EXAM 1 REVIEW SHEET

Do your best to answer the questions below. The more completely you answer them, the better your study material will be and the better you will do on the exam

CHAPTER 1 - Intro

- What is an example of homeostasis?
    - Temperature regulation (shivering when cold, sweating when hot)
    - Blood glucose regulation via insulin and glucagon
- What is the difference between an external and internal stimulus?
    - External: intense heat, cold, lack of oxygen
    - Internal: Psychological stress, exercise
- What is the difference between a negative and positive feedback loop? Give an example of each.
    - Negative: response reverses the original stimulus
        - Hypothalamus-pituitary-target gland hormone regulation where hormone levels inhibit further release.
    - Positive: response enhances original stimulus
        - Childbirth—pressure on cervix triggers oxytocin release, increasing contractions until birth

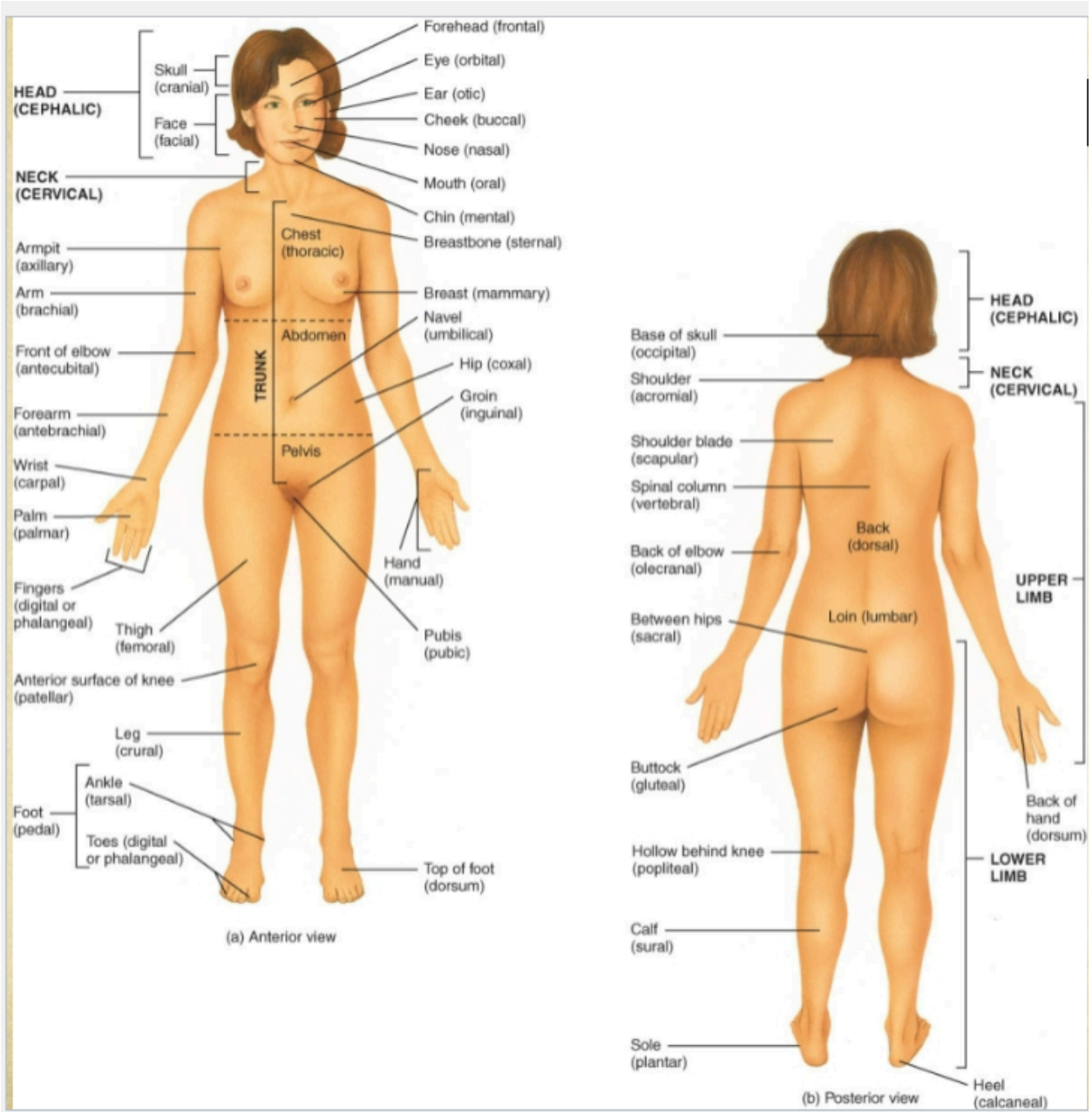
· What are the three components to a feedback system?

