

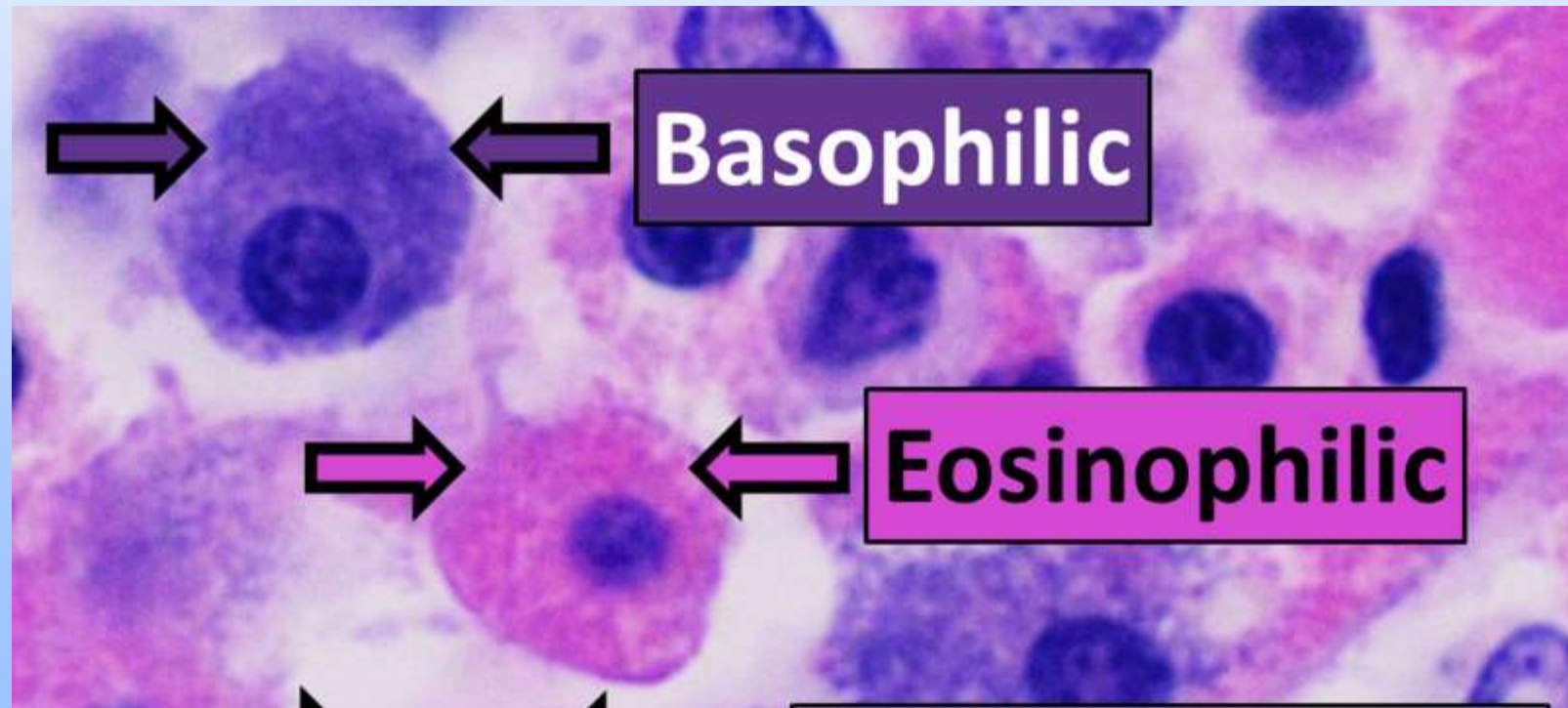
Cell Injury and Necrosis-2

