Tissue

Human body tissue consists of groups of cells with a similar structure working together for a specific function. There are four main types of tissue in a body.

1. Epithelial Tissue,
2. Muscular Tissue,
3. Connective Tissue,
4. Nervous Tissue.

1. Epithelial Tissue

- Epithelial tissue, commonly referred to as epithelium is made up of one or more layers of cells that covers or lines the external and internal surfaces of various body parts.
- It consists of variously shaped cells closely arranged in one or more layers.

Types

- Simple Epithelium
  - **Squamous**
  - **Cuboidal**
  - **Columnar**
  - **Ciliated**
  - **Pseudostratified**
  - **Glandular**
- Compound

Simple Epithelium

- Are most common concerned with absorption, secretion and filtration because simple epithelia are usually very thin, protection is not one of their specialties.

Squamous Epithelium:

- This epithelium occurs in the walls of blood vessels, air sacs of the lungs where oxygen and carbon dioxide are exchanged, lymph vessels, wall of Bowman's capsule, loops of the nephrons of Kidneys.
- Functions:
  - Exchange of gases.
  - Filtration in Bowman's Capsule.
  - Exchange of materials in blood capillaries and tissue fluid

Cuboidal Epithelium:

It consists of a single layer of cube-like (cubical) cells lying on a basement membrane. Nuclei are rounded and lie in the centre of the cells. Free surfaces of the cells may be smooth or bear minute finger-like projections known as microvilli.

- *It is generally found in the tubular parts of nephrons in kidneys, ducts of glands thyroid follicles, salivary glands, pancreas, ovaries and testes.*
- *Function:*
  - *Reabsorption of useful substances.*
  - *Secretion and excretion by glands.*

Columnar Epithelium

- *It consists of a single layer of tall and slender cells, lying on a basement membrane.*
- *The intestinal mucosa bearing microvilli is called brush-bordered columnar epithelium.*
- *It is found in the lining of the entire length of the stomach and intestine.*
- *Epithelial membranes that form line cavities open to the body exterior are called* ***mucosa*** *.*
- ***Function:***
  - *Absorption*
  - *Secretion*

Ciliated Epithelium

- *If the columnar or cuboidal cells bear cilia on their free surface, they are called ciliated epithelium.*
- *It is of two types: Ciliated cuboidal epithelium and Ciliated columnar epithelium*

- ***Function:***
  - *It is responsible for passing of ovum through fallopian tube.*
  - *In respiratory tract, it helps in expelling the mucus and particles trapped in it, towards the pharynx.*

Pseudostratified Epithelium

- A pseudostratified epithelium is a type of epithelium that, though comprising only a single layer of cells, has its cell nuclei positioned in a manner suggestive of stratified epithelia.
- Its cells are columnar but unequal in size.
- Pseudostratified non-ciliated columnar epithelium tissue is found in urethra of human male and in large ducts of certain glands such as parotid gland.
- Pseudostratified ciliated columnar epithelium is found in trachea and large bronchi.

Compound/Stratified:

They provide protection to underlying tissues against mechanical, chemical, thermal or osmotic stresses.

- It may be stratified or transitional.

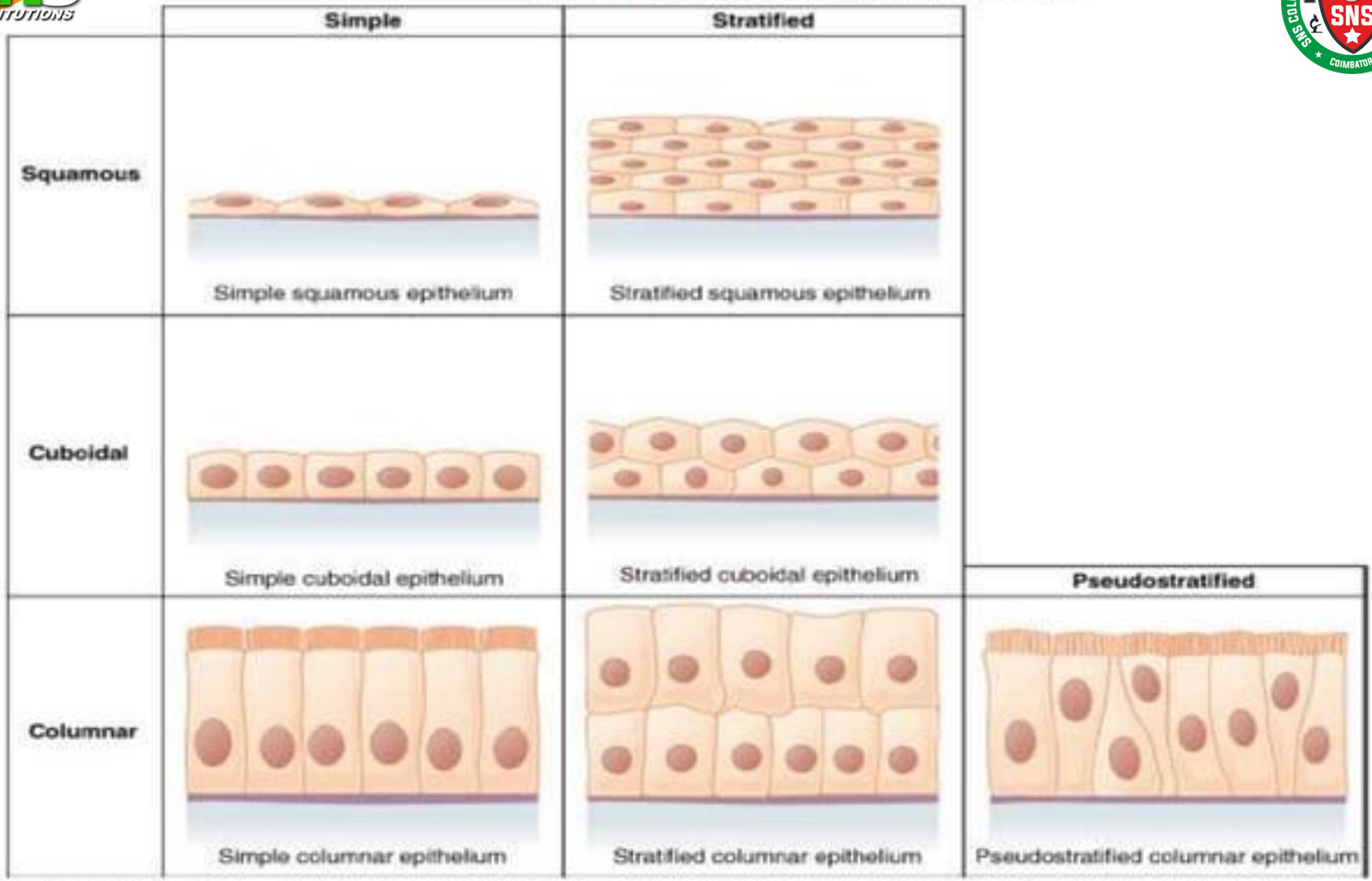
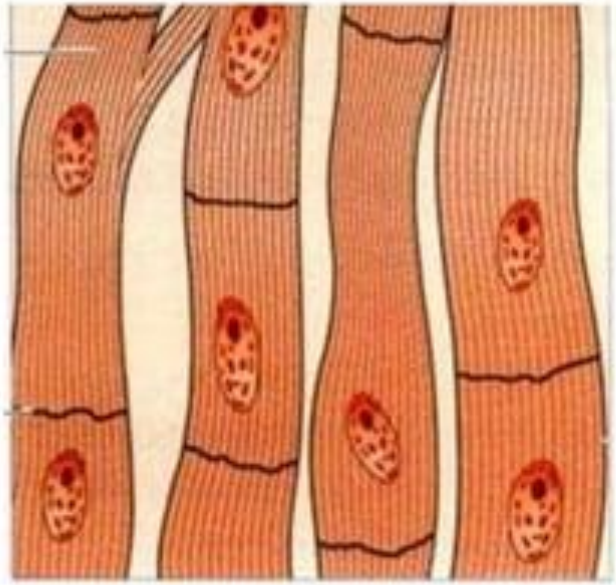


