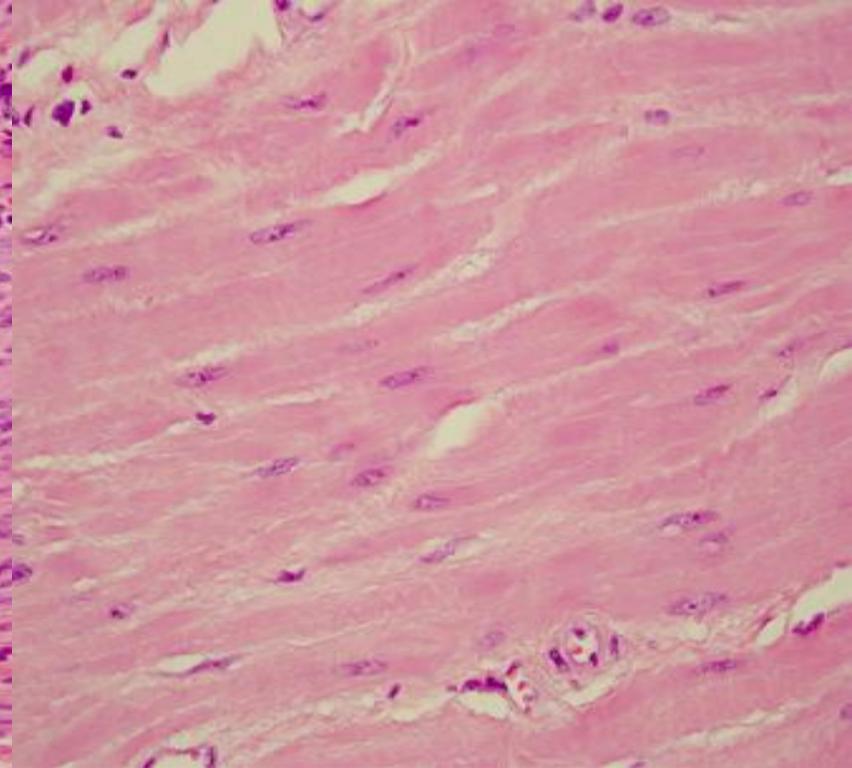
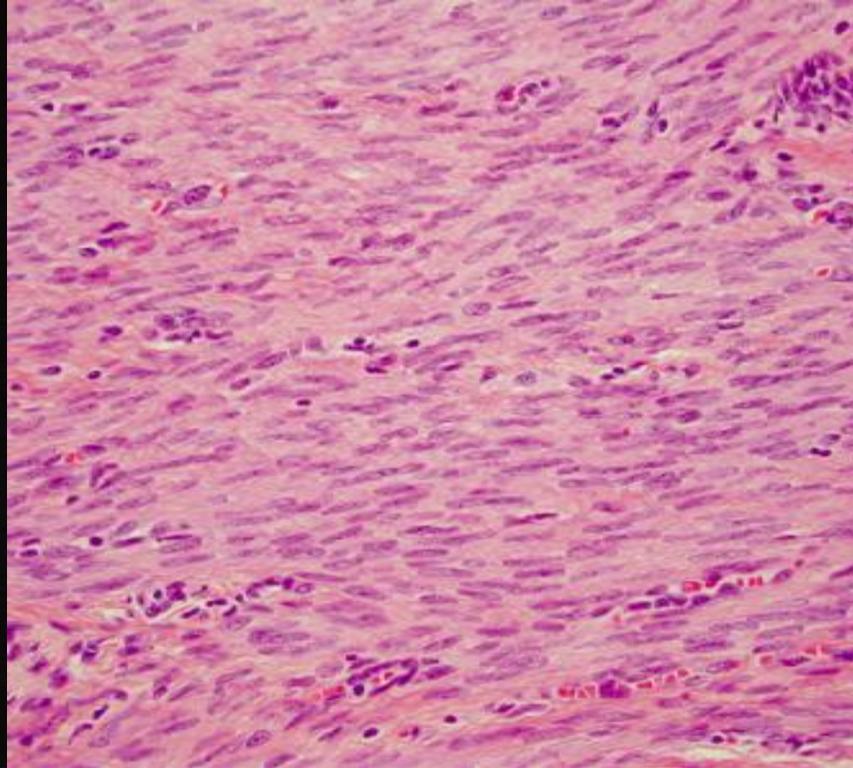


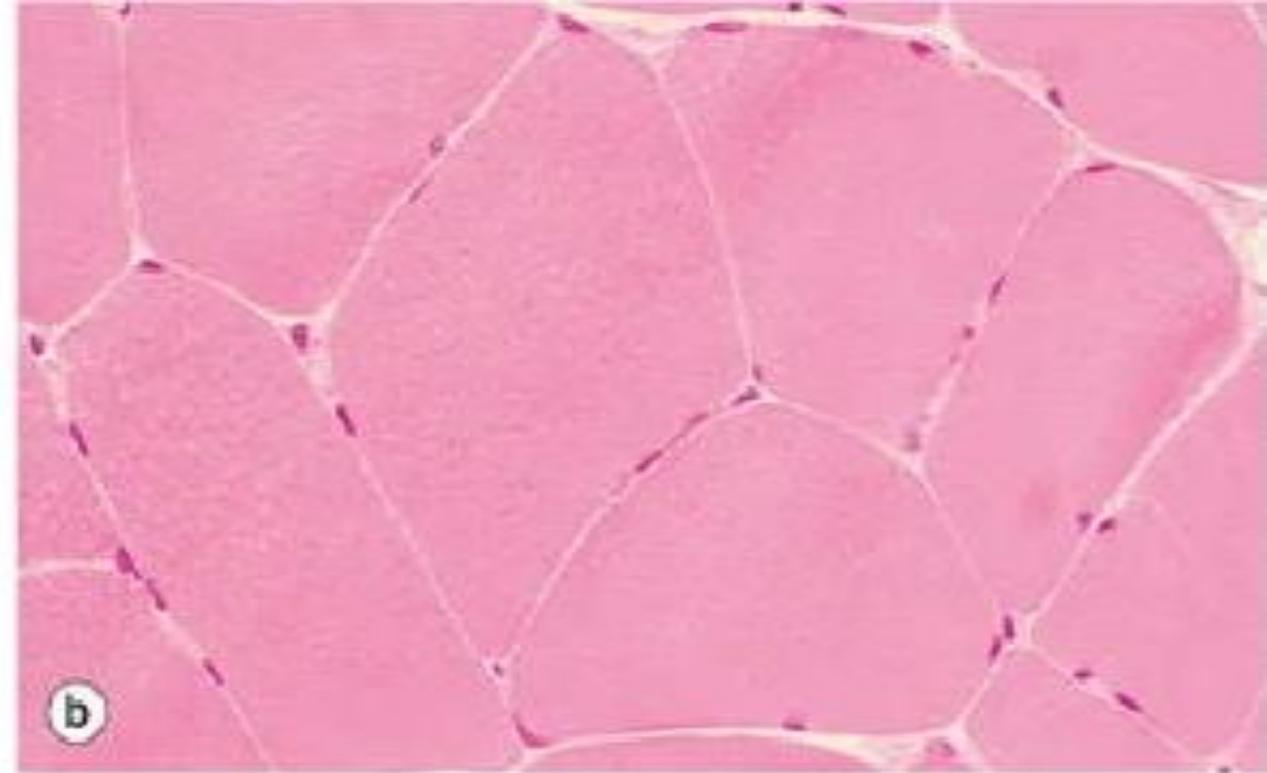
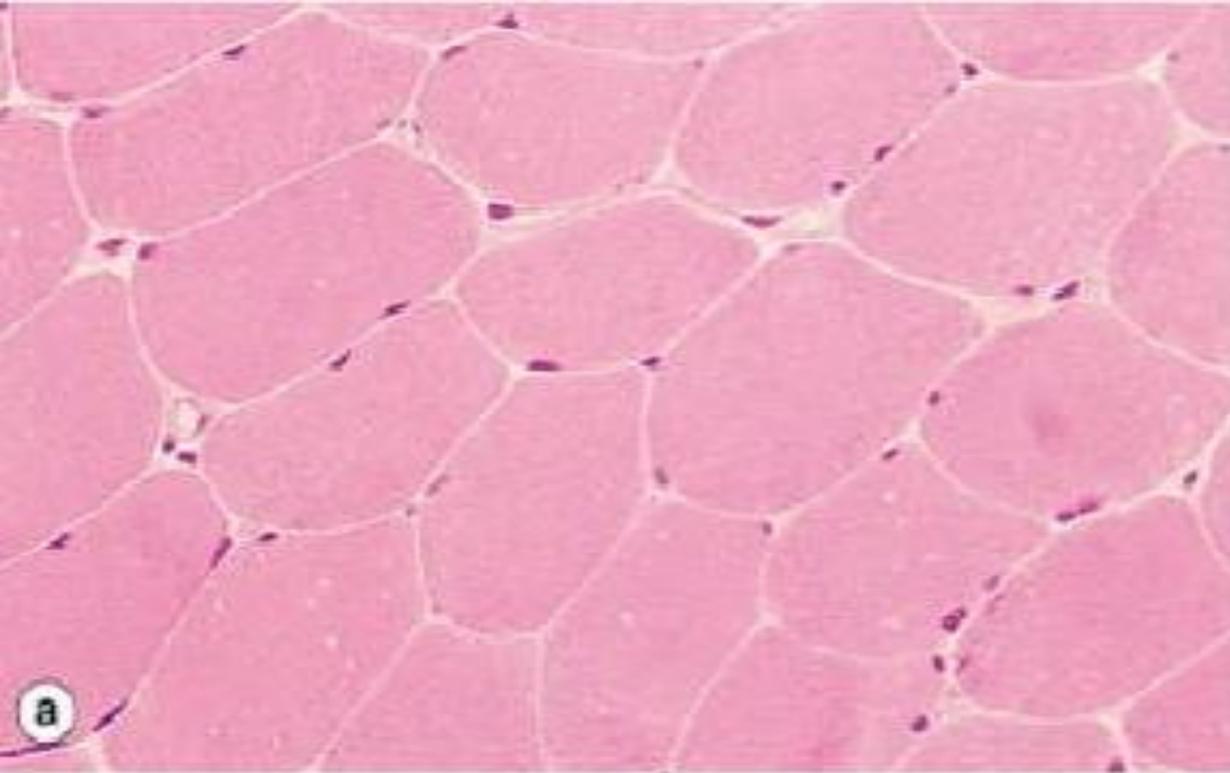
Cellular Adaptations and accumulations

Dr. Bushra Al-Tarawneh, MD
Anatomical pathology
Mutah University
School of Medicine-
Department of Microbiology & Pathology
lectures 2022



