Introduction to Anatomy and Physiology: Tissues and Integumentary System

Biology 105
Lecture 7
Chapter 4
Outline

I. Tissues
   A. Epithelial
   B. Connective
   C. Muscle
   D. Nervous tissues

II. Cell-to-cell contact

III. Body cavities

IV. Membranes

V. Homeostasis

VI. Integumentary System
   • Includes: skin, hair, nails
Multicellular organisms require specialized cells to perform specific tasks.

These cells then organize into tissues, organs, and organ systems.
A **tissue** is a group of cells that work together to accomplish a common function.

There are four primary tissue types:

1. Epithelial tissue
2. Connective tissue
3. Muscle tissue
4. Nervous tissue
Tissues

- **Epithelial tissue** covers the body surfaces, lines cavities and organs, and forms glands.
- **Connective tissue** binds and supports the body, provides protection for our organs, serves as a storage site for fat, and participates in immunity.
- **Muscle tissue** is responsible for movement.
- **Nervous tissue** receives stimuli and conducts nerve impulses.
Epithelial Tissue

- **Epithelial tissues** (epithelium) **cover surfaces** such as the outside of the body (our skin), as well as **line** internal cavities and tubes and the inside surface of the stomach and the lungs.

- Serves for **protection, secretion and absorption**, and may contain glands.

- Cells are tightly packed together.
Epithelial Tissue

- All epithelial tissues share two characteristics:

  1. A free surface that may be specialized for protection, secretion, or absorption

  2. A basement membrane, which binds the epithelial cells to underlying connective tissue
Epithelial Tissue - Shapes

- The three basic shapes of epithelial cells:
  1. Squamous epithelium
  2. Cuboidal epithelium
  3. Columnar epithelium
Types of Epithelial Tissue

- Simple epithelial – a single layer of cells classified according to cell type.
- Stratified epithelial – two or more layers of cells, with one on top of the other.
- Pseudostratified epithelial – looks like it has more than one layer, but really does not.
- Glandular epithelial – secretes products like mucus, digestive enzymes, and hormones.
Simple Squamous Epithelium

- **Simple squamous epithelium** – one layer of flattened cells

- Forms the lining of blood vessels and air sacs in lungs (= alveoli).

- Functions: exchange of nutrients, waste and gases, and protection
Simple Squamous Epithelium

**Simple Squamous**
- One layer of flattened cells
- Located in air sacs of lungs, and forms the lining of the heart and blood vessels
- Allows exchange of nutrients, gases, and wastes
Stratified Squamous Epithelium

- Several layers of flattened cells

- Located on surface of skin, and lining of mouth, esophagus, and vagina

- Functions: provides protection against abrasion, infection, and drying out
Stratified Squamous

- Several layers of flattened cells
- Located on surface of skin, and lining of mouth, esophagus, and vagina
- Provides protection against abrasion, infection, and drying out
Simple Cuboidal Epithelium

- **Simple cuboidal epithelium** – one layer of *cube-shaped* cells

- Lines the kidney tubules, ovaries, and glands

- Functions: secretion and absorption
Simple Cuboidal Epithelium

Simple Cuboidal
- One layer of cube-shaped cells
- Located in linings of kidney tubules and glands
- Functions in absorption and secretion
Stratified Cuboidal Epithelium

- **Stratified cuboidal epithelium** – more than one layer of cube-shaped cells

- Located in ducts of mammary glands, sweat glands, and salivary glands

- Functions: protection
Stratified Cuboidal Epithelium

• Usually two layers of cube-shaped cells
• Located in ducts of mammary glands, sweat glands, and salivary glands
• Functions in protection
Simple Columnar Epithelium

- Simple columnar epithelium – one layer of rectangular cells

- Lines the digestive tract, respiratory tract, and the uterus

- Functions: absorption and secretion
Simple Columnar Epithelium

**Simple Columnar**
- One layer of tall, slender cells
- Located in lining of gut and respiratory tract
- Functions in absorption and secretion
Pseudostratified ciliated columnar epithelium – looks like it has more than one layer, but it does not

- Lines respiratory tract.

