

UNIT 3 - CELLS, HISTOLOGY, INTEGUMENTARY SYSTEM

LECTURE NOTES

3.01 DESCRIBE THE FOUR PRINCIPLE PARTS OF ANIMAL CELL

A. Nucleus

1. Description of the Nucleus

- a. The nucleus is generally the largest structure within the cell.
- b. The nucleus contains the chromosomes - genetic structures controlling protein synthesis.
 - (1). Chromosomes - shorter, rod shaped structures of DNA found when the cell is reproducing.
 - (2). Chromatin - thread-like mass of DNA found when the cell is not reproducing.
- c. The nucleus contains the nucleolus.

2. Functions of the Nucleus

The nucleus is the control center of the cell which directs all cellular activities and protein synthesis.

B. Cytosol

1. Description of the Cytosol

- a. The semi-fluid portion of the cell which is also known as the cytoplasm or intracellular fluid.
- b. Cytosol is composed of 75% to 90% water.
- c. Cytosol is composed of 10% - 25% proteins, carbohydrates, lipids, inorganic substances and colloids.

2. Functions of the Cytosol

- a. Site of some chemical reactions (anaerobic phase of cellular respiration).
- b. Site where new substances are made for cellular use.
- c. Packaging of chemicals for transport to other parts of the body.
- d. Facilitates the excretion of waste material.
- e. Contains the cellular organelles.

C. Organelles

Permanent small organs found within the cytosol. Each organelle has a unique morphology making them highly specialized for specific cellular activities. The specific organelles will be discussed in 3.07.

D. Cell Membrane

The outer, limiting membrane separating the cell's internal parts from extracellular material and the external environment. Will be discussed in 3.02.

3.02 DESCRIBE THE STRUCTURE AND FUNCTION OF THE CELL MEMBRANE

A. Structure of the Cell Membrane

1. Phospholipid Bilayer

- a. The cell membrane is composed of a phospholipid bilayer or two layers of phospholipids.
- b. Phospholipids are insoluble lipids with a phosphate group attached to them.
- c. The phospholipid molecule has heads that face outward while the tails face inward. This creates a polar hydrophilic phosphoric head and a non-polar hydrophobic tail.

2. Proteins

- a. Proteins are scattered within the phospholipid bilayer.
- b. Some proteins function as transport proteins which regulate entry and exit of molecules into and out of the cell.
- c. Some proteins extend from the surface of the cell membrane surface to help cells identify each other.
- d. Proteins on the membrane function as receptors for hormones.

3. Cholesterol

- a. Cholesterol is a lipid produced by the liver.
- b. Cholesterol helps to stabilize the cell membrane by providing strength and rigidity.
- c. Cholesterol helps prevent the fatty acid chains of the phospholipids from sticking to each other which would collapse the membrane.

4. Carbohydrates

Carbohydrate chains extend from the surface of the cell membranes and help in cell identification.

B. Functions of the Cell Membrane

1. The cell membrane forms the outermost limit of the cell.
2. It regulates what enters and exits the cell.
3. The cell membrane acts as receptors for molecules such as hormones.
4. The cell membrane contains proteins which act as channels or pores allowing substances to move through the membrane.
5. The cell membrane contains small globular proteins which function as enzymes that promote specific chemical reactions.
6. The structure of the cell membrane helps to identify the cell as part of the body.

3.03 SELECTIVELY PERMEABLE MEMBRANES AND FACTORS WHICH INFLUENCE PERMEABILITY

A. Selectively Permeable

The ability of the cell membrane to allow certain substances to enter or exit the cell while not permitting others to do the same. It is required to maintain the cell's homeostasis.

B. Factors Influencing Permeability

1. Structure of the Membrane

- a. The two fatty acid tails of the phospholipids are non-polar whereas the heads are polar. The polar phosphate groups allow the cell membrane to react with its watery environment.
- b. The inner fatty acid tails create a water-insoluble barrier, which prevents water-soluble molecules from flowing through the membrane. Electrolytes and water-soluble molecules require the use of protein channels to move through the membrane. Movement of water is not restricted.
- c. Fat-soluble products such as oxygen and carbon dioxide pass directly through the phospholipid bilayer.
- d. The carrier proteins found in the membrane transport molecules that would not normally pass through the membrane. For example, blood glucose requires a protein carrier molecule in order to move across the membrane.

