

# General Biology 1

BIO1201 RM 1021

Syllabus & Textbook:

<https://openlab.citytech.cuny.edu/oer-biology/lecture-schedule/>

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## Grade Breakdown:

Lecture (60%)

Exams (4): 22.5% Each

Pop Quizzes (?): 10% Average

Lab (40%) – Lab Instructor

<u>Letter Grade</u>	<u>Numerical Ranges</u>
A	93-100
A-	90-92.9
B+	87-89.9
B	83-86.9
B-	80-82.9
C+	77-79.9
C	70-76.9
D	60-69.9
F	59.9 and below

**DOMAIN: Eukarya**  
**KINGDOM: Animalia**



**CHARACTERISTICS**

- Multicellular
- Well-developed tissues (except sponges)
- Usually motile
- Heterotrophic by ingestion or absorption, generally a digestive cavity
- Diploid life cycle

**Invertebrates\***

PHYLUM: Porifera	—————>	sponges	
PHYLUM: Cnidaria	—————>	jellyfishes, sea anemones, corals	
PHYLUM: Ctenophora	—————>	comb jellies, sea walnuts	
PHYLUM: Platyhelminthes	—————>	flatworms (e.g., planarians, flukes, tapeworms)	■
PHYLUM: Nemertea	—————>	ribbon worms	
PHYLUM: Nematoda	—————>	roundworms	■
PHYLUM: Rotifera	—————>	rotifers	
PHYLUM: Mollusca	—————>	chitons, snails, slugs, clams, oysters, mussels, squids, octopuses	
PHYLUM: Annelida	—————>	segmented worms (e.g., clam worms, earthworms, leeches)	■
PHYLUM: Arthropoda	—————>	spiders, scorpions, horseshoe crabs, lobsters, crayfish, shrimps, crabs, millipedes, centipedes, insects	
PHYLUM: Echinodermata	—————>	sea lilies, sea stars, brittle stars, sea urchins, sand dollars, sea cucumbers, sea daisies	■
PHYLUM: Chordata			
SUBPHYLUM: Urochordata	—————>	sea squirts	
SUBPHYLUM: Cephalochordata	—————>	lancelets	

What is the first Protostome?

What is the first Pseudocoelomate?  
 What is the first eucoelomate?

What is the first Deuterostome?

What are the 4 characteristics of Chordates?

- Nerve Chord
- Notochord
- Phalangeal Pouches
- Post Anal tail

**Vertebrates\***

**SUBPHYLUM: Vertebrata**

SUPERCLASS: Agnatha	—————>	jawless fishes (e.g., lampreys, hagfishes)
SUPERCLASS: Gnathostomata	—————>	jawed fishes; all tetrapods
CLASS: Chondrichthyes	—————>	cartilaginous fishes (e.g., sharks, skates, rays)
CLASS: Osteichthyes	—————>	bony fishes (e.g., herring, salmon, cod, eel, flounder)
CLASS: Amphibia	—————>	frogs, toads, salamanders, newts, caecilians
CLASS: Reptilia	—————>	snakes, lizards, turtles, crocodiles
CLASS: Aves	—————>	birds (e.g., sparrows, penguins, ostriches)
CLASS: Mammalia	—————>	mammals (e.g., cats, dogs, horses, rats, humans)

\* Not in the classification of organisms, but added here for clarity

# Animal Organization & Homeostasis

Chap. 31: pp. 576-592



# Levels of Organization

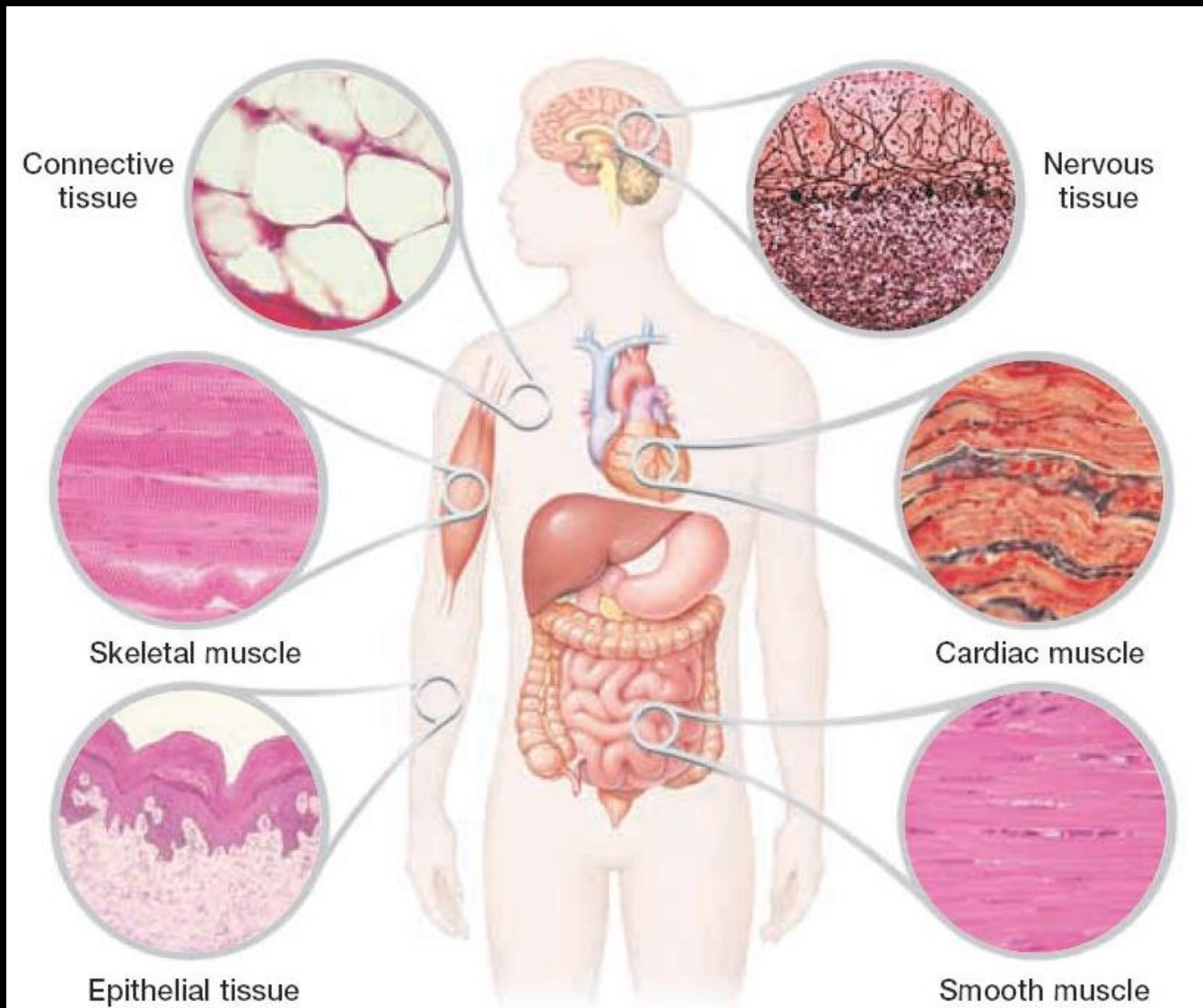
- **Tissue** - Group of similar cells performing a similar function
- **Organ** - Group of tissues performing a specialized function
- **Organ System** - Collection of several organs functioning together
- **Organism** - A collection of organ systems

# Types of Tissues

- Tissues are:
  - Collections of specialized cells and cell products organized to perform a limited number of functions
    - Histology = study of tissues
- Four major vertebrate tissue types
  - Epithelial
  - Muscular
  - Nervous
  - Connective (adipose, cartilage, bone, blood...)

