tissue is a group of similar cells of the same origin that perform a specific function

There are four basic tissue types in the body are :-

1- Epithelial tissues (Epithelium)

2- Connective tissues

3- Muscular tissues

4- Nervous tissues

epithelial tissues consist of two types :-

A- Covering or lining epithelial tissues

B- Glandular epithelial tissues

Covering epithelial tissues covers the outer layers or lining of the organs , according to the number of cells layers classified to :-

a-Simple epithelial tissue

1-Simple squamous epithelial tissue

2- Simple cuboidal epithelial tissue

3- Simple columnar epithelial tissue

4-peudostratified columnar epithelial tissue

b- Stratified epithelial tissue

1- Stratified sequamous epithelial tissue

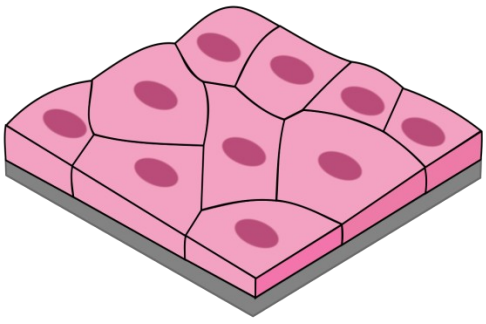
2- Stratified cuboidal epithelial tissue

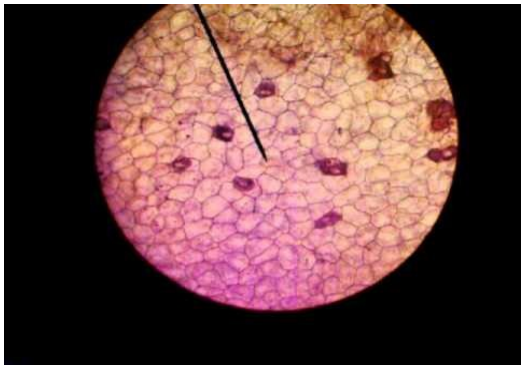
3- Stratified columnar epithelial tissue

4-Transitional epithelial

A\ a-Simple epithelial tissue:

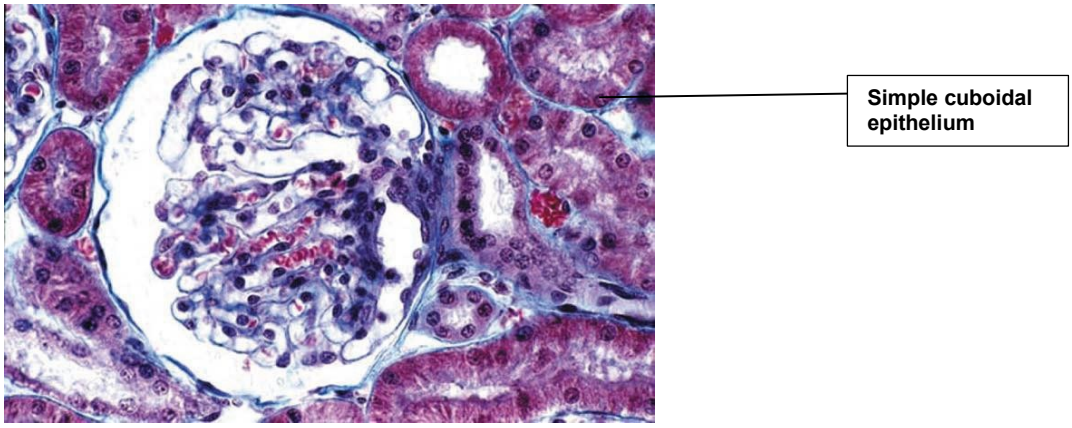
1\Simple sequamous epithelial tissue:- composed of only one layer based on basement membrane (blood vessels, covering of organs)





2-Simple cuboidal epithelial tissue:-

Composed of a single layer of cells whose height , width and depth are the same and have centrally placed nucleus . Line small excretory ducts like proximal convoluted tubule kidney



Simple cuboidal epithelium

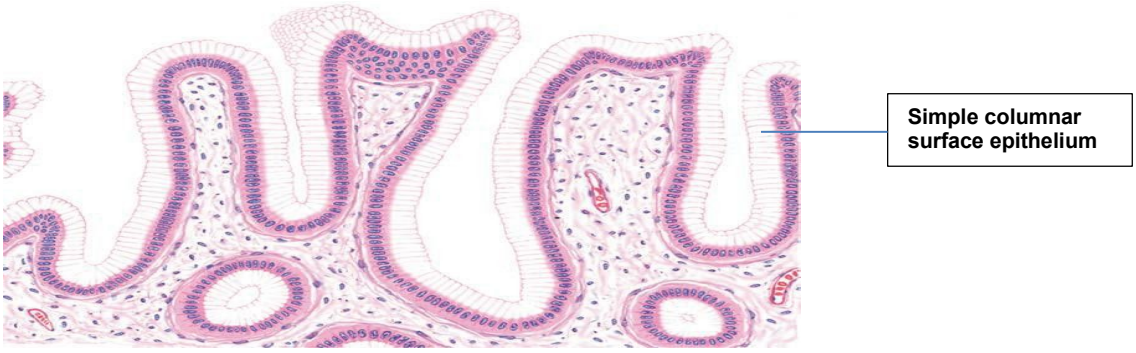
3-Simple columnar epithelial tissue :-

. The intestinal villi, illustrated in transverse section and longitudinal section, are covered by simple columnar epithelium. **In the small intestine**, the epithelium consists of two cell types:

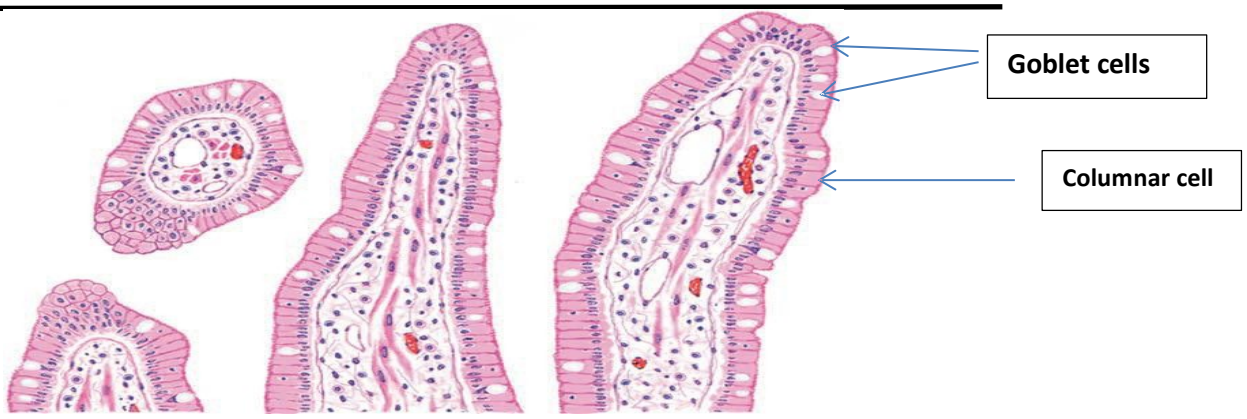
columnar cells with striated borders and oval-shaped **goblet cells**.

The striated border is seen as a reddish outer cell layer with faint vertical striations; these striations represent microvilli on the apices of columnar cells.

Pale-staining goblet cells are interspersed among the columnar cells. During routine histologic preparation, the mucus is lost.



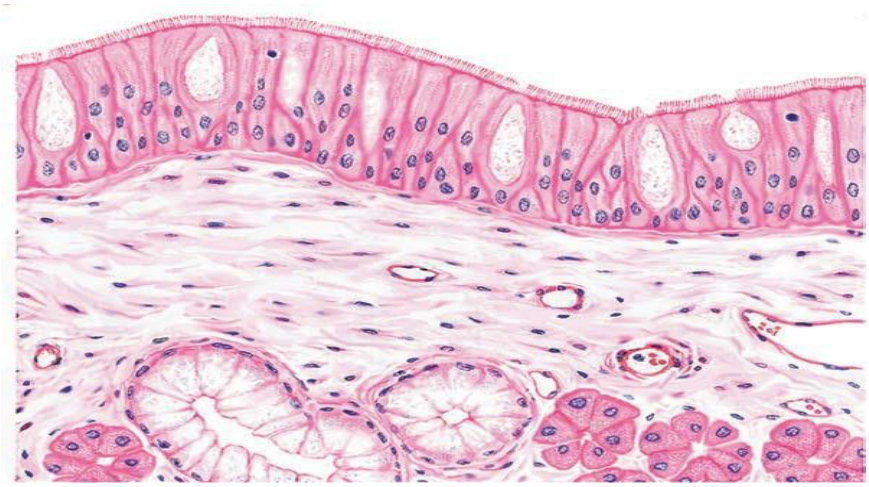
Simple columnar epithelial tissue



Simple columnar epithelial tissue

4-pseudostratified columnar epithelial tissue :- Several layers of nuclei suggest several layers ,**found in the trachea**, composed of four types of cells these are :-

1- Columar cells 2- Fusiform cells 3- Basal cells 4- Goblet cells .



pseudostratified columnar epithelial tissue

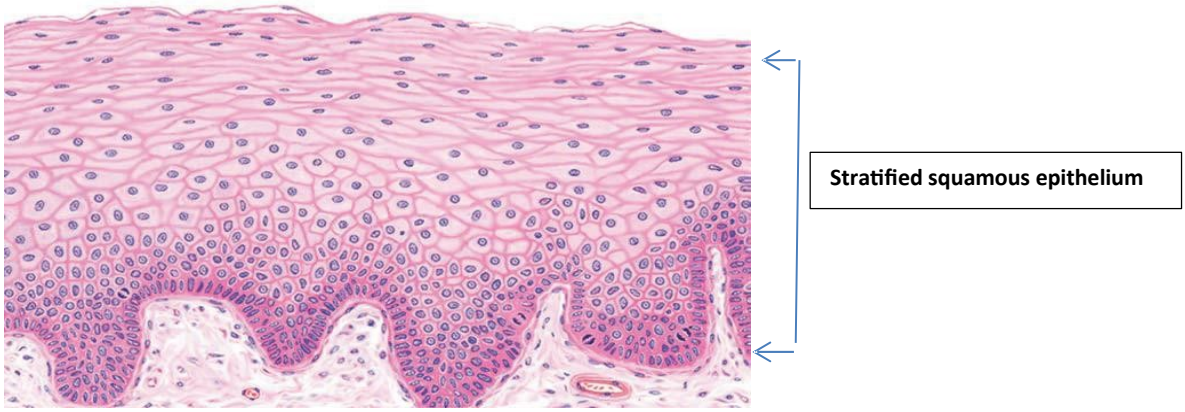
B\Stratified epithelial tissue :- Composed of more than one layer based on basement membrane , classified to :-

1-Stratified squamous epithelial tissue

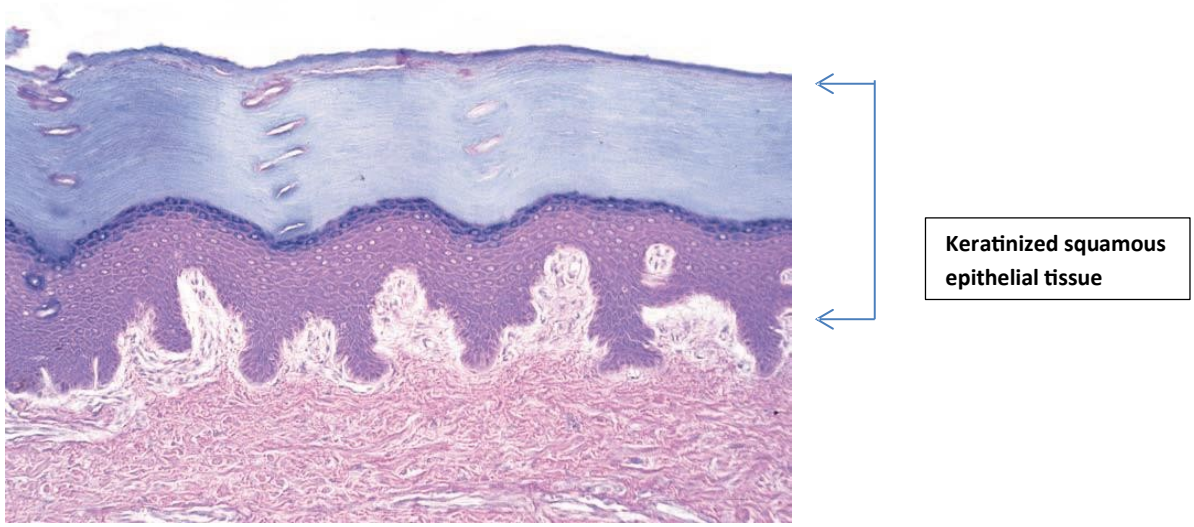
Contains multiple cell layers , the basal cell are cuboidal to columnar , these cells give rise to cells that migrate to word the surface and become squamous . There are two types of stratified squamous epithelial tissue:-

-**Non keratinized squamous epithelial tissue** which is covering moist cavities such as **mouth** .

- **Keratinized squamous epithelial tissue** found on exposed surface of the body such as the **skin** .



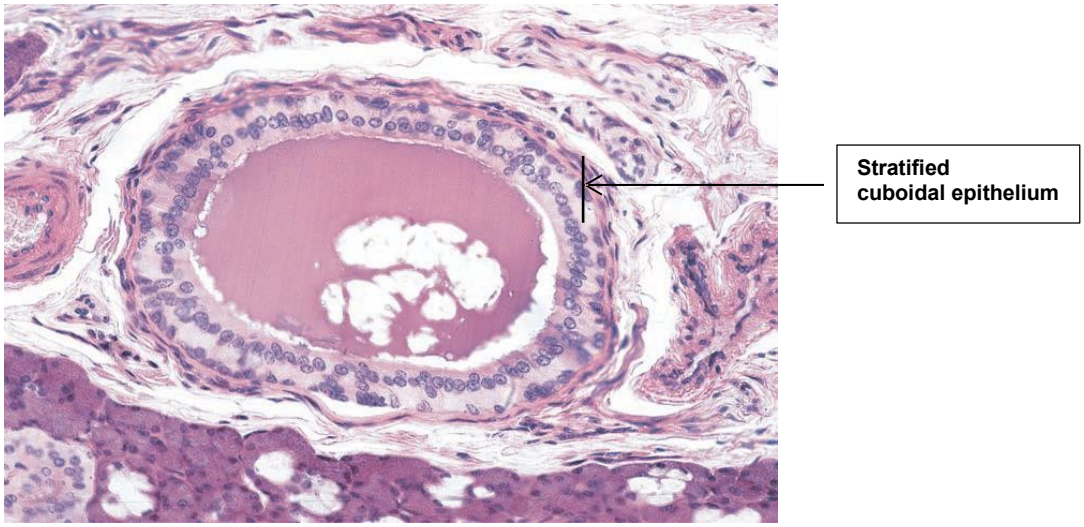
Non keratinized squamous epithelial tissue



Keratinized squamous epithelial tissue

2- Stratified cuboidal epithelial tissue

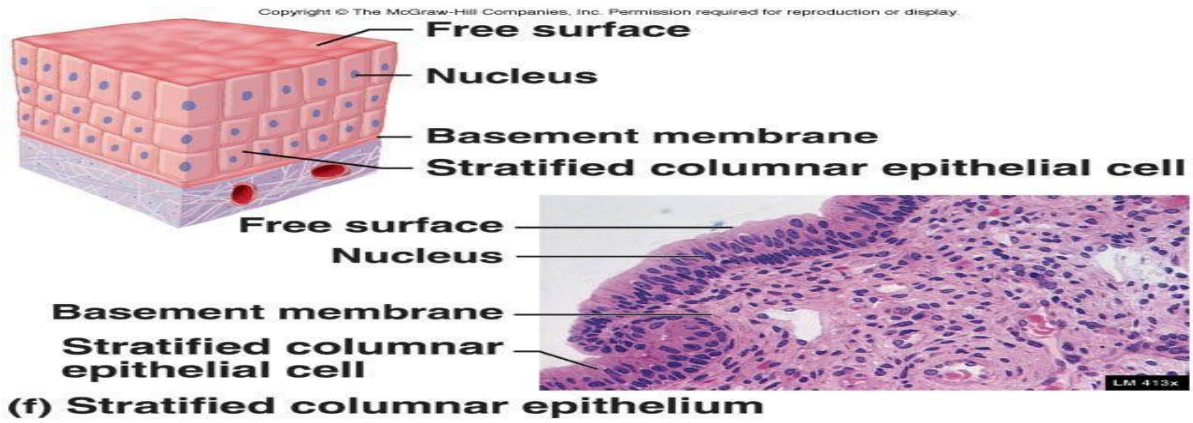
The surface layer cuboidal in shape , found in the **large excretory ducts in the salivary glands.**



Stratified cuboidal epithelium

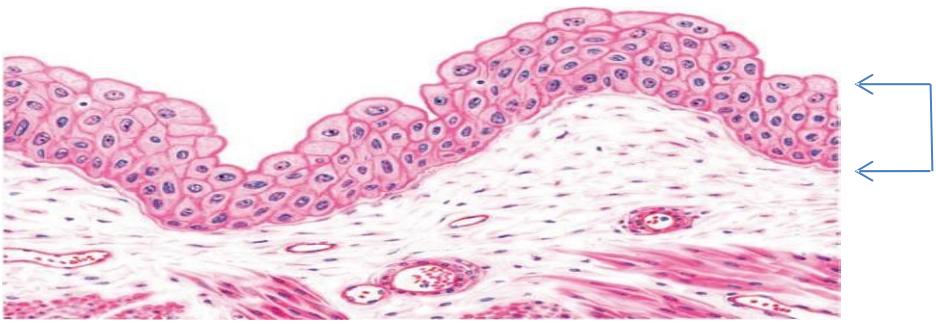
3- Stratified columnar epithelial tissue

Is found in **sweat glands**.