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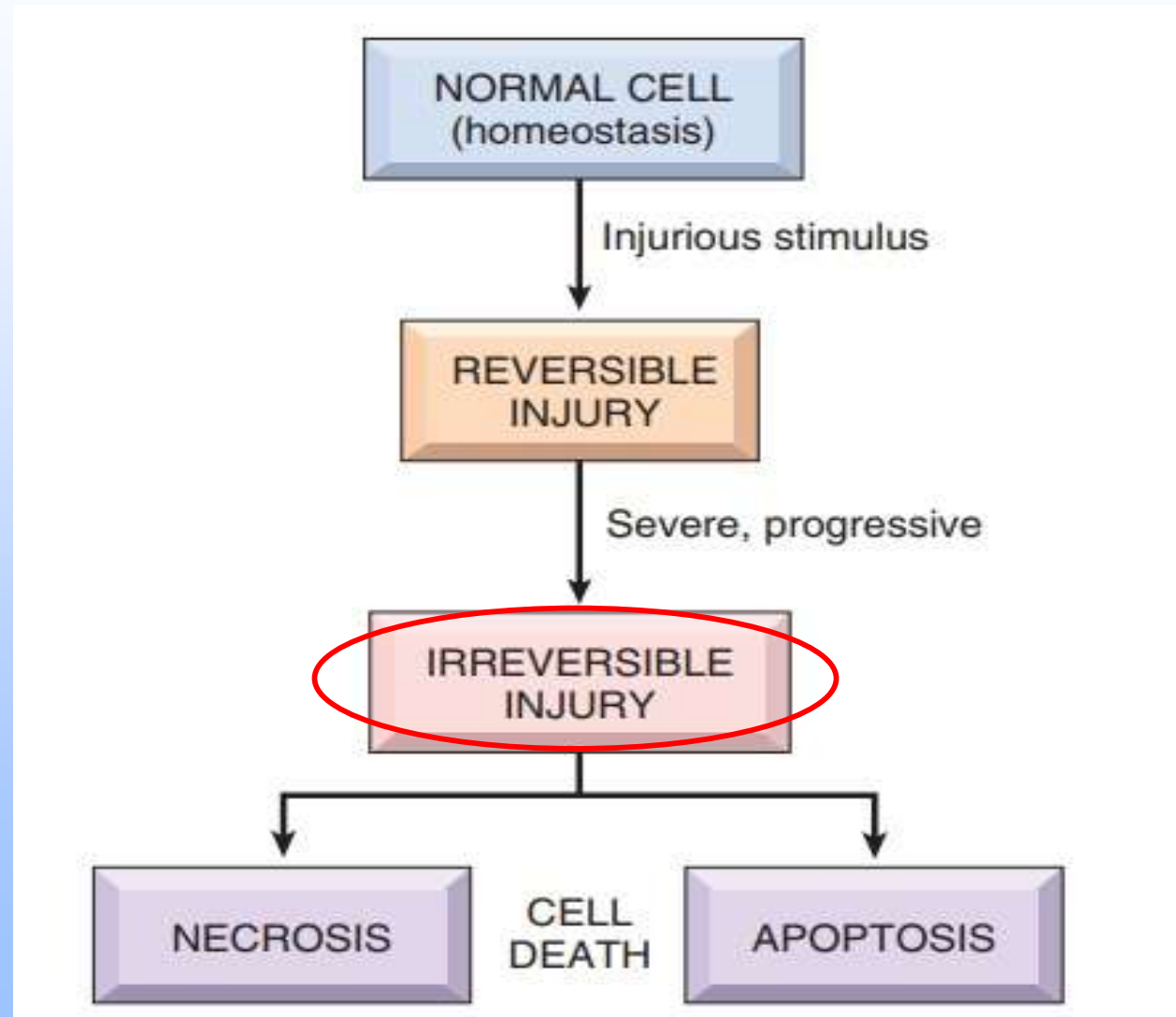
7-10-2024