Hypertrophy - physiologic - stimulation

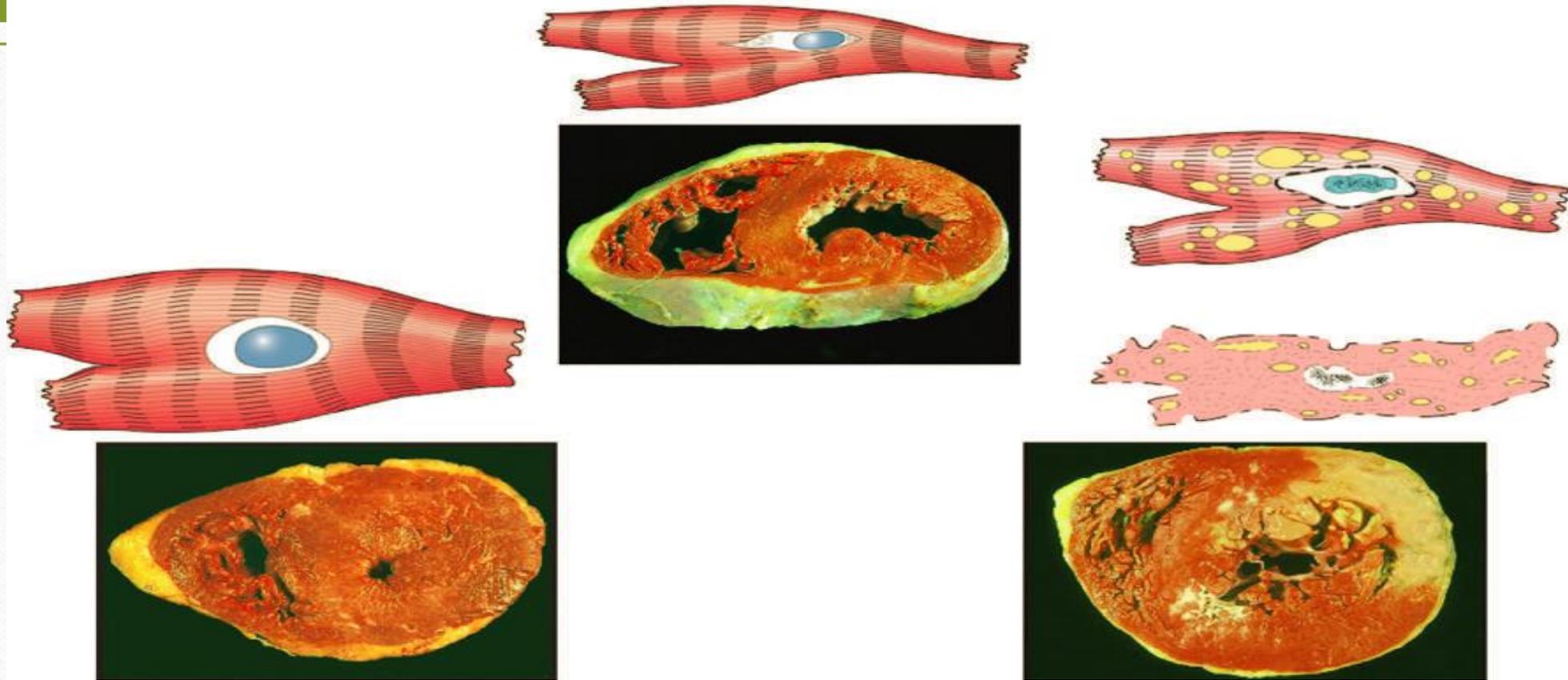
The massive enlargement of the uterus during pregnancy → a consequence of estrogen stimulated smooth muscle hypertrophy & smooth muscle hyperplasia.



Stevens et al: Core Pathology, 3rd Edition.
Copyright © 2009 by Mosby, an imprint of Elsevier, Ltd . All rights reserved.

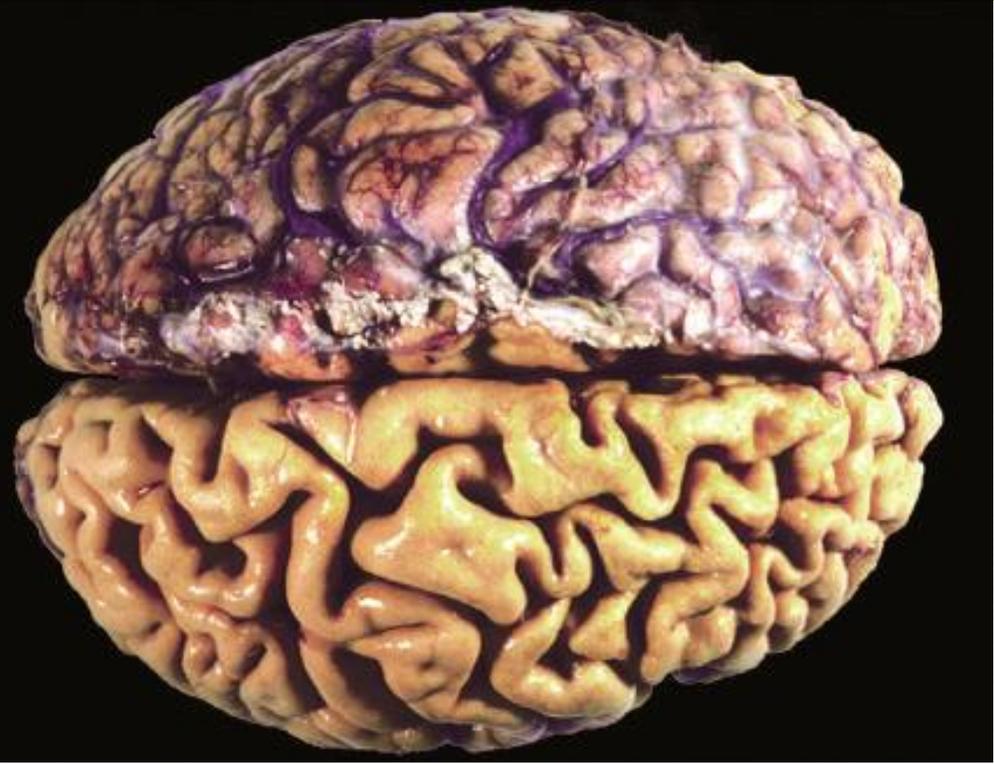
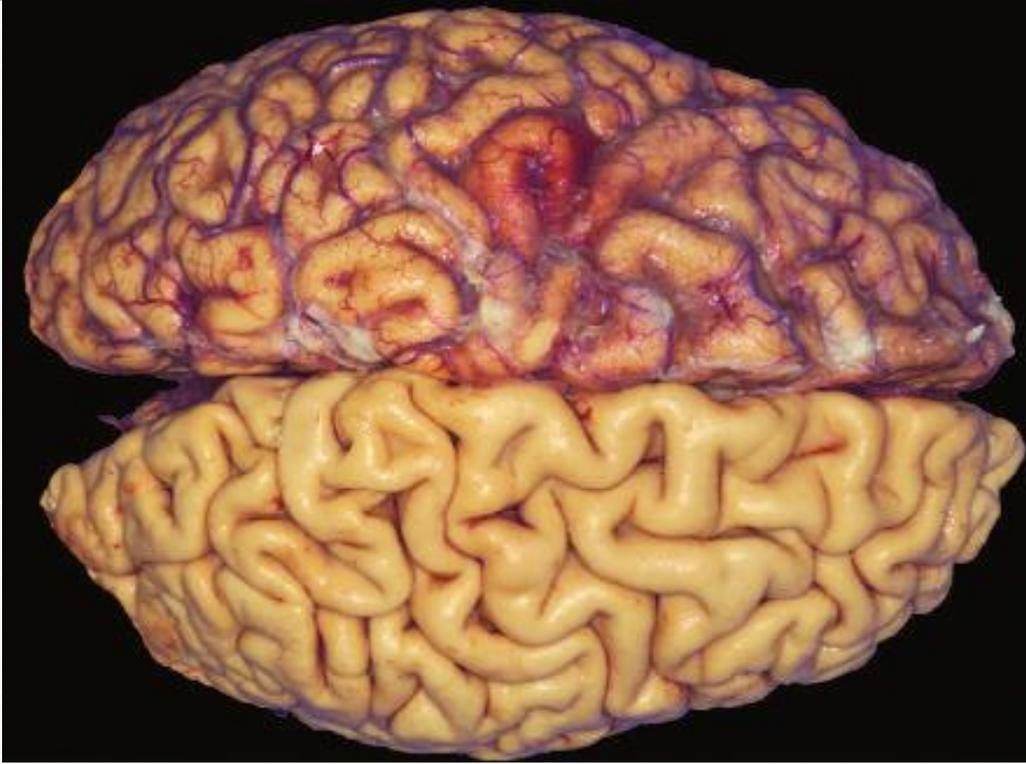
Hypertrophy - physiologic - ↑ demand

In response to increased workload the striated muscle cell undergo hypertrophy. **Adult muscle cells have a limited capacity to divide** → chiseled physique of weightlifter stems only from the hypertrophy.



