

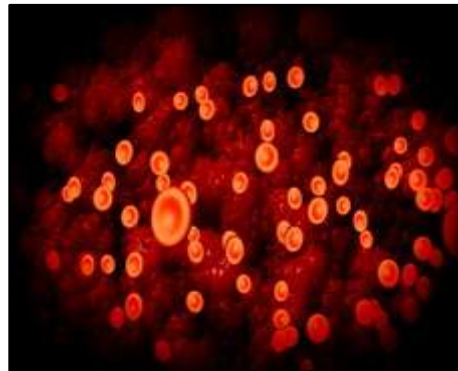
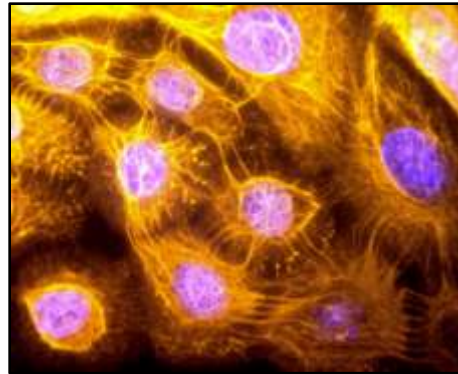
Tissue

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Prepared For:

Human Physiology-I



Definition of Tissues

Biological tissue is a collection of interconnected cells that perform a similar function within an organism.

In other words, it is a group of cells working together mainly inside an organ.

Classification of Tissues

Human body is composed of
4 basic types of tissue:

- Epithelial tissue
- Connective tissue
- Muscular tissue
- Nervous tissue

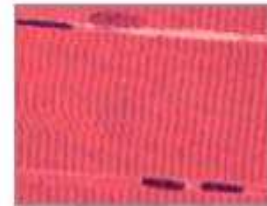
Four types of tissue



Connective tissue



Epithelial tissue



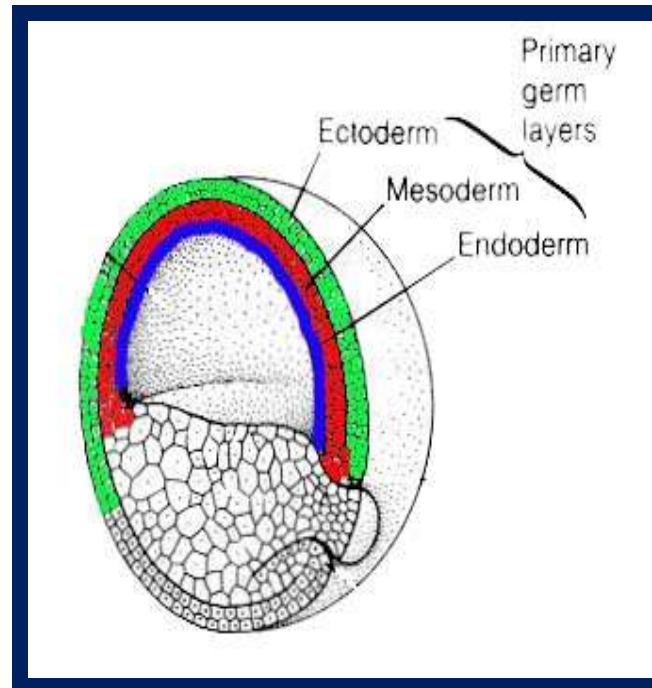
Muscle tissue



Nervous tissue

Origin of Tissue

A fertilized egg divides to produce 3 primary germ cell layers. These layers differentiate to form the tissues of the body.



Epithelial Tissue

Epithelial cells cover or line all body surfaces, cavities and tubes. So, These are called *covering epithelia*.

Epithelial cells form the functional units of secretory glands. So, These are called *glandular epithelia*.

General Characteristic

- ✓ Closely attached to each other forming a protective barrier.
- ✓ Always has one free (apical) surface open to outside the body or inside (cavity) an internal organ.
- ✓ Always has one fixed (basal) section attached to underlying connective tissue.
- ✓ Has no blood vessels but can soak up nutrients from blood vessels in connective tissue underneath.
- ✓ Can have lots of nerves in it (innervated).
- ✓ Very good at regenerating (fixing itself). i.e. sunburn, skinned knee.

Functions

- ❑ To protect the tissues that lie beneath it from radiation, desiccation, toxins, invasion by pathogens, and physical trauma.
- ❑ The regulation and exchange of chemicals between the underlying tissues and a body cavity.
- ❑ The secretion of hormones into the blood vascular system, and/or the secretion of sweat, mucus, enzymes, and other products that are delivered by ducts glandular epithelium.
- ❑ To provide sensation.
- ❑ Absorbs stomach and intestinal lining (gut).
- ❑ Filters the kidney.
- ❑ Forms secretory glands.


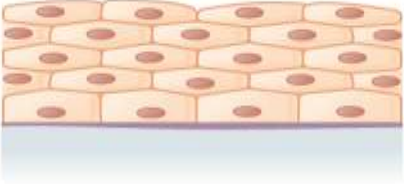

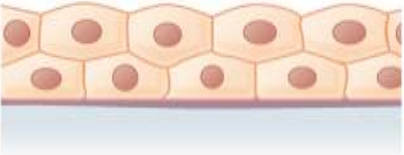

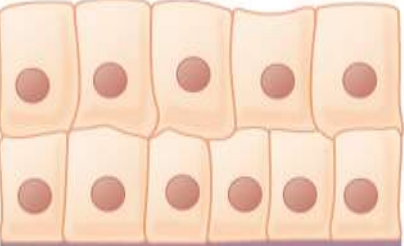
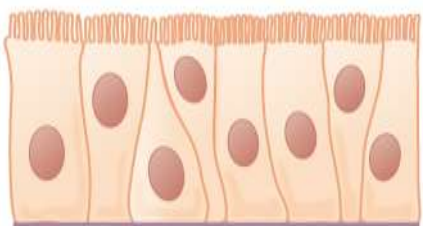
Classification of Epithelia

According to thickness

- ✓ “simple” - one cell layer
- ✓ “stratified” – more than one layer of cells (which are named according to the shape of the cells in the apical layer)

According to shape

- ✓ “squamous” – wider than tall
- ✓ “cuboidal” – as tall as wide
- ✓ “columnar” - taller than wide