- Sensor – detects stimuli or changes
- Control Center – processes information and sends commands
- Effector – executes response (i.e. muscle contraction)

- What is “proper anatomical position”? Make sure you are clear on how the body is positioned in anatomical position.

    - Standing upright
    - Feet shoulder-width apart, flat on the floor
    - Arms at the sides with palms facing forward
    - Head level, facing forward (no tilting or turning)
    - Legs straight, toes pointing forward
    - Terms like left and right always refer to the individual's left and right, not the observer's.

- What are the locations of all of the common regional names?



- What is the difference between:
    - Frontal - divides body/organ into front (anterior) and back (posterior)
    - Traverse - divides body/organ into upper (superior) and lower (inferior)
    - Sagittal - divides body/organ into left and right sides
    - Midsagittal - produces equal halves
    - Parasagittal - produces unequal halves
    - Coronal - same as frontal
    - Horizontal - same as transverse

- Cross-section - same as transverse
- Oblique planes - some combination of 2 other planes

    o Frontal, transverse, sagittal, midsagittal, parasagittal, coronal, horizontal, cross-section, oblique planes

- What is the difference between:

    o Parietal versus visceral

        Parietal: lines the walls of the cavity

        Visceral: covers the surface of organs

    o Pleura vs pericardium vs peritoneum

Cavity	Membrane Name	Visceral	Parietal
Pleural Cavity	Pleura	Surface of Lungs	Chest Wall
Pericardial Cavity	Pericardium	Surface of Heart	Tough Sack Surrounding heart
Abdominal Pelvic Cavity	Peritoneum	Abdominal Organs	Abdominal Wall

- Definitions:

    o Metabolism: Sum of all chemical reactions

    o Responsiveness: Ability to detect and respond to stimuli

    o Movement: Physical relocation of body or cells

    o Growth: Increase in size by cell number or cell size

    o Differentiation: Process where unspecialized cells (like stem cells) become specialized (bone, nerve, blood cells)

    o Reproduction: producing new organisms (offsprings) / cellular reproduction to replace damaged cells

- Homeostasis: body's ability to maintain a stable internal environment despite external/internal changes
- Disease: A specific abnormality characterized by identifiable signs and symptoms.
- Disorder: A broad term indicating any abnormality in structure or function (e.g., personality disorder).
- Sign: An objective measurable indication (e.g., fever, rash).
- Symptom: A subjective experience reported by the patient (e.g., headache, nausea).
- Define and use in a sentence:
    - Prone: Lying face down
    - Supine: Lying face up
    - Medial: Toward the midline (imaginary line dividing body into halves)
    - Lateral: Away from the midline, toward the sides
    - Superior: Toward the head or upper part of a structure
    - Inferior: Away from the head or lower part of a structure
    - Proximal: Closer to the attachment of a limb to the trunk
    - Distal: Further from the attachment of a limb to the trunk
    - Deep: Further away from the body surface
    - Superficial: Closer to the surface of the body
    - Dorsal: Toward the back of the body
    - Ventral: Toward the front of the body
    - Anterior: Toward the front of the body
    - Posterior: Toward the back of the body

- Ipsilateral: On the same side of the body as another structure
- Contralateral: On the opposite side of the body