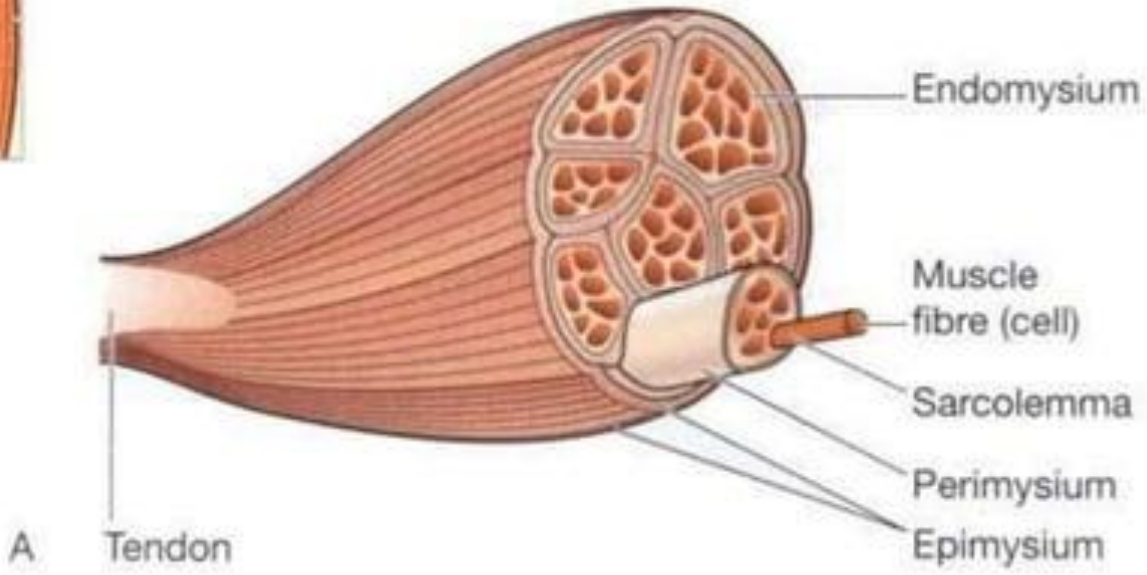
Figure 4.2.2 – Cells of Epithelial Tissue: Simple epithelial tissue is organized as a single layer of cells and stratified epithelial tissue is formed by several layers of cells.

2. Muscular Tissue

Muscle: an organ composed of one of three types of muscle tissue (skeletal, cardiac or smooth) , specialized for contraction to produce voluntary or involuntary movement

Muscular Tissue





Muscular Tissue

A group of cells (fibers) specialized to produce motion in response to muscle action potentials by its qualities of contractility, extensibility, elasticity and excitability

Properties of Muscular Tissue

1. **Excitability**: an ability of muscle to generate impulse.

2. **Contractility:** it is either shortening or development of tension or both.

A. Isotonic Contraction-contraction in which tension remains same whereas changes occurs in the length of muscle fiber. E.g. flexion of arm

B. Isometric Contraction-contraction in which length of muscle fibers remain same and tension is increased. E.g. holding book by hand, pulling any heavy object

3. **Muscle Tone-** the muscle fibers always maintain a state of slight contraction with certain degree of vigor and tension. This is a state of partial contraction of muscles. It is achieved by the contraction of a few muscle fibres at a time.
4. **Extensibility-** an ability of muscle fibers to stretch without being damaged
5. **Elasticity-** an ability of muscle fibers to return to its original length and shape after contraction or extension

Functions of Muscular tissue:

Through sustained contraction or alternating contraction & relaxation, muscular tissue has four functions:

1. **Producing Body Movements-** movements of the whole body such as walking and running, and localized movements such as holding pen, nodding head, rely on integrated functioning of bones, joints and skeletal muscles

2. **Stabilizing Body Positions-** Skeletal muscle contractions stabilize joints and help maintain body positions such as sitting & standing

3. **Storing and moving substances within body-** sustained contractions of sphincters temporarily stores food in stomach and urine in urinary bladder. Cardiac muscle contractions pump blood through blood vessels of the body.

-cont.

Smooth muscles contractions move food and substances such as bile, enzymes through g.i.t., push gametes through passageway of reproductive system, propel urine through urinary system.

Skeletal muscle contractions promote the flow of lymph and helps the return of blood to heart.

4. **Generating heat-** As muscular tissue contracts, it produces heat, by thermogenesis. Heat generated by muscle is used to maintain normal body temp.

Types of Muscular Tissue

Muscle	Striations	Control	Nerve Supply
Skeletal	Present	Voluntary	Somatic
Cardiac	Present	Involuntary	Autonomic
Smooth	Absent	Involuntary	Autonomic

COMPOSITION OF CONNECTIVE TISSUE

- **Collagen Fibers:** Large fibers made of the protein collagen and are typically the most abundant fibers. Promote tissue flexibility.
- **Elastic Fibers:** Intermediate fibers made of the protein elastin. Branching fibers that allow for stretch and recoil
- **Reticular Fibers:** Small delicate, branched fibers that have same chemical composition of collagen. Forms structural framework for organs such as spleen and lymph nodes.

CLASSIFICATION OF CONNECTIVE TISSUE

1) Loose connective tissue :

a) Areolar connective tissue

b) Adipose connective tissue

c) Reticular connective tissue

2) Dense connective tissue:

a) Dense regular connective tissue

b) Dense irregular connective tissue

c) Elastic connective tissue

CLASSIFICATION OF CONNECTIVE TISSUE

3) Cartilage:

a) Hyaline cartilage

b) Fibro cartilage

c) Elastic cartilage

4) Bone tissue

Liquid connective tissue

a) Blood tissue

b) Lymph

Loose connective tissue

Areolar Connective tissue:

1) They forms a loose network in intracellular material .

2) It consists of collagen, elastic fibers, reticular fibers and several kinds of cells.