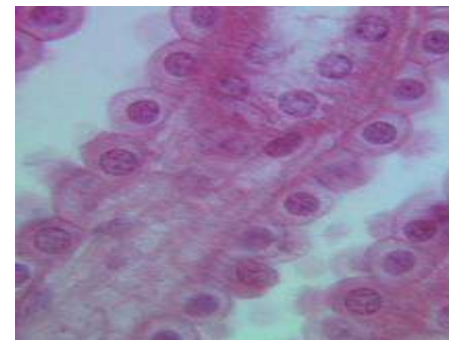
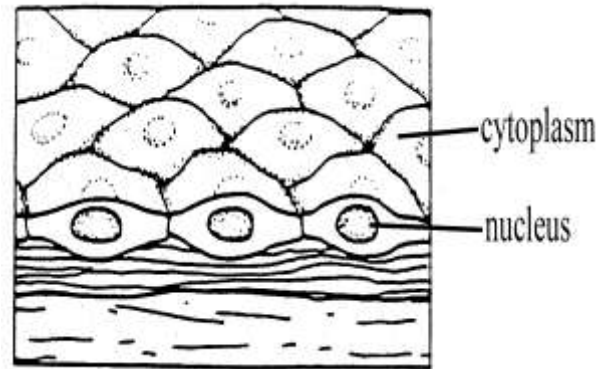
	Simple	Stratified	
Squamous	 <p>Simple squamous epithelium</p>	 <p>Stratified squamous epithelium</p>	
Cuboidal	 <p>Simple cuboidal epithelium</p>	 <p>Stratified cuboidal epithelium</p>	
Columnar	 <p>Simple columnar epithelium</p>	 <p>Stratified columnar epithelium</p>	Pseudostratified
			 <p>Pseudostratified columnar epithelium</p>

Simple squamous epithelium

Description: Single layer of flattened cells with disc-shaped central nuclei and sparse cytoplasm; the simplest of the epithelia.

Function: Passive transport of gases and fluids.

Location: Alveoli of lungs, lining body cavities (mesothelium), lining blood vessels (endothelium)

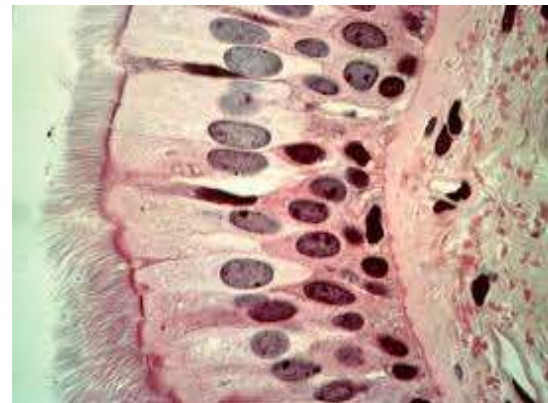
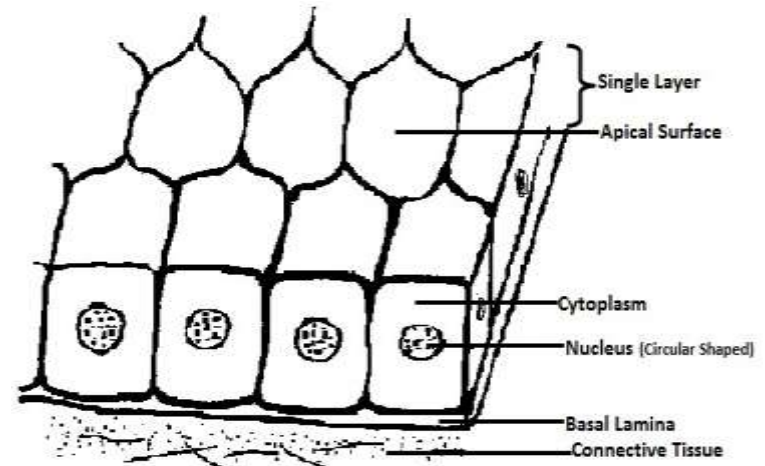


Simple cuboidal epithelia

Description : Single layer of cubelike cells with large, spherical central nuclei.

Function : Secretion and absorption.

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



Simple columnar epithelia

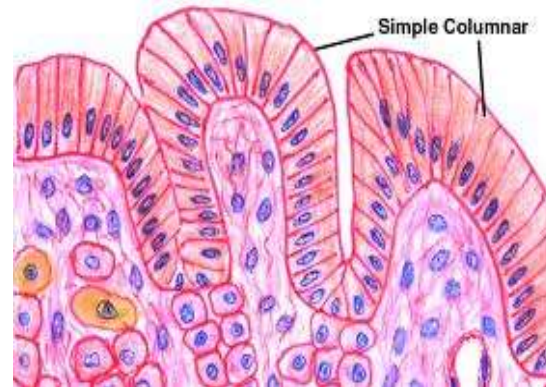
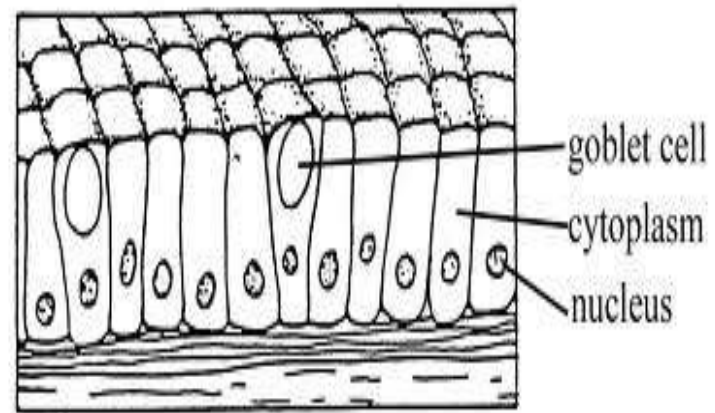
Description: Single layer of tall cells with round to oval nuclei.

Types: (i) Ciliated columnar epithelia.

(ii) Non-ciliated columnar epithelia.

Function: Absorption; secretion of mucus, Enzymes and other substances.

Location: Digestive tract, gall bladder etc.



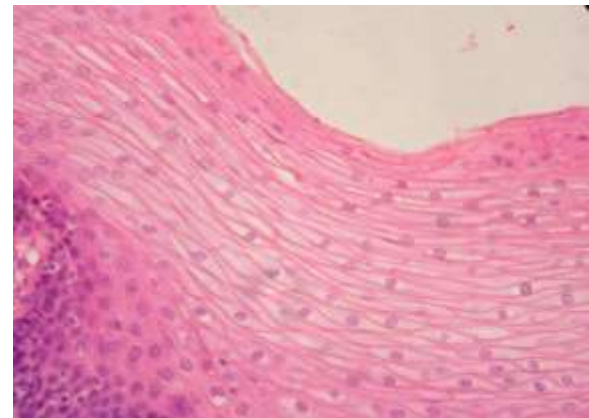
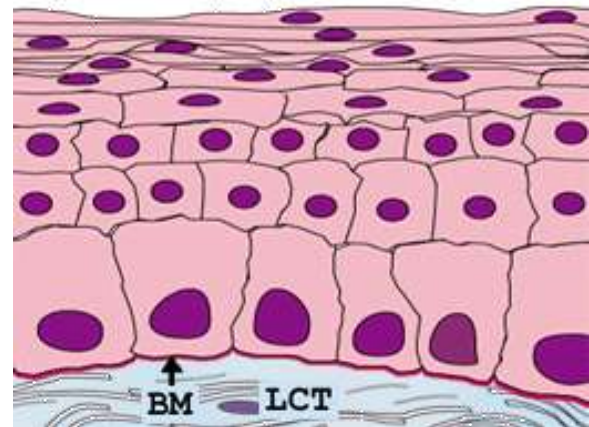
Stratified squamous epithelia

Description:

Multilayered, surface cell are squamous, basal cells are cuboidal and divided constantly.

