

Considering the chemicals that you are made of, how much is your body worth?

65% Oxygen

18% Carbon

10% Hydrogen

3% Nitrogen

1.5% Calcium

1% Phosphorous

0.35% Potassium

0.25% Sulfur

0.15% Sodium

0.15% Chlorine

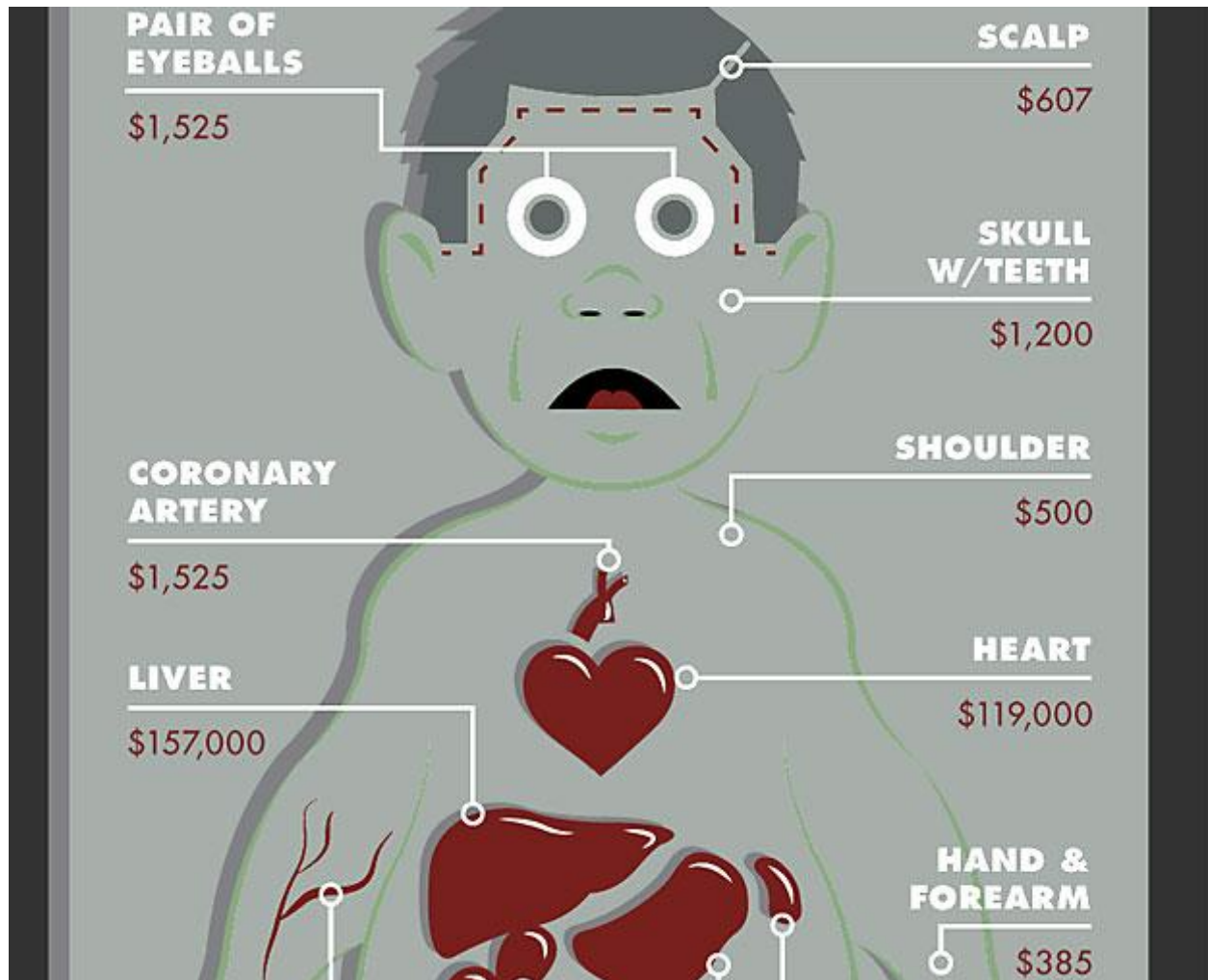
0.05% Magnesium

0.0004% Iron

0.00004% Iodine

So.....About \$4.50

Or, if you prefer to part yourself out:



Why Chemistry in Anatomy & Physiology?!?

- You are made of chemicals and run by reactions
 - Your food is chemicals
 - Medicine is chemicals

I. Chemical Compounds

A. Two types of chemical compounds:

1. **Organic**

- a. based on a chain of 2 or more carbon atoms.
- b. mainly “CHNOPCa”.
- c. the basis of biochemistry

2. **Inorganic** – everything else.

EX) water, salts, acids, bases

II. Macromolecules

A. Large, organic molecules that make up living things.

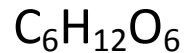
B. Four types of macromolecules:

1. Carbohydrates

a. sugars and starches

b. easily and quickly broken down by our body for quick, short energy.

c. all have same chemical formula:



d. tip: all carbohydrates end in “-ose”.

2. Lipids

a. fats, waxes, oils

b. insoluble in water

c. energy storage and cell membranes

3. Proteins

a. form many body structures

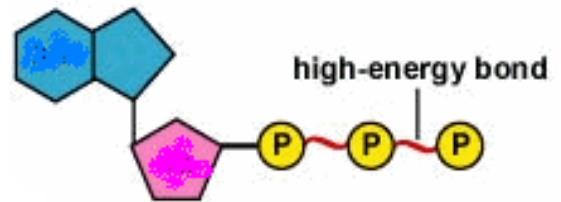
b. slowly broken down by body to provide long-lasting energy.

c. enzymes – proteins that catalyze reactions.