4-Transitional epithelial tissue

Is found in **bladder of the urinary system**. Its composed of several layer of similar cells . this type of tissue allows distention of urinary organs during urine accumulation.



Transitional epithelial tissue

B-Glandular tissue

cells of the glands developed from epithelial tissue , the glandular epithelial tissues classified to :-

1-Exocrine glands (intestinal glands)

A -Unicellular glands.

B-multicellular glands.

2- Endocrine glands (pituitary, thyroid glands)

3-mixed gland (pancreas).

connective tissues

Second stage

Connective Tissue

Consists of two basic elements:

Cells

and

Matrix(Ground Substance & fibers)

True Connective Tissue Cells

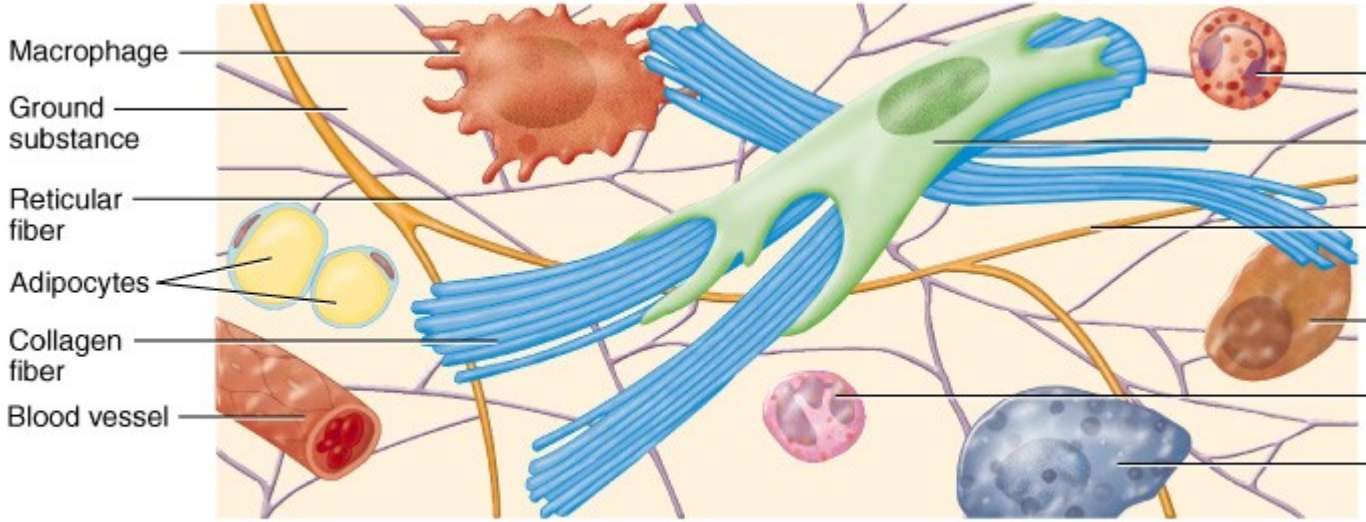
Fibroblasts: Secrete both fibers and ground substance of the matrix .

Macrophages: Phagocytes that develop from Monocytes .

Plasma Cells: Antibody secreting cells that develop from B Lymphocytes .

Mast Cells: Produce histamine that help dilate small blood vessels in reaction to injury.

Adipocytes: Fat cells that store triglycerides, support, protect and insulate .



Matrix Fibers

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.

TYPES OF CONNECTIVE TISSUE

1-Embryonic c.t

a-mesenchymal c.t

b-mucous c.t

2. True Connective Tissue

   a. **Loose Connective Tissue**
   b. **Dense Connective Tissue**

3. Supportive Connective Tissue

   a. **Cartilage**
   b. **Bone**

4. Liquid Connective Tissue

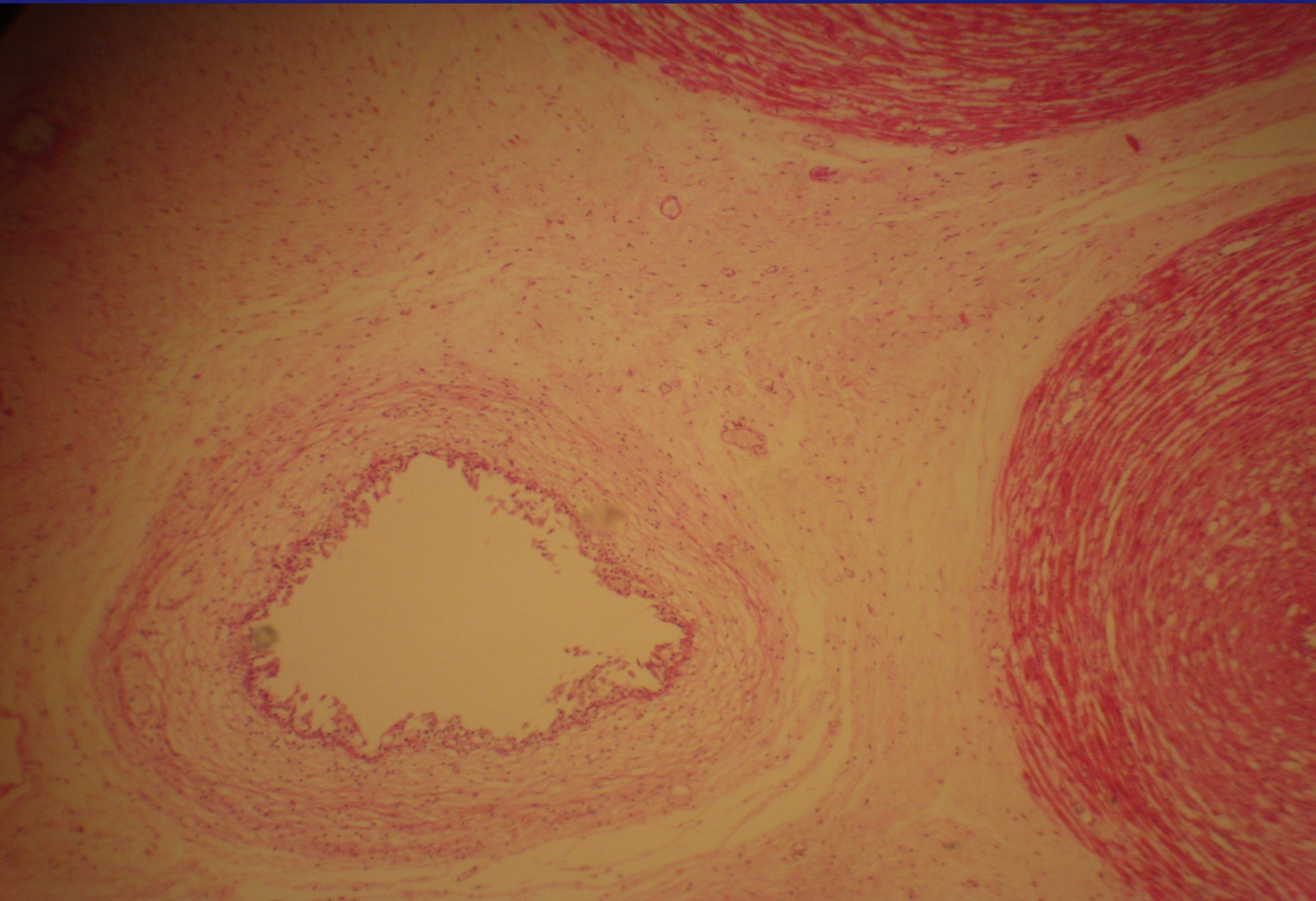
   a. **Blood**

Embryonic C.T.

- **1-Mesenchymal C.T.(Mesenchyme)**
- The mesenchyme present only in the early weeks of embryo the C.T.s originated from the embryonic tissue (mesenchyme) formed by ***elongated*** undifferentiated cells . These cells one characterized by ***oval nuclei*** with ***prominent nucleoli***
  viscous extracellular substance containing **few fiber**

- **2-Mucous tissue**
- The mucous tissue has an a ***bundant of ground substance*** composed chiefly of hyaluronic acid , making it a ***jelly like*** tissue containing ***very few collagen fibers*** with scattered ***fibroblasts*** distributed randomly in an abundant ground substance The mucous tissue is the principal component of the umbilical cord

Mucous tissue



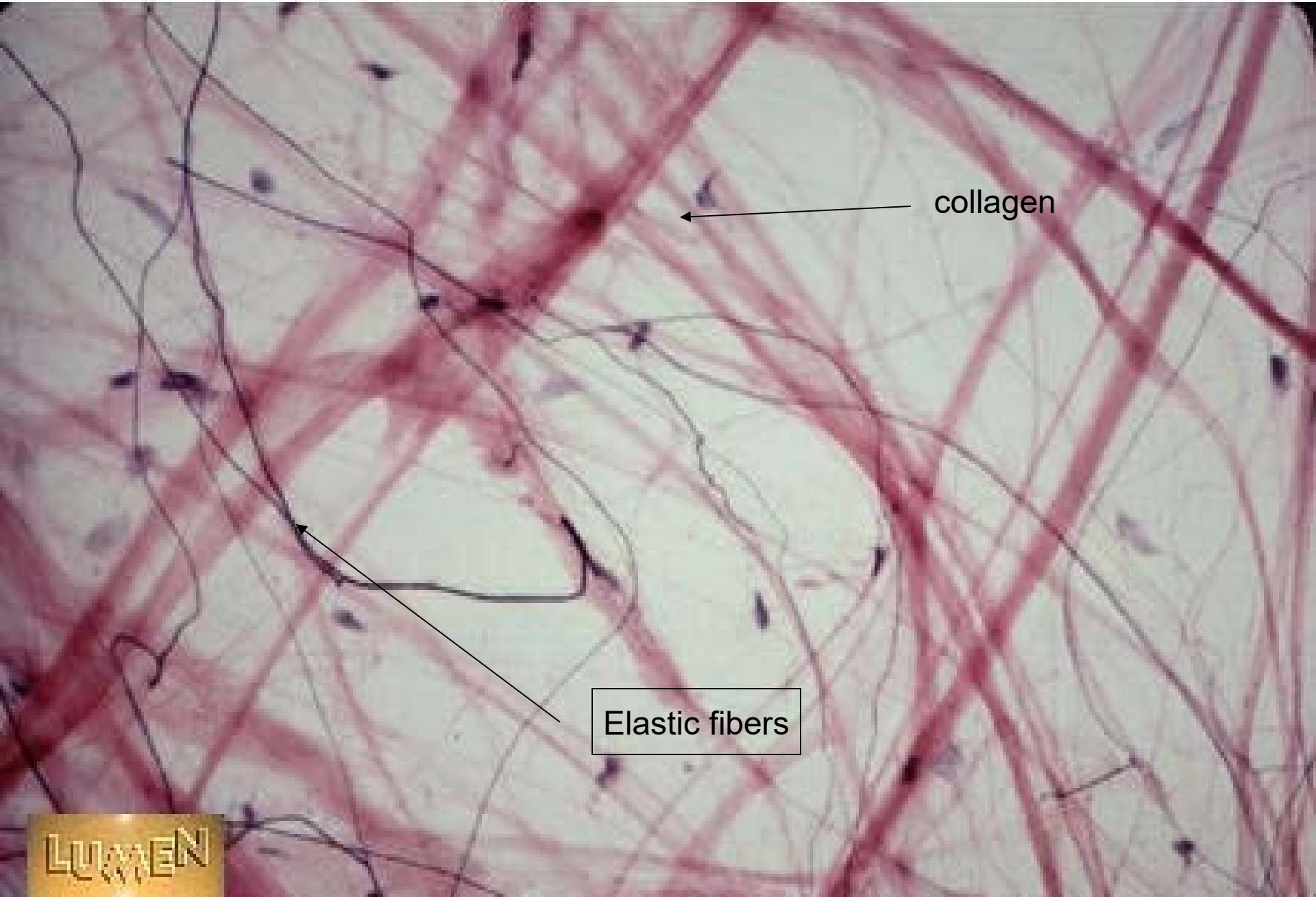
True or Proper Connective Tissue

1. **Loose Connective Tissue:**
   - **a. Areolar tissue**
     - Widely distributed under epithelia
   - **b. Adipose tissue**
     - Hypodermis, within abdomen, breasts
   - **c. Reticular connective tissue**
     - Lymphoid organs such as lymph nodes

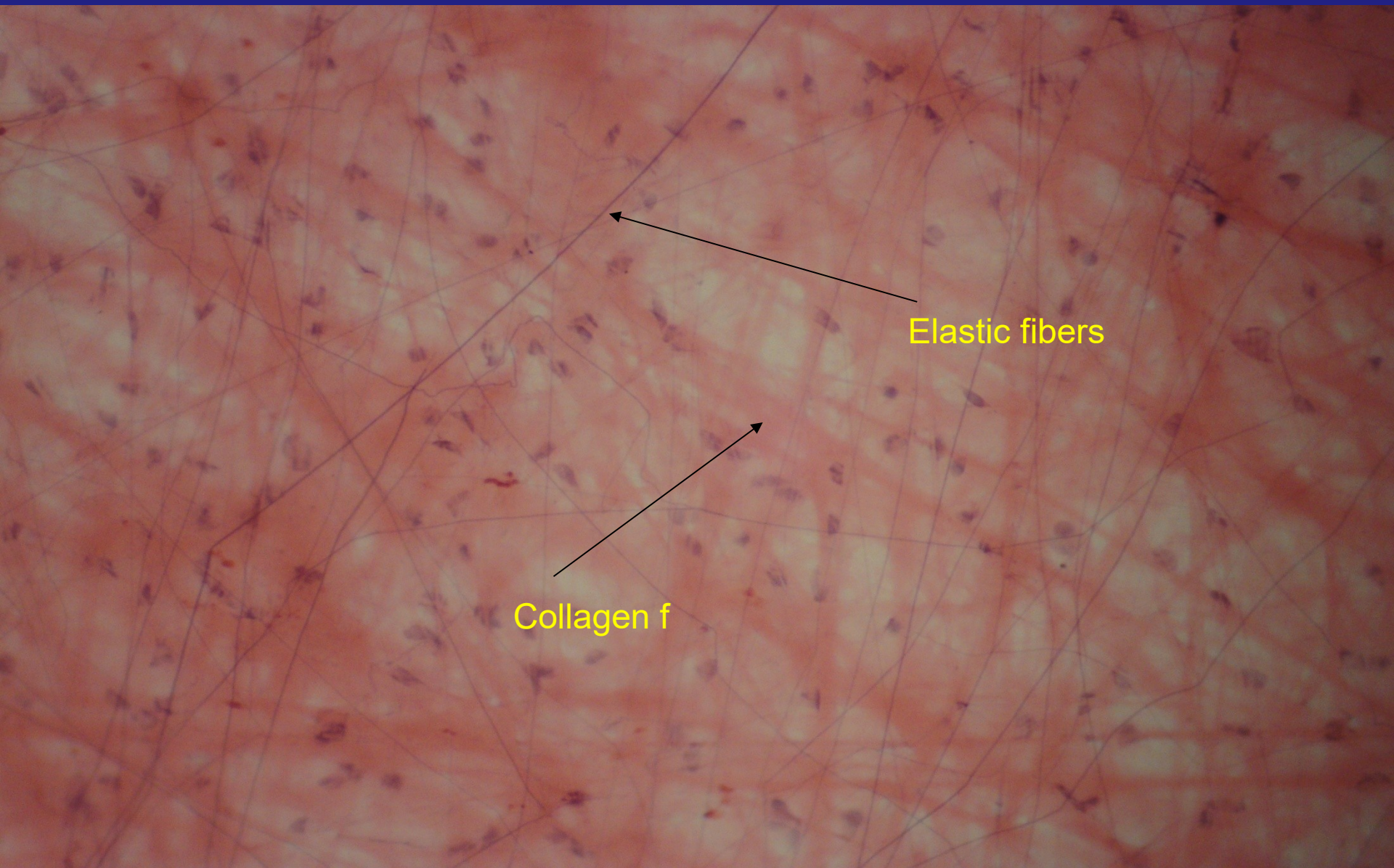
LOOSE Connective Tissue:

