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Animal Organization & Homeostasis

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BIOLOGY

10th Edition

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PowerPoint® Lecture Slides are prepared by Dr. Isaac Barjis, Biology Instructor

Outline

- Tissue Types
  - Epithelial
  - Connective
  - Muscular
  - Nervous
- Organs
- Organ Systems
- Homeostasis
  - Negative Feedback
  - Positive Feedback

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

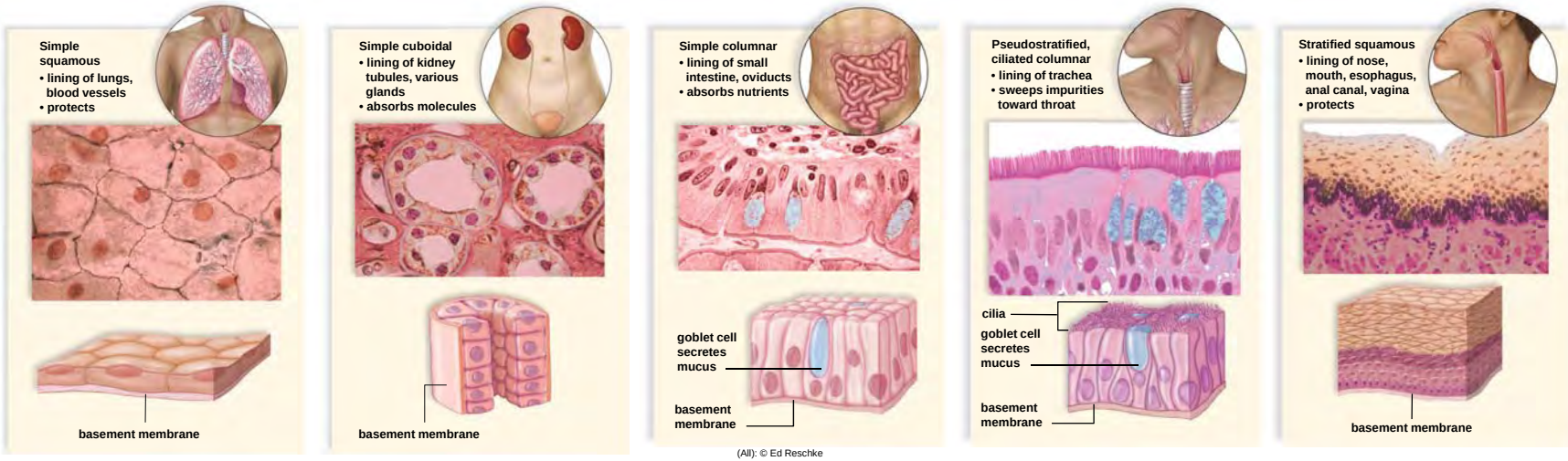
Tissues and Tissue Types

- Tissues are:
  - Collections of specialized cells and cell products organized to perform a limited number of functions
    - Histology = study of tissues
- The four tissue types are:
  - Epithelial
  - Connective
  - Muscular
  - Nervous

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

Types of Epithelial Tissues in the Vertebrates



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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