2. Size of the Molecules

- a. Large molecules are too big to pass through the membrane
- b. Examples: Plasma proteins such as albumin, globulin, and fibrinogen are too big to pass through the membrane.

3. Charges of Ions (Electrolytes)

- a. Ions that have opposite charges of the cell membrane are attracted to and pass across the membrane more easily.
- b. Sodium (Na^+), a positively charged ion, continually diffuses into the cell which carries a negative charge.

3.04 CONTRAST INTRACELLULAR AND EXTRACELLULAR FLUID

A. Intracellular Fluid (ICF)

1. Location

ICF is the water found in living cells.

2. Composition

In addition to water, ICF contains large amounts of potassium, phosphate, magnesium, and other negatively charged ions. ICF forms 2/3 of the body's total water.

B. Extracellular Fluid (ECF)

1. Location

ECF is found in the tissues (interstitial fluid), plasma in the circulating blood, lymph, cerebrospinal fluid (CSF), synovial fluid, (joints) serous fluid (between membranes), aqueous humor (eye), perilymph and endolymph (ear).

2. Composition

In addition to water, ECF contains large amounts of sodium, chloride, and bicarbonate ions. ECF forms 1/3 of the body's total water.

3.05 CELLULAR TRANSPORT PROCESSES

A. Passive Transport Processes

Passive transport processes involve the movement of molecules down a concentration gradient. It does not require energy, although the molecules may be forced against a concentration gradient by pressure.

1. Diffusion

a. Description of Diffusion

Movement of molecules or ions from a region containing a higher concentration of molecules to a region of containing a lower concentration of molecules until the molecules are evenly distributed. It may occur through water or the air.

b. Examples of Diffusion

Examples of diffusion include opening a perfume bottle and eventually everyone in the room will be able to smell it or add food coloring to a beaker of water and the water will turn one particular color. Another example is the movement of oxygen from the blood into the body cells.

2. Osmosis

a. Description of Osmosis

Osmosis is the movement of water molecules through a selectively permeable membrane from an area of higher water concentration to an area of lower water concentration.

b. Passage of water through a selectively permeable membrane creates a pressure called osmotic pressure or the pressure needed to stop the flow of water across the membrane.

c. The effects of osmosis will be described in section 3.06.

3. Facilitated Diffusion

a. Description of Facilitated Diffusion

Facilitated diffusion is the movement of molecules from an area of higher concentration to an area of lower concentration using proteins in the cell membrane as carriers of molecules to transporting them through the cell membrane.

b. Example of Facilitated Diffusion

Blood glucose requires a protein carrier molecule in order to diffuse across the cell membrane and enter the cell.

4. Dialysis
 - a. Description of Dialysis
Dialysis is the diffusion of small solute particles, but not larger ones, through a selectively permeable membrane resulting in separation of large and small solutes.
 - b. Example of Dialysis
Kidney dialysis which results in the separation of larger molecules from smaller ones.

5. Filtration
 - a. Description of Filtration
Filtration is the process of removing particles from a solution by allowing the liquid to pass through a membrane. It is controlled and influenced by gravity or hydrostatic pressure.
 - b. Example of Filtration
Filtration is the movement of blood through the glomeruli of the kidneys, which results in many of the smaller particles leaving the blood and entering the glomerular (Bowman's) capsule during the first step of urine formation.

- B. Active Transport Processes
Active transport processes use biological energy in the form of ATP.
 1. Endocytosis
When molecules are too big to enter a cell by diffusion or active transport, they may be transported within a vesicle formed from the cell membrane.
 - a. Phagocytosis
Phagocytosis or cell eating occurs when a portion of the cell membrane pinches off around solid material forming a sac-like structure called a vesicle. The vesicle moves into the interior of the cell, the membrane breaks down, and the solid particle is now inside the cell. This is how many white blood cells work to fight infection.

