Histology :- The science which deals with structures & microscopic anatomy of body tissues . this science include 3 parts :-

1- Cytology **علم الخلية**

2- General Histology **علم الانسجة العام**

3- Organology **علم الاعضاء**

Cell :- Is the smallest unit of living matter of amulticellular living organism . shape , structure & size of cells vary with specific functions of the cells .

Structures of cell :-

1- Cell membrane

2- Cytoplasm which include :-

a- Central body

b- Mitochondria

c- Golgi Apparatus

d- Endoplasmic reticulum

e- Ribosome

f- Lysosomes

g- Vacuoles

h-Nissl Bodies

i- Fibrils

3- nucleus

a- Nuclear Membrane

b- Nucleoli

c- Nuclear Sap

d- Chromocentres

e- Barr body .

Cell division :- which divided into

1- Binary fission الانقسام اللاخيطي او الثنائي (غير المباشر)

2- Mitosis :- which include الانقسام الخيطي (المباشر)

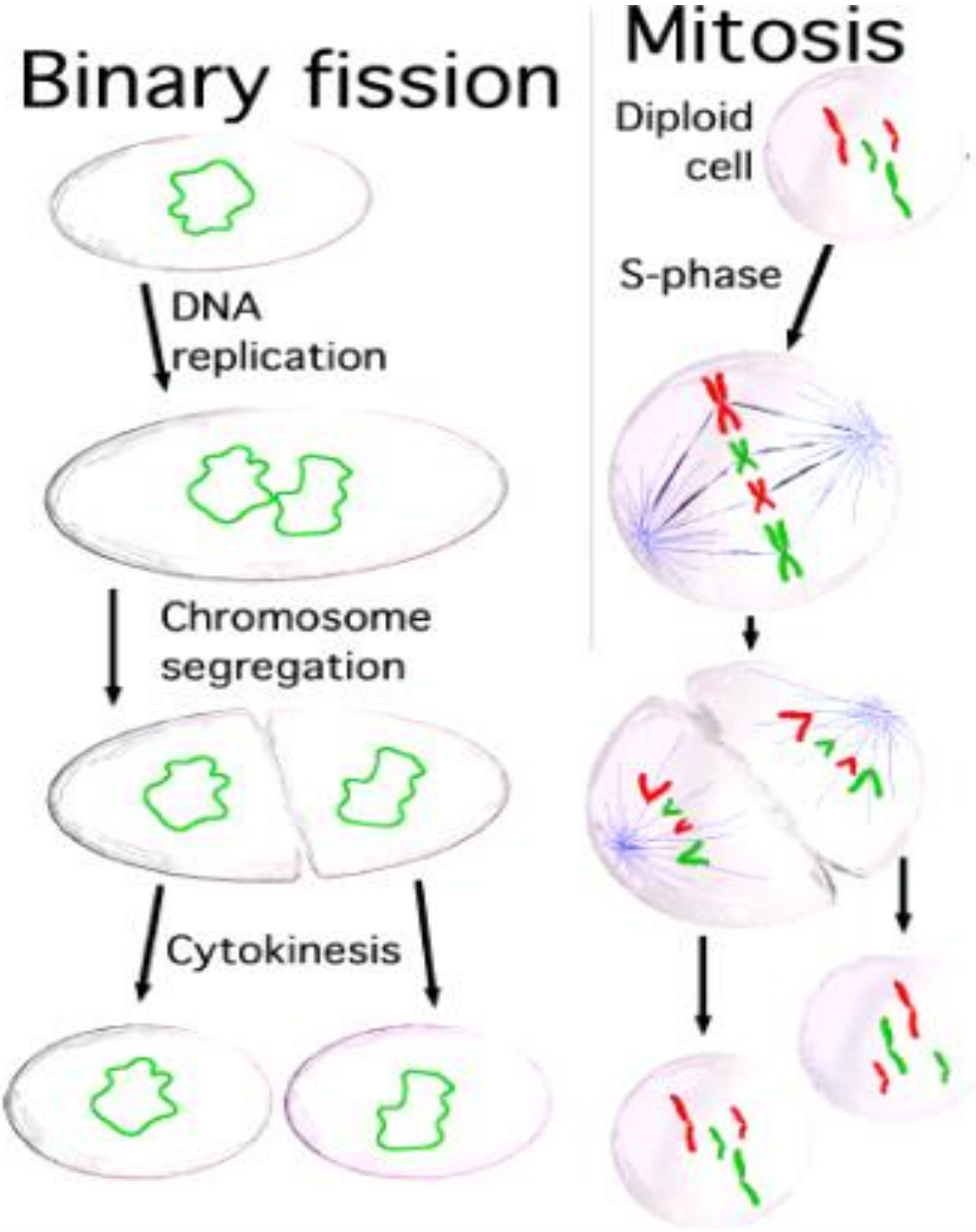
a- prophase الطور البيني

b- prometaphase الطور التمهيدي

c- metaphase الطور الاستوائي

d- anaphase طور التباعد

e- telophase الطور النهائي


Binary fission
DNA replication
Chromosome segregation
Cytokinesis
Mitosis
Diploid cell
S-phase

Type of tissues -The tissues Classified in to **انواع الانسجة :- تصنف الأنسجة إلى**

1. Epithelhal Tissue **النسيج الظهاري**

2. Connective T . **النسيج الضام**

3. Blood and Lymph **الدم واللمف**

4. Musclar T. **النسيج العضلي**

5. Nervous T. **النسيج العصبي**

Characterize of Epithelhal Tissue :-

1- Epithelium covers all free surfaces of the body like skin .

2- The epithelium tissue are separated by a basement membrane .

3- The epithelium tissue free from blood vessels & nerves end .

4- This tissue is composed from a single layer or multiple layer .

Functions of Epithelhal Tissue :-

1- protection الحماية

2- sense الاحساس

3-Secretion الافراز

4 –Excretory الابراز

5-Absorption الامتصاص

Epithelia are classified on the basis of the number of cell layers and the shape of the cells in the surface layer.

- **If there is only one layer of cells in the epithelium, it is designated simple.**
- **If there are two or more layers of cells, it is termed stratified.**
- **Cells in the surface layer are, as a rule, described according to their height as squamous (scale- or plate-like), cuboidal or columnar.**

1- Simple Epithelia **النسيج الظهاري البسيط**

a- Simple squamous epithelium

b- Simple cuboidal epithelium

c- Simple columnar epithelium

2- Stratified Epithelia **النسيج الظهاري الطبقي (المركب)**

a- Stratified squamous epithelium:- which divided into **النسيج الظهاري الطبقي الحرشفي**

- Cornified Stratified Squamous **النسيج الظهاري الطبقي الحرشفي المتقرن**

- Non- Cornified Stratified Squamous **النسيج الظهاري الطبقي الحرشفي غير المتقرن**

b- Stratified cuboidal epithelium

c- Stratified columnar epithelium

3- Pseudo Stratified Columnar epithelium -: النسيج الظهاري العمودي الطبقي الكاذب

4- Transtional epithelium -: النسيج الظهاري الانتقالي

- النسيج الضام :- Connective Tissue

Connective tissue consists of cells separated by varying amounts of extracellular substance. In connective tissues cells typically account for only a small fraction of the tissue volume. The extracellular substance consists of fibres which are embedded in ground substance containing tissue fluid.

Structure of Connective Tissue :- **مكونات النسيج الضام**

1- Fibers-: الالياف

a- Collagen fibres :-

Collagen fibres are the dominant fibre type in most connective tissues. The primary function of collagen fibres is to add strength to the connective tissue.The thickness of the fibres varies from ~ 1 to 10 µm

b- Reticular fibres :-

Reticular fibres are very delicate and form fine networks instead of thick bundles. They are usually not visible in histological sections but can be demonstrated by using special stains. For example, in silver stained sections reticular fibres look like fine, black threads .

c- Elastic fibres :-

Elastic fibres are coloured in fresh tissues - they are light yellow - but this coloration is only visible if large amounts of elastic fibres are present in the tissue, for example, in the elastic ligaments of the vertebral column

2- Cells الخلايا

a- Fibroblasts الاورمات الليفية

b- Macrophages الخلايا البلعمية

c- Plasma cells الخلايا البلازمية

e- Mast cell الخلايا البدينة

f- Fat cells الخلايا الدهنية

3- intracellular Substance

4- Tissue Fluid

Classification of Connective Tissue :-

First :- connective Tissue proper :- which divided into :-

1- Loose connective tissue :- Loose connective tissue is relatively cell rich, soft and compliant. It is also rich in vessels and nerves. It is best understood as a kind of generalised connective tissue in which all connective tissue cell types may occur. which contain 4 types :-

a- Areolar connective tissue :-

is a common type of connective tissue, also referred to as "loose connective tissue". It is strong enough to bind different tissue types together, yet soft enough to provide flexibility

b- Adipose connective tissue :-

Adipose tissue is essentially loose connective tissue containing large numbers of adipocytes. There are two types of adipose tissue, which derive their names from the

colour of the tissue (white or brown) and the number of lipid droplets found in the adipocytes.

- **Adipocytes of white, unilocular adipose tissue contain one large lipid droplet.**
- **Adipocytes of brown, multilocular adipose tissue contain many lipid droplets.**

c- Mucoid connective tissue :-the intracellular substance is gelatinous texture a good example spinal cord

d- Reticular connective tissue :- consists of reticular cells and the network of reticular fibres formed by them .. for example, in the liver, lymph nodes and the spleen.

2- Dense connective tissues:-النسيج الضام الكثيف

Dense connective tissues are completely dominated by fibres which divided in to :-

a- Collagen fibrous tissueالنسيج الليفي الغرائي

b- Yellow elastic fibrous tissueالنسيج الليفي الاصفر المرن

They are subdivided according to the spatial arrangement of the fibres in the tissue . Iregular dense connective tissue the fibres do not show a clear orientation within the tissue. A good example is the dermis of the skin .Regular dense connective tissue if the fibres run parallel to each other. Good examples of regular dense connective tissue are tendons, ligaments ,

Second :- Skeletal Connective tissue:- which divided into

1- Bone :- Bone gives the skeleton the necessary rigidity to function as attachment and lever for muscles and supports the body against gravity.

- There is two types of bone can be distinguished macroscopically :-

a- **spongy bone The ends of long bones (or epiphyses) consist mainly of trabecular bone.**

b- **Compact bone does not have any spaces or hollows in the bone matrix that are visible to the eye. Compact bone forms the thick-walled tube of the shaft (or diaphysis) of long bones, which surrounds the marrow cavity (or medullary cavity). A thin layer of compact bone also covers the epiphyses of long bones.**

Bone Cells

1- Osteoblasts :-

Osteoblasts may form a low columnar "epitheloid layer" at sites of bone deposition.