1. Areolar CT
   - consists of all 3 types of fibers, several types of cells, and semi-fluid ground substance
   - found in subcutaneous layer and mucous membranes, and around blood vessels, nerves and organs
   - function = strength, support and elasticity

Histology Lab Part 3: Slide 8

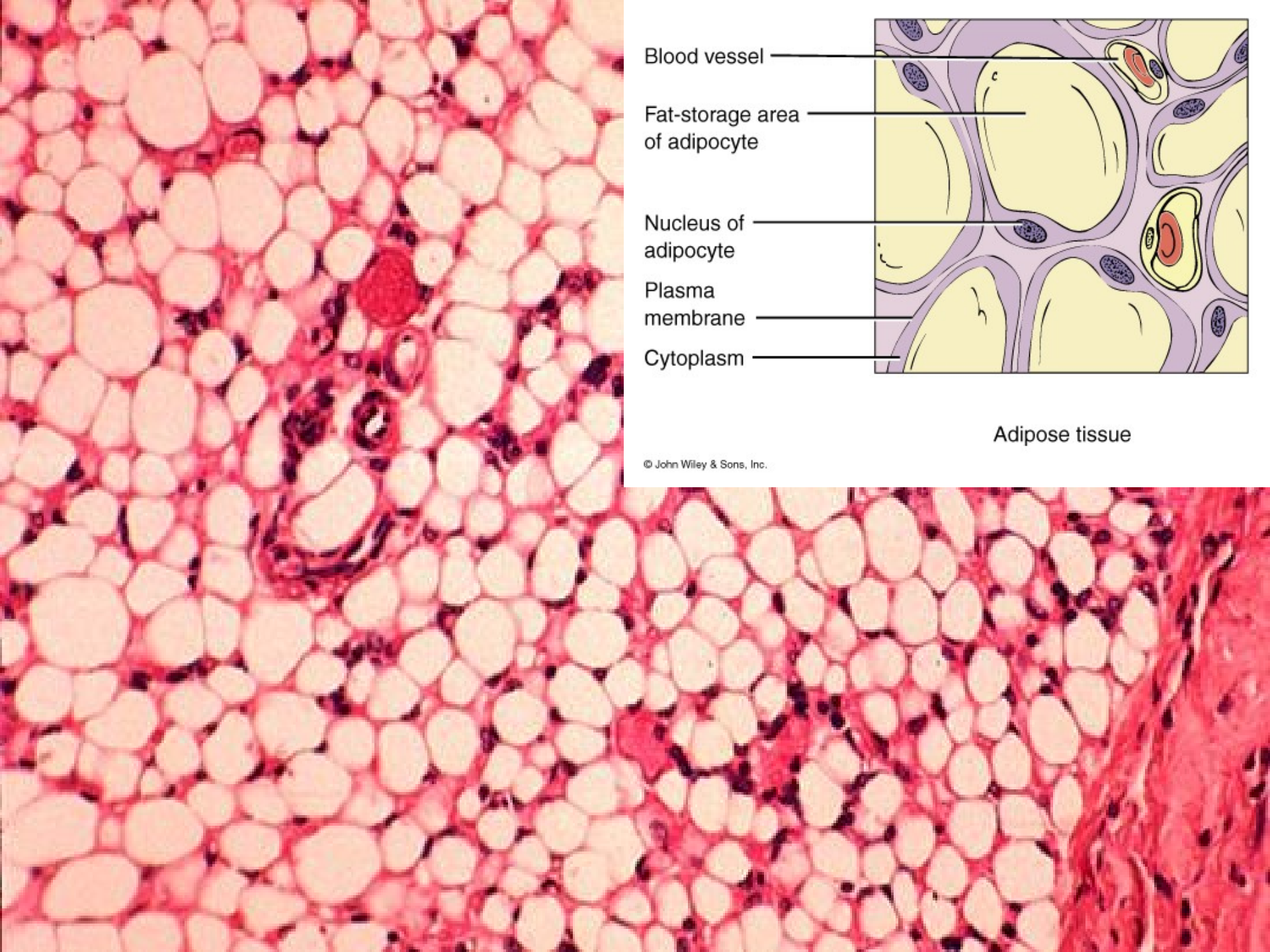


Areolar connective ts



LOOSE Connective Tissue:

2. Adipose tissue
   - consists of adipocytes; "signet ring" appearing fat cells. They store energy in the form of triglycerides (lipids).
   - found in subcutaneous layer, around organs and in the yellow marrow of long bones
   - function = supports, protects and insulates, and serves as an energy reserve



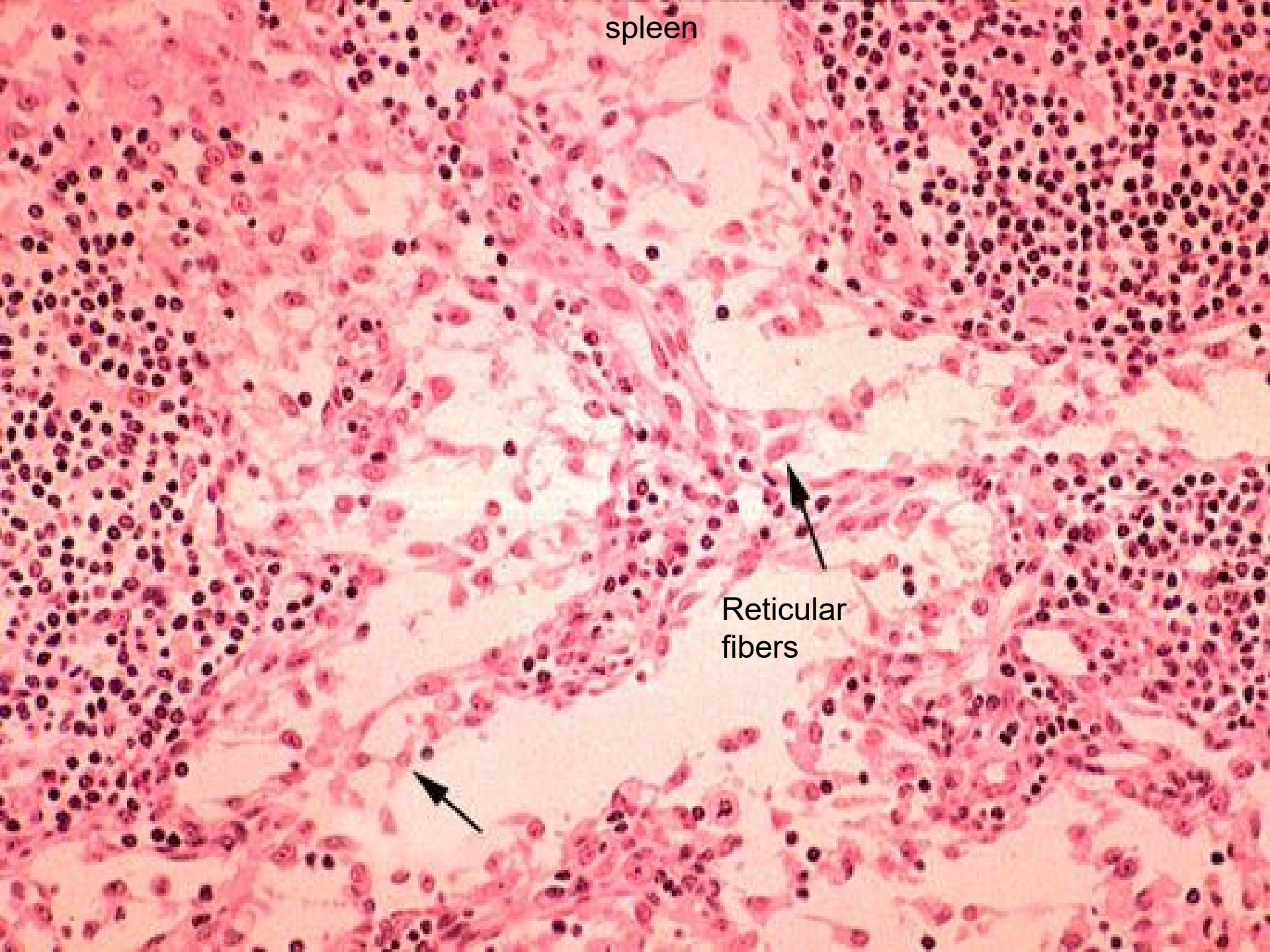
Adipose tissue

Adipose tissue

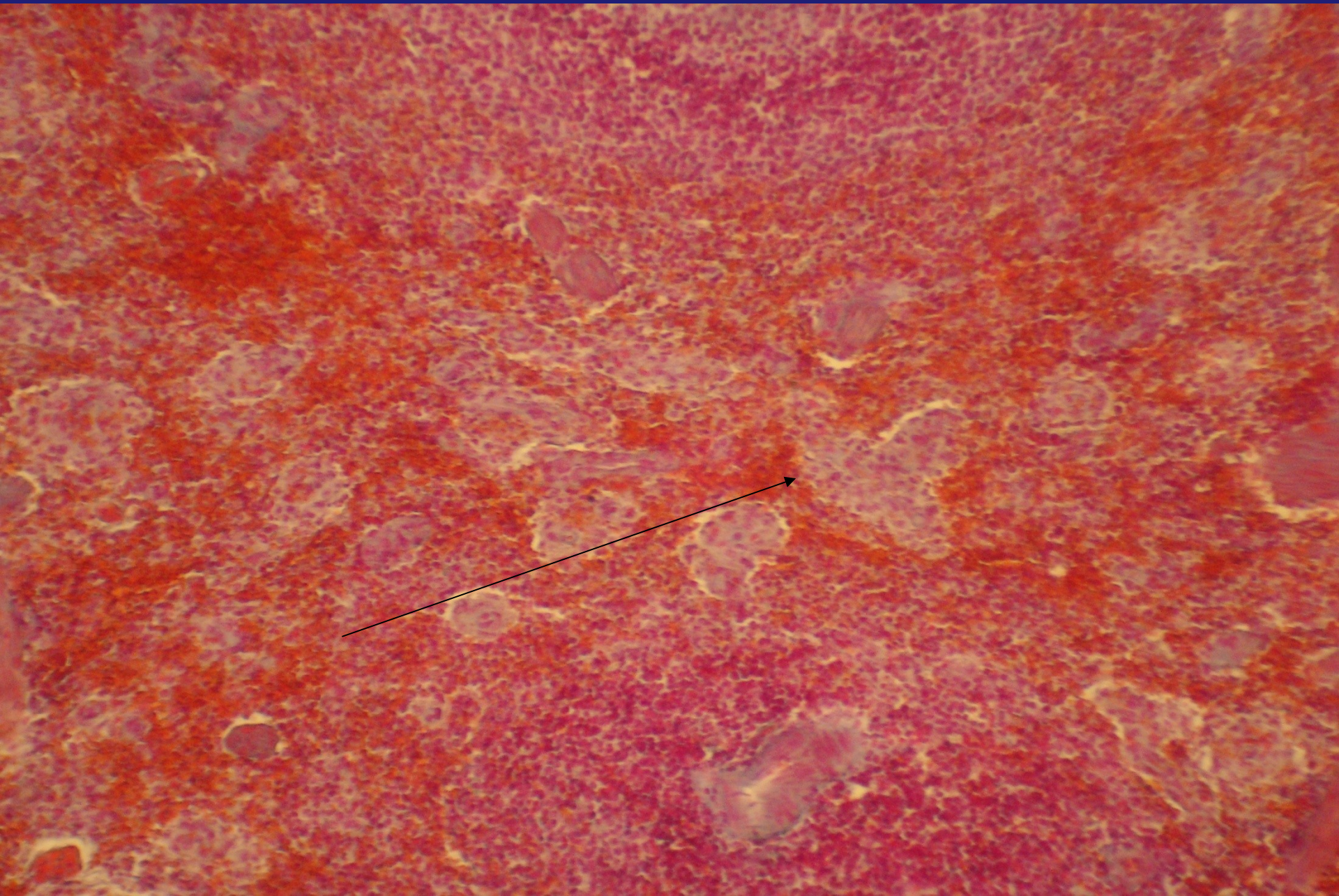
LOOSE Connective Tissue:

3. Reticular CT

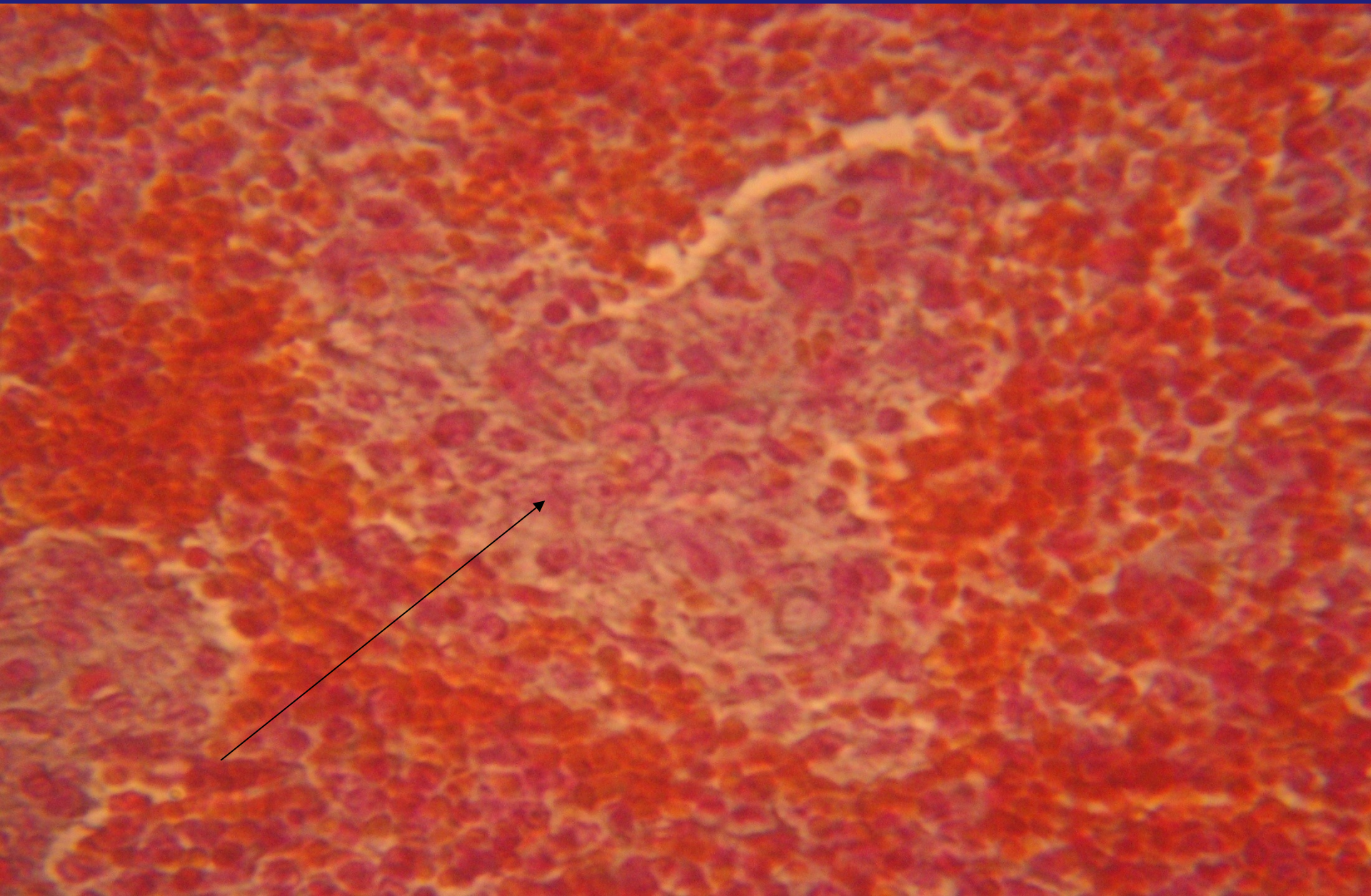
- Consists of fine interlacing reticular fibers and reticular cells
- Found in liver, spleen and lymph nodes
- Function = forms the framework (stroma)