CHAPTER 2 - Chemistry

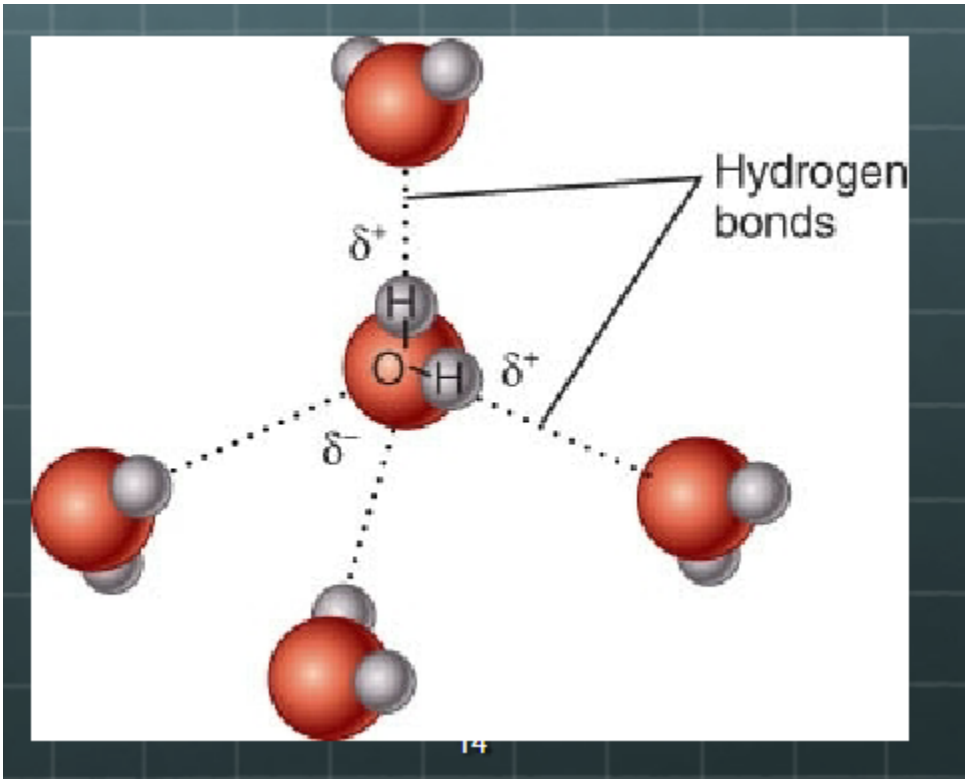
- What is the difference between a polar covalent bond and a non-polar covalent bond?

Polar: Unequal sharing of electrons (H_2O)

Polar covalent bonds create molecules with distinct positive and negative ends, critical in biological systems.

Nonpolar: Equal sharing of electrons (CH_4)

- What is a hydrogen bond? Draw it. Be able to give an example of a hydrogen bond in biology.



Hydrogen bonds form when the slightly negative oxygen of one water molecule is attracted to the slightly positive hydrogen of another.

- What is the difference between hydrolysis and dehydration synthesis?

Hydrolysis: Water breaks bonds in larger molecules to form simpler ones.

Dehydration synthesis: Removal of water allows smaller molecules to join, forming larger ones.

- Give an example of a solvent and a solute.

Solvent: water, solute: salt

- Give an example of something that is hydrophilic and hydrophobic

  Salt / oils,fats

- What is meant by the following:

  - Water has a high heat capacity.

    Water absorbs heat breaking hydrogen bonds before temperature rises; helps regulate body temperature.

  - Water has a high heat of vaporization

    Requires significant energy to vaporize; important for cooling via sweating.

  - Water has high surface tension

    Hydrogen bonds hold water molecules tightly, allowing small insects (e.g., water striders) to walk on water and enabling water to slightly overflow a glass without spilling immediately.

- What is the difference between an acid and a base?

Acids: Electrolytes that release hydrogen ions (H^+).

Bases: Electrolytes that release hydroxide ions (OH^-).

Salts: Electrolytes that release ions but neither H^+ nor OH^-.

- How is pH determined?

A measure of the concentration of hydrogen ions (H^+) in a solution. It ranges from 0 to 14, with lower values indicating acidity, higher values indicating alkalinity (basicity), and 7 representing neutrality.

