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الانسجة

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Compound Microscope

Shapes of cell

Histology

Histology meaning the study of the tissue, it's the study of the fundamental tissues of the body. The term **histology** is derived from two Greek words:

Histos = Tissue

Logos = Science

Histology : deals with the study of minute structure of tissue in general.

Micro-anatomy : deals with the fine structure of all the tissue present in particular organ. Cytology: deals with the detailed study of individual cell and its internal components .

Cell :

Cell is the unit of structure and function in animals and plants. It was first named as cell by Robert Hooke in 1665, the cell is a membrane bound unit containing discrete organelles, protoplasm and nucleus, the organelles are organized forms of biological molecules which play an important role in the function of cell, example Mitochondria for providing energy, endoplasmic reticulum for producing secretions like enzymes and hormones.

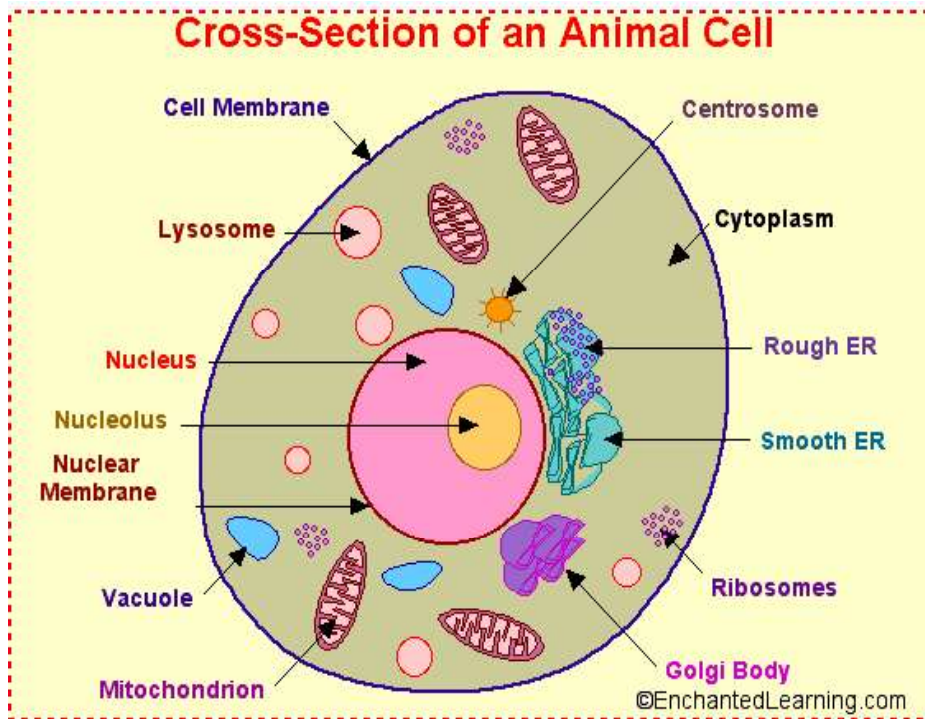
Cell membrane :

Each cell is limited by semi-permeable membrane called cell membrane (plasmalemma) in which cell protoplasm is limited, cell membrane is made of double layers of phospholipids and protein molecules.

Animal cell organelles :

- 1- **Cell membrane** : the thin layer of protein and fat that surrounds the cell. The cell membrane is semipermeable, allowing some substances to pass into the cell and blocking others and give cell shape.
- 2- **Cytoplasm** : the jelly like material outside the cell nucleus in which the organelles are located.
- 3- **Nucleus** : spherical body containing many organelles, including the nucleolus. The nucleus controls many of the functions of the cell (by controlling protein synthesis) and contains DNA (in chromosomes). The nucleus is surrounded by the nuclear membrane.
- 4- **Nuclear membrane** : the membrane that surrounds the nucleus.
- 5- **Nucleolus** : an organelle within the nucleus - it is where ribosomal RNA is produced.
- 6- **Mitochondria** : spherical to rod-shaped organelles with a double membrane. The inner membrane is infolded many times. The mitochondrion converts the energy stored in glucose into ATP (adenosine triphosphate) for the cell.

- 7- Endoplasmic reticulum: (ER) a vast system of interconnected, membranous, infolded and convoluted sacks that are located in the cell's cytoplasm (the ER is continuous with the outer nuclear membrane).
- 8- Ribosomes: small organelles composed of RNA-rich cytoplasmic granules that are sites of protein synthesis.
- 9- Golgi apparatus: **Golgi body** - : a flattened, layered, sac-like organelle that looks like a stack of pancakes and is located near the nucleus. It produces the membranes that surround the lysosomes. The Golgi body packages proteins and carbohydrates into membrane-bound vesicles for " export " from the cell.
- 10- **Lysosome**: (also called cell vesicles) round organelles surrounded by a membrane and containing digestive enzymes. This is where the digestion of cell nutrients takes place.
- 11- **Vacuole** - fluid-filled, membrane-surrounded cavities inside a cell. The vacuole fills with food being digested and waste material that is on its way out of the cell.



Cross Section of Animal cell

Tissue

Tissue : Is a group of similar cells specialised in common direction and set a part for performance of a common function .

Classification of Tissue Types :

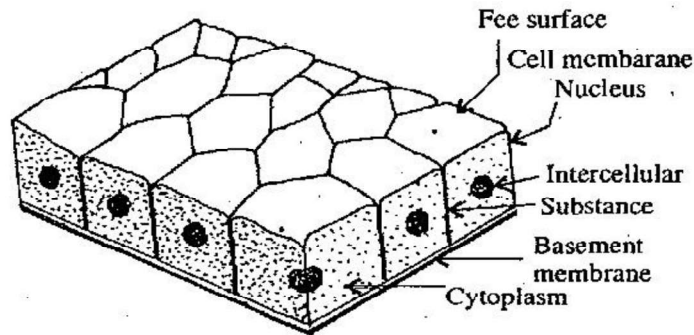
Tissues are classified into four primary tissues according to **structure** and **function** .

There are Four (4) Basic Types of Animal Tissue :

Epithelial Tissue	Connective Tissue	Muscular Tissue	Nervous Tissue
Covers body surfaces and lines body cavities	Binds and Supports body parts	Enables movement of structures within the body and movement of the entire person/animal	Enables responses to stimuli and coordinates bodily functions

Epithelial tissue :

Its is a cellular layer which lines the body surface , skin , mucous membranes and glands. Cells may be arranged in a single or multiple layers, the cells rest on abasement membrane which is made of non-cellular amorphous substances mainly mucopolysaccharides.



General Structure of Epithelia

General functions of epithelial tissue :

- 1- **Selective diffusion.**
- 2- **Protection .**
- 3- **Transport :** mucous & particulate material is transported along the epithelial surface.
- 4- **Secretion :** in glandular epithelium.
- 5- **Excretion :** urine, sweat & CO_2 are diffused across the epithelial surfaces, they filter from blood the waste product of metabolism.
- 6- **Absorption :** as in intestinal epithelium.
- 7- **Sensory reception :** some epithelium cells are specialized for impulse transmission ,e.g: taste bud.
8. **Lubrication :** mucous secreted by epithelial cells act as lubricant.
9. Transitional epithelium has two important functions:
 - **It's capable of distension .**
 - **Provide a waterproof surface impermeable to urine .**

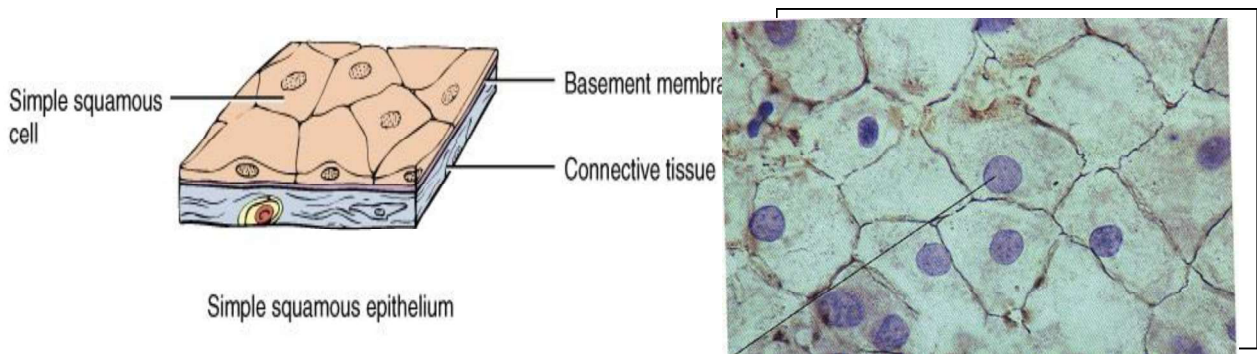
Classification of Epithelial tissue :

Classification of epithelium is based on the shape of the cells and the arrangement of the cells within the tissue, the arrangement of the cells is stated first, then the shape,

and is followed by “ **epithelium** ” to complete the naming (Ex. Simple Squamous Epithelium).