spleen
Reticular
fibers

Reticular CT



Reticular CT



True or Proper Connective Tissue

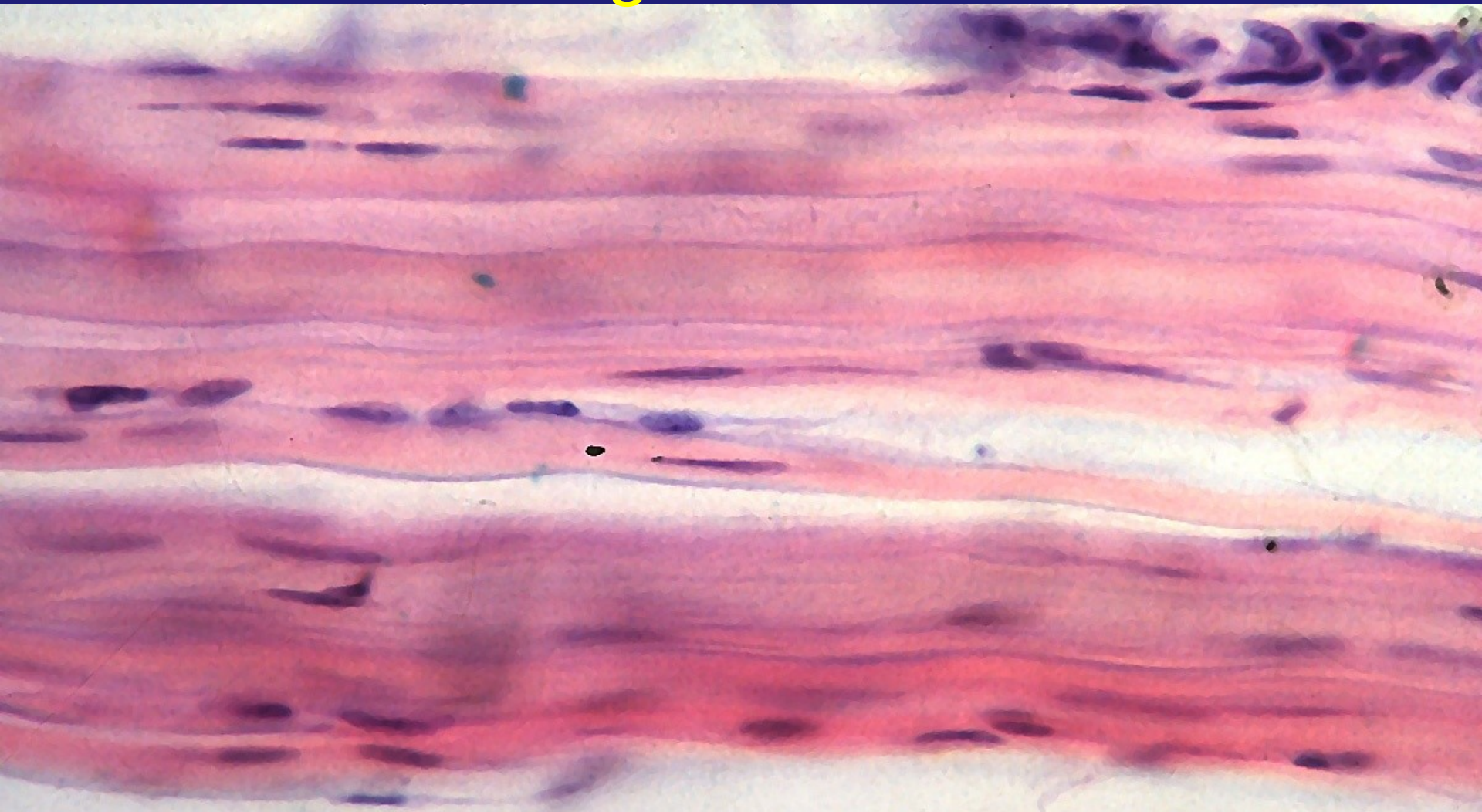
2. **Dense Connective Tissue:**
    a. **Dense regular connective tissue**
        Tendons and ligaments
    b. **Dense irregular connective tissue**
        Dermis of skin, submucosa of digestive tract

Dense Connective Tissue:

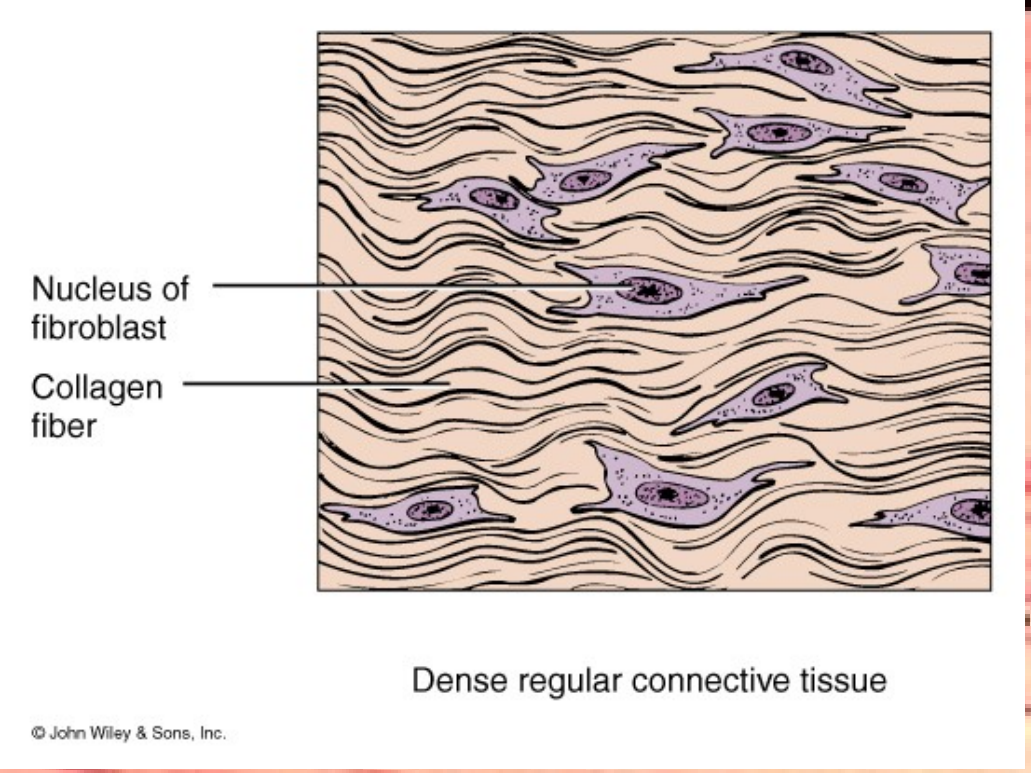
- contains more numerous and thicker fibers and far fewer cells than loose CT

1. dense regular Connective Tissue
   - consists of bundles of collagen fibers and fibroblasts
   - forms tendons, ligaments and aponeuroses
   - Function = provide strong attachment between various structures

Dense Regular CT = tendon



Parallel bundles of collagen (pink) with aligned fibroblasts

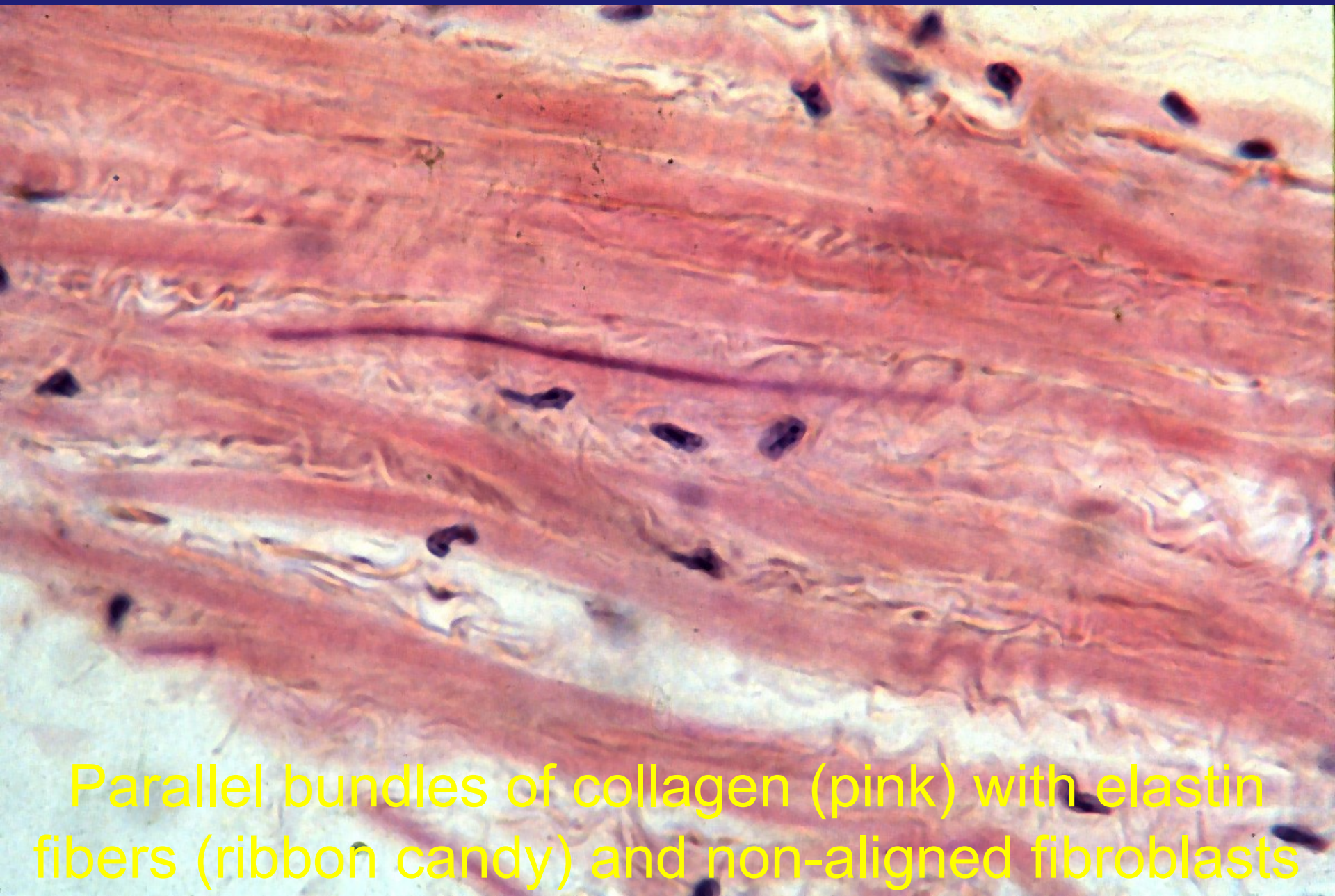


Dense regular connective tissue

Tendon : Dense Regular connective tissue

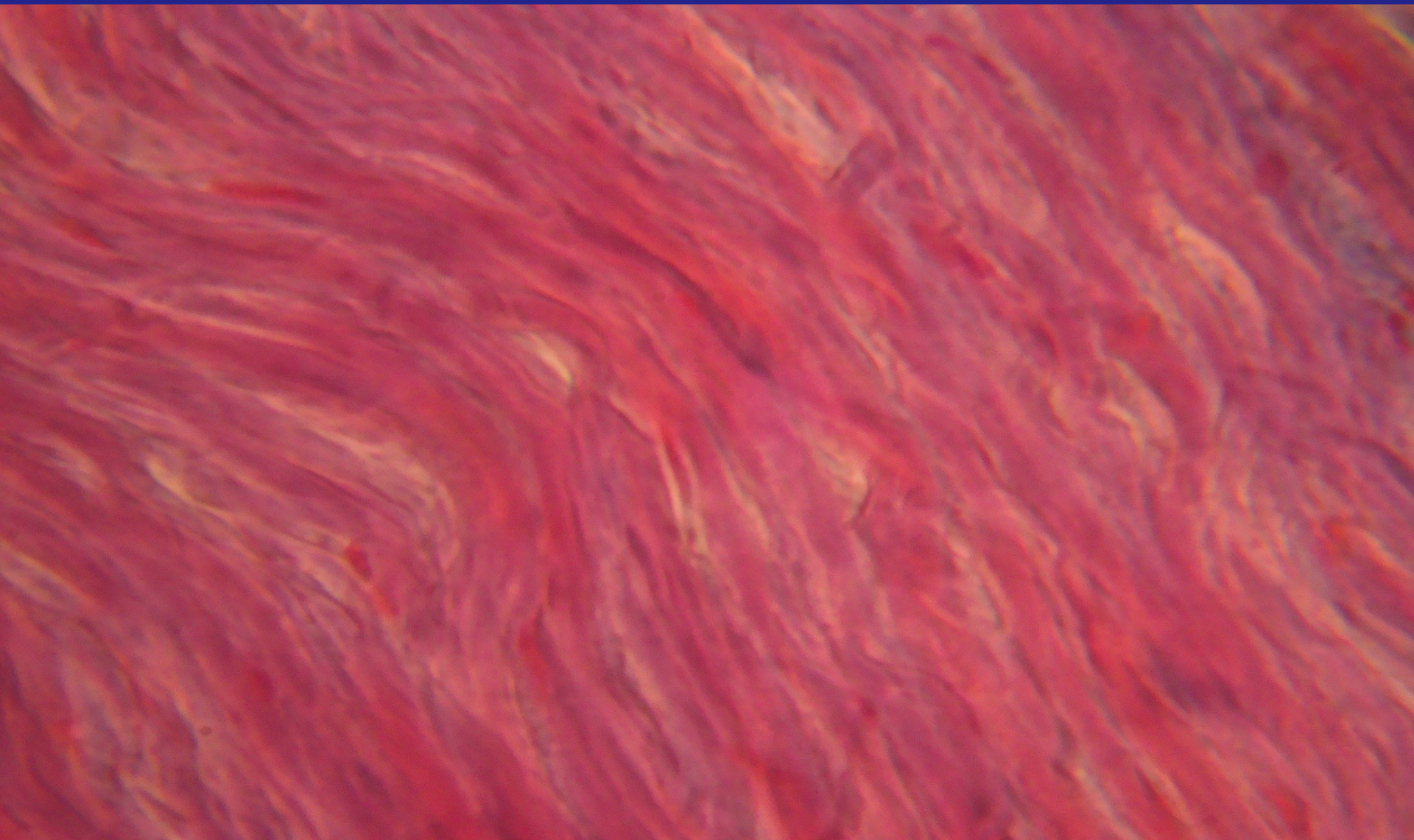
tendon : Dense Regular connective tissue

Dense Regular CT = ligament

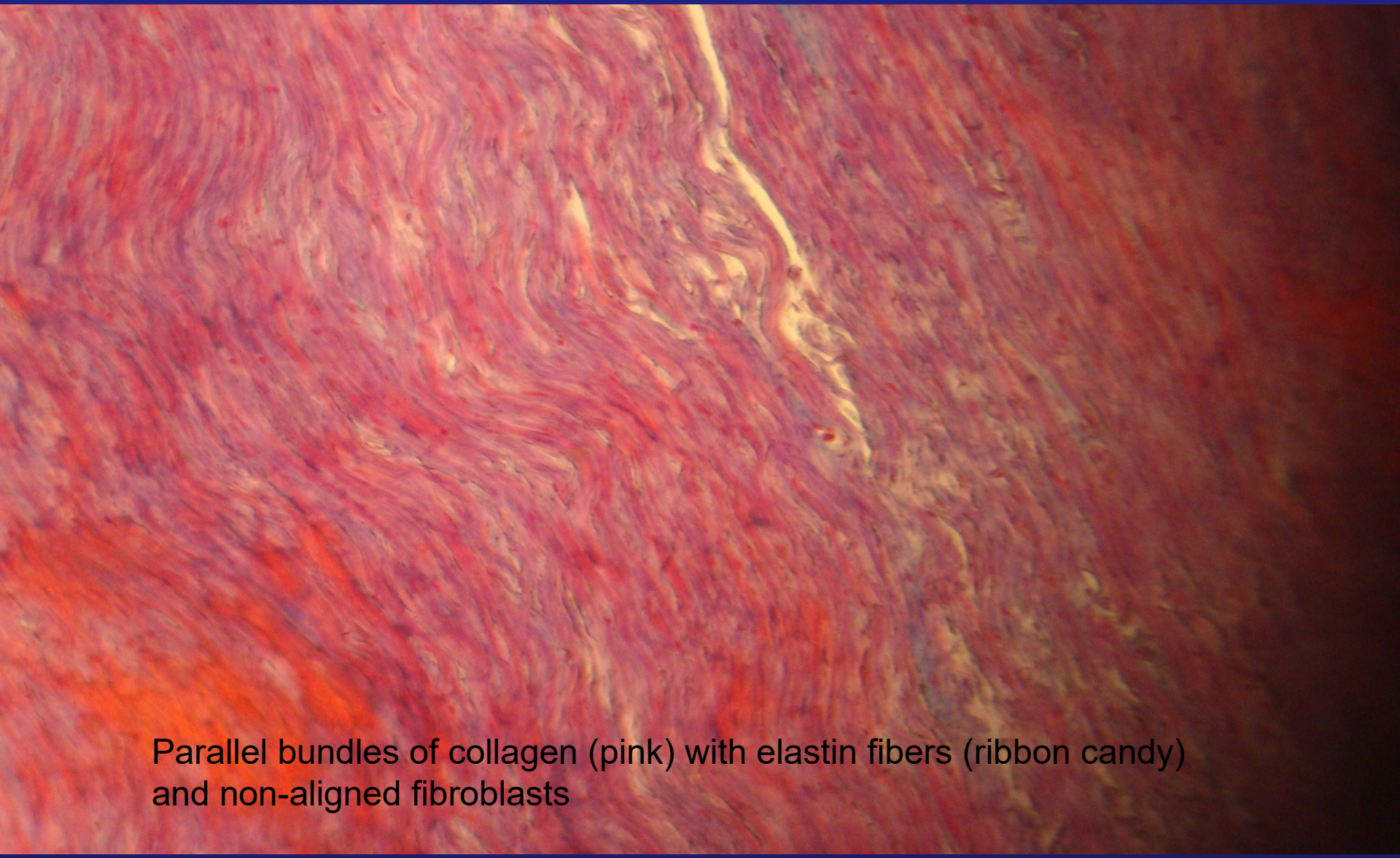


Parallel bundles of collagen (pink) with elastin fibers (ribbon candy) and non-aligned fibroblasts