2- Osteocytes:-

Osteocytes contain less endoplasmatic reticulum and are somewhat smaller than osteoblasts.

3- Osteoclasts :-

are very large (up to 100 µm) . Osteoclasts attach themselves to the bone matrix and form a tight seal at the attachment site.

2- Cartilage :-

is a specialised type of connective tissue. consists, like other connective tissues, of cells and extracellular components , unlike other connective tissues, not contain vessels or nerves , is surrounded by a layer of dense connective tissue, the perichondrium .

Types of Cartilage :-

a- Hyaline Cartilage which found in Trachea

b- Elastic Cartilage which found in Epiglottis

c- Fibrous Cartilage which found in Intervertebral Disc

MUSCLE

Motion, as a reaction of multicellular organisms to changes in the internal and external environment, is mediated by muscle cells.

Three structurally and functionally distinct types of muscle are found in vertebrates:

1. **smooth muscle,**
2. **skeletal muscle and**
3. **cardiac muscle.**

Smooth Muscle

- **Smooth muscle consists of spindle shaped cells of variable size.**

  The largest smooth muscle cells occur in the uterus during pregnancy (12x600 µm). The smallest are found around small arterioles (1x10 µm).

- **Smooth muscle cells contain one centrally placed nucleus.**

  The chromatin is finely granular and the nucleus contains 2-5 nucleoli.
- **The innervation of smooth muscle is provided by the autonomic nervous system.**

Skeletal Muscle

- **Skeletal muscle consists of very long tubular cells, which are also called muscle fibres.**

  The average length of skeletal muscle cells in humans is about 3 cm (sartorius muscle up to 30 cm, stapedius muscle only about 1 mm). Their diameters vary from 10 to 100 µm.
- **Skeletal muscle fibres contain many peripherally placed nuclei.**

  Up to several hundred rather small nuclei with 1 or 2 nucleoli are located just beneath the plasma membrane.
- **Skeletal muscle fibres show in many preparations characteristic cross-striations. It is therefore also called striated muscle.**
- **Skeletal muscle is innervated by the somatic nervous system.**
- **Skeletal muscle makes up the voluntary muscle.**

Cardiac Muscle

- **Cardiac muscle, the myocardium, consists of muscle cells, cardiomyocytes, with one centrally placed nucleus.**

  Nuclei are oval, rather pale and located centrally in the muscle cell which is 10 - 15 µm wide.

- **Cardiac muscle cells exhibit cross-striations.**
- **Cardiac muscle cells excitation is mediated by rythmically active modified cardiac muscle cells.**
- **Cardiac muscle is innervated by the autonomic nervous system, which adjusts the force generated by the muscle cells and the frequency of the heart beat.**
- **Cardiac muscle is for these reasons also called involuntary striated muscle.**

BLOOD

Blood is sometimes considered to be a fluid connective tissue because of the mesenchymal origin of its cells and a low ratio of cells to liquid intercellular substancethe blood plasma. In human adults about 5 liter of blood contribute 7-8 % to the body weight of the individualErythrocytes, leukocytes and blood Erythrocytes

Erythrocytes do not contain a nucleus. They do contain haemoglobin, which fills almost the entire cytoplasm. The average diameter of the disk is ~7 µm. The granular appearance is caused by haemoglobin molecules. Foetal erythrocytes (up to the 4th month of gestation) are larger than "adult" erythrocytes, and they are nucleated.

Functions

Erythrocytes function in the transport of oxygen. Haemoglobin, the oxygen binding protein in erythrocytes, contributes about 30% of the weight of an erythrocyte. The lifespan of an erythrocyte in the blood stream is 100-120 days.

Leukocytes

Leukocytes can be further subdivided into granular leukocytes, i.e. neutrophils, basophils and eosiniphils, and non-granular leukocytes, i.e. monocytes and lymphocytes.

In healthy individuals the relative numbers of circulating leukocyte types are quite stable. range of normal frequencies reported in different texts :

- **~ 60% neutrophils (50% - 70%)**
- **~ 3% eosinophils (>0% - 5%)**
- **~ 0.5% basophils (>0% - 2%)**
- **~ 5% monocytes (1% - 9%)**
- **~ 30% lymphocytes (20% - 40%)**

Changes in their relative numbers indicate that something abnormal is happening in the organism. A larger than usual number of neutrophils (neutrophilia) would indicate e.g. an acute or chronic infection. The number of basophils and eosinophils may increase (eosinophilia or basophilia) as a consequence of e.g. allergic disorders.

Granular Leukocytes

Granular leukocytes are all approximately the same size - ~ 12-15 µm in diameter. Their nuclei form lobes, and nucleoli cannot be seen. The number of nuclear lobes varies according to cell type. All granulocytes are motile.

The term granulocytes refers to the presence of granules in the cytoplasm of these cells.

Neutrophil granulocytes (or neutrophils)

have a very characteristic nucleus. It is divided into 3-5 lobes. The number of lobes increases with cell age. Up to 7 lobes can be found in very old neutrophils.

neutrophils contain enzymes with strong bactericidal actions.

Functions

Neutrophils play a central role in inflammatory processes. Large numbers invade sites of infection in response to factors . Neutrophils are the first wave of cells invading infection area . Receptors in their plama membrane allow them to recognise foreign bodies, e.g. bacteria, and tissue debris, which they begin to phagocytose and destroy. Dead neutrophils and tissue debris are the major components of pus. Their lifespan is only about one week.

Eosinophil granulocytes (or eosinophils)

Their nucleus usually has only two lobes. Almost all of the cytoplasm appears filled with the specific granules of the eosinophils. These specific granules contain, in addition to enzymes that otherwise are found in lysosomes .

Functions

The presence of antibody-antigen complexes stimulates the immune system. Eosinophils phagocytose these complexes, and this may prevent the immune system from "overreacting". Their granules also contain the enzyme histaminase .

Basophil granulocytes (or basophils)

Basophilic granulocytes have a 2 or 3 lobed nucleus . They contain heparin, histamine, lysosomal enzymes

Functions

Heparin and histamine are vasoactive substances. They dilate the blood vessels, make vessel walls more permeable and prevent blood coagulation. As a consequence, they facilitate the access of other lymphocytes and of plasma-borne substances of importance for the immune response (e.g. antibodies) to, e.g., a site of infection.

Non-granular leukocytes

Monocytes

These cells can be slightly larger than granulocytes (~ 12-18 µm in diameter). but it does not contain any structures which would be visible in the light microscope .

Functions

Once monocytes enter the connective tissue they differentiate into macrophages. At sites of infection macrophages are the dominant cell type after the death of the invading neutrophils. The phagocytose microorganisms,

Lymphocytes

These cells are very variable in size. The smallest lymphocytes may be smaller than erythrocytes (down to ~ 5 µm in diameter) while the largest may reach the size of large granulocytes (up to 15 µm in diameter).

Functions

Most lymphocytes in the blood stream belong to either the group of B-lymphocytes (~5%) or the group of T-lymphocytes (~90%). Unless they become activated, the two groups can not easily be distinguished using routine light or electron microscopy.

Blood Platelets (or thrombocytes)

Blood platelets do not contain a nucleus. Unlike erythrocytes, which also lack a nucleus, the blood platelets of mammals have never been nucleated cells. Instead, blood platelets are fragments of the cytoplasm of very large thrombocyte precursor cells, Platelets are about 3 µm long but appear somewhat smaller in the microscope. This is because their cytoplasm is divided into two zones: and outer hyalomere, which hardly stains, and an inner granulomere, which contains bluish staining granules .

Functions

Platelets assist in haemostasis, the arrest of bleeding .

Veins

The walls of veins are thinner than the walls of arteries, while their diameter is larger. In contrast to arteries, the layering in the wall of veins is not very distinct. The tunica intima is very thin.

The walls of veins in the lower parts of the body are typically thicker than those of the upper parts of the body, and the walls of veins which are embedded in tissues that may provide some structural support are thinner than the walls of unsupported veins.

Arteries

All arterial vessels originate with either the pulmonary trunk (from the right ventricle) or the aorta (from the left ventricle). Specialisations of the walls of arteries relate mainly to two factors: the pressure pulses generated during contractions of the heart (systole) and the regulation of blood supply to the target tissues of the arteries. The tunica media is the main site of histological specialisations in the walls of arteries.

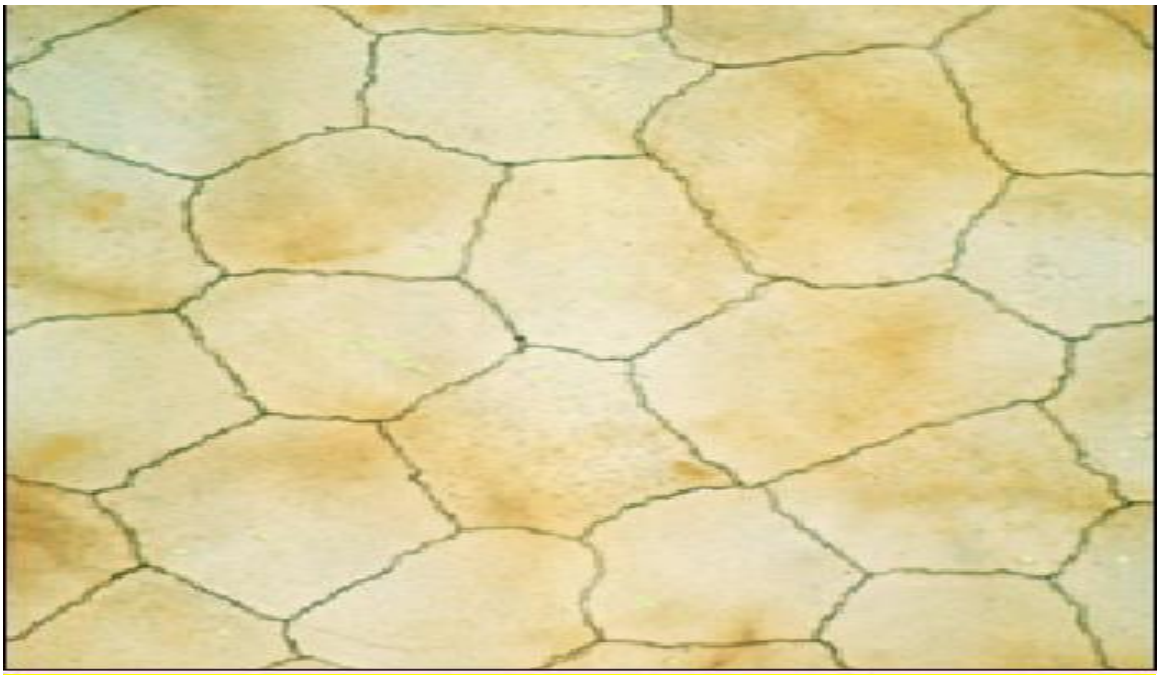
Capillaries

The sum of the diameters of all capillaries is significantly larger than that of the aorta (by about three orders of magnitude), which results in decreases in blood

pressure and flow rate. Also, capillaries are very small vessels. Their diameter ranges from 4-15 µm. The wall of a segment of capillary may be formed by a single endothelial cell. This results in a very large surface to volume ratio. The low rate of blood flow and large surface area facilitate the functions of capillaries in