4. Nucleic Acids

- a. DNA and RNA – storage of genetic information.

III. Adenosine Triphosphate (ATP)



A. Chemical energy usable by all body cells

B. Made from glucose

C. glucose \rightarrow ATP $\xrightarrow{\text{ENERGY}}$ ADP $\xrightarrow{\text{ENERGY}}$ AMP

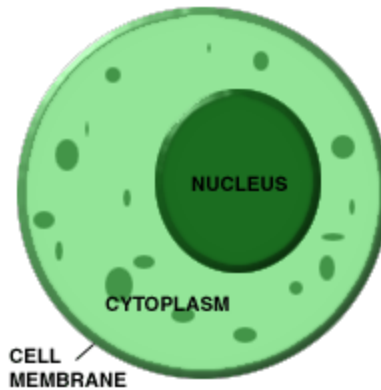
p.51: SAE#1,2,4,7,18,26,29;
ATC-any 2 of your choice.

I. Cells

A. The smallest unit of life

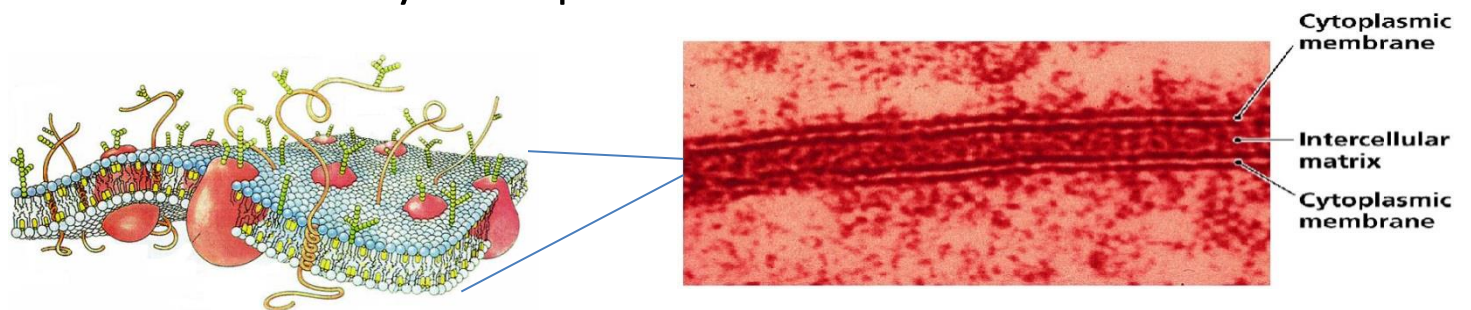
B. Made of four main elements: C, O, H, N

C. Three major regions:

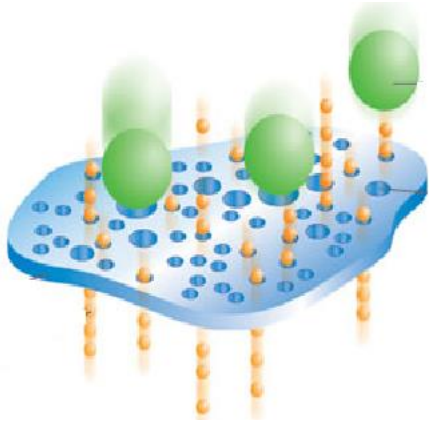


D. Cell Membrane

1. Double layer of lipids:



2. Selective Permeability – only certain substances are allowed to pass through:

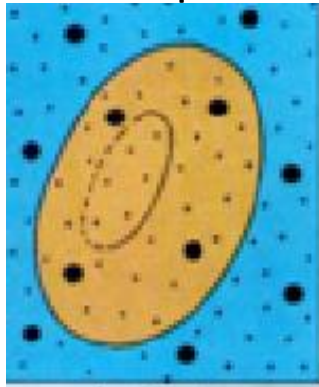


3. Cells' reaction to **solution tonicity**

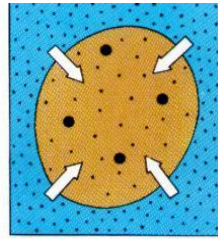
- a. A measure of pressure resulting from water concentration in and around the cell.
- b. Refers to the **medium that the cells are in.**
- c. THINK ABOUT THE % OF WATER,
NOT THE % OF STUFF IN THE WATER!!!

d. Isotonic Solutions

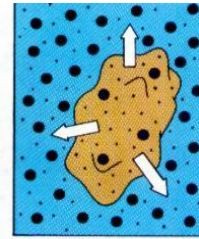
- Have the same (water : solute) concentration as the cells' internal cytoplasm.
- **No change** in cell shape or size.
- Example: 0.9% NaCl (saline) I.V. solutions.