Hypertrophy - pathologic - \uparrow demand

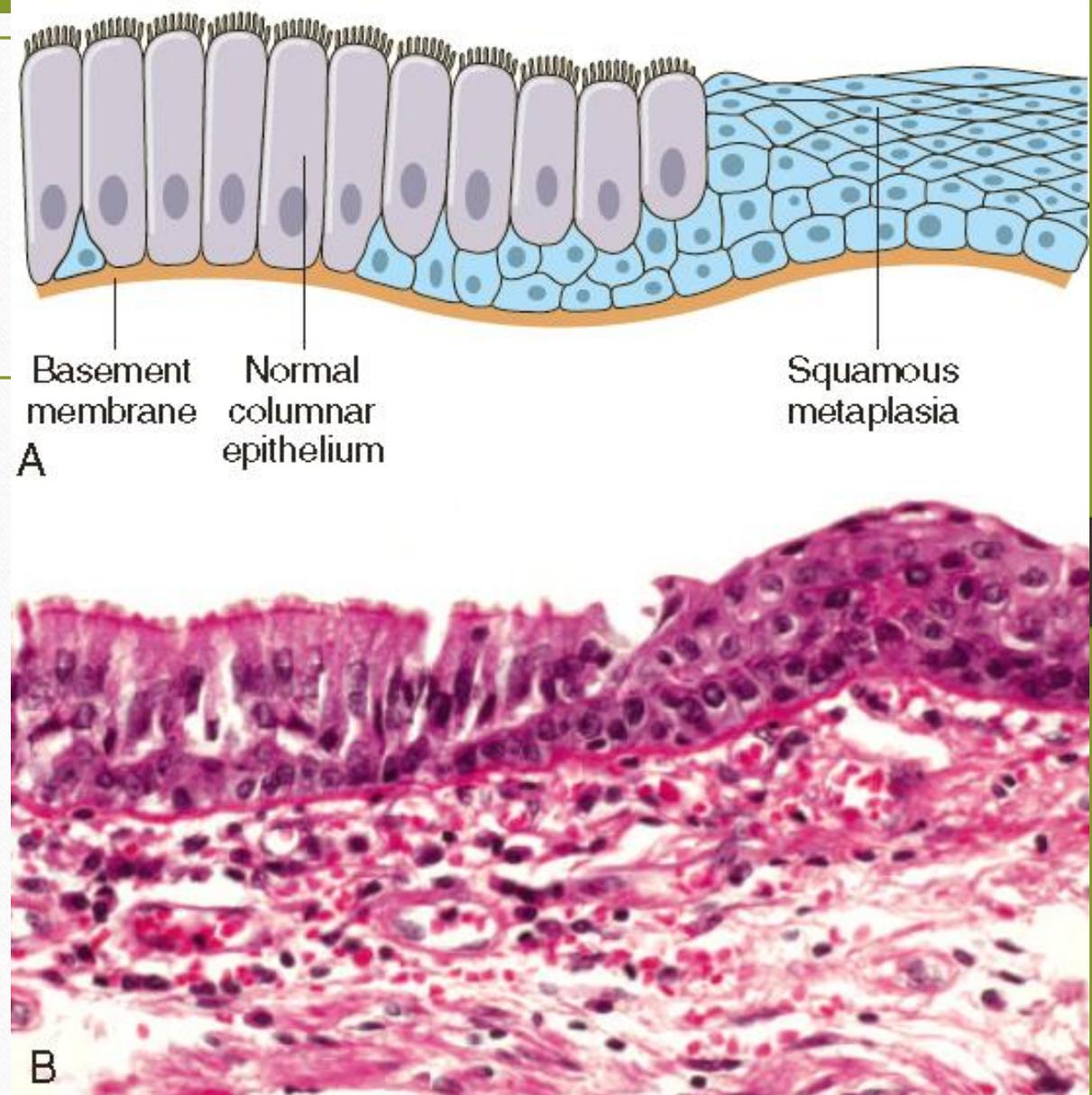
In response to increased workload (hypertension or aortic valve disease) myocardial hypertrophy (lower left \rightarrow to generate the required higher contractile force \rightarrow heart undergo **only hypertrophy** because cardiac muscles have a limited capacity to divide.



Atrophy - pathologic - ↓ blood supply

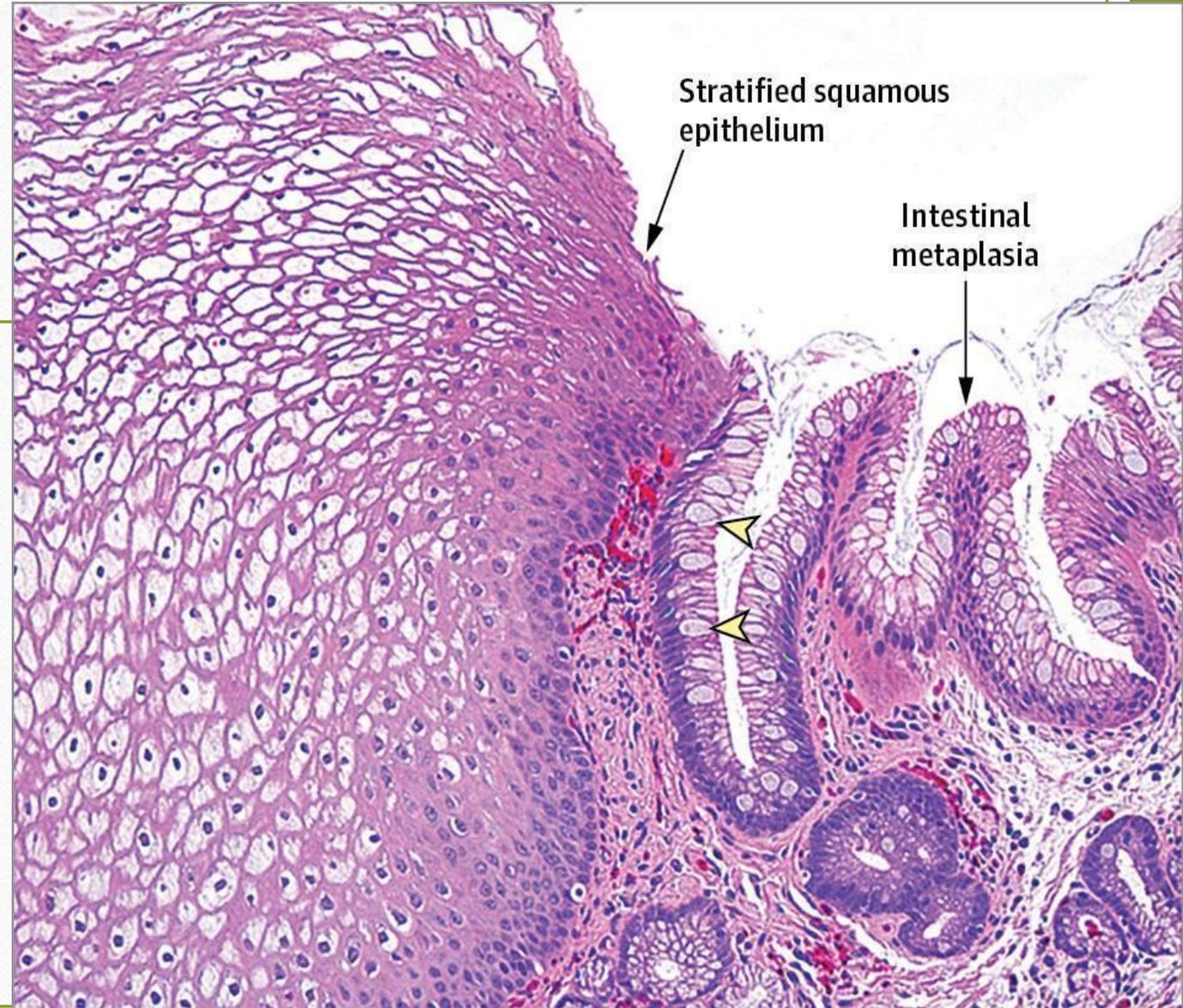
82-year-old man with atherosclerotic disease. Atrophy of the brain is caused by aging & reduced blood supply. Note that loss of brain substance **narrows the gyri & widens the sulci**. The meninges have been stripped from the bottom half of each specimen to show the surface of the brain.

- In the respiratory epithelium of habitual cigarette smokers the normal ciliated columnar epithelial cells of the trachea and bronchi → metaplasia → stratified squamous epithelial cells.
- The rugged stratified squamous epithelium can survive the noxious chemicals in cigarette smoke that columnar epithelium would not tolerate.
- Metaplasia here has survival advantages, but important protective mechanisms are lost, such as mucus secretion and ciliary clearance.



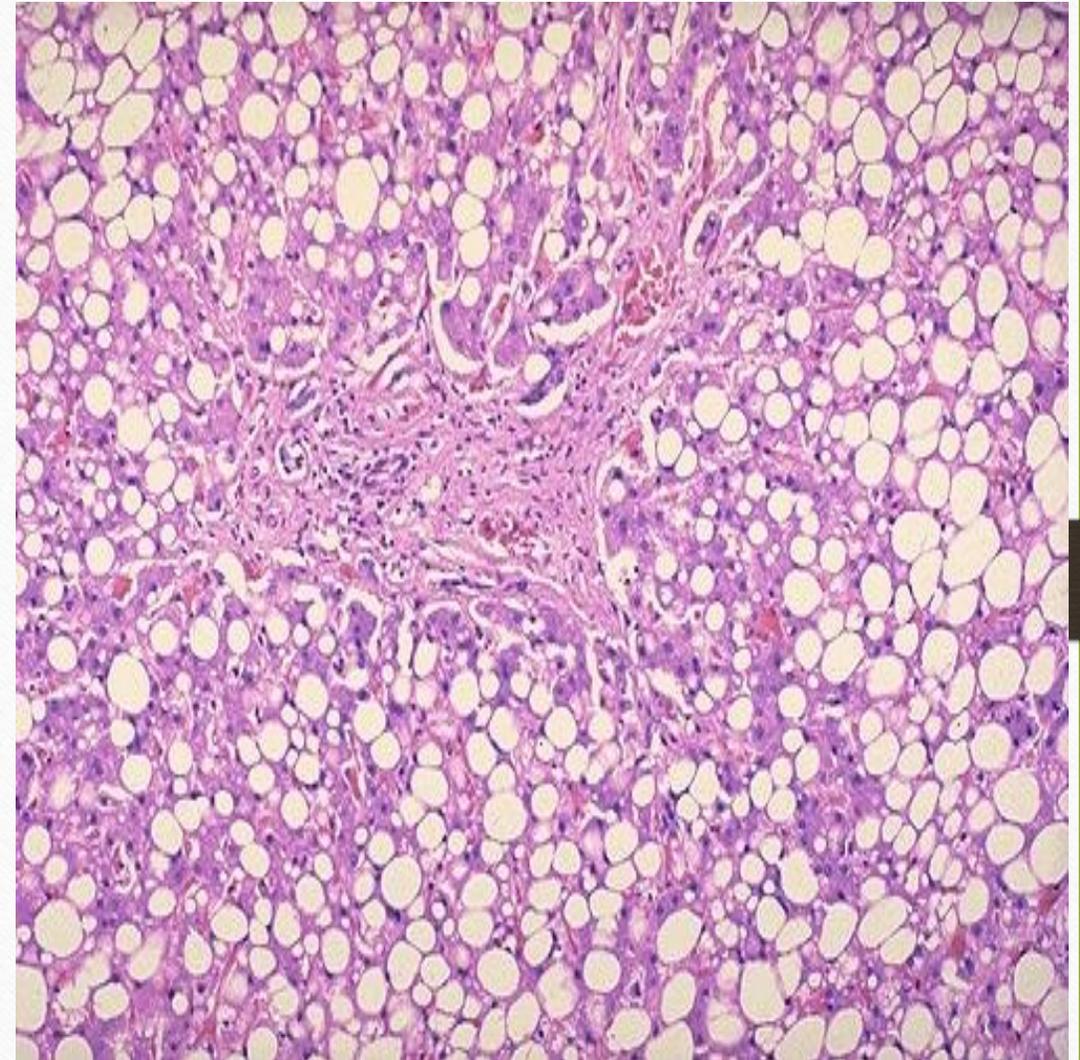
- In chronic gastric reflux; the normal stratified squamous epithelium of the lower esophagus → metaplasia → gastric or intestinal-type columnar epithelium.

- Metaplasia also occur in mesenchymal cells, where it is generally a reaction to some pathologic alteration (bone is occasionally formed in soft tissues, particularly in foci of injury).



