The background of the slide is a collage of four microscopic images. The top-left image shows a layer of cuboidal epithelial cells with a prominent purple-stained nucleus. The top-right image shows a network of pink-stained fibers, likely collagen, characteristic of connective tissue. The bottom-left image shows a bundle of striated muscle fibers with visible nuclei. The bottom-right image shows a cross-section of cartilage with large, blue-stained chondrocytes.

Lab:3

Connective Tissue

- Ast. Lec. Mariam Ahmad Ali



Connective Tissue

Consists of two basic elements:

Cells
and
Fibers



Function:

- Provides substance and form to the body and organs.
- Bind and support other tissues.
- Defends against infection.
- Aids in injury repair.
- Stores lipids.
- Provides a medium for diffusion of nutrients and wastes.
- Attaches muscle to bone and bone to bone.

True Connective Tissue Cells

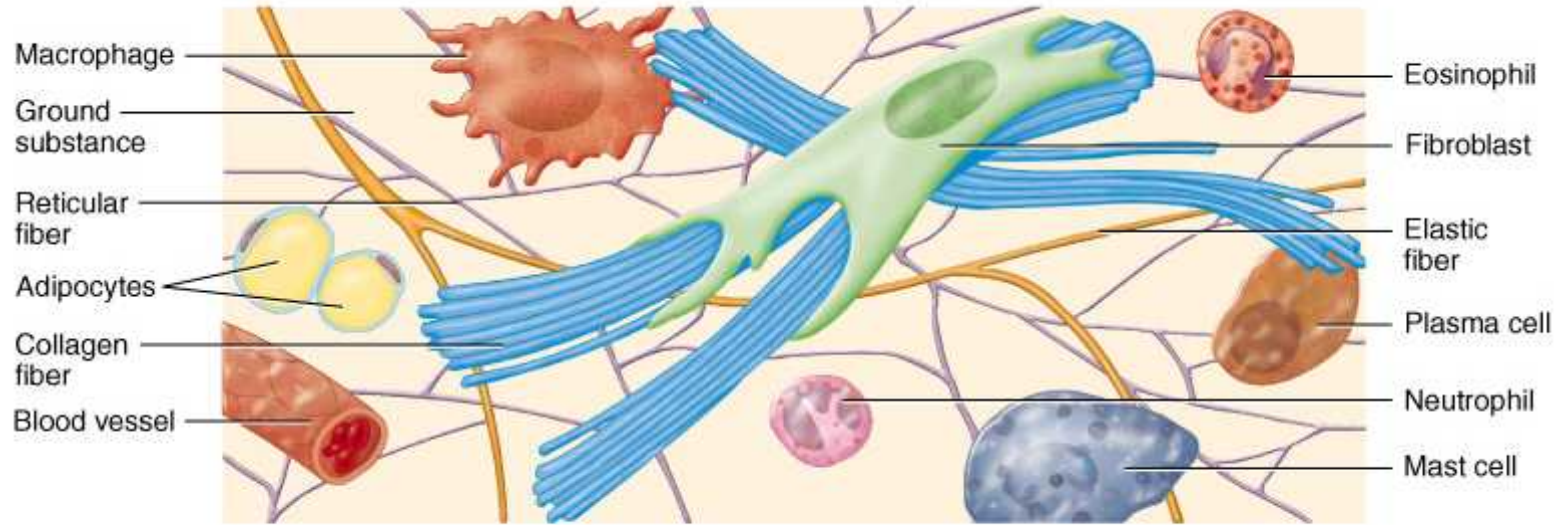
Fibroblasts: Secrete both fibers and ground substance of the matrix (wandering)

Macrophages: Phagocytes cell that develop from Monocytes (wandering or fixed)

Plasma Cells: Antibody secreting cells that develop from B Lymphocytes (wandering)

Mast Cells: Produce histamine that help dilate small blood vessels in reaction to injury (wandering)

Adipocytes: Fat cells that store triglycerides, support, protect and insulate (fixed)



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LUNNEN

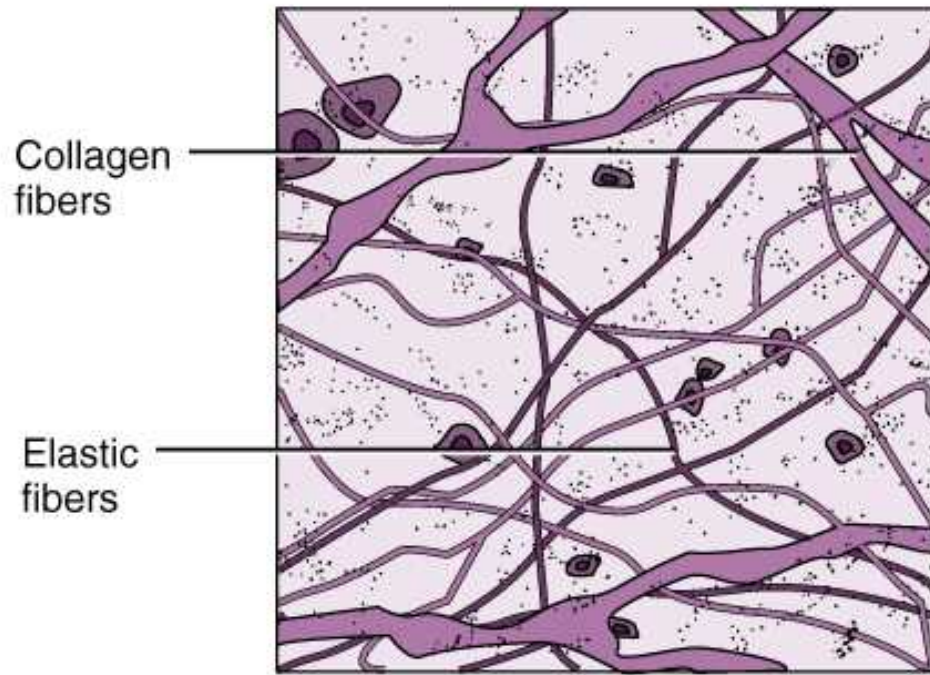
Fibers: there are three

Collagen Fibers: Large fibers made of the protein collagen and are typically the most abundant fibers. Promote tissue flexibility, it keeps the muscle from tearing away from the bone.

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, liver and lymph nodes.

art 4: Slide 28



Areolar connective tissue

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TYPES OF CONNECTIVE TISSUE

1. True Connective Tissue

- a. Loose Connective Tissue
- b. Dense Connective Tissue

2. Supportive Connective Tissue

- a. Cartilage
- b. Bone

5. Liquid Connective Tissue

- a. Blood
- b. lymph



True or Proper Connective Tissue

1. Loose Connective Tissue:

a. Areolar connective tissue

Widely distributed under
epithelia

b. Adipose tissue

Hypodermis, within abdomen, breasts

c. Reticular connective tissue

Lymphoid organs such as lymph nodes

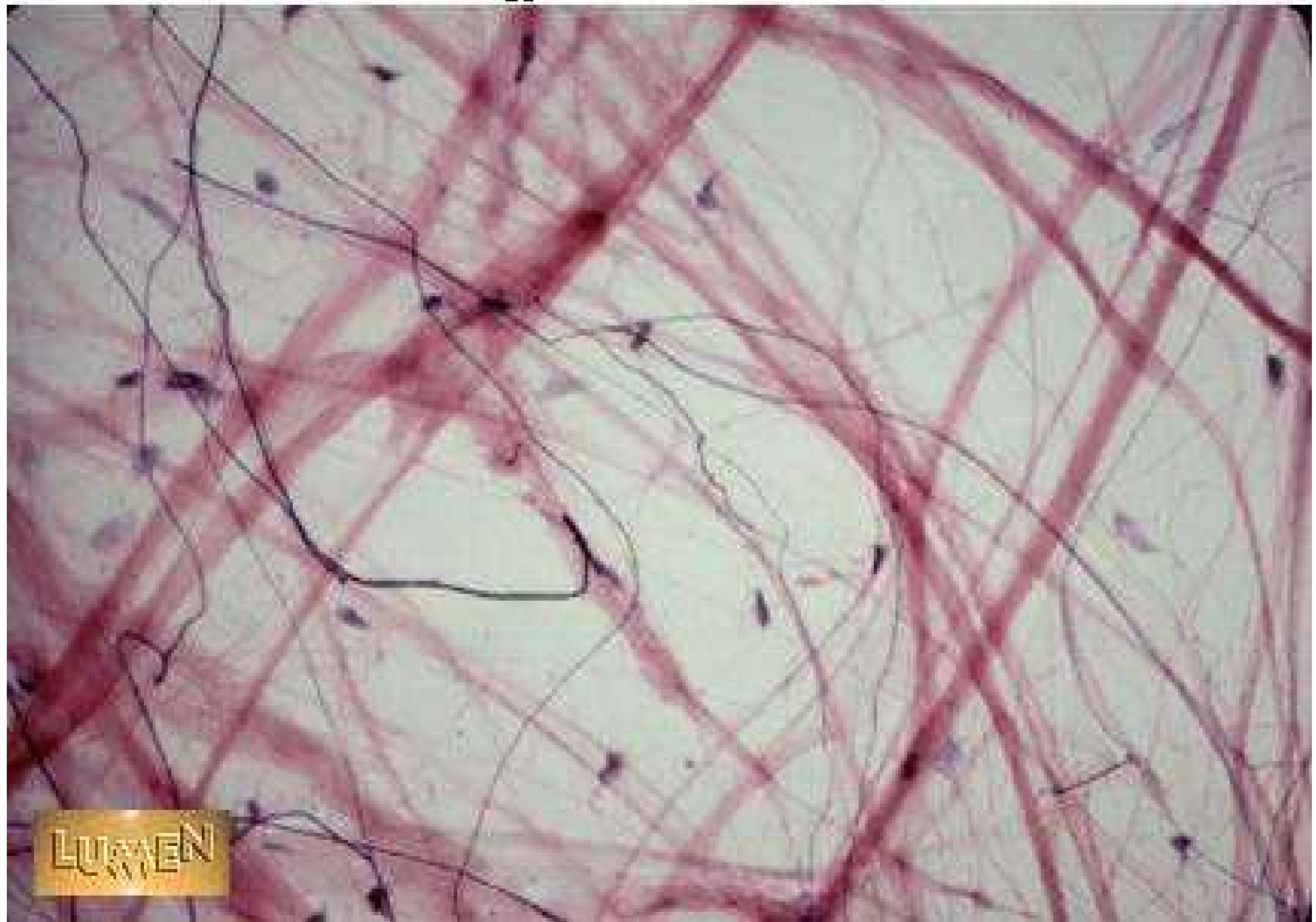


Loose Connective Tissue:

1- Areolar Connective tissue:

- 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, it binds epithelia to underlying tissues and holding organs in place.**