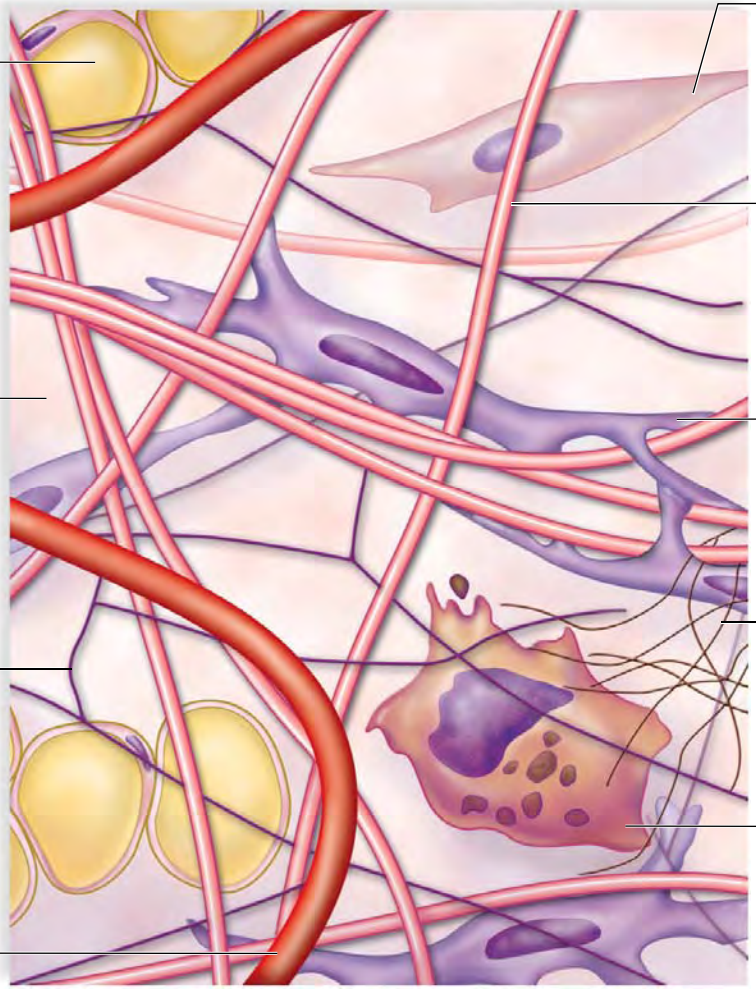
Classification of Epithelial Tissue

- Number of cell layers
  - Simple
  - Stratified
- Shape of apical surface cells
  - Squamous
  - Cuboidal
  - Columnar

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

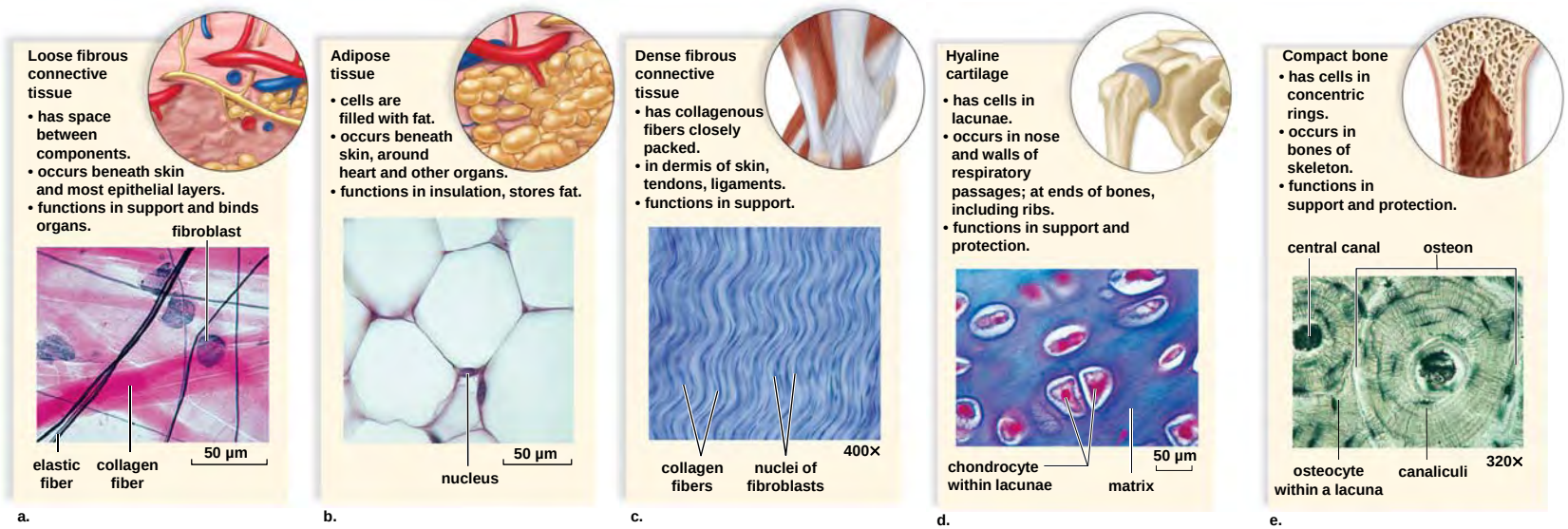
Diagram of Fibrous Connective Tissue



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 Examples



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)