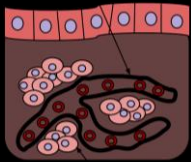


# Major tissues in the human body

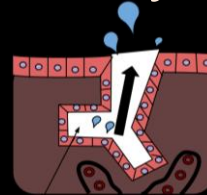


# Epithelial Tissue

- Includes glands and epithelium
  - Glands are secretory



- Exocrine glands - Secrete products into ducts or cavities
- Endocrine glands - Secrete products directly into the bloodstream



- Is avascular
- Forms a protective barrier that regulates permeability
- Cells may show polarity

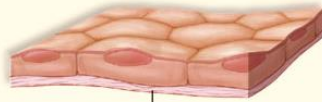
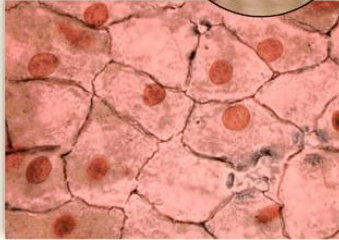
# Classification of Epithelial Tissue

- Number of cell layers
  - Simple
  - Stratified -- Layered
- Shape of apical surface cells
  - Squamous - cells are wider than their height (flat and scale-like).
  - Cuboidal – cells have their height and width approximately the same (cube shaped).
  - Columnar - cells are taller than they are wide (column-shaped).



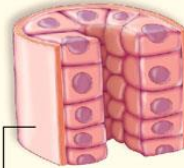
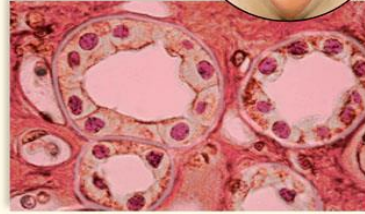
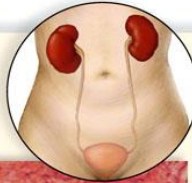
# Types of Epithelial Tissues Vertebrates

**Simple squamous**  
 • lining of lungs, blood vessels  
 • protects



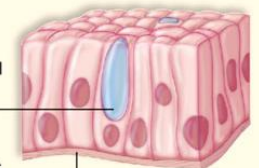
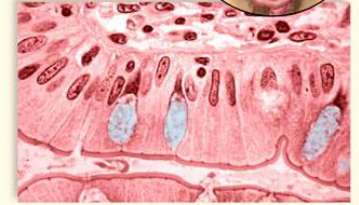
basement membrane

**Simple cuboidal**  
 • lining of kidney tubules, various glands  
 • absorbs molecules



basement membrane

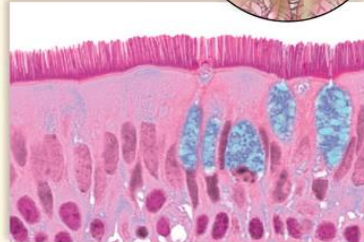
**Simple columnar**  
 • lining of small intestine, oviducts  
 • absorbs nutrients



goblet cell  
 secretes  
 mucus

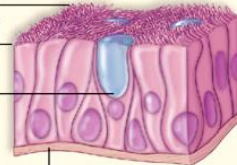
basement  
 membrane

**Pseudostratified, ciliated columnar**  
 • lining of trachea  
 • sweeps impurities toward throat

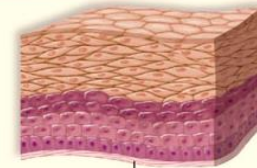
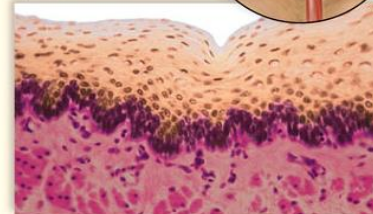


cilia  
 goblet cell  
 secretes  
 mucus

basement  
 membrane



**Stratified squamous**  
 • lining of nose, mouth, esophagus, anal canal, vagina  
 • protects



basement membrane

# Epithelial Tissue

- Epithelial tissue:
  - Forms a continuous layer over body surfaces
  - Lines inner cavities
  - Covers abdominal organs
- Functions of epithelial tissue
  - Physical protection
  - Control permeability
  - Provide sensation
  - Produce specialized secretions

# Muscular Tissue

- Contractile cells containing actin and myosin filaments
- Cells are called **muscle fibers**
  - Skeletal Muscle
    - Voluntary - Long, striated fibers
  - Smooth Muscle
    - Involuntary - No striations
  - Cardiac Muscle
    - Striated, but mostly involuntary
    - Bound by intercalated disks

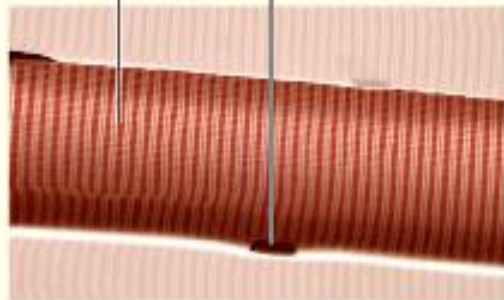
# Muscular Tissue

## Skeletal muscle

- has striated cells with multiple nuclei.
- occurs in muscles attached to skeleton.
- functions in voluntary movement of body.



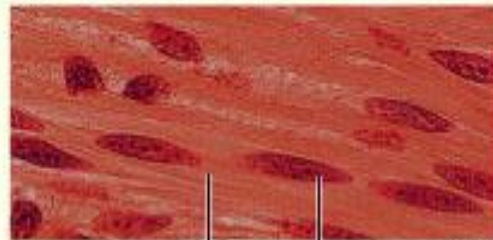
striation      nucleus



a.

## Smooth muscle

- has spindle-shaped cells, each with a single nucleus.
- cells have no striations.
- functions in movement of substances in lumens of body.
- is involuntary.
- is found in blood vessel walls and walls of the digestive tract.



smooth muscle cell      nucleus

400×



b.

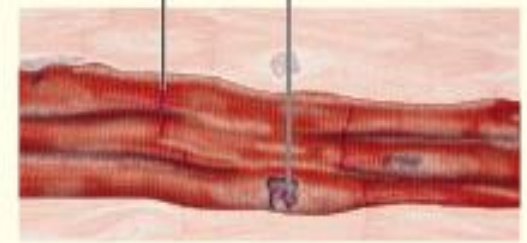
## Cardiac muscle

- has branching, striated cells, each with a single nucleus.
- occurs in the wall of the heart.
- functions in the pumping of blood.
- is involuntary.



intercalated disk      nucleus

250×

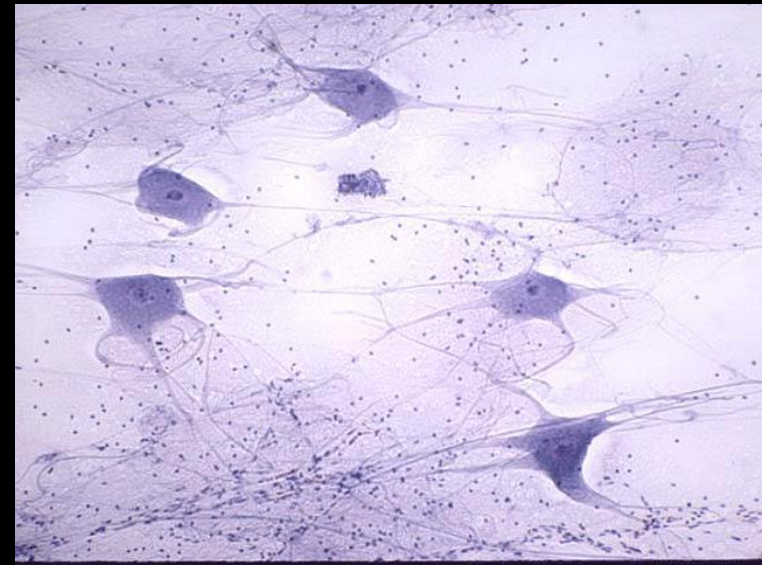


c.