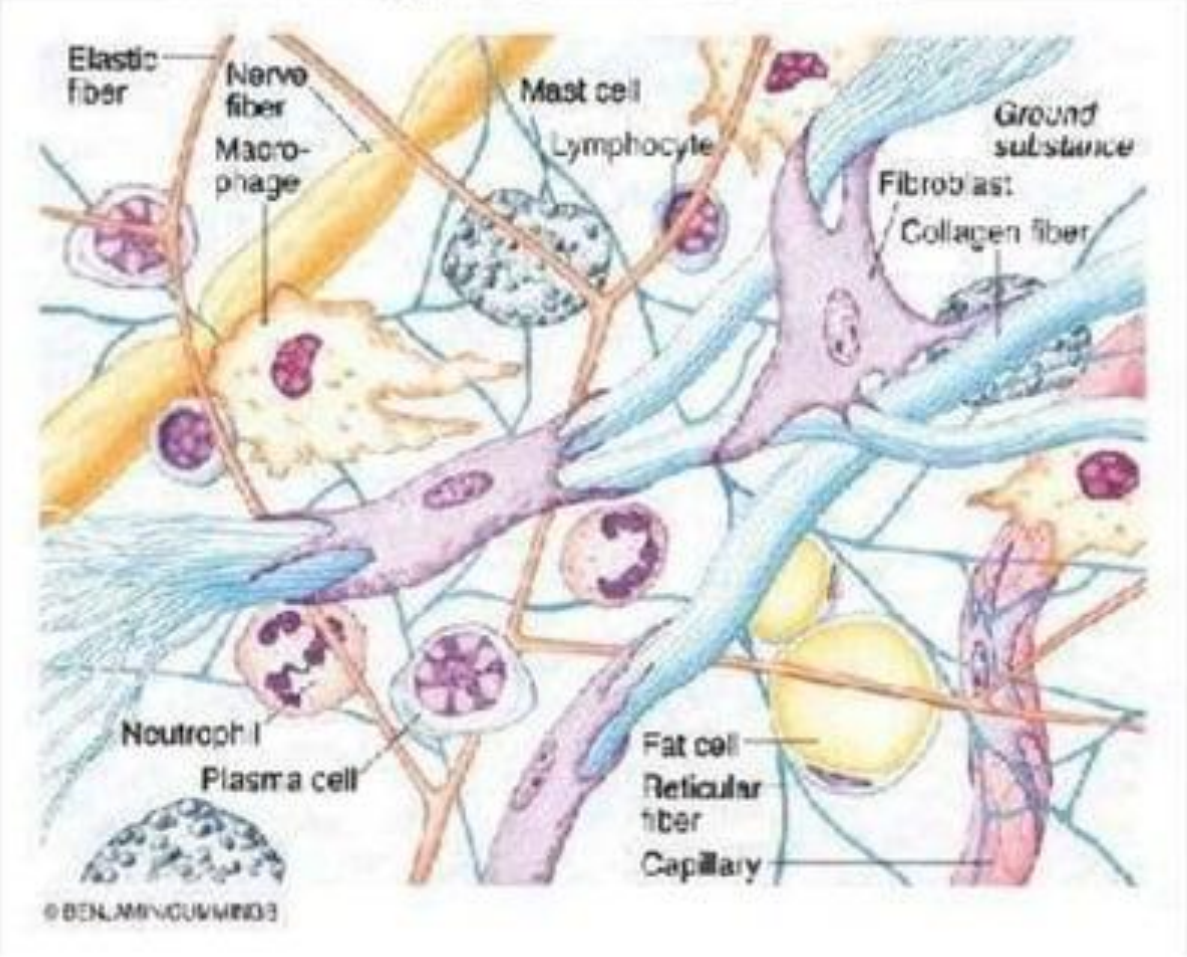
Location: Below the skin, fill space between muscles, supports blood vessels and nerves in alimentary canal.

Functions: It gives strength, elasticity and support to tissue.

Areolar Connective tissue:

Areolar Tissue

the Prototype Connective Tissue



ADIPOSE CONNECTIVE TISSUE

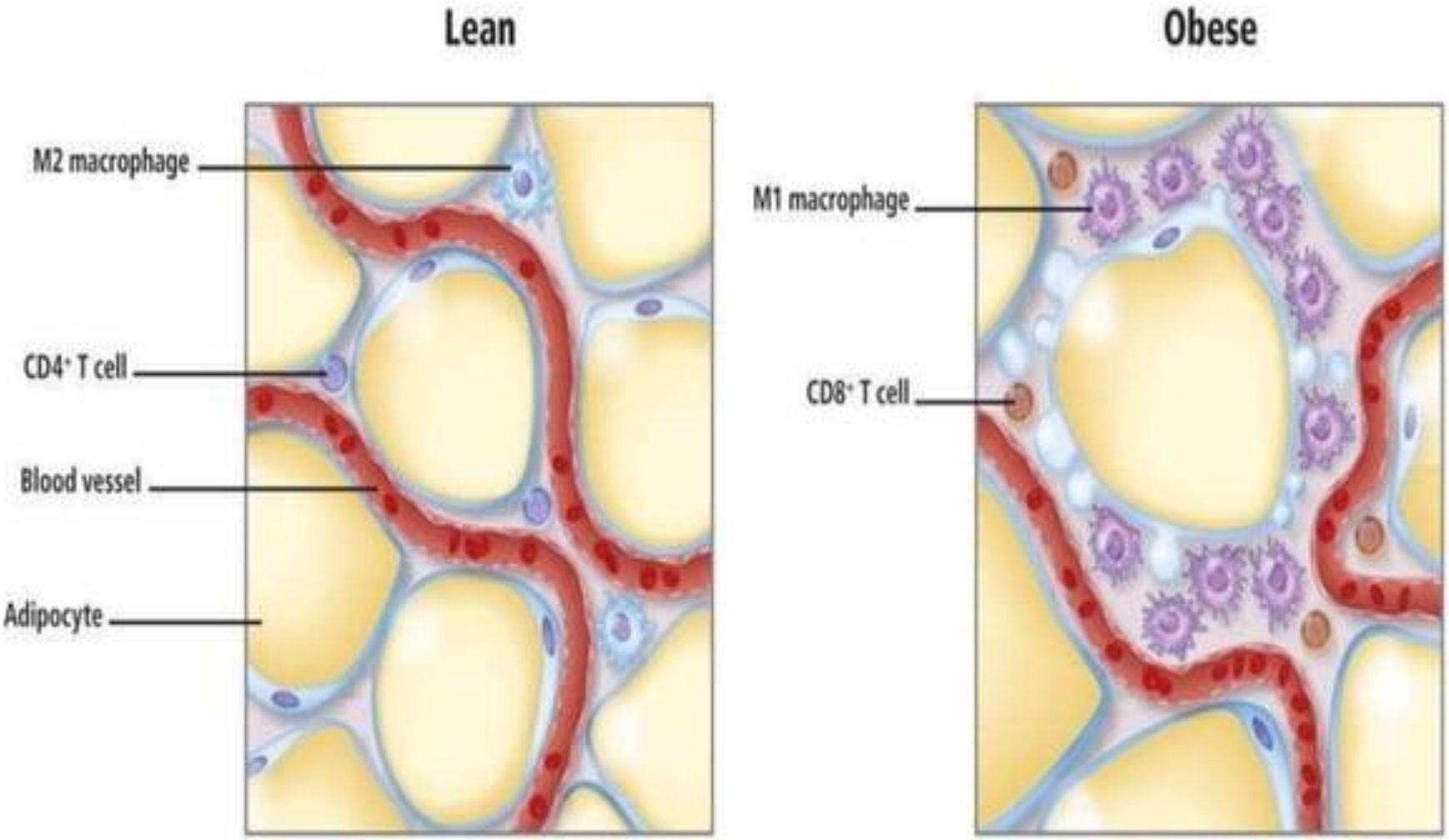
- It consists of adipocytes which stores fat.