Dense regular Connective Tissue(ligements)



Dense regular Connective Tissue(ligement)



Parallel bundles of collagen (pink) with elastin fibers (ribbon candy) and non-aligned fibroblasts

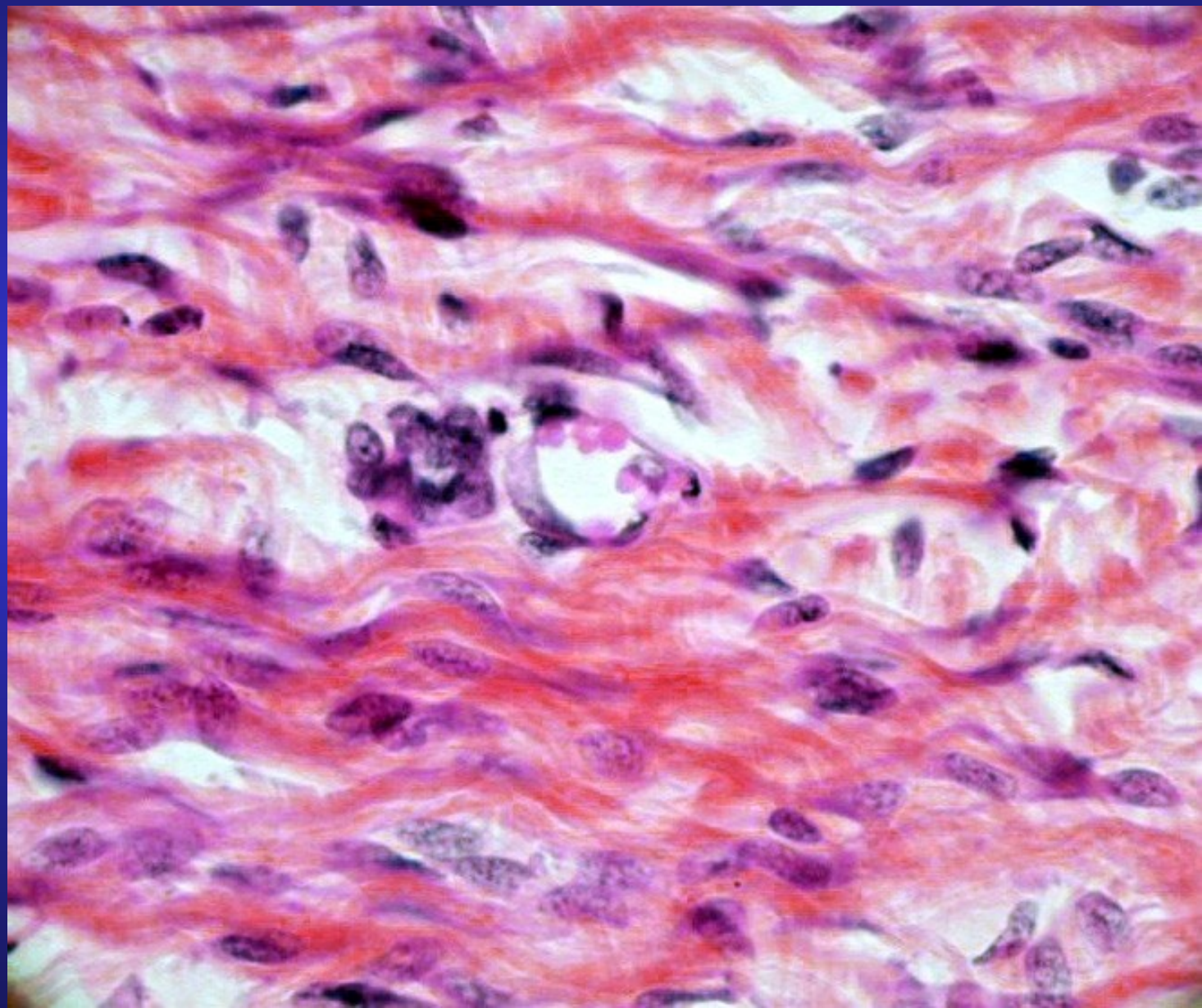
Dense Connective Tissue:

2. Dense Irregular CT

- consists of randomly-arranged collagen fibers and a few fibroblasts
- Found in fasciae, dermis of skin, joint capsules, and heart valves
- Function = provide strength

Dense Irregular CT = dermis

Fibroblasts with collagen fibers (red) in different planes




Dense Irregular CT = dermis

Reference :-

Color Atlas and text histology

Sixth edition

Thanks

3-Supportive Connective Tissue

Cartilage and Bone

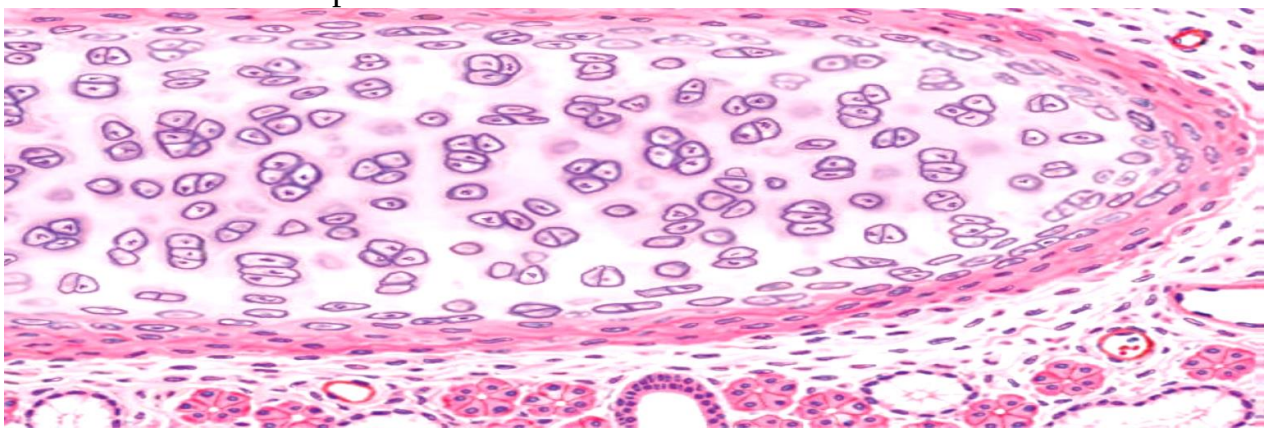
- **Cartilage** is a special form of connective tissue.
- Cartilage consists mainly of cells called **chondrocytes** and **chondroblast**.
- The Cells Lie In Small Chambers Called **Lacunae.**

Types Of Cartilage

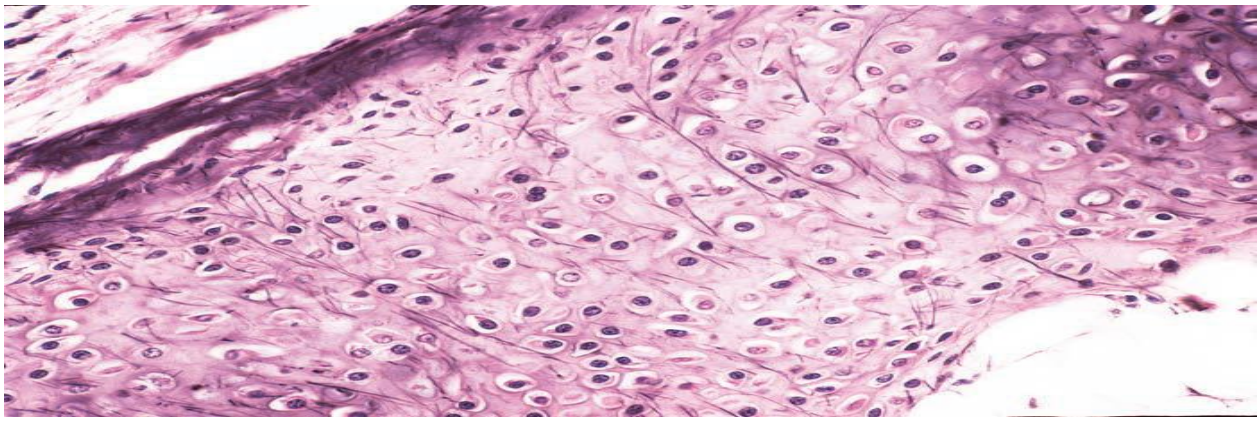
There are three main types of cartilage in the body:

- ✓ **hyaline cartilage(**found in the nose and at the ends of the long bones and the ribs**).**
- ✓ **elastic cartilage(**is more flexible and is found, for example, in the framework of the outer ear**).**
- ✓ **fibro cartilage(**is found pads between the vertebrae in the backbone and the wedges in the knee joint)

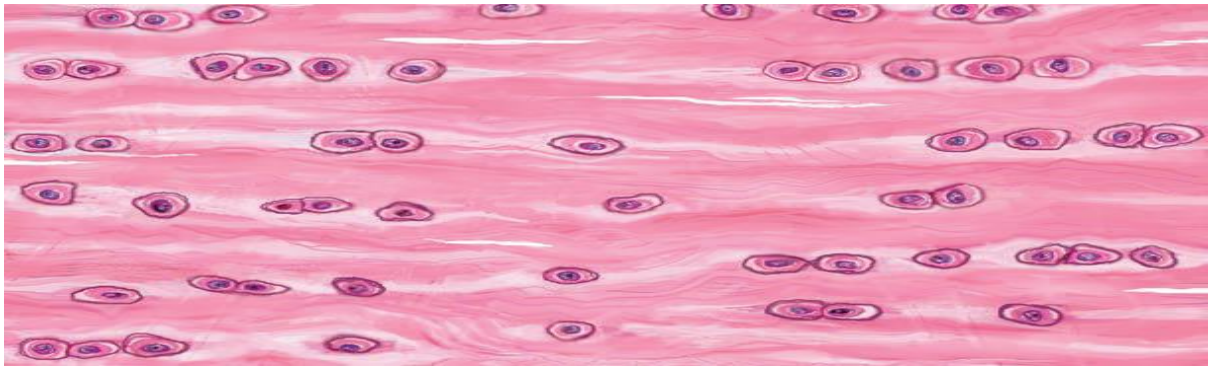
Their classification is based on the amount and types **of connective tissue fibers t**hat are present in the extracellular



Hyaline cartilage



Elastic cartilage



Fibro cartilage

Bone

The bone is specialized connective tissue .

There are three types of cell in the bone:

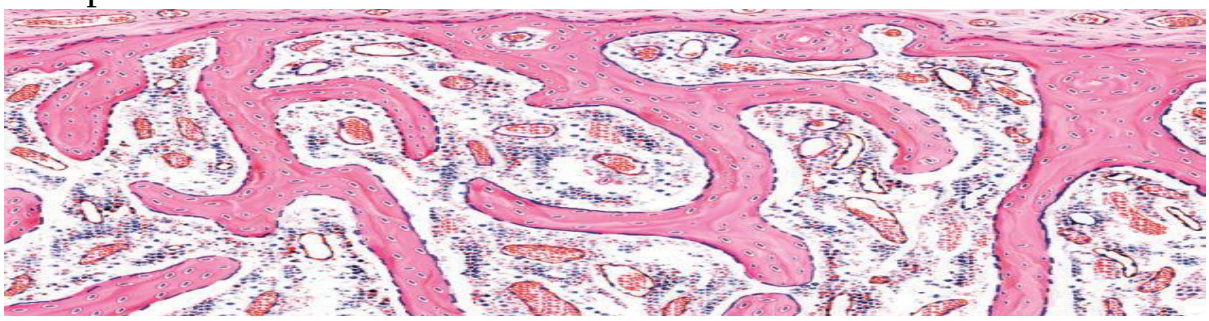
1. Osteoblast.
2. Osteocytes .
3. Osteoclasts.

The kind of the bone:

There are two kind of bone:

1- Spongy or trabecular bone .

2- Compact bone.



Spongy or trabecular bone

Compact bone

4-Liquid Connective Tissue

Blood

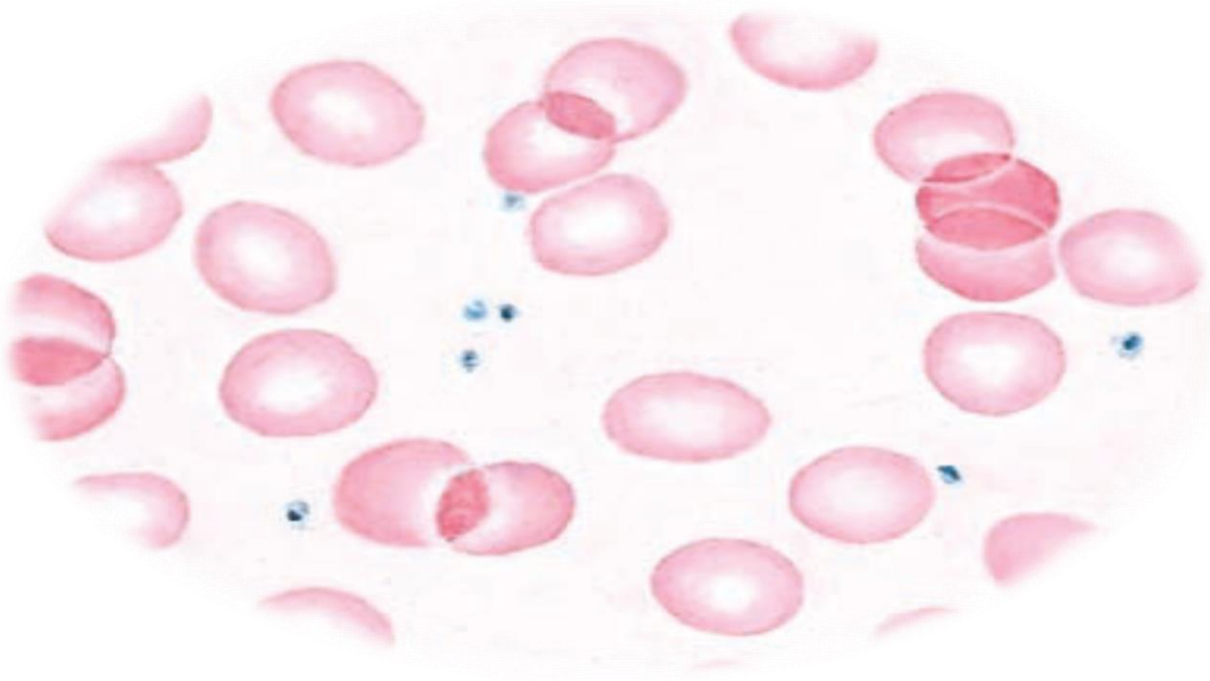
- **Consists of formed elements, erythrocytes, leukocytes, and platelets suspended in plasma.**

- **Erythrocytes**

• Erythrocytes are non nucleated cells that remain in the blood.

- **Platelets**

Function in blood vessels to promote blood clotting when blood vessel wall is damaged.