- **providing nutrients and oxygen to the surrounding tissue, in**
- **the absorption of nutrients, waste products and carbon dioxide, and in**
- **the excretion of waste products from the body.**

الظهارة الحرشفية البسيطة



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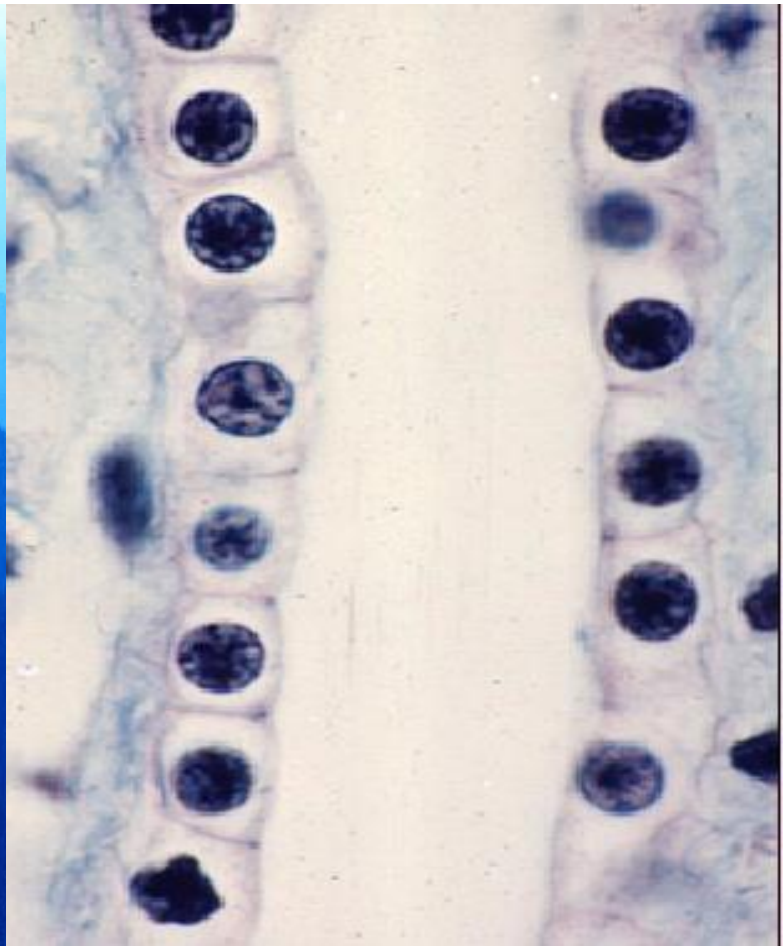

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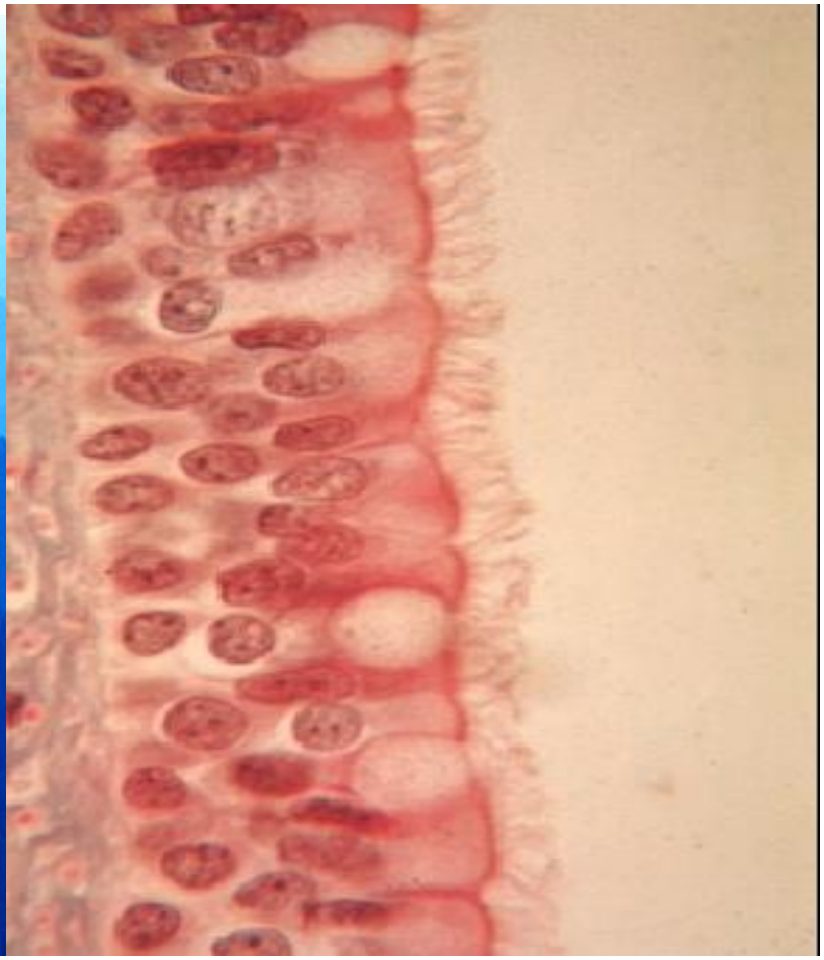
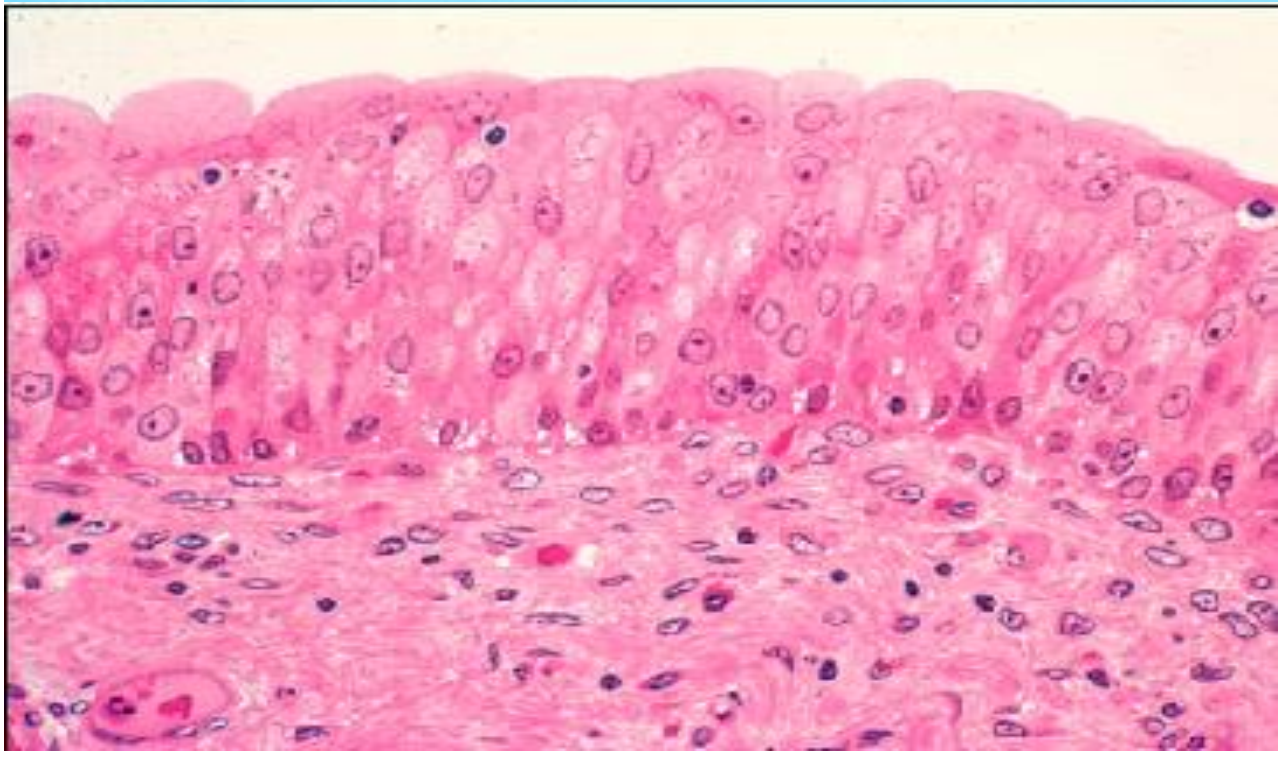


النسيج الظهاري الانتقالي



النسيج
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dense
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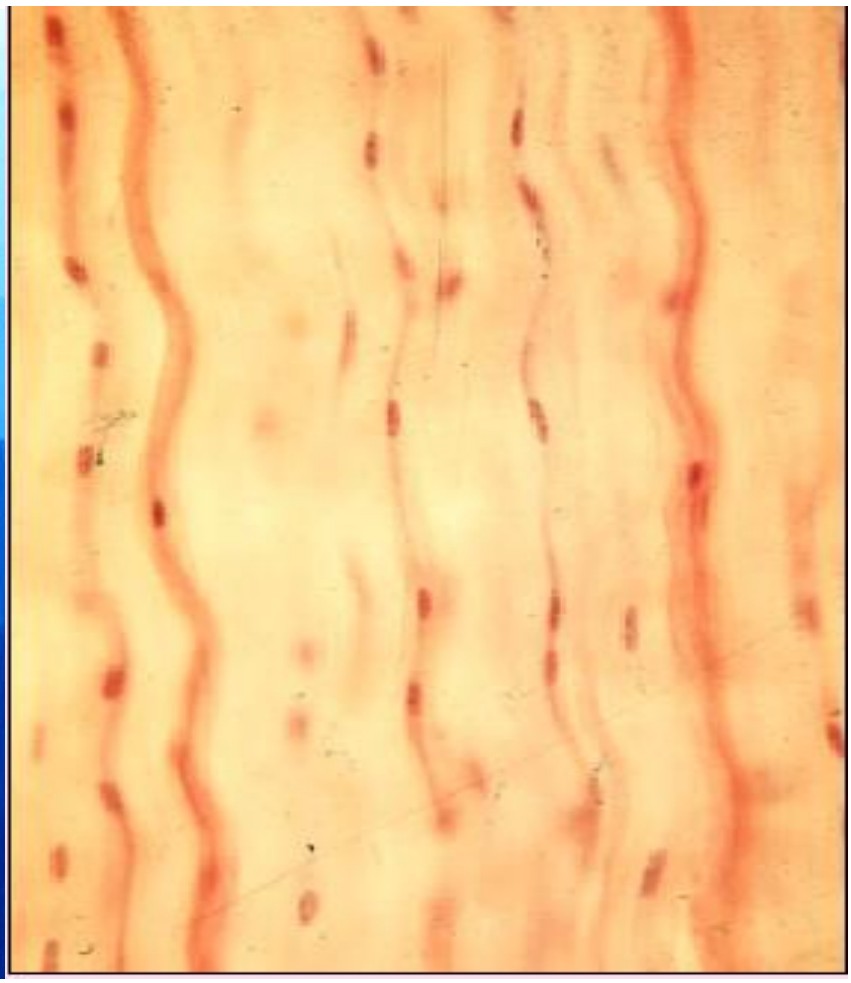
C.T.