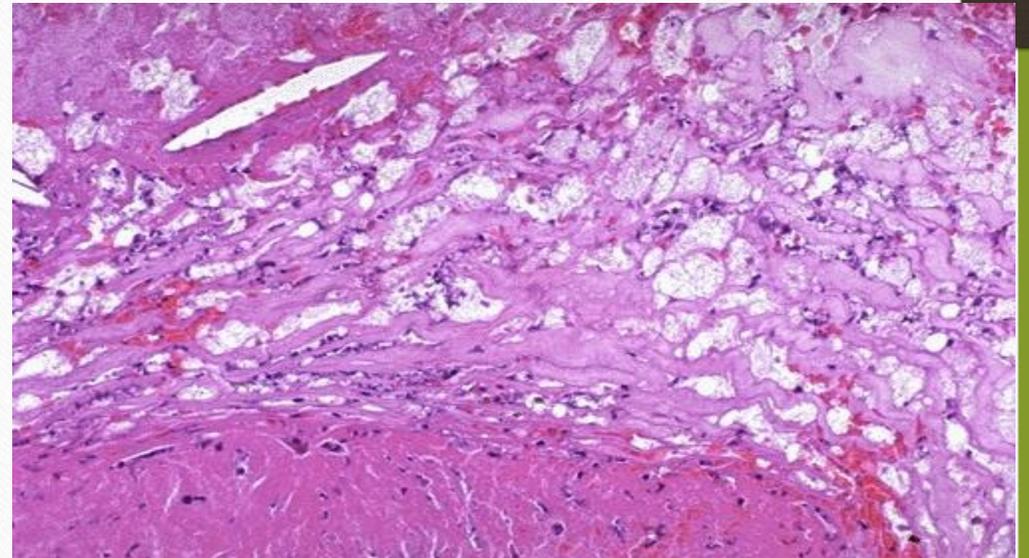
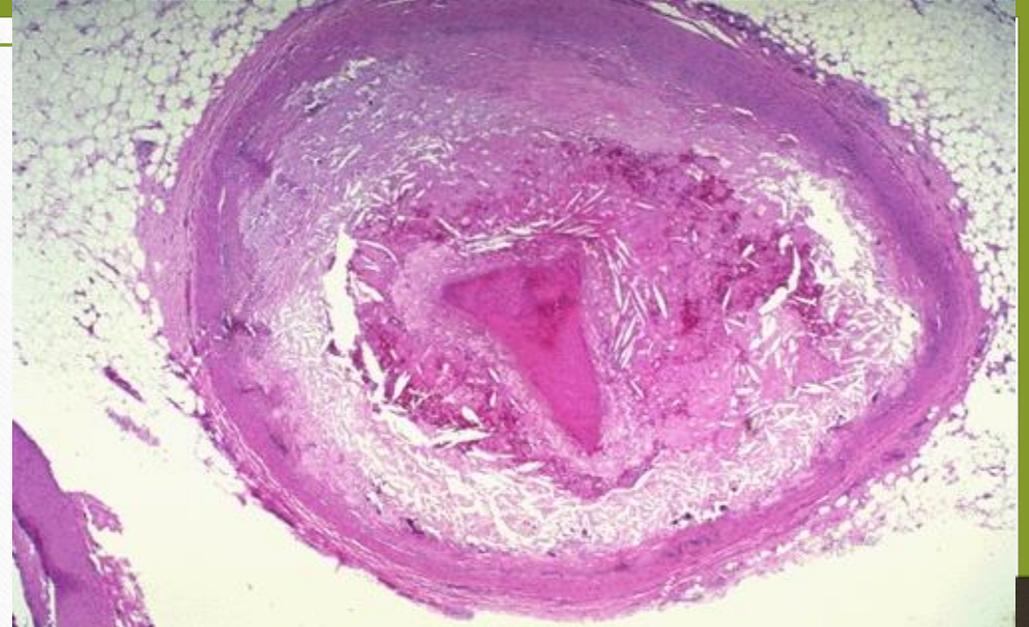
Fatty Change

- ❑ Fatty change, called steatosis.
- ❑ Any accumulation of triglycerides within parenchymal cells.
- ❑ Mostly seen in the liver, (the major organ involved in fat metabolism) , also occur in heart, skeletal muscle, kidney, and other organs.
- ❑ Caused by toxins, protein malnutrition, diabetes mellitus, obesity, or anoxia.
- ❑ Alcohol abuse and diabetes associated with obesity are the most common causes of fatty change in the liver.



Cholesterol and Cholesteryl Esters

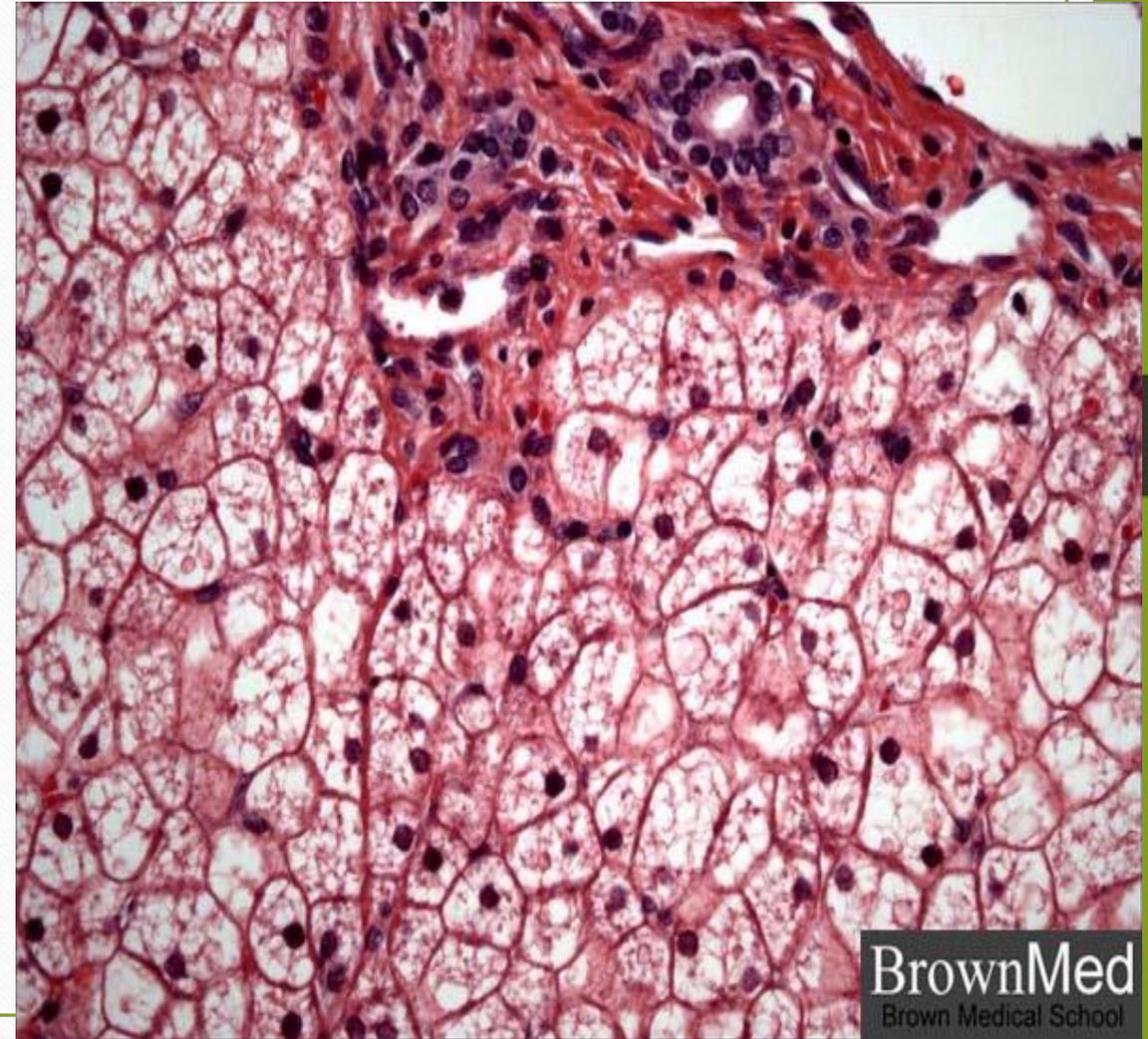
- Cellular cholesterol metabolism is tightly regulated to ensure normal generation of cell membranes (in which cholesterol is a key component) without accumulation.
- Atherosclerosis is the most important.



Glycogen.

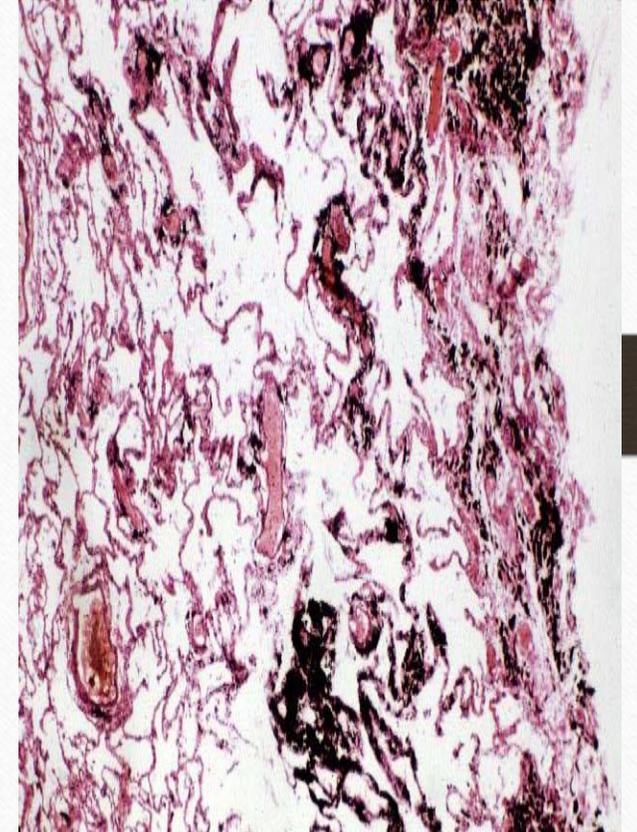
Excessive intracellular accumulation of glycogen are associated with abnormalities in the metabolism of glucose or glycogen.

Glycogen also accumulates within cells in a group of related genetic disorders collectively referred to as glycogen storage diseases.