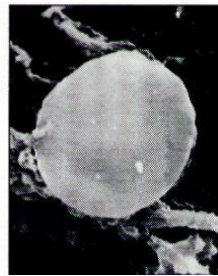
Isotonic



Hypotonic

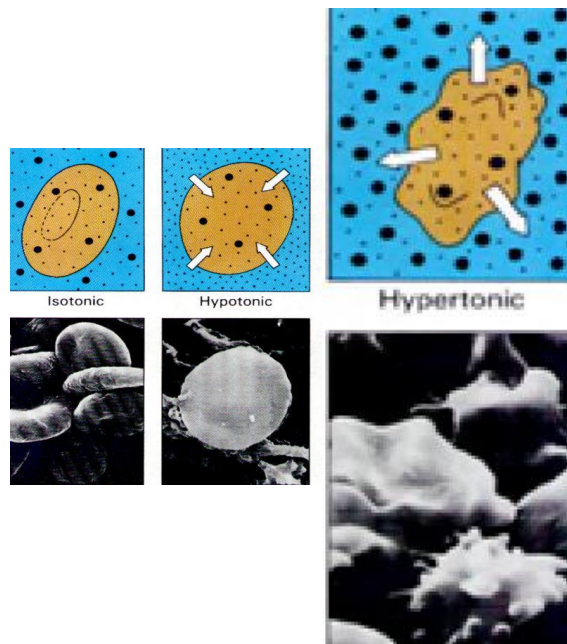


Hypertonic



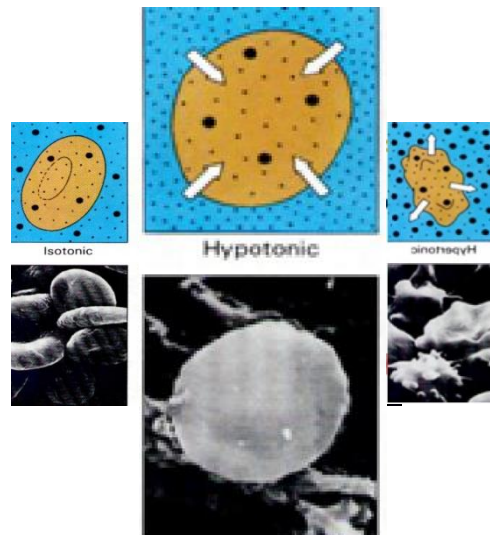
e. Hypertonic solutions

- Has **more solute** and **less water** than the cells' internal cytoplasm.
- Water concentration & pressure is **higher inside** the cell, so it **leaves the cell** and the **cell shrinks**.
- Example: 5% saline I.V. for patients with **edema** (swelling from fluids building up in body tissues)
- Also, why you shouldn't drink sea water!



f. Hypotonic solutions

- Has ***less solute*** and **more water** than the cells' internal cytoplasm.
- Water is forced into the cell and it expands.
- Example: 0.45% saline ("*half-saline*") I.V. for severely dehydrated patients.



Video of RBC's in various solutions:

<http://www.youtube.com/watch?v=crpeX8nBgJE>

Assignment: p.89 short Answer Essay 1-3, 5, 11

II. Tissues – groups of cells similar in structure and function

A. Four primary tissue types

1. epithelium (covering)
2. connective (support)
3. nervous (control)
4. muscle (movement)

B. Epithelium

1. lines & covers body parts
2. forms glands
3. four functions:
 - a. **protection** – skin, trachea
 - b. **absorption** – stomach, small intestines
 - c. **filtration** – kidneys
 - d. **secretion** – glands
4. Characteristics:
 - a. Form thin sheets.
 - b. One surface called the “**apical surface**” not attached to anything and exposed to the surroundings.
 - c. Lower surface called “**basement membrane**” attached to underlying tissues.
 - d. No blood supply (avascular).
 - e. Regenerate easily and quickly.

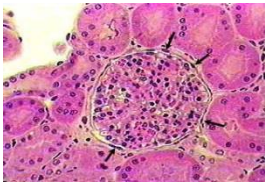
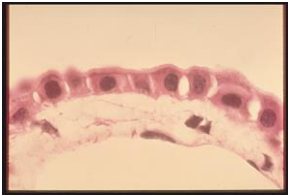
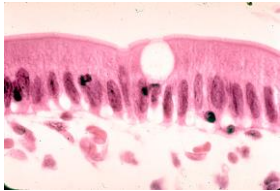
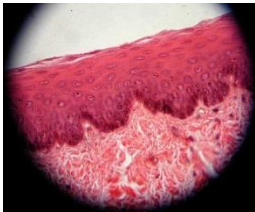
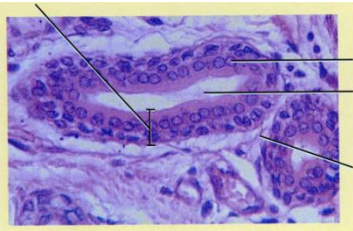
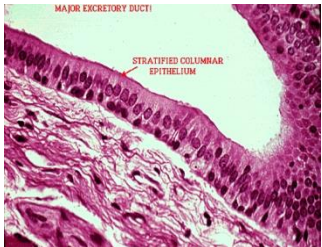
5. Named according to