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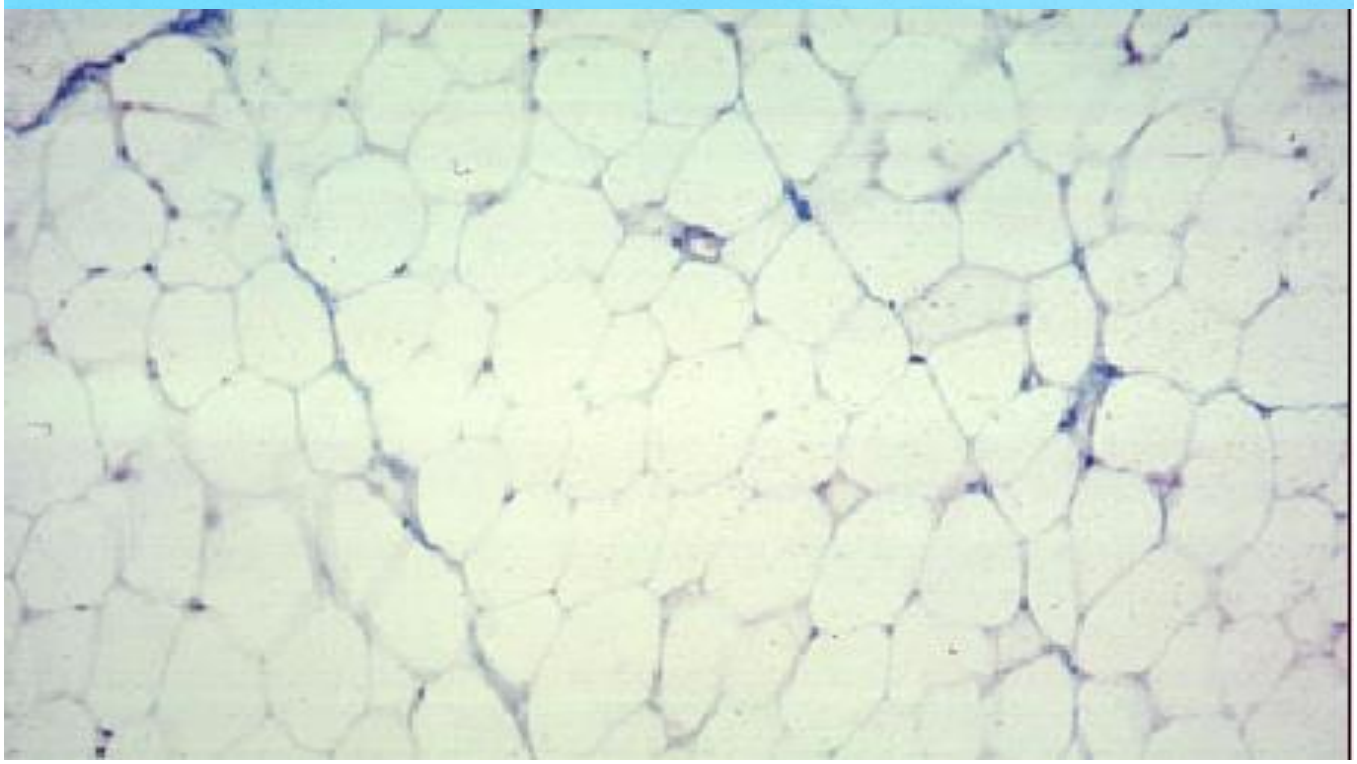
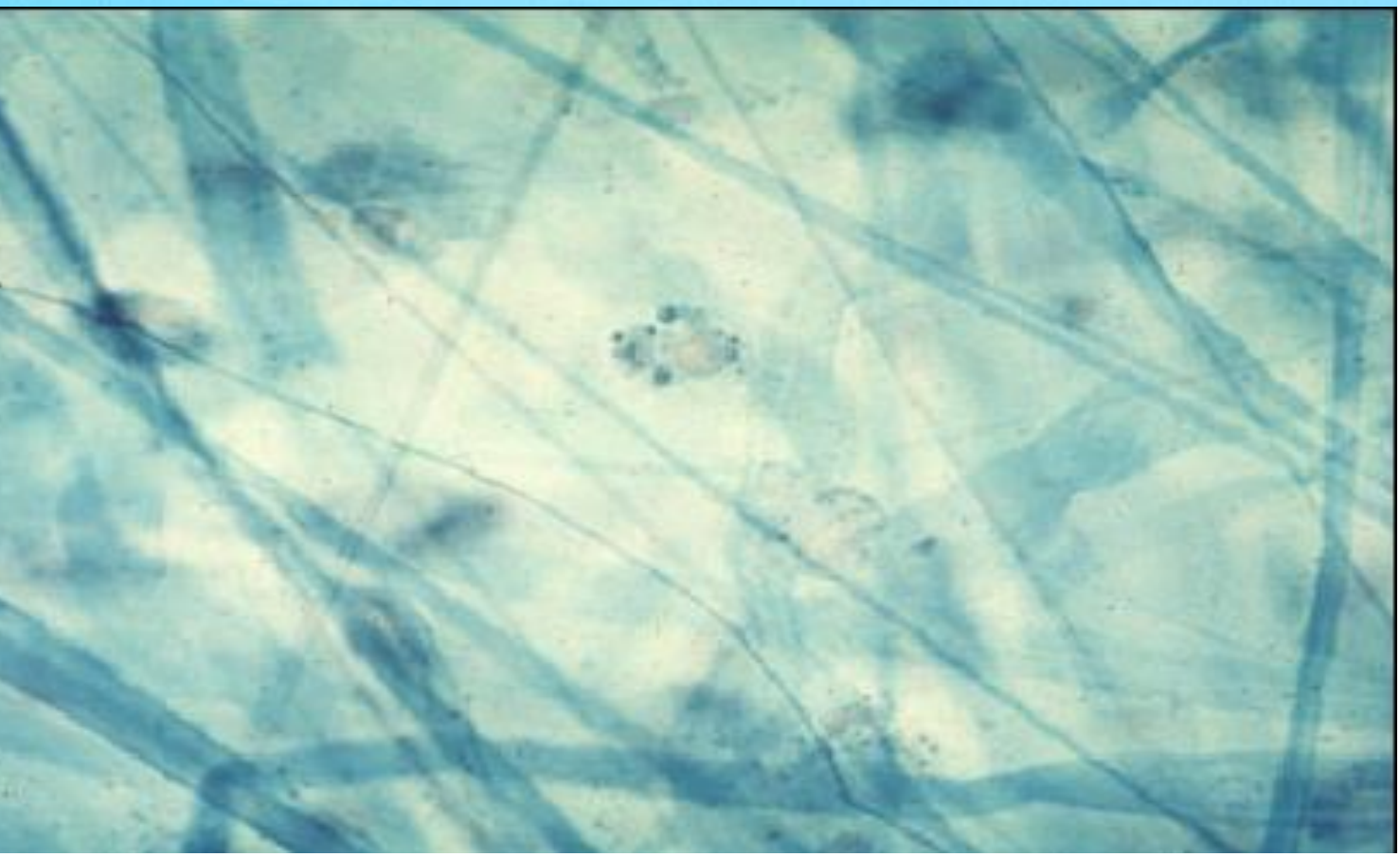
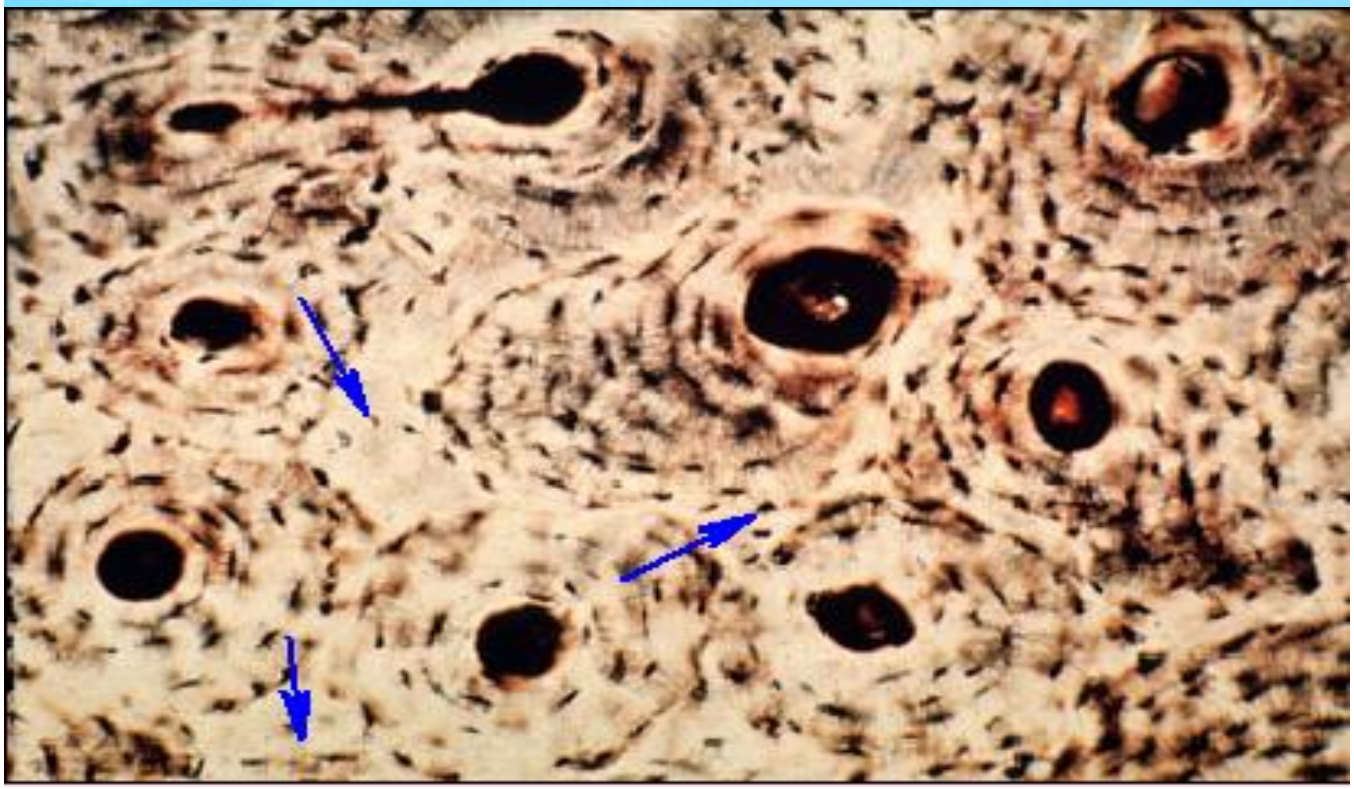
Adipose C.T.



