Biology 12 - Human Organization: Chapter Notes

*The human body has several **levels of organization**:*

- Cells of the same type joined together are called **TISSUES**
- Different Tissues are joined together to form **ORGANS**
- Various organs are arranged into an **ORGAN SYSTEM**

Lets look at tissues first...

- four major types of tissues in the human body:

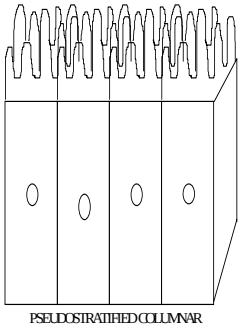
EPITHELIAL: covers body surfaces and lines body cavities
CONNECTIVE: binds and supports body parts
MUSCULAR: causes parts to move
NERVOUS: responds to stimuli and transmits impulses from one body part to another

EPITHELIAL TISSUES: covers body, lines cavities

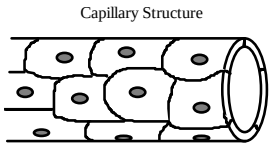
- covers entire body surface and most of the body's inner cavities.
- outer epidermis (skin) **protects from injury** and **drying out**
- inner epidermal tissue, on internal surfaces protects, secretes mucus (e.g. along digestive tract)

Types:

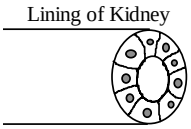
1. **Squamous Epithelium**: Function in protection, diffusion, filtration. Made of **flat cells**. Lines **alveoli** and walls of **capillaries**, **blood vessels**.


PSEUDOSTRATIFIED COLUMNAR

2. **Cuboid Epithelium**: function in **secretion** and **absorption**, **protection**. **cube** shaped cells. e.g. line kidney tubules, surface of ovaries.


Capillary Structure

3. **Columnar Epithelium**: column-shaped. Often have **microvilli** or **cilia** to aid function. e.g. lining of intestine, oviduct lining, lining of uterus.
   - Each type can exist as a single layer or be **stratified** (layers stacked on top of each other). e.g. mouth, nose, vagina lined by stratified squamous epithelium.
   - **Pseudostratified Columnar**: appear to be layered but is really just one layer of cells. e.g. lining of respiratory tract.


Lining of Kidney

Summary of Epithelial Tissues		
Type	**Function**	**Location**
Simple Squamous	Filtration, diffusion, osmosis	Oral cavity, lining of blood vessels
Simple Cuboidal	Secretion, absorption	Surface of ovaries, linings of kidney tubules
Simple Columnar	Protection, secretion, absorption	Lining of Uterus, tubes of the digestive tract
Pseudostratified Columnar	Protection, secretion, movement of mucus and sex cells	Linings of respiratory passages, various tubes of the reproductive systems
Stratified Squamous	Protection	Outer layers of skin, vagina, and anal canal

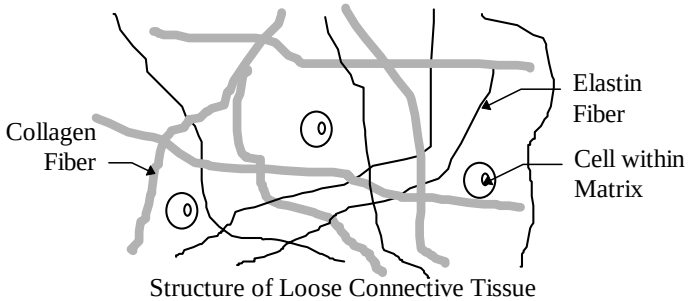
CONNECTIVE TISSUE: connects organs

Functions

- bind structures together
- provide support and protection
- fill up spaces
- store fat

Structure

- cells in connective tissue usually in **MATRIX** (a **non-cellular material** found between cells) usually made up of either **collagen** or **elastin**.



Structure of Loose Connective Tissue

Types of Connective Tissue:

1. **Loose**: join tissues, hold organs in place, fat storage
2. **Fibrous**: bundles of **collagen** fibers, **very strong**. Used in **tendons** (connect muscle to bone) and **ligaments** (connect bones to other joints.
3. **Cartilage**: has flexible matrix rich in protein and

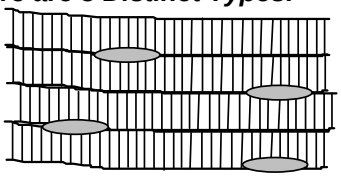
fibers. e.g. nose, ears, vertebrae, ends of bones.