a. Cell Arrangement (# of layers)– **Simple** or **Stratified**

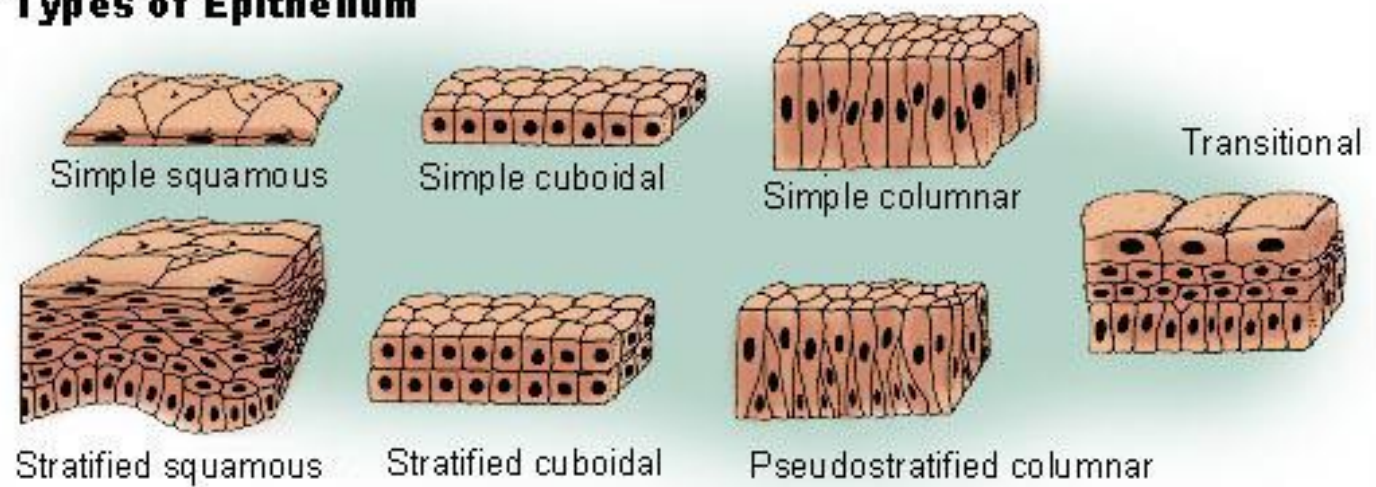
b. Cell Shape – **squamous, cuboidal, columnar**

~~Assn: Body Tissues packet #13, 15, 16~~

~~Textbook: p89 Multiple Choice #8 and p90 Short Answer Essay # 17-21~~

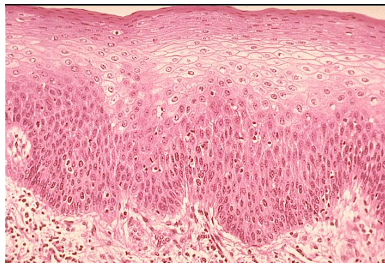
	Squamous	Cuboidal	columnar
Simple	<p>Simple Squamous</p> <ul style="list-style-type: none"> • Filtration • Quick diffusion • EX) lung 	<p>Simple Cuboidal</p> <ul style="list-style-type: none"> • Organ walls 	<p>Simple Columnar</p> <ul style="list-style-type: none"> • Secretes mucous • Lining of digestive tract 
Stratified	<p>Stratified Squamous</p> <ul style="list-style-type: none"> • Resists abuse • EX) outer skin layer, lining of throat 	<p>Stratified Cuboidal</p> <ul style="list-style-type: none"> • Rare in body • Ducts of large glands 	<p>(Pseudo)Stratified Columnar</p> <ul style="list-style-type: none"> • Absorption & secretion • Lines respiratory tract 

Types of Epithelium



a. Transitional Epithelium

- highly modified stratified squamous
- lining of urinary system
- very stretchable

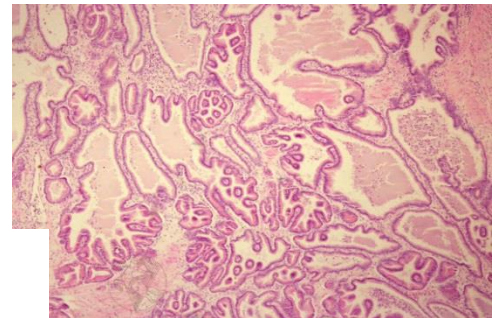
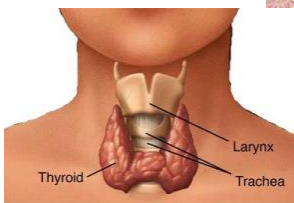


b. Glandular Epithelium

- cells that secrete a particular product (secretion = proteins in an aqueous fluid)
- two major types of glands (made of epithelial sheets)