Histology Lab Part 3: Slide 8



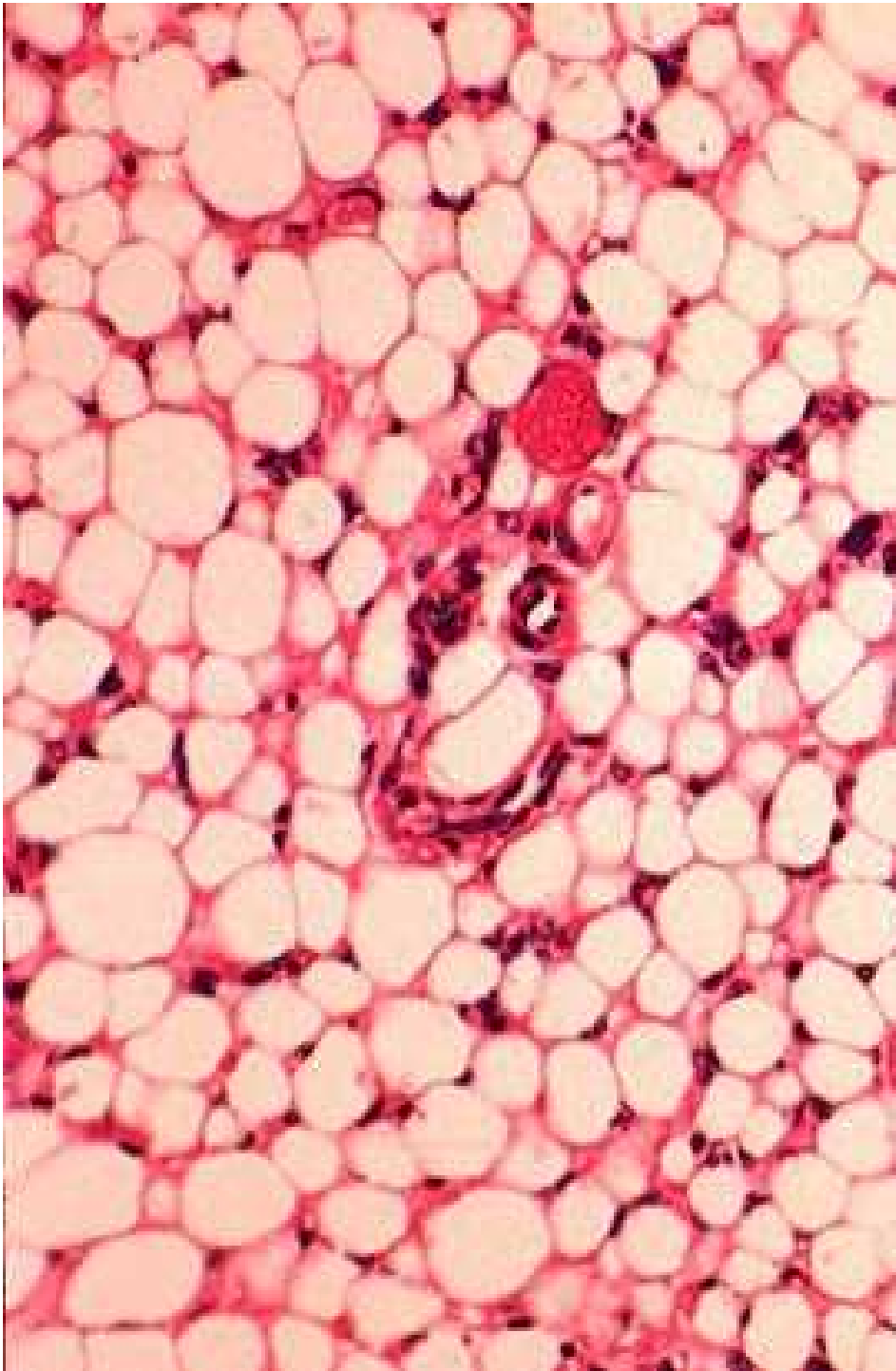
Loose Connective Tissue:

2- Adipose tissue: it is specialized form of loose C. T.

- consists of adipocytes, each adipose cell contains a large fat vacuole or droplet. 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**

Histology Lab Part 3: Slide 11





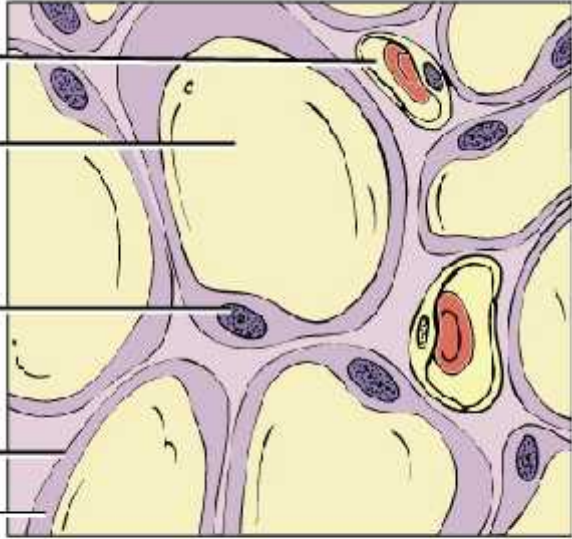
Blood vessel

Fat-storage area
of adipocyte

Nucleus of
adipocyte

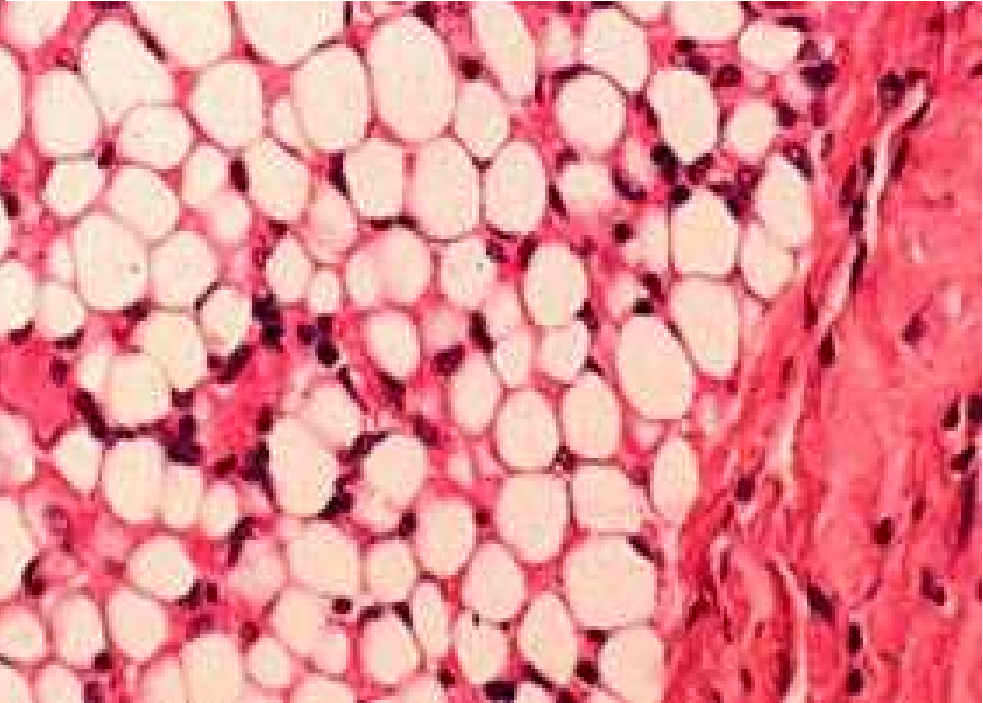
Plasma
membrane

Cytoplasm



Adipose tissue

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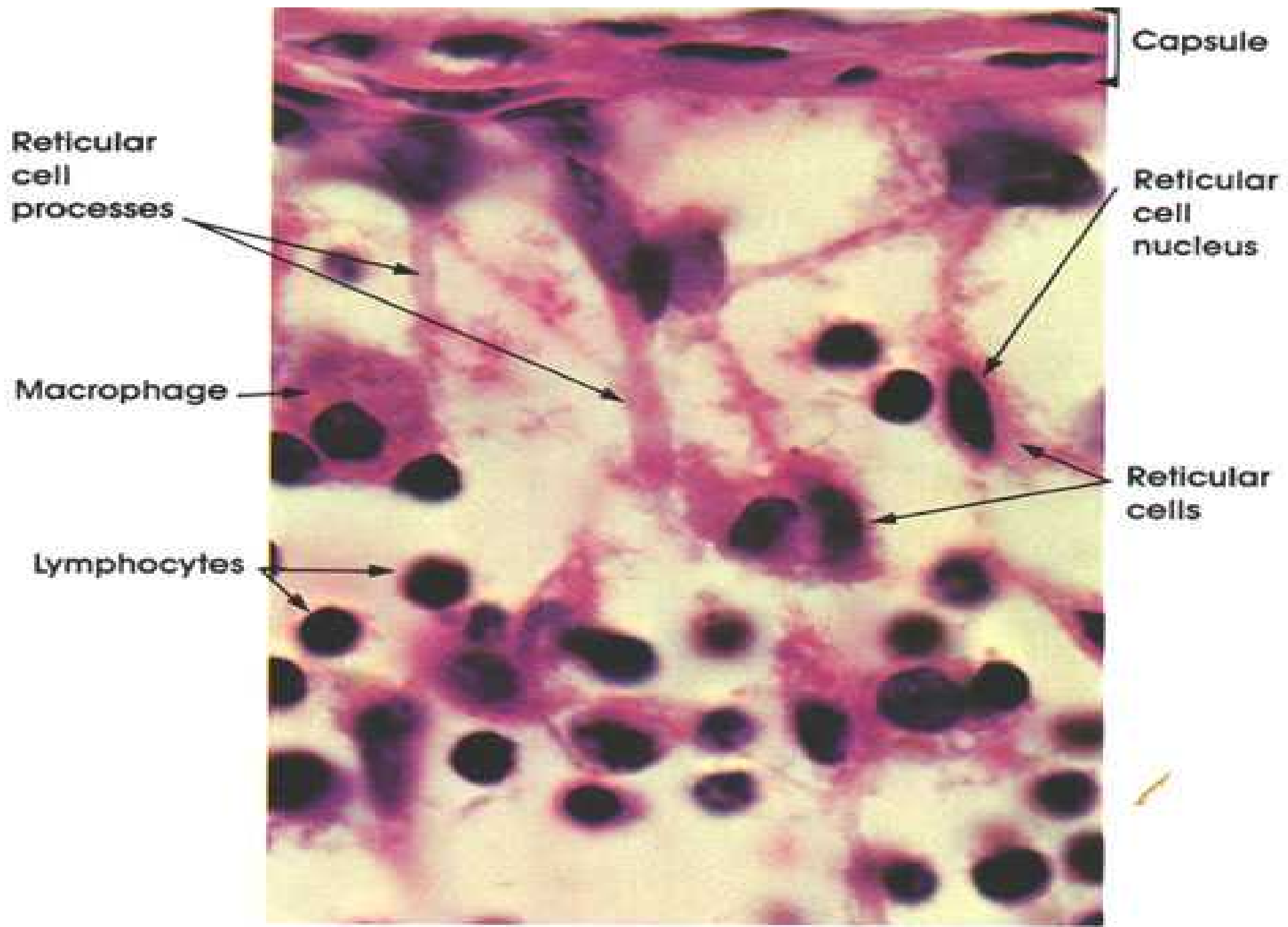