Loss C. T. النسيج الضام الخلالي (areolar C.T)



Bone العظم



قناة
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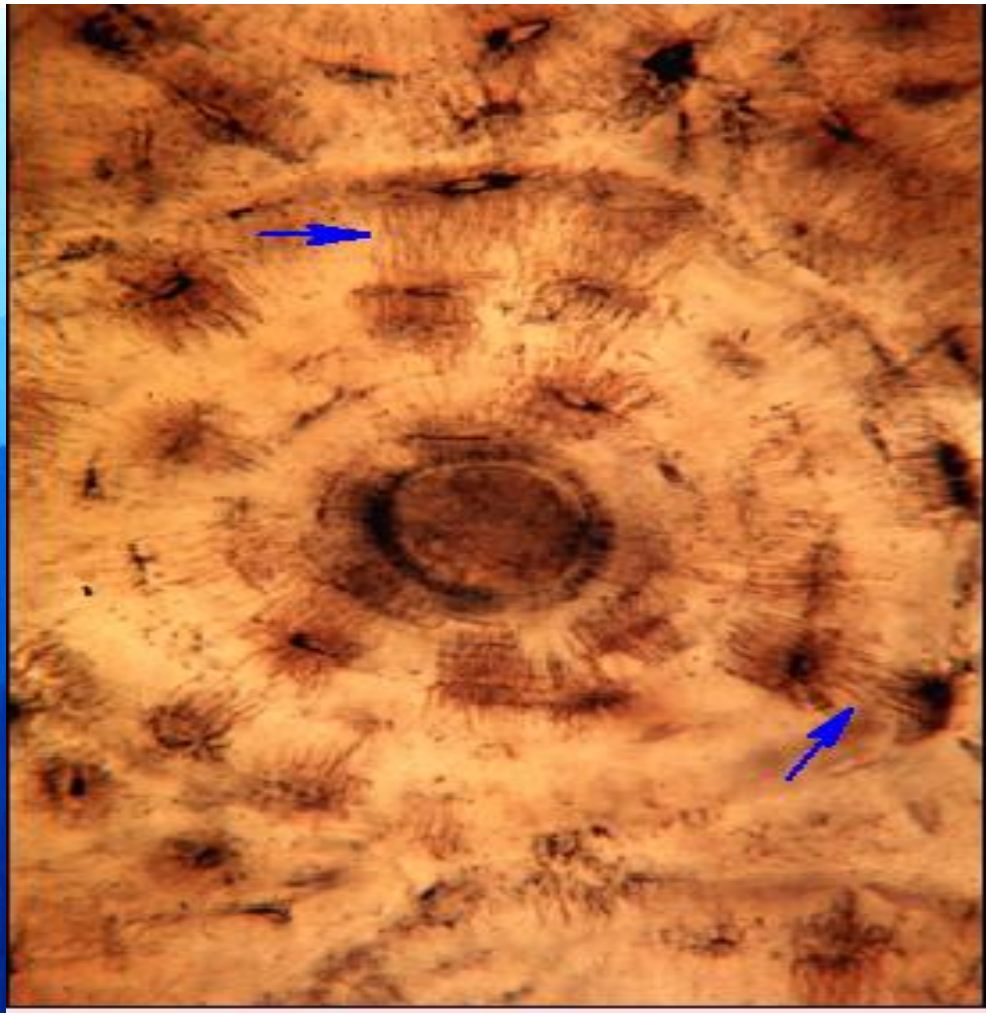