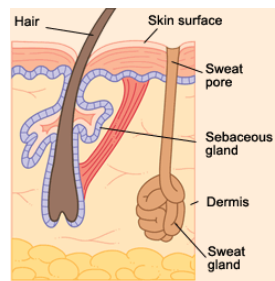
1. Endocrine Glands

- no ducts
- hormones only
- EX) thyroid, adrenal

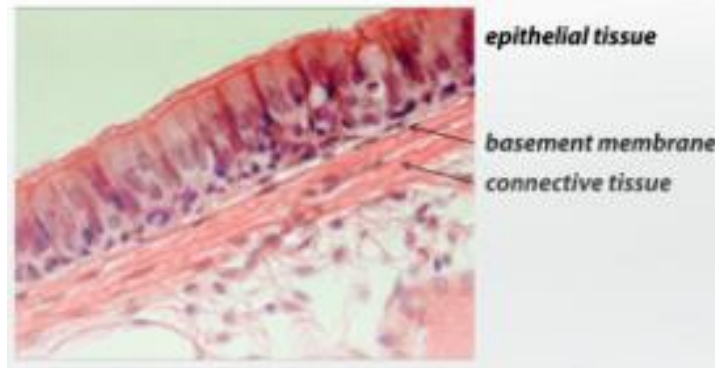


2. Exocrine Glands

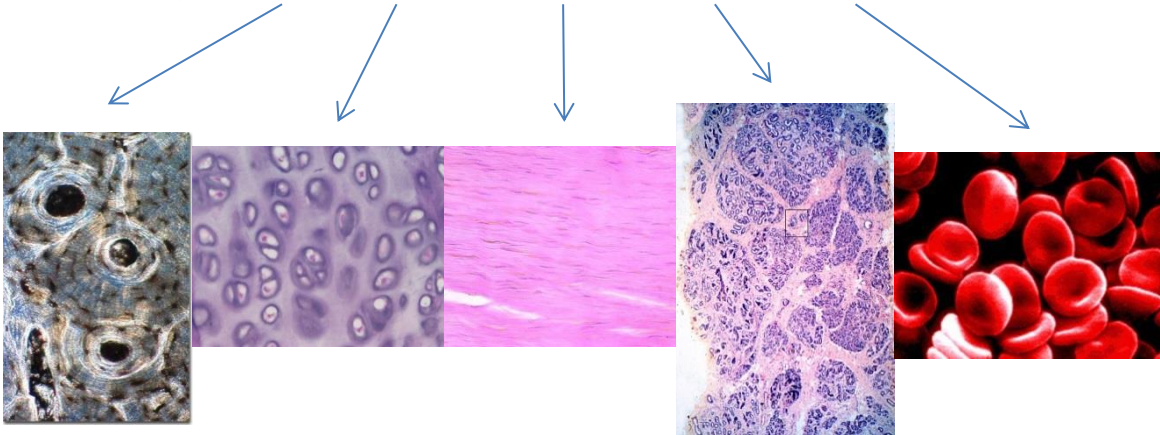
- have ducts to surface
- internal & external
- EX) sweat, pancreas



III. Connective Tissue – protects, supports, binds together other body tissues



A. Five types: bone, cartilage, dense c.t., loose c.t., blood



B. Common Characteristics

1. Blood supply is variable:

- Good blood supply to bones and fat
- Poor blood supply to tendons and ligaments
- No blood supply to cartilage

2. **Extracellular Matrix**

- Nonliving substance outside the cell
- Secreted by the c.t. cells
- Can be liquid, gel, or solid

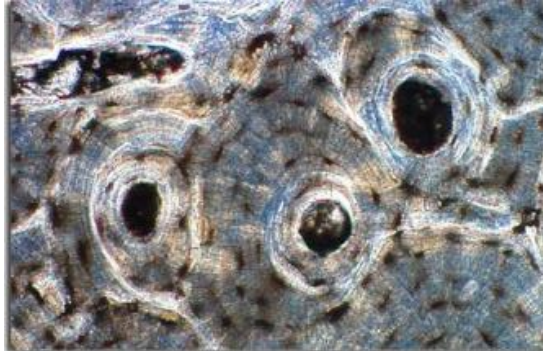
(fat cells)

(bone cells)

C. Details of the 5 Connective Tissue Types (from most to least rigid)

1. Bone

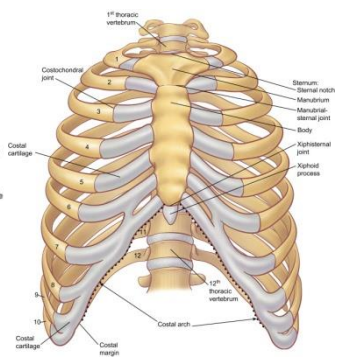
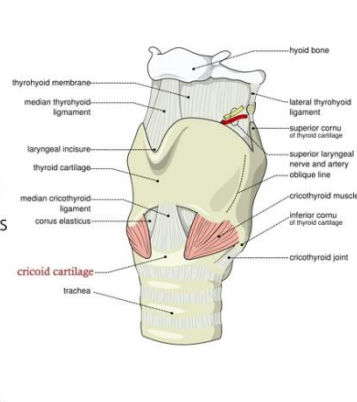
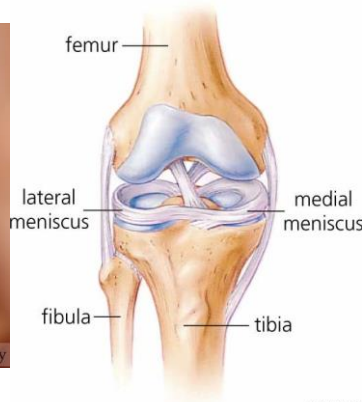
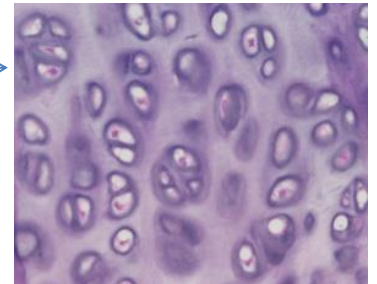
- a. the most rigid
- b. few living cells surrounded by many layers of very hard matrix



2. Cartilage

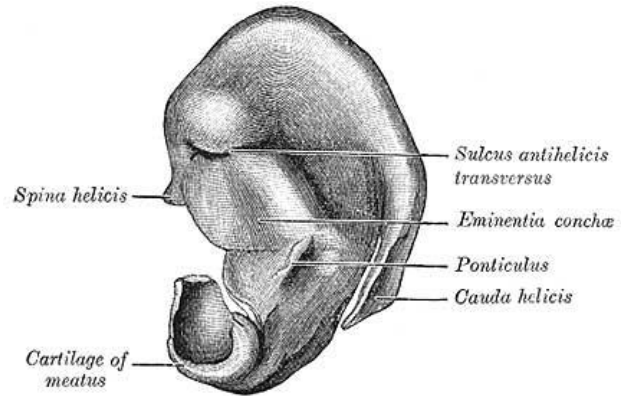
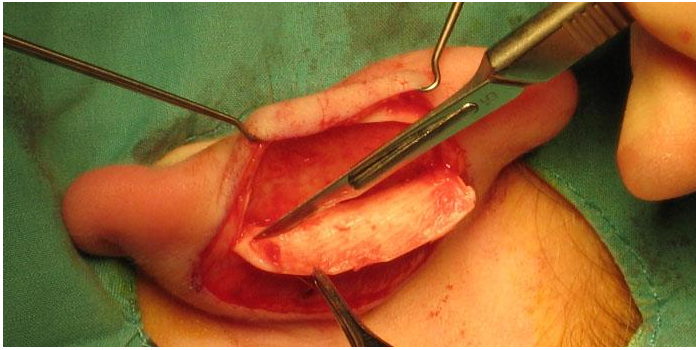
- a. supportive, but softer and more flexible than bone
- b. avascular
- c. three types in body:
 - i. hyaline cartilage