Normal cells in H&E stain

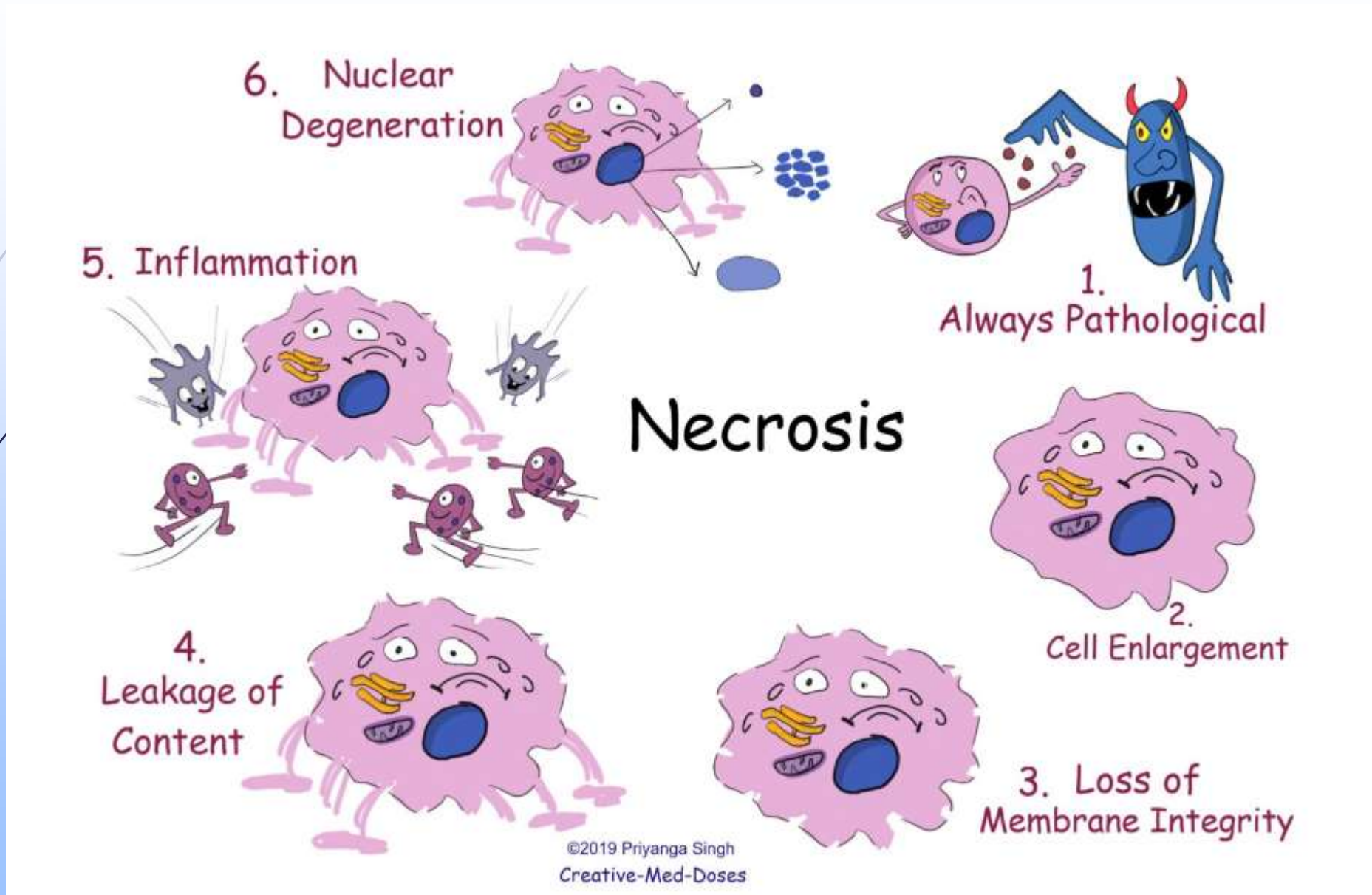
- ✓ H&E is the combination of two histological stains: hematoxylin and eosin.
- ✓ The hematoxylin stains cell nuclei a purplish blue, and eosin stains the extracellular matrix and cytoplasm pink