- Function: removes debris from the lungs
Stratified Columnar Epithelium

- Stratified columnar epithelium – more than one layer of rectangular cells

- Location (rare!): urethra, and junction of esophagus and stomach

- Functions: protection and secretion
Stratified Columnar Epithelium

STRATIFIED EPITHELIUM

Stratified Columnar
• Several layers of tall, slender cells
• Rare: located in urethra (tube through which urine leaves the body)
• Functions in protection and secretion
<table>
<thead>
<tr>
<th>Tissue</th>
<th>Specialization</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple squamous</td>
<td>Diffusion</td>
<td>Alveoli and blood vessels</td>
</tr>
<tr>
<td>Simple cuboidal</td>
<td>Absorption and secretion</td>
<td>Kidney tubules, ovaries, and glands</td>
</tr>
<tr>
<td>Simple columnar</td>
<td>Absorption and secretion</td>
<td>Digestive tract, respiratory tract, and uterus</td>
</tr>
<tr>
<td>Pseudo-stratified</td>
<td>Removing debris</td>
<td>Respiratory tract</td>
</tr>
<tr>
<td>Tissue</td>
<td>Specialization</td>
<td>Location</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td>Stratified squamous</td>
<td>Protection</td>
<td>Skin, mouth, esophagus, vagina</td>
</tr>
<tr>
<td>Stratified cuboidal</td>
<td>Protection</td>
<td>Ducts of mammary, sweat, and salivary glands</td>
</tr>
<tr>
<td>Stratified columnar</td>
<td>Protection and secretion</td>
<td>Urethra, junction of esophagus and stomach</td>
</tr>
</tbody>
</table>
### Table 4.1 Review of Epithelial Tissue

<table>
<thead>
<tr>
<th>Shape</th>
<th>Number of Layers</th>
<th>Example Locations</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squamous (flat, scale-like cells)</td>
<td>Simple (single layer)</td>
<td>Lining of heart and blood vessels, air sacs of lungs</td>
<td>Allows passage of materials by diffusion</td>
</tr>
<tr>
<td></td>
<td>Stratified (more than one layer)</td>
<td>Linings of mouth, esophagus, and vagina; outer layer of skin</td>
<td>Protects underlying areas</td>
</tr>
<tr>
<td>Cuboidal (cube-shaped cells)</td>
<td>Simple</td>
<td>Kidney tubules, secretory portion of glands and their ducts</td>
<td>Secretes; absorbs</td>
</tr>
<tr>
<td></td>
<td>Stratified</td>
<td>Ducts of sweat glands, mammary glands, and salivary glands</td>
<td>Protects underlying areas</td>
</tr>
<tr>
<td>Columnar</td>
<td>Simple</td>
<td>Most of digestive tract (stomach to anus), air tubes of lungs (bronchi), excretory ducts of some glands, uterus</td>
<td>Absorbs; secretes mucus, enzymes, and other substances</td>
</tr>
<tr>
<td></td>
<td>Stratified</td>
<td>Rare; urethra, junction of esophagus and stomach</td>
<td>Protects underlying areas, secretes</td>
</tr>
</tbody>
</table>
Glands are composed of epithelial tissue.

- **Exocrine glands** secrete their products into ducts.

- **Endocrine glands** secrete their products directly into blood.
Which of the following is a location where you would find simple cuboidal epithelium?

1. Blood vessels
2. Uterus
3. Kidneys
4. Digestive tract
Connective Tissue

- **Connective tissues** stabilize, bind, and support other tissues.

- Cells in connective tissue are usually separated from each other by extracellular material (examples: fibers, carbohydrates).

- The connective tissue cells secrete this extracellular material.
Connective Tissue

- Many different types of connective tissue:

1. Areolar
2. Adipose
3. Dense (tendons and ligaments)
4. Cartilage
5. Bone
6. Blood
1. Loose Areolar Connective Tissue

- Cells: fibroblasts
- Fibroblasts secrete protein fibers
- Functions – bind and support
- Locations – under skin, around organs, between muscles
Cells = fibroblasts

a. Loose fibrous connective tissue
   • has space between components.
   • occurs beneath skin and most epithelial layers.
   • functions in support and binds organs.
2. Loose Adipose Connective Tissue

- **Cells**: adipose cells
- **Stores triglycerides**
- **Functions** – energy storage, insulation, cushioning for organs
- **Locations** – under skin, and around kidneys and heart
Loose Adipose Tissue

Adipose (Fat) Tissue
- Found under skin, around kidneys and heart
- Functions in energy storage and insulation; provides cushioning for organs
3. Dense Connective Tissue