Animation


Osteoporosis
Baby's bone
Play
Pause
Audio
Text
Bone is living tissue. Bone building is far from complete when a baby is born. During growth from infancy to adulthood, bone is increased in size, strength and hardness.
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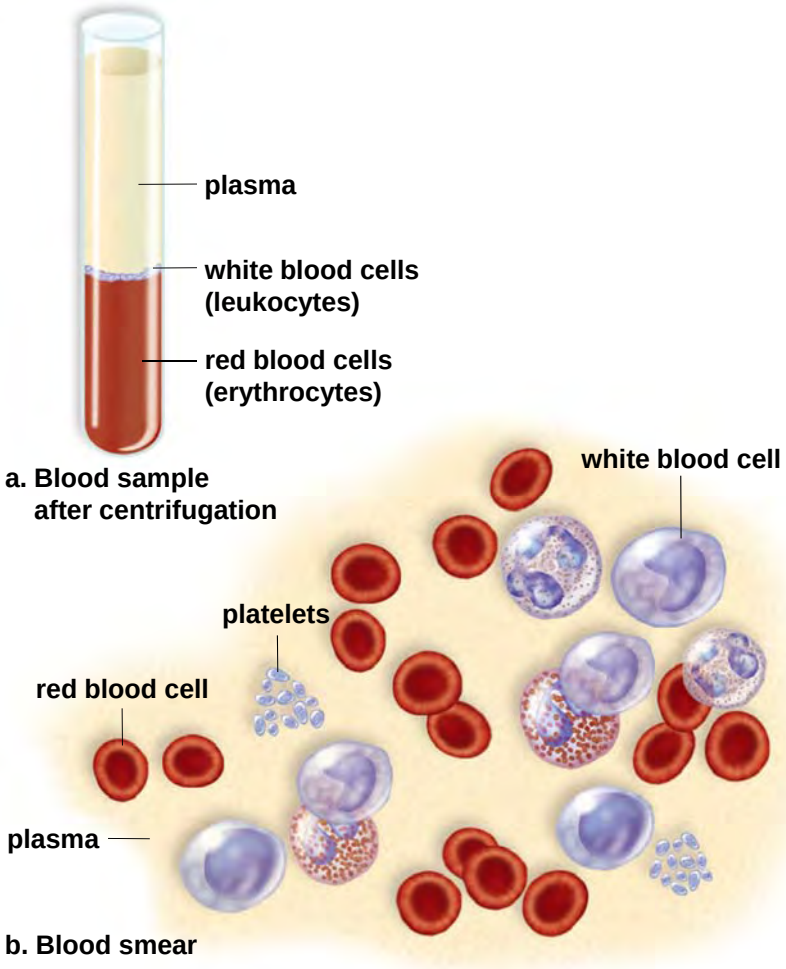
Blood