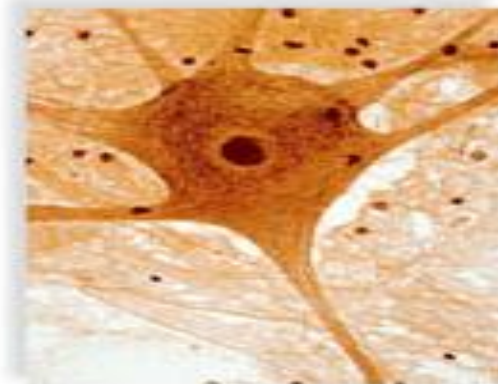
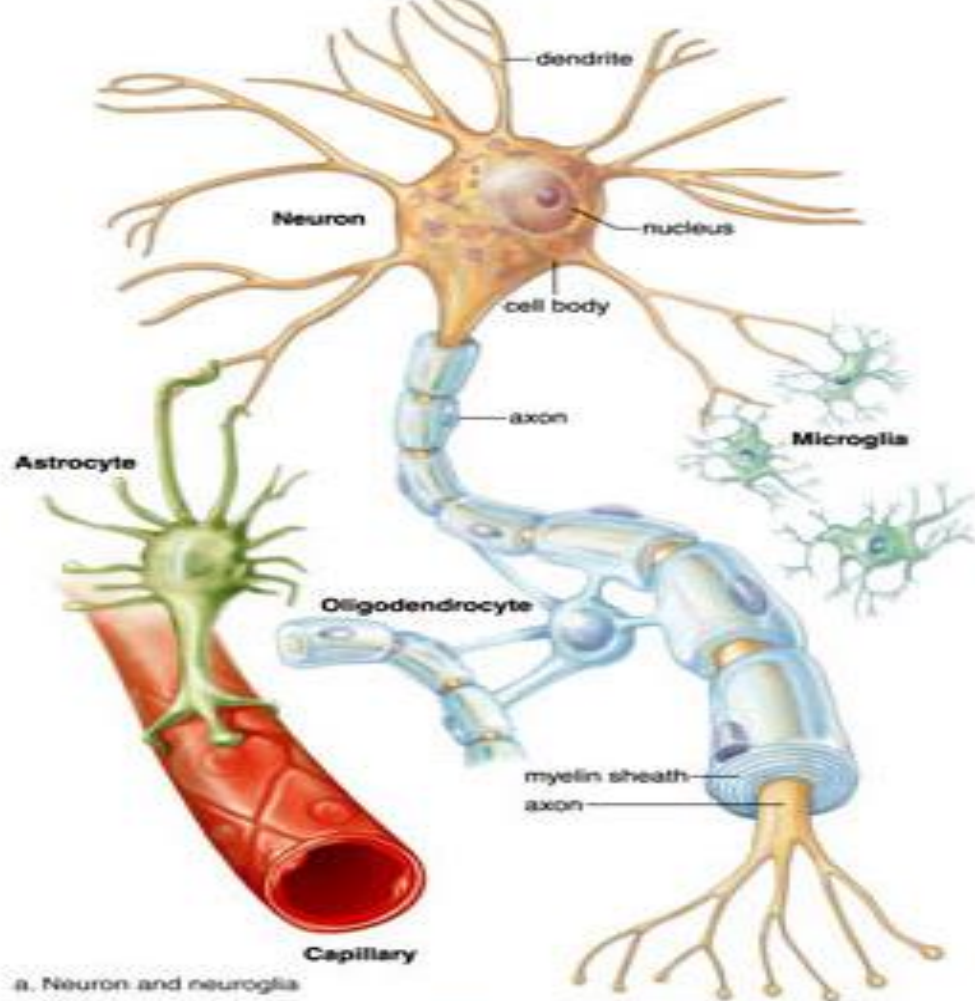


# Nervous Tissue

- Conducts electrical impulses
- Conveys information from one area to another
- Nerve tissue contains:
  - Neurons
    - Transmit information
    - Consist of dendrites, a cell body and an axon
  - Neuroglia (glial cells)
    - Support and nourish neurons



# Neurons and Neuroglia



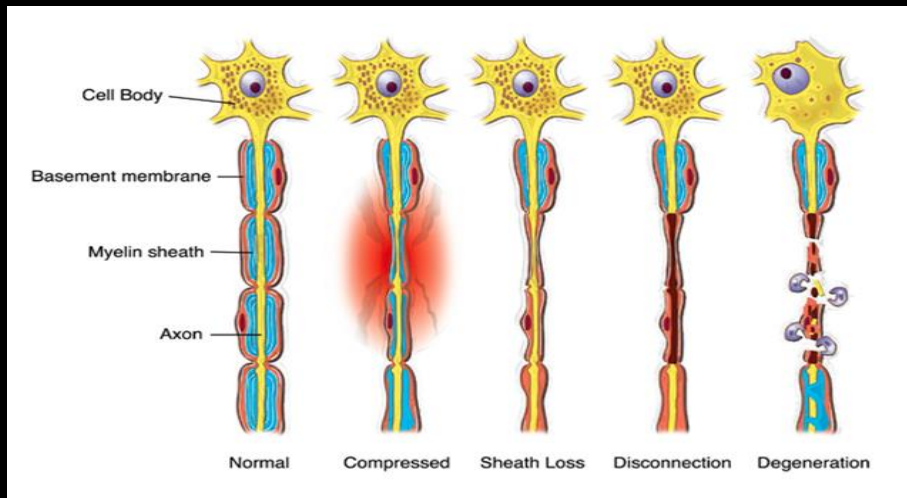


# Nervous Tissue

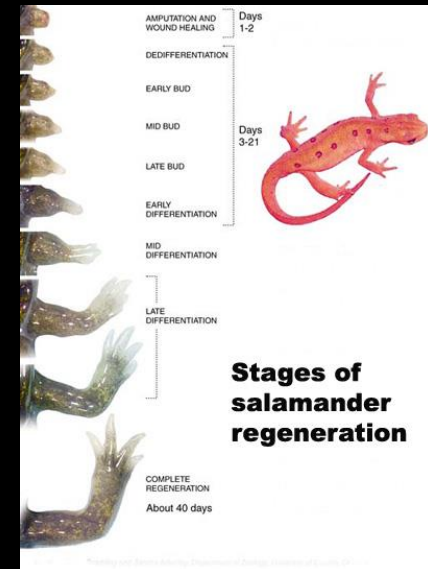
- Nervous system has three functions
  - Sensory input
    - Sensory receptors detect changes
    - Transmit info to the spinal cord
  - Data integration
    - Spinal cord and brain integrate
    - Decision is made regarding appropriate response
  - Motor output
    - Response is transmitted to effector (gland or muscle)
    - Effector initiates actual response

# Nerve Regeneration

- In humans, axons outside the brain and spinal cord can regenerate, but not those inside these organs.
- Injury in CNS degenerate
  - Permanent loss of nervous function.

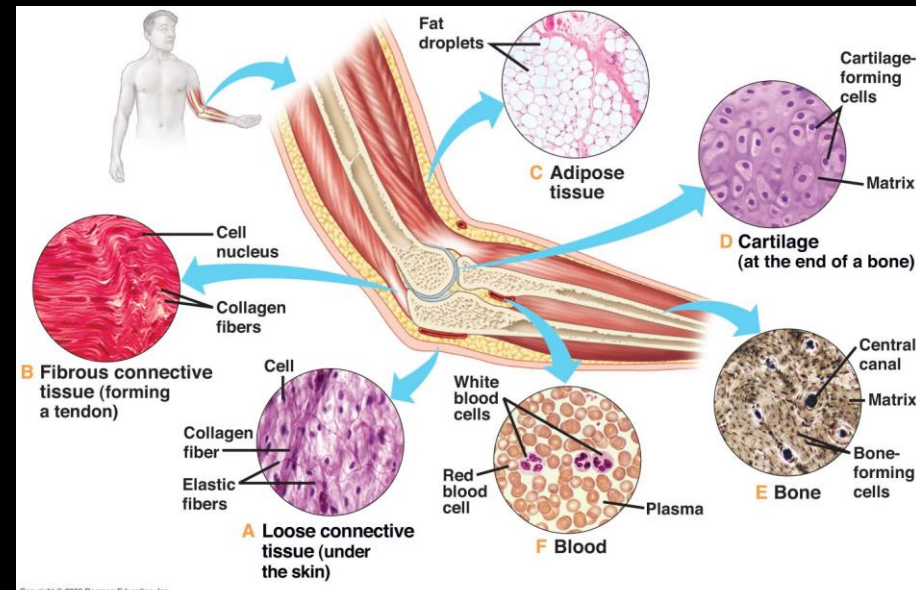


- In cold-water fishes and amphibians axon regeneration in the CNS does occur.
  - Several proteins play role in axon regeneration