- **Cells:** fibroblasts

- **Functions:** attaches bone to bone (ligaments), and attaches muscle to bone (tendons)

- **Locations** – tendons and ligaments
Dense Connective Tissue

- Found in tendons and ligaments
- Forms strong bands that attach bone to muscle or bone to bone
4. Cartilage (Specialized Connective Tissue)

- Cells: chondrocytes
  - Cells are located in chambers = lacunae
- Lacunae are surrounded by a matrix:
  - This type of tissue is strong but flexible.
- Functions: support and protection (cushioning)
- Locations: nose, ends of long bones, ribs, in joints, outer ear, and between the vertebrae in the backbone
- There is not a direct blood supply, so this type of tissue heals slowly.
c. 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.
5. Bone (Specialized Connective Tissue)

- Bone cells: osteocytes
  - Cells are found in lacunae.
- Rigid connective tissue.
- Made of hard matrix (provides strength), and protein fibers including collagen (provide strength and flexibility)

Functions:
1. Protects and supports internal structures
2. Facilitates movement along with the muscles
3. Stores lipids, calcium, and phosphorus
4. Produces blood cells
Bone

- Found in the skeleton
- Functions in support, protection (by enclosing organs), and movement
6. Blood (Specialized Connective Tissue)

- **Blood** consists of liquid (plasma) and formed elements including:
  - Red Blood Cells (RBC) – transport oxygen to body cells
  - White Blood Cells (WBC) – fight infection
  - Platelets – cell fragments necessary for blood clotting.
Blood

- Found within blood vessels
- Transports nutrients, gases, hormones, wastes; fights infections
## Connective Tissue

### Table 4.2 Review of Connective Tissue

<table>
<thead>
<tr>
<th>Type</th>
<th>Example Locations</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connective tissue proper</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loose, areolar</td>
<td>Between muscles, surrounding glands, wrapping small blood vessels and nerves</td>
<td>Wraps and cushions organs</td>
</tr>
<tr>
<td>Loose, adipose (fat)</td>
<td>Under skin, around kidneys and heart</td>
<td>Stores energy, insulates, cushions organs</td>
</tr>
<tr>
<td>Dense</td>
<td>Tendons, ligaments</td>
<td>Attaches bone to bone (ligaments) or bone to muscle (tendons)</td>
</tr>
<tr>
<td><strong>Specialized connective tissue</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cartilage (semisolid)</td>
<td>Nose (tip); rings in respiratory air tubules; external ear</td>
<td>Provides support and protection (by enclosing) and serves as lever for muscles to act on</td>
</tr>
<tr>
<td>Bone (solid)</td>
<td>Skeleton</td>
<td>Provides support and protection (by enclosing), and levers for muscles to act on</td>
</tr>
<tr>
<td>Blood (fluid)</td>
<td>Within blood vessels</td>
<td>Transports oxygen and carbon dioxide, nutrients, hormones, and wastes; helps fight infections</td>
</tr>
</tbody>
</table>
Which cells are found in dense connective tissue?

1. Chondrocytes
2. Osteocytes
3. Fibroblasts
4. Osteoblasts
Muscle Tissue

- Muscle tissue can contract and shorten

- There are three types of muscle tissue that vary in structure, location, and control mechanisms:

  1. Skeletal
  2. Cardiac
  3. Smooth
Skeletal Muscle Tissue

- **Location**: attached to bones
- **Type of Control**: under *voluntary* control
Skeletal Muscle Tissue

- Long cylindrical striated cells with many nuclei
- Voluntary contraction
- Most are found attached to the skeleton
- Responsible for voluntary movement

Skeletal Muscle

Nucleus

Striation

Width of one muscle cell
Cardiac Muscle Tissue

- **Location**: walls of the heart

- **Type of Control**: under involuntary control
Cardiac Muscle Tissue

- Branching striated cells with one nucleus
- Involuntary contraction
- Found in wall of heart
- Pumps blood through the body
Smooth Muscle Tissue

- **Locations**: surrounds other organs and structures (examples: blood vessels, digestive system, lungs)

- **Type of Control**: under *involuntary* control
Smooth Muscle Tissue

- Cells tapered at each end with one nucleus
- Involuntary contraction
- Found in walls of hollow internal organs such as the intestines, and tubes such as blood vessels
- Contractions in digestive system move food along
- When arranged in circle, controls diameter of tube
# Muscle Tissue