Location: It is present in subcutaneous layer deep in the skin, around the heart and kidneys

Functions :

- Prevents heat loose from body.
- Act as reservoir of energy.
- It give shape to the limbs and body.
- It protects underlying organ from injury.

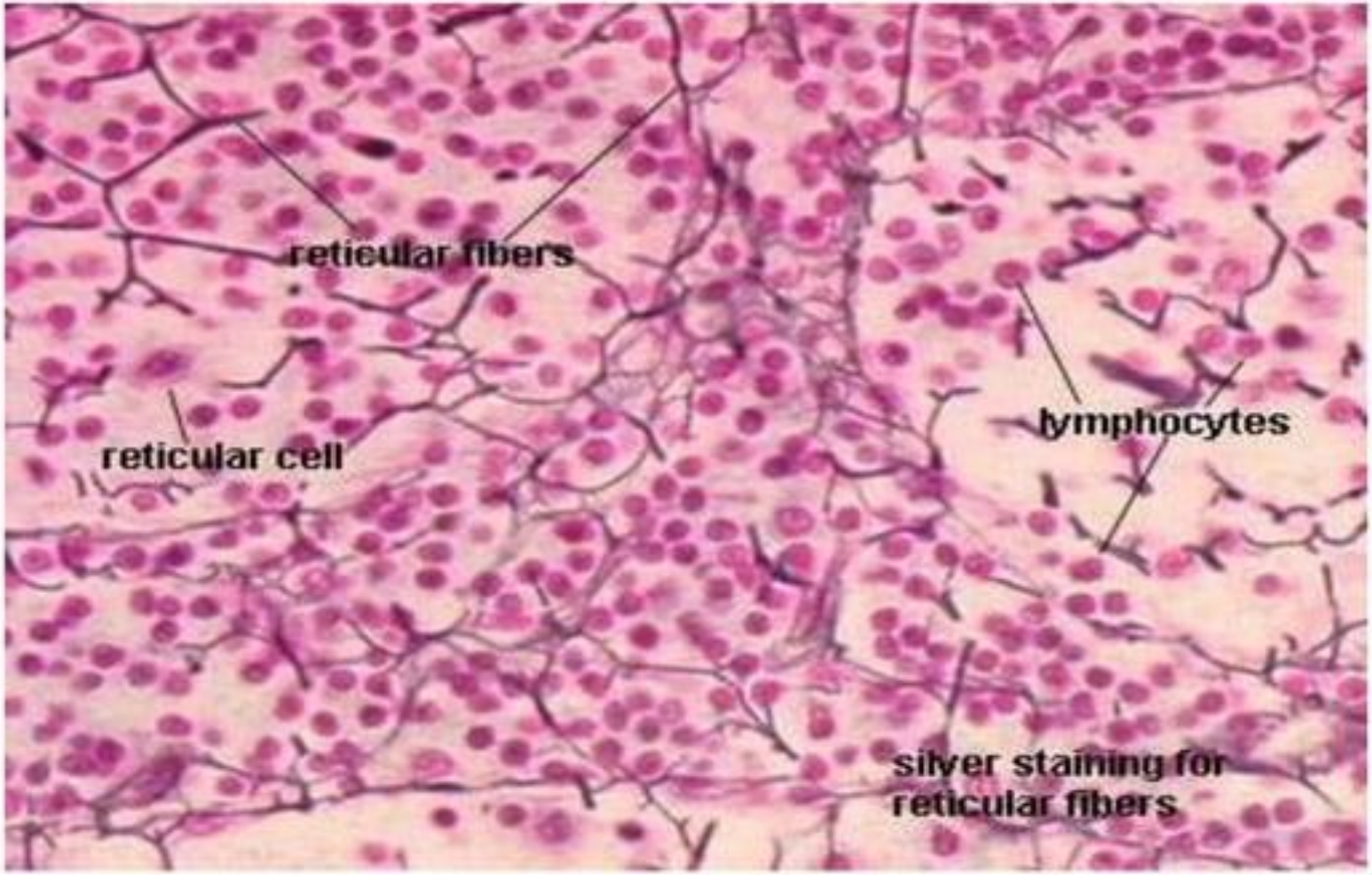
ADIPOSE CONNECTIVE TISSUE



RETICULAR CONNECTIVE TISSUE

- It contains reticular fibers and reticular cells.
- **Location:** It is present in the supporting framework of liver, spleen, lymph nodes, red bone marrow and it is also found around blood vessels and muscles.
- **Functions:** It binds together smooth muscle tissue cells, filters and removes microbes in the lymph node.

RETICULAR CONNECTIVE TISSUE



DENSE CONNECTIVE TISSUE

- In this tissue, fibers are densely packed.
- The fiber content is higher.
- Cell content is lower as compared to loose connective tissue.