# Connective Tissue

- Connective tissues consist of:
  - Fibroblast cells
  - A **matrix** containing collagen and elastic fibers
- Loose fibrous connective tissue
  - Allows organs to expand
- Dense fibrous connective tissue
  - Strong connective tissue
    - Tendons
    - Ligaments



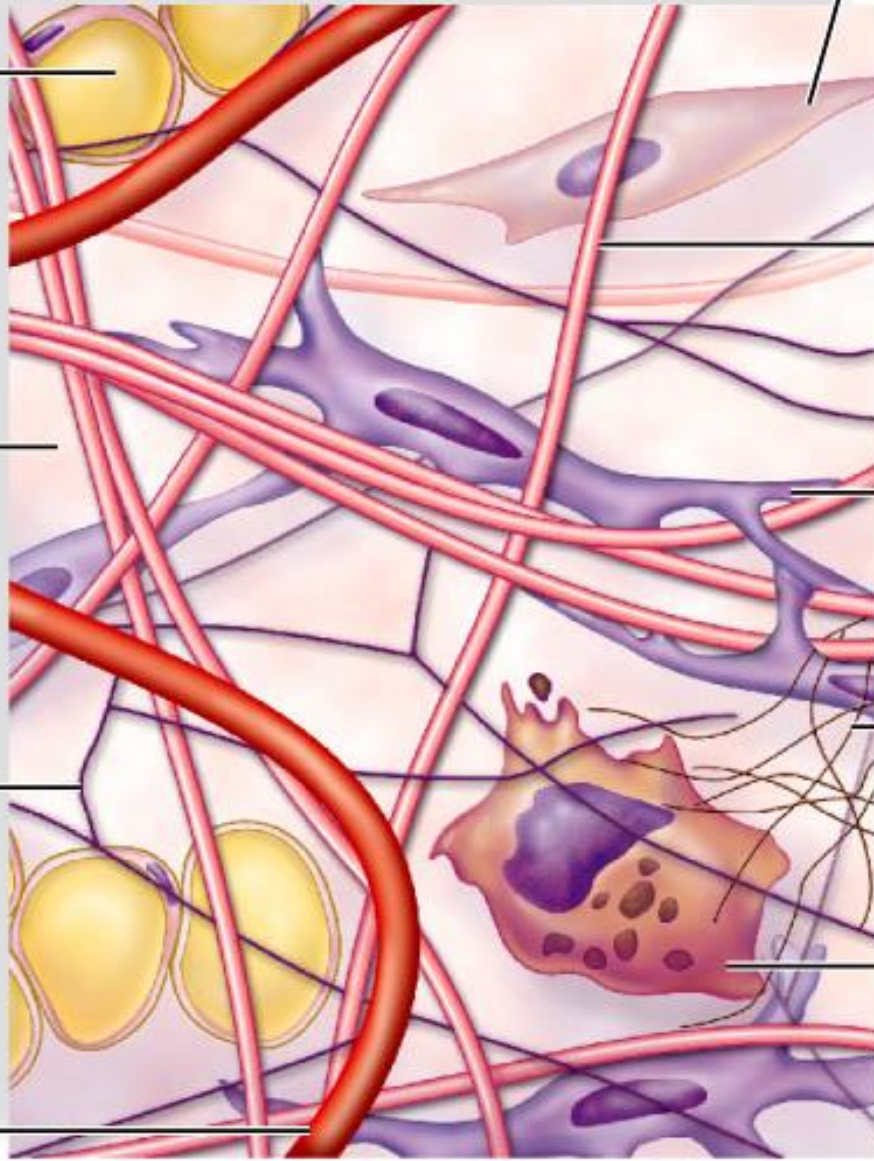
# Diagram of Fibrous Connective Tissue

**Adipose cell:**  
stores fat

**Ground substance:** fills spaces between cells and fibers

**Elastic fiber:**  
branched and stretchable

**Blood vessel**



**Stem cell:** divides to produce other types of cells

**Collagen fiber:**  
unbranched, strong but flexible

**Fibroblast:** divides to produce other types of cells

**Reticular fiber:**  
branched, thin, and forms network

**White blood cell:**  
engulfs pathogens or produces antibodies



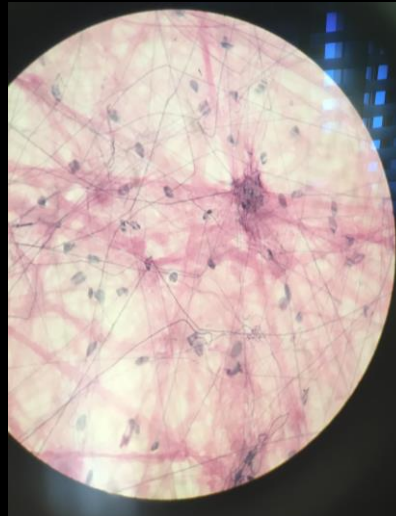
# Connective Tissue

- **Adipose Tissue**

- Insulates the body and provides padding

- **Cartilage**

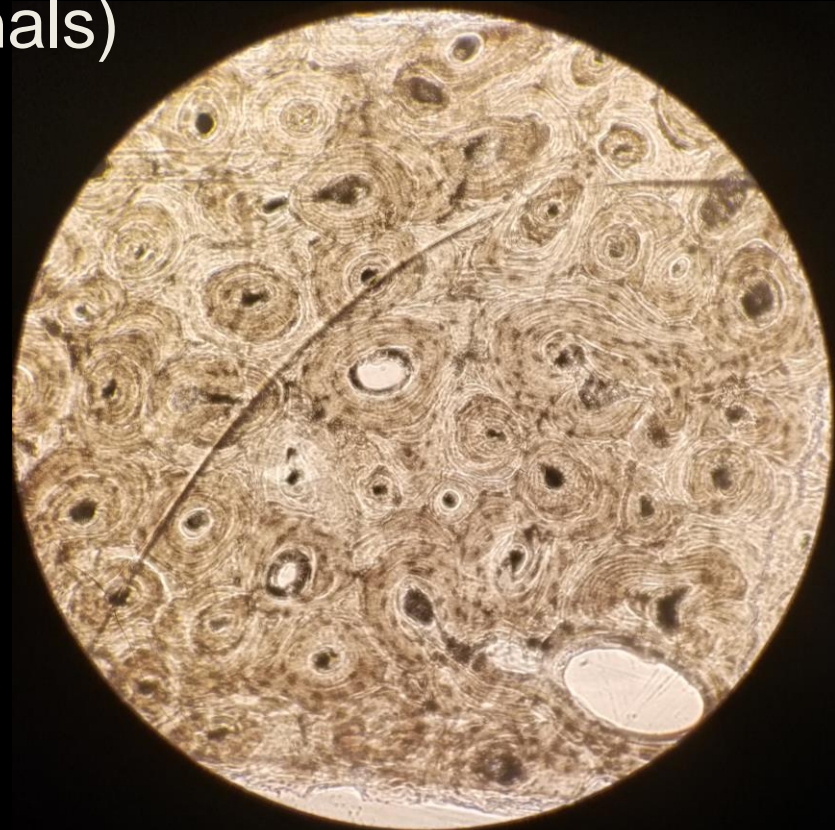
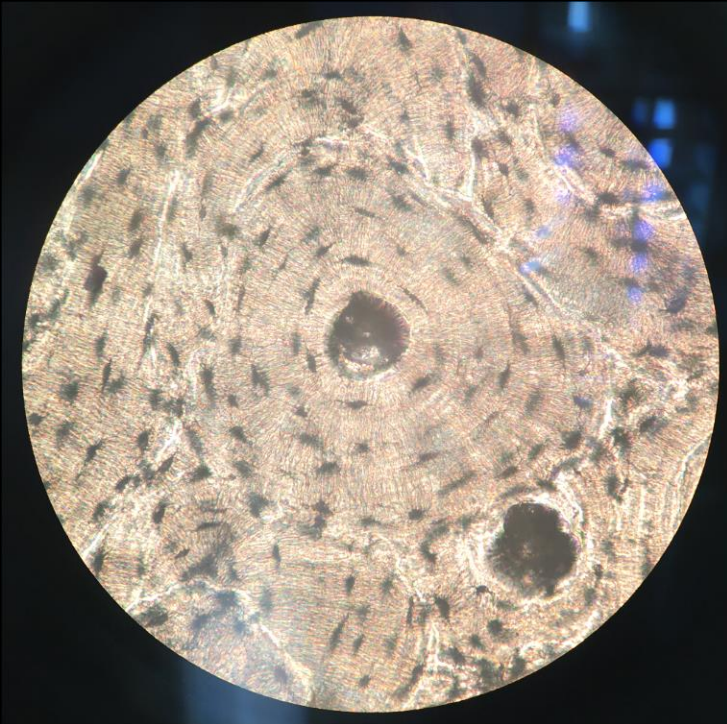
- Classified according to type of collagen and elastic fibers found in the matrix
- Cartilage cells (chondrocytes), lie in small chambers (lacunae) in the matrix