Function: Protection.

Location: Oral cavity, cervix, anal canal.

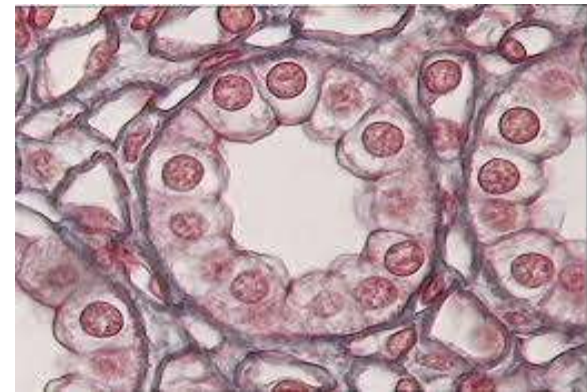
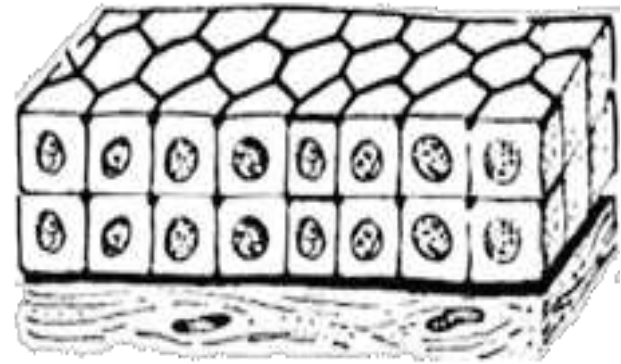


Stratified cuboidal epithelia

Description: Generally two layers of cube-like cells.

Function: Protection.

Location: Large ducts of sweat glands, mammary glands, and salivary glands.

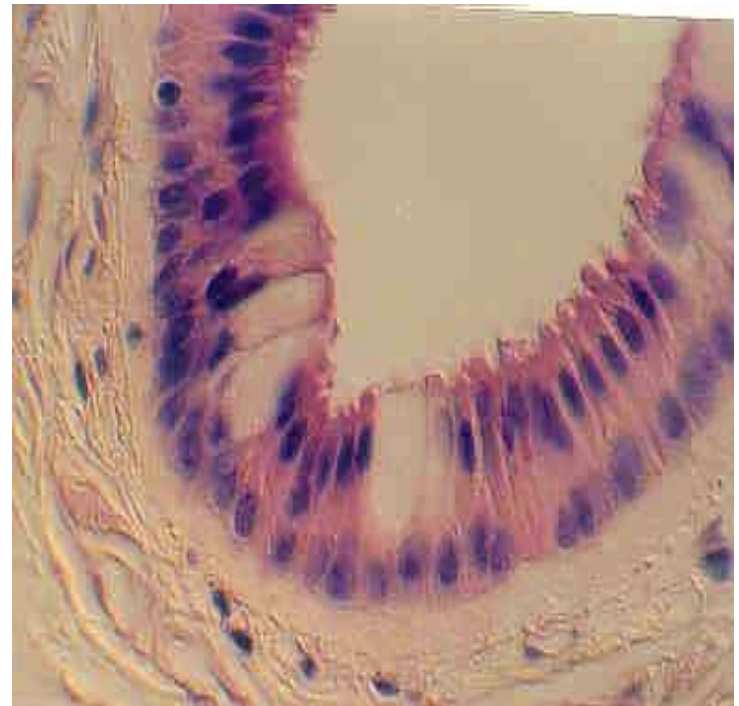


Stratified columnar epithelia

Description:
Multilayered, superficial cells elongated and columnar.

Function: Protection;
secretion.

Location: Rare in the body;
small amount in the male
urethra.

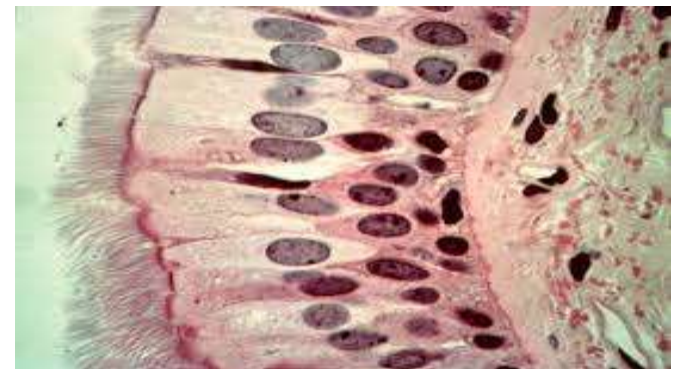
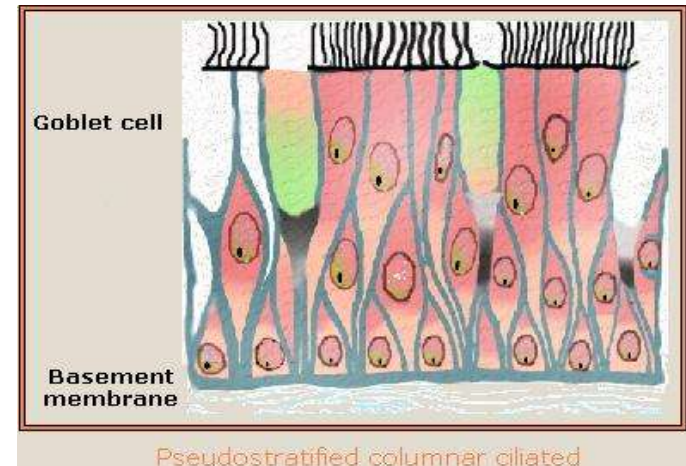


Pseudo stratified columnar epithelia

Description: Single cell layered, all cell attach to the basement membrane but not all reach the free surface. Nuclei at varying depth.

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

Location: Lines of trachea.

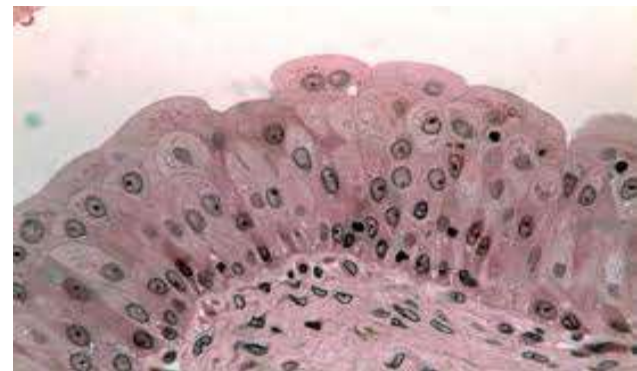
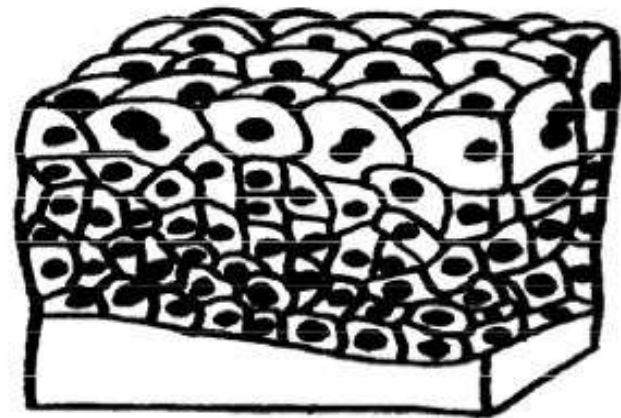


Transitional epithelia

Description: Characterized by domelike cells that are neither squamous nor columnar. The form of the cells changes.