- 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

Blood, a Liquid Tissue



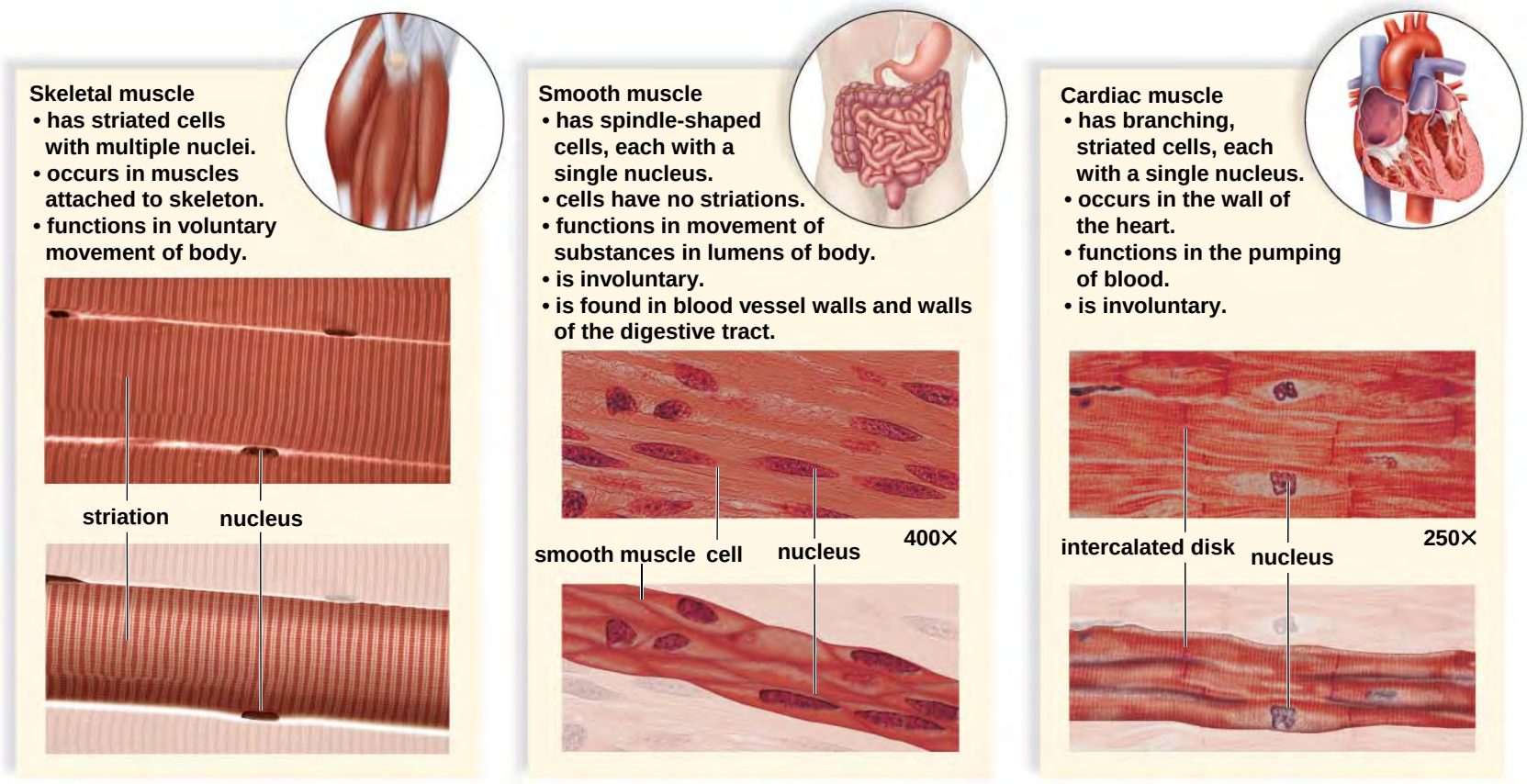
Function of Connective Tissue

- 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

Muscular Tissue

- Contractile cells containing actin and myosin filaments
- Cells are called muscle fibers
- Three types of muscle tissue:
  - Skeletal Muscle
    - Voluntary - Long, striated fibers, multinucleated
  - Smooth Muscle
    - Involuntary - No striations
  - Cardiac Muscle
    - Striated, but mostly involuntary
    - Bound by intercalated disks
    - Relies on pacemaker cells for regular contraction

Muscular Tissue



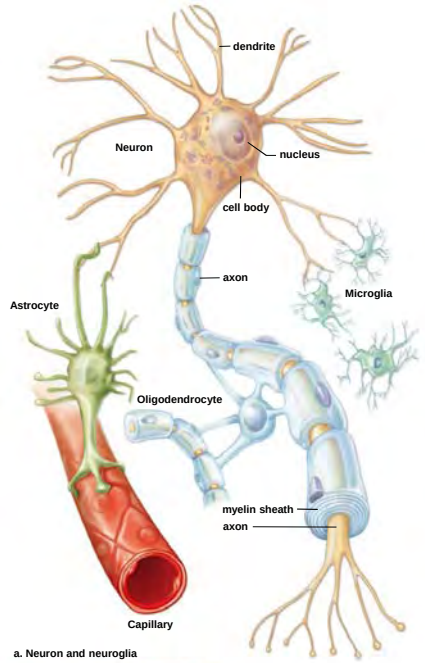
Nervous Tissue

- 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
    - Support and nourish neurons