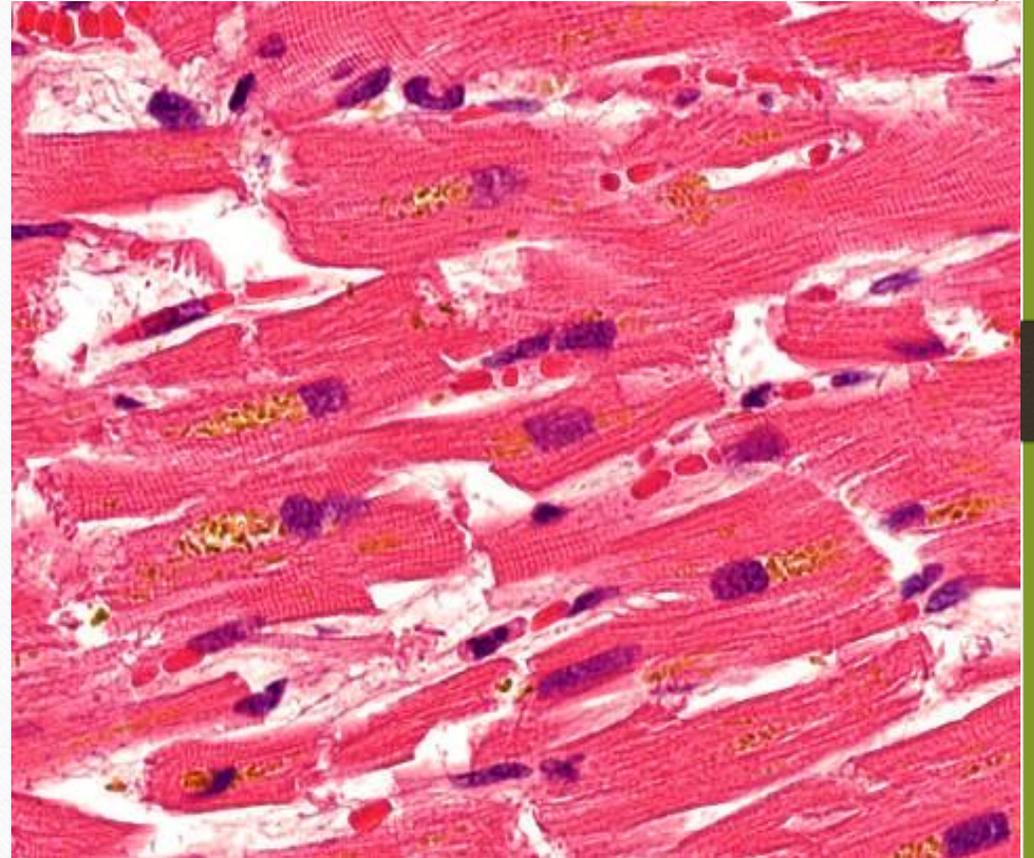
Pigments – Carbon

- Pigments are colored substances :
- + exogenous (from outside the body) such as **carbon**,
- + endogenous (synthesized within the body) itself, such as lipofuscin, melanin, and certain derivatives of hemoglobin.
- The most common exogenous pigment is carbon, a ubiquitous air pollutant of urban life.
- When inhaled → phagocytosed by alveolar macrophages → transported by lymphatic channels to regional lymph nodes.
- Aggregates of the pigment blacken the draining lymph nodes and pulmonary parenchyma (called **anthracosis**)



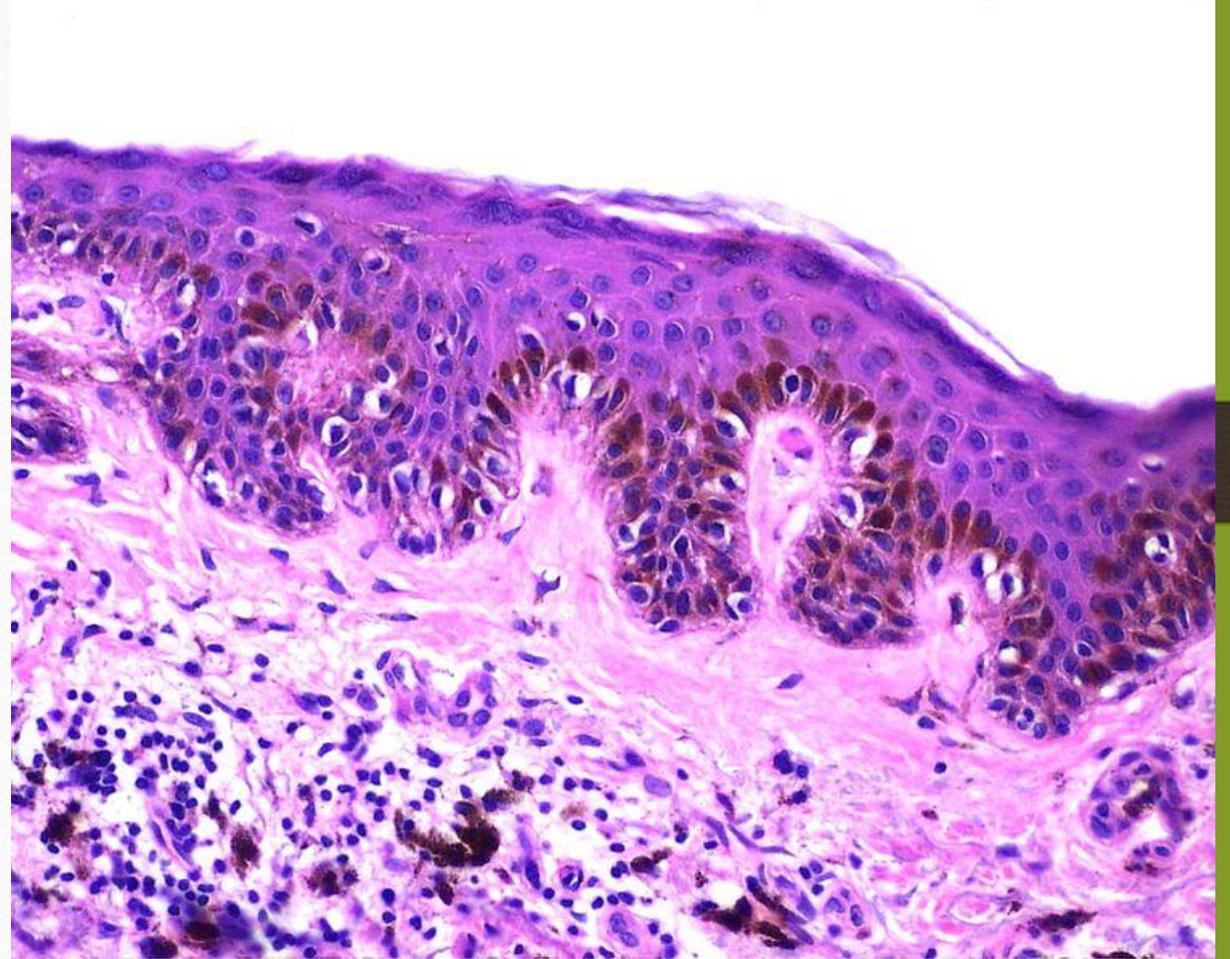
Pigments-Lipofuscin “wear-and-tear pigment”

- An insoluble brownish-yellow granular intracellular material that accumulates in a variety of tissues (heart, liver, and brain) with **aging or atrophy**.
- Lipofuscin represents complexes of lipid & protein that are produced by the free radical-catalyzed peroxidation of polyunsaturated lipids of subcellular membranes.
- It is not injurious to the cell but is a marker of past **free radical injury**.



Pigments - Melanin.

An endogenous, brown-black pigment that is synthesized by melanocytes located in the epidermis.

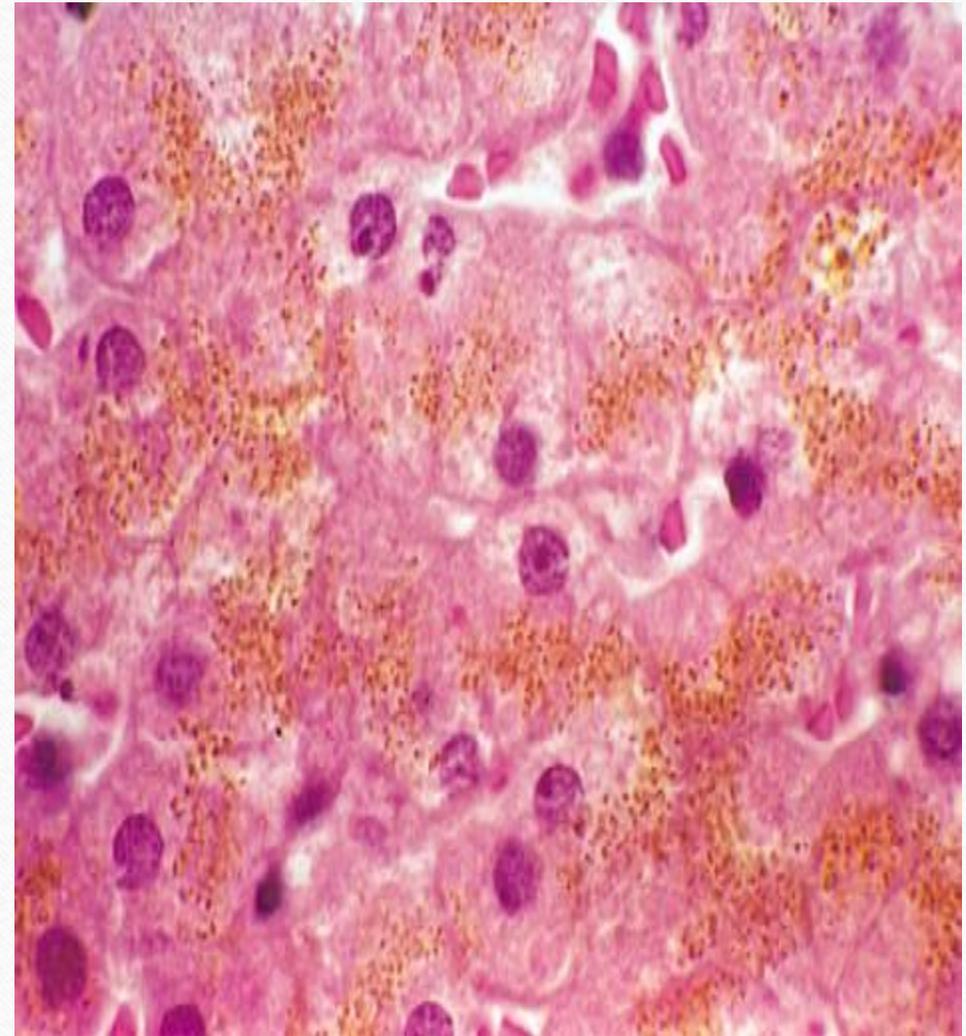


Pigments - Hemosiderin.

A hemoglobin-derived granular pigment that is golden yellow to brown.

Accumulates in tissues when there is a local or systemic excess of iron.

Hemosiderin pigment represents large aggregates of these ferritin micelles, readily visualized by light and electron microscopy.



