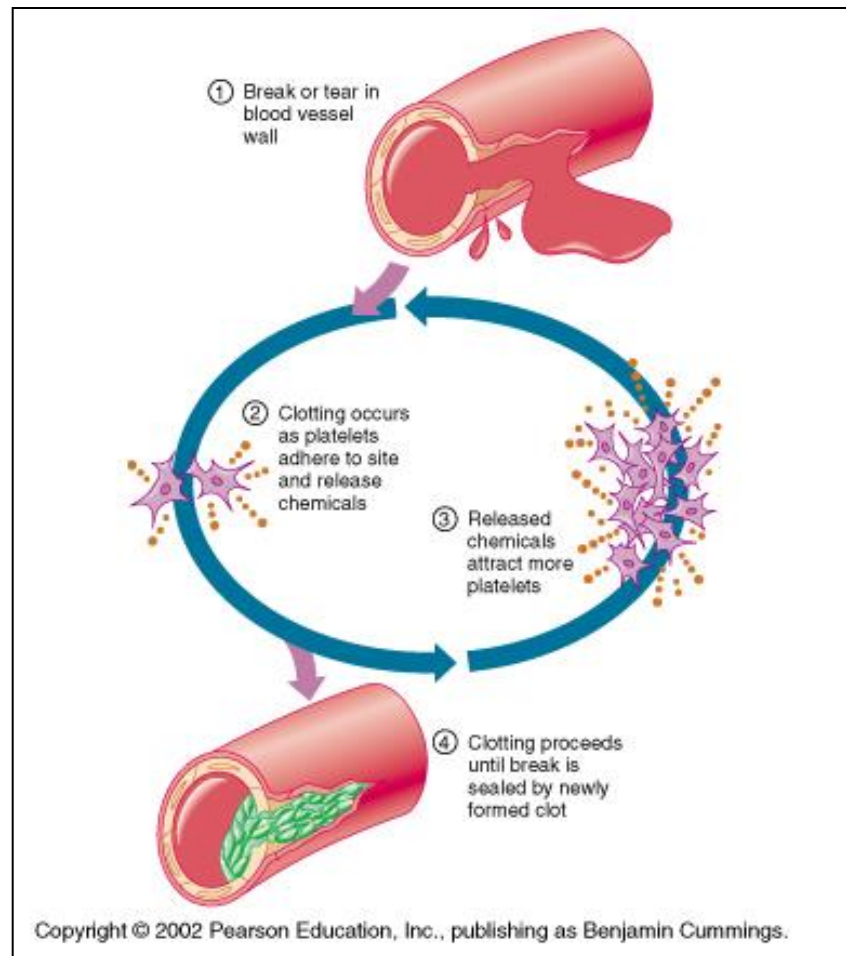
5. An effector produces a response that maintains homeostasis. In this case, changing heart rate changes blood pressure.



# Positive Feedback

- In positive feedback systems, the output enhances or “turns up” the original stimulus
- Examples: Regulation of blood clotting, Uterine contractions during labor.

# Positive Feedback



# Organ Systems

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

# Organ Systems

- 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

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

# Organ Systems

- 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

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



# Organ Systems

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

# Organ Systems

- 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

- 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 System Interrelationships

- 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