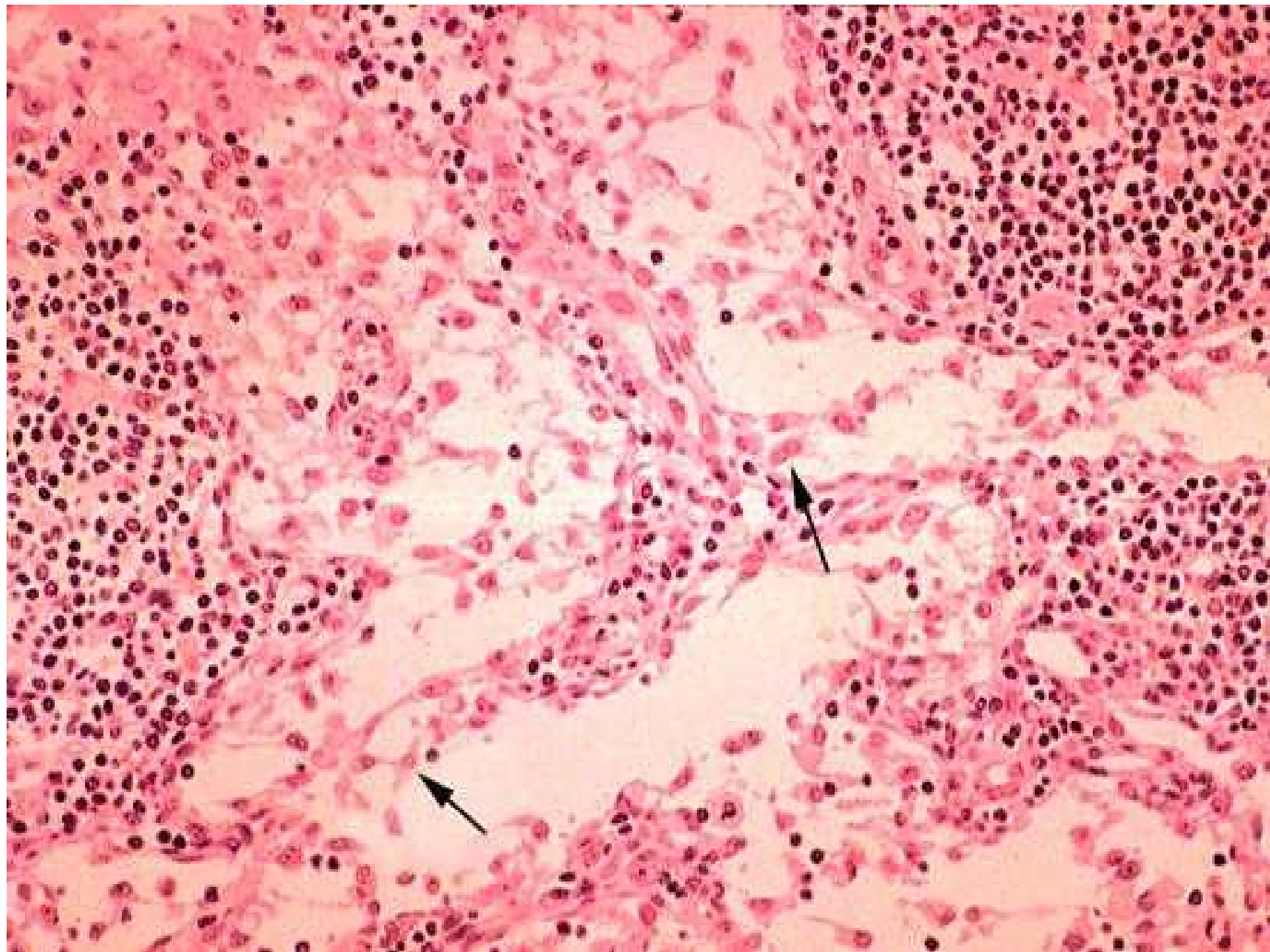
Loose Connective Tissue:

3- Reticular connective tissue:

- Consists of fine interlacing reticular fibers and reticular cells**
- Found in liver, spleen and lymph nodes**
- Function = forms the framework (stroma) of organs and binds together smooth muscle tissue cells**



20 μm





True or Proper Connective Tissue

2- Dense Connective Tissue:

contains more numerous and thicker fibers and far fewer cells than loose C.T.

a. Dense regular connective tissue

Tendons and ligaments

b. Dense irregular connective tissue

Dermis of skin, submucosa of digestive tract



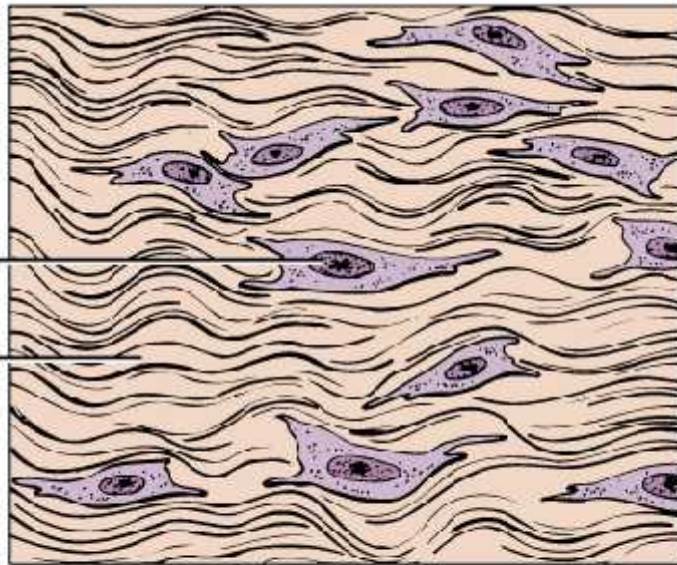
Dense Connective Tissue:

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

Nucleus of fibroblast

Collagen fiber

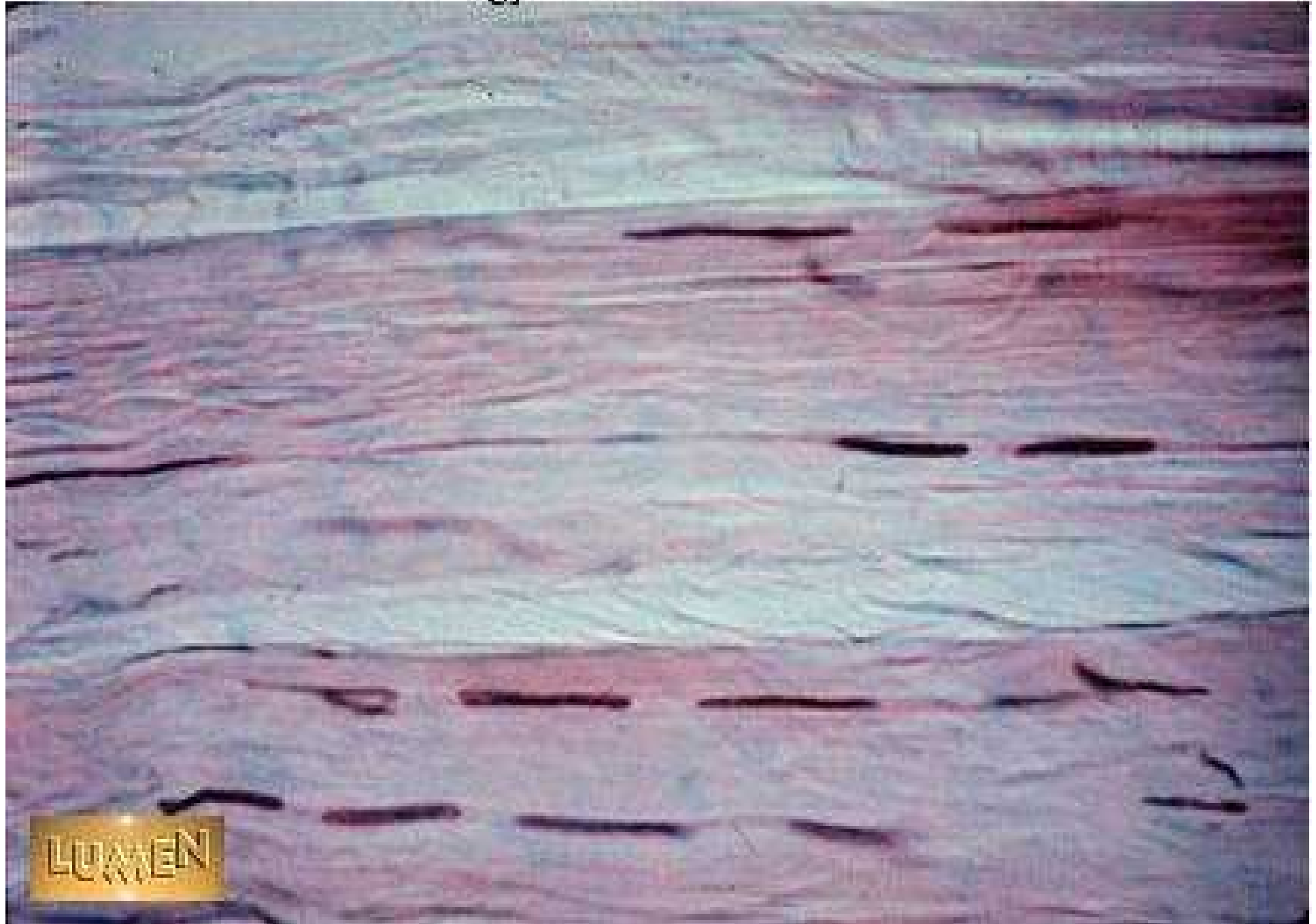


Dense regular connective tissue

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Histology Lab Part 3: Slide 15



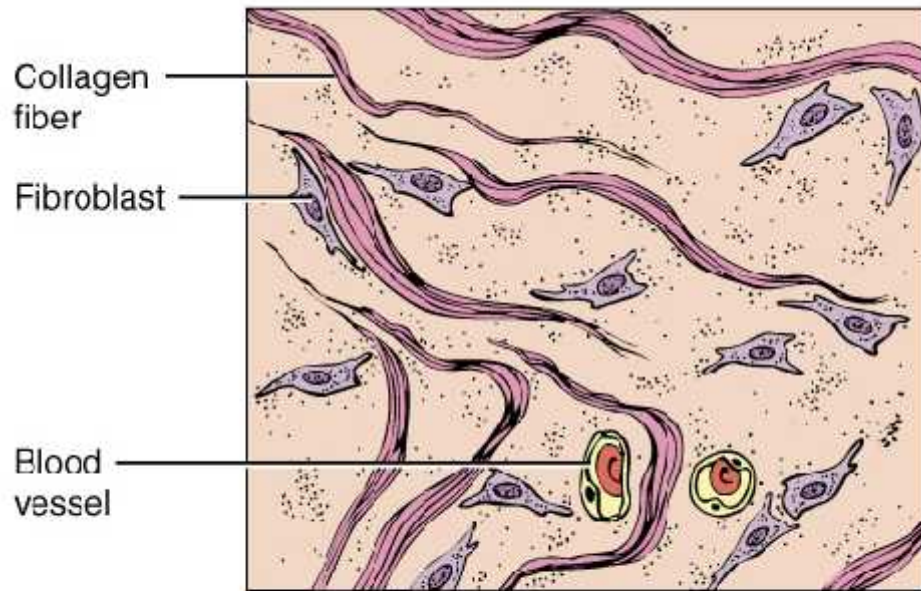


Dense Connective Tissue:

2- Dense Irregular Connective Tissue:

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

Part 3: Slide 9



Dense irregular connective tissue

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Supportive Connective Tissue:

1- CARTILAGE: Jelly-like matrix (chondroitin sulfate) containing collagen and elastic fibers and chondrocytes surrounded by a membrane called the **perichondrium**.