- The most abundant type
- Many collagen fibers in a “glassy” matrix
- EX) larynx, rib attachment, bone joints, fetal skeleton



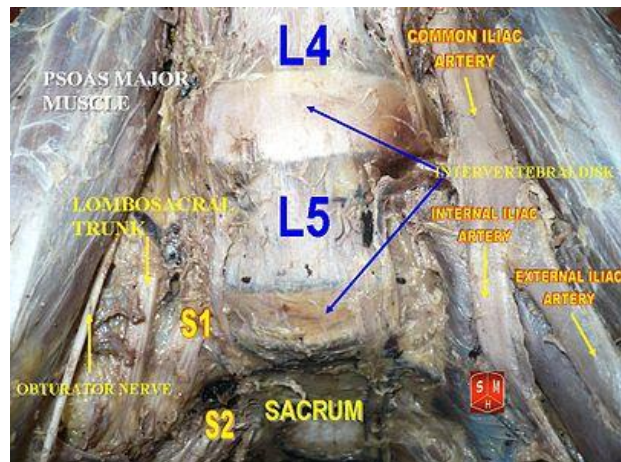
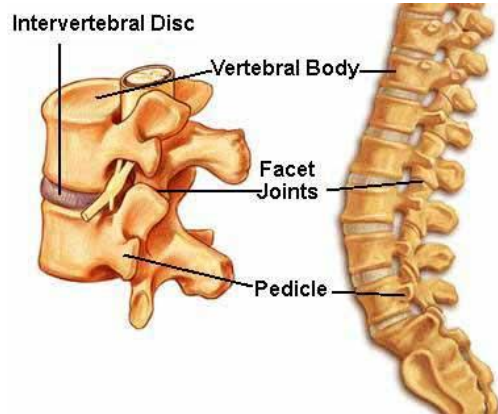
ii. elastic cartilage

- Very flexible
- EX) external ear



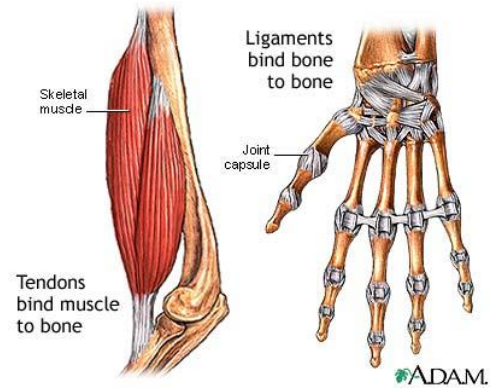
iii. fibrocartilage

- Compressible, cushioning
- EX) intervertebral discs



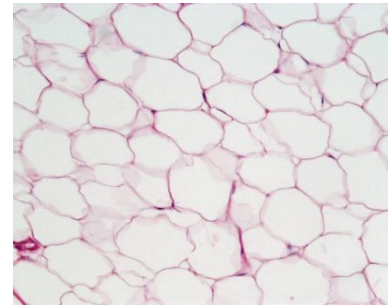
3. Dense Connective Tissue

- a. mostly collagen fibers (few living cells)
- b. form strong, ropelike structures
 - Tendons – attach skeletal muscle to bone
 - Ligaments – connect bone to bone at joints
 - Lower layers of skin



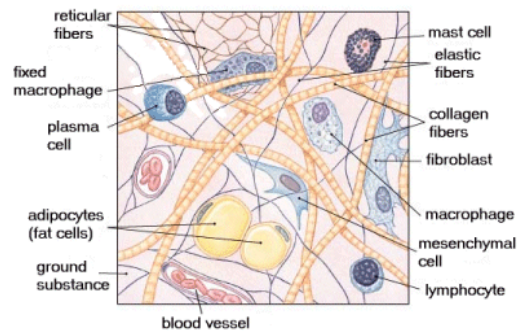
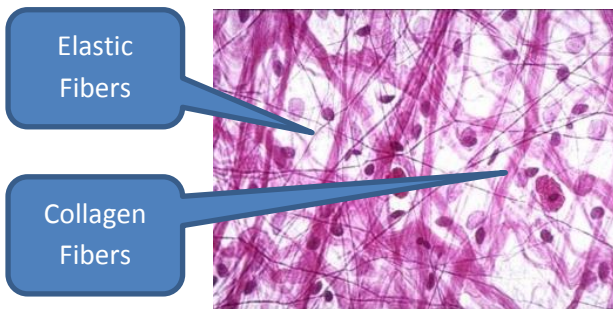
4. Loose Connective Tissue (“fat”)

- a. more living cells and fewer fibers
- b. Adipose Tissue
 - Universal “packaging” tissue
 - Wraps around and cushions body organs
 - Reservoir of fluids and salts for organs
 - Soaks up excess fluid (edema)



c. Areolar Tissue

- Common “fat”
- Cells made mostly of stored oils (high energy storage)
- Insulation, organ protection, stored fuel



5. Blood

- a. living cells (rbc's, wbc's, platelets, etc.) surrounded by nonliving matrix (plasma)
- b. fibers only apparent during clotting