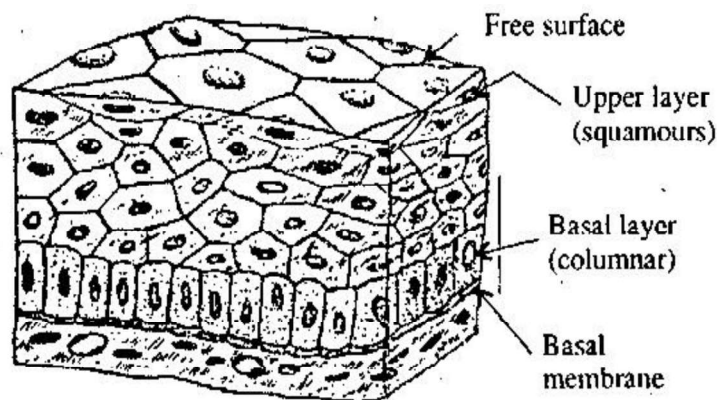
A - Arrangement of the cells :

1-Simple epithelium tissue : Cells are found in a single layer attached to the basement membrane.



2- Stratified epithelial tissue :

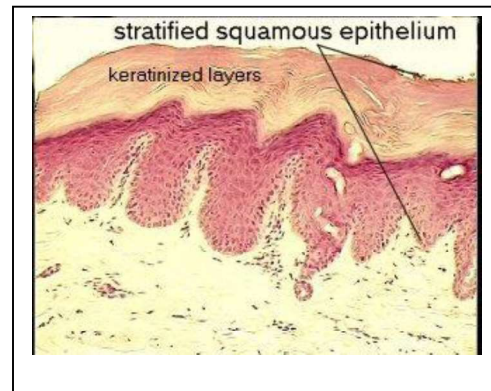
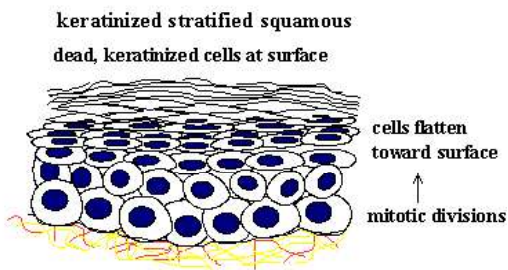
Cells are found in 2 or more layers stacked atop each other. the deepest layer consist of columnar cells arranged on basement membrane, middle layer or layers contain polyhedral cells and superficial are squamous cells (flattened cells). This tissue is specialized for resistance friction.



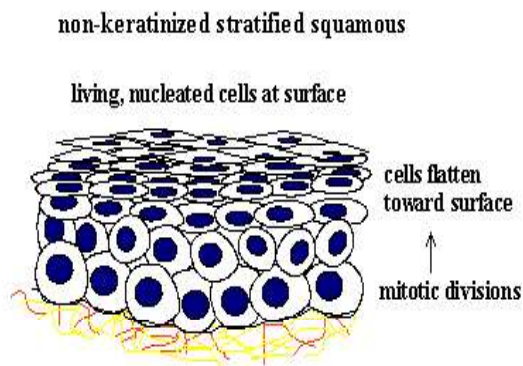
Stratified epithelium

There are 2 types of stratified squamous epithelium :

- ▶ **Kertinized :** As in epidermis (palm of hand) , where the superficial squamous cells are hardened due to a protein keratin .



- ▶ **Non-keratinised :** Example : cornea, oesophagus, skin frog .



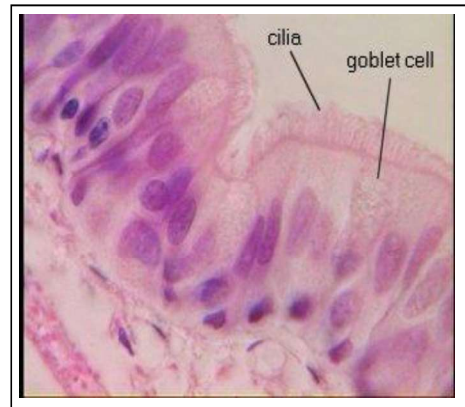
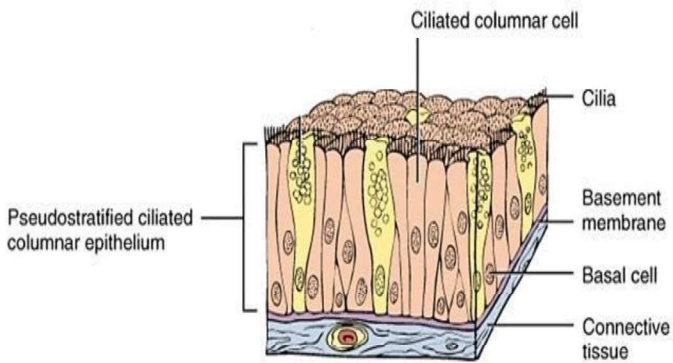
3- Pseudostratified epithelial tissue :

A single layer of cells that appears to be multiple layers due to variance in height and location of the nuclei in the cells. A single layer of cells set on a basement membrane but the height of the cells varies; all cells don't reach the surface, the nuclei too are present at different levels.

Function: Secretion, particularly of mucus; propulsion of mucus by ciliary action.

Location: Non-ciliated type in male's sperm-carrying ducts and ducts of large glands;

Ciliated variety lines the trachea, most of the upper respiratory tract.



4-Transitional epithelial tissue :

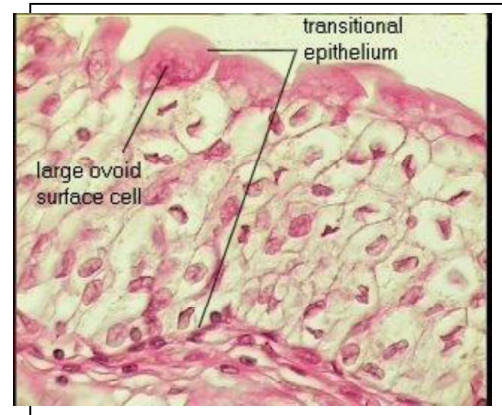
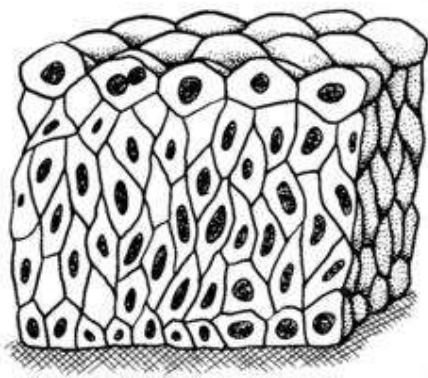
Cells are rounded. Its appearance varies with the state of distension or contraction of the wall, its characteristic of urinary bladder and part of urethra.

1- In the relaxed condition it has 5 to 6 layers, the basal cells are polyhedral, the middle ones are pear shaped with their conical ends touching the basement membrane cells, the superficial cells are dome shaped (umbrella) with the basal surface touching the rounded end of pear shaped cells of second layer.

2- In distended condition the cells of superficial layer get more flattened & those of middle layers get sandwiched between deeper cells.

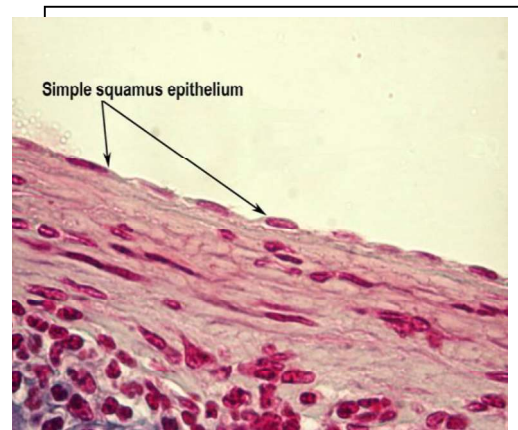
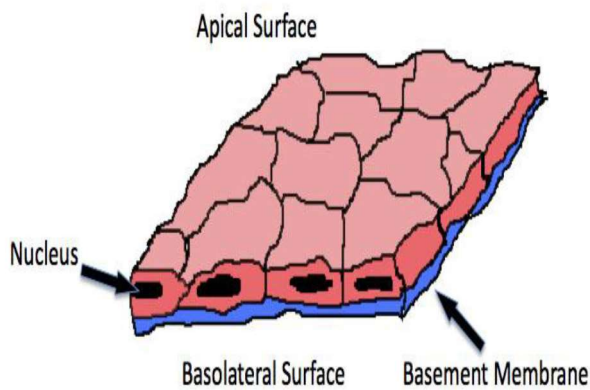
Function: stretches readily and permits distension of urinary organ by contained urine.

Location: lines the ureters, urinary bladder, and part of the urethra.



B-Shape of cell .