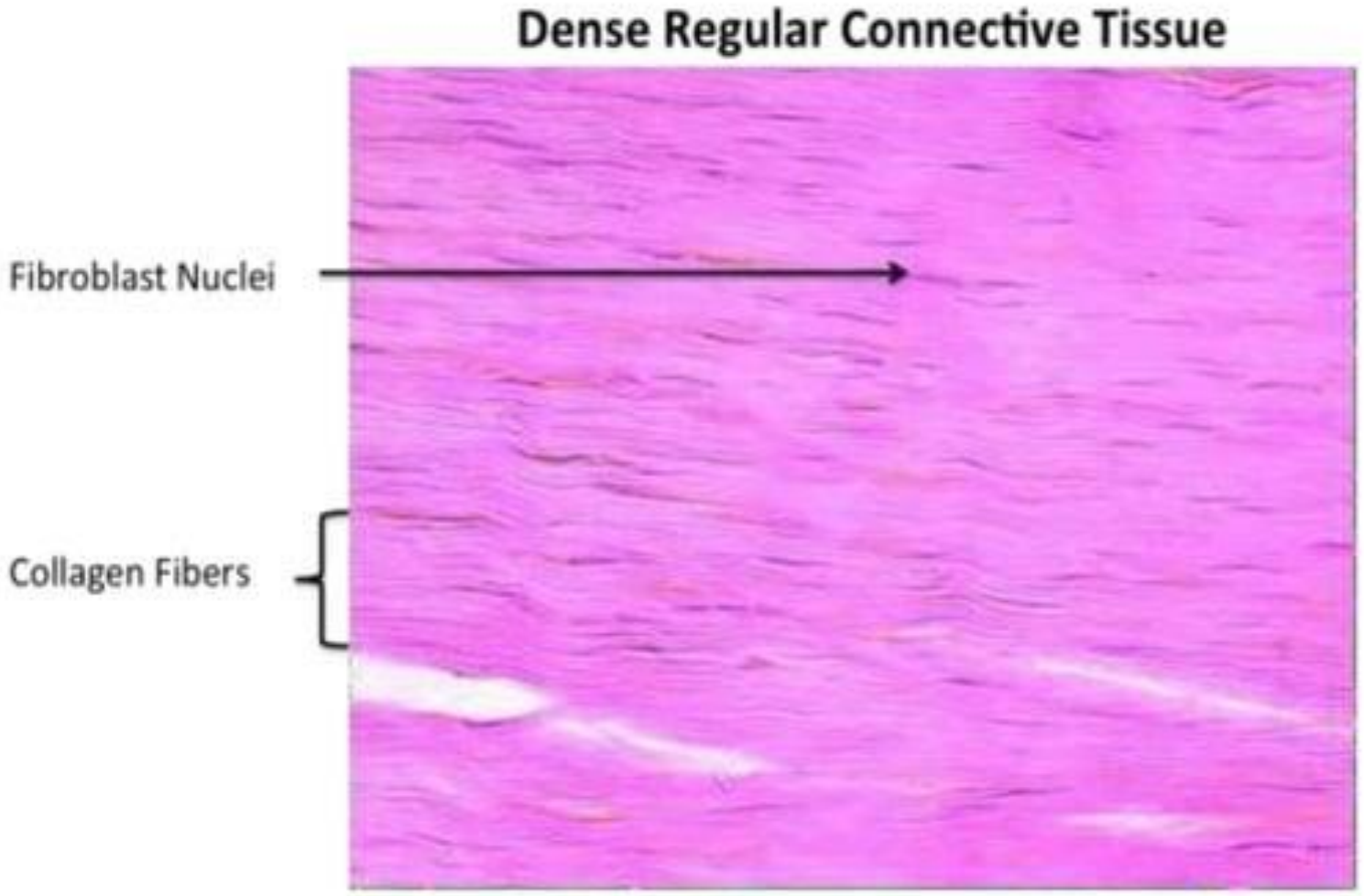
DENSE REGULAR CONNECTIVE TISSUE

- Bundles of collagen fibers are arranged in parallel patterns to provide strength to tissue.
- Fibroblast are appear in rows between the fibers.
- It is tough in nature.

Location: It forms tendons (attach muscle bone) and ligaments(attach bone to bone).

Functions: It provides strong attachment to structure.

DENSE REGULAR CONNECTIVE TISSUE



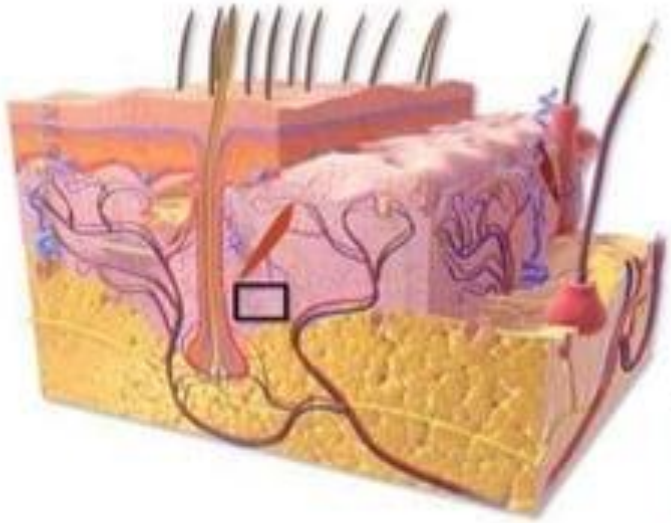
DENSE IRREGULAR CONNECTIVE TISSUE

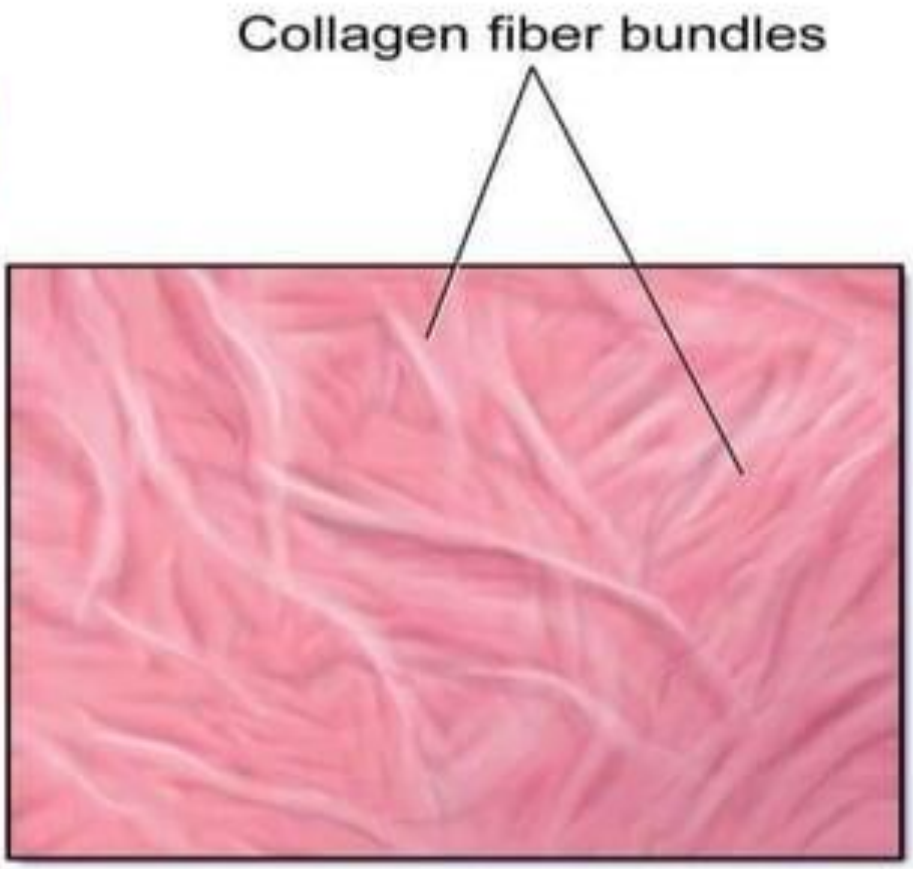
- It contains collagen fibers which are irregular arranged and a few fibroblasts are appear in rows between the fibers.

Location: It present in dermis layer of skin, membrane capsules around kidneys, liver, testes and lymph node, heart valves.

Functions: It provides strength to different organs.