Function: Stretching and protection.

Location: Bladder and part of urethra.



Connective Tissues

The tissues that connect the different parts of the body together are called connective tissues.

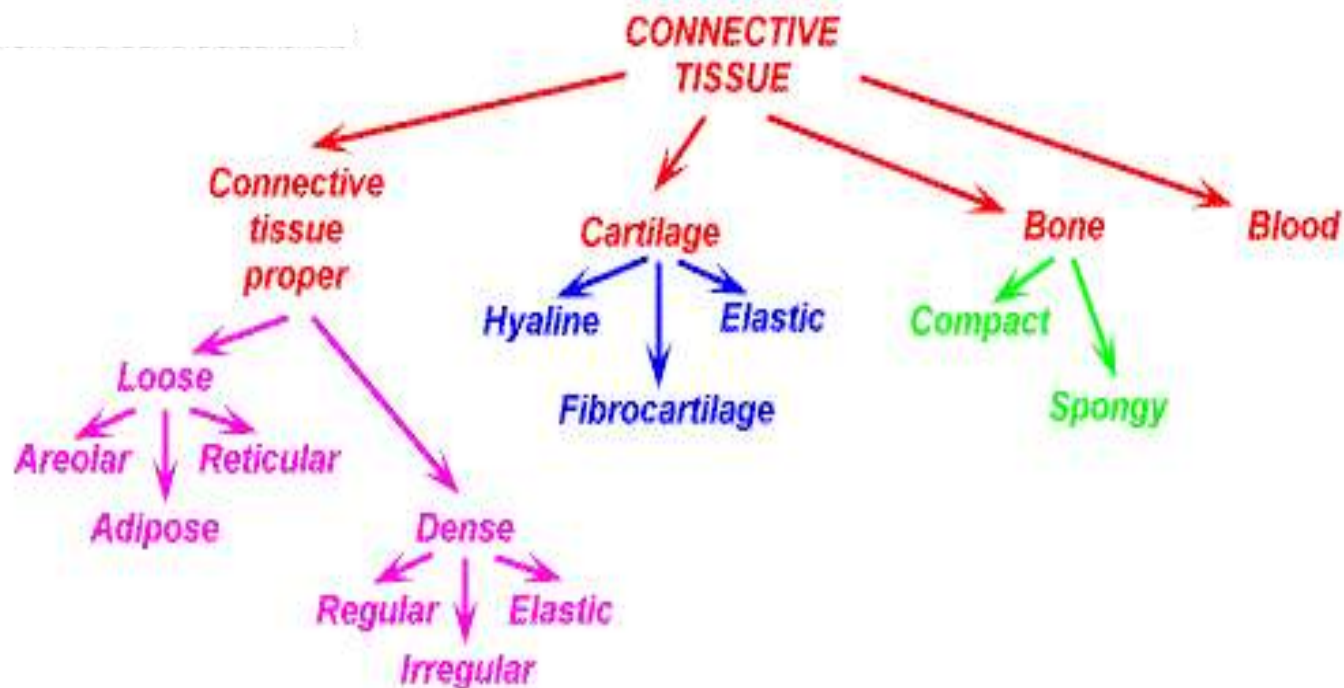
General characteristic

- ✓ The intercellular material is maximum where as the cellular component is minimum.
- ✓ Unlike the other tissues, (e.g. epithelium, muscle and nerve) which are formed mainly by cells, the major constituent of connective tissue is ECM (Extra-cellular matrix).
- ✓ Possess cells, fibers and ground substances.

Basic Functions

- ❑ Support and binding of other tissues
- ❑ Holding body fluids
- ❑ Defending the body against infection
 - macrophages, plasma cells, mast cells, WBCs
- ❑ Storing nutrients as fat

Classification of connective tissues



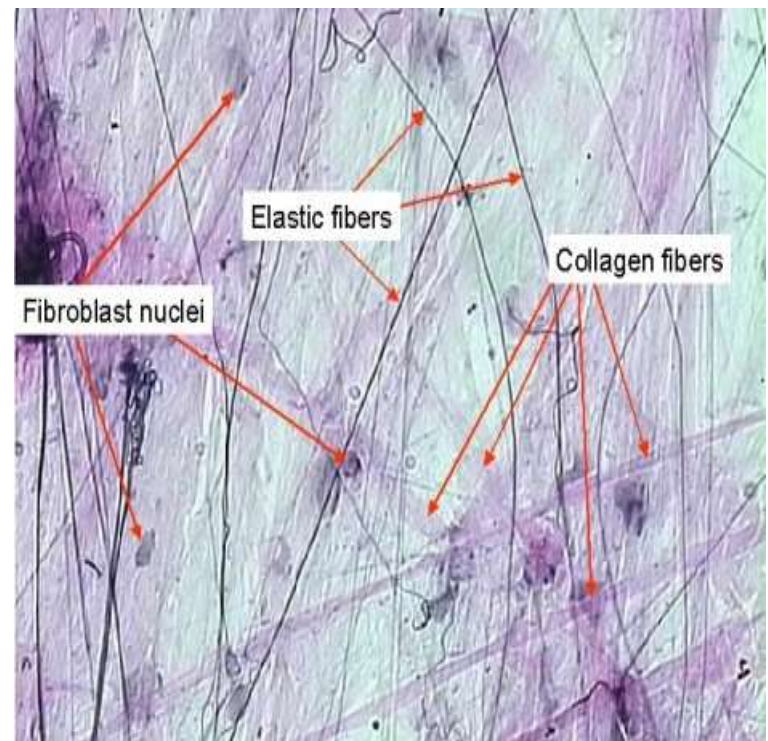
Connective tissue proper :

Loose CT ; Areolar

Description: Gel like matrix with all three fiber types ; cells: fibroblasts, macrophages, mast cells, and white blood cells.

Function: Its macrophages phagocytize bacteria ; plays important role in inflammation ; holds and conveys tissue fluid.

Location: Distributed under epithelia of body; surrounds capillaries.