Unlike other CT, cartilage has **NO** blood vessels or nerves except in the perichondrium.

The strength of cartilage is due to collagen fibers and the resilience is due to the presence of chondroitin sulfate. Chondrocytes occur within spaces in the matrix called **lacunae**.

The background of the slide is a collage of four microscopic images. The top-left image shows a cluster of cells with large, pale nuclei, characteristic of adipose tissue. The top-center image shows a dense network of fibers, likely fibrous connective tissue. The top-right image shows a regular arrangement of cells, possibly hyaline cartilage. The bottom-left image shows a highly organized, striated structure, likely skeletal muscle. The bottom-center image shows a cross-section of a joint with a central space, possibly articular cartilage. The bottom-right image shows a dense, fibrous network with a reddish hue, likely elastic cartilage.

Supportive Connective Tissue

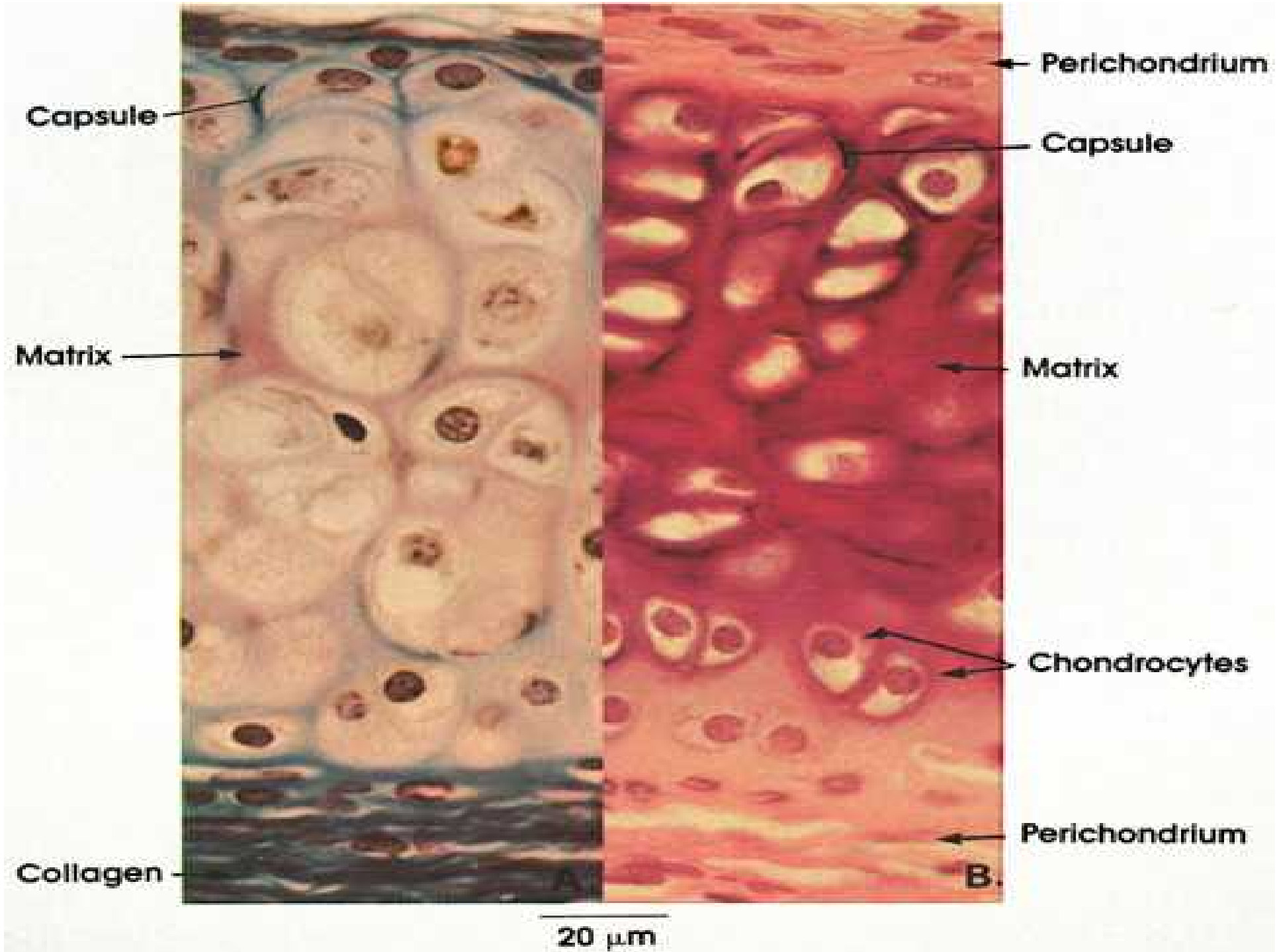
1. **Hyaline cartilage**
2. **Fibrocartilage**
3. **Elastic cartilage**



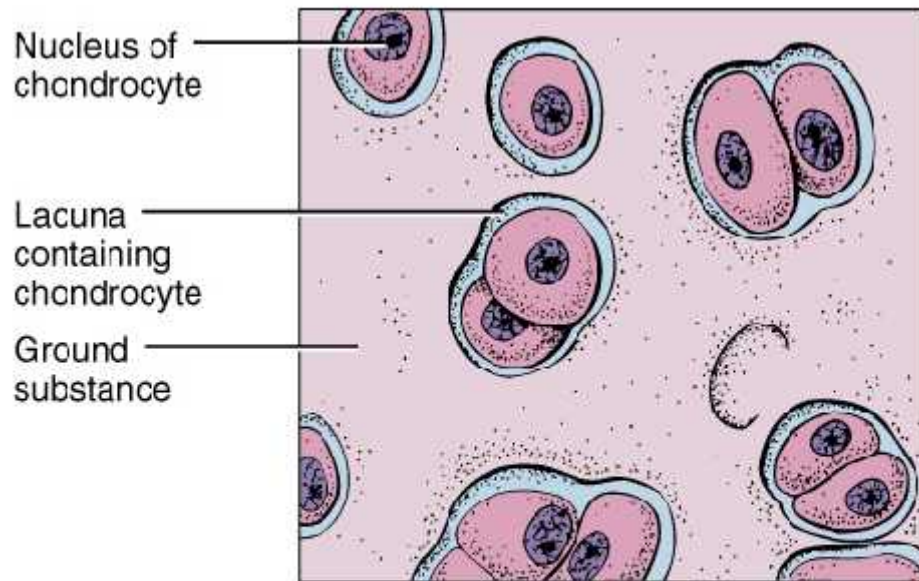
Supportive Connective Tissue:

1. Hyaline Cartilage (most abundant type)

- collagen fibers embedded in matrix with chondrocytes inside lacunae.
- Found in embryonic skeleton, at the ends of long bones, in the nose and in respiratory structures.
- Function= flexible, provides support, allows movement at joints



Part 9: Slide 35



Hyaline cartilage

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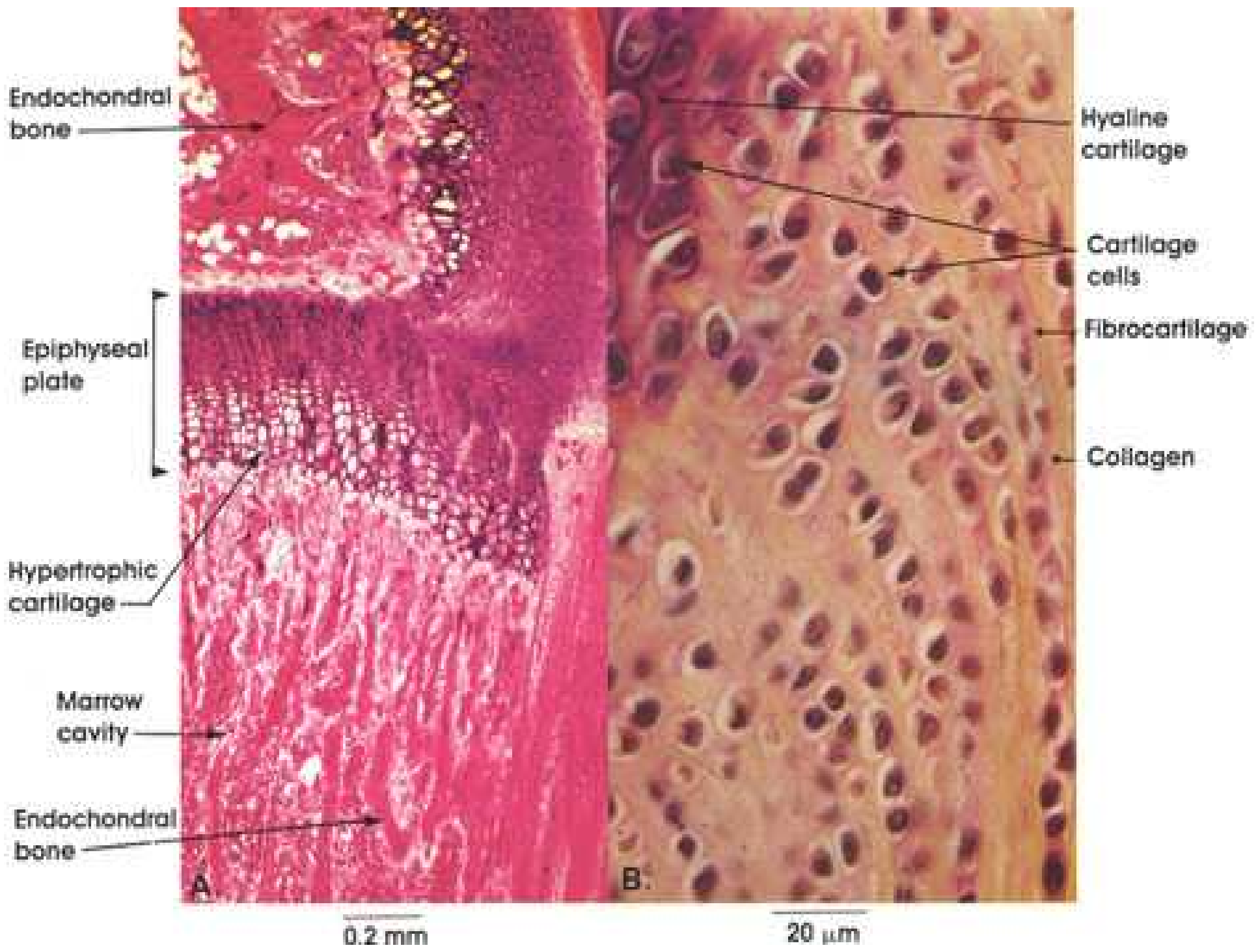
LUNNEN