 2. Exocytosis
Any remaining particles from phagocytosis may be expelled from the cell when a vesicle joins with the cell membrane and the contents are moved out of the cell.

 3. Active Transport
The movement of molecules from areas of lower concentration to areas of higher concentration. It requires the use of energy. 40% of a cell's ATP supply may be utilized in the active transport process.

a. Sodium-Potassium Pump

The cell transports potassium into the cell while transporting sodium out of the cell in an effort to maintain the ion concentration needed for action potentials or nerve impulses transmissions to occur. This happens in the refractory period during the action potential.

3.06. EFFECTS OF OSMOSIS

A. Isotonic Solution

A solution containing the same concentration of dissolved substances and water as the living cell placed in it.

1. Since the concentration of water is the same on both sides of the cell membrane, equal amounts of water enter the cell as exit the cell. For human blood, the isotonic solution is 0.9% saline.
2. Example: Blood cells will stay the same size when placed in an isotonic solution.

B. Hypotonic Solution

A solution containing a lower concentration of dissolved substances and a greater concentration of water than found in the cell.

1. Since the concentration of water is higher outside the cell membrane than inside the cell membrane, there is a net movement of water into the cell by osmosis. Because of the osmotic pressure produced by the water as it enters the cells, animal cells swell and may burst (cell lysis) when placed in a hypotonic solution.
2. Examples:
This situation occurs when blood cells are placed in distilled water. The blood cells would swell and burst in a process known as hemolysis. The same principle is used daily in the produce department at the grocery store. The vegetables are frequently sprayed with water which enters the cells by osmosis. The vacuoles within the cells fill with water and enlarge which in turn causes the vegetables to be firm to the touch.

C. Hypertonic Solution

A solution containing a higher concentration of dissolved substances and a lower concentration of water than inside the cell.

1. Since the concentration of water is higher on the inside of the cell than outside of the cell membrane, there is a net movement of water out of the cell by osmosis. As water leaves the cell, the cell shrinks in a process called crenation.
2. Example:
If a person's boat sinks at sea, he or she cannot drink the salty sea water or massive dehydration and shrinking of the body cells would result.

3.07 CELL STRUCTURES

I. Structures Associated With the Nucleus

A. Nucleolus

1. A small, dense, structure found within the nucleus and is nicknamed the “little nucleus.” It is composed of RNA and proteins.
2. Responsible for producing ribosomes and RNA.

B. Gene

1. A gene is located on the chromosomes.
2. A gene is a section of DNA that codes for specific proteins such as eye color, hair color, blood type, etc.

C. Chromatin

Thread-like mass of DNA found in the nucleus of cells. Chromatin is seen when the cell is not actively reproducing.

D. Chromosomes

1. Chromosomes are rod-shaped bodies of DNA present when cell is reproducing which contain the genes.
2. There are 46 chromosomes in a typical human body cell.

E. DNA (Deoxyribonucleic Acid)

1. DNA is a double helix composed of nucleotides (sugar, phosphate, and a nitrogen base) and is found in the nucleus of all cells except for mature RBCs and platelets.
2. DNA contains genetic code or the information needed for life – complete instructions for making all necessary proteins – held in the sequence of the nucleotides.

II. Cellular Organelles

Organelles are small, specialized structures found within the cytoplasm. These "mini" organs have characteristic shapes to perform specific functions for chemical assembly, transport, storage, digestion, and energy production within a cell.

A. Ribosomes

1. Description

Ribosomes are tiny, granular structures composed of a type of RNA called ribosomal RNA (rRNA).

2. Function

Ribosomes function as sites of protein synthesis by assembling the proper order of the amino acids as directed by a specific section (gene) of the DNA.

B. Endoplasmic Reticulum (ER)

1. Description

- a. The ER is composed of double membranous, fluid-filled channel which is continuous with the nuclear membrane.
- b. Two Types of Endoplasmic Reticulum
 - (1). Granular (Rough) Endoplasmic Reticulum
The rough ER has ribosomes attached to the membranous channels.
 - (2). Agranular (Smooth) Endoplasmic Reticulum
The smooth ER does not have ribosomes attached to the membranous channels.