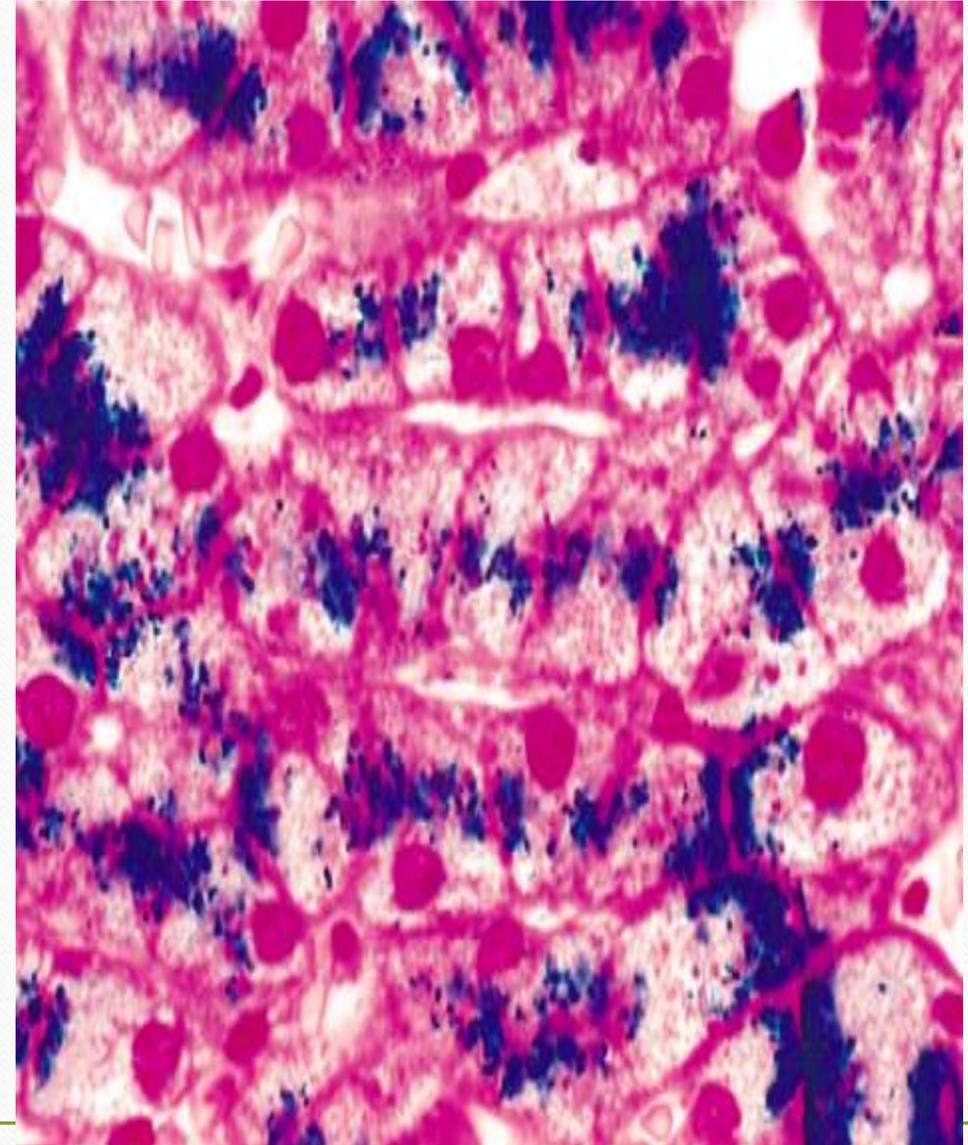
... Pigments - Hemosiderin.

the iron can be unambiguously identified by the **Prussian blue** histochemical reaction

Small amounts of this pigment are normal in the mononuclear phagocytes of the bone marrow, spleen, and liver, where aging red cells are normally degraded.

Excessive deposition of hemosiderin, called **hemosiderosis**.

more extensive accumulations of iron seen in **hereditary hemochromatosis**.



Cell Injury & Necrosis-2

Dr. Bushra Al-Tarawneh, MD

Anatomical pathology

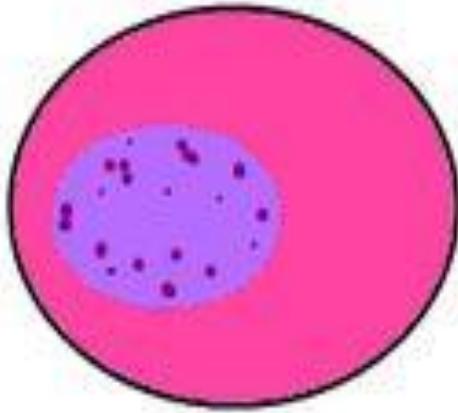
Mutah University

School of Medicine-

Department of Microbiology & Pathology

lectures 2022

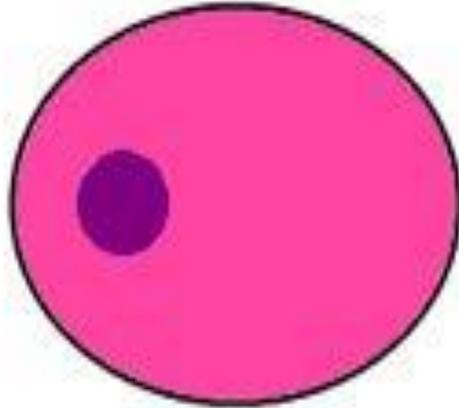
KARYOLYSIS



Nuclear fading

chromatin dissolution due to action of DNAases & RNAases

PYKNOSIS



Nuclear shrinkage

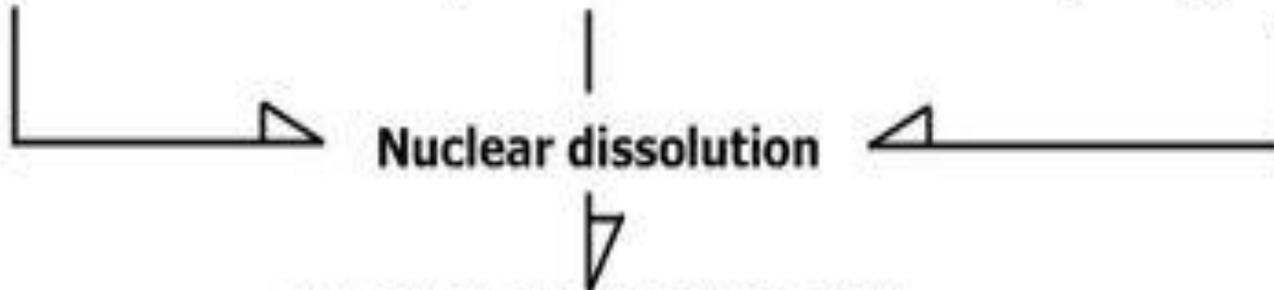
DNA condenses into shrunken basophilic mass

KARYORRHEXIS



Nuclear fragmentation

Pyknotic nuclei membrane ruptures & nucleus undergoes fragmentation



ANUCLEAR NECROTIC CELL

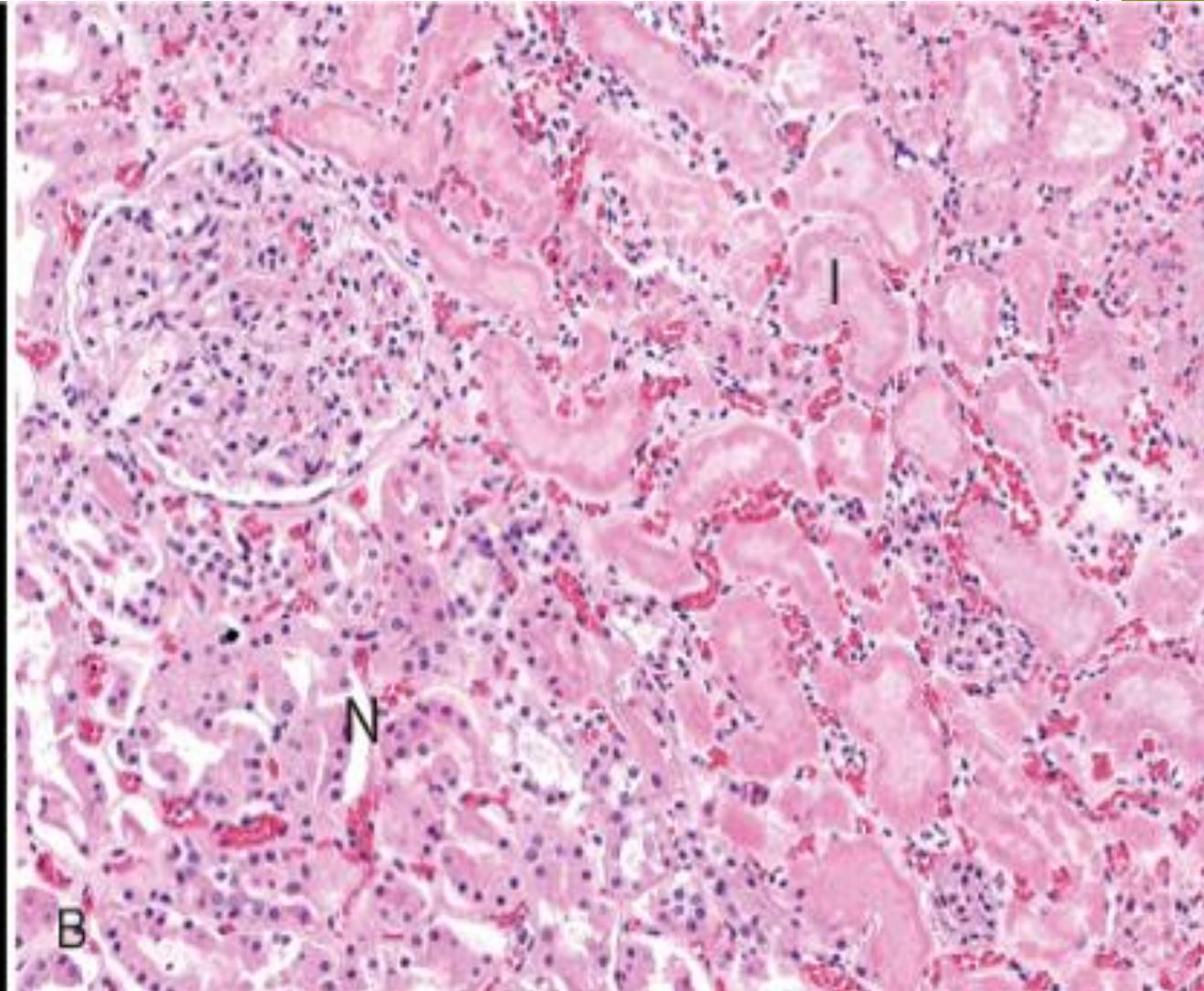
Specific Morphologic Patterns of Necrosis

- Coagulative necrosis
- Liquefactive necrosis
- Gangrenous necrosis
- Caseous necrosis
- Fat necrosis
- Fibrinoid necrosis