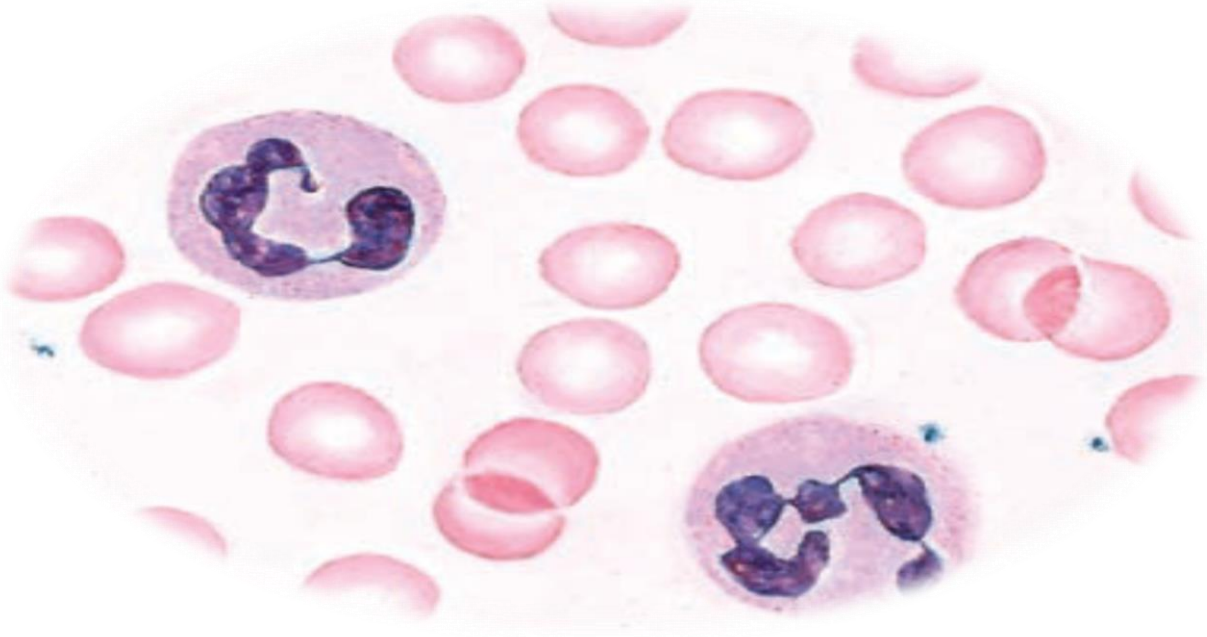


- **Leukocytes**

- **Granulocytes contain cytoplasmic granules; they are neutrophils, Eosinophils , and basophils**
- **A granulocytes are without cytoplasmic granules; they are monocytes and lymphocytes.**

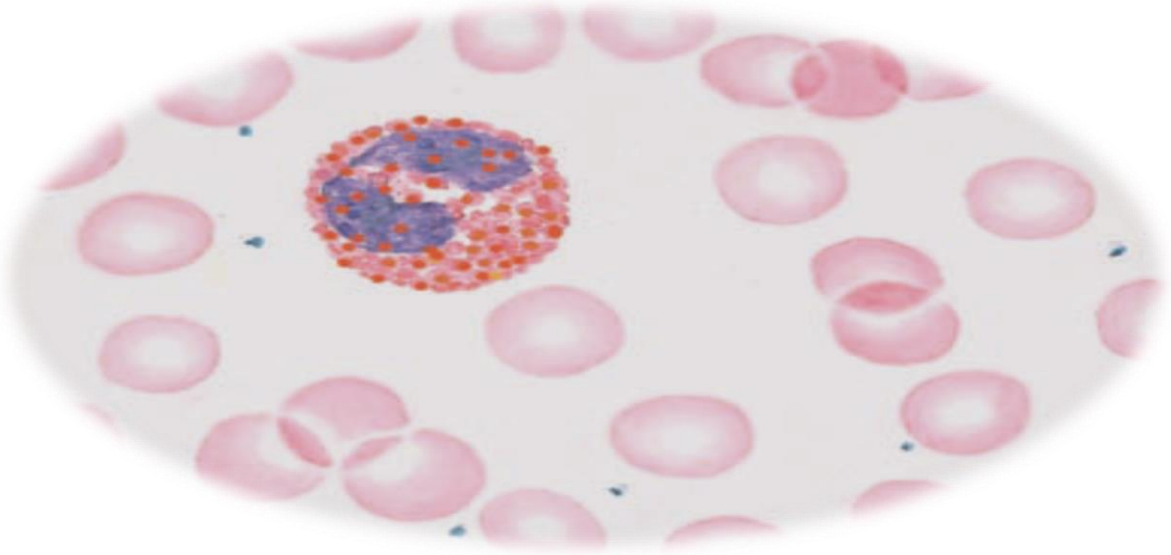
✓ **Neutrophils**

- **Cytoplasm appears clear under microscope**
- **Nucleus contains several lobes connected by thin chromatin strands**



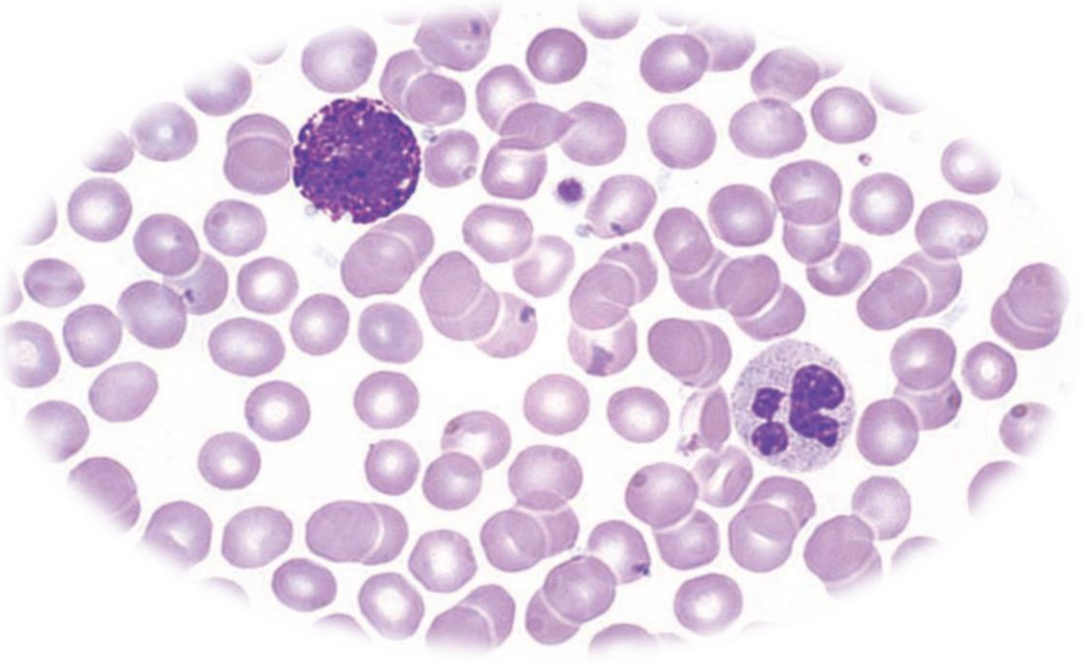
✓ **Eosinophils**

- **Cytoplasm filled with large pink or eosinophilic granules**
- **Nucleus typically bilobed**



✓ **Basophils**

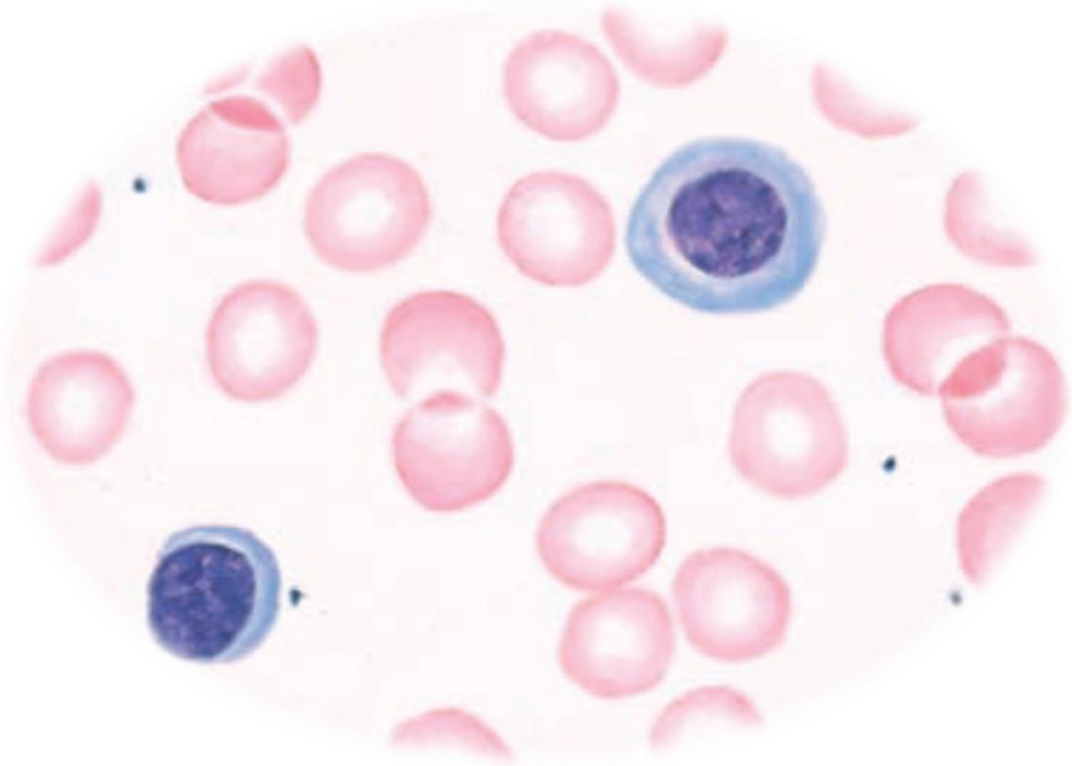
- **Cytoplasm contains dark blue or brown granules**



Agranulcytes

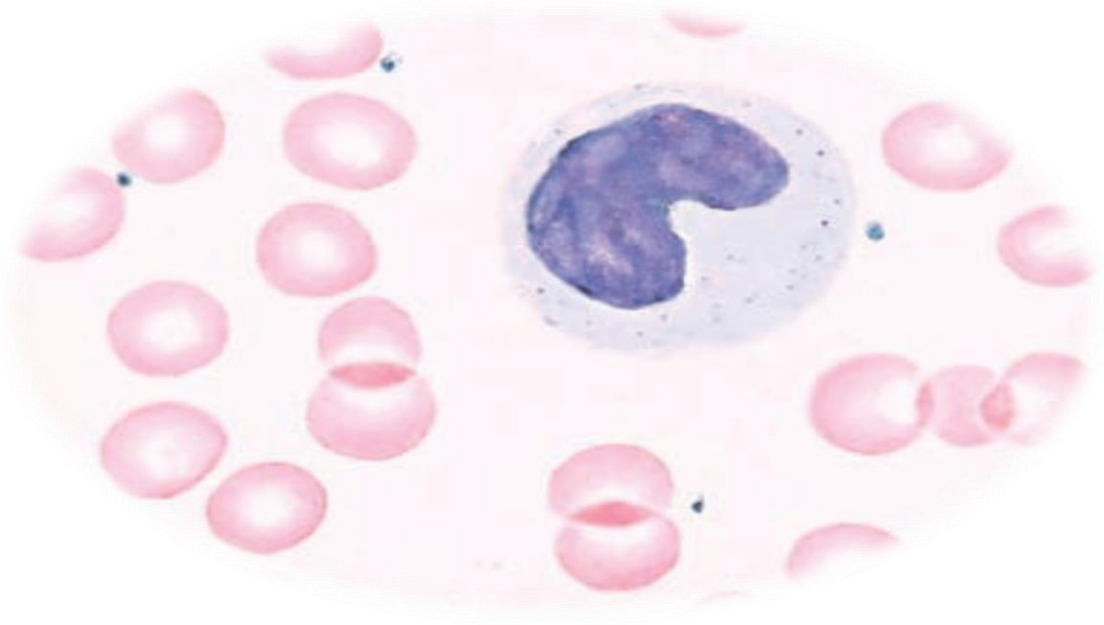
1-Lymphocytes

- **No granules in cytoplasm**
- **Dense-staining nucleus surrounded by a narrow cytoplasmic .**



2-Monocytes

- **Largest agranular leukocyte characterized primarily by horseshoe-shaped nucleus**



Muscle Tissue

Special terms have been used for the various cytoplasmic organelles of the muscle fibers:

- *Plasma membrane—sarcolemma*
- *Cytoplasm—sarcoplasm*

There are following three types of muscles:

1. Skeletal muscle
2. Cardiac muscle
3. Smooth muscle

Skeletal Muscle

Characterization

1. Skeletal muscle fibers are long
2. Cylindrical
3. Multinucleated cells, with peripheral nuclei.
4. Skeletal muscles attached to bones

Figure: Longitudinal and transverse sections of skeletal (striated) muscles of the tongue

Smooth Muscle

1. Smooth muscle fibers are appear smooth non- striated.
2. Contain a single central **nucleus.**
3. Smooth muscles are found in the linings of **visceral hollow organs** and **blood vessels**

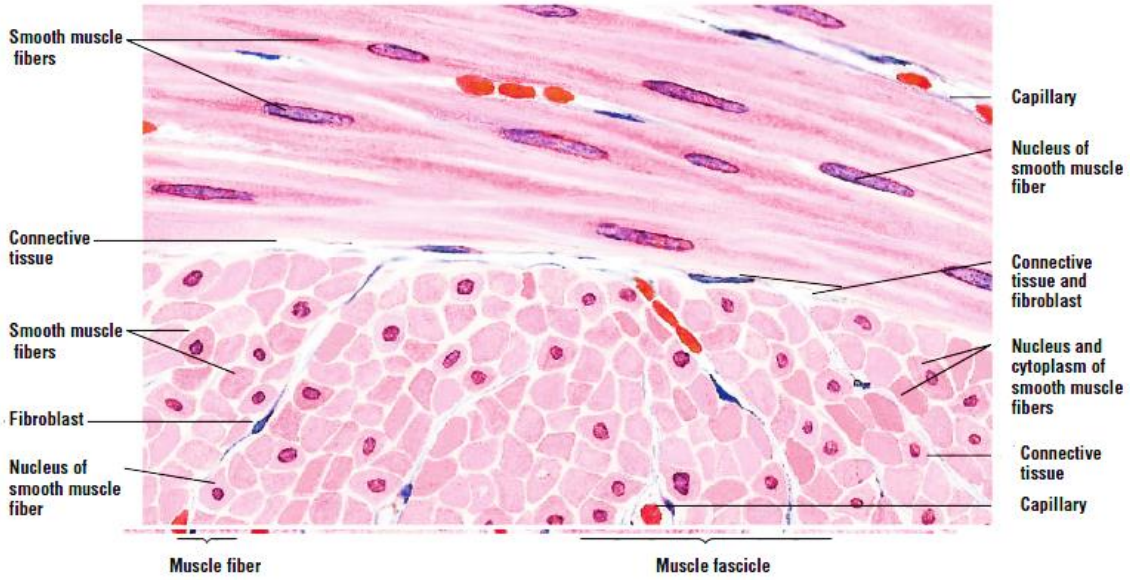


Figure: Longitudinal and transverse sections of smooth muscle in the wall of the small intestine.

Cardiac Muscle

1. Cardiac muscle fibers are also cylindrical
2. Cardiac muscle fibers exhibit only one or two **central nuclei**.
3. The terminal ends of adjacent cardiac muscle fibers show characteristic and dense-staining, end-to-end junctional complexes called **intercalated disks.**
4. They are primarily located in aorta and pulmonary trunk.