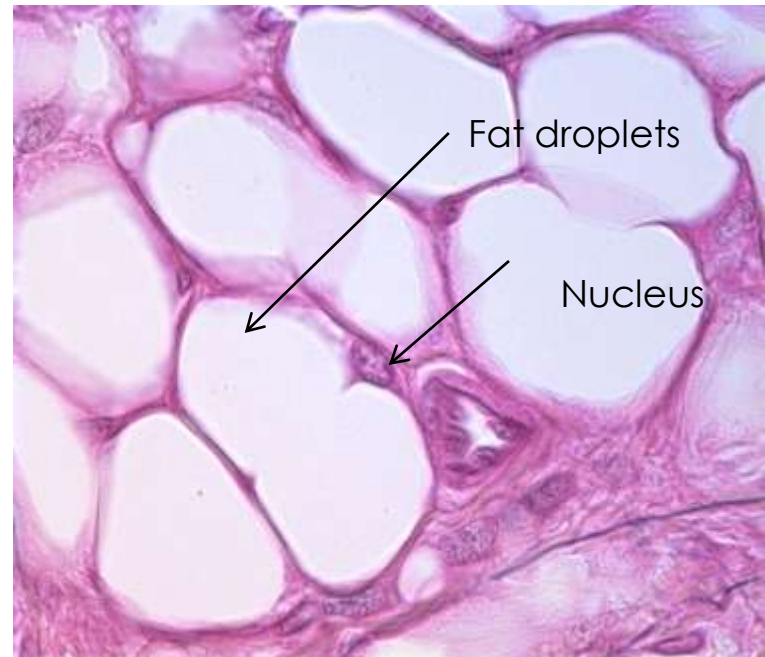


CT proper : Loose CT ; Adipose

Description: Matrix as in areolar, but very sparse; closely packed adipocytes, or fat cells, have nucleus pushed to the side by large fat droplet.

Function: Provides reserve food fuel; insulates against heat loss; supports and protects organs.

Location: Under skin; around kidneys and eyeballs; within abdomen; in breasts.

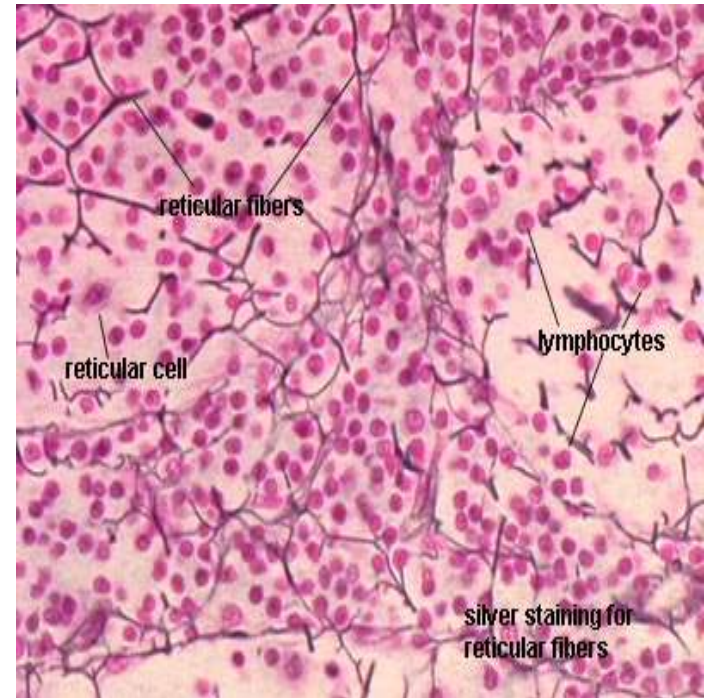


CT proper: Loose CT; reticular

Description: Network of reticular fibers in a typical loose ground substance; reticular cells lie on the network.

Function: Fibers form a soft internal skeleton that supports other cell types including white blood cells, mast cells, and macrophages.

Location: Lymphoid organs (lymph nodes, bone marrow, and macrophages).

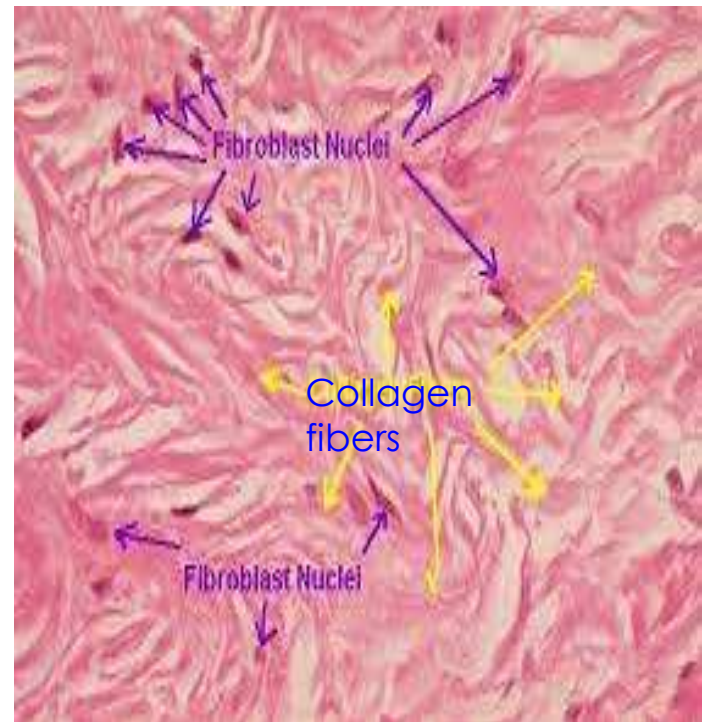


CT proper: dense CT; Irregular

Description: Primarily irregularly arranged collagen fibers; some elastic fibers; major cell type is the fibroblast.

Function: Elasticity and structural support.

Location: Dermis of the skin; submucosa of digestive tract and joints.

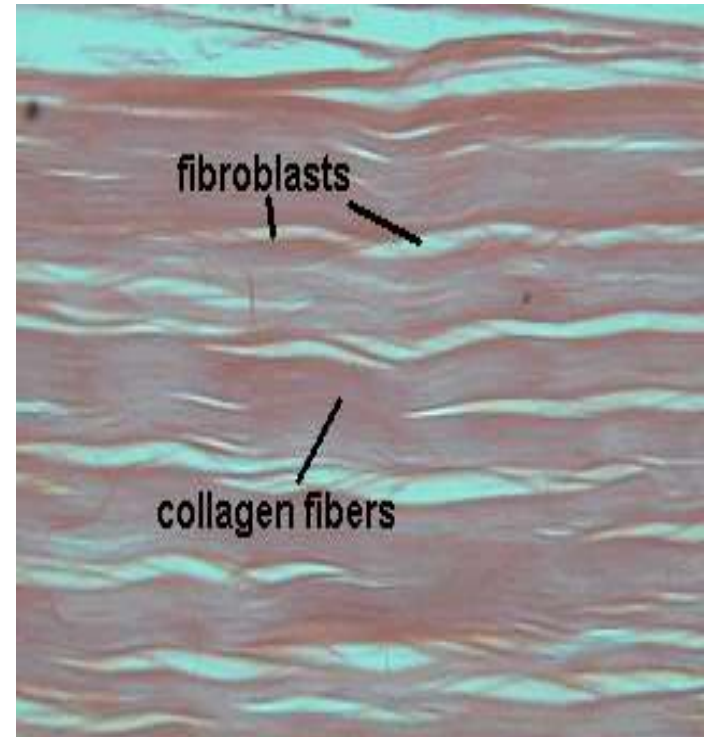


CT proper: dense CT; Regular

Description: Primarily parallel collagen fibers; a few elastin fibers; major cell type is the fibroblast.