2. Functions

- a. The ER provides surface area for many chemical reactions.
- b. The ER is an intracellular transport system.
- c. Lipid synthesis occurs in the smooth ER.
- d. Protein synthesis occurs in the ribosomes of the rough ER.
- e. Detoxification of many molecules occurs in the smooth ER.
- f. The ER releases calcium ions involved in muscle contraction.

C. Golgi Complex (Golgi Bodies)

1. Description

The Golgi complex is composed of flattened membranous sacs (4 - 8) stacked upon one another and is usually located near the nucleus.

2. Functions

The Golgi Complex functions to process, sort, package, and deliver proteins to various parts of the cell

D. Mitochondria

1. Description

The mitochondria are small, slipper-shaped organelles surrounded by a double membrane. A cell may contain 300 to 800 mitochondria.

2. Function

Mitochondria produce energy (ATP) during the aerobic phase of cellular respiration.

E. Lysosomes

1. Description

Lysosomes are small sac-like structure surrounded by a single membrane. Lysosomes contain enzymes.

2. Function

Lysosomes digest excess of worn out organelles, food particles, or engulfed bacteria and viruses.

F. Vacuoles

1. Description

Vacuoles are fluid-filled organelles enclosed by a membrane.

2. Function

Vacuoles are used to store water or digested food.

G. Peroxisomes

1. Description

Peroxisomes are very small sac-like structures surrounded by a single membrane.

2. Function

Peroxisomes are usually found in cells of the liver and kidneys which function to detoxify molecules such as alcohol and hydrogen peroxide.

H. Microfilaments

1. Description

Microfilaments are thin, solid, thread-like protein strands.

2. Function

Microfilaments are associated with the cell's ability to move, maintain its structure, help in muscle contraction as well as moving organelles throughout the cell.

I. Microtubules

1. Description

Microtubules are thin, hollow tubes made of protein.

2. Function

Microtubules function to maintain a complex internal structure which provide support and shape to the cell. Microtubules form structures which assist in movement of the cell as well as chromosomes during cell division. Structures formed from microtubules include centrioles, cilia, and flagella.

J. Centrioles

1. Description

A pair of cylindrical structures composed of microtubules located within the centrosomes.

2. Function

In humans, centrioles assist with the formation of the spindle fibers which help to separate the chromosomes during cell division.

K. Centrosomes

1. Description

The centrosomes are round, dense structures located near the nucleus.

2. Function

The centrosomes contain one or two centrioles, (which are used during mitosis and meiosis to move chromosomes).

III. Modifications of the Cell Membrane

A. Flagellum (singular) Flagella (plural)

1. Description

A flagellum is a single whip-like projection modification of the cell membrane.

2. Function

The flagellum is used for locomotion of the cell. In humans, only sperm cells use this method of movement.

B. Cilia

1. Description

Cilia are small, hair-like projections of the cell membrane composed of microtubules.

2. Function

Cilia function to move substances along the surface of the cell or moving the cell itself. In humans, cilia are common in the trachea to move mucous and debris past the cells and are also found in the uterine tubes to help move ova.

C. Microvilli

1. Description

Microvilli are folds in the surface of the cell membrane.

2. Function

Microvilli increase the surface area of the cell membrane which increases the area available for the absorption of nutrients.

3.08 CELL DIVISION

A. Division of the Nucleus

1. Mitosis

Mitosis is the division of body (somatic) cells. Each newly formed daughter cell contains the same number of chromosomes as the parent cell. The purpose of mitosis is to increase the number of cells which are needed for growth and repair. In humans, each cell formed by mitosis contains 46 chromosomes.

2. Meiosis

Meiosis is cell division occurring in the ovaries to form eggs (ova) and in the testes to form sperm. The chromosome number is reduced by one half. In humans, each ova and sperm formed should contain 23 chromosomes.

B. Cytokinesis

Cytokinesis is the separation of the cytoplasm into two parts. This occurs after the last phase of mitosis and meiosis to divide the cytosol and cellular organelles.

3.09 GENERAL CHARACTERISTICS AND FUNCTIONS OF TISSUES

A tissue is a group of similar cells which function together to perform a specialized activity. Tissues are classified into four principle categories based upon their structure and function.