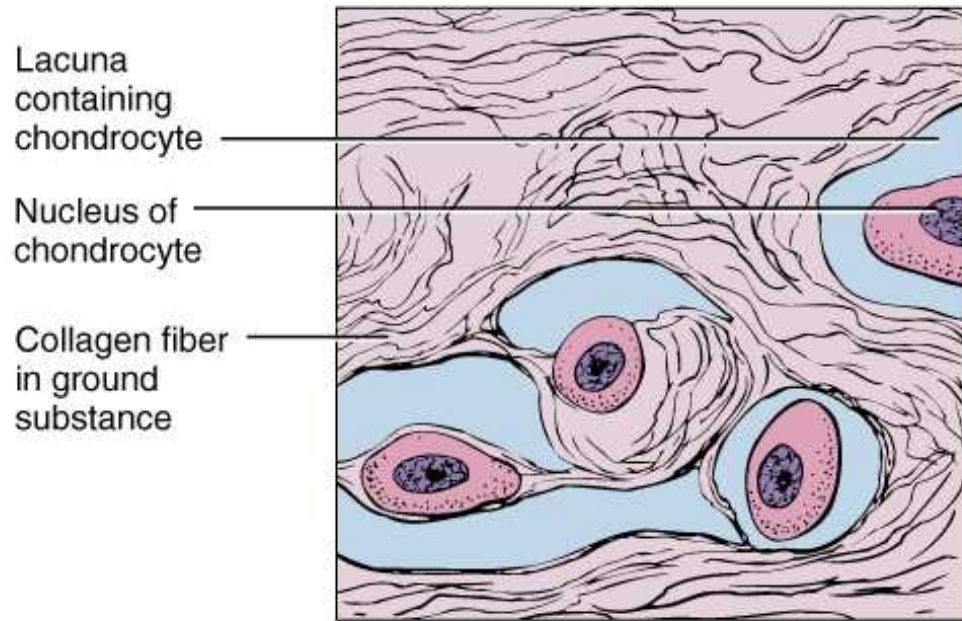
Supportive Connective Tissue:

2. Fibrocartilage

- **contains bundles of collagen in the matrix that are usually more visible under microscopy.**
- **Found in the intervertebral discs**
- **Function = support and absorbs shocks.**

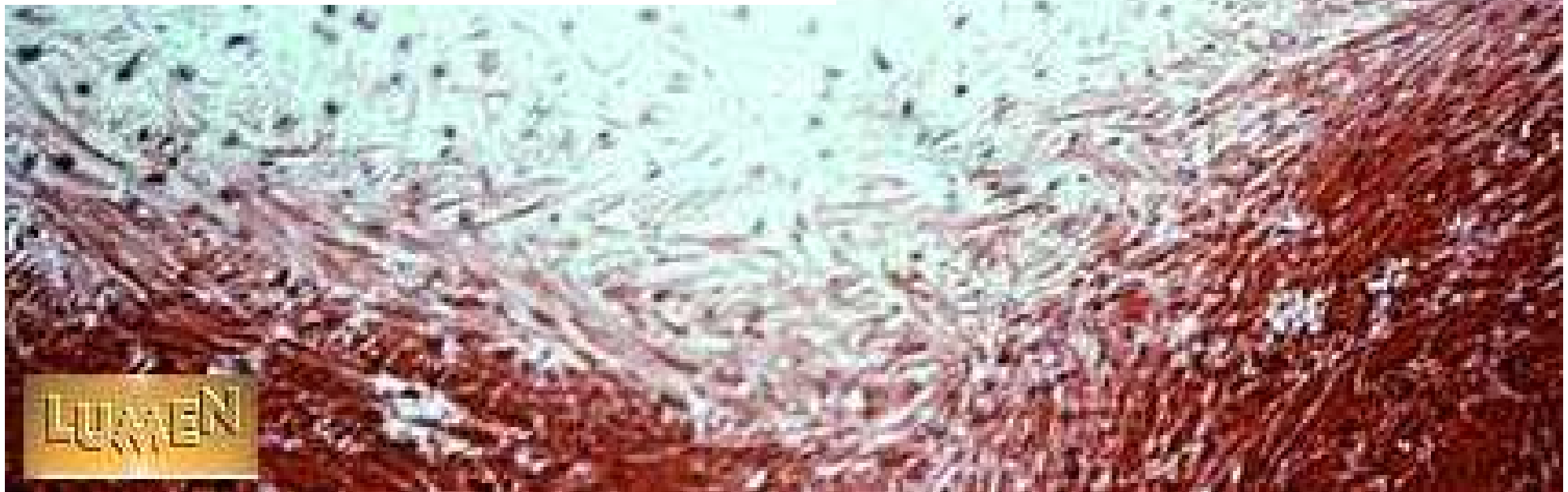
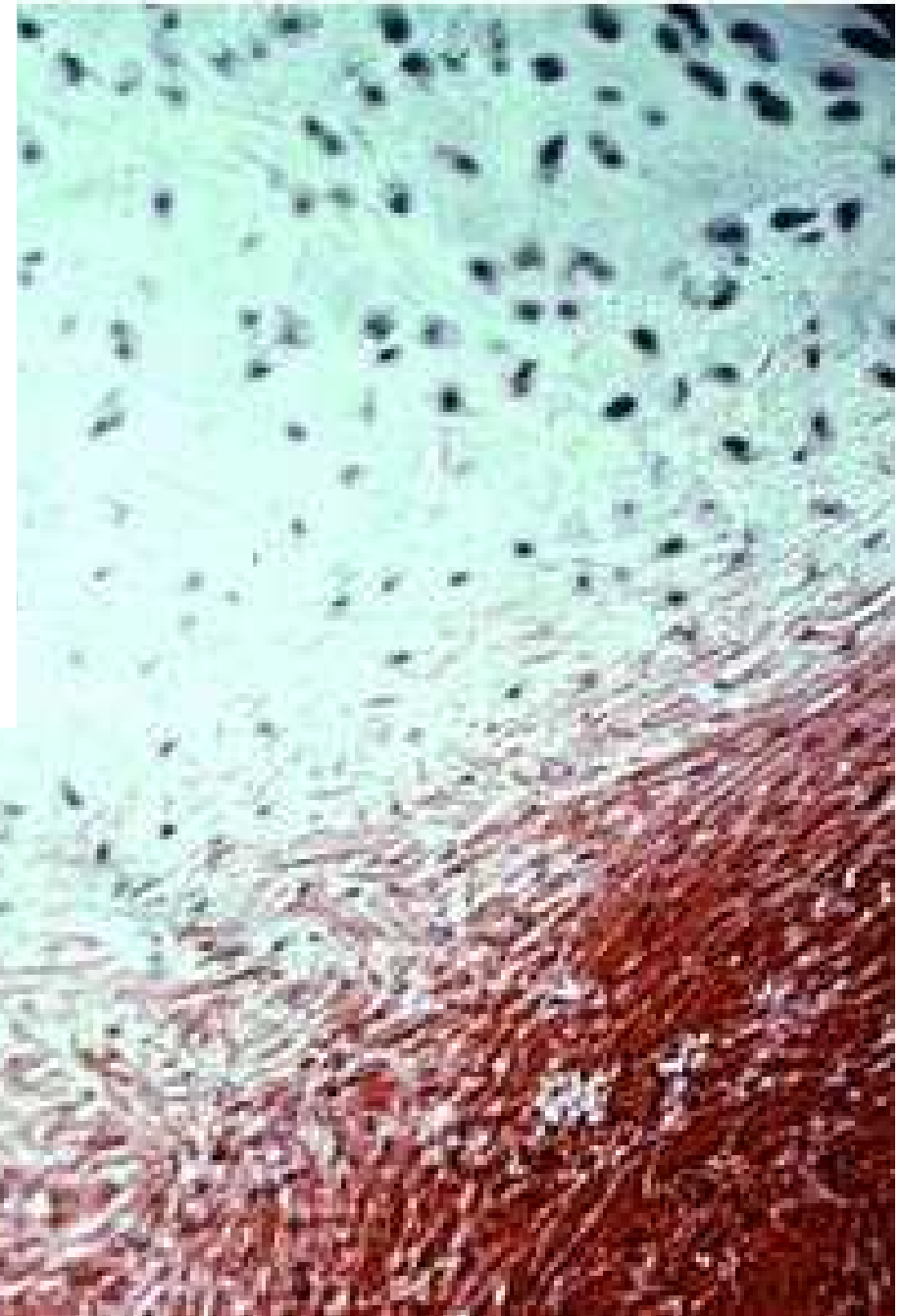


Part 9: Slide 39



Fibrocartilage

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Histology Lab Part 9: Slide 38



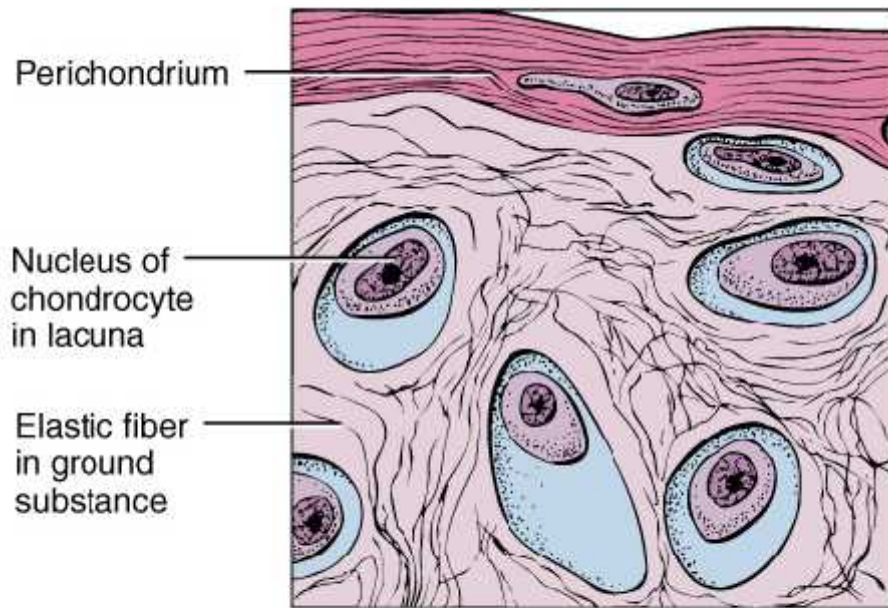


Supportive Connective Tissue:

3. Elastic Cartilage

- **threadlike network of elastic fibers within the matrix.**
- **found in external ear, and epiglottis.**
- **function = gives support, maintains shape, allows flexibility**

Part 9: Slide 36

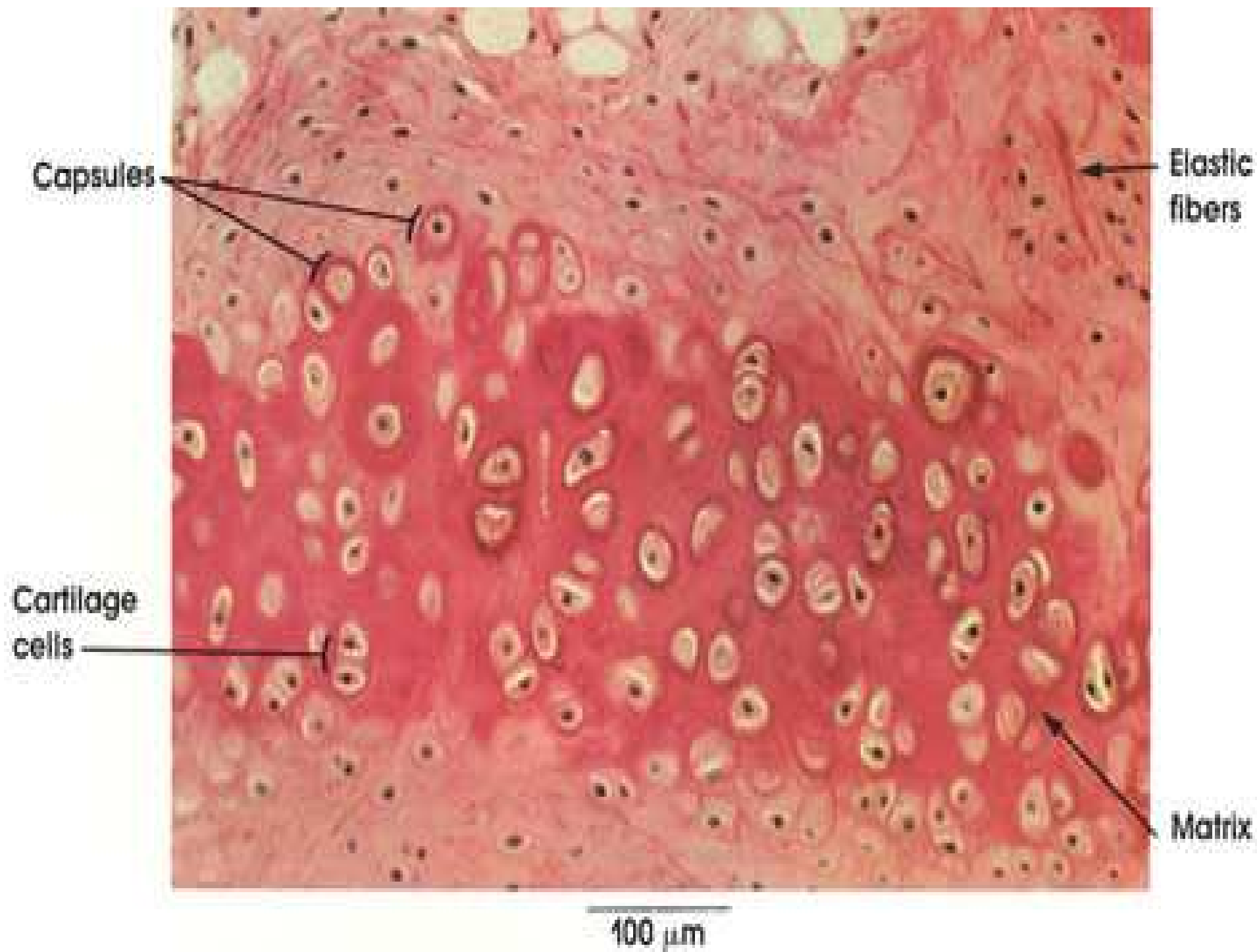


Elastic cartilage

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LUMEN



BONE

1-Spongy bone:

Its is made of spongy porous, not like compact bone.

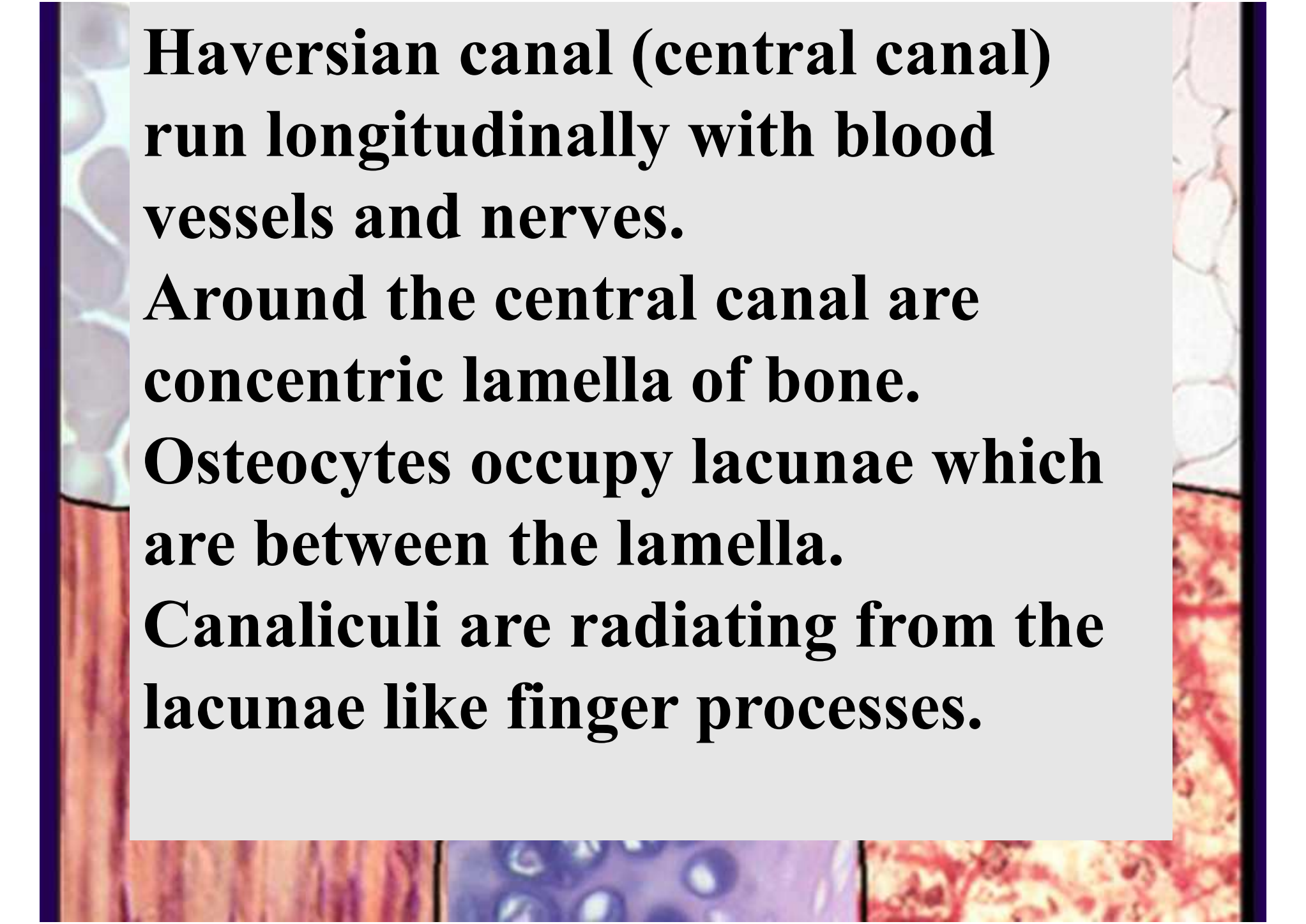
Found in ends of long bones.

Function: for producing blood cells.

2-Compact bone:

Found in most long tissue.

Blood vessels and nerves penetrate periosteum through horizontal opening called Volkmann's canals.

The background of the slide features several microscopic images of bone tissue. On the left, there is a vertical strip showing a cross-section of a bone with a central canal. On the right, there is another vertical strip showing a cross-section of a bone with a central canal. At the bottom, there are three horizontal strips: the left one shows a cross-section of a bone with a central canal, the middle one shows a cross-section of a bone with a central canal, and the right one shows a cross-section of a bone with a central canal.

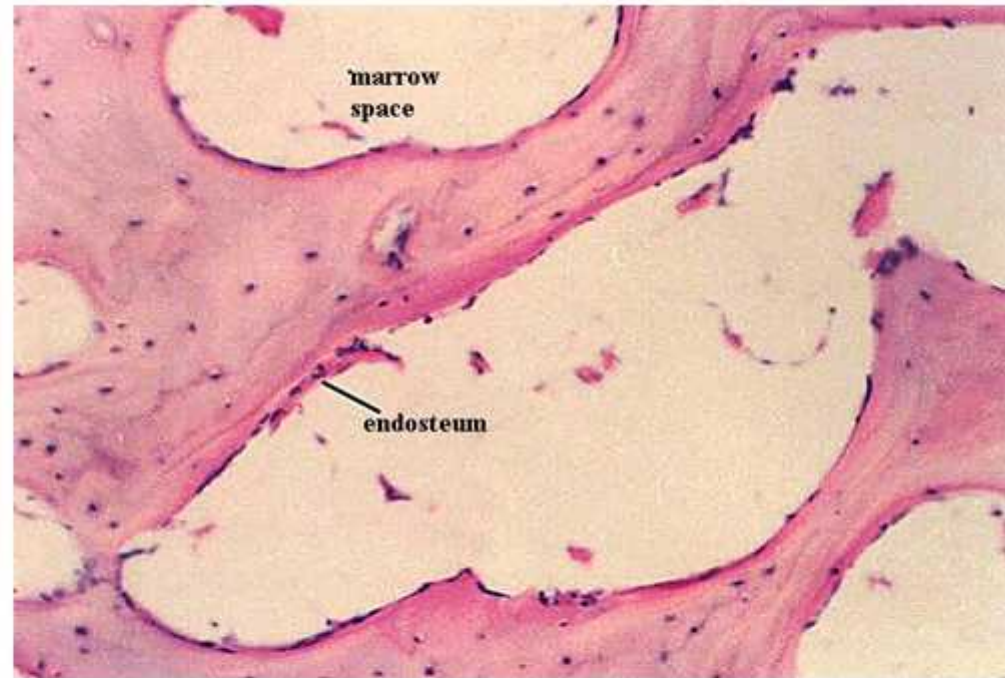
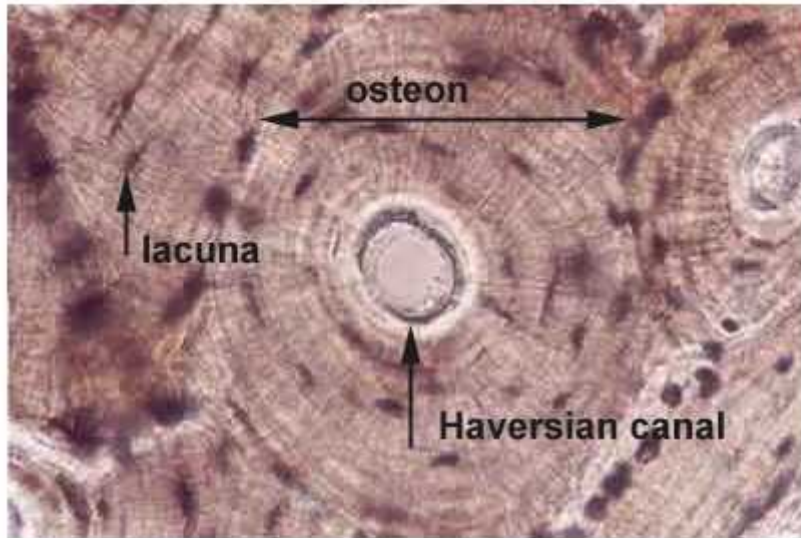
**Haversian canal (central canal)
run longitudinally with blood
vessels and nerves.**