Consequences of injury



Necrosis



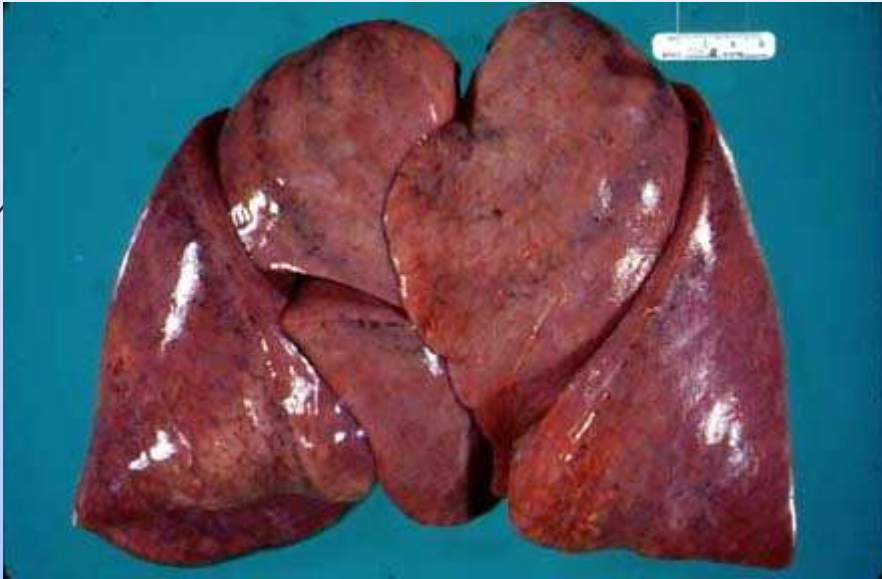


Necrosis

- It is an uncontrolled cell death that results in swelling of the cell organelles, plasma membrane rupture and eventual lysis of the cell, and spillage of intracellular contents into the surrounding tissue leading to tissue damage.
- Considered as culmination of reversible cell injury that cannot be corrected.
- **Usually elicits a local host reaction, inflammation** (due to the release of heat shock proteins, uric acid, ATP, DNA, and nuclear proteins).

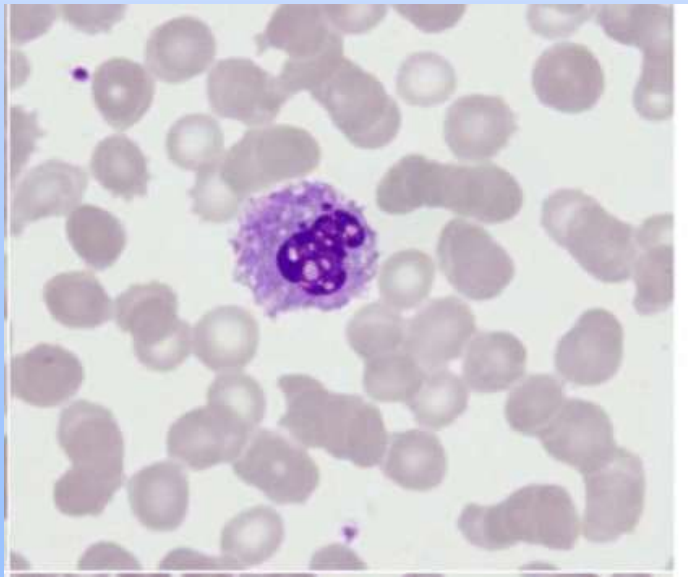
Morphological features of necrosis:

I. Grossly:

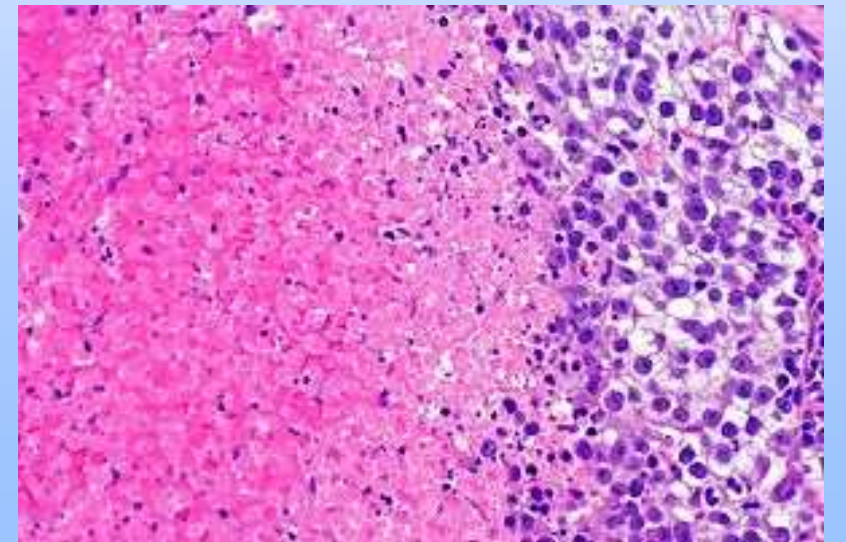


Microscopic appearance of Necrotic dead cells:

nuclear



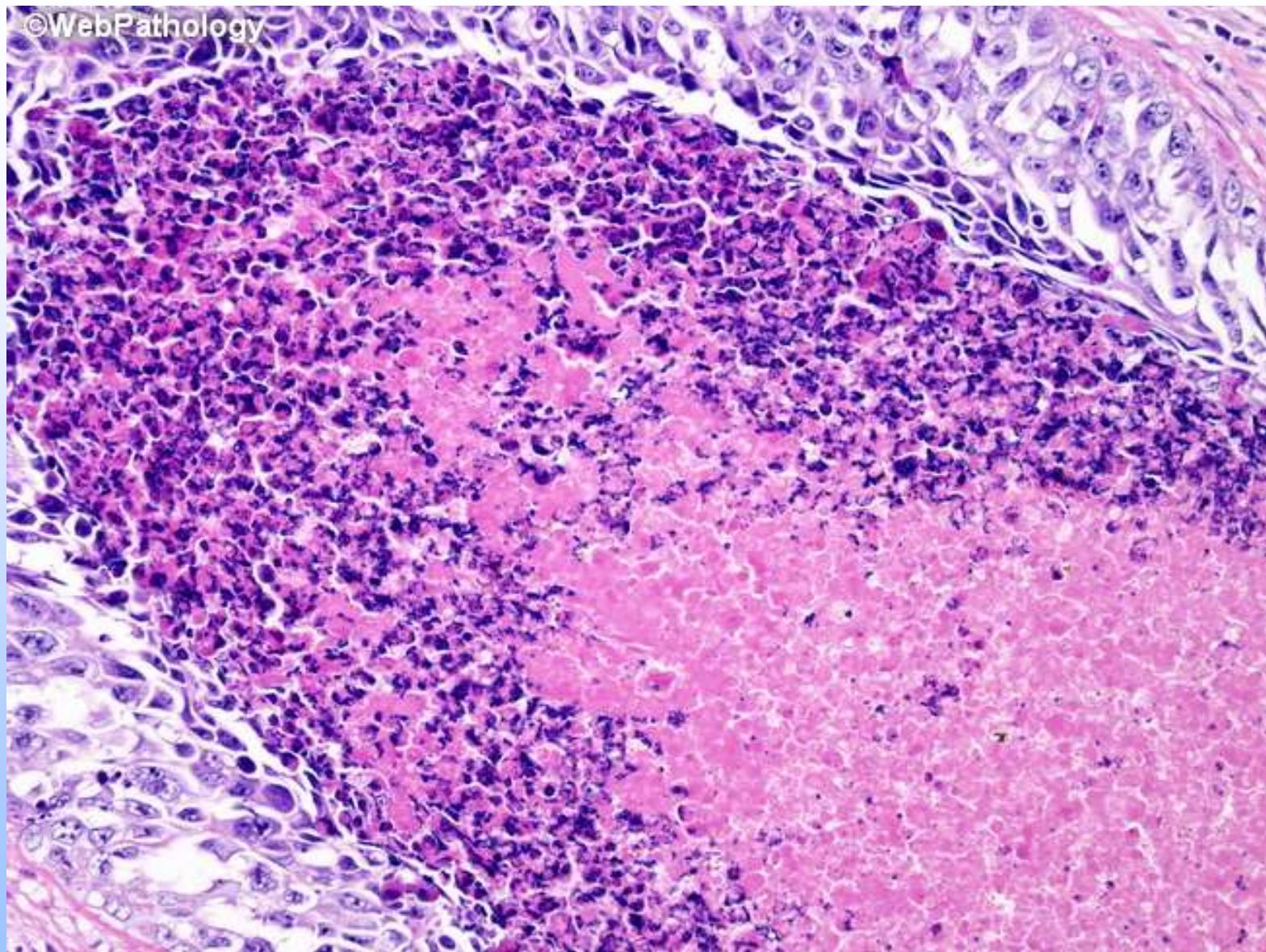
cytoplasmic





Cytoplasmic

- ▶ increased binding of eosin to denatured cytoplasmic proteins, loss of basophilic ribonucleic acid (RNA) in the cytoplasm .
- ▶ A glassy, homogeneous appearance, mostly because of the loss of lighter staining glycogen particles.
- ▶ cytoplasm vacuolated and appears “moth-eaten “, due to enzymes