More hydrogen ions - more acidic, more hydroxide ions - more basic

Acid H+, Base OH-

- What numbers are considered acidic vs basic vs neutral?

0-7 acidic, 7 neutral, 7-14 basic

- What is meant by pH being a logarithmic scale?

meaning each whole number change represents a tenfold difference in hydrogen ion concentration.

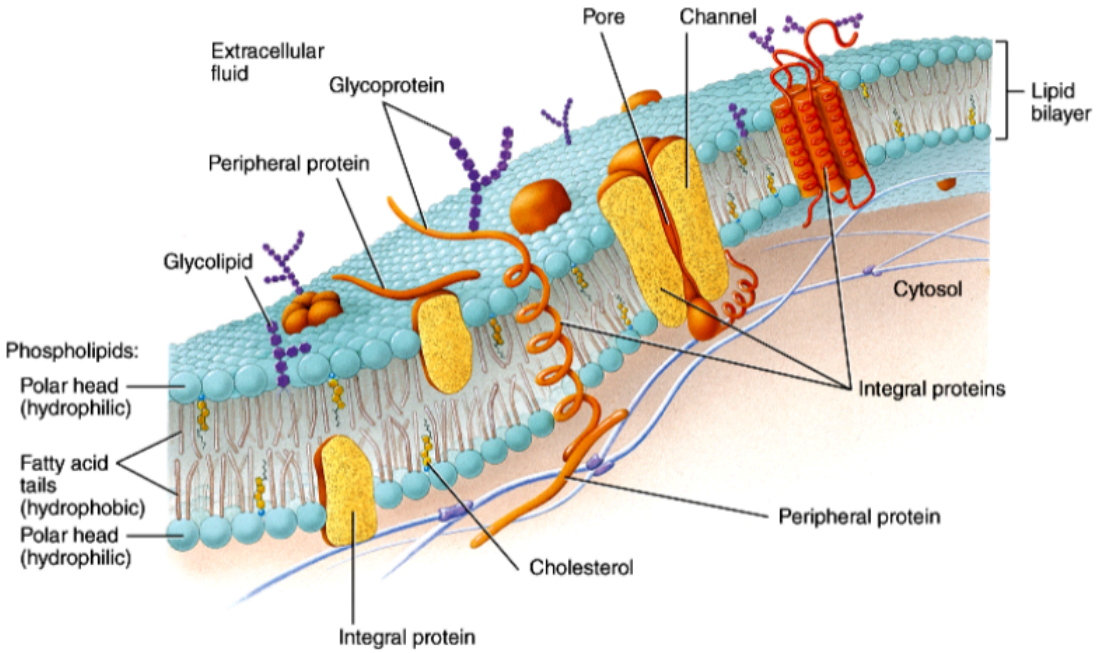
- Give an example of an enzyme and what it breaks down.

Protease (break down proteins), lipase (lipids), sucrase (sucrose)

- Definitions:
    - Free radical: atom, molecule, or ion that has at least one unpaired valence electron, making it highly reactive, unstable, and short-lived
    - Cation: Positively charged ion (when lose electron)
    - Anion: Negatively charged ion (when gain electron)
    - Solvent: something that dissolves solute
    - Solute: dissolves in solvent to create solution
    - Hydrophilic: likes water, dissolves in water
    - Hydrophobic: hates water: doesn't dissolve in water
    - Enzyme: proteins that catalyze (speed up) chemical reactions without being consumed or altered.

CHAPTER 3 - Cell

- To help you understand the cell membrane draw a simple diagram of one and include the following:



- What is the role of cholesterol in the cell membrane?

Regulates membrane fluidity depending on temperature:

- At warm temperatures, cholesterol decreases membrane fluidity by restraining phospholipid movement, preventing the membrane from becoming too fluid or "melting."
- At cold temperatures, cholesterol prevents membrane solidification by disrupting tight packing of phospholipids, maintaining membrane flexibility and preventing breakage, especially important in neurons and muscle cells.

- What is the role of phospholipids in the cell membrane?