4. **Bone**: rigid connective tissue. Matrix of calcium salts.
5. **Blood**: matrix is **liquid** called **plasma**.

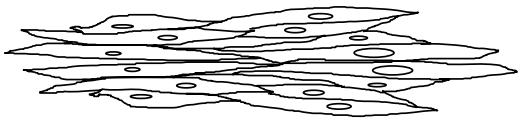
Muscle Tissue: Contracts for Movement

- muscle tissue is composed of fibers made of **actin** and **myosin** proteins (among other "helper" proteins) whose interaction is responsible for **movement**.

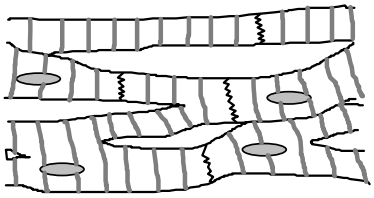
There are 3 Distinct Types:



Skeletal Muscle
Striated, Voluntary



Smooth Muscle
non-striated, Involuntary

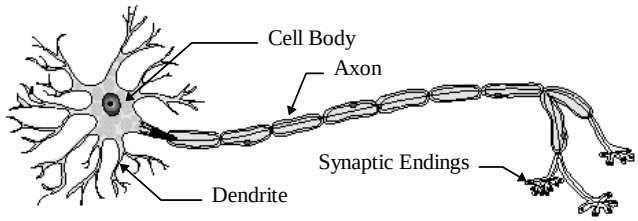


Cardiac Muscle
Striated, Involuntary

1. **SKELETAL MUSCLE**: **striated** (alternating light and dark bands) attached to bones, used for movement, **voluntary control**. Can contract quickly and strongly but will fatigue in time.
2. **SMOOTH MUSCLE**: **non-striated**, **involuntary control**, found in walls of internal organs, intestine, stomach, blood vessels. Contracts more slowly, but can contract over a longer period of time.
3. **CARDIAC MUSCLE**: **striated**, **involuntary**, forms **heart muscle**. Found only in the heart. Can contract quickly, and beats your whole life through.

Nervous Tissue: Conduct Electrochemical Messages

- specialized tissue that forms **nerves**, **brain**, **spinal cord**
- conduct electrical & chemical messages along special cells called neurons. Composed of **cell body**, **dendrites** (conduct messages ***to*** cell body), **axon** (send messages ***away*** from cell body).
- axons and dendrites are nerve fibers. Bundles of nerve fibers are called **nerves**.
- Nerves **conduct messages** to and from spinal cord, brain, and sense organs to register **sensation** and **trigger muscle movement**.



Structure of a Neuron (in this case, a *motor neuron*)

- **GLIAL** cells are cells that surround nerve cells. They help to support, protect, and nourish nerve cells. They provide nutrients to the neurons and help keep the tissue free of debris.

What are Glands?

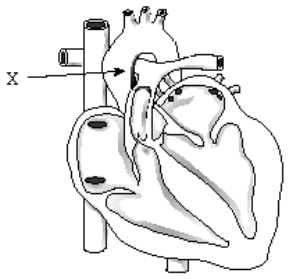
Gland: a single cell, or a collection of cells that **secrete** something

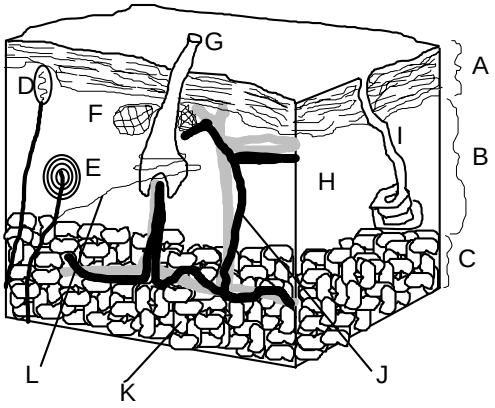
i. **Exocrine glands**: secrete into **ducts**. e.g. the gall bladder is an exocrine gland because it secretes bile in a duct. Sweat glands are exocrine glands.

ii. **Endocrine glands**: secrete chemicals (especially **hormones**) into **bloodstream** (e.g. pituitary gland, pancreas secretes insulin into the blood).