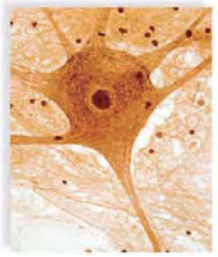
Nervous Tissue

- 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

Neurons and Neuroglia



a. Neuron and neuroglia



b. Micrograph of a neuron 200×

Nerve Regeneration

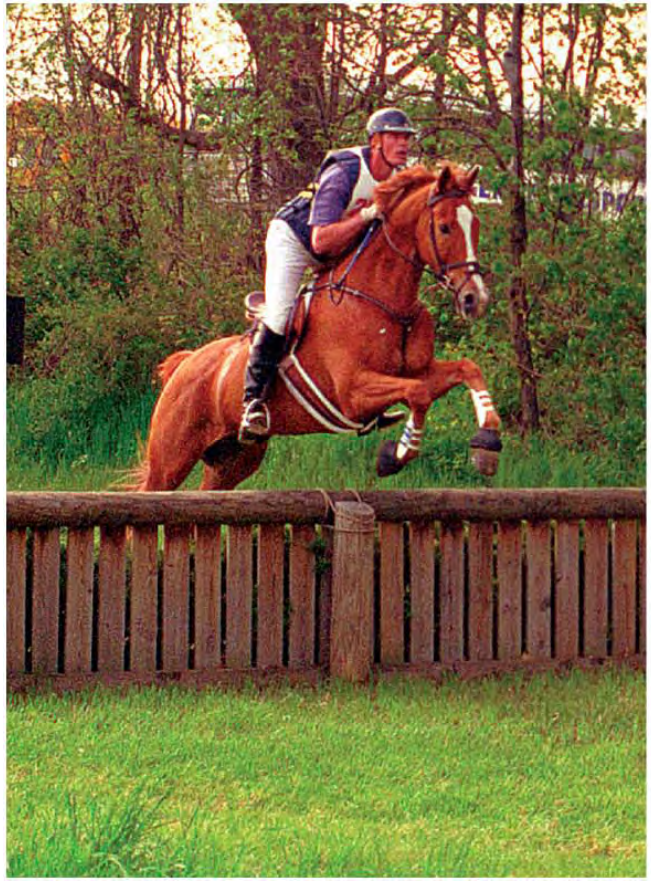
- In humans, axons outside the brain and spinal cord can regenerate, but not those inside these organs.
- Injury in CNS degenerate
  - Permanent loss of nervous function.
- In cold-water fishes and amphibians axon regeneration in the CNS does occur.
  - Several proteins play role in axon regeneration

Researchers at Work

a.

b.

Treatment Today for Spinal Cord Injuries



a.

b.