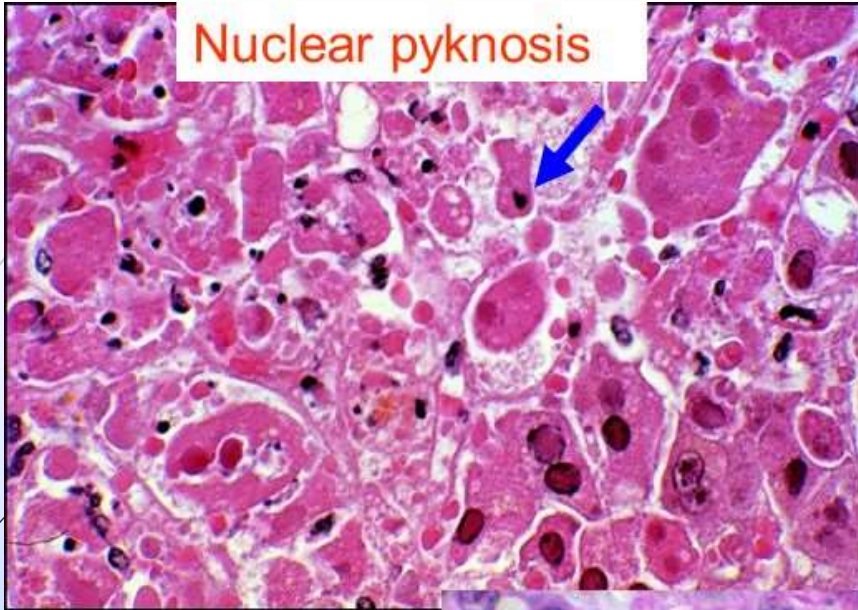


Nuclear changes

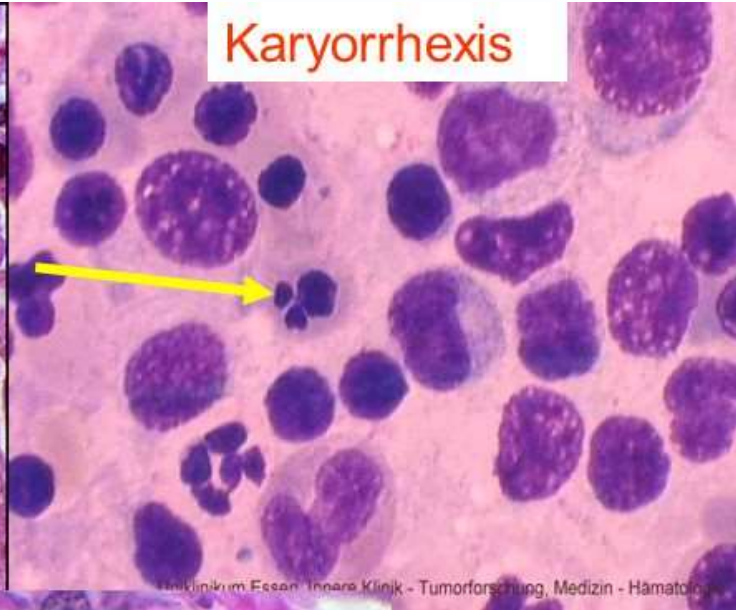
- * Result from break down of DNA; appear as three patterns:
 - **Pyknosis:** shrinkage and increased basophilia.
 - **Karyorrhexis:** fragmentation of pyknotic nucleus
 - **Karyolysis:** decrease basophilia of chromatin, DNAase: (deoxyribonuclease, DNA digestion).

In 1-2 days the nucleus in a dead cell may completely disappear.