Function: Attaches muscles to bones and bones to bones.

Location: Tendons and in most ligaments.



Cartilage: Hyaline

Description: Amorphous but firm matrix; chondroblasts produce the matrix and when mature lie in lacunae.

Function: Supports and reinforces; resists compressive stress.

Location: Forms most of the embryonic skeleton; ends of long bones; cartilages of nose.

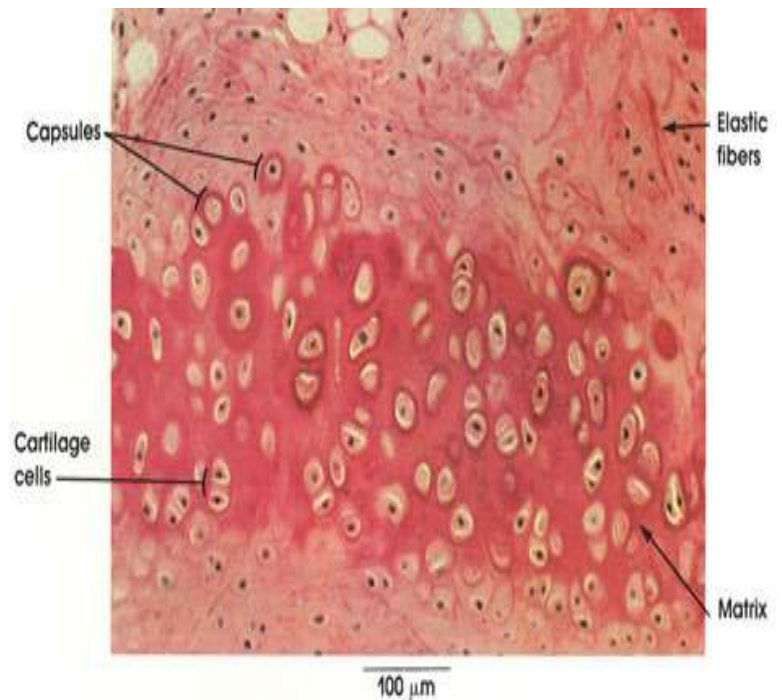


Cartilage: Elastic

Description: Similar to hyaline cartilage, but more elastic fibers in matrix.

Function: Maintains the shape and allows flexibility.

Location: Supports the external ear (pinna).

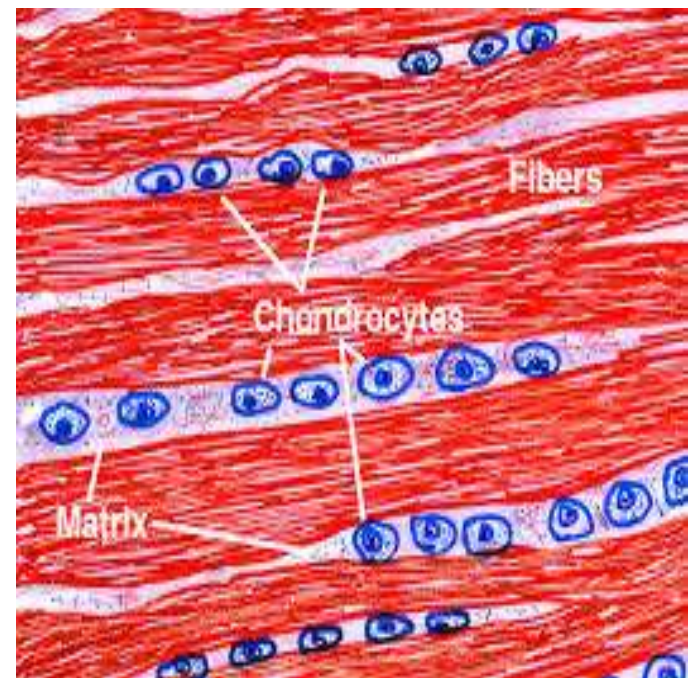


Cartilage : Fibrocartilage

Description : Collagen fibers are predominant ; matrix is as hyaline but less firm.

Function: High tensile strength, compressive shock absorb.

Location: Intervertebral disc; discs of knee joint.

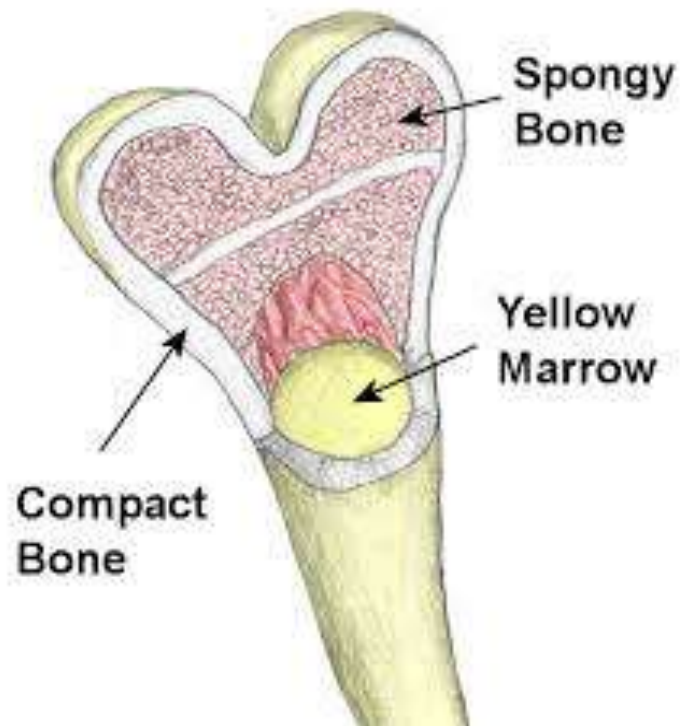


Bone

Description: Hard, calcified matrix containing many collagen fibers. Very well vascularized.

Function: Bone supports and protects; provides levers for the muscles to act on; stores calcium and other minerals and fat; bone marrow is the site of blood cell formation.

Location: Skeleton.

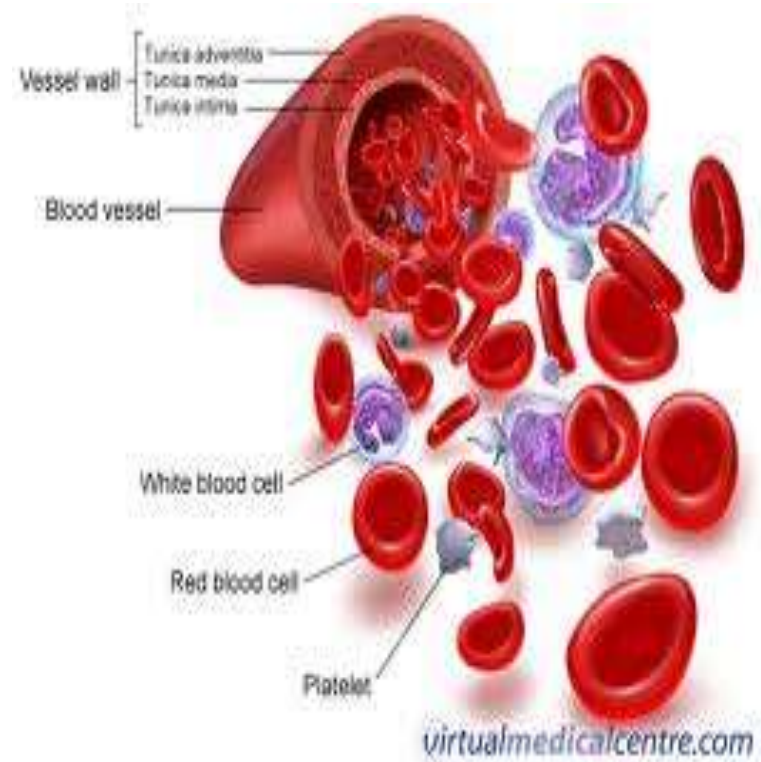


Blood

Description: Liquid connective tissue, red and white blood cells in fluid matrix.