Coagulative necrosis



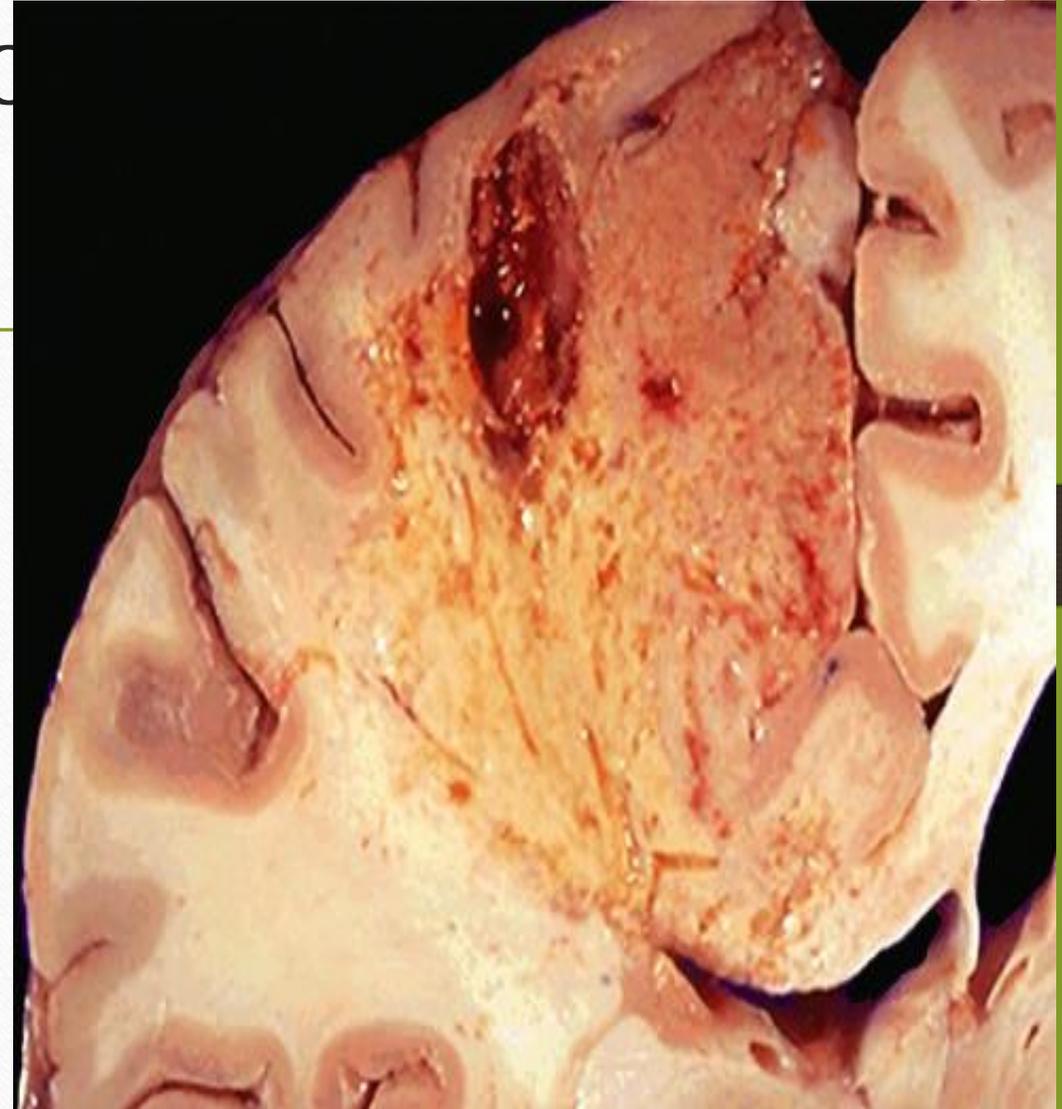
A

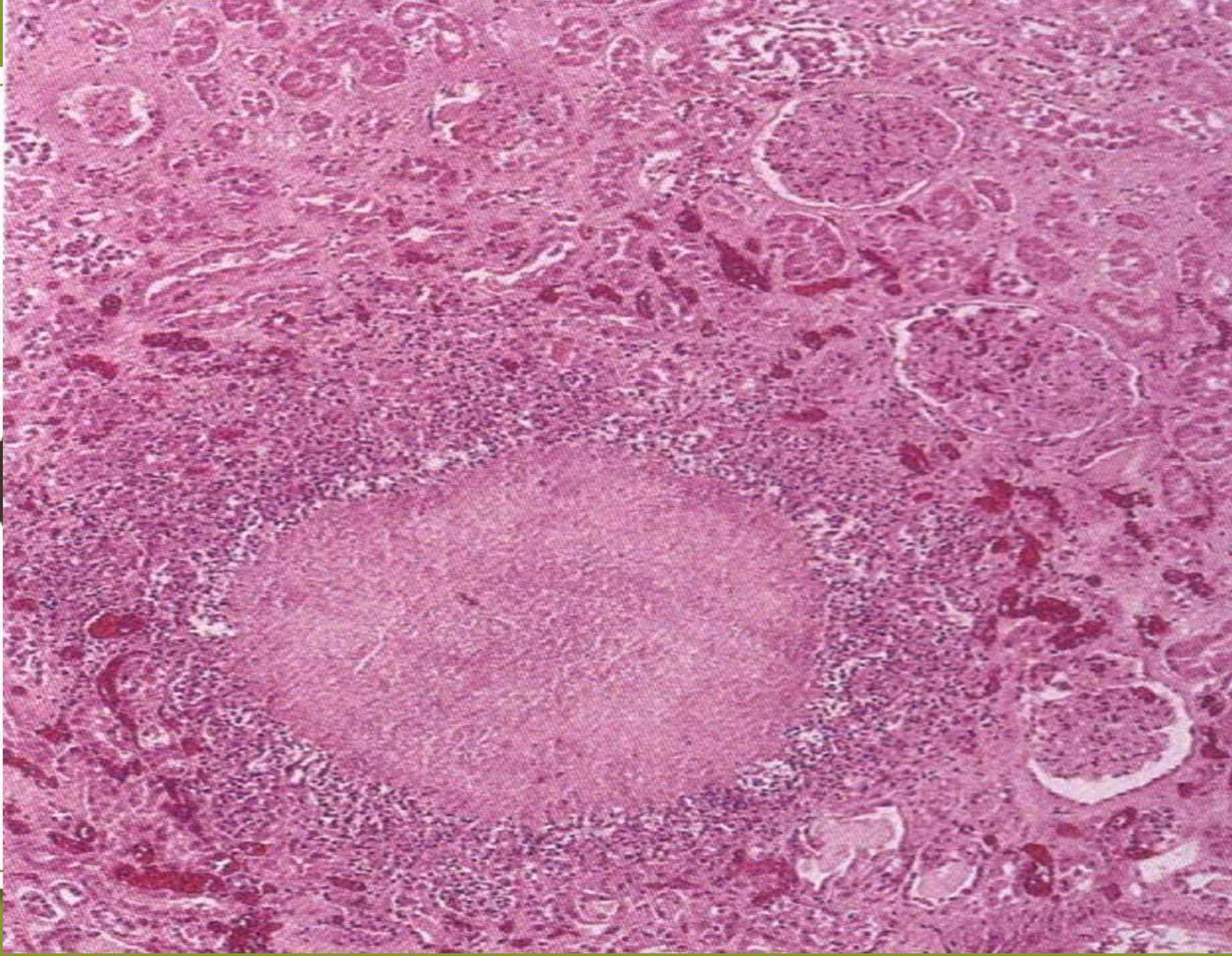


B

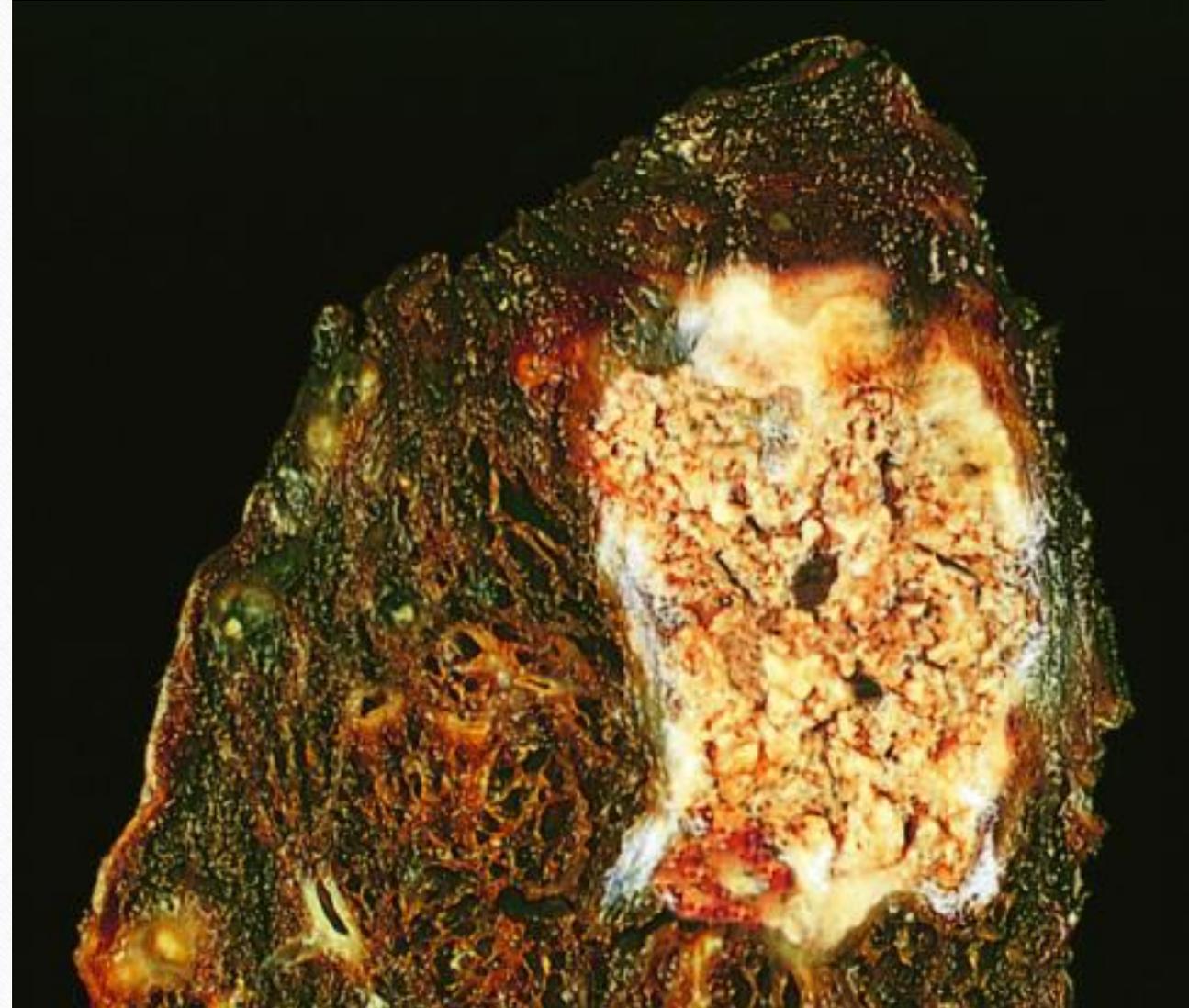
Liquefactive necro

- Focal bacterial and fungal infections.
- Hypoxic & death of cells within the central nervous system.
- Microbes -rapid accumulation of inflammatory cells-enzymes of leukocytes digest (“liquefy”) the tissue.
- If acute infection - creamy yellow & is called **pus**