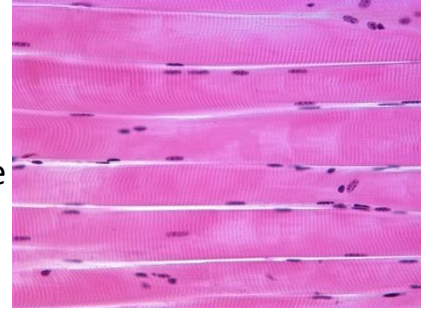
IV. Muscle Tissue

A. Highly specialized tissue to do one thing: contract

B. Three types of muscle tissue:

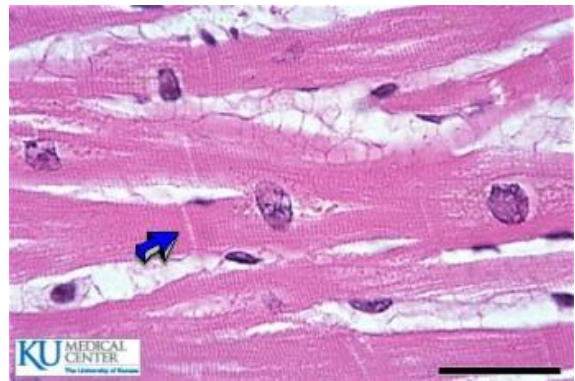
1. Skeletal Muscle

- a. muscle tissue packed into organs by connective tissue to form muscles
- b. controlled voluntarily
- c. pull on bones or skin to produce movement
- d. cells are long, cylindrical, **multinucleate**, **striated**



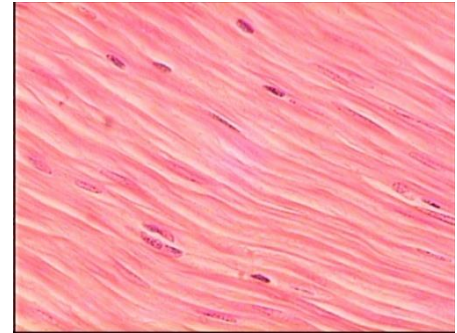
2. Cardiac Muscle

- a. found only in the heart
- b. striated, but only one nucleus per cell
- c. cells fit tightly together at junctions called **intercalated discs** which allow heart cells to synchronize their contractions
- d. controlled involuntarily



3. Smooth Muscle

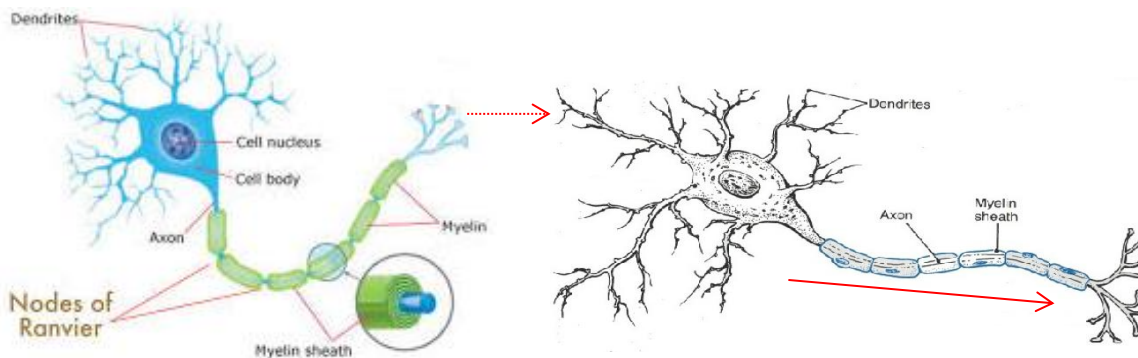
- a. no visible striations
- b. cells have one nucleus
- c. cells are spindle-shaped (pointed at both ends)
- d. found in the walls of hollow organs
(intestine, bladder, stomach, blood vessels)
- e. Contractions are very slow and result in food moving through the digestive system in a process called peristalsis.



V. Nervous Tissue

A. Made of cells called neurons.

B. Shape of a neuron:



C. Highly specialized to receive and conduct electrochemical impulses

*Major functions: Irritability and conductivity

(All-or-nothing response)

(how well signal is sent along length)

~~Assn: p90 Short Answer Essay #24, 25, 26~~
~~p90 At the Clinic #4~~

VI. Tissue Damage & Repair

A. Three lines of defense against damage:

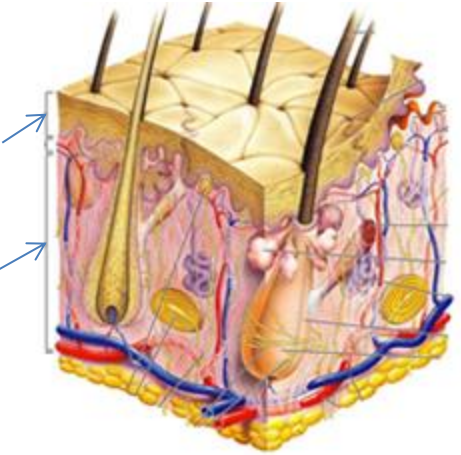
1. **First defense**: two layers of integument

a. **Stratified Squamous Epithelium** in Epidermis

- Many “sacrificial” layers of dead cells

b. Dense Fibrous **Connective Tissue** in Dermis

- Tough strands of collagen



2. **Second defense**: Inflammation

- a. More blood is pumped to the damaged area.
- b. Blood brings healing nutrients and carries away damaged cells.
- c. Area swells and becomes red and warmer.
- d. “**Generalized**” response.