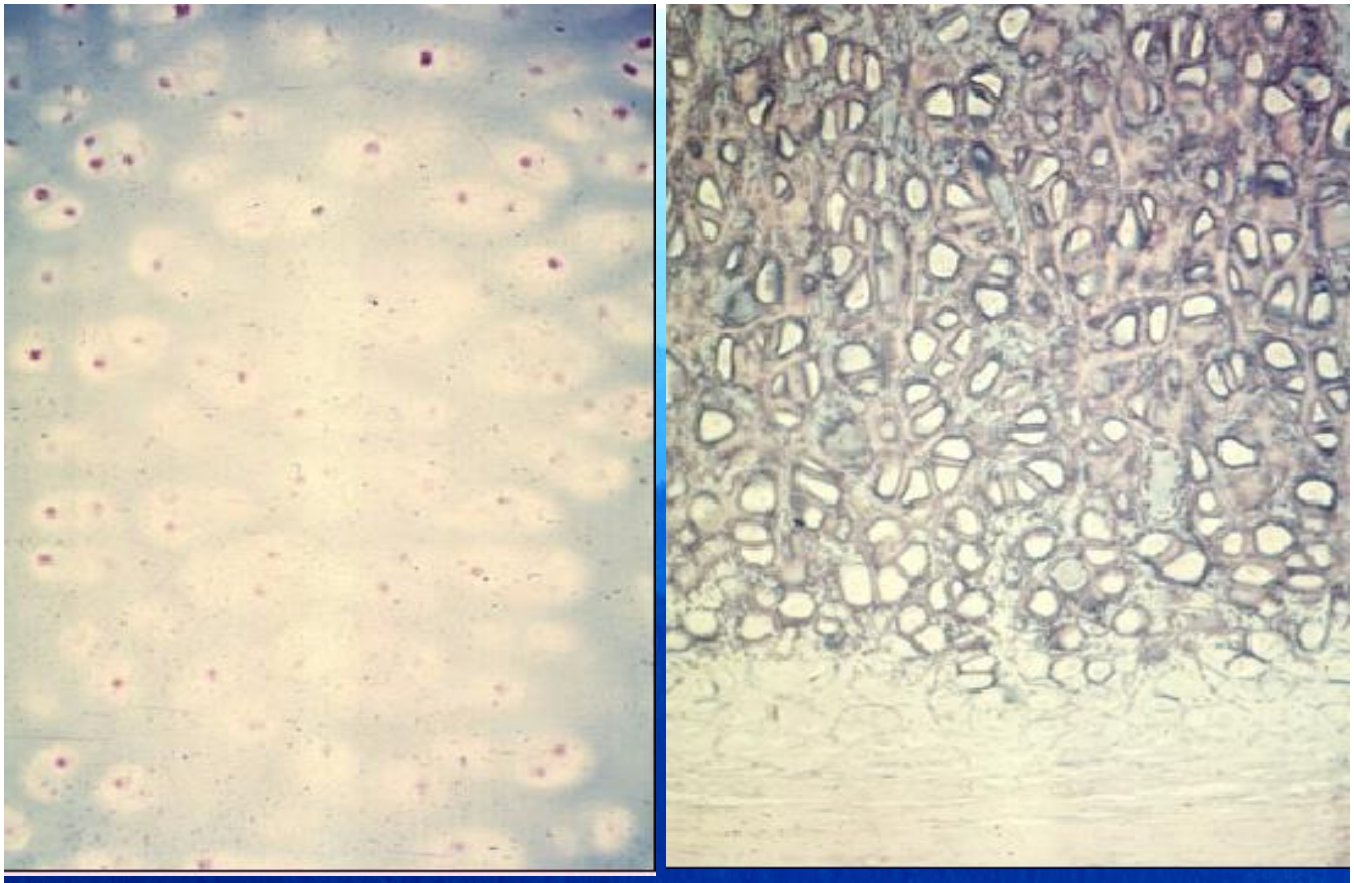
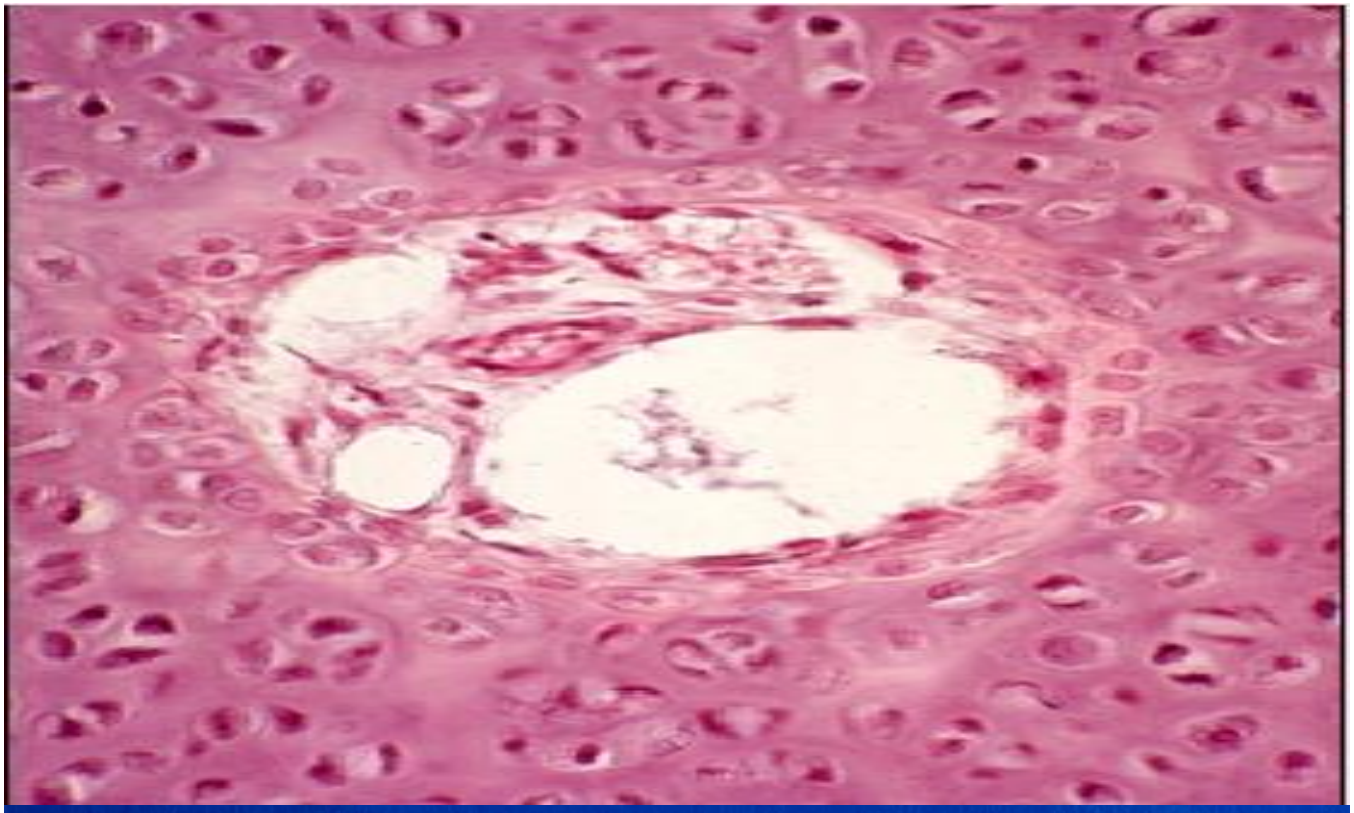
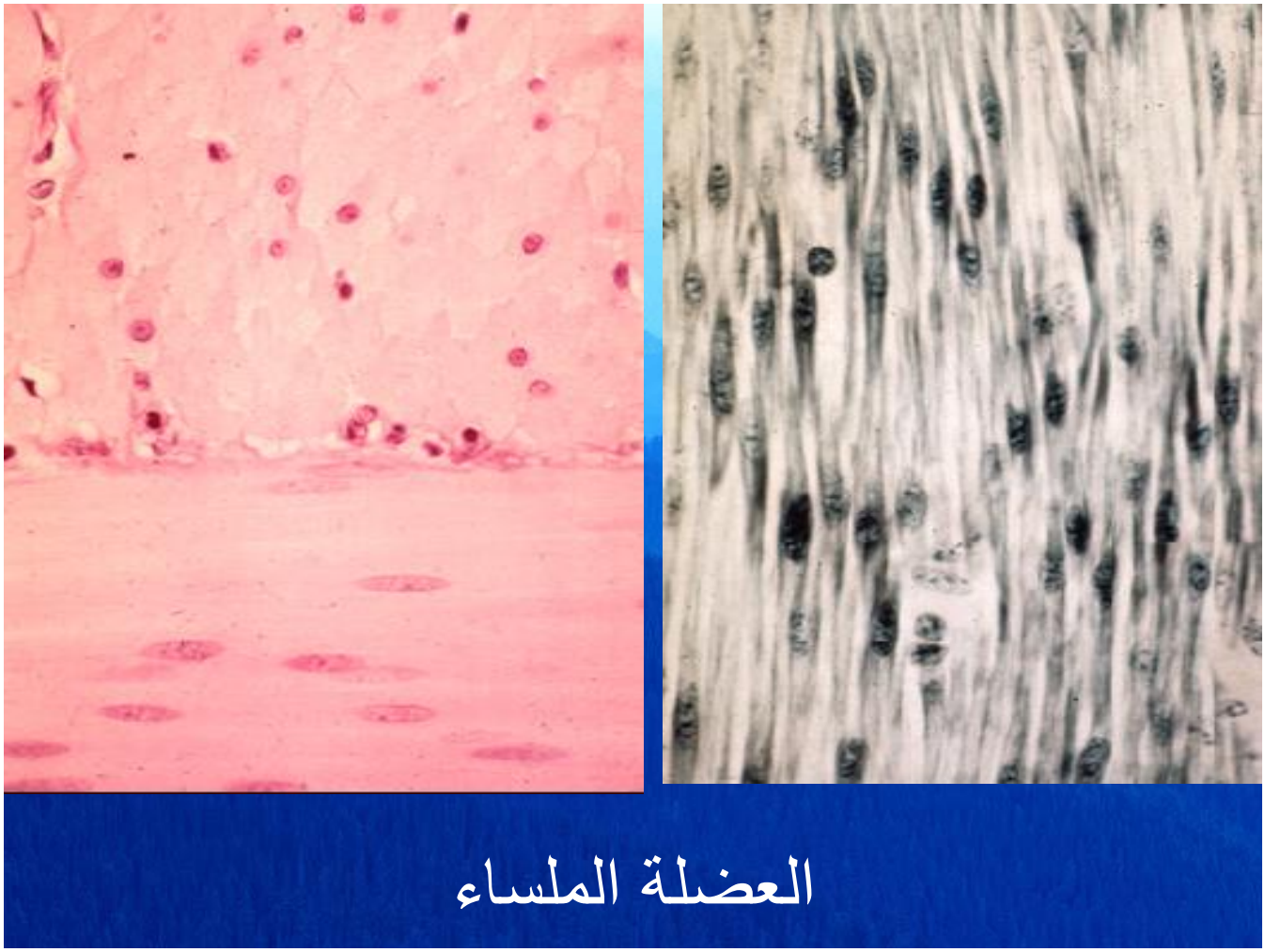