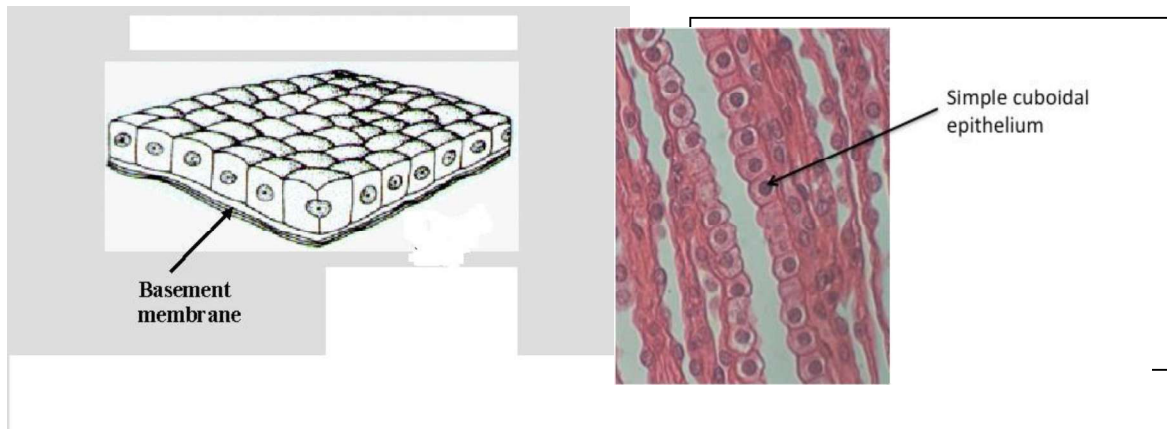
1-Simple squamous epithelial tissue : flat, thin, scale-like cells.: flat, thin, scale-like-cells.



2- Simple cuboidal epithelial tissue : cells that have a basic cube shape. Typically the cell's height and width are about equal.

Function: secretion and absorption.

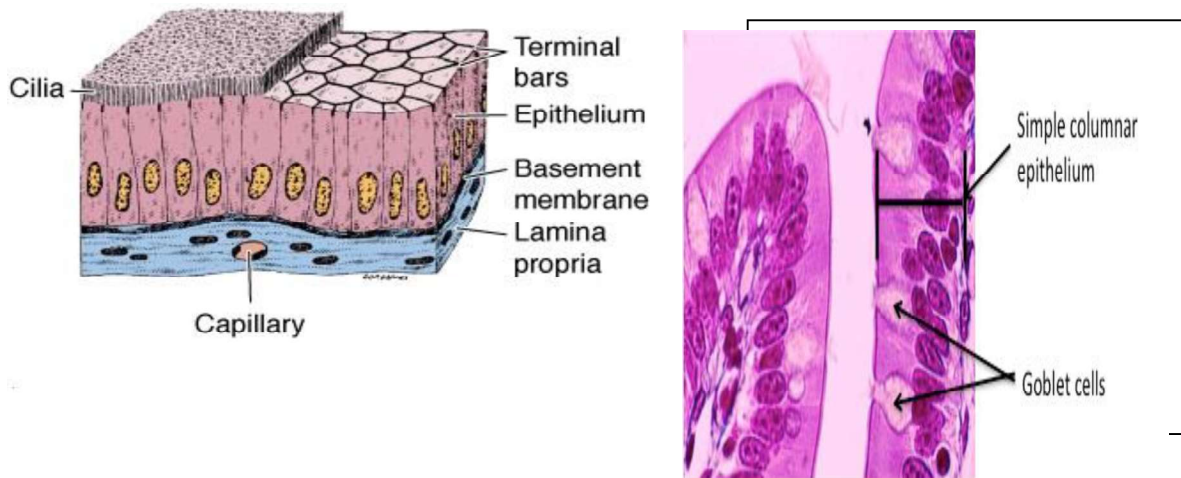
Location: Kidney tubules; ducts and secretory portions of small glands, ovary surface.



3- Simple columnar epithelial tissue: tall, rectangular or column-shaped cells. Typically taller than they are wide.

Function: Absorption; secretion of mucus, enzymes, and other substances; ciliated type propels mucus (or reproductive cells) by ciliated action.

Location: nonciliated type lines most of the digestive tract (stomach to anal canal), gallbladder and excretory ducts of some glands; ciliated variety lines small bronchi, uterine tubes, and some regions of the uterus.



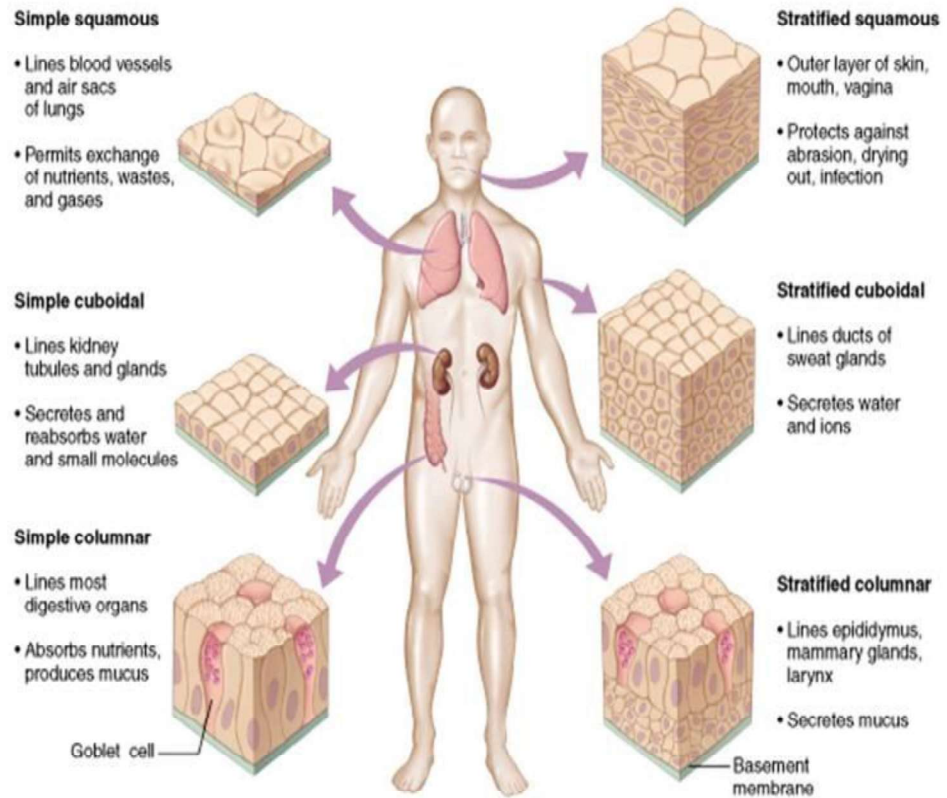
Special Features of Epithelium :

1-Cilia : (singular= cilium, Latin= eyelash) - hair-like appendages attached to the apical surface of cells that act as sensory structures or to produce movement.

2-Goblet cells : Specialized cells that produce mucus to lubricate and protect the surface of an organ .

3-Villi : (singular= villus, Latin= shaggy hair)- finger-like projections that arise from the epithelial layer in some organs. They help to increase surface area allowing for faster and more efficient absorption.

4-Microvilli : Smaller projections that arise from the cell's surface that also increase surface area. Due to the bushy appearance that they sometimes produce, they are sometimes referred to as the **brush border** of an organ.



(a) Most epithelial tissues line or cover surfaces or body cavities

Connective Tissue :

Connective tissue (CT) is one of the four types of biological tissue that support, connect, or separate different types of tissues and organs in the body. The other three types are epithelial, muscle, and nervous tissue. Connective tissue is found in between other tissues everywhere in the body, including the nervous system. In the central nervous system, the three outer membranes (the meninges) that envelop the brain and spinal cord are composed of connective tissue.

Classification of Connective tissue :

1- Connctive tissue **proper** :

♣ Loose connective tissue :

- **Areolar connective tissue.**
- **Adipose tissue.**
- **Reticular tissue.**

♣ Dense connective tissue :

- **Fibrous tissue.**
- **Elastic tissue.**

2- **Specialized connective tissue** :

Skeletal tissue : Bone and Cartilage

Cartilage :

- **Hyaline cartilage.**
- **Fibro cartilage.**
- **Elastic cartilage.**

Bone :

- **Compact bone.**
- **Spongy bone.**

Blood:

Lymph

All have a common embryonic origin known as mesenchyme. Mesenchyme's are undifferentiated loose connective tissue that are capable of developing into connective tissue, such as bone and cartilage.

Cells of Connective tissue:

1. Mesenchymal cells - embryonic cells which persist in the adult and are capable of differentiation and proliferation during regeneration.

2. Fibroblasts - large, flat, branching cells which appear spindle-shaped in a side view. Fibroblasts have large, oval and faint staining nuclei with one or two obvious nucleoli.

3. Macrophage (histiocyte) /next in abundance to the fibroblasts in loose connective tissue, these cells are initially non-motile. During inflammation, they become very actively amoeboid and phagocytic. The nucleus of this cell type is often indented and dark staining. These cells are an important component of the reticuloendothelial system (RES) located in the spleen, liver, lymph nodes and other organs.