# Connective Tissue

- **Compact Bone**

- Matrix is inorganic salts deposited around protein fibers
- Bone cells (osteocytes) are located in lacunae
- Lacunae arranged in concentric circles within osteons around tiny tubes (central canals)

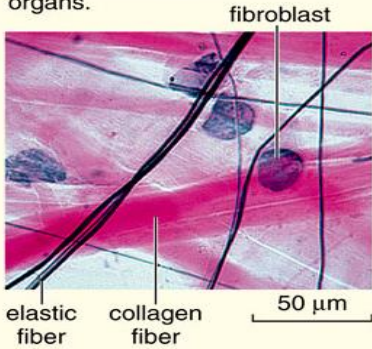
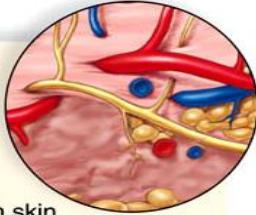




# Connective Tissue Examples

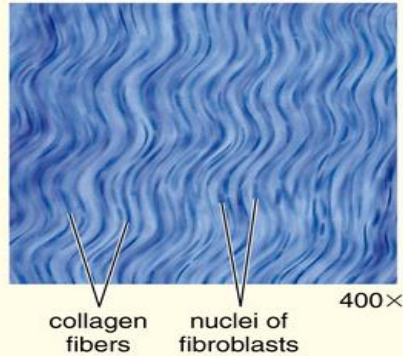
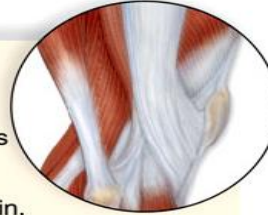
## Loose fibrous connective tissue

- has space between components.
- occurs beneath skin and most epithelial layers.
- functions in support and binds organs.



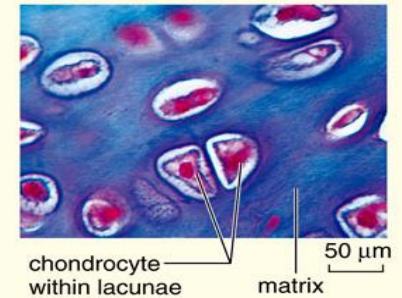
## Dense fibrous connective tissue

- has collagenous fibers closely packed.
- in dermis of skin, tendons, ligaments.
- functions in support.



## Hyaline cartilage

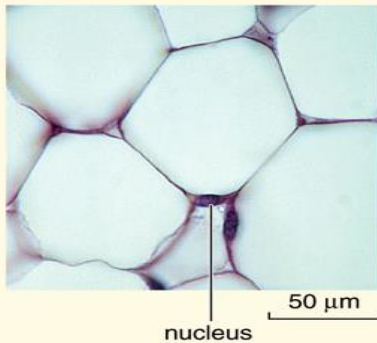
- has cells in lacunae.
- occurs in nose and walls of respiratory passages; at ends of bones, including ribs.
- functions in support and protection.



a.

## Adipose tissue

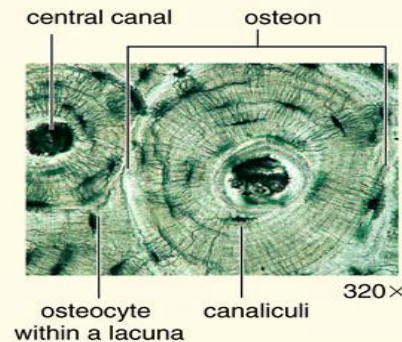
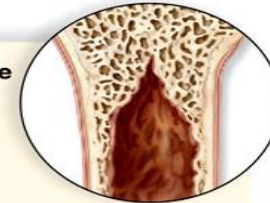
- cells are filled with fat.
- occurs beneath skin, around heart and other organs.
- functions in insulation, stores fat.



b.

## Compact bone

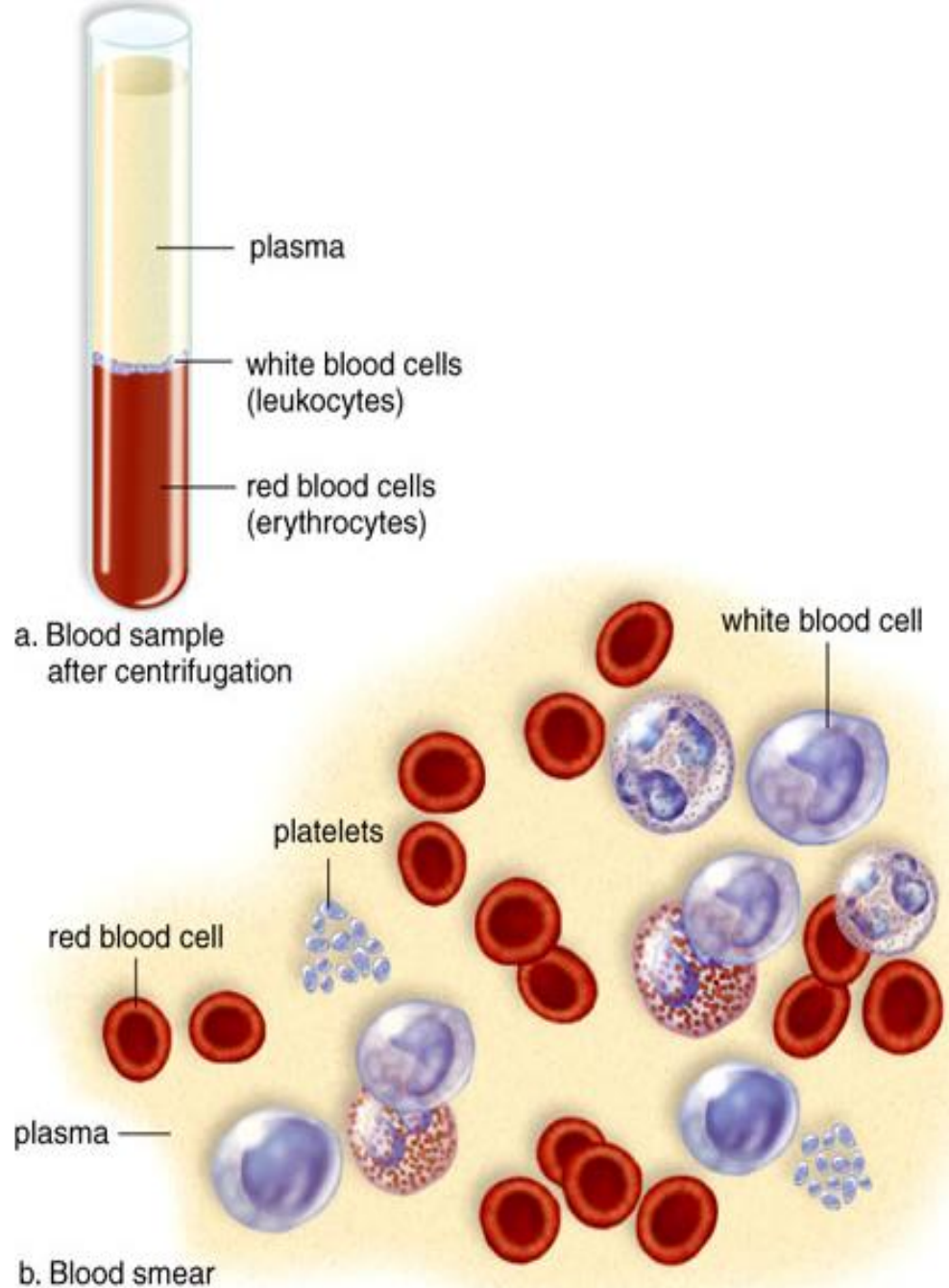
- has cells in concentric rings.
- occurs in bones of skeleton.
- functions in support and protection.



e.