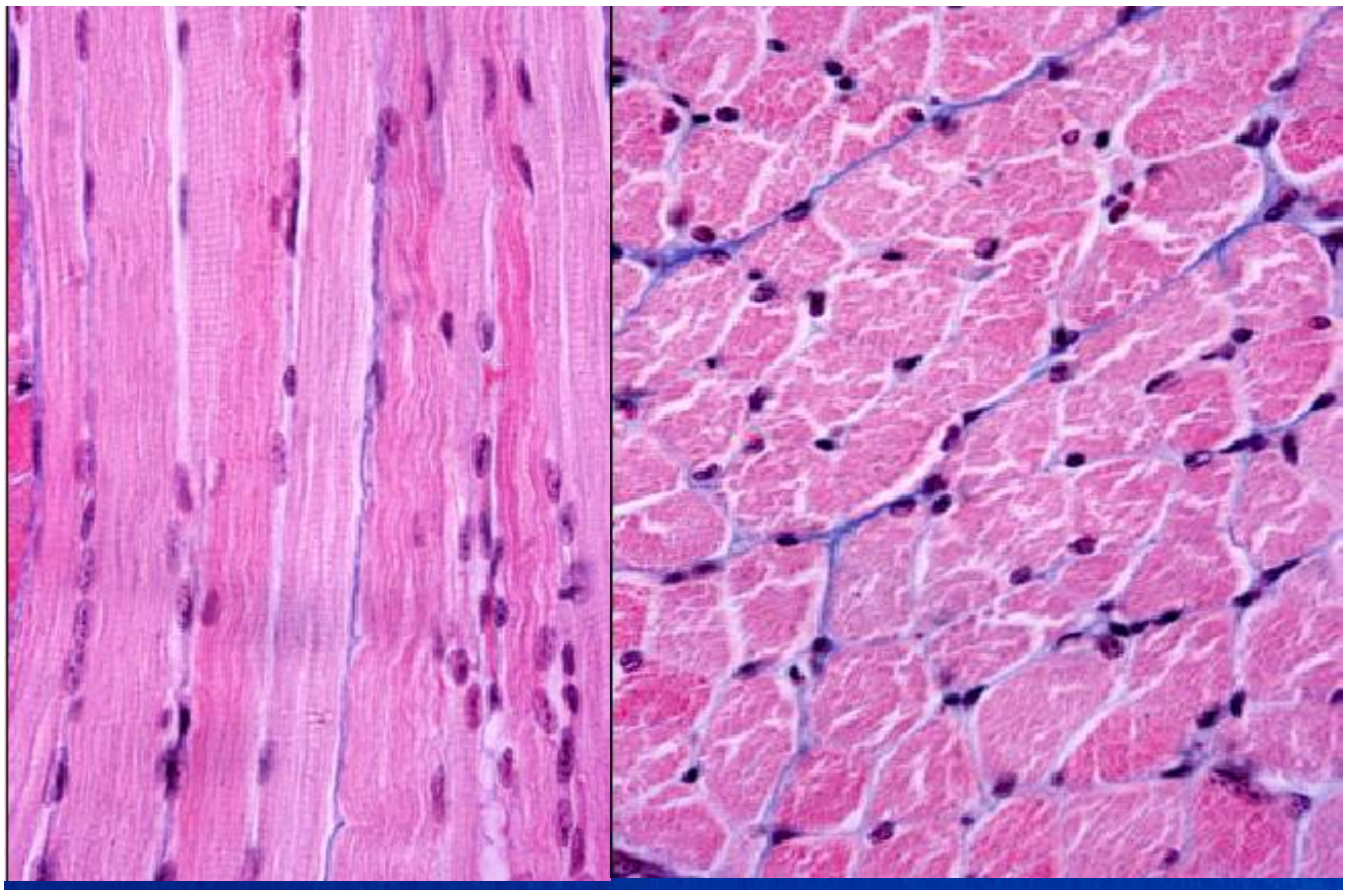
Elastic cart. الغضروف المطاطي المرن



الغضروف الزجاجي



العضلة الملساء



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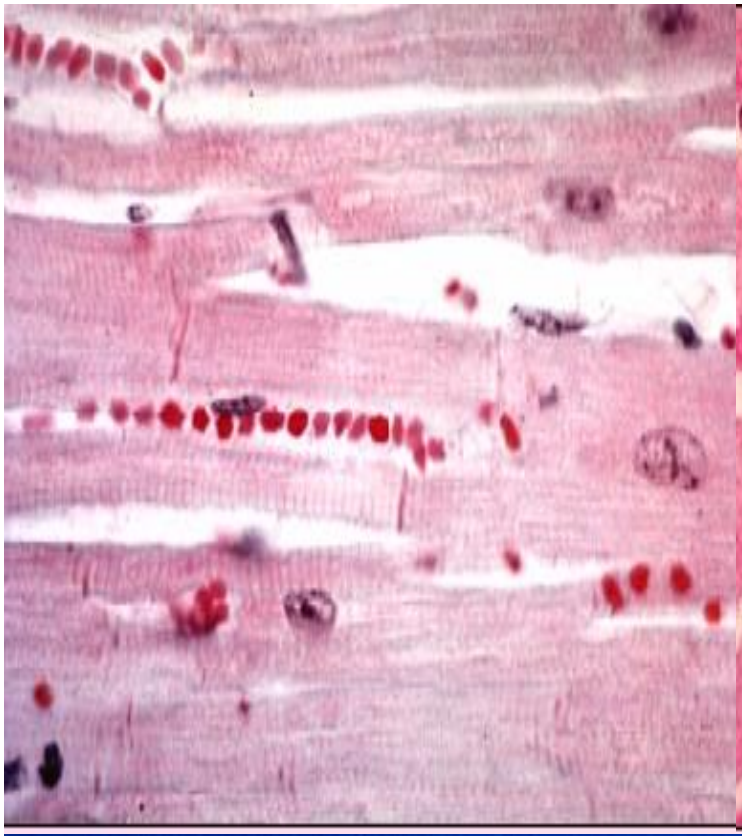
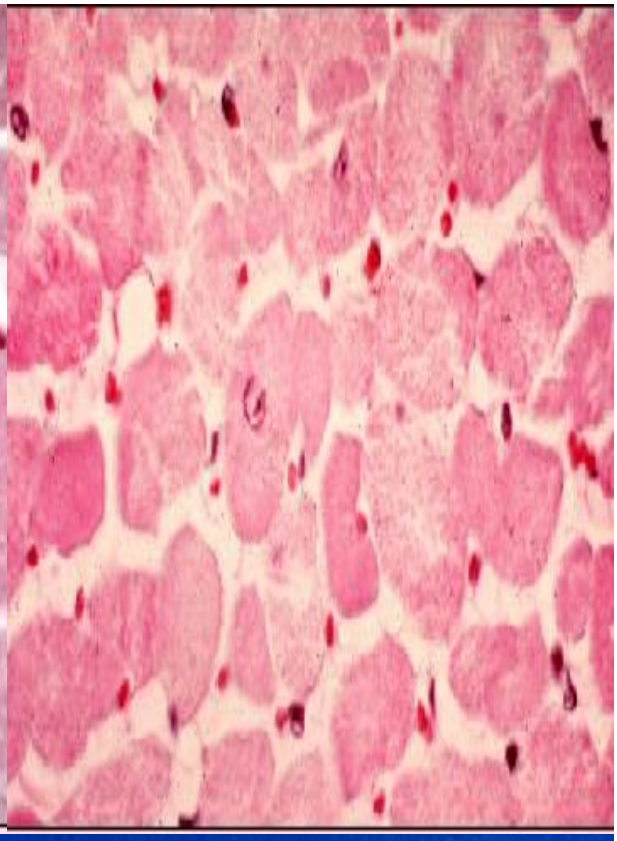
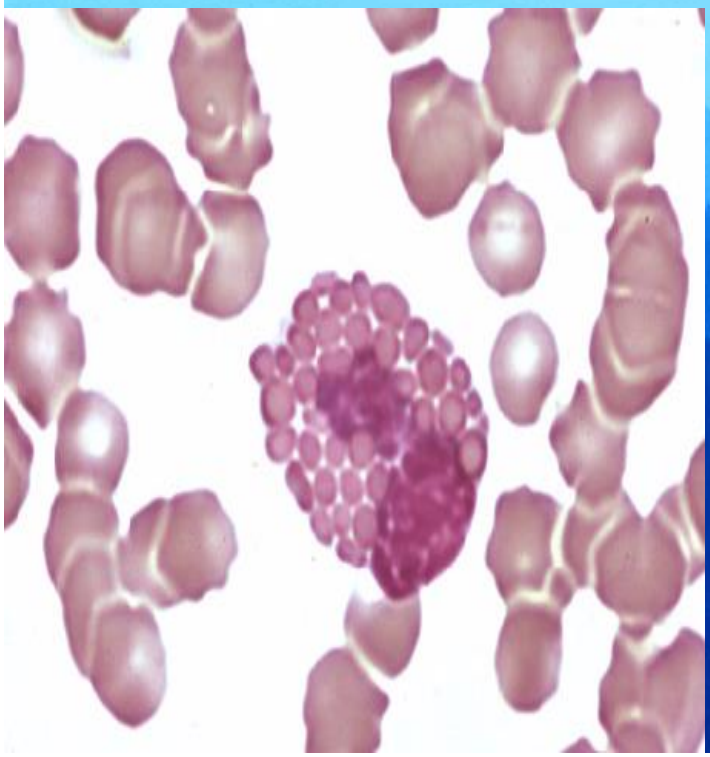
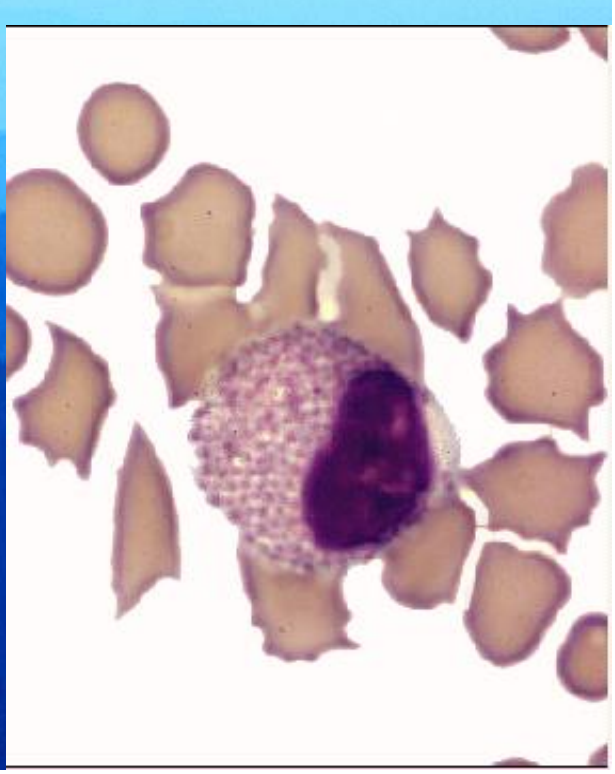