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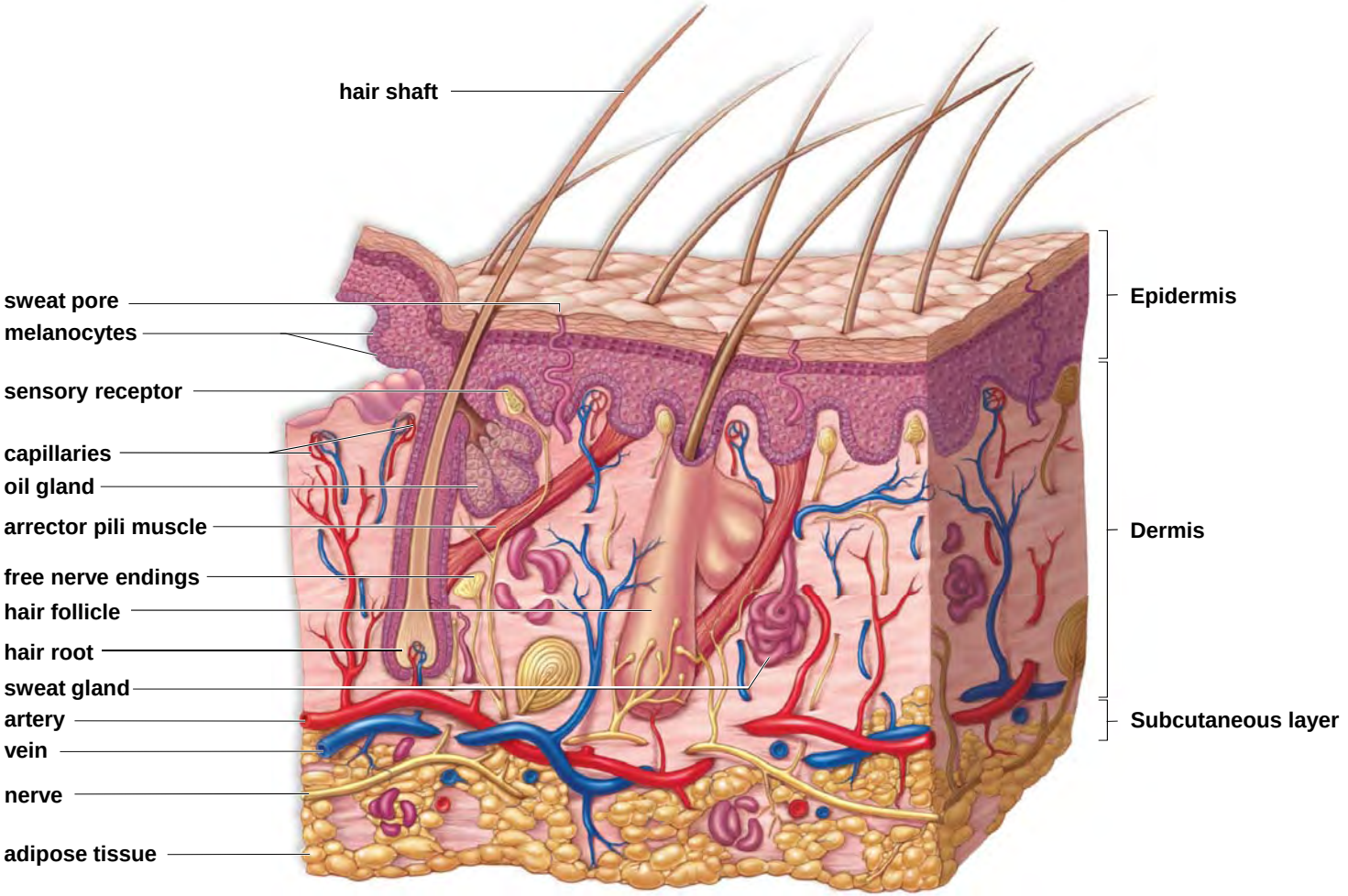
Functions & Regions of Skin

- 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

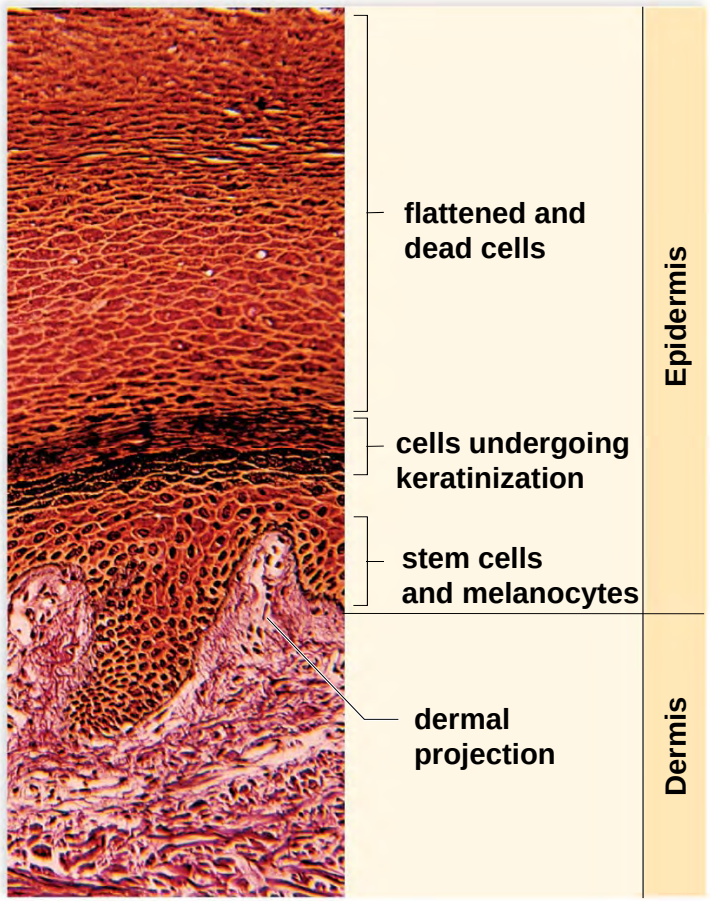
Human Skin Anatomy



Regions of Skin

- Dermis - Deeper and thicker than epidermis
  - Fibrous connective tissue containing elastic and collagen fibers contains:
    - Hair follicles
    - Sebaceous glands
    - Receptors
    - Nerve fibers
    - Blood vessels
- Subcutaneous Layer - Loose, connective tissue located below dermis