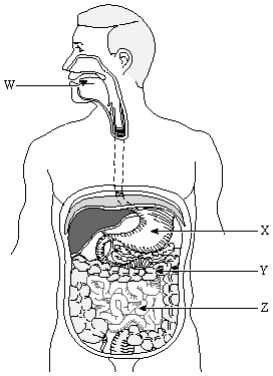
ORGANS: Tissues working together

- organs (e.g. the heart) are made up of **one or more types of tissues** (usually more).
- **SKIN** is also an example of an organ. It is your largest organ, and has several tissue layers.
- Skin **covers** body surfaces, gives **protection** from water loss and invasion by microorganisms, contains **sense organs**, helps to regulate body temperature Skin is made up of **Three Layers**.





1. **Epidermis**: is **outer layer**. Composed of **stratified squamous epithelial** cells. **Basal cells** at base of this layer produce new cells. **Pigment** cells (**melanocytes**) here produce **melanin**, responsible for **skin colour**. **Keratin protein** hardens skin cells. (**Hair & nails** are made of tightly packed keratinized cells).
2. **Dermis**: **middle layer**. **Loose connective tissue** with many **elastic fibers**. **Sweat glands**, nerve endings, blood vessels, and **hair follicles** located here.
3. **Subcutaneous Layer**: **bottom layer.** Loose connective tissue containing adipose cells (fat!)



Human Organ Systems

- each located in specific location, with specific functions. (e.g. digestive system).
- many internal organ systems enclosed within **coelom**, a cavity within the body.
- organ systems contribute to maintaining a stable internal environment (**homeostasis**). e.g. Temp, pH, [glucose], blood pressure.

Summary of the Function of Human Organ Systems:

Name	Function
1. Digestive	convert food to usable nutrients
2. Circulatory	transport of necessary molecules to cells
3. Immune	defense against invading pathogens
4. Respiratory	gas exchange
5. Excretory	gets rid of metabolic wastes
6. Nervous & Sensory	regulation and control, response to stimuli, processing information
7. Muscular & Skeletal	support and movement
8. Hormonal	regulation of internal environment, development
9. Reproductive	producing offspring

EXERCISE: You may answer directly on this sheet.

1. Tissues specialized for contraction are categorized as _____ tissue.
2. Adipose tissue is categorized as a type of _____tissue.
3. Bone cells are located in lacunae, which are arranged in concentric circles around tiny tubes called _____canals.
4. In the blood, the _____cells fight infection.
5. Within the _____layer of the skin, the cells become keratinized as they push toward the surface.
6. Sense organs are located in the _____layer of the skin.
7. The heart and lungs are located in a portion of the coelom termed the _____cavity.
8. Constancy of the internal environment is known as _____.
9. Smooth muscle is _____and non-_____.
10. Adipose tissue cells contain _____droplets.
11. What are the four categories of tissues recognized by the text?

12. Name one place in the human body where squamous epithelial tissue might be found.
_____
13. Draw a diagrammatic representation of the specified tissue types. Be sure to **label**.

Squamous epithelium	Cuboid Epithelial	Columnar Epithelial	Loose Connective

Cartilage (label lacunae and matrix)	Blood (white, red cells, platelets)	Skeletal muscle	Smooth Muscle
Cardiac Muscle	Bone (lacunae, matrix, Haversian Canals)	Nervous Tissue (axon, dendrite, cell body)	Skin

14. Name one place in the human body where cuboidal epithelial tissue might be found.
_____
15. Name one place in the human body where columnar epithelial tissue might be found.
_____
16. The windpipe is lined with pseudostratified ciliated columnar epithelium. Describe this tissue.

17. Sometimes epithelial cells line a gland. What is the difference between exocrine glands and endocrine glands?
_____
18. Complete the following table about muscle tissue:

	FIBER APPEARANCE	LOCATION	CONTROL
SKELETAL			
CARDIAC			
SMOOTH			

19. The brain and nerve cord are made up of cells called _____
20. The long fibers of these cells are bound together by connective tissue to formed _____
21. Refer to the diagram at right, and label the correct parts of a cross section of human skin.

A	
B	
C	
D	
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