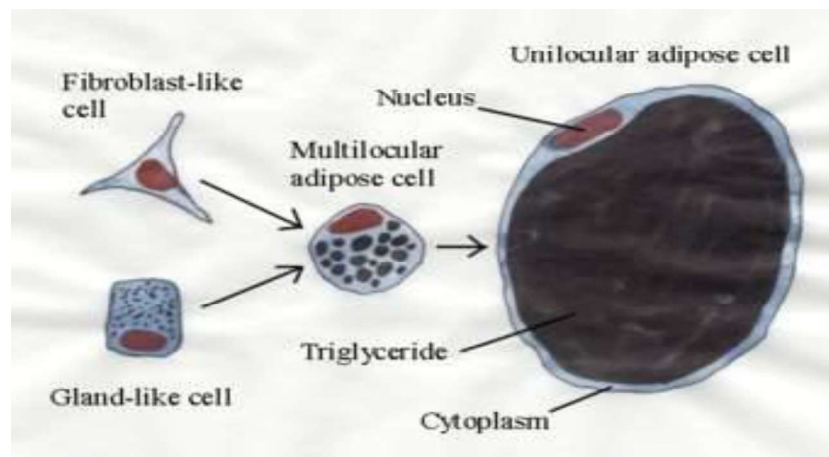
4. Adipose cells / These cells are commonly seen in loose connective tissue (areolar). They are often found arranged around small blood vessels. Initially they resemble fibroblasts but with numerous vacuoles of fat droplets.

5. Leukocytes - are white blood cells which wander into the connective tissues surrounding blood vessels.

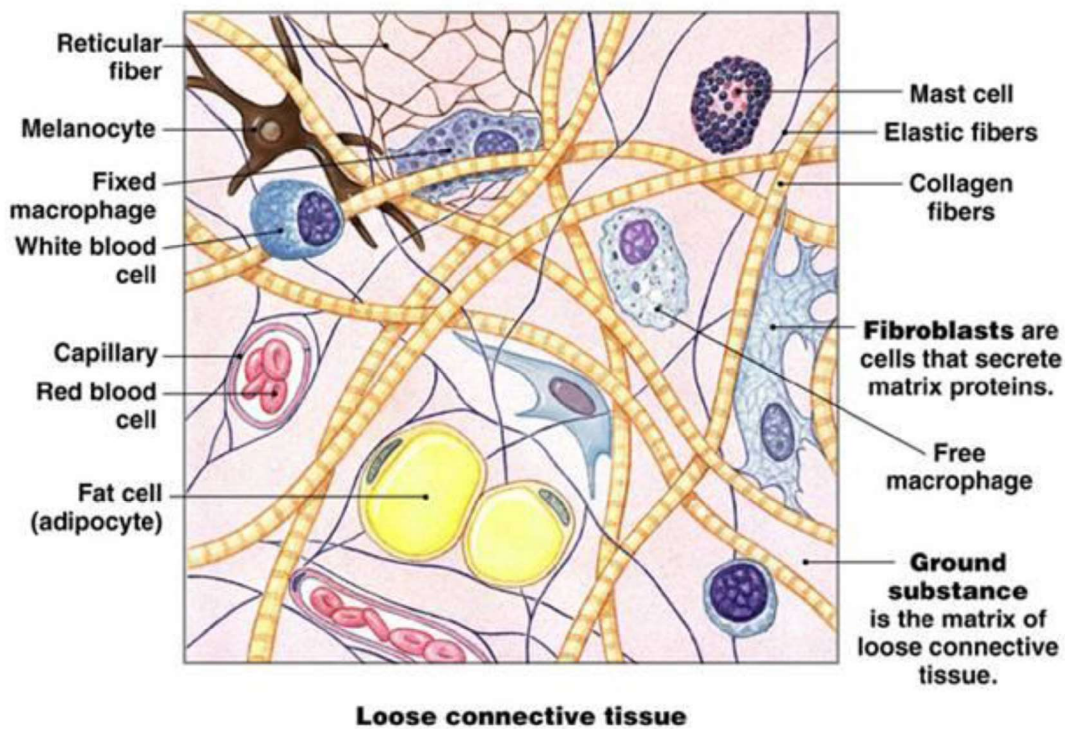
- **Eosinophiles** are very common throughout the respiratory and digestive tracts, as well as in active mammary tissue.

- **Neutrophils** are found at sites of inflammation. Plasma cells, derived from B-lymphocytes, are common in areas of chronic inflammation.

6. Mast cells - are large cells (20 to 30 μm) filled with deeply basophilic granules which often obscure the nucleus. They are usually adjacent to blood vessels. Like the blood basophils, these cells contain mediators of immediate hypersensitivity such as histamine, heparin and serotonin.



Cell connective tissue



Structural Elements of Connective Tissue :

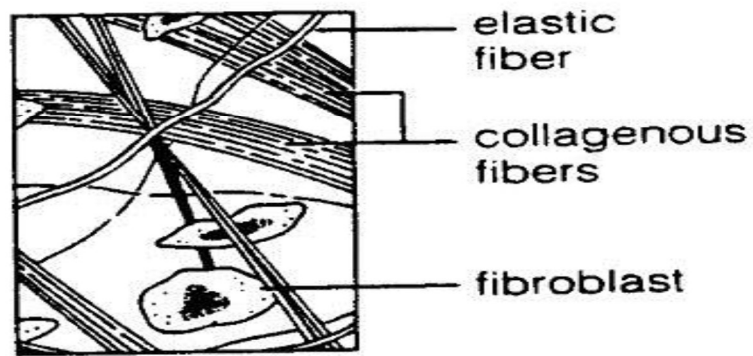
Connective tissues contains a matrix and 3 types of fibers :

Matrix : Matrix is produced by the cells of the tissue and can be fluid, gel-like, or solid

1- Collagenous fibers : Collagenous fibers provide **strength**. They are made of collagen and consist of bundles of fibrils.

2- Elastic fibers : Elastic fibers make tissue “**stretchable**” and are made of elastin.

3- Reticular fibers : Reticular fibers **join** connective tissues to other tissues. Reticular fibers consist of one or more types of very thin collagen fibers.



Section of Elastic Fiber

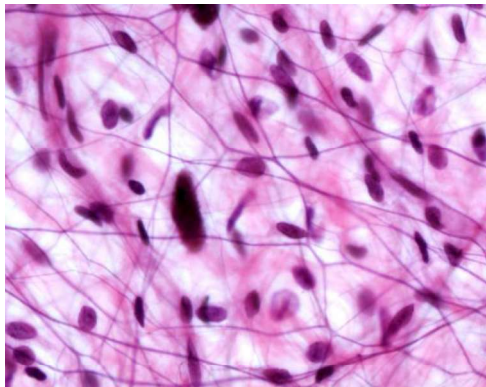
1- Connective Tissue Proper :

♣ Loose connective Tissue:

This type of tissue contains many cells, a loose arrangement of fibers, and moderately viscous fluid matrix.

1- Areolar :

Loose areolar connective tissue is the most widespread type of connective tissue proper. It underlies almost all of the epithelia in the body.



Functions : Support and binding of other tissues, holding body fluids, defending the body against infection, storing nutrients as fat.

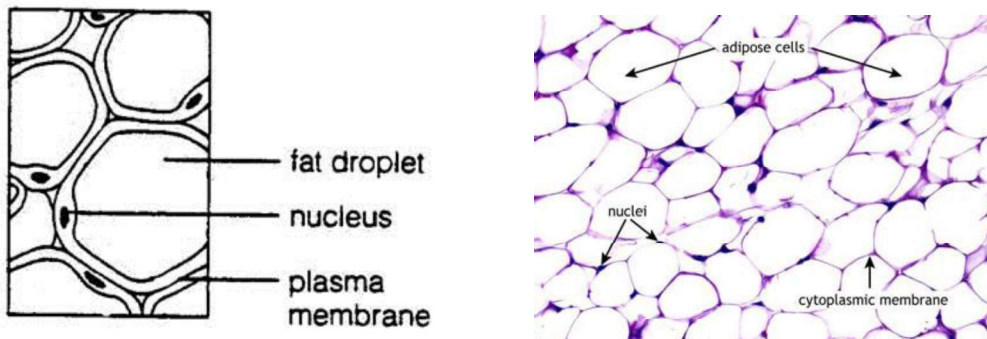
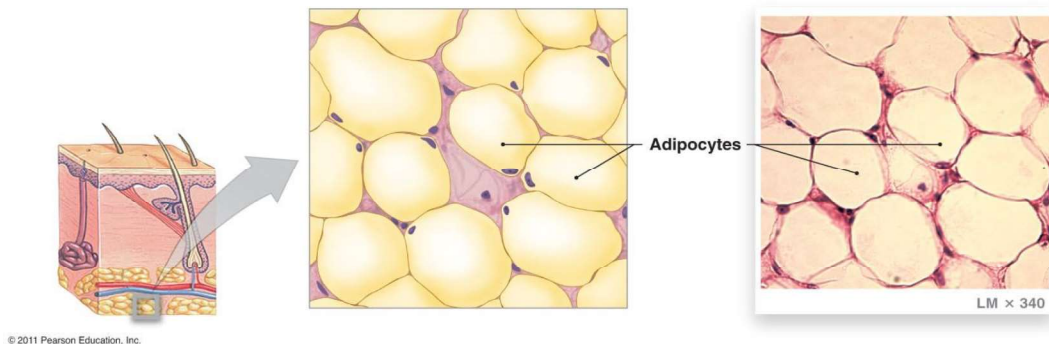
It contains 2 types of fibers :

- **White or collagenous fibers** .
- **Yellow or elastic fibers** .