Lipid molecule with hydrophilic head and hydrophobic tail, forms the bilayer of the cell membrane

Phospholipid heads: Hydrophilic (water-attracting), face outward toward watery environments inside and outside the cell.

Phospholipid tails: Fatty acids, hydrophobic (water-repelling), face inward, away from water.

- What are the functions of membrane proteins?

Integral Proteins:

- Embedded within the membrane, some spanning partially, others spanning fully (transmembrane proteins).
- Transmembrane proteins form channels or pores allowing selective substances to cross the membrane.

Peripheral Proteins:

- Attached to the membrane surface, either inside or outside, but do not penetrate the membrane.

1. Formation of Channel: passageway to allow specific substance to pass through

2. Transporter Proteins: bind a specific substance, change their shape & move it across

membrane

3. Receptor Proteins: cellular recognition site -- bind to substance

4. Cell Identity Marker: allow cell to recognize other similar cells

5. Linker: anchor proteins in cell membrane or to other cells/ allow cell movement/ cell shape & structure

6. Act as Enzyme: speed up reactions

- What is meant by the cell membrane being selectively permeable?

Some things can pass through, others cannot

- What is a concentration gradient? Give an example. Why is it important?

the difference in the concentration of a chemical between one side of the plasma membrane and the other.

likened to passengers moving from crowded to empty train cars.

Important because acts as a passing drive force for movement of molecules across cell membranes WITHOUT requiring energy

- Give an example of diffusion.

Facilitated diffusion is a passive transport process that allows molecules to cross the cell membrane with the help of transmembrane proteins, without using ATP. It includes several types:

- Channel-mediated facilitated diffusion: Molecules or ions pass through channel proteins (similar to aquaporins). These can be:
    - Voltage-gated ion channels: Open or close in response to changes in membrane voltage, controlling ion flow essential for nerve and muscle function.
    - Ligand-gated ion channels: Open when a specific molecule (like a neurotransmitter such as acetylcholine) binds to the channel, enabling ion exchange.
- Carrier-mediated facilitated diffusion: Carrier proteins bind to molecules (e.g., glucose) and undergo conformational changes to transport them across the membrane.
    - Example: Insulin triggers insertion of glucose transporters into the cell membrane, facilitating glucose uptake.

        - Explain how the sodium potassium pump works?

Example: Sodium-potassium pump (Na^+/K^+-ATPase)

- Pumps 3 sodium ions out of the cell and 2 potassium ions into the cell per ATP molecule hydrolyzed.
- Maintains essential ion gradients critical for cell function, especially in nerve cells.
- Operates via conformational changes triggered by phosphorylation and dephosphorylation.

        - Give an example of an antiporter and symporter.

Secondary active transport: Uses the energy stored in ionic gradients created by primary active transport.

- Antiporters: Move two substances in opposite directions (e.g., Na^+ in, Ca^{2+} or H^+ out).
    - Important in kidney function for pH regulation.
- Symporters: Move two substances in the same direction (e.g., Na^+ and glucose).
    - Exploit sodium gradient to bring glucose or amino acids into cells without direct ATP use.

        - Make sure you know what all the following organelles do. (Refer to the table on the PowerPoint slides. Slide # 27)

            - Cytoskeleton: Supports cell structure / Skeleton

                Microfilaments / Intermediate Filaments / Microtubules

            - Endoplasmic Reticulum: Moves proteins & Fats / Cell Highway

            - Ribosomes: Make Proteins / Protein factories

- Golgi Complex: Packages & Ships materials / Post Office
- Lysosomes: Breaks down waste / recycle bin
- Mitochondria: Produces energy (ATP) / powerhouse

- Definitions:
  - Concentration gradient: Movement of molecules from high to low concentration areas
  - Diffusion: enables selective, condition-dependent passive transport without energy expenditure.
  - Osmosis: Movement of water across a membrane driven by solute concentration differences.
  - Isotonic solution: The solute concentration is equal inside and outside the cell.
  - Hypotonic solution: The solution outside the cell has a lower concentration of solute compared to inside the cell.
  - Hypertonic solution: The external solution has a higher solute concentration than the inside of the cell.

In hypotonic solutions, red blood cells swell and may burst.