A. Epithelial Tissue

Epithelial tissue covers body surfaces, lines body cavities and ducts, and forms glands.

1. Characteristics of Epithelial Tissue

Epithelial cells are in close contact with each other. There is no direct blood supply.

2. Functions of Epithelial Tissue

- a. Forms the outer covering of external body surfaces and some internal organs.
- b. Lines the body cavities and interiors of the respiratory and digestive systems, blood vessels, and ducts.
- c. Forms some of the sense organs for smell, hearing, vision, taste, and touch.
- d. Is the tissue from which gametes (sperm and egg) develop.

3. Strategies for Identifying Types of Epithelial Tissues

a. Number of Cell Layers

i. Simple Epithelium is a single layer of cells.

- (1) Used for transport processes including diffusion, absorption and filtration.
- (2) Found in areas with minimal wear and tear.

ii. Stratified Epithelium has cells found in multiple layers.

- (1) Found in areas with a high degree of wear and tear such as the mouth and skin.
- (2) Provides protection.

iii. Pseudostratified Columnar Epithelium has only one layer of cells but some of the cells do not reach the surface of the tissue making it appeared layer when it is not. Also contains goblet cells to produce mucous and cilia at the surface.

- (1) Provides protection by trapping debris and microorganisms in the sticky mucous which are swept away by the cilia.
- (2) Located in the trachea to filter the air we breathe

b. Epithelial Cell Shapes

i. Squamous - flat with a scale-like shape.

ii. Cuboidal - cube-shaped or box-shaped when viewed from the cross-section.

- iii. Columnar - tall and cylindrical or rectangular.
- iv. Transitional - combination of shapes, though most often cuboidal.
 - (1) Usually found where there is a great deal of distention or stretching, such as in the urinary bladder
 - (2) Cells pull out of shape as it stretches, such as when the urinary bladder fills with urine.

B. Connective Tissue

Connective tissue protects and supports the body, forms the framework of organs, binds organs together, and stores energy. The cells of connective tissue are few in number and the bulk of the tissue consists of an intercellular substance called a matrix. Connective tissues are highly vascular with the exception of cartilage and fibrous connective tissue.

1. Adipose Tissue

a. Characteristics of Adipose Tissue

Adipose tissue is a form of loose connective tissue in which the cells (adipocytes) are specialized for fat storage. When full of fat or triglycerides, the nuclei of the adipocytes are pushed to one side making it an easily identifiable tissue.

b. Location of Adipose Tissue

Adipose tissue is located in the subcutaneous layer of the skin, and surrounding all body organs and the eyeballs.

2. Cartilage

a. Characteristics of Cartilage

Cartilage is a strong tissue and is capable of withstanding tremendous forces. It has no blood vessels or nerves (very slow healing). It consists of an extremely dense network of collagen fibers and elastic fibers firmly embedded in chondroitin sulfate, a jelly-like intercellular substance.

b. Types of Cartilage:

i. Hyaline Cartilage

Hyaline cartilage is the most abundant type of cartilage and is a bluish-white, shiny substance composed of collagen. It is found covering the ends of long bones, forming the articular cartilage, to reduce friction of the joints. It also forms the embryonic skeleton, the rings in the trachea, the external nose, rib cartilage, and in the growth plate (epiphyseal plate) of long bones.