# Blood: a liquid tissue

- Actually a **connective tissue** in which cells are embedded in a liquid matrix (plasma)
  - Red blood cells - erythrocytes
  - White blood cells - leukocytes
- Transports nutrients and oxygen to cells
- Removes carbon dioxide and other wastes







# Function of Connective Tissue

- Establishing a structural framework
- Transporting fluids and dissolved materials
- Protecting delicate organs
- Supporting, surrounding and interconnecting tissues
- Storing energy reserves
- Defending the body from microorganisms

# Questions

A group of cells that perform a similar function are known as

- A. Organisms
- B. Organs
- C. Organ systems
- D. Tissues.

Salivary glands are formed from a type of...

- A.nerve tissue.
- B.epithelial tissue
- C.connective tissue
- D.muscle tissue

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BIO1201 RM 1021

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Email: [mgotesman@citytech.cuny.edu](mailto:mgotesman@citytech.cuny.edu)

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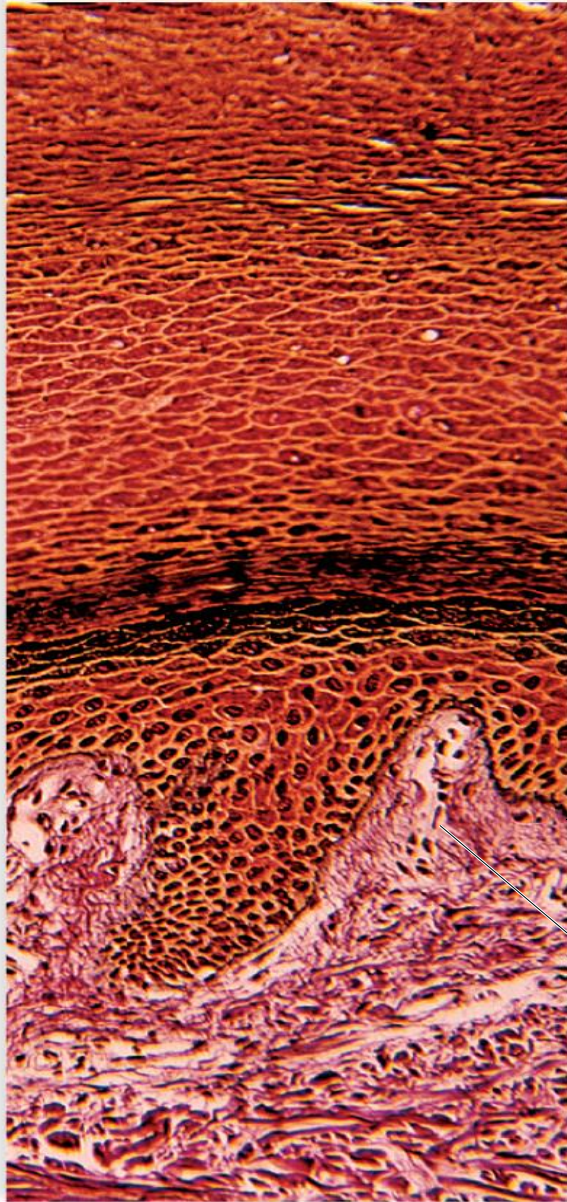
# Types of Tissues

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    - Histology = study of tissues
- Four major vertebrate tissue types
  - Muscular
  - Nervous
  - Connective (adipose, cartilage, bone, blood...)
  - Epithelial

# Organ: Functions & Regions of Skin

- Functions of skin
  - Covers and protects underlying body regions
  - Regulate body temperature, and
  - Contains sensory receptor
- **Epidermis** - Outer, thinner region
  - Stratified squamous epithelium
  - New cells are pushed outward, become keratinized, and are sloughed off
  - Melanocytes produce melanin (pigment)
  - Nails grow from specialized epidermal cells

# The Epidermis



flattened and  
dead cells

cells undergoing  
keratinization

stem cells  
and melanocytes

dermal  
projection

Epidermis

Dermis



b. Basal cell carcinoma



c. Melanoma

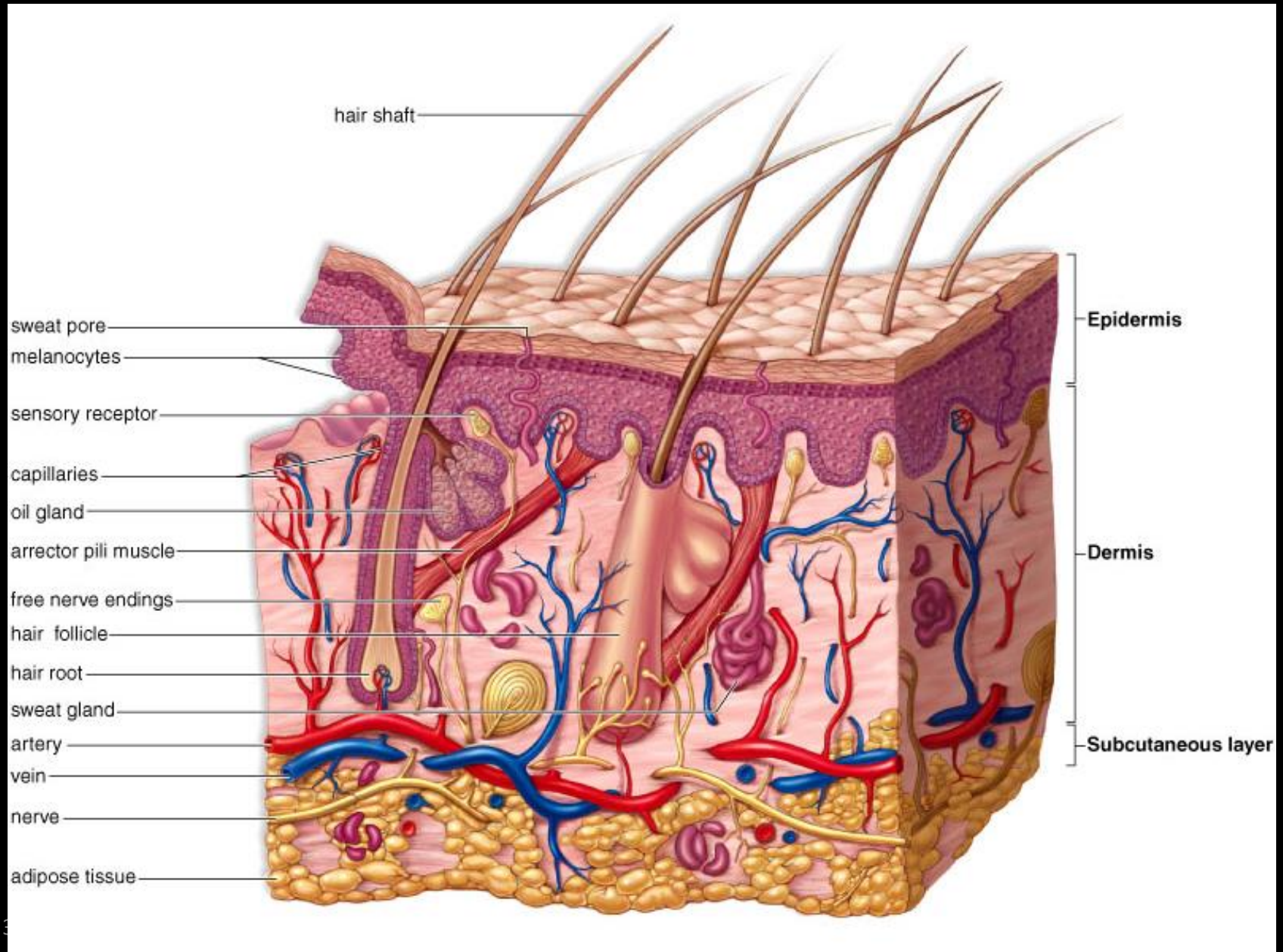
a. Photomicrograph of skin

# Regions of Skin

- **Dermis** - Deeper and thicker than epidermis
  - Fibrous connective tissue containing elastic and collagen fibers, Contains:
    - Hair follicles
    - Sebaceous glands - a small gland in the skin which secretes a lubricating oily matter (sebum) into the hair follicles to lubricate the skin and hair.
    - Receptors
    - Nerve fibers
    - Blood vessels
- **Subcutaneous Layer** - Loose, connective tissue located below dermis