In isotonic solutions, red blood cells maintain their normal shape.

In hypertonic solutions, red blood cells shrink and shrivel.

- Antiporter: Transporter moving two substances in opposite directions
- Symporter: Transporter moving two substances in the same direction
- Cell division: Process by which cells reproduce themselves (mitosis/meiosis, cytokinesis)
- Transcription: Copying DNA instructions into mRNA in the nucleus.
- Translation: Ribosomes reading mRNA to assemble proteins outside the nucleus.

- Cancer: out of control cell division
- Benign tumor: does not metastasize or spread
- Malignant tumor: spreads due to cells that detach from tumor and enter blood or lymph

Types of Cancer by Cell Origin

Cancer Type	Origin Cell/Tissue	Notes
Carcinoma	Epithelial cells (skin, organ linings)	Most common type; affects skin, mouth, stomach, intestines
Melanoma	Melanocytes (skin pigment cells)	Often related to UV damage; responsible for tanning/freckling
Sarcoma	Muscle or connective tissue (bone, cartilage)	Less common, arises from structural tissues
Leukemia	Blood-forming organs (bone marrow)	Affects blood production; bone marrow transplants may be needed
Lymphoma	Lymphatic tissue	Cancer of the immune system's lymph tissues

Chapter 4 - Tissues

- What are the general features of epithelial tissue?

Core Concepts:
Cellular Arrangement: Epithelial cells are closely packed with minimal extracellular matrix, forming continuous sheets. This tight packing is crucial for their barrier function.

Polarity: Epithelial cells exhibit polarity with distinct:

- Apical surface (top, exposed to lumen or outside)
- Basal surface (bottom, attached to basement membrane)

Basement Membrane: Composed of two layers:

- Basal lamina (produced by epithelial cells, rich in collagen fibers)

- Reticular lamina (from underlying connective tissue, contains reticular fibers)
- Typically appears as a thin line under the microscope, supporting cell attachment.

Avascularity: Epithelial tissue lacks blood vessels, relying on diffusion from underlying connective tissue for nutrients and waste removal.

Innervation: Despite being avascular, epithelia have a rich nerve supply, contributing to sensory functions like touch.

Cell Division: Epithelial cells exhibit a high mitotic rate, enabling rapid regeneration and wound healing.

Functions:

Protective Barrier: Limits entry of pathogens and harmful substances; loss of this barrier (e.g., burns) leads to infection risks.

Selective Absorption and Filtration: Thin epithelial layers facilitate diffusion, seen in lungs (alveoli) and intestines.

Secretion: Many glands originate from epithelial tissue, producing enzymes, hormones, mucus, and oils.

Mechanical Protection: Shields softer underlying tissues from abrasion.

- What are functions of and where would you find:

Simple squamous epithelium: Diffusion/filtration; found in alveoli, blood vessels, and body cavity linings.

Simple cuboidal epithelium: Secretion/absorption; found in kidney tubules and small gland ducts.

Simple columnar epithelium: Absorption/secretion; found in stomach and intestinal lining.

Ciliated simple columnar epithelium: Moves substances via cilia; found in uterine tubes and small bronchi.

Pseudostratified ciliated columnar epithelium: Secretes and moves mucus; found in trachea and upper respiratory tract.

Stratified squamous epithelium: Protection; found in skin, mouth, esophagus, and vagina.

Transitional epithelium: Stratified with variable shapes, capable of stretching; found in bladder and ureters.

- Know the difference between merocrine, apocrine and holocrine glands
    - Merocrine: Vesicles fuse with membrane, release product only / Saliva, Watery Sweat
    - Apocrine: Apical part of cell pinches off with secretion / Breast Milk
    - Holocrine: Entire cell disintegrates to release secretion / Sebaceous (oil) glands

- What is the extracellular matrix made of in general?

ater, fibrous proteins, and glycosaminoglycans (GAGs) or proteoglycans

- What are the three different types of matrix fibers? What are they made of? What is their function?