- ii. Fibrocartilage
Fibrocartilage contains a fibrous collagen matrix. It is responsible for absorbing the majority of shock within the body. It is found in the menisci of the knees, intervertebral disks and the symphysis pubis.
 - iii. Elastic Cartilage
Elastic cartilage contains an elastin matrix. It provides strength, rigidity, and flexibility while it maintaining the shape of some organs. It is found in the larynx and external parts of the ear (pinna/auricle).
3. Dense Fibrous Tissue
Dense fibrous connective tissue is composed of a tightly packed matrix of collagen fibers and fibroblasts that are either regularly or irregularly arranged.
- a. Irregular Arrangement
 - i. Occurs in sheets
 - ii. Found where multi-directional tensions are encountered
 - iii. Locations:
 - (a). Most fasciae
 - (b). Reticular region of the dermis
 - (c). Periosteum of bone
 - (d). Perichondrium of cartilage
 - (e). Membranous capsules around organs
 - b. Regular Arrangement
 - i. Fibers are arranged in orderly, parallel fashion
 - ii. Adapted for tension in one direction
 - iii. Locations:
 - (1) Tendons connect muscle to bone.
 - (2) Ligaments connect bone to bone.
4. Vascular Tissue (Blood)
Blood is liquid connective tissue.
- a. The intercellular liquid (matrix) is called plasma, a straw-colored liquid composed mostly of water.
 - b. Cells of blood tissue are collectively called formed elements.
 - i. Erythrocytes (red blood cells) transport oxygen and carbon dioxide.
 - ii. Leukocytes (white blood cells) are involved in phagocytosis, immunity, and allergic reactions.
 - iii. Thrombocytes (platelets) function in blood clotting.
5. Osseous Tissue (Bone)
- a. Characteristics of Bone
 - i. Osteocytes are mature bone cells.
 - ii. Intercellular substances (matrix) between osteocytes consist of mineral salts (calcium phosphate and calcium carbonate) and collagen fibers.

- b. Functions of Bone
 - i. Structure of the body.
 - ii. Movement
 - iii. Storage of minerals
 - iv. Production of all blood cells
 - v. Protection

- c. Classification of Bone
 - i. Compact (Dense) Bone
 - (a). Made up of densely packed osteons.
 - (b). Osteons consist of lamellae or concentric rings of intercellular substances, lacunae or small spaces between lamellae that contain the osteocytes, and canaliculi which are minute radiating canals that provide routes for nourishment and waste product removal to and from the osteocytes.
 - (c). Contains a central osteonic canal (Haversian canal) that contains blood vessels and nerves.
 - ii. Spongy Bone (Trabecular Bone)
 - (a). Osteons are not as densely packed.
 - (b). Contains spaces with blood forming tissues (red marrow)
 - (c). Matrix is made up of thin plates of mineral salts and collagen fibers called (spicules or trabeculae).

- C. Muscle Tissue
 - 1. Description of Muscle Tissue

Muscle tissue is composed of fibers (muscle cells) which are highly specialized for the active generation of tension.

 - 2. Function of Muscle Tissue

Muscle tissue can convert chemical energy to mechanical energy and plays a major role in heat production within the body.

 - 3. Classification of Muscle Tissue
 - a. Skeletal Muscle (striated muscle, voluntary muscle)
 - i. Attached to bones
 - ii. Striated (alternating light and dark protein bands) appearance under microscope
 - iii. Under control of conscious nervous system; voluntary
 - vi. Multinucleated muscle fibers (cells)

 - b. Cardiac
 - i. Forms the majority of the heart wall
 - ii. Striated muscle
 - iii. Typically involuntary muscle
 - vi. Branches to form networks throughout the tissue
 - v. Usually has a centrally located nucleus

vi. Sarcolemmas of adjoining cardiac cells are connected by structures called intercalated discs and gap junctions which strengthens the cardiac muscle tissue and aids in propagating simultaneous contraction of the heart muscle fibers so the atria contract together and the ventricles contract together.

c. Smooth Muscle (Visceral)

- i. Located in the walls of hollow, internal organs such as blood vessels, the stomach, intestines, and urinary bladder
- ii. Usually involuntary
- iii. Nonstriated in appearance

D. Nervous Tissue

Initiates, transmits, and interprets nerve impulses to coordinate body activities.

1. Neurons (Nerve Cells)

- a. Highly specialized cells that are sensitive to various stimuli
- b. Capable of converting stimuli to electrical impulses, which may be transmitted to other neurons, muscles fibers, or glands
- c. Composed of three basic parts the dendrites, cell body, and axon.
 - (1) Dendrites are highly branched receptive surfaces which detect incoming stimuli and direct it to the cell body.
 - (2) The cell body contains the organelles.
 - (3) The axon is usually a slender structure which conducts nerve impulses (the action potential) and sends it to the next structure such as another neuron, muscle or gland.

