Chapter 4: Organization & Regulation of Body Systems

What is a tissue?
• A collection of cells of the same type that perform a common function
• There are 4 major tissue types in the body:
  1. Connective
  2. Muscular
  3. Nervous
  4. Epithelial

1. Connective tissue
• Binds and supports parts of the body
• All have specialized cells, ground substance and protein fibers
• Ground substance is noncellular and ranges from solid to fluid
• The ground substance and proteins fibers together make up the matrix of the tissue
• There are three main types of connective tissue: A. fibrous, B. supportive and C. fluid
• See Page 44: Figure 4:4

A. Fibrous connective tissue
• There are two types: dense or loose, but both contain fibroblast cells with a matrix of collagen and elastic fibers
• Loose fibrous tissue is found supporting epithelium and many internal organs
• Adipose tissue is a special loose fibrous tissue where fat is stored
What does loose fibrous connective tissue look like?

B. Supportive connective tissue: Cartilage
- Cells are in chambers called lacunae
- Matrix is solid but flexible
- 3 types are distinguished by types of fibers
  1. **Hyaline cartilage** – fine collagen fibers
     Location: Nose, ends of long bones and fetal skeleton
  2. Elastic cartilage – more elastic fibers than cartilage fibers
     Location: Outer ear
  3. Fibrocartilage – strong collagen fibers
     Location: Disks between vertebrae

B. Supportive connective tissue: Bone
- Cells are in chambers called lacunae
- Matrix is solid and rigid that is made of collagen and calcium salts
- 2 types are distinguished by types of fibers
  1. Compact – made of repeating circular units called osteons which contain the hard matrix and living cells and blood vessels
     Location: Shafts of long bone
  2. Spongy – an open, latticework with irregular spaces
     Location: Ends of long bones
What do bone (Pg.63) and cartilage look like?

4.2 Connective tissue connects and supports

C. Fluid connective tissue: Blood

- Made of a fluid matrix called plasma and cellular components that are called formed elements
- 3 formed elements:
  1. Red blood cells – cells that carry oxygen
  2. White blood cells – cells that fight infection
  3. Platelets – pieces of cells that clot blood

4.2 Connective tissue connects and supports

C. Fluid connective tissue: Lymph

- Matrix is a fluid called lymph
- White blood cells congregate in this tissue
2. Muscle tissue

- Allows for movement in the body
- Made of muscle fibers/cells and protein fibers called actin and myosin
- There are 3 types of muscle tissue in humans:
  A. Skeletal
  B. Smooth
  C. Cardiac

4.3 Muscle tissue moves the body

A. Muscle tissue - Skeletal

- Appearance: long, cylindrical cells, multiple nuclei, striated fibers
- Location: attached to bone for movement
- Nature: voluntary movement

4.3 Muscle tissue moves the body

B. Muscle tissue - Smooth

- Appearance: spindle-shaped cell with one nucleus, lack striations
- Location: walls of hollow organs and vessels
- Nature: involuntary movement
C. Muscle tissue - Cardiac

- Appearance: branched cells with a single nucleus, striations with darker striations called intercalated disks between cells
- Location: heart
- Nature: involuntary movement

3. Nervous tissue

- Allows for communication between cells through sensory input, integration of data and motor output
- Made of 2 major cell types:
  A. Neurons
  B. Neuroglia

4.4 Nervous tissue communicates

A. Nervous tissue - neurons

- Made of dendrites, a cell body and an axon
- Dendrites carry information toward the cell body
- Axons carry information away from the cell body
A. Nervous tissue - neuroglia

- A collection of cells that support and nourish neurons
- Outnumber neurons 9:1
- Examples are oligodendrocytes, astrocytes and microglia

4. Epithelial tissue

- A groups of cells that form a tight, continuous network
- Lines body cavities, covers body surfaces and found in glands
- Cells are anchored by a basement membrane on one side and free on the other side
- Named after the appearance of cell layers and the shape of the cells
- There is transitional epithelium that changes in appearance in response to tension

How do we name epithelial tissue?