3. **Third Defense**: Immunity

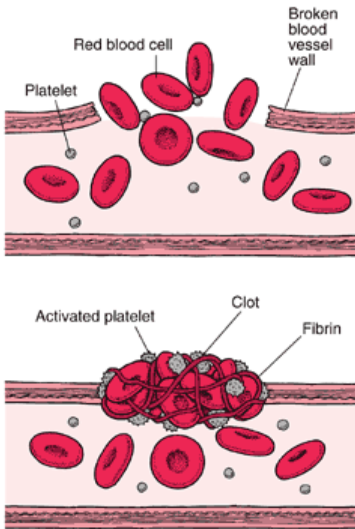
- a. Response to pathogens (bacteria, viruses, toxins, foreign bodies)
- b. **Specific** response.

B. Tissue Repair

1. [Steps in Tissue Repair](#)

- a. Clotting proteins sense wound and link up to form long strands.
- b. Strands catch on wound edges and form “net” to trap blood cells.

*this is what we call a “clot”!

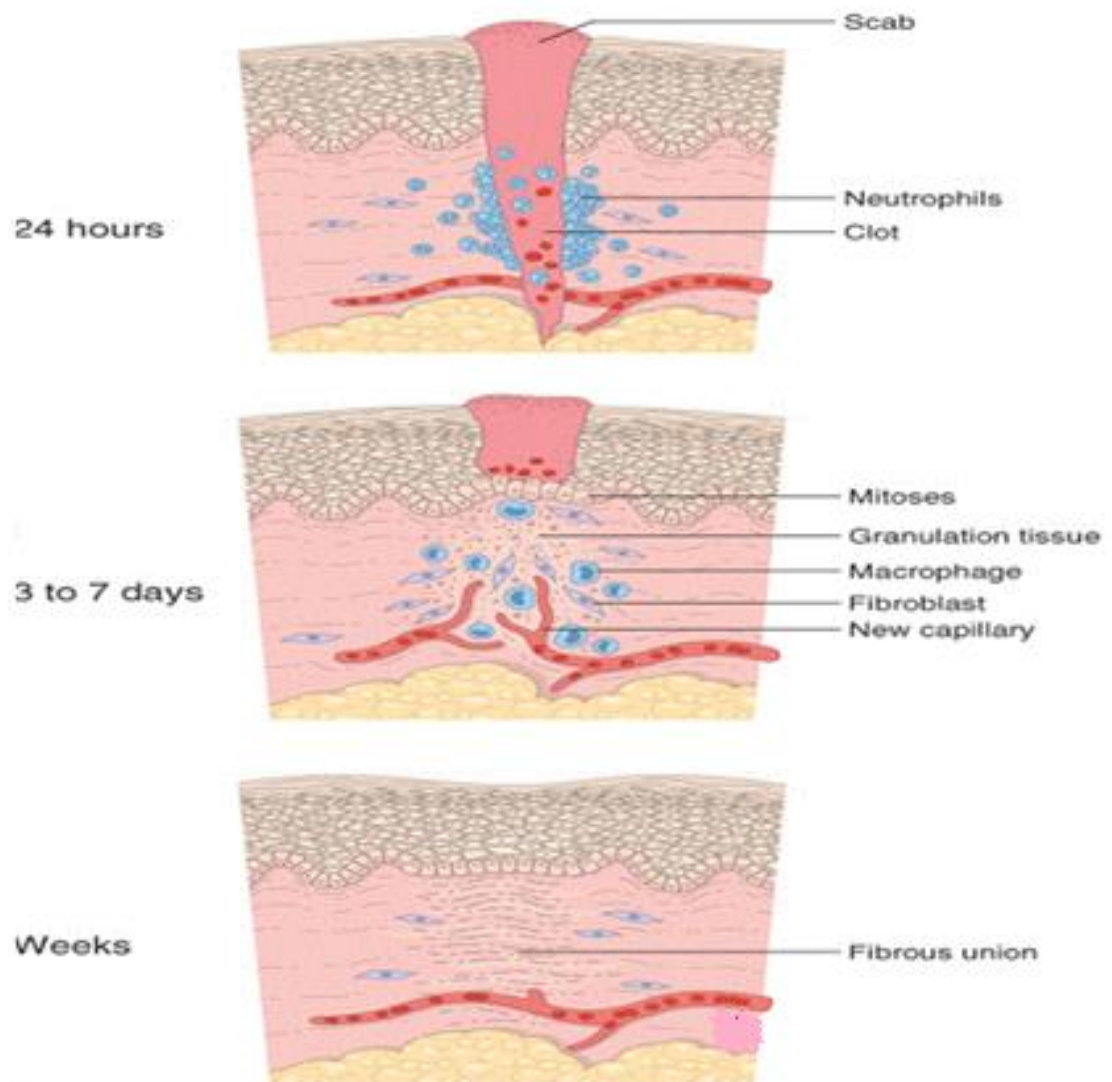


c. Granular Tissue fills in wound.

-delicate, capillary-rich, generalized tissue to knit edges together.

-first (living) layer of epidermis forms under granular tissue and begins to generate more layers of epidermis.

-growing epidermis pushes scab (dried G.T.) from wound.



2. Two Mechanisms of Tissue Repair

a. Regeneration

- Damaged tissue is replaced by original tissue type.
- Small wounds and wounds with clean edges.
- No scarring

b. Fibrosis

- Damaged tissue is replaced by Dense Fibrous Connective Tissue
- Large wounds and wounds with jagged edges.
- Scarring occurs.