2. Neuroglia

- a. Cells that protect and support the neurons
- b. Frequently the site of tumors of the nervous system

3.10 EXOCRINE AND ENDOCRINE GLANDS

Glands are structures composed of one cell or a group of highly specialized epithelial cells.

A. Exocrine Glands

Exocrine glands secrete their products into ducts (tubes) that empty at the epithelial surface or lining. Examples include goblet cells producing mucous, sweat glands, salivary glands, and the lacrimal glands which produce tears.

B. Endocrine Glands

Endocrine glands are ductless glands that secrete their products into the extracellular spaces where it diffuses into the blood. The endocrine secretions are called hormones. Hormones are chemicals that regulate physiological activities such as growth and development. Examples of endocrine glands include the pituitary gland, thyroid gland, and adrenal glands.

3.11 MEMBRANES

A. Mucous Membranes

1. Line body cavities that open directly to the exterior.
2. Line the gastrointestinal, respiratory, urinary and reproductive tracts.
3. Epithelial layer secretes mucus
 - a. Prevents cavities from drying out
 - b. Traps particles in the respiratory passageways
 - c. Lubricates food as it moves through the digestive tract
 - d. Moves urine along the urinary tract
 - e. Moves sex cells along the reproductive tracts

B. Serous Membranes (Serosa)

1. Lines body cavities that do not open to the exterior
2. Covers organs found within those closed body cavities
3. Made up of two layers
 - a. Parietal Layer: Layer directly attached to the cavity wall
 - b. Visceral Layer: Layer directly attached to the organ(s) found inside closed body cavities
 - c. Serous Fluid is a watery fluid secreted by the epithelial layer of serous membranes which allows organs to easily glide past one another by reducing friction.
4. Examples of Specific Serous Membranes
 - a. Pleura: Membranes covering the lungs
 - b. Pericardium: Membrane covering the heart
 - c. Peritoneum: Membranes covering the abdominal organs

C. Synovial Membranes

1. Line the cavities of freely movable joints
2. Secrete synovial fluid which lubricates the articular cartilage at the ends of bones as they move to nourish the articular cartilage covering the bones that form the joints

D. Cutaneous Membranes (Skin)

1. Composed of epithelial tissue
2. Provide some protection for the body against U-V light, microorganisms, and water loss.

3.12 DESCRIBE THE STRUCTURES AND FUNCTIONS OF THE INTEGUMENTARY SYSTEM (SKIN)

The integumentary system is considered an organ because it consists of tissues structurally joined together to perform specific activities.

A. Characteristics of Skin

1. It is the largest organ in the body (average adult = 2 sq. m. of surface area)
2. Consists of the skin and its derivatives (hair, nails, glands, and nerve endings)

B. Functions of Skin

1. Regulation of Body Temperature: Produces perspiration by the sudoriferous glands (sweat glands) to help maintain normal body temperature
2. Protection: Provides a physical barrier between the environment and underlying tissues. Provides protection from abrasions, bacterial invasion, dehydration, and ultraviolet radiation
3. Reception of Stimuli: Contains numerous nerve endings and receptors to detect touch, pressure, and pain.
4. Excretion: Eliminates water, salts and organic compounds through the skin
5. Immunity: Certain cells of the epidermis are important components of the immunological system
6. Synthesis of Vitamin D: in the presence of ultraviolet radiation (sunlight), the skin synthesizes Vitamin D which is necessary for the absorption of calcium.

C. Glands of the Skin (also objective 3.14)

a. Sebaceous (Oil) Glands

1. Usually associated with hair follicles
2. Secrete an oily substance called sebum, a mixture of fats, cholesterol, protein, and inorganic salts
3. Keeps hair from drying out and becoming brittle
4. Keeps skin soft and pliable
5. Inhibits the growth of certain bacteria

b. Sudoriferous (sweat) glands

1. Perspiration or sweat is produced by the sudoriferous glands.
2. Composed of water, salts, amino acids, ammonia, urea, uric acid, sugar, lactic acid, and ascorbic acid
3. Principle function is regulation of body temperature by evaporation of water
4. Functions in the elimination of waste products