DENSE IRREGULAR CONNECTIVE TISSUE





Dense Irregular Connective Tissue

Deep Dermis

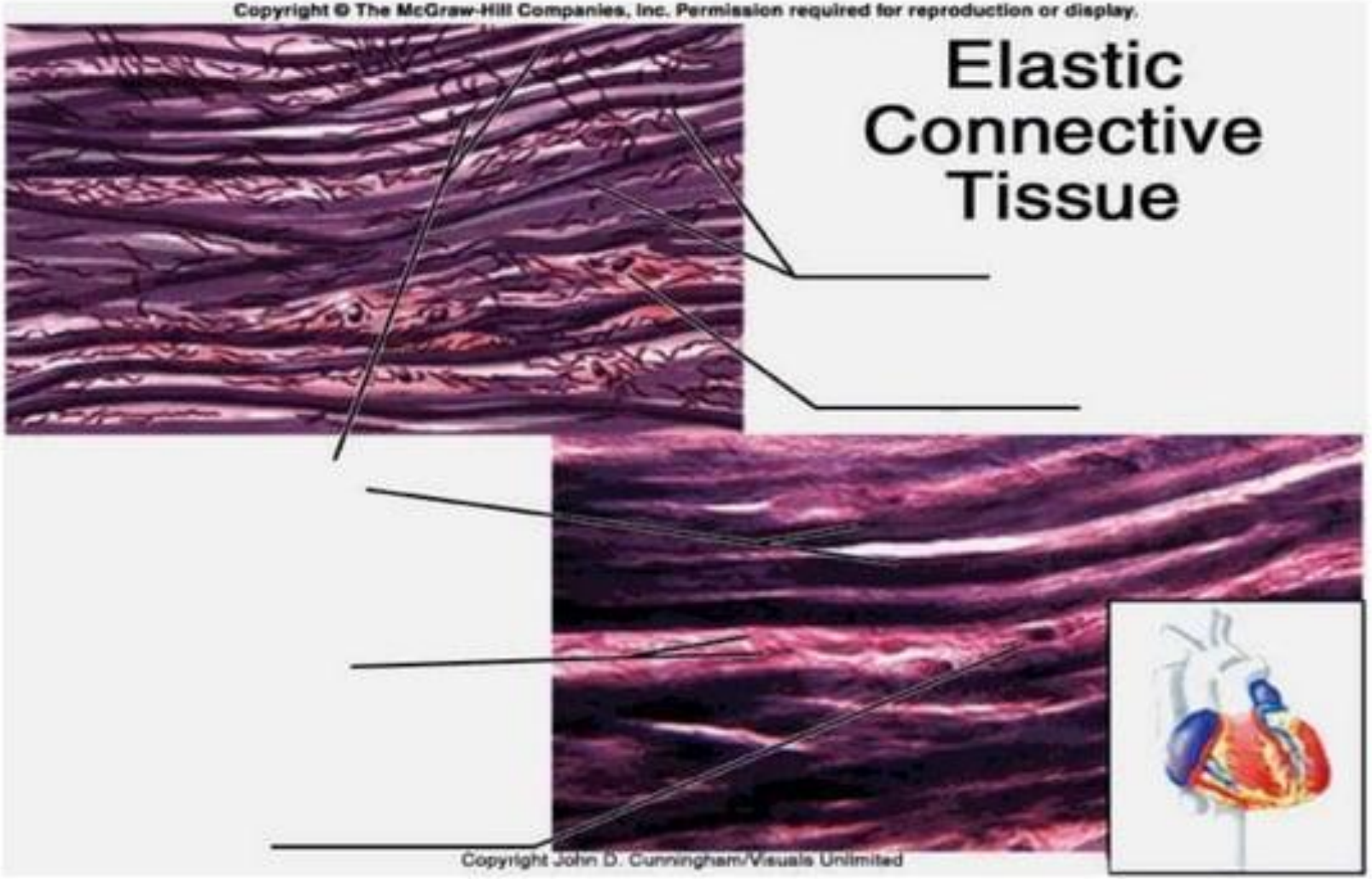
ELASTIC CONNECTIVE TISSUE

- It consists of freely branching elastic fibers.
- Fibroblast are present in space between fibers.
- It is yellowish in colour.

Location: It is present in tissues , walls of elastic arteries, trachea, bronchial tubes and vocal cords.

Functions: It allows stretching of various organs.

ELASTIC CONNECTIVE TISSUE



CARTILAGE

- It consist of network of closely packed collagen fibers and elastic fibers.
- The cells of mature cartilage called as chondrocytes.

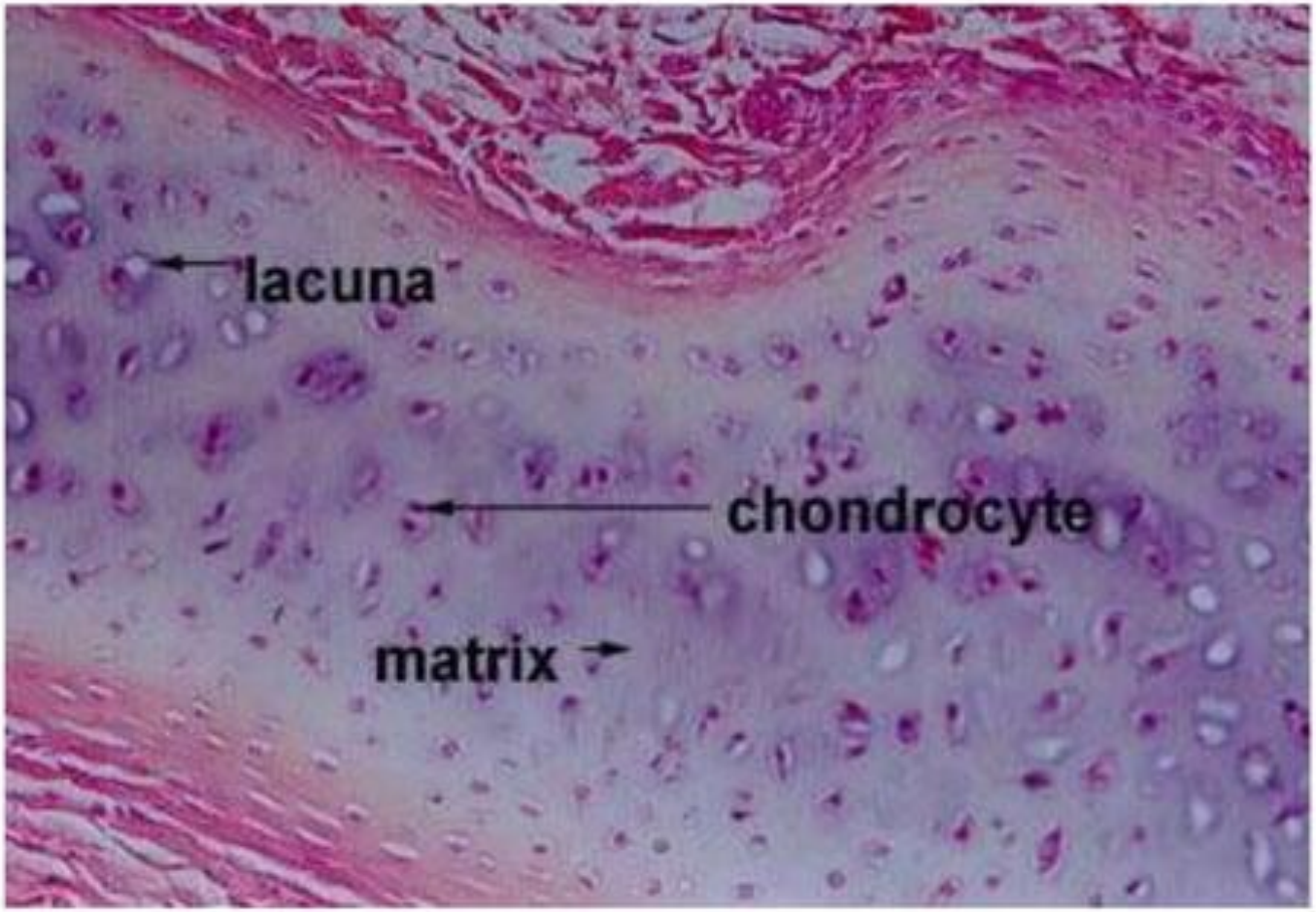
HYALINE CARTILAGE

- It is bluish white in color.
- It consists of fine collagen fibers and many chondrocytes.