2-Adipose :

Loose adipose tissue is crowded with fat cells, which account for 90% of its mass. Adipose tissue is richly vascularized. It removes lipids from the bloodstream after meals and later releases them into the blood, as needed.

The structure of adipose tissue deep to the skin

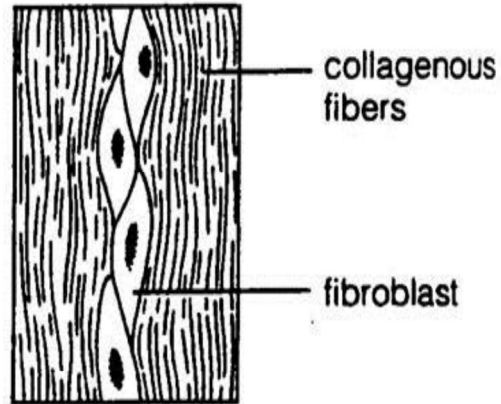


Function : Reserve food fuel, insulates against heat loss, supports and protects organs.

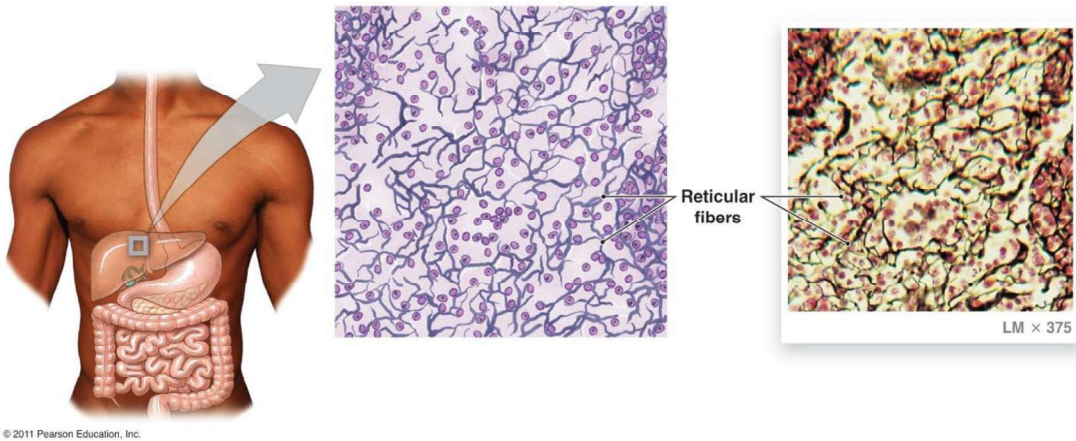
Location : Much of the body's adipose tissue is found in the hypodermis, but it is also abundant in the mesenteries and forms cushioning pads around the kidneys and behind the eyeballs.

3- Reticular :

Loose reticular tissue is similar to areolar tissue but the only fibers in its matrix are reticular fibers. Bone marrow, spleen and lymph nodes consist largely of reticular connective tissue.



The structure of reticular tissue in the liver



Function : Form a soft internal skeleton that supports other cell types like white blood cells, mast cells, macrophages.

♣ Dense Connective Tissue :

In this type of tissue, the collagen fibres are densely packed, and arranged in parallel. This type of tissue is found in ligaments (which link bone to bone at joints) and tendons (connections between bones or cartilage and muscle). These are powerfully resistant to axially loaded tension forces, but allow some stretch.

These three types of fibers are combined in different levels to produce connective tissue with different properties. For example, if a tissue has more elastin it will be **stretchy**. If the tissue has more collagenous fibers it will be **sturdy and strong**.

Dense connective tissue : include :

1- Dense Regular connective tissue :

Appearance: Fibers are “regular” in the sense that they all run parallel to each other or in the same direction.

Location: Tendons, Ligaments, Aponeurosis (similar to tendons)

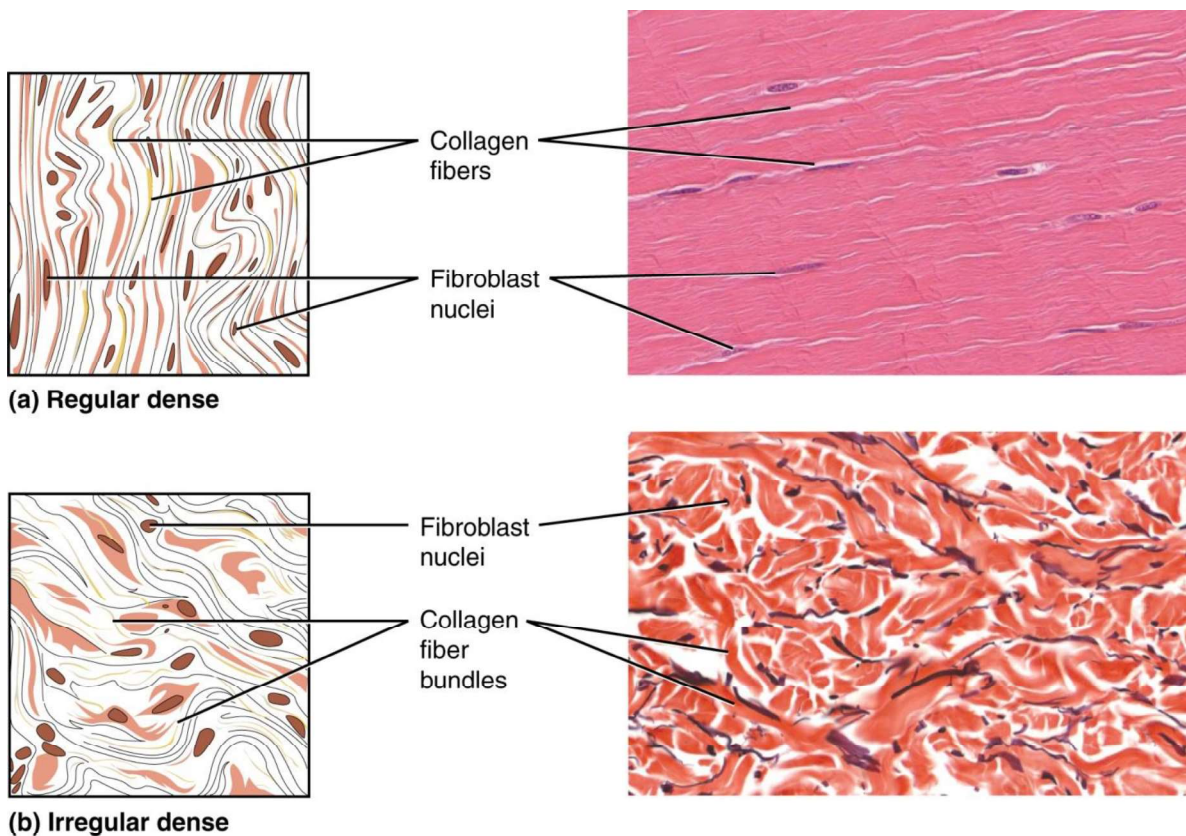
Function: Their main function is to support other tissues, but mainly in one direction because the fibers all run in one direction.

2- Dense Irregular connective tissue :

Appearance : Fibers are “irregular” in the sense that they run in multiple directions.

Location : Fibrous capsules of organs and joints, dermis of the skin, submucosa of the digestive tract.

Function: Dense irregular tissue functions to support tissues in multiple directions. This is because the fibers run in multiple directions.



3. Elastic connective tissue :

Has the ability to receive a relatively large amount of blood all at once with a lot of pressure. The aorta for example has to expand and recoil RIGHT AWAY because the next heart beat is on the way. It's just like a dense regular connective tissue but with a high proportion of elastic fibers instead.

Location : Between vertebrae of the spinal column and in the blood vessel walls.

Function: Stabilizes of vertebrae and penis cushions shocks, permits expansion and contraction of organs .