# Human Skin Anatomy

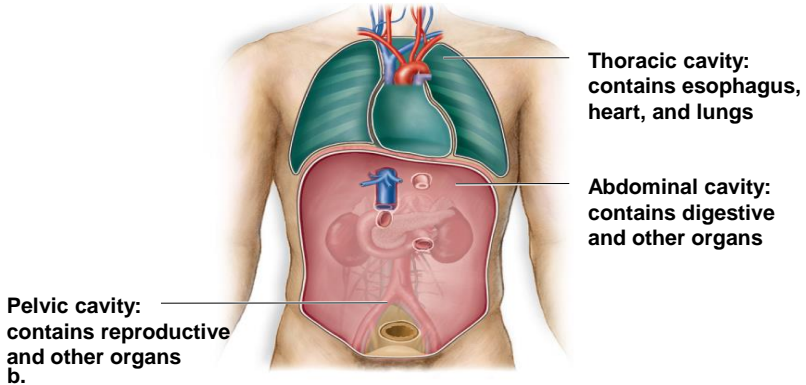
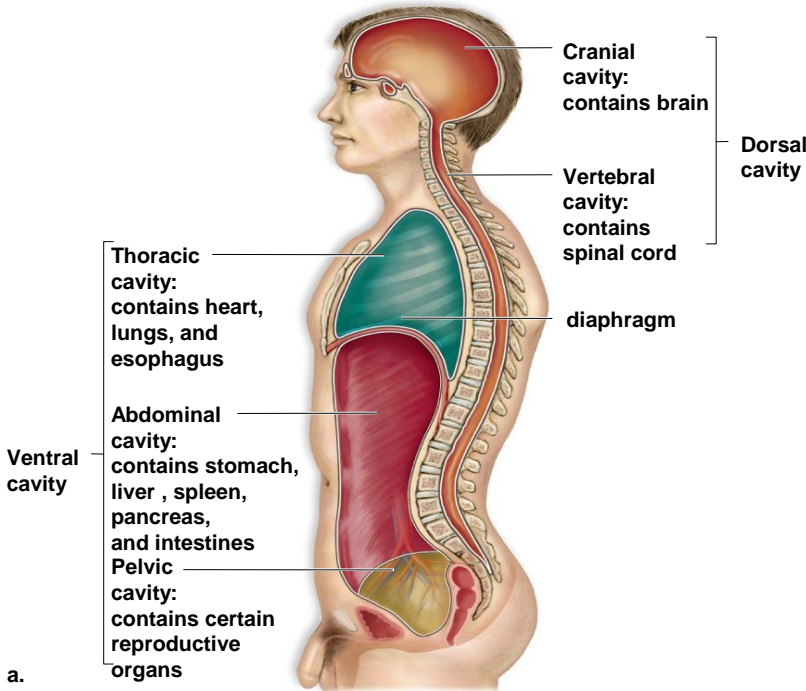


# Organ Systems

- Body Cavities
  - Dorsal cavity (toward the back)
    - Contains the cranial cavity and the vertebral canal
    - The brain is in the cranial cavity, and
    - The spinal cord is in the vertebral canal
  - Ventral cavity (toward the front) is divided by the diaphragm into
    - The thoracic cavity (includes heart and lungs) and
    - The abdominal cavity (most other internal organs)
    - The pelvic cavity



# Mammalian Body Cavities



# Homeostasis

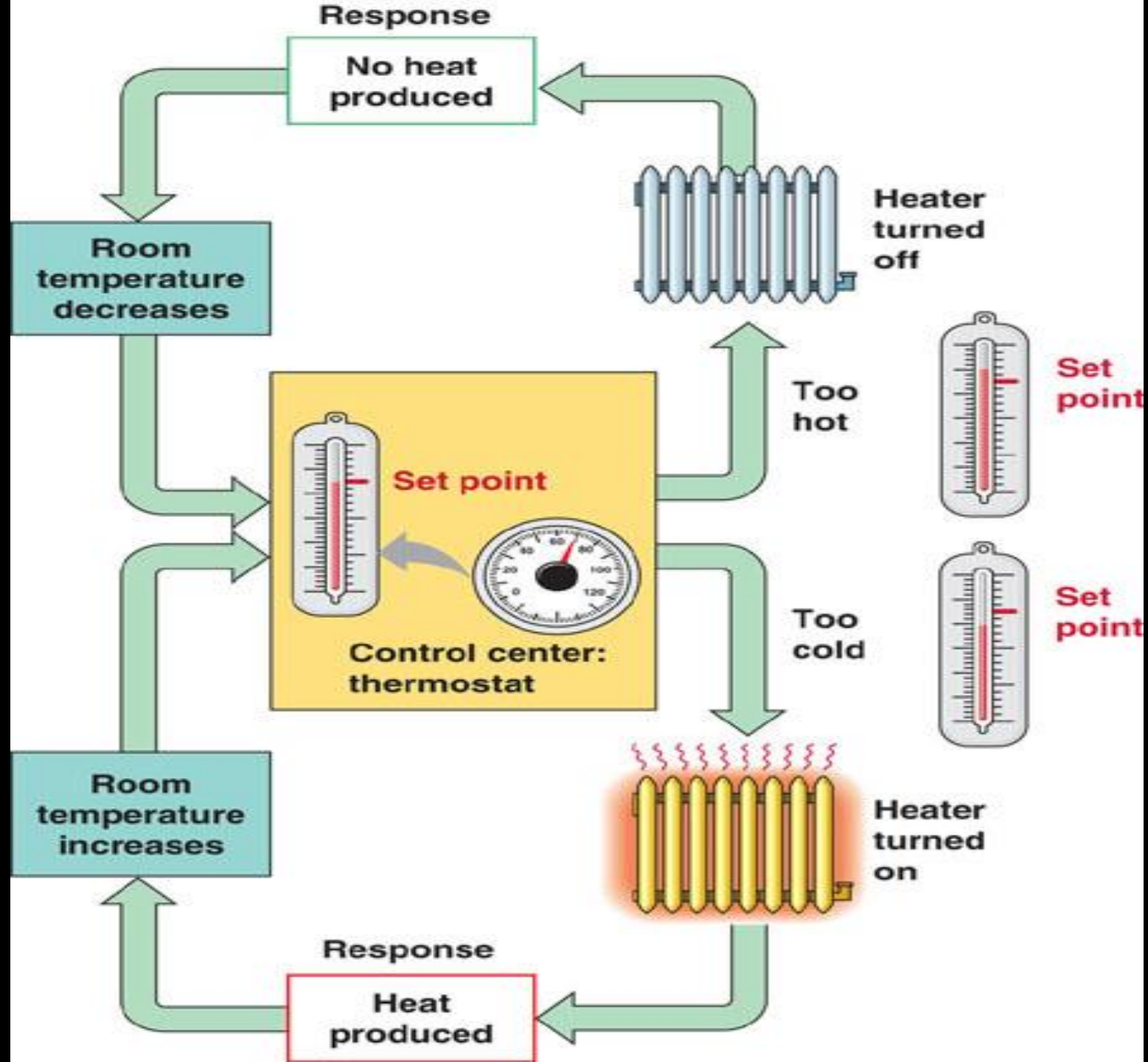
- Homeostasis - steady-state or internal balance
  - ...is “dynamically responsive,” reacts to changes to maintain stability
- Homeostatic Control
  - Partially controlled by hormones
  - Ultimately controlled by the nervous system