Location: It is present at the end of long bones, anterior ends of ribs, nose and parts of larynx, trachea, bronchi, bronchial tubes.

Function: It provides small surface for movement at joints, flexibility and support.

HYALINE CARTILAGE



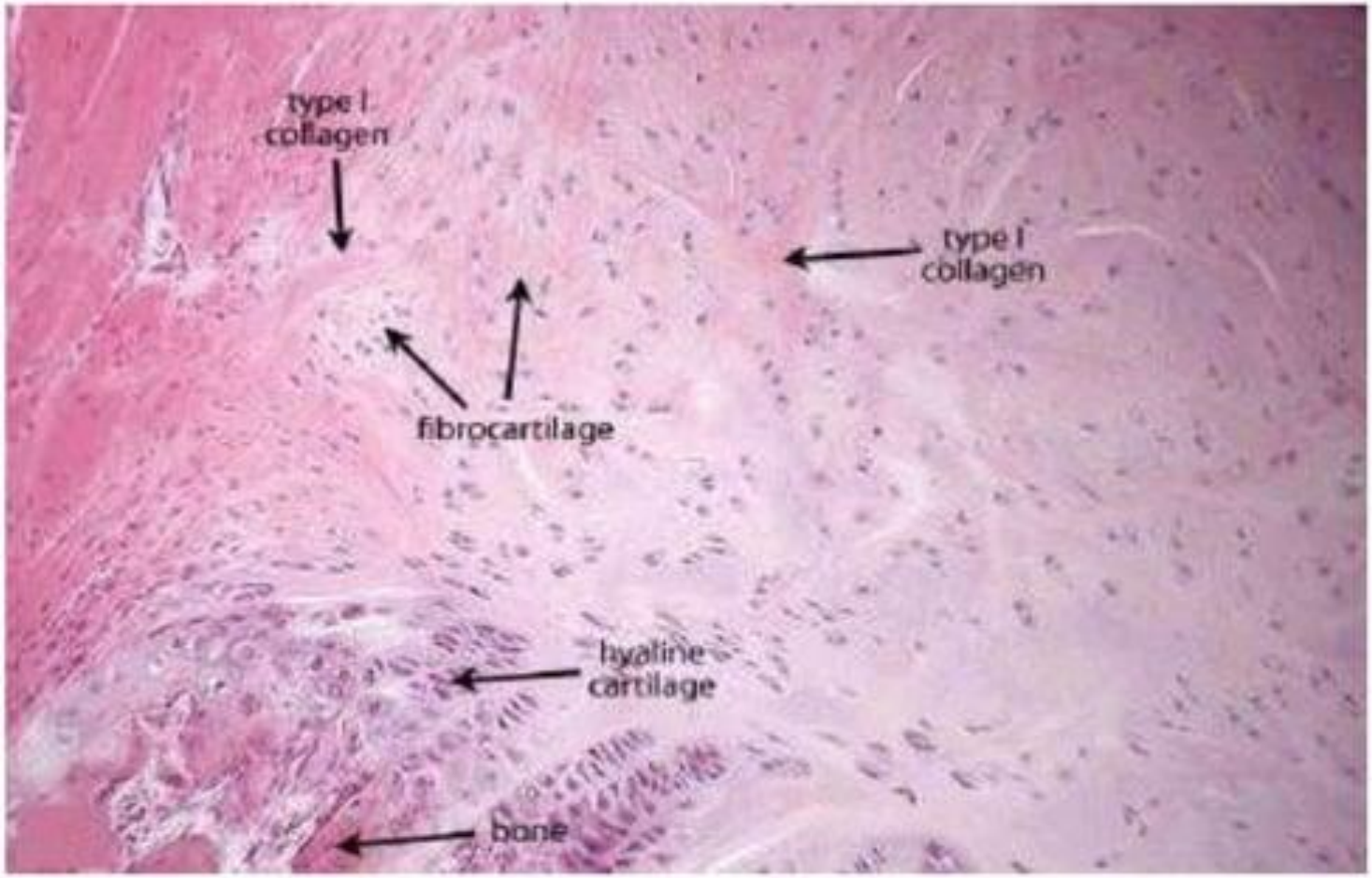
FIBRO CARTILAGE

- It is strongest form of cartilage.
- The chondrocytes are scattered among the bundle collagen fibers within the extracellular matrix.

Location: It is present in inter-verteblar disc.

Functions: It covers and protects bony structures of body.