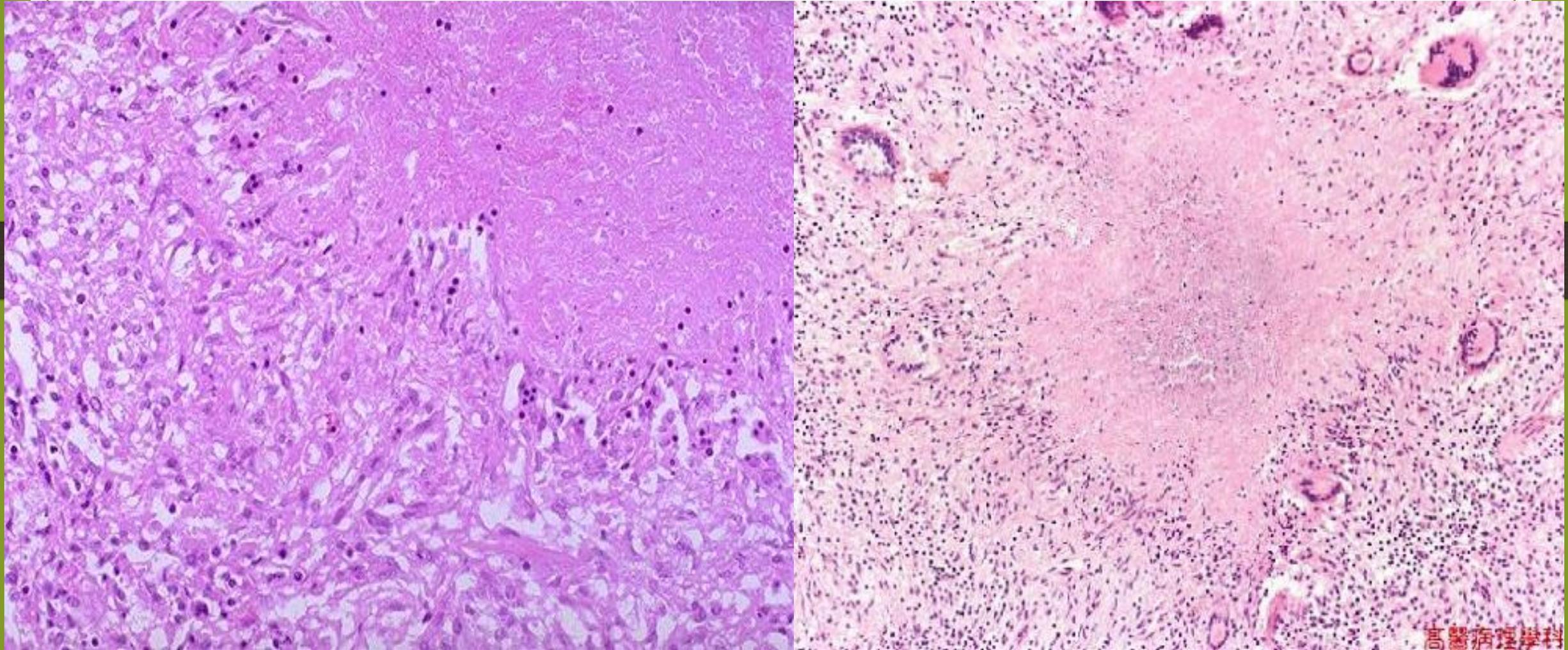




Caseous Necrosis



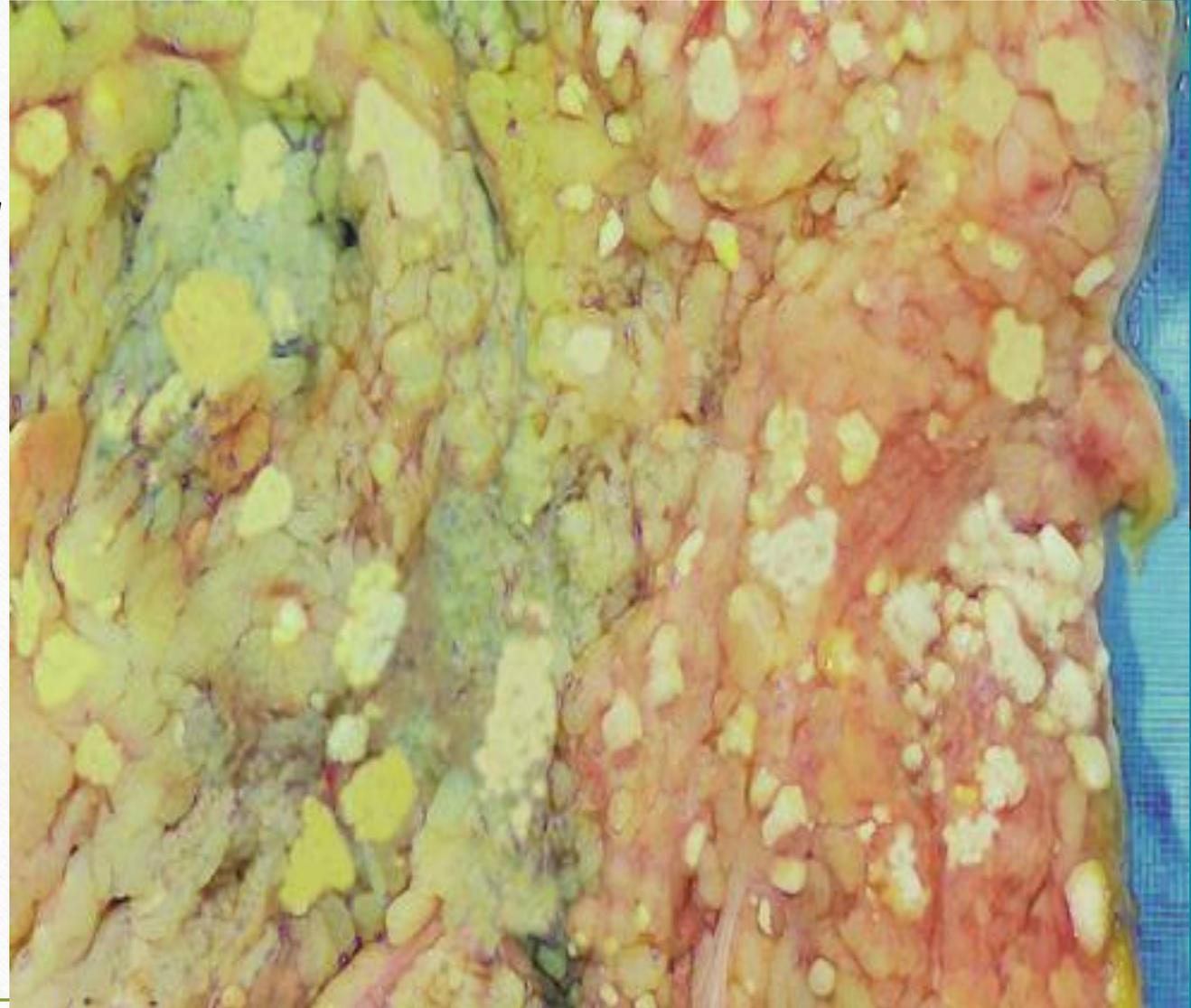
Caseous Necrosis



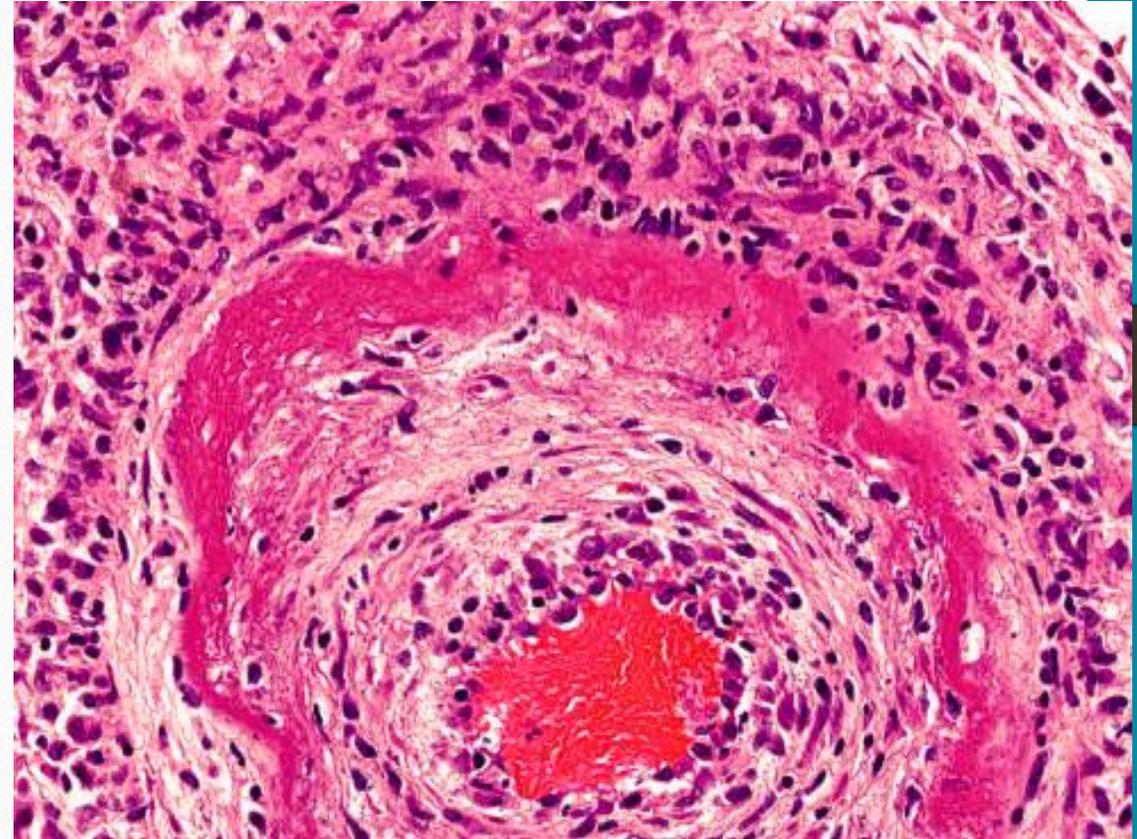
These salts look:

*+ chalky white on **gross** examination.*

*+ basophilic in **histological** sections stained with H&E*



A bright pink, amorphous appearance on H&E preparations called fibrinoid (fibrin-like) by pathologists..





THANK YOU
GOOD LUCK IN YOUR EXAM



THANK YOU
GOOD LUCK ☺