Function: Transport respiratory gases, nutrients, wastes and other substances.

Location: In the blood vessels.



Muscle Tissue

- Muscle is one of our 4 tissue types and muscle tissue combined with nerves, blood vessels, and various connective tissues.
- Muscles are quite complex and as we'll find out, they are a marvel of both biology and physics.

General characteristics

1. Excitability

- The ability to receive and respond to a stimulus
 - **In skeletal muscle**, the stimulus is a neurotransmitter (chemical signal) release by a neuron (nerve cell).
 - **In smooth muscle**, the stimulus could be a neurotransmitter, a hormone, stretch, ΔpH , ΔPco_2 , or ΔPo_2 .
 - **In cardiac muscle**, the stimulus could be a neurotransmitter, a hormone, or stretch.
- The response is the generation of an electrical impulse that travels along the plasma membrane of the muscle cell.

2. **Contractility**

- **The ability to shorten forcibly when adequately stimulated.**
- **This is the defining property of muscle tissue.**

2. **Extensibility**

- **The ability to be stretched (Extended)**

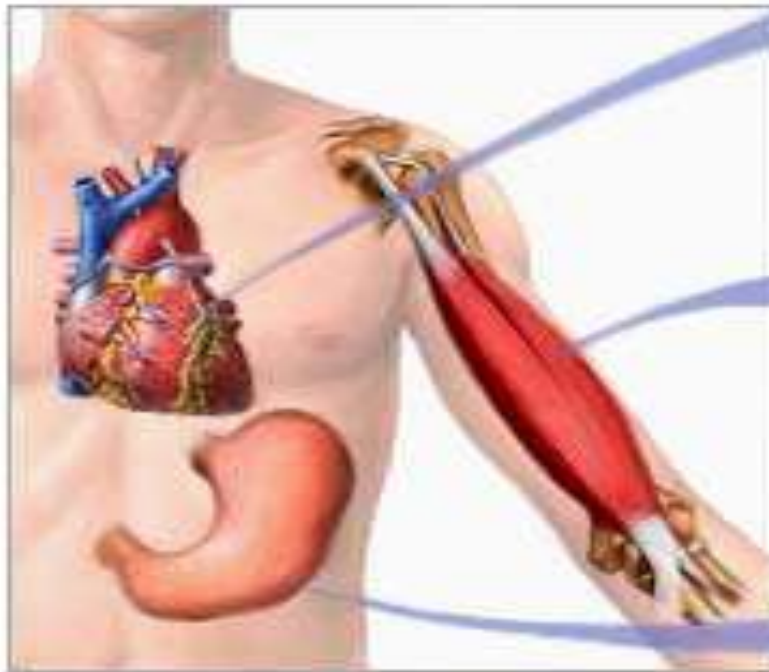
4. **Elasticity**

- **The ability to recoil and resume original length after being stretched.**

Functions

- Movement
- Locomotion
- Maintains posture
- Produces heat
- Facial expressions
- Pumps blood
- Peristalsis

3 Types of Muscle Tissue



Cardiac muscle cell



Skeletal muscle cell



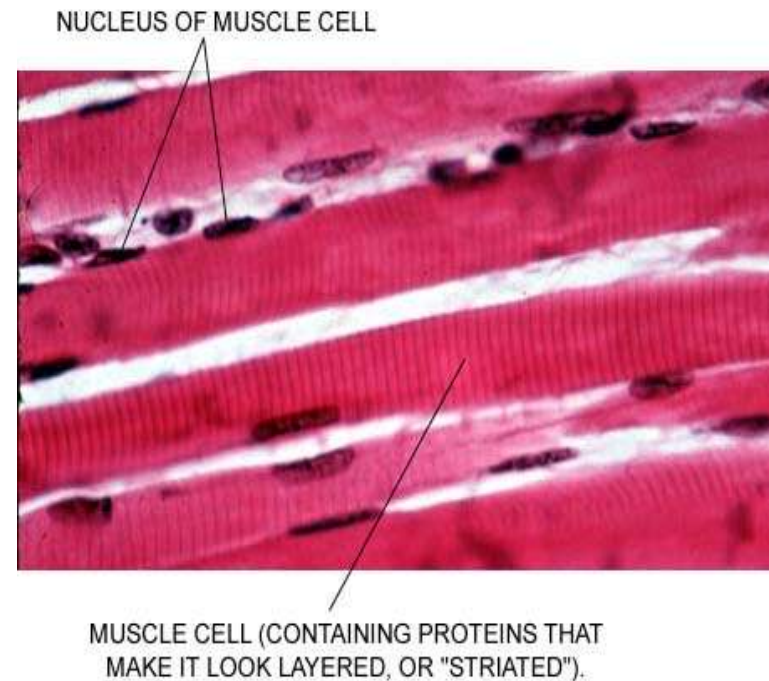
Smooth muscle cell

Skeletal Muscle Tissue

Description: Long striated cells with multiple nuclei.

Function: Contraction for voluntary movements.

Location: In skeletal muscle.

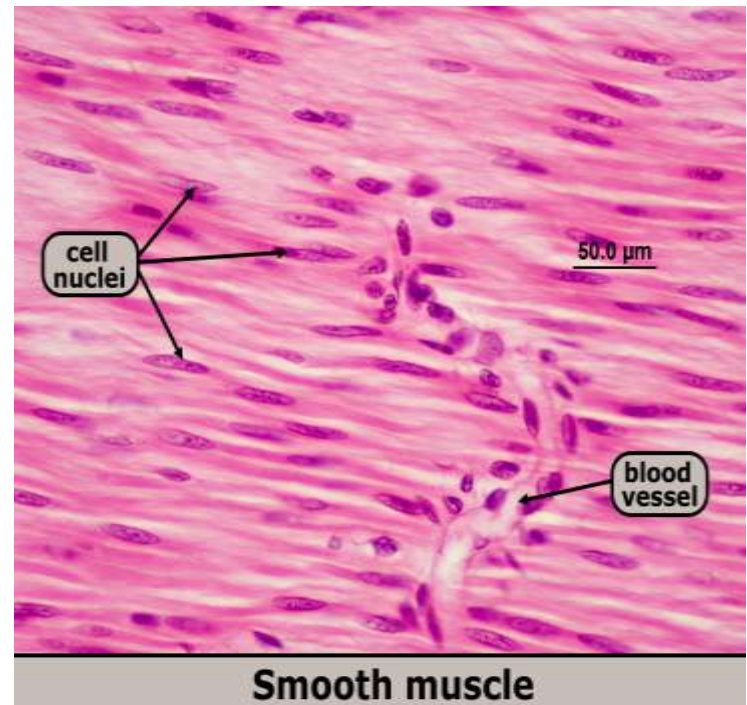


Smooth Muscle Tissue

Description: Long, spindle-shaped cells, each with a single nucleus.