FIBRO CARTILAGE



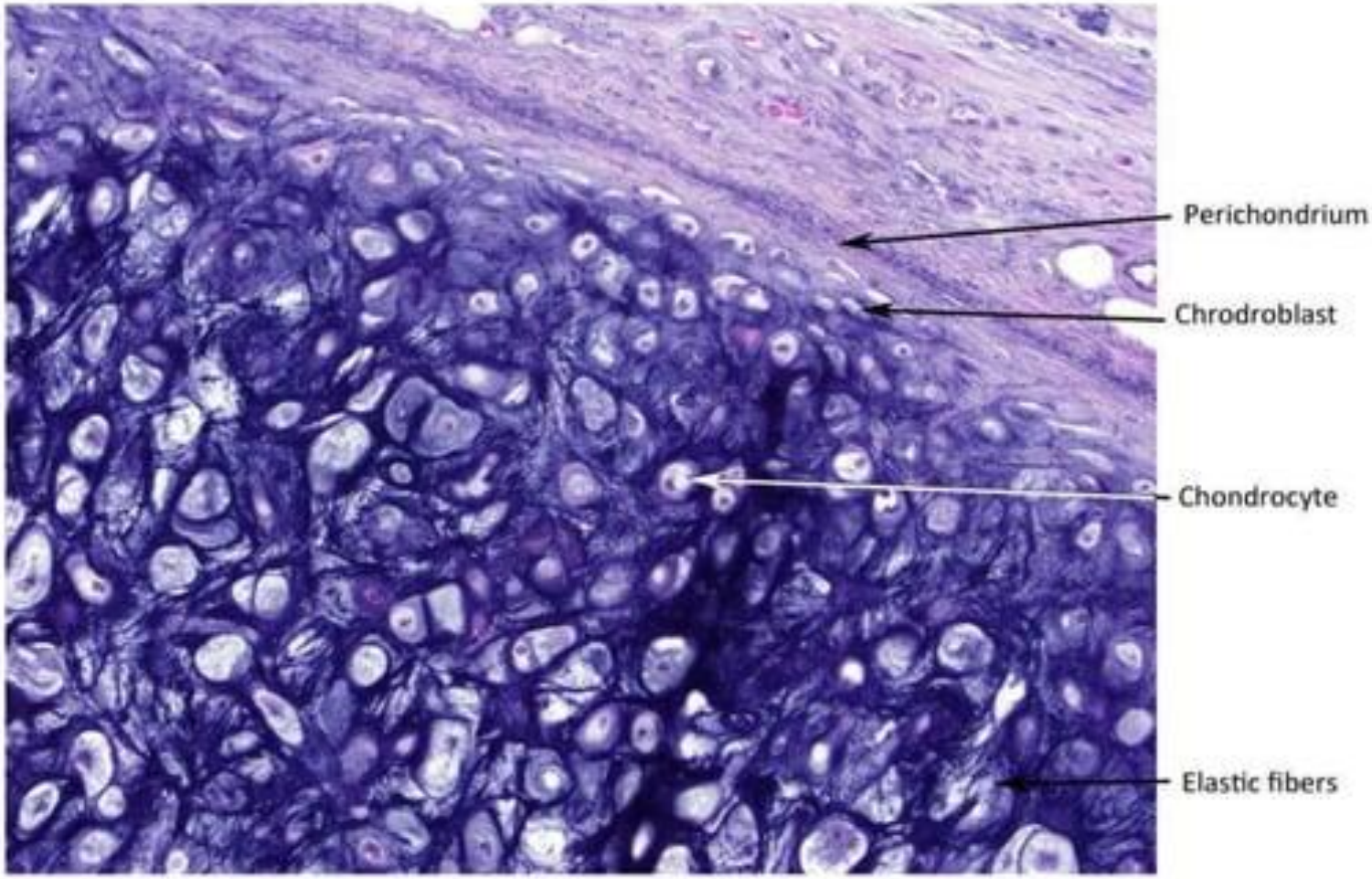
ELASTIC CARTILAGE

- The chondrocytes are located within a threadlike network of elastic fibers within extracellular matrix.

Location: It is present in pinna of ear and top of larynx.

Functions: It provides strength and elasticity and maintain the shape of certain organs such as the external ear.

ELASTIC CARTILAGE



Nervous Tissue

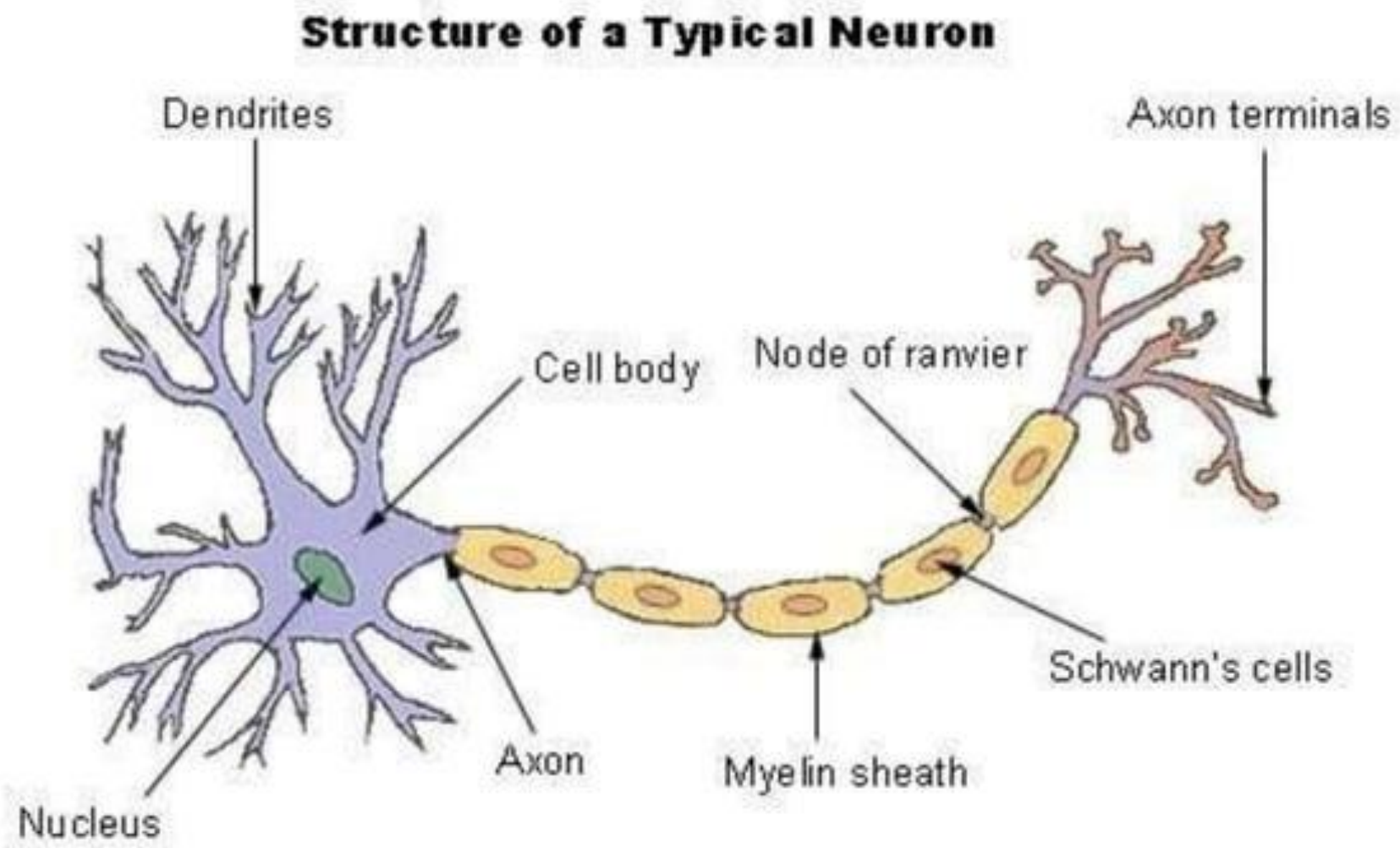
The human body is composed of approximately 200 distinctly different types of cells. These cells are organized into four basic tissues that in turn, are assembled to form organs.

Nervous tissue consists of two kinds of nerve cells:

Neurons are the basic structural unit of the nervous system. Each cell consists of the following parts; the cell body contains the nucleus and other cellular organelles.

The dendrites are typically short, slender extensions of the cell body that receive stimuli. The axon is typically a long, slender extension of the cell body that sends stimuli. The axon branches are, typically, smaller extensions of the axon. Neuroglia, or glial cells, provides support functions for the neurons, such as insulation or anchoring neurons to blood vessels.

Neuron


Structure of a Typical Neuron
Dendrites
Axon terminals
Cell body
Node of ranvier
Schwann's cells
Axon
Myelin sheath
Nucleus

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