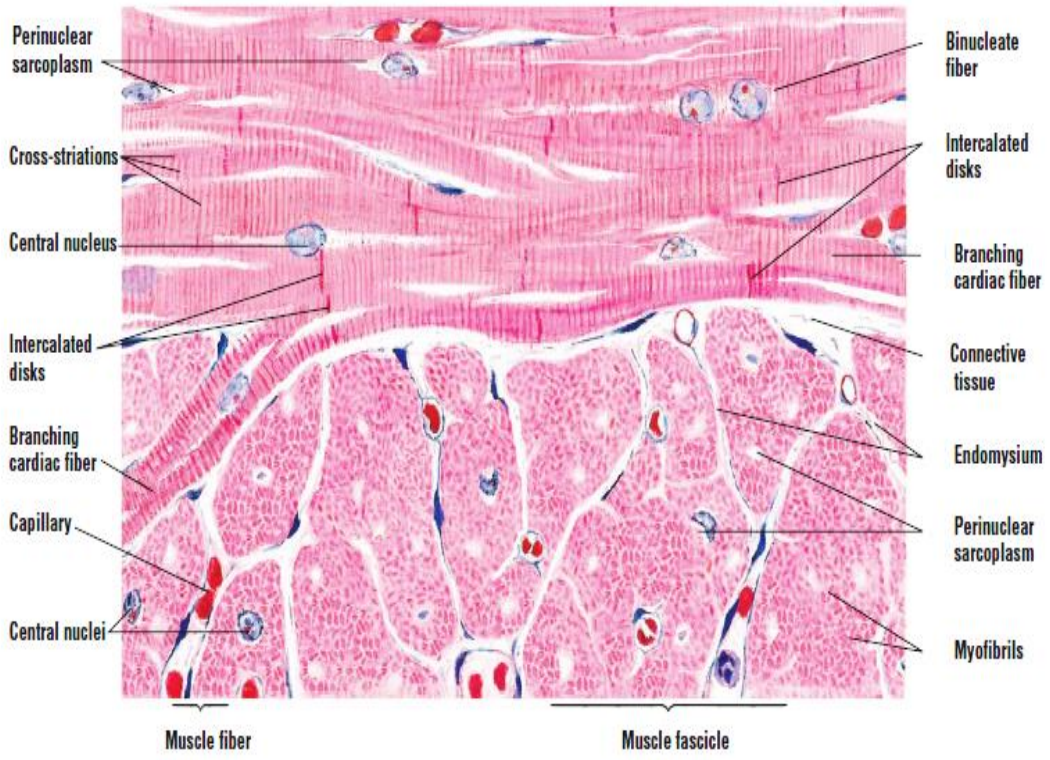


Figure: Longitudinal and transverse sections of cardiac muscle

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Nervous tissue

The mammalian nervous system is divided into two major parts:

1- **central nervous system (CNS)** The CNS consists of the **brain** and **spinal cord**

2-**peripheral nervous system (PNS).**: The components of the PNS—the **cranial** and **spinal** nerves—are located outside the CNS**.**

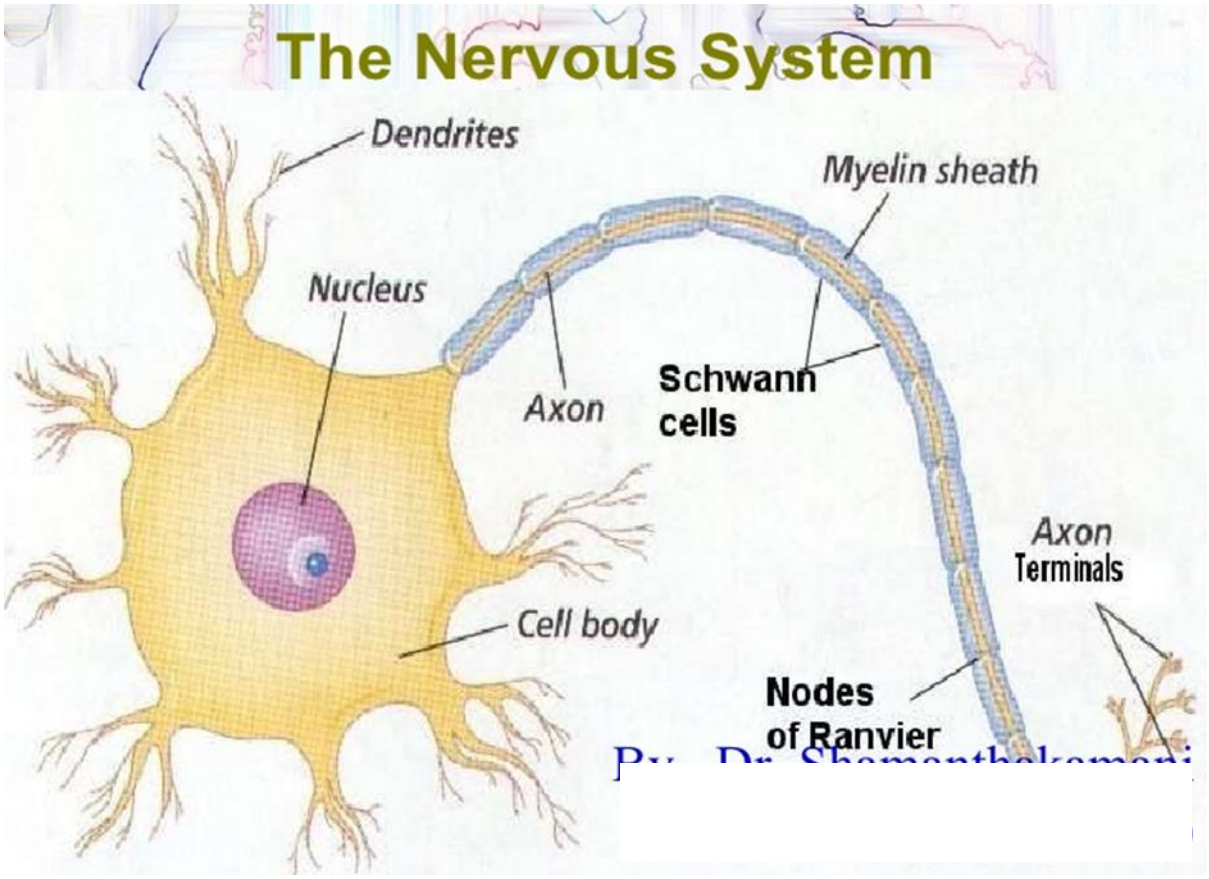
general structure of nervous tissue:

The structural and functional cells of the nervous tissue are the **neurons**. Each neuron consists of

1-soma or **cell body.**

2- **dendrites.**

3-single axon.



Surrounding the neurons are the smaller and more numerous supportive cells collectively called **neuroglia.** These cells form the nonneural components of the CNS.

Supporting Cells in the CNS: Neuroglia

The four types of neuroglia cells are

(astrocytes, oligodendrocytes, microglia, and ependymal cells).

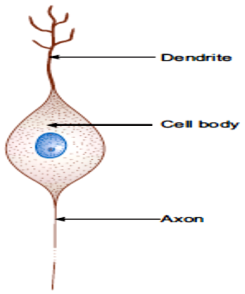
Types of Neurons in the CNS

The three major types of neurons in the nervous system

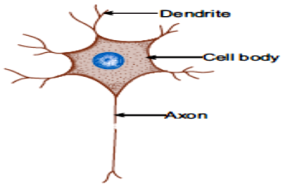
1. *Unipolar neurons*:. Most neurons in the adult organism that exhibit only one process leaving the cell body were initially bipolar during embryonic development. The two neuronal processes fuse during later development and form one process. The unipolar neurons (formerly called (**pseudounipolar neurons**) are also **sensory.** Unipolar neurons are found in numerous sensory ganglia of cranial and spinal nerves.

2. *Bipolar neurons*. These are not as common and are purely **sensory neurons.** In bipolar neurons, a single dendrite and a single axon are associated with the cell body. (retina of the eye).

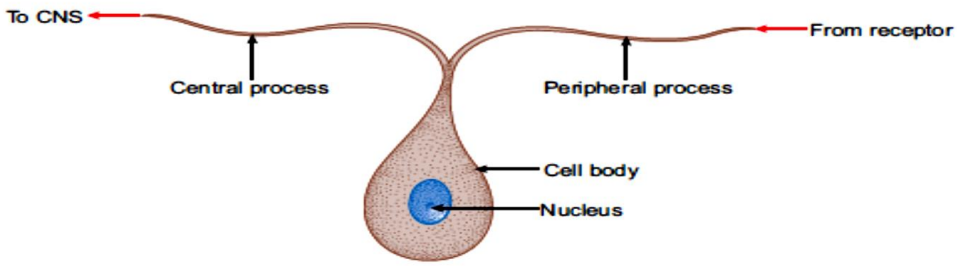
3. *Multipolar neurons*. These are the most common type in the CNS and include all **motor neurons** and **interneurons** of the brain, cerebellum, and spinal cord. Projecting from the cell body of a multipolar neuron are numerous branched dendrites. On the opposite side of the multipolar neuron is a single axon **.**



Bipolar neuron



Multipolar neuron



Pseudo-unipolar

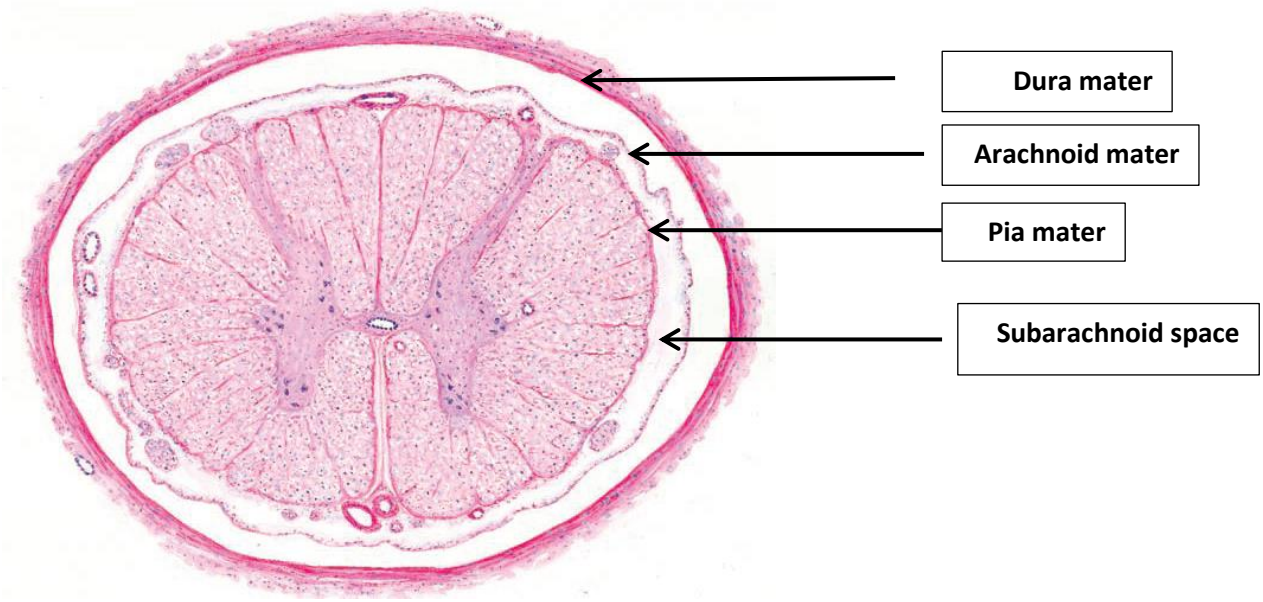
The Protective Layers of the Central Nervous System (CNS)

1- dura mater :The outermost meningeal layer, strong, and thick layer of dense connective tissue fibers.

2- arachnoid mater : Deep to the dura mater is a more delicate connective tissue, The dura mater and arachnoid mater surround the brain and spinal cord on their external surfaces.

3- pia mater : The innermost meningeal layer ,the delicate connective tissue. This layer contains numerous blood vessels and adheres directly to the surfaces of the brain and spinal cord.

Between the arachnoid mater and the pia mater is the subarachnoid space. Circulating in the subarachnoid space is the cerebrospinal fluid (CSF) that bathes and protects both the brain and spinal cord.



Spinal cord (transverse section)

Nervous system

It is the most complex system in the body .the N.S.is divided into:

1-Central N.S. (CNS):includes brain and spinal cord.

2-Perpheral N.S.(PNS): includes nerve fibers spinal and cranial nerve

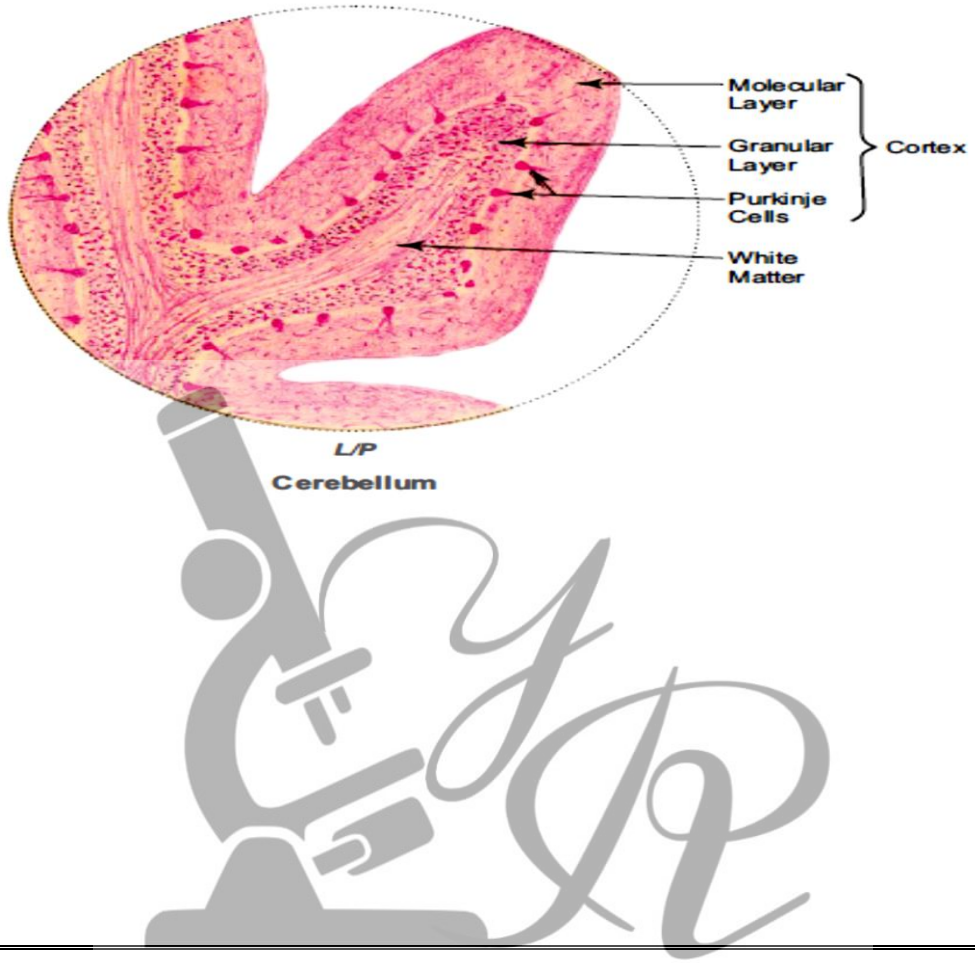
Central N.S. (CNS):

Brain

It consists of two parts**:**

1-Cerebrum:when sectioned, it shows two different regions, the superficial one appear grey called grey matter, and the inner or deep one which appears white called white matter**.**

2-Cerebellum:like cerebrum, it consist of an external grey matter , and an inner white matter the medulla.



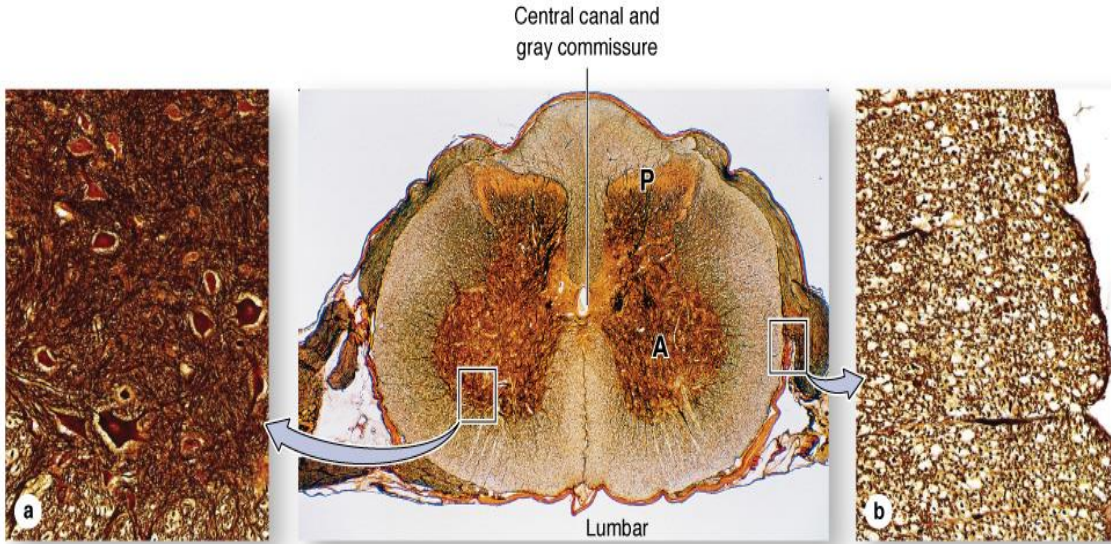
Spinal cord

In cross section , two regions are recognized; an outer white matter ,and an inner grey matter, with a central opening called **central canal.**

1-Grey matter: it has an **H-shape** ,where the horizontal bar represents the **grey commissure**.It is divided into **anterior** and **posterior** commissures in relation to the **central canal**.