D. Hair

1. Specialized growth from the epidermis
2. Primary function is protection
 - a. Guards scalp from injury and sunlight
 - b. Eyebrows and eyelashes protect the eyes
 - c. Hair in the external ear and nostrils prevent insects and dust from entering these cavities

E. Nails

1. Specialized growth of epidermal tissue that consists of plates of tightly packed, hard, keratinized cells
2. Forms a clear, solid covering over the dorsal surfaces of the terminal portions of the fingers and toes
3. Help us grasp and manipulate small objects
4. Provides protection against trauma to the ends of the digits

3.13 LAYERS OF THE SKIN

A. Epidermis

1. The epidermis is the outermost layer of skin which is composed of stratified squamous epithelium. It is extremely thin.
2. The epidermis is avascular. If it is cut or suffers abrasions, there will be no blood loss.
3. Types of Cells in the Epidermis
 - a. Keratinocyte
 - (1). Produces keratin, a strong protein
 - (2). Helps waterproof and protect skin as well as forming the nails and hair
 - b. Melanocyte
 - (1). Produces the pigment melanin
 - (2). Helps absorb U-V light and provides skin coloration

B. Dermis

The dermis is the true skin and is composed of collagen and elastin fibers. The dermis also contains nerves, blood vessels, hair follicles, sweat glands, and sebaceous glands.

C. Subcutaneous Layer (Hypodermis)

The subcutaneous layer is the layer of the skin which attaches to underlying organs such as muscle or bone. It contains adipose tissue which stores fat.

3.14 SUDORIFEROUS AND SEBACEOUS GLANDS

Please refer to Section D Glands found 3.12.

3.15 DISEASES AND DISORDERS OF THE INTEGUMENTARY SYSTEM

A. Acne - An inflammatory disease of the sebaceous glands and hair follicles of the skin, characterized by comedones, papules, and pustules. It primarily affects teenagers. It strikes boys more often and more severely than girls since androgens stimulate sebaceous gland growth and the production of sebum. The skin bacteria secrete enzymes which produce free fatty acids which causes the inflammation. Treatment may include the use of antibiotics and drugs like Accutane © to dry up secretions.

B. Skin Cancer - A general definition for cancer is the uncontrolled cell growth derived from normal tissues, which is able to kill the host by cells spreading from the site of origin to distant sites or invading local tissues. The American Dermatology Association recommends the ABCD method to assess skin lesions for skin cancer. A = asymmetry, B= border, C = color, and D = diameter. All moles and skin lesions should be symmetrical or the same on both halves. Borders should be smooth – not irregular or jagged. The color should not change to a different or darker color. The diameter of the mole or growth should be less than 6 millimeters. (Six millimeters is the size of a pencil eraser. If you notice any of these changes, please consult your health care practitioner. It is also recommended a person limit exposure to U-V light both from the sun and tanning beds and use sun block with a high sunscreen number.

1. Basal Cell Carcinoma

Basal cell CA is a slow growing, destructive tumor. It tends to occur in people who are over 40, fair-skinned and blonde. It is common on the face, especially the forehead and nose. They are many colors and may be the normal skin color with depressed centers, elevated (like a pimple), with firm borders.

2. Squamous Cell Carcinoma

Squamous cell CA is an invasive tumor with a potential for spreading. It arises from the epidermal layer. It generally occurs in older males with fair skin. It commonly develops on the face, ears, or the back of hands and arms. The nodule grows slowly on a firm base. It eventually opens and invades the underlying tissues.

3. Malignant Melanoma

Malignant melanoma is a tumor that grows from the melanocytes. Melanoma may spread through the lymph and blood. Common sites for The metastasis of melanoma include the head, neck, legs, and back. Melanoma should be suspected when any skin lesion changes color, becomes inflamed, ulcerates, or bleeds.

C. Decubitus Ulcers

Also known as a pressure sore or bed sore, it is an ulcer, initially of the skin, due to prolonged pressure against areas of the skin over bony areas for a person who is bed-ridden. This prolonged pressure prevents the flow of blood to the affected region and the tissue breaks down and dies. It is extremely important to change the position of bed-bound or chair-bound individuals at least every two hours to help prevent this disorder.