## Table 4.3 Review of Muscle Tissue

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Example Locations</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skeletal</td>
<td>Long, cylindrical cells; multiple nuclei per cell; obvious striations</td>
<td>Muscles attached to bones</td>
<td>Provides voluntary movement</td>
</tr>
<tr>
<td>Cardiac</td>
<td>Branching, striated cells; one nucleus; specialized junctions between cells</td>
<td>Wall of heart</td>
<td>Contracts and propels blood through the circulatory system</td>
</tr>
<tr>
<td>Smooth</td>
<td>Cells taper at each end; single nucleus; arranged in sheets; no striations</td>
<td>Walls of digestive system, blood vessels, and tubules of urinary system</td>
<td>Propels substances or objects through internal passageways</td>
</tr>
</tbody>
</table>
This type of muscle is under voluntary control:

1. Skeletal
2. Smooth
3. Cardiac
Nervous Tissue

- Nervous tissue:
  - Consists of neurons and neuroglia
    - **Neurons** – nerve cells that conduct the message
    - **Neuroglia** – cells that support neurons
  - Makes up the brain, spinal cord, and nerves
  - **Functions** – conducts messages throughout the body
The cells that make up tissues are held together by three types of junctions:

1. Tight junctions
2. Adhesion junctions
3. Gap junctions
Tight Junctions

- **Function** – prevent substances from leaking across tissues
- **Locations** – urinary and digestive tracts
Tight Junctions

• Creates an impermeable junction that prevents the exchange of materials between cells
• Found between epithelial cells of the digestive tract, where they prevent digestive enzymes and microorganisms from entering the blood
Adhesion Junctions

- **Function** – holds adjacent cells together and allows tissues to be flexible

- **Locations** – skin, and opening of the uterus
Adhesion Junctions

• Holds cells together despite stretching
• Found in tissues that are often stretched, such as the skin and the opening of the uterus
Gap Junctions

- **Function** – open channels between cells allowing rapid communication due to quick transfer of ions and small molecules between neighboring cells

- **Locations** – heart and smooth muscle
Gap Junctions

• Allows cells to communicate by allowing small molecules and ions to pass from cell to cell
• Found in epithelia where the movement of ions coordinates functions, such as the beating of cilia
• Found in excitable tissue, such as heart and smooth muscle
Which junction allows rapid communication between neighboring cells?

1. Tight
2. Adhering
3. Gap
Which junction prevent substances from leaking across tissues?

1. Tight
2. Adhering
3. Gap
Body Cavities

- We have two main body cavities:
  - Dorsal cavity (posterior)
  - Ventral cavity (anterior)
Body Cavities

Dorsal cavity
- Cranial cavity contains brain
- Spinal cavity contains spinal cord

Ventral cavity
- Rib
- Thoracic cavity
- Diaphragm
- Abdominal cavity

Vertebra
Ventral Body Cavity

- The ventral cavity is divided into two cavities:
  - Thoracic cavity
    - The thoracic cavity is further subdivided into:
      - Pleural cavities – contains lungs
      - Pericardial cavity – contains heart
  - Abdominal cavity
    - The abdominal cavity contains the digestive system, the urinary system, and the reproductive system.
- The **diaphragm** is a broad sheet of muscle that divides the two cavities.
Body Cavities

Thoracic cavity

Pleural cavity contains a lung

Pericardial cavity contains heart

Ventral cavity

Thoracic cavity

Diaphragm

Abdominal cavity

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Dorsal Cavity

- The dorsal cavity is divided into two cavities:
  - Cranial – contains brain
  - Spinal – contains spinal cord
Body Cavities

- **Dorsal cavity**
  - Cranial cavity contains brain
  - Spinal cavity contains spinal cord
  - Vertebra
The arrow is pointing to the:

1. Cranial
2. Thoracic
3. Abdominopelvic

Cranial: 33%
Thoracic: 33%
Abdominopelvic: 33%
The arrow is pointing to the:

1. Cranial
2. Thoracic
3. Abdominopelvic
The arrow is pointing to the:

1. Pleural
2. Pericardial
Membranes

- Body cavities and surfaces of organs are covered with membranes.
- Membranes are sheets of epithelium supported by connective tissues.
- Membranes protect tissues and organs.
Membranes

- There are four types of membranes:
  1. Mucous
  2. Serous
  3. Synovial
  4. Cutaneous
Mucous Membranes

- **Mucous** – line passages to the exterior world, including those of the respiratory, digestive, reproductive, and urinary systems in the body

- Secrete mucus
Serous Membranes

- **Serous** – line thoracic and abdominopelvic cavities and the organs contained in them

- Secrete lubricating fluid
Synovial Membranes

- **Synovial** – line cavities of freely movable joints
- Secrete a lubricating fluid
Cutaneous Membranes

- **Cutaneous** – skin, lines the outside of the body (thick and dry)
Organs and Organ System

- An organ is a group of tissues that work together to perform a specific function.