2- Specilised connective tissue :

Include : Skeletal tissue : Bone and Cartilage

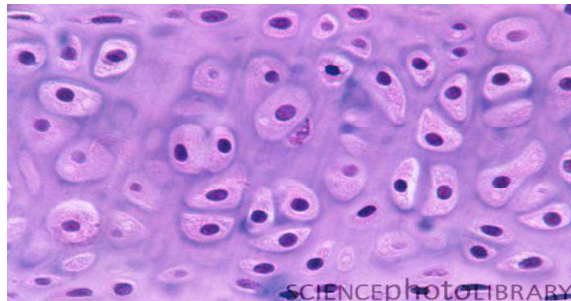
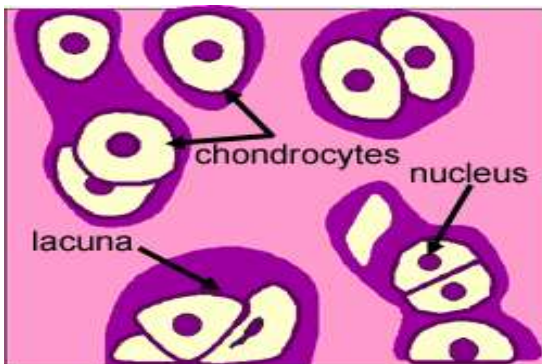
- **Cartilage :**

Is a flexible connective tissue , including the joints between bones, the rib cage, the ear, the nose, the bronchial tubes and the intervertebral discs. It is not as hard and rigid as bone, but it is stiffer and less flexible than muscle.

There are three types of cartilage:

1- Hyaline Cartilage :

This type of cartilage has a glassy appearance when fresh. **Hyaline cartilage** has widely dispersed fine **collagen fibres** ,which strengthen it. It has a **perichondrium**, and it is the **weakest** of the three types of cartilage.

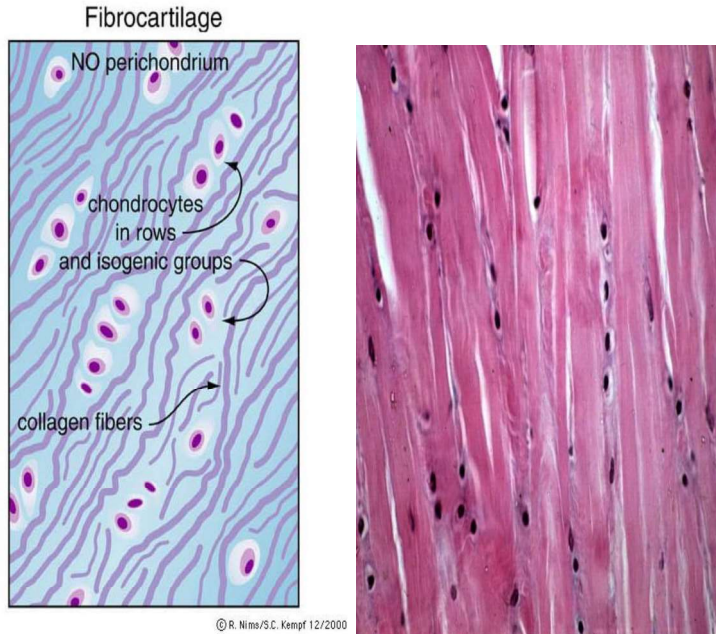


Function : Supports and reinforces

Location : found in the **ribs, nose, larynx, trachea**. Is a precursor of bone.

2 - Fibro cartilage :

Matrix is similar to hyaline cartilage but less firm. Thick collagen fibers predominate. This is the **strongest** kind of cartilage, because it has alternating layers of hyaline cartilage. This type of cartilage *does not* have a **perichondrium** as it is usually a **transitional layer** between hyaline cartilage and tendon or ligament.

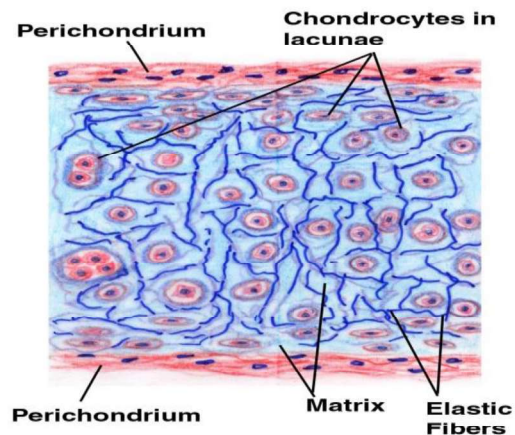


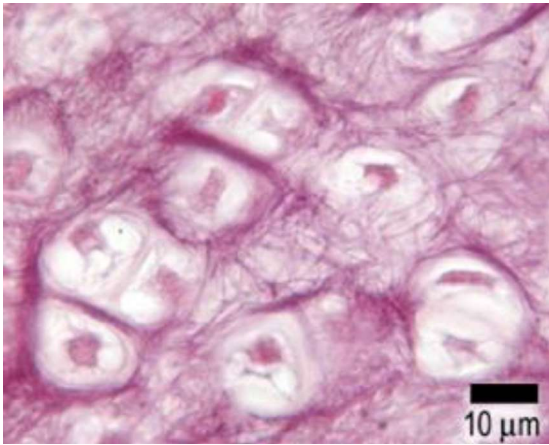
Function : Absorbs compressive shock.

Location : Is found in **vertebral discs, joint capsules, ligaments.**

3- Elastic Cartilage :

Similar to hyaline cartilage but more elastic fibers in the matrix. In **elastic cartilage**, the chondrocytes are found in a threadlike network of elastic fibres within the matrix. **Elastic cartilage** provides strength, and elasticity, and maintains the shape of certain structure such as the external ear. It has a **perichondrium**.





Function: Maintains shape of structure while allowing great flexibility.

Location : Is found in the **external ear, epiglottis and larynx.**

- **Bone tissue :**

Bone tissue is a type of connective tissue that contains lots of calcium and phosphorous salts. About **25%** of bone tissue is water, another **25%** is made up of protein fibers like collagen. The other **50%** of bone tissue is a mixture of mineral salts, primarily calcium and phosphorous.

Bone cells :

1-Osteoblasts :- These are the bone forming cells (osteogenic). These are cuboidal or trapezoid in shape with the nuclei lying at one or the other. They have many processes. The cytoplasm is rich with RNA.

2-Osteocytes :- They flattened , ovoid shaped lying in the lacunae and each consists of darkly staining nucleus with small amount of cytoplasm and numerous branching processes. The processes of an osteocytes joined with the other osteocyte (adjacent cells) , their function generate osteoblasts when the bone has been laid down.

3-Osteoclasts:- These are large cells found on the surface bone where resorption are taken place. They are multinucleated with a vacuolated cytoplasm. They have important role in remodeling of bone.

Function :

1- Support: Bones provide a framework for the attachment of muscles and other tissues.

2- Protection: Bones such as the skull and rib cage protect internal organs from injury.

3- Movement: Bones enable body movements by acting as levers and points of attachment for muscles.

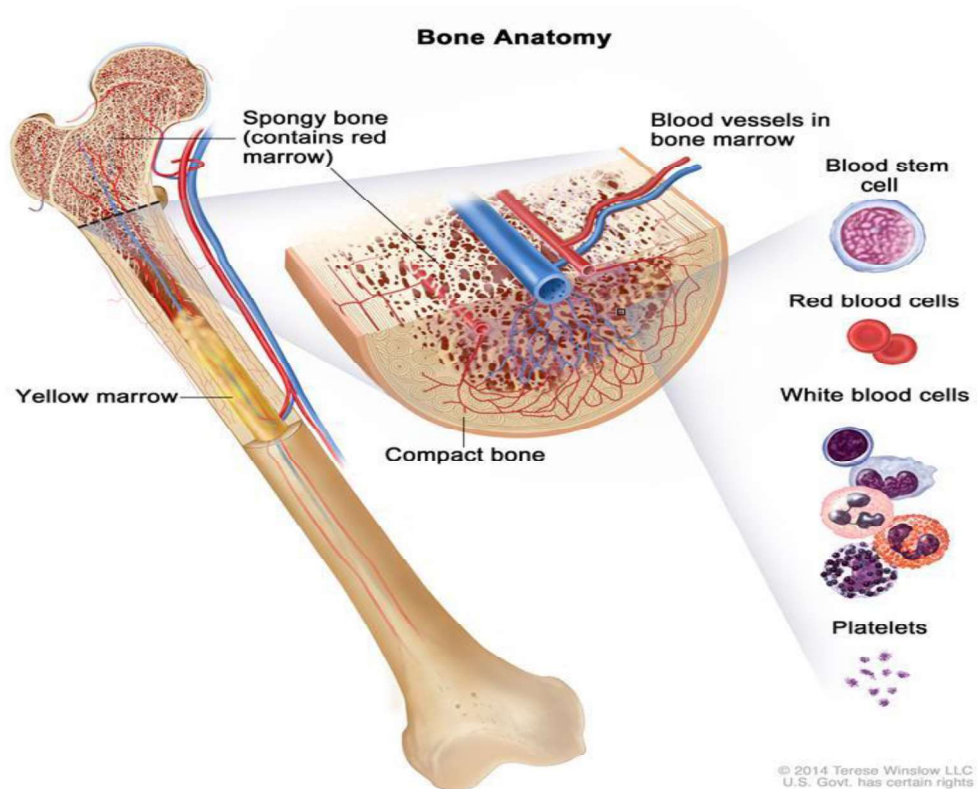
4- Mineral storage: Bones serve as a reservoir for calcium and phosphorus, essential minerals for various cellular activities throughout the body.