The arms of H represent the **posterior horns** ,while the legs represent the **anterior horns**.

2-White matter :consist mainly of myelinated nerve fibers.



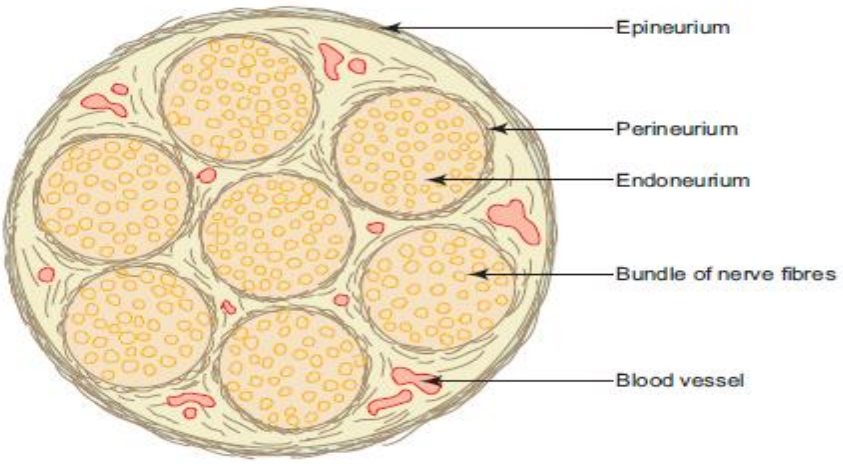
Peripheral Nervous system

Each peripheral nerve (spinal , cranial) is made of bundles of nerve fibers ,The bundles are held together by connective tissue which provides structural support as well as nutritional support by carrying blood vessels to nerve fibers. The connective tissue framework is well appreciated in cross section of a nerve where following structures can be observed:

– *Epineurium:* Dense connective tissue sheath surrounding the entire nerve.

– *Perineurium:* flattened specialized epithelial cells surrounding the bundles of nerve fibers.

– *Endoneurium:* Loose connective tissue composed of reticular fibers supporting individual nerve fibers.



Synapse

It is unidirectional area of nerve impules transmission through a contact between neurons and effectors cells (muscle or gland).

1-Axosomatic.

2-Axodendritic.

3-Axoaxonic.

Endocrine system

- Pituitary gland

Anterior lobe

The epithelial-derived adenohypophysis has three subdivisions: the pars distalis, pars tuberalis, and pars intermedia. The **pars distalis** is the largest part of the hypophysis. The **pars tuberalis** surrounds the neural stalk. The **pars intermedia** is a thin cell layer between the pars distalis and the neurohypophysis.

Posterior lobe

The neurohypophysis, situated posterior to the adenohypophysis, also consists of three parts: the median eminence, infundibulum, and pars nervosa.The large portion of the neurohypophysis is the pars nervosa

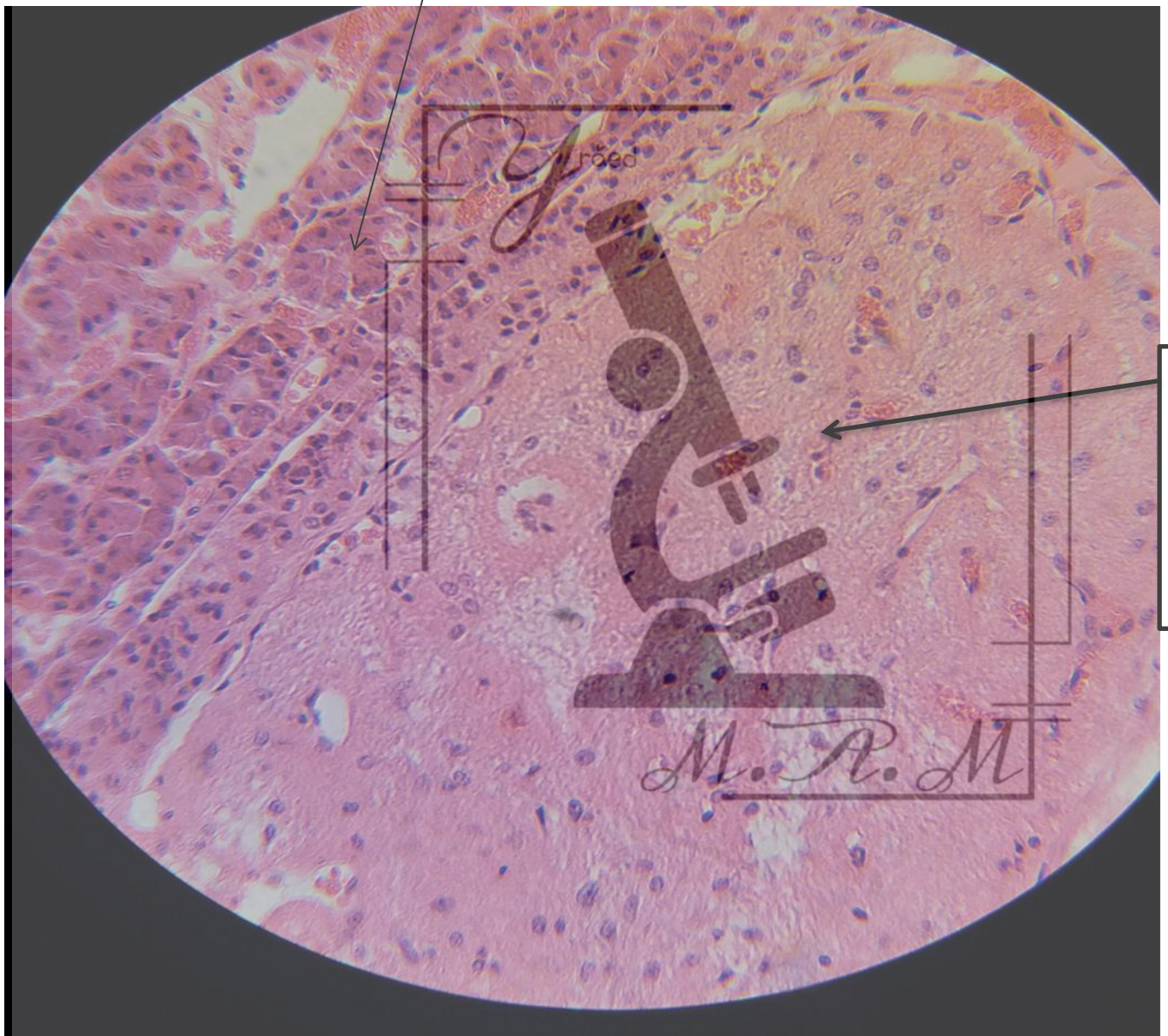
- Pituitary gland

Divisions

- Adenohypophysis (Anterior lobe).
  - Pars distalis
  - Pars intermedia
  - Pars tuberalis
- Neurohypophysis (Posterior lobe).
  - Pars nervosa
  - Infundibulum

Pituitary gland

(**Anterior lobe**)**Pars distalis**: acidophils, basophils , chromophobes



(**Posterior lobe**)

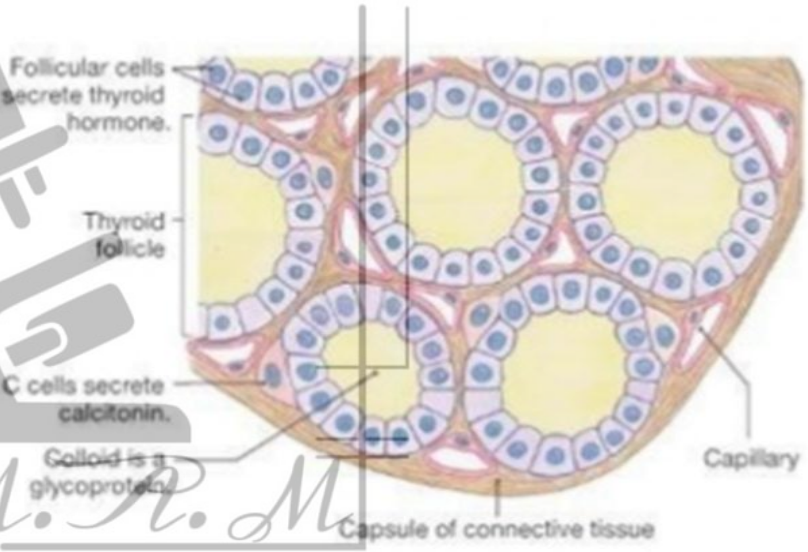
Pars nervosa:

herring bodies

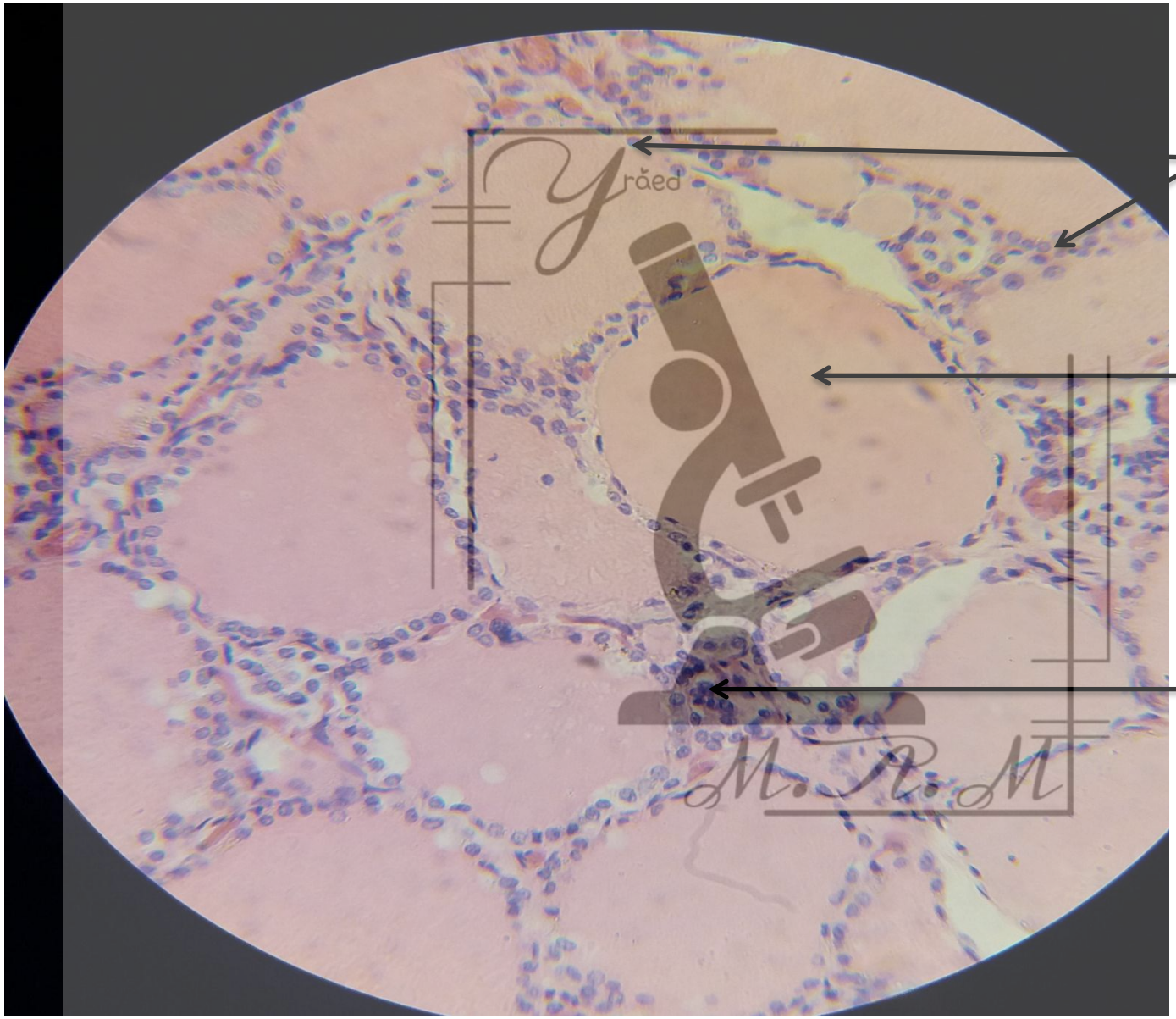
Thyroid gland

Microscopic structure

- Structural unit is follicle or acinus.
- Follicle consist of layer of simple epithelium, enclosing cavity called the follicular cavity.
- The cavity is usually filled with gel-like viscous iodine-rich material called colloid.
- Interfollicular spaces are filled by reticular connnective tissue, adipose tissue and blood vessels.



Thyroid gland

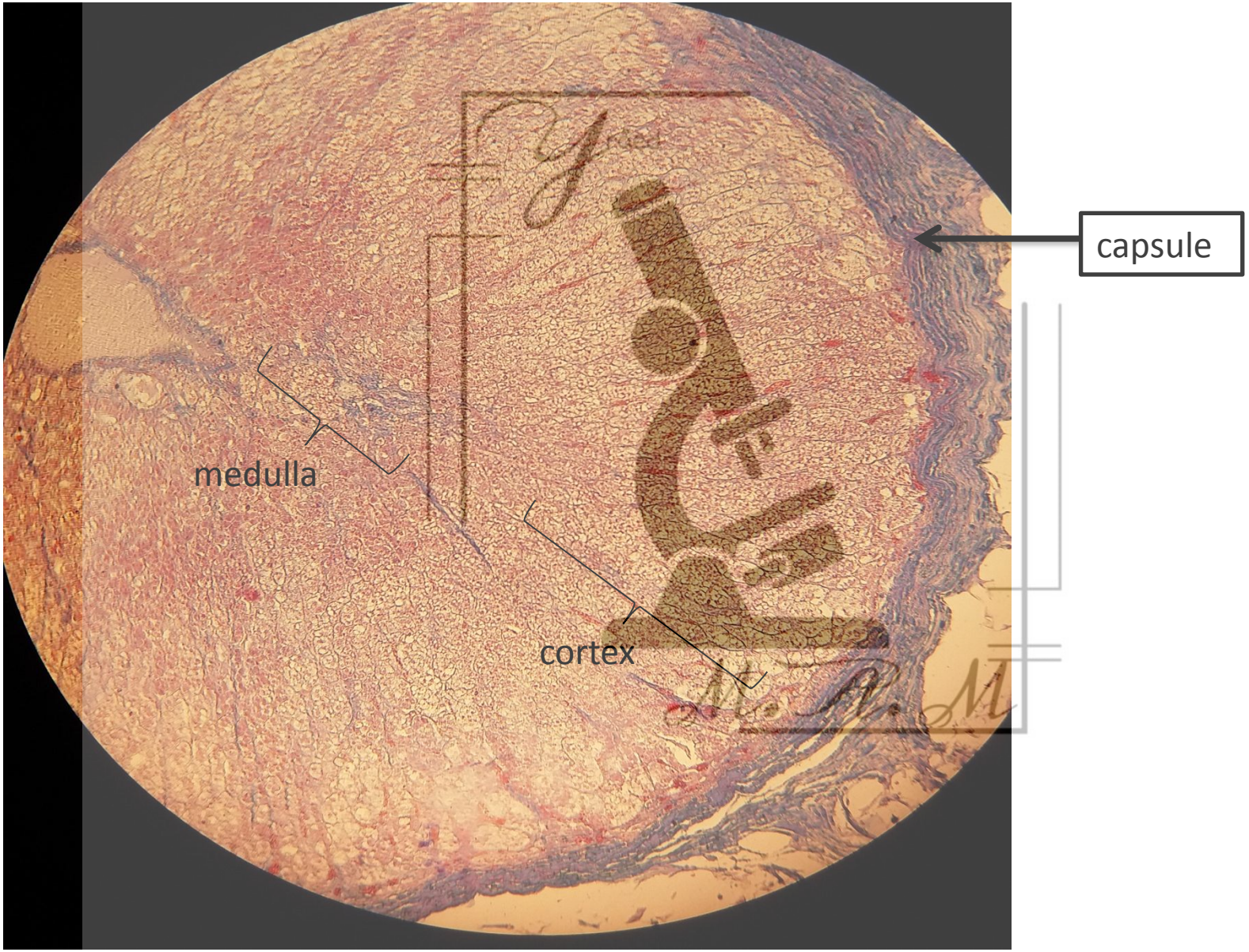


Adrenal Glands

The adrenal (suprarenal) gland consists of an outer cortex and an inner medulla ,surrounded by a thick connective tissue capsule.

Cortex subdivided into three zones: zona glomerulosa, zona fasciculata, and zona reticularis.

Adrenal Glands



Adrenal Glands