The Epidermis



a. Photomicrograph of skin

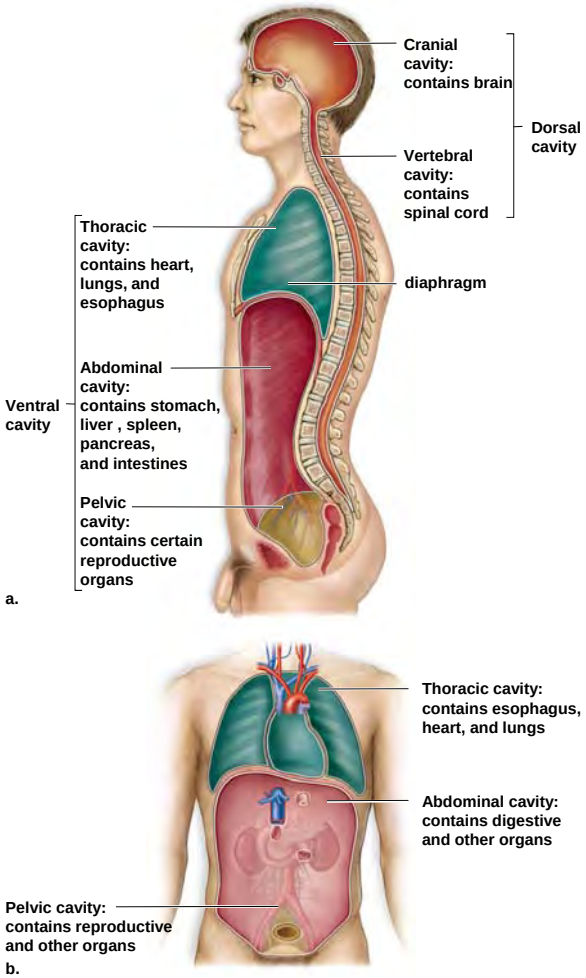
b. Basal cell carcinoma

c. Melanoma

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



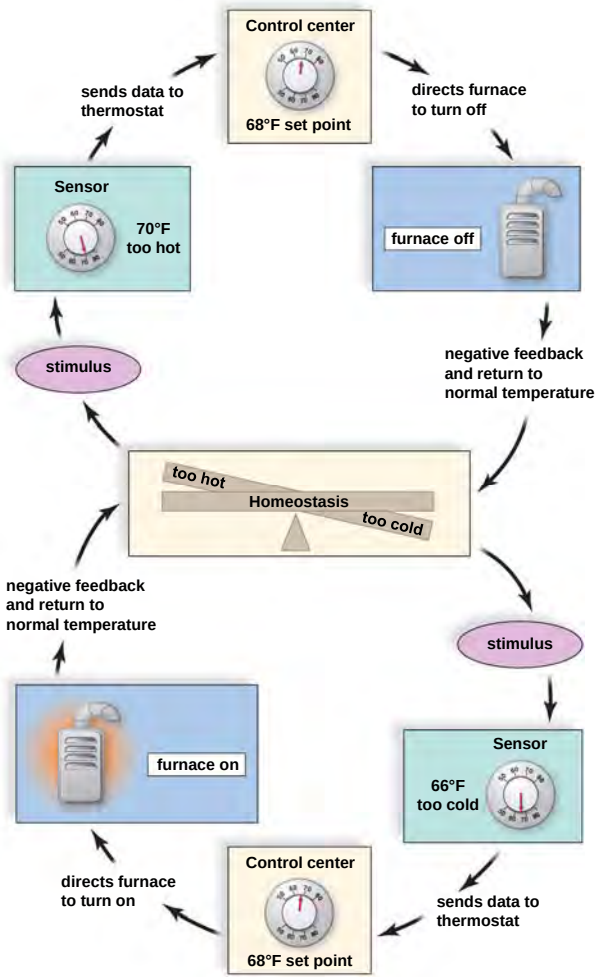
Homeostasis

- The organ systems of the human body contribute to homeostasis
  - 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
  - The liver and the kidneys
    - Store excess glucose as glycogen
    - Later, glycogen is broken down to replace the glucose used
    - The hormone insulin regulates glycogen storage
  - The kidneys
    - Under hormonal control as they excrete wastes and salts