5- Blood cell production: The production of blood cells, or hematopoiesis, occurs in the red marrow found within the cavities of certain bones.

6-Energy storage: Lipids, such as fats, stored in adipose cells of the yellow marrow serve as an energy reservoir.

Bone marrow :

It is present in the cavity of compact and spongy bone , consist of reticular connective tissue , fibers ,RBC,WBC ,platelets, fat cells and blood vessels . They are two types of bone marrow :



Types of Bone Tissue :

There are two different types of bone tissue: Compact and Spongy bone.

Compact bone :

- Is made up of concentric rings of matrix that surround central canals which contain blood vessels.
- Embedded in this bone tissue are small cave-like spaces called **lacunae**, which are connected to each other through small tunnels called **canalicula**.
- The lacunae contain **osteocytes cells**. Osteocytes help maintain healthy bone tissue and are involved in the bone remodeling process (lifelong process where mature bone tissue is removed from the skeleton and new bone tissue is formed)

Spongy bone :

- Looks like an irregular latticework (or sponge) with lots of spaces throughout.
- These spaces are filled with red bone marrow which is the site of **hemopoiesis** or formation of blood cell.

- (a) Compact bone is a dense matrix on the outer surface of bone.
 (b) Compact bone is organized into rings called osteons.
 (c) Osteoblasts surround the exterior of the bone.

Function : Supports and protects, provides levers for the muscles to act on, stores calcium and other minerals and fat. Marrow inside bones is site of blood cell formation.

3- Blood :

Blood/ is the most atypical connective tissue. It does not bind things together or give mechanical support. It is classified as connective tissue because it develops from mesenchyme and consists of blood cells surrounded by a non living matrix. Blood tissues are found inside the blood vessels. (arteries, arterioles, capillaries, venules and veins).

Some white blood cells are also found in other types of body tissues, for example lymphocytes are also found in the lymphatic system.

Even though it has a different function in comparison to other connective tissues it does have an extracellular matrix. The matrix consists of the plasma, while red blood cells, white blood cells, and platelets are suspended in the plasma.

Function : Transport of respiratory gases, nutrients and wastes .

Location : Within the blood vessels .

4- Lymph

Lymph is another type of fluid connective tissue. This clear fluid originates from blood plasma that exits blood vessels at capillary beds. A component of the lymphatic system, lymph contains immune system cells that protect the body against pathogens.

Muscular tissue

Muscle/ is an organ specializing in the transformation of chemical energy into movement.

Functions of muscle tissue:

- 1-Body movement (Locomotion)
- 2-Heart beat.
- 3-Maintenance of posture.
- 4- Production of body heat (Thermogenesis)
5. Stabilizing joints.
6. Respiration (Diaphragm and intercostal contractions)
7. Communication (Verbal and Facial)
8. Constriction of organs and vessels
 - Peristalsis of intestinal tract
 - Vasoconstriction of blood vessels and other structures (pupils).

Characteristics:

- 1- Excitability:** Capacity of muscle to respond to a stimulus
- 2- Contractility:** Ability of a muscle to shorten and generate pulling force
- 3- Extensibility:** Muscle can be stretched back to its original length
- 4-Elasticity:** Ability of muscle to recoil to original resting length after stretched.

There are 3 Types of muscle tissue :

Skeletal muscle

1-

- These muscles are responsible for movement of skeleton (locomotion), facial expressions, posture, respiratory movements and other types of body movement.
- Under voluntary (conscious) control; controlled by somatic motor neurons
- Appears striated under the microscope

- Skeletal muscle contains three layers of connective tissue:

Epimysium—this layer surround the entire muscle.

Perimysium—this layer is continuous with the epimysium and it surrounds bundles of muscle fibers.

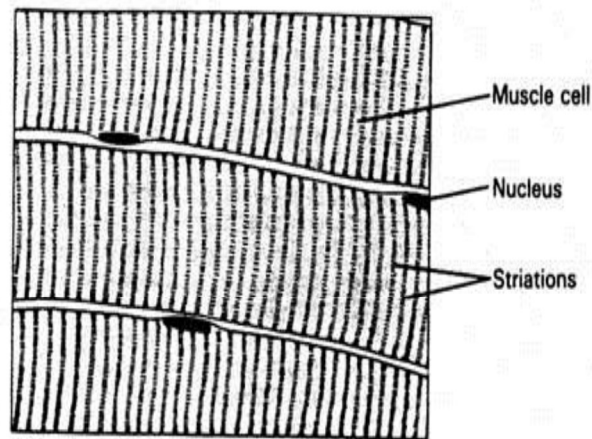
Endomysium—this layer is continuous with the perimysium and it surrounds individual muscle fibers. It contains capillaries and nerve fibers that supply the muscle fiber.

- The cells of skeletal muscle are referred to as **muscle fibers**. The fibers are long, tapering cells that contain many nuclei (i.e., **multinucleated**). The cell membrane is called the **sarcolemma** and the cytoplasm is called the **sarcoplasm**.

Classification of muscle fibers :

There are three kinds of muscle fibers found in skeletal muscle :

- 1- **Red fibers:** these are small diameter fibers that contain an abundant amount of **myoglobin**, which is functionally similar to hemoglobin, and many **mitochondria**. (i.e., “dark meat”).
- 2- **White fibers:** these are larger diameter fibers that contain lesser amounts of myoglobin and mitochondria. These fibers can contract more rapidly than red fibers, but they also fatigue more rapidly (i.e., “white meat”).
- 3- **Intermediate fibers:** these fibers have characteristics of both red and white fibers.

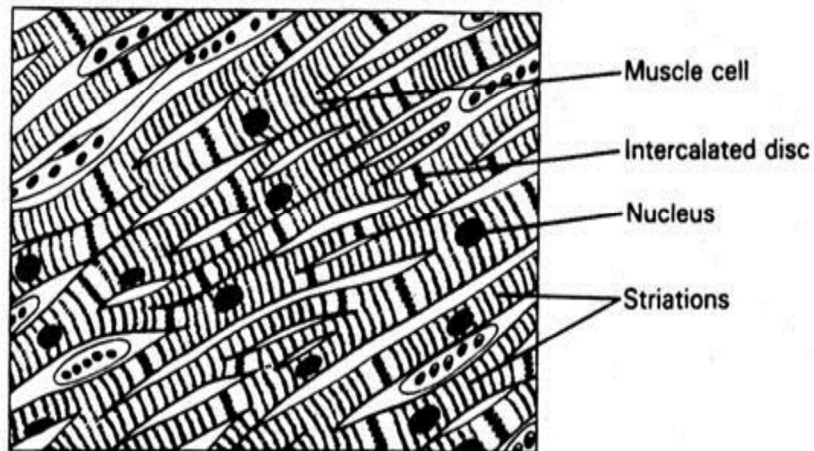


section of skeletal muscle

2- **Cardiac muscle**

Cardiac muscle is found only in the **heart**. Similar to skeletal muscle, cardiac muscle has a single, centrally-located nucleus.

- This muscle is responsible for movement of heart (and blood).
- Under involuntary (unconscious) control involuntarily by endocrine and autonomic nervous systems.
- Also appears striated under the microscope.



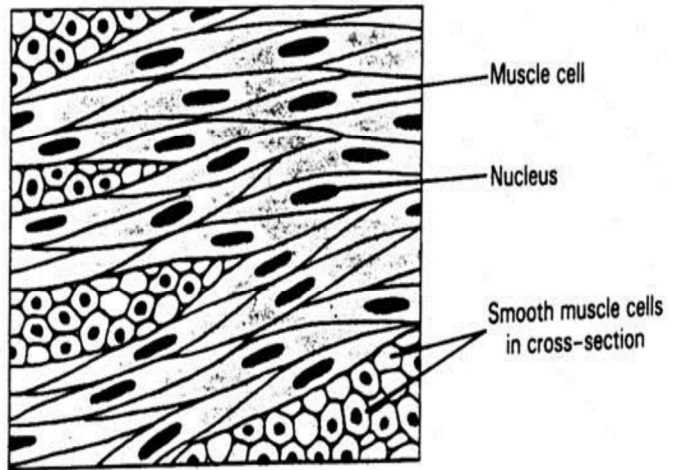
Section of Cardiac muscle

3-

Smooth

Smooth muscle cells have a single, centrally-located nucleus and are spindle shaped. The walls of blood vessels, the tubes of the digestive system, and the tubes of the reproductive systems are composed primarily of smooth muscle.

- This muscle is responsible for movement of hollow organs such as digestive tract, uterus, bladder, blood vessels, skin, eye, glands.
- Also under involuntary (unconscious) control involuntarily by endocrine and autonomic nervous systems.
- Does not appear striated under the microscope.



Section of Smooth muscle

Nervous tissue :

Nervous tissue is one of four major classes of vertebrate tissue. It is the specialized tissue that makes up **the central nervous system** and **the peripheral nervous system**. Nervous tissue is the main component of the nervous system: the [brain](#), [spinal cord](#), and nerves.