**Around the central canal are
concentric lamella of bone.**

**Osteocytes occupy lacunae which
are between the lamella.**

**Canaliculi are radiating from the
lacunae like finger processes.**

Compact Bone (Ground bone) vs. Spongy Bone (Cancellous bone)



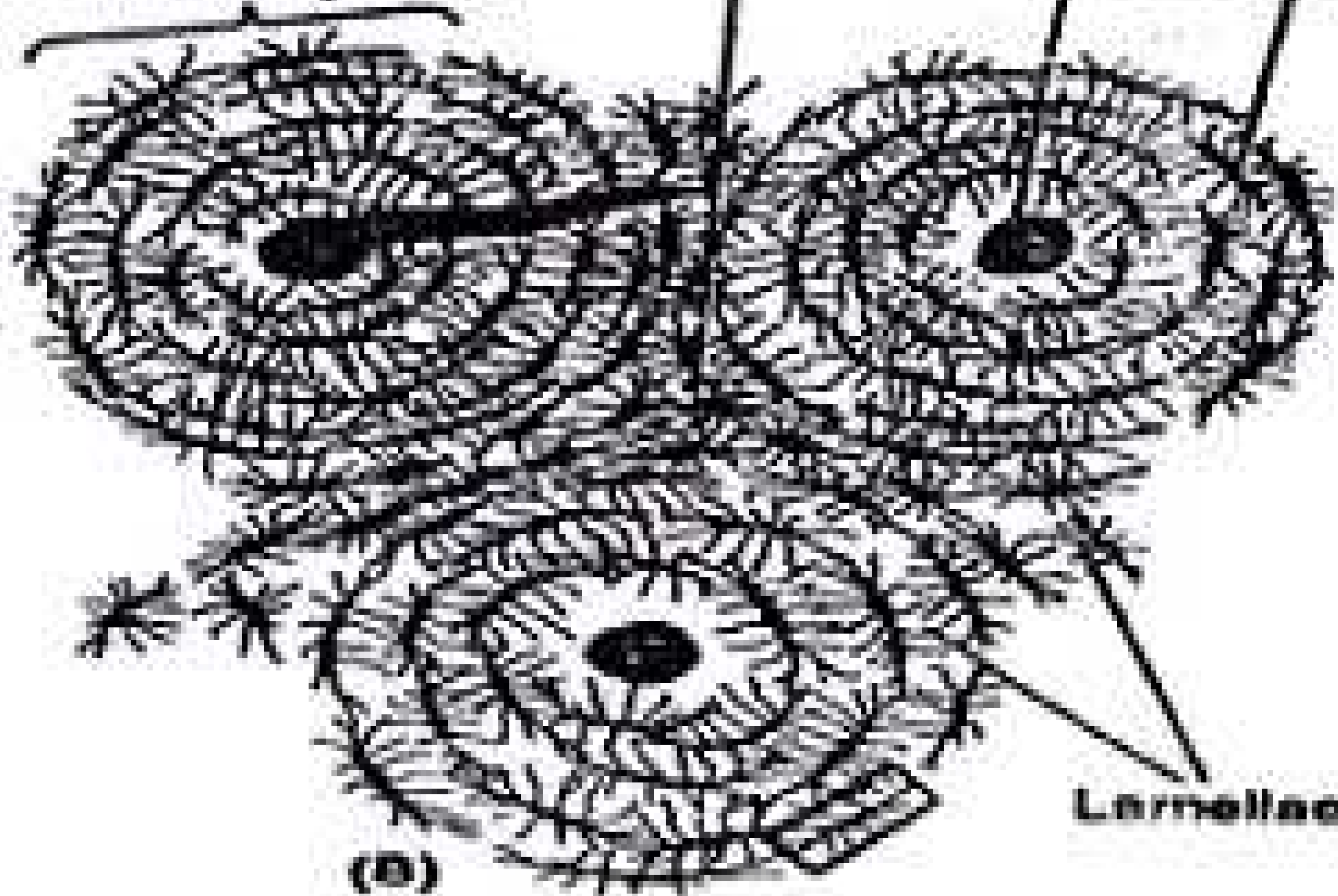
Note the absence of osteons in spongy bone

Haversian canal

Non haversian system

Lacunae

Haversian system



Lamellae

(a)



Blood System Overview

Blood transports oxygen and nutrients to body cells

Blood removes carbon dioxide and other waste products from body cells for elimination

Composition of Blood

- Plasma

- 90 percent water = liquid portion of blood

- Transports cellular elements of blood throughout circulatory system

- Remaining portion is salts and plasma proteins: albumins, globulins, and fibrinogen

Blood Cells

blood cells are two types:

- **1-Erythrocytes**

- Known as **red blood cells (RBC)**

- Tiny biconcave-shaped disks
- Thinner in center than around edges
- No nucleus in mature red blood cell

- Average life span = approximately 120 days

- Main component = hemoglobin

- Primary function = transport oxygen to cells of body

A microscopic image of blood cells, showing various types of leukocytes and erythrocytes. The background is a light gray rectangle containing the text.

- **2- Leukocytes**

- **Known as white blood cells (WBC)**

- **Larger than erythrocytes, but fewer in number**
- **Mature WBC has a nucleus; does not have hemoglobin**

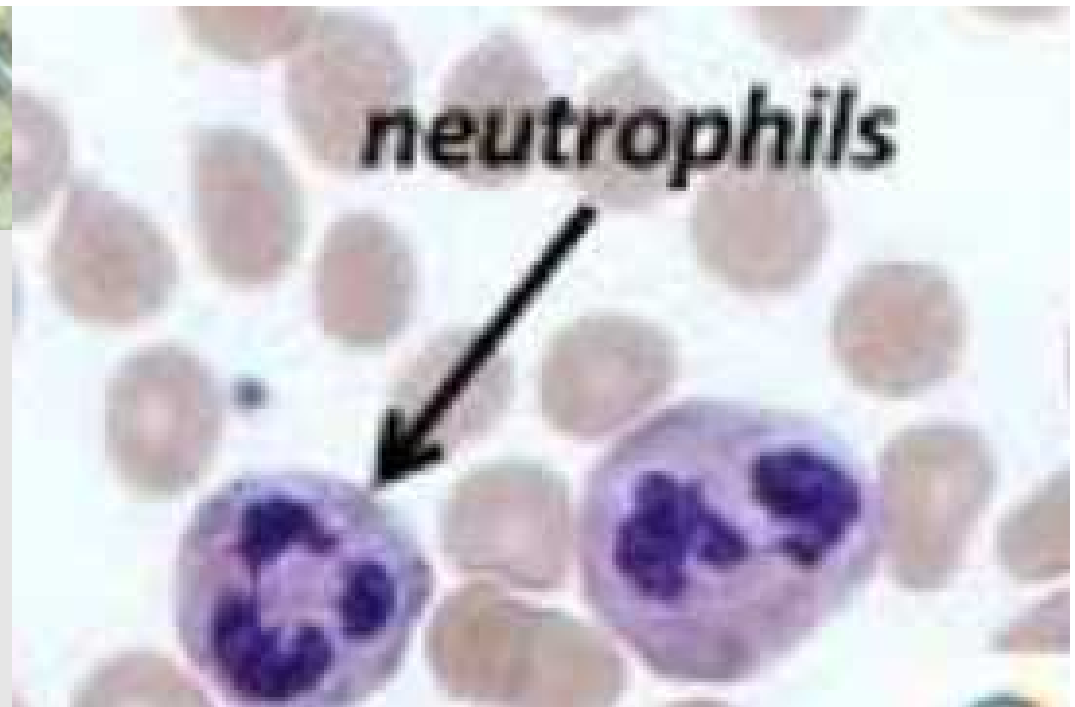
- **Two categories = granulocytes + agranulocytes**