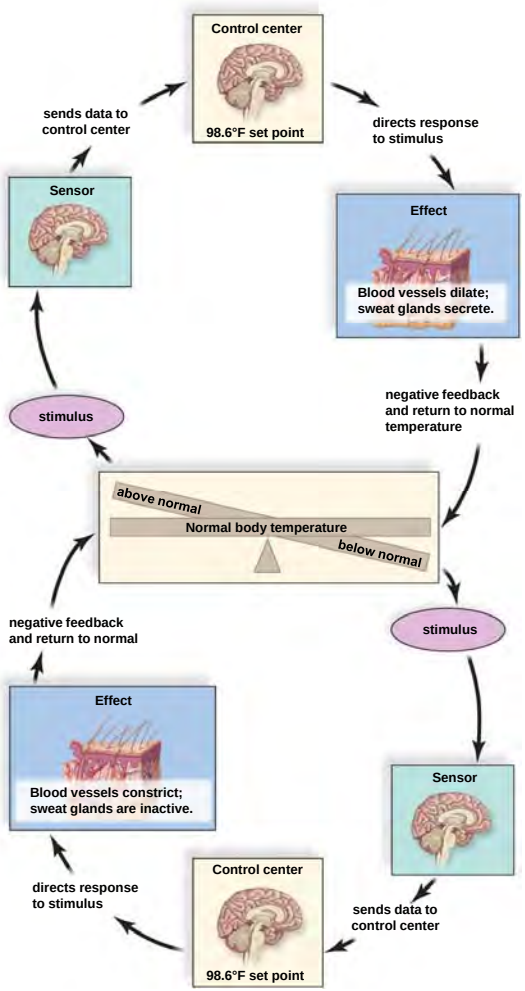
Negative Feedback

- Homeostatic Control
  - Partially controlled by hormones
  - Ultimately controlled by the nervous system
- Negative Feedback is the primary homeostatic mechanism that keeps a variable close to a set value
  - Sensor detects change in environment
  - Regulatory Center activates an effector
  - Effector reverses the changes

Regulation of Room Temperature



Regulation of Body Temperature

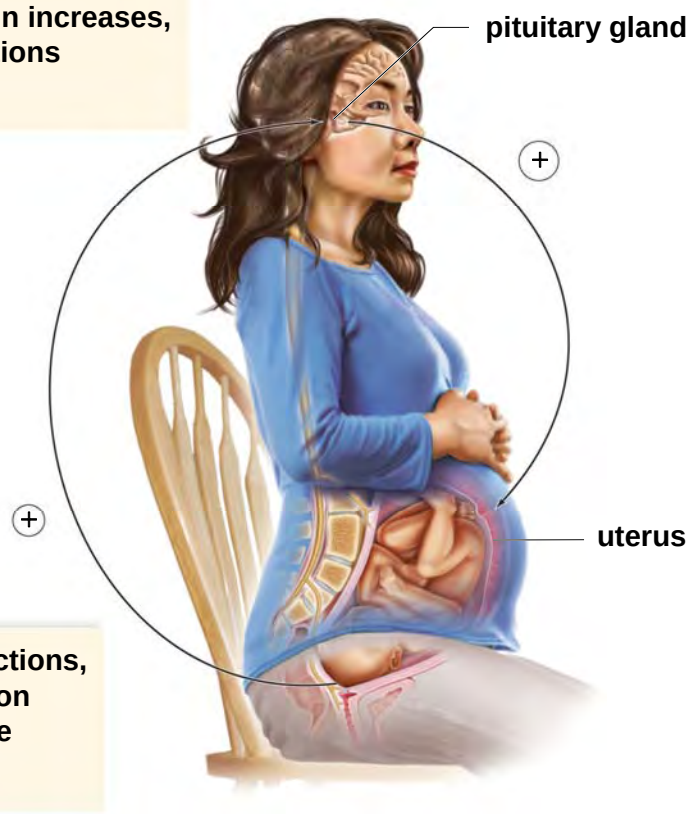


Positive Feedback

- 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.

Review

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