- In turn, organs work together to form an organ system.
Example Organ: Stomach

1. Epithelium lines the stomach and secretes acid to digest the food.

2. Nervous tissue stimulates cells to release the acid.

3. Muscles contract to push food through the stomach.

4. Connective tissue supports these other tissues.
Remember Homeostasis?!?

- **Homeostasis** – the ability to maintain a relatively stable environment in the body

- How does the body accomplish this daunting task?!?
The body uses the nervous system and the endocrine systems to maintain homeostasis.

Controlled by negative or positive feedback
**Feedback**

- **Step 1:** A receptor detects a change and sends information to the control center.
- **Step 2:** The control center integrates information from the receptors and directs the appropriate responses.
- **Step 3:** The effector brings about the necessary adjustment.

Variable Factor to Be Controlled in Homeostasis
Feedback Mechanism

- A **sensor/receptor** detects a change (= **stimulus**) in the internal or external environment.

- A **control center**, such as a part of the brain, integrates the information coming from all receptors and sends out an appropriate response.

- The **effector** carries out the response, returning the system to homeostasis again.
Hormones

- **Hormone** – a substance released into the blood that carries a message to other parts of the body.

- When hormones are released from one part of the body, they cause another part of the body to react.
Feedback

- In general, Negative Feedback is used to keep the body in balance, and it maintains the “status quo”.

- Positive Feedback is used to change the situation.
Negative Feedback Example: Calcium

- Example: calcium regulation

- Calcium is stored in the bones and circulates in the blood stream.

- Cells in the bones, osteoclasts, release calcium from bone.
Negative Feedback Example: Calcium

- **Stimulus**: calcium levels drop too low in the bloodstream

- **Sensor/receptor**: parathyroid glands

- **Control center**: the parathyroid gland releases parathyroid hormone

- **Effectors**: osteoclast cells in bone release calcium and the kidneys reabsorb more calcium
Negative Feedback Example: Calcium

- **Stimulus**: calcium levels increase too high in the blood stream

- **Sensor/receptor**: parathyroid glands

- **Control center**: the parathyroid gland stops releasing parathyroid hormone

- **Effectors**: osteoclast cells in bone stop releasing calcium and the kidneys reabsorb less calcium
Read pages 79-81: temperature regulation in the body

Hyperthermia: abnormally elevated body temperature

Hypothermia: abnormally low body temperature

The thermostat for the body is located in the hypothalamus.
**Positive Feedback Example: Childbirth**

- **Stimulus**: when the baby leaves the uterus, the muscles in the cervix stretch.
  - Nerves in the cervix send a message to the hypothalamus gland.

- **Sensor/receptor**: stretch receptors in the cervix

- **Control Center**: hypothalamus gland causes the pituitary gland to release oxytocin

- **Effector**: muscles of uterus contract
More pressure stimulates the stretch receptors, which signal the hypothalamus to tell the pituitary gland to release more oxytocin.
Components of the integumentary system:

- Skin
- Nails
- Hair
- Exocrine glands (sweat and oil glands)
Integumentary System Functions

1. Provides protection from bacteria, UV radiation, chemicals, physical injury

2. Reduces water loss

3. Temperature regulation

4. Vitamin D production

5. Contains sensors that detect pain, temperature, and pressure
The skin has two layers:

1. **Epidermis** – thin outer layer of stratified squamous epithelial tissue

2. **Dermis** – thick underlying layer of mainly connective tissue
Figure 4.8

- Hair shaft
- Sweat pore
- Area of rapidly dividing cells
- Sensory receptor
- Sensory nerve fiber
- Oil (sebaceous) gland
- Adipose tissue
- Pressure receptor
- Vein
- Artery
- Hair root
- Hair follicle
- Arrector pili muscle
- Epidermis
- Dermis
- Hypodermis
- Sweat gland
- Hair root
a. Photomicrograph of skin

Epidermis
- flattened and dead cells
- cells undergoing keratinization

Dermis
- stem cells and melanocytes
- dermal projection
Epidermis

- **Epidermis** consists of several layers of squamous epithelial cells (stratified).
  