- Number of cell layers:
  - Simple: one layer of cells
  - Stratified: more than one layer of cells
  - Pseudostratified: appears to have layers but only has one layer
- Shape of cell:
  - Cuboidal: cube-shaped
  - Columnar: column-shaped
  - Squamous: flattened
What does epithelial tissue look like?

How are cells connected within a tissue?

- Tight junctions – proteins join and form an impermeable barrier between plasma membranes in a zipper-like fashion.
- Adhesion junctions – cytoskeletal fibers join between cells and have flexibility.
- Gap junctions – a fusion of adjacent plasma membranes with small channels between them that allow small molecules to diffuse.

Cell junctions
Moving from tissue to organs and organ systems

- An organ is 2 or more tissue types working towards a particular function
- An organ system is a combination of organs that work together to carry out a particular function

4.7 Integumentary system

4.8 Organ systems

What are the body cavities?

- Mucous membranes - lining of the digestive, respiratory, urinary and reproductive systems (Parts with connection to OUTSIDE)
- Serous membranes - line lungs, heart, abdominal cavity and covers the internal organs; named after their location (Ventral C.): Pleura: lungs, Peritoneum: abdominal cavity and organs, Pericardium: heart
- Synovial membranes - lines the cavities of freely movable joints
- Meninges - cover the brain and spinal cord

What about the body membranes that line the cavities?
The integumentary system:

- Includes the skin and accessory organs such as hair, nails, and glands
- The skin has two main regions called the epidermis and the dermis
- Under the skin there is a subcutaneous layer between the dermis and internal structures where fat is stored
- Is important for maintaining homeostasis
What are the functions of the integumentary system

1. **Protects** the body from physical trauma, invasion by pathogens and water loss

2. Helps regulate body temperature

3. Allows us to be aware of our surroundings through sensory receptors

4. **Synthesizes** chemicals such as melanin and vitamin D

There are two regions of the skin

- **Epidermis**
  - The thin, outermost layer of the skin
  - Made of epithelial tissue
  - Cells in the uppermost cells are dead and become filled with keratin thus acting as a waterproof barrier
  - Langerhans cells are a type of white blood cell that help fight pathogens
  - Melanocytes produce melanin that lend to skin color and protection for UV light
  - Some cells convert cholesterol to vitamin D

- **Dermis**
The dermis:
• The thick, inner layer of the skin
• Made of dense fibrous connective tissue
• Contains elastic and collagen fibers
• Contains blood vessels, many sensory receptors and glands

What are the accessory organs of the skin and why are they important?
• Includes nails, hair and glands
• Nails are derived from the epidermis that offer a protective covering
• Hair follicles are derived from the dermis but hair grows from epidermal cells (protects & warms)
• Oil glands are associated with hair and produce sebum that lubricates hair and skin as well as retards bacterial growth
• Sweat glands are derived from the dermis and helps to regulate body temperature

What might skin cancer look like?
What you need to know about skin cancer?

- 2 of the 3 types that arise in the epidermis:
  - Basal cell carcinoma is the most common yet least deadly form of skin cancer
  - Melanoma is the most deadly form of skin cancer but is the least common

- What can you do to help prevent this?
  - Stay out of the sun between 10am-3pm
  - Wear protective clothing (tight weave, treated sunglasses, wide-brimmed hat)
  - Use sunscreen with an SPF of at least 15 and protects from UV-A and UV-B rays
  - Don’t use tanning beds

What is homeostasis?

- The ability to maintain a relatively constant internal environment in the body

- The nervous and endocrine systems are key in maintaining homeostasis

- Changes from the normal tolerance limits results in illness or even death

All systems are important in maintaining homeostasis
4.9 Homeostasis

Negative feedback

- The primary mechanism for maintaining homeostasis

- Has two components:
  - sensor
  - control center

- The output of the system dampens the original stimulus

4.9 Homeostasis

An example of negative feedback: body temperature

Positive feedback

- A mechanism for increasing the change of the internal environment in one direction

- An example is the secretion of oxytocin during birth to continually increase uterine contractions

- Can be harmful such as when a fever is too high and continues to rise