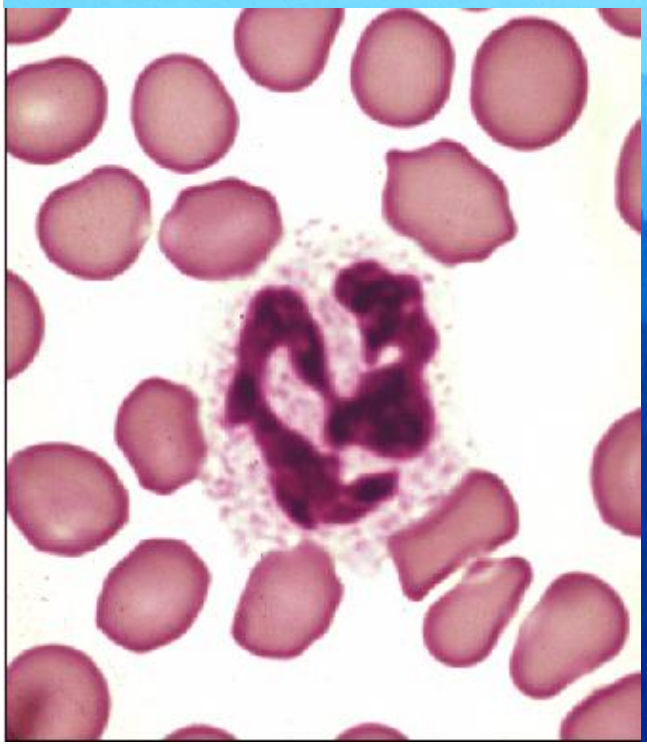
العضلة القلبية

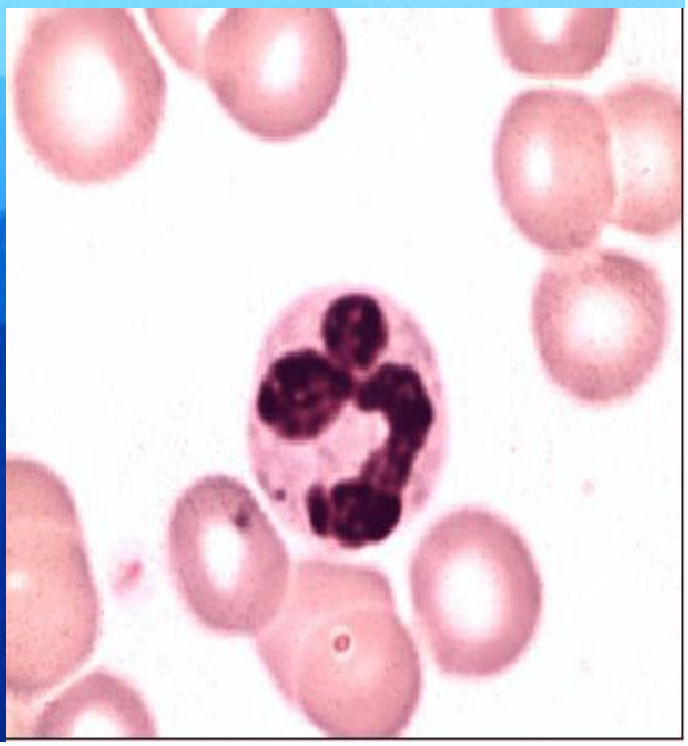
الحمضات eosinphlic



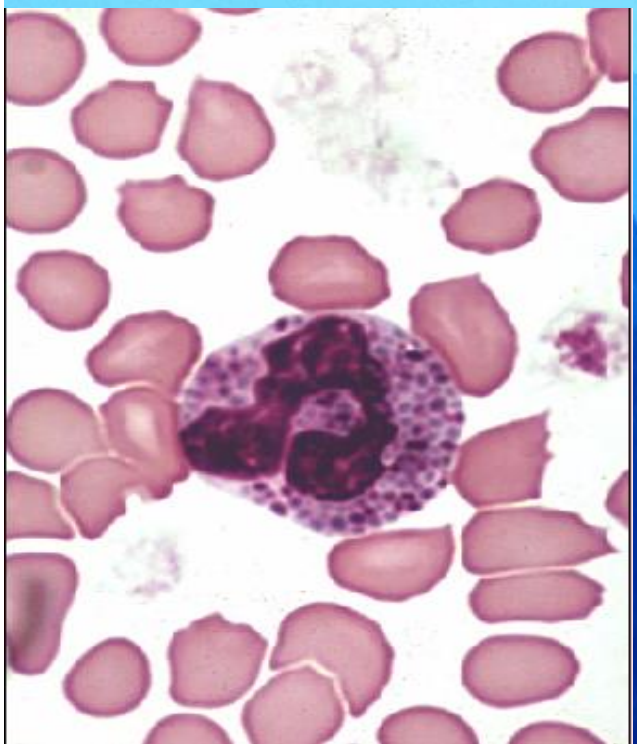


Netrophil العدلات

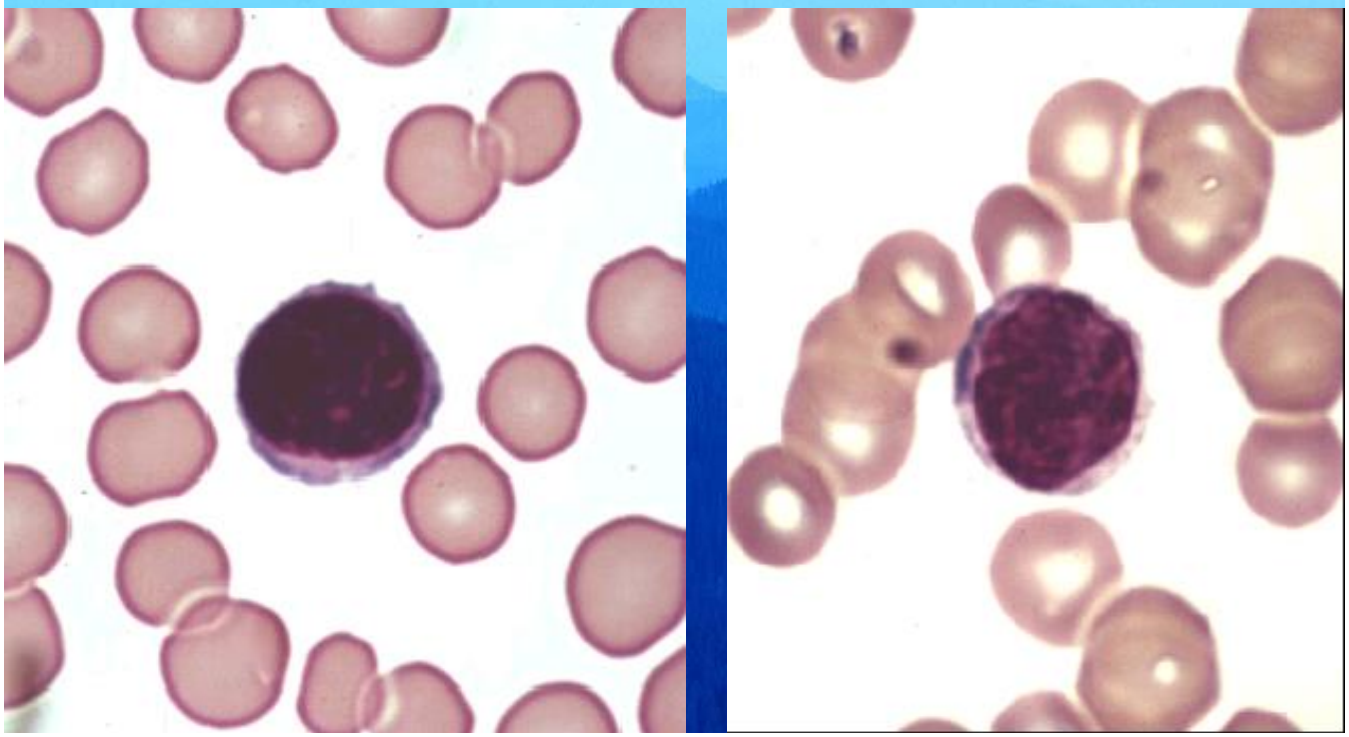




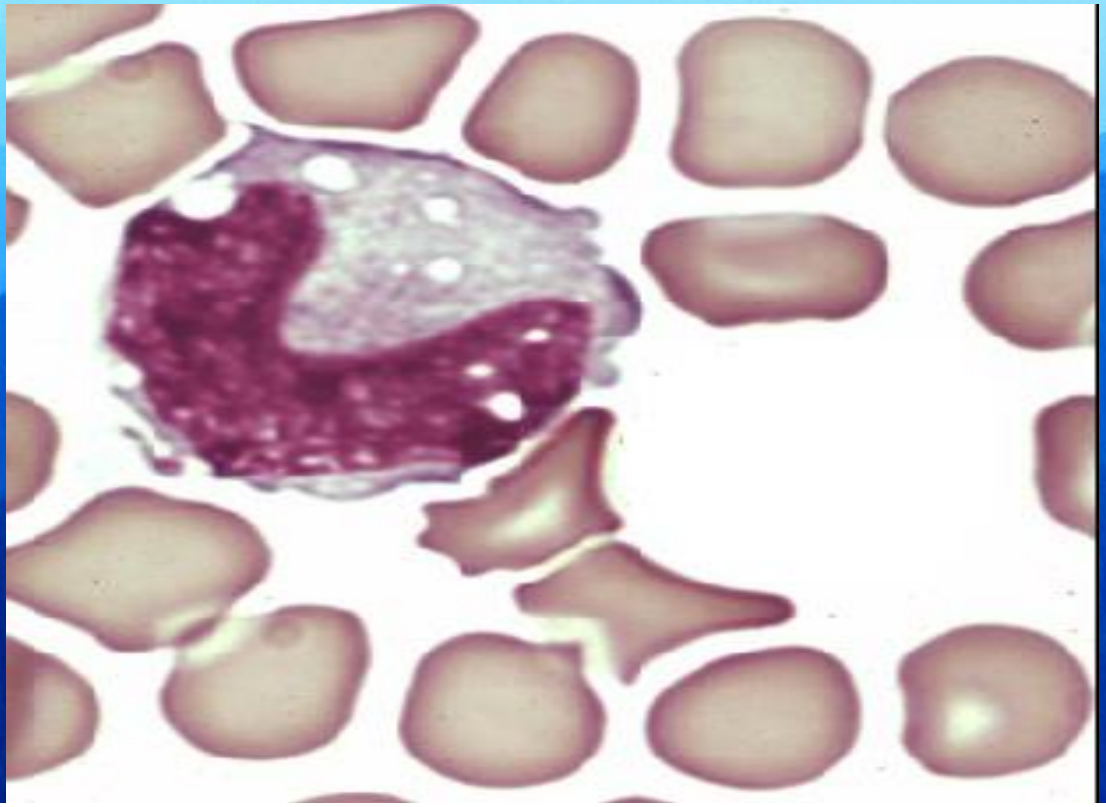
Basophile القعدة



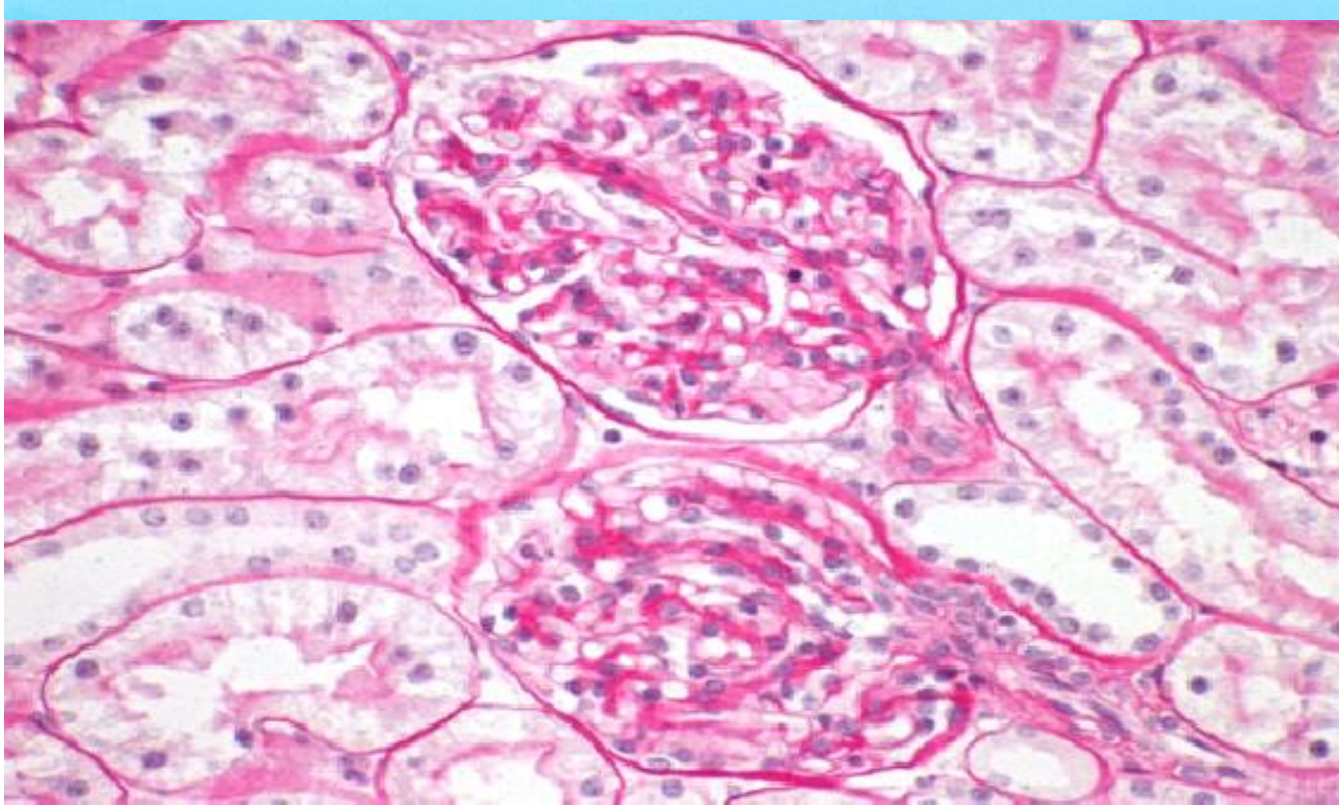
Lymphocyte الخلية اللمفية



وحيدة النواة Monocyte



Kidney الكلية



Nerve cell خلية عصبية