  - Deepest layer contains rapidly dividing cells.
  
  - Outer surface is made up of dead skin cells.
  
  - Protective properties come from **keratin**.
  
  - **Melanocytes** produce **melanin**.
Dermis

- The **dermis** consists primarily of **connective tissue**.

- Also contains vascular tissue, hair follicles, sweat glands, nerves, and sensory receptors.

- Collagen and elastic fibers are found in the lower layer, which allows the skin to stretch and return to its original shape.
Hypodermis

- The **hypodermis** is a layer of loose connective tissue beneath the dermis and epidermis, connecting them to other tissues.

- The hypodermis is not a part of the skin – it lays underneath the skin.
Accessory Organs of the Skin

- **Nails** - sheets of hard keratinized cells forming a protective covering for the fingers and toes.

- **Hair follicles** - found in the dermis and where sebum is released to lubricate the hair.

- **Sweat glands** - play a role in modifying body temperature and have ducts that lead to a pore at the surface of the skin.

- **Sebaceous glands** - secrete sebum, an oily substance that lubricates the skin and hair.
Skin Cancer

- Melanin protects against UV radiation.

- Three types of skin cancer:
  1. Basal cell carcinoma – from rapidly dividing cells deep in the epidermis
  2. Squamous cell carcinoma – from newly formed cells as they flatten
  3. Melanoma – from melanocytes; far more dangerous than other skin cancers and more likely to spread to other body parts
Figure 4.A Three skin cancers

(a) Basal cell carcinoma
(b) Squamous cell carcinoma
(c) Melanoma
## Melanoma in the United States – 2005 Estimates

Ref: the American Cancer Society

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>New Cases</td>
<td>59,600</td>
</tr>
<tr>
<td>Deaths Per Year</td>
<td>7,800</td>
</tr>
<tr>
<td>5-Year Overall Survival Rate</td>
<td>91%</td>
</tr>
<tr>
<td>5-Year Localized Survival Rate</td>
<td>98%</td>
</tr>
<tr>
<td>5-Year regional Survival Rate</td>
<td>60%</td>
</tr>
<tr>
<td>5-Year distant Survival Rate</td>
<td>14%</td>
</tr>
</tbody>
</table>
These cells found in skin produce pigments:

1. Chondrocytes
2. Melanocytes
3. Fibroblasts
4. Osteocytes
Important Concepts

- Read chapter 4
- What are the four tissue types, their functions, and examples of each type?
- What are examples, functions, and locations of each of the types of connective tissue?
- Why does it take longer for cartilage to heal?
- What cell types are found in each type of connective tissue?
Important Concepts

- What are the functions of red blood cells, white blood cells, and platelets?
- What are the three types of muscle? What are their functions, and where they are found? Are they under voluntary or involuntary control?
- What are the two types of nervous tissue cells and their functions?
- What are the types of epithelial tissue, where are they found, and what are their functions?
Important Concepts

- What are the two types of glands?

- How do negative and positive feedback mechanisms work?
  - Be able to describe the examples of negative and positive feedback given in class and in the textbook (e.g. identify the sensor, control center, and effector for each example).

- What are the three cell-to-cell junctions and their functions?
Important Concepts

- Identify the body cavities: what are their locations and what is contained in each of the cavities?

- What are the four types of membranes, their functions and locations?

- What are the functions of the integumentary system?

- Components of the integumentary system and their functions
Important Concepts

- What are the two layers of the skin? Which type of tissues comprise each layer, and where are the layers located?

- What layer is found underneath the skin, and which tissue type comprises this layer?

- What are the three types of skin cancer, where do they originate, and which is more likely to spread to other parts of the body?

- What are melanocytes, and what is their function?
Definitions

- Tissue, organ, organ system, tight junctions, adhesion junctions, gap junctions, exocrine glands, endocrine glands, homeostasis, hormone, hypodermis, diaphragm, sebum, sebaceous glands, keratin, basement membrane, lacunae, voluntary control, involuntary control, hyperthermia, hypothermia, melanin