1. Collagen fibers

composed of the protein collagen

tough and resistant to stretching

2. Elastic fibers

composed of the protein elastin

provide strength and stretching capacity

3. Reticular fibers

composed of collagen and glycoprotein

supporting network

- Know the functions and locations:

1. Connective Tissue Proper

- Loose Connective Tissue: Fibers are loosely woven. Subtypes include:
    - Areolar tissue: Contains both collagen and elastic fibers, fibroblasts are the predominant cells. Found beneath the skin, filling spaces between organs.
    - Adipose tissue: Fat-storing tissue.
        - White (yellow) fat: Stores energy, cells contain large fat droplets pushing organelles to cell periphery.
        - Brown fat: Rich in blood vessels, metabolically active, produces heat, especially important in infants for thermoregulation. Adults have variable amounts, influencing metabolism and weight regulation.
- Reticular connective tissue: Contains reticular fibers; forms supportive frameworks in lymph nodes, spleen, and bone marrow.

2. Dense Connective Tissue

- Dense Regular Connective Tissue:
    - Fibers (mainly collagen) are densely packed and aligned in parallel.
    - Found in tendons (link muscle to bone) and ligaments (link bone to bone).
    - Adapted to withstand unidirectional tension.
- Dense Irregular Connective Tissue:
    - Collagen fibers are densely packed but arranged irregularly, allowing resistance to stress from multiple directions.
    - Found in the dermis of the skin and areas like the eyeball's white layer.
- Elastic Connective Tissue:
    - Contains abundant elastic fibers allowing tissues to stretch and recoil.
    - Found in the aorta (largest artery), lung tissue, vocal cords, and ligaments between vertebrae.
    - Crucial for maintaining pressure and shape under mechanical stress.

Type	Characteristics	Locations and Functions

Hyaline Cartilage	Most common, smooth and glassy matrix	Fetal skeleton precursor; articular cartilage on bone ends in adults
Elastic Cartilage	High elastin content, flexible and resilient	External ear, epiglottis, Eustachian tube
Fibrocartilage	Toughest, dense collagen fibers, very rigid	Intervertebral discs, shock absorption

- Blood: liquid matrix called plasma

Red blood cells (erythrocytes) – Oxygen transport

White blood cells (leukocytes) – Immune response

Platelets (thrombocytes) – blood clotting

- Lymph

Interstitial Fluid flowing in lymph vessels

Contains less protein than plasma

Move cells and substances (e.g. lipids) from one part to another

- Bone

Osteocytes are the primary bone cells, residing in spaces called lacunae, producing a matrix composed of collagen fibers and a calcified ground substance.

Bone functions include:

- Protection of vital organs (e.g., chest protects heart, lungs; skull protects brain).
- Movement via muscle attachment.
- Mineral storage, primarily calcium, which is crucial for muscle contraction and nerve signaling.
- Blood cell formation occurs in red bone marrow, especially in long bones.

Bone types:

- Spongy bone: Porous, sponge-like structure.

- Compact bone: Dense, solid bone composed of repeating units called osteons.

- What is the function and location of : skeletal, cardiac, smooth muscle? What are distinguishing characteristics between the three.

- Skeletal muscle:
  - Long, cylindrical cells formed by fusion of multiple cells, thus multinucleated.
  - Characterized by striations (light and dark bands).
  - Voluntary control.
- Cardiac muscle:
  - Branched cells with usually one nucleus.
  - Striated like skeletal muscle.
  - Involuntary control.
  - Connected by intercalated discs containing desmosomes (for strong adhesion) and gap junctions (for rapid electrical communication), enabling coordinated heart contractions.
- Smooth muscle:
  - Spindle-shaped cells, single nucleus.
  - Non-striated (smooth appearance).
  - Found in walls of hollow organs (blood vessels, gastrointestinal tract, bladder).
  - Involuntary control.
  - Responsible for automatic movements like peristalsis and vessel constriction.

- Definitions:
  - Avascular: Epithelial tissue lacks blood vessels, relying on diffusion from underlying connective tissue for nutrients and waste removal.
  - Neuron: nerve cells
  - Neuroglia: protective and supporting cells
  - Axon: Signal travels away from cell body

- Dendrite: Signal travels toward the cell body