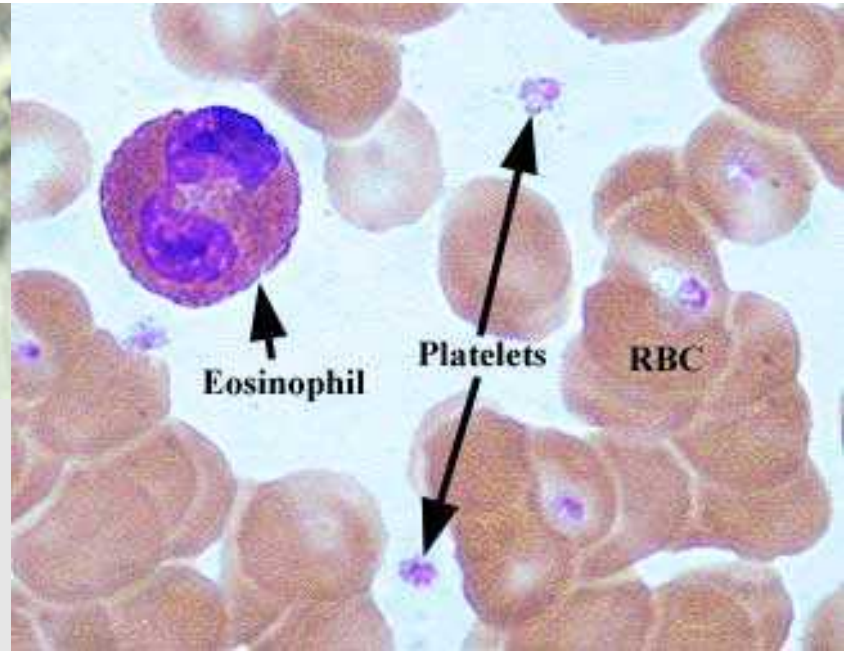
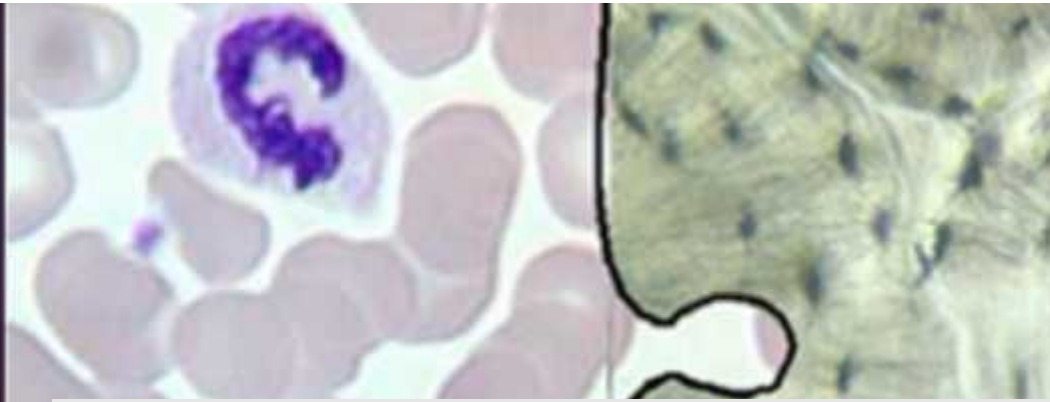
- **Granulocytes have granules in their cytoplasm**
- **Agranulocytes have no granules in their cytoplasm**
- **Five different types of leukocytes within the categories**

- **granulocytes**

- **Neutrophils**

- **Constitute approximately 60-70 percent of all WBCs**
- **Have multi-lobed nuclei**
- **Phagocytic in nature**
- **Do not absorb acid or base dye well**
 - **Remain fairly neutral color**





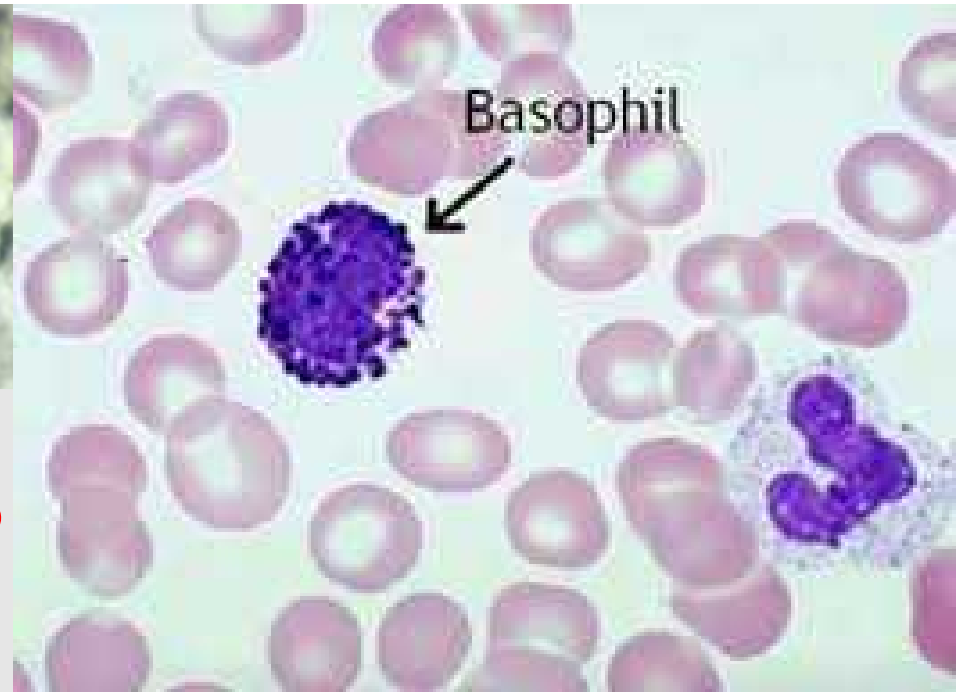
- **granulocytes**

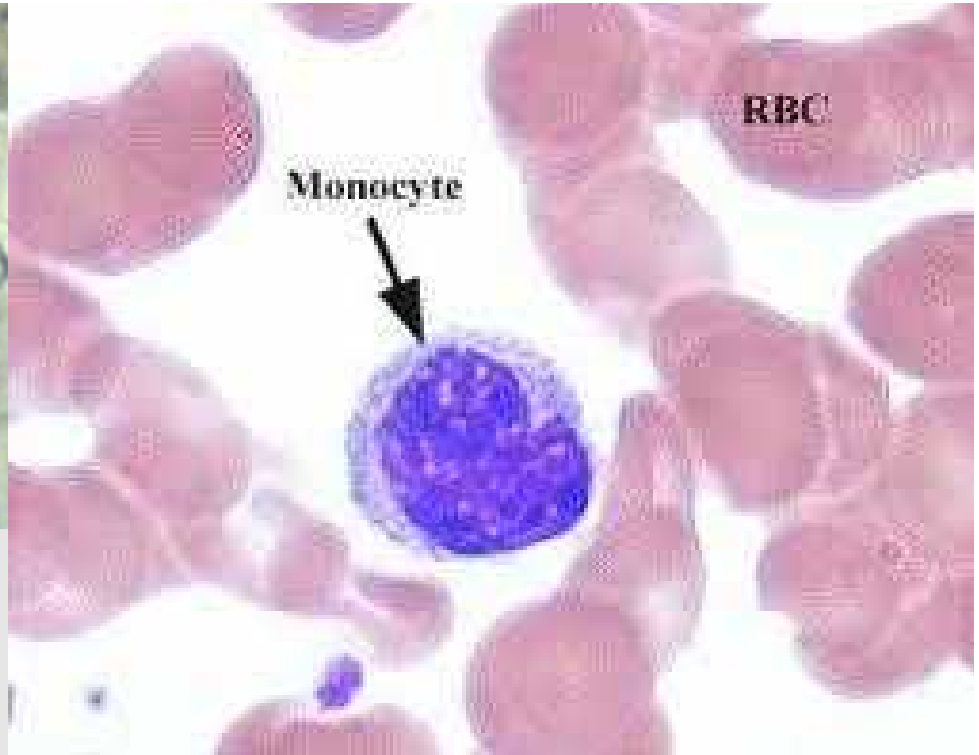
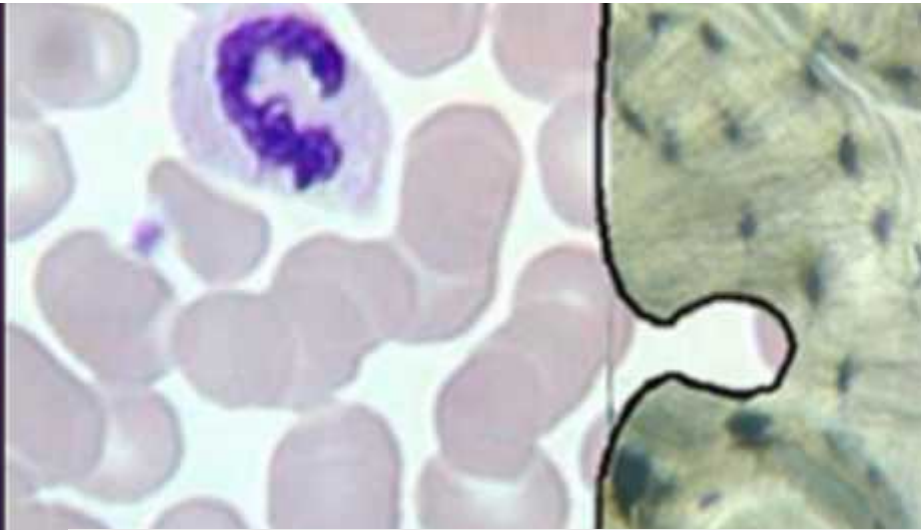
- **Eosinophils**

- **Constitute approximately 2-4 percent of all WBCs**
- **Have a nucleus with two lobes**
- **Increase in number in response to allergic reactions**
- **Stain a red, rosy color with an acid dye**

- **granulocytes**
- **Basophils**

- **Constitute less than 1 percent of all WBCs**
- **Have a nucleus with two lobes**
- **Secrete histamine during allergic reactions**
- **Secrete heparin – a natural anticoagulant**
- **Stain a dark blue with a base dye**





- **A granulocytes**

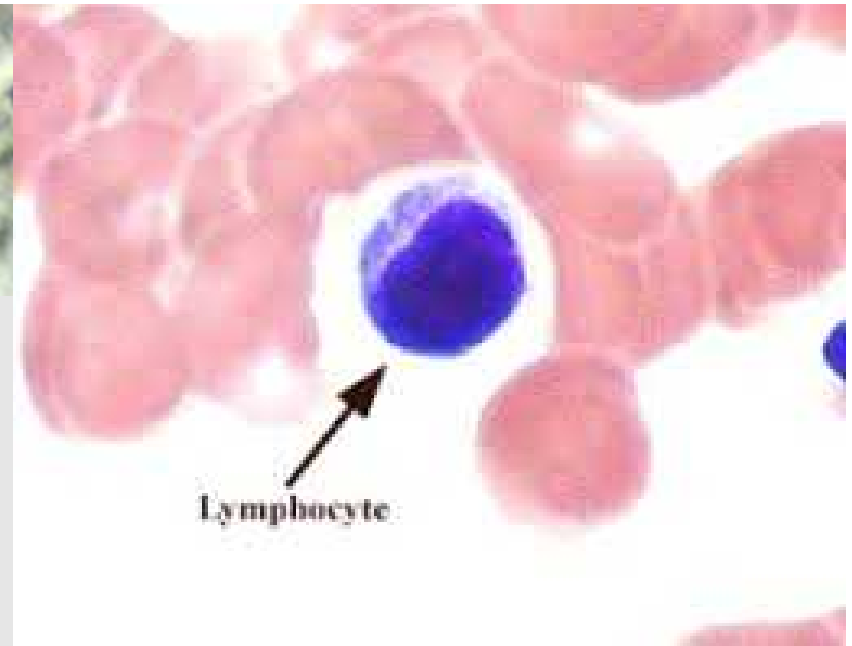
- **Monocytes**

- **Constitute approximately 3-8 percent of all WBCs**
- **Largest of all white blood cells**
- **Have a kidney bean-shaped nucleus**
- **Phagocytic in nature**

A granulocytes

Lymphocytes

- Constitute approximately 20-25 percent of all WBCs
- Have a large spherical-shaped nucleus
- Play important role in immune process
- Some lymphocytes are phagocytic
- Other lymphocytes produce antibodies





Cell Fragments

- **Thrombocytes**
 - Also known as platelets
 - Contain no hemoglobin
 - Essential for normal clotting of blood