# Organ systems & Homeostasis

- The organ systems of the human body contribute to homeostasis
- Ex:
  - The digestive system
    - Takes in and digests food
    - Provides nutrient molecules that replace used nutrients
  - The respiratory system
    - Adds oxygen to the blood
    - Removes carbon dioxide

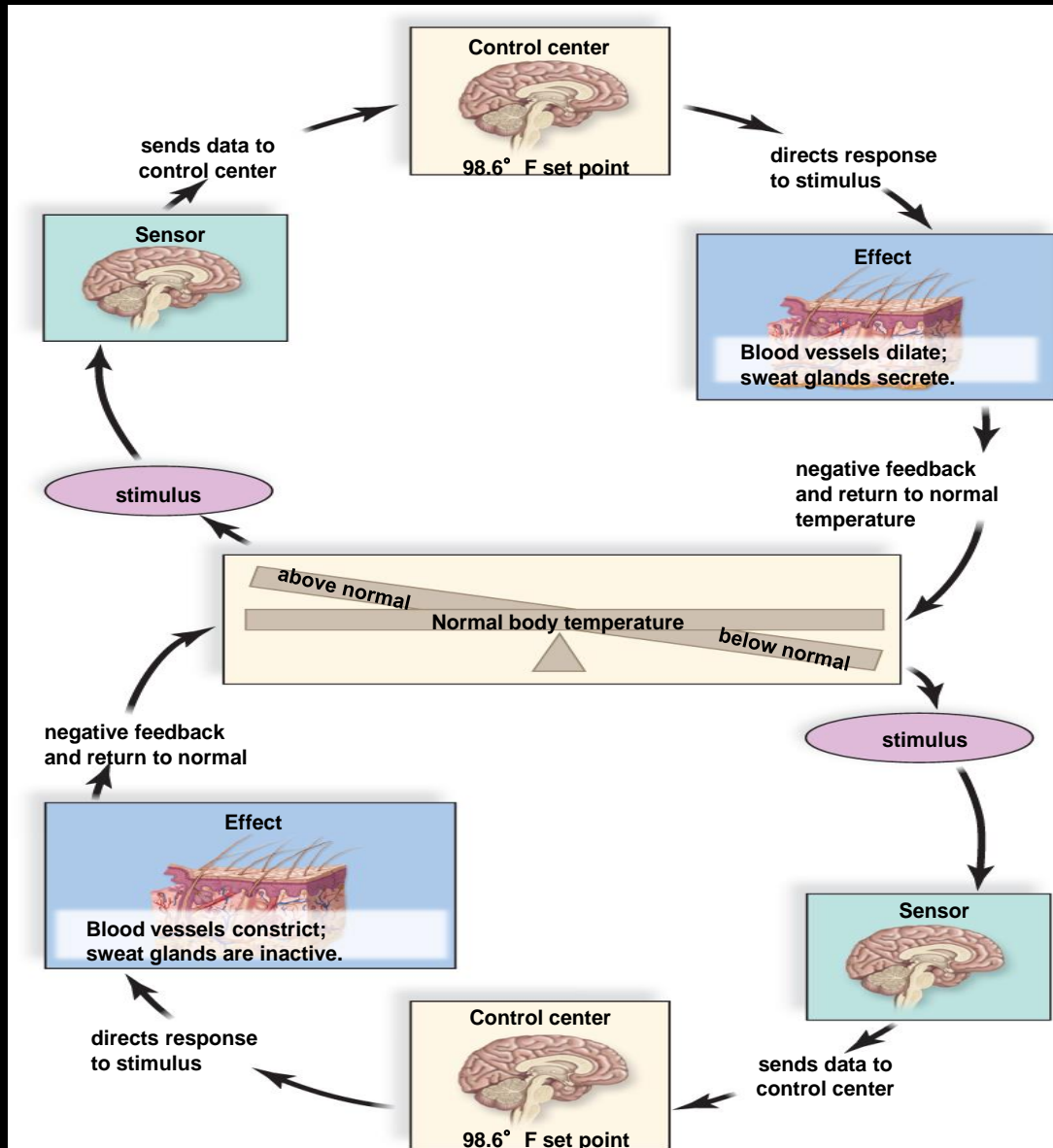
# Homeostasis

- Three key components of homeostasis:
  - Receptor – detects that an internal change is occurring
  - Control center – processes the input from receptor, directs a response
  - Effector – physiological response to restore the balance
- Homeostasis requires **Negative Feedback** to counter-balance the rapidly changing external environment and keep a constant internal environment
  - negative feedback: buildup of the end product shuts the system off
  - positive feedback: a change in a variable triggers mechanisms that amplify rather than reverse the change





# Regulation of Body Temperature

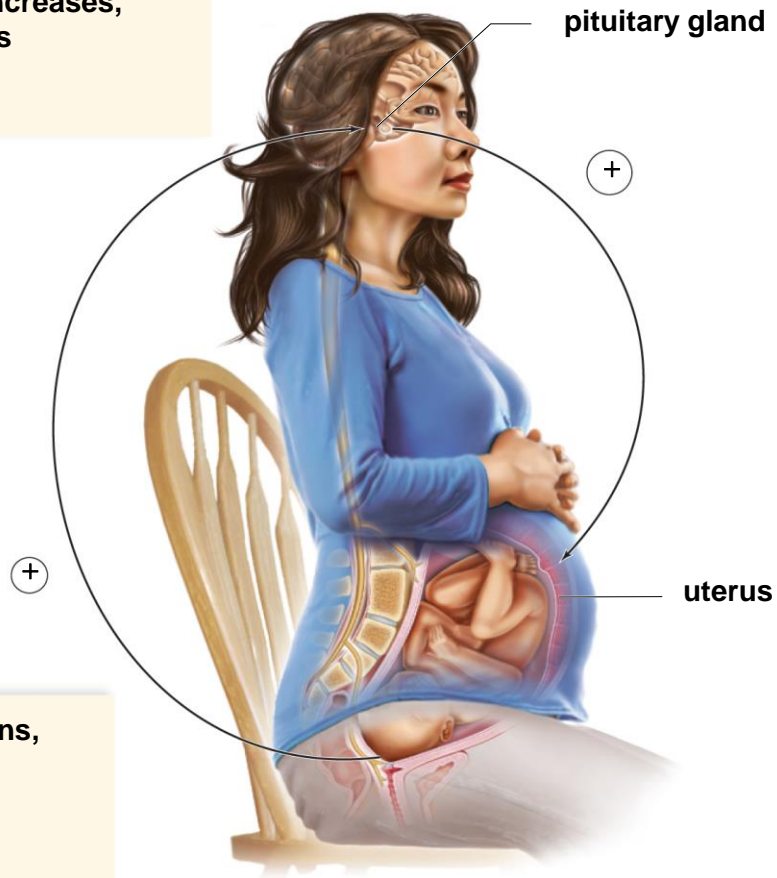


# Positive Feedback

- During positive feedback, an event increases the likelihood of another event
  - Childbirth process
  - Urge to urinate
- Positive Feedback
  - Does not result in equilibrium
  - Does not occur as often as negative feedback

# Positive Feedback

2. Signals cause pituitary gland to release the hormone oxytocin. As the level of oxytocin increases, so do uterine contractions until birth occurs.



1. Due to uterine contractions, baby's head presses on cervix, and signals are sent to brain.

# Question

When describing homeostasis, the term *dynamic constancy* refers to

- A. a now disregarded theory that suggested there were no external energy requirements to maintain cell homeostasis.
- B. a constant movement toward equilibrium.
- C. the direct interaction of each positive feedback system with its corresponding negative feedback system.
- D. even though physical & chemical changes do occur, conditions are kept within a range