Function: Propulsion of substances along internal passageways.

Location: In hollow organs(e.g. stomach)



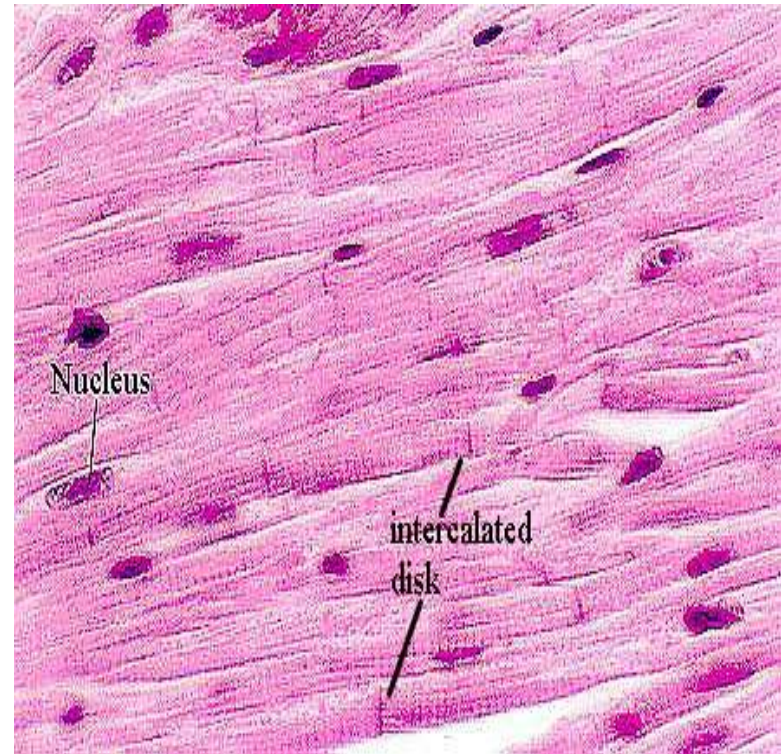
Cardiac Muscle tissue

Description:

Branching, striated cells fused at plasma membranes.

Function: Pumping of blood in the circulatory system.

Location: Wall of heart.



Nerve Tissue

By far the most complex tissue in the human body is nerve tissue.

Formed by a network of more than 100 million nerve cells, assisted by many more glial cells.

Each neuron has, on an average , at least a thousand interconnection with other neurons forming a very complex nervous system.

Functions

- ✓ **Regulates & controls body functions**
- ✓ **Generates & transmits nerve impulses**
- ✓ **Supports, insulates and protects impulse
generating neurons.**

Composition of Nerve Tissue

The nerve tissue is composed of two elements:

1. The nerve cell or neuron
2. The neuroglia

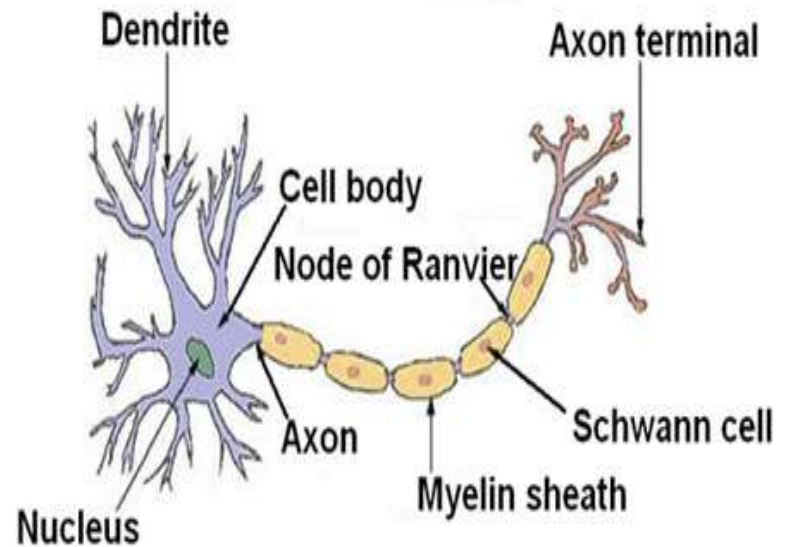
Neuron

Description: Neurons are branching cells; cell processes that may be quite long extend from the nucleus-containing cell body.

Function: Transmit electrical signals from sensory receptors and to effectors (muscles and glands) that control their activity.

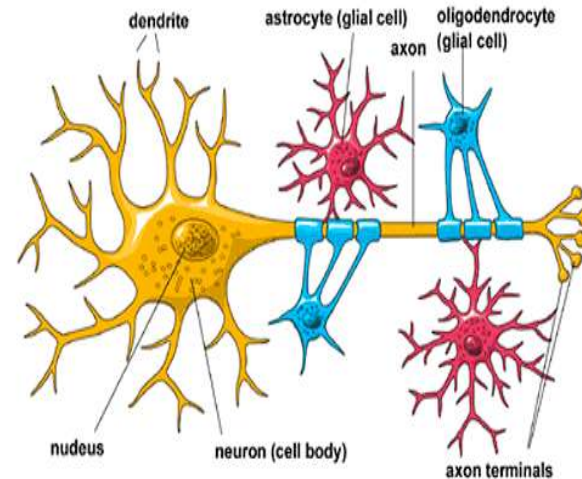
Location: Brain, spinal cord and nerves.

Structure of a Typical Neuron



Glial cells

Glia carry nutrients, speed repair, provide myelin for axons, support the blood-brain barrier, and may form their own communication network. They are also involved in neurogenesis.



References:

1. Gray's Anatomy, 40th Edition
By Susan Standing, PhD, DSc, FKC
2. <http://www.highlands.edu/academics/divisions/scipe/biology/labs/rome/histology>
3. <http://krupp.wcc.hawaii.edu/BIOL100L/powerpoint/tissues>
4. <http://www.iteachbio.com/Anatomy-Physiology/BodyTissues>
5. http://www.lavc.edu/instructor/watson_k/docs/Tissues
6. <http://www.nakedscience.org/mrg/Anatomy%20Unit%204%20-%20Tissue%20Types>

A human skeleton is depicted sitting on a toilet. The skeleton is positioned in a way that suggests it is using the toilet. A speech bubble originates from the skeleton's mouth area, containing the text "Thank You ALL". The background is dark, and the toilet is a standard white fixture.

**Thank
You ALL**