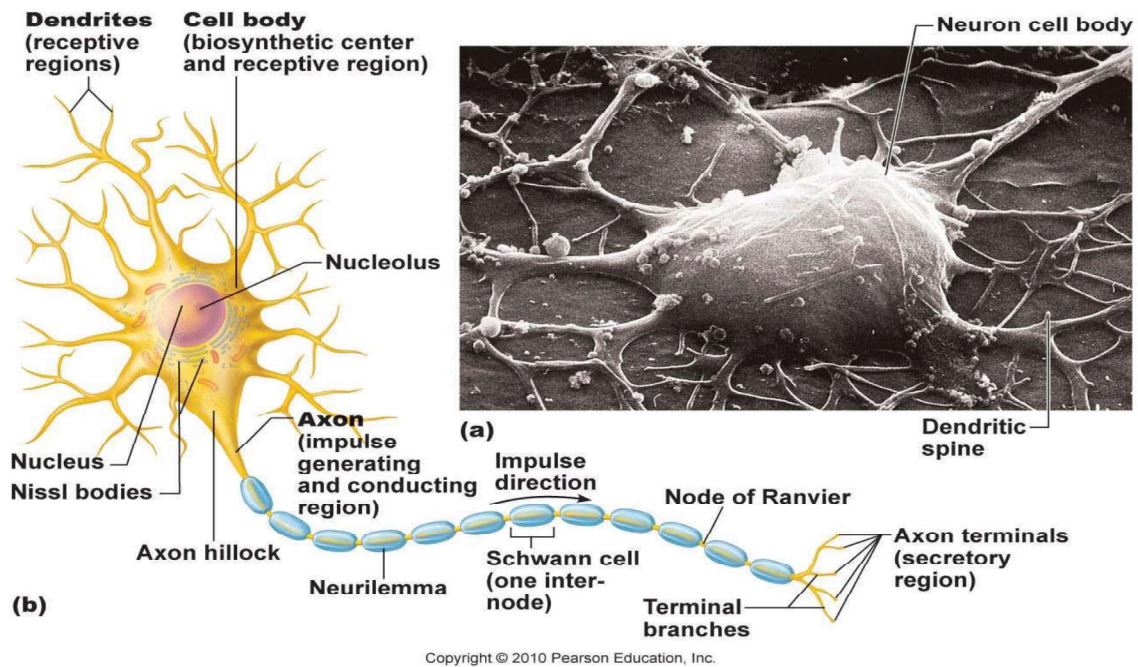
Nerve tissue :

Nerve tissue is composed of 2 main types of cells :

Neurons - nerve cells that are specialized to detect and react to stimuli, by generating and conducting nerve impulses.

Neuroglial cells - accessory cells for filling spaces and supporting neurons.

All neurons have a cell body called **soma** which contains a nucleus, organelles, and a modified endoplasmic reticulum called **Nissl body**. Although there is **DNA** in the neuron, somehow DNA replication and mitosis do not occur, resulting in the neurons lack of ability to reproduce or regenerate.



Extensions of the soma form nerve such as **dendrites** which conduct nerve impulses toward the soma, and **axon** which conducts nerve impulses away from the soma (to another neuron, or to an effect or organ).

- The number of dendrites ranges from 1(in unipolar and bipolar neurons) to thousands (in multipolar neurons).
- All neurons only contain 1 axon.
- Longer axons are enclosed by a lipoprotein substance called **myelin sheath** produced by a type of neuroglia cell called **Schwann cells**.

Structure of nervous cell

- This myelin sheath insulates the axon against depolarization, and forces action potential to occur in the gaps (**node of Ranvier**) in between the myelin sheath.

- Axons enclosed by myelin sheath are called myelinated axons which make up the **white matter** in the nervous system; while axons that have no myelin sheath are called unmyelinated axons which make up the **gray matter** in the nervous system.

Synapse :

A **synapse**/ is the junction between two neurons, or between a neuron and an effector organ (muscle or gland).

Each synapse consists of:

Presynaptic neuron, Axon , Synaptic knobs , Synaptic vesicles, Synaptic cleft, Dendrite, Postsynaptic neuron.

Classification of neurons

A- Classification based on structure :

a) **Unipolar neuron** - a single nerve fiber is extended from the soma, and it divides into a dendrite and an axon (sensory neurons that conduct reflexes or detect various stimuli).

b-**Bipolar neuron** - a dendrite and an axon extend from the soma independently (sensory neurons involved in special senses such as vision, olfaction, and hearing).

c) **Multipolar neuron** - one axon and many dendrites extend from the soma (interneurons located inside the brain and spinal cord).

B- classification based on function

a) **Sensory or afferent neuron:**

- conducts nerve impulses from the body to the brain or spinal cord.
- endings of its dendrite may be modified to become nerve receptors.
- usually unipolar in structure

b) Interneuron:

- relays nerve impulse from sensory neuron to motor neuron .
- located totally inside the tissues of the brain or spinal cord.
- involved in the processing and integration in the nervous system.
- usually multipolar in structure.

c) Motor or efferent neuron:

- conducts nerve impulses from the brain or spinal cord to the effector organ (muscles or glands).
- usually multipolar in structure.

Classification of Neuroglia :

Neuroglia: are the supporting cells of the nervous system.

1. Astrocytes: star shaped cells found between neurons and blood vessels.

Function: structural support, transport of substance between blood vessels and neurons.

2. Microglial cells: small ovoid cells.

Function: structural support and phagocytosis (immune protection).

3. Ependymal cells: cuboidal or columnar shaped cells.

Function: form a porous layer through which substances diffuse between the interstitial fluid and the cerebrospinal fluid.

4. Oligodendrocytes: resemble astrocytes but have less processes and arranged in rows along nerve fibers.

Function: produce myelin sheath within the brain spinal cord.

Anatomy

Anatomy/ is the identification and description of the structures of living things.

Anatomy is a branch of biology and medicine.

Anatomy can be divided into three broad areas:

1- Human anatomy.

2- Zootomy (animal anatomy).

3- phytotomy (plant anatomy).

The word anatomy comes from the Greek *ana-* meaning "up", and *tome-* meaning "a cutting". Anatomy, especially in the past, has depended heavily on dissection. In

Greek and Latin the words "anatomy" and "dissection" have virtually the same meanings. Although both words have similar origins, anatomy has evolved to become a broad discipline of its own, while dissection remains a technique of anatomical science.

Anatomy can be divided into Gross Anatomy (macroscopic anatomy) and Microscopic Anatomy.

What is Gross Anatomy

Gross anatomy In medicine, also known as topographical anatomy or macro anatomy, refers to the study of the biological structures that may be seen with the naked eye.

Gross anatomy may involve dissection or noninvasive methods; the aim is to acquire data about the larger structures of organs and organ systems.

In dissection, the human or animal cadaver is cut open and its organs are studied. Endoscopy, inserting a tube with a camera at the end, might be used to study structures within living animals. There are non-invasive way of studying, for example, the blood vessels of living animals or humans; an opaque dye may be inserted into the animal to observe the circulatory system (angiography). Live beings may also be studied using [MRI](#) (magnetic resonance imaging) or X-ray.

Medical and dental students, as part of their course, will have to perform some kind of practical work in gross human anatomy, this will involve dissection. In many cases, the students dissect human corpses (cadavers).

Human anatomy :

Human anatomy- including histology and gross human anatomy, is the study of the structures of the human body.

Most health care related studies require some or extensive training in gross anatomy and histology. Examples include people preparing to become paramedics, physical therapists (UK: physiotherapists), occupational therapists, medical doctors, orthotists, prosthetists, and biological scientists.

Medical students will be required to do practical anatomical work, which involves dissection and inspecting cadavers.

Digestive system

Digestive system/ is made up of a group of organs working together. The digestive tract is made up of the mouth, esophagus, stomach, small intestine, and the large intestine. There are also associated organs that support the digestive tract.

Parts of the human digestive system:

1- Mouth/the first of the digestive tract the entry point of the food, the smell and sight of food, stimulates salivary glands to secrete fluid called saliva (consisting of water and enzymes).

Salivary glands/ are glands in the mouth that produces saliva to begin the chemical digestion of food.

The purpose of the saliva is to lubricate the food for swallowing, dissolve water soluble food particles, and start chemical digestion of carbohydrates (starch) into smaller molecules.

2- Esophagus/ muscular tube that connecting the mouth to the stomach running through the **thoracic cavity**, the site of esophagus lies behind trachea.

The trachea has an epiglottis which prevents food from entering the trachea, moving the food to the esophagus while swallowing.

Food travels down the esophagus, through a series of rhythmic contractions (wave-like) called **peristalsis**.

The lining of the esophagus secretes mucus, lubricating to support the movement of food.

The end of esophagus linked with the upper part of stomach by cardiac sphincter, its muscular ringed valve, the role of sphincter is to prevent stomach acids from back flowing in to the esophagus creating a burning feeling known as heart burn.