Nuclear pyknosis



Karyorrhexis

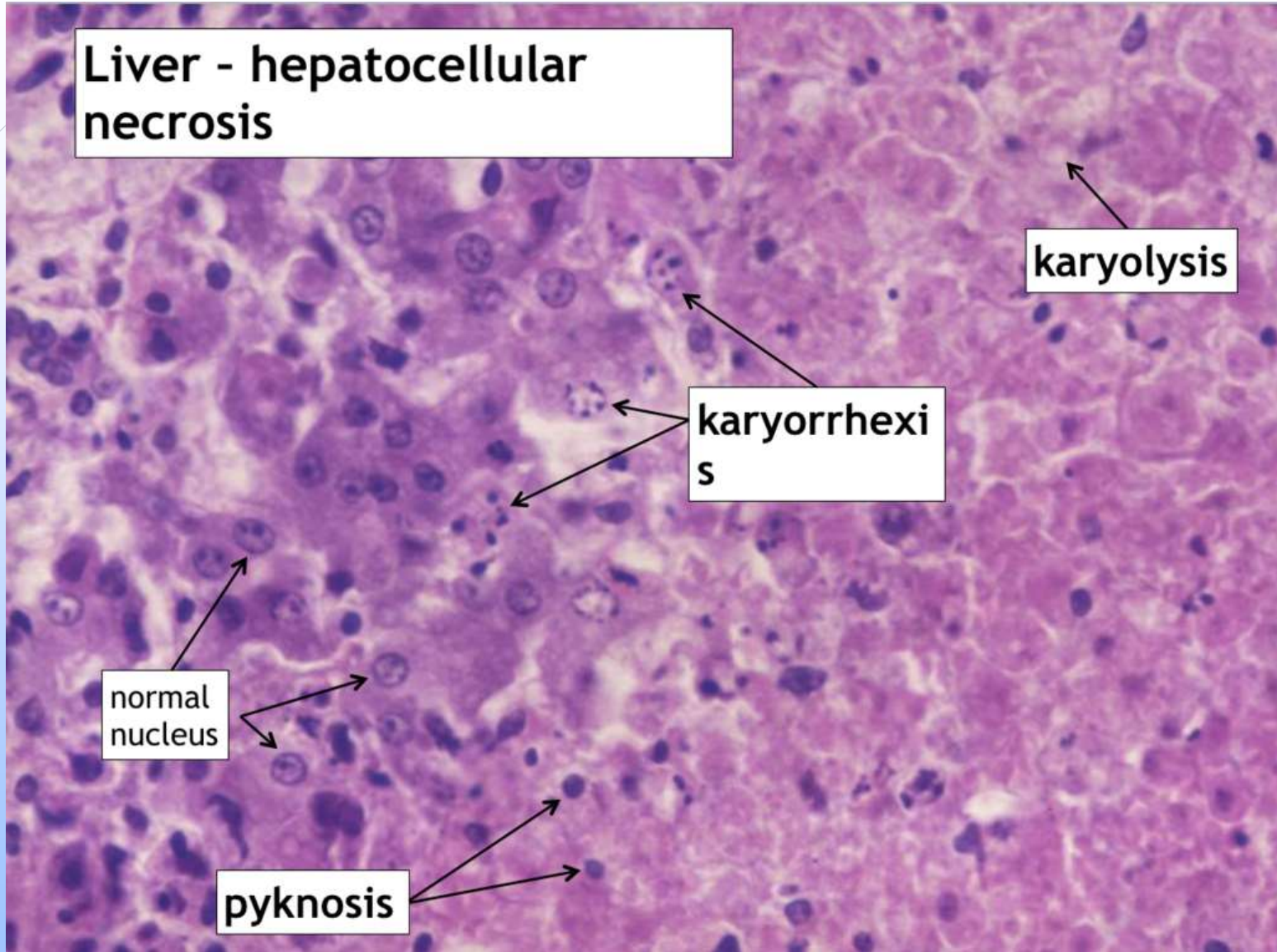


Karyolysis



Stadtklinikum Essen - Innere Klinik - Tumorforschung, Medizin - Hämatologie

**Liver - hepatocellular
necrosis**



karyolysis

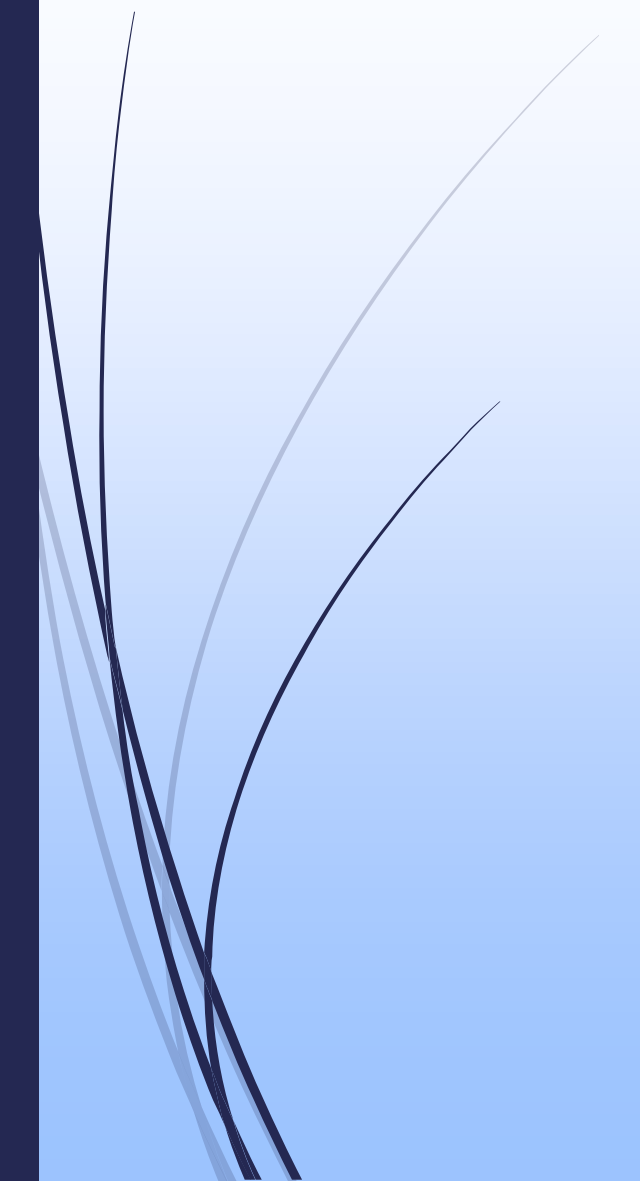
karyorrhexis

normal
nucleus

pyknosis



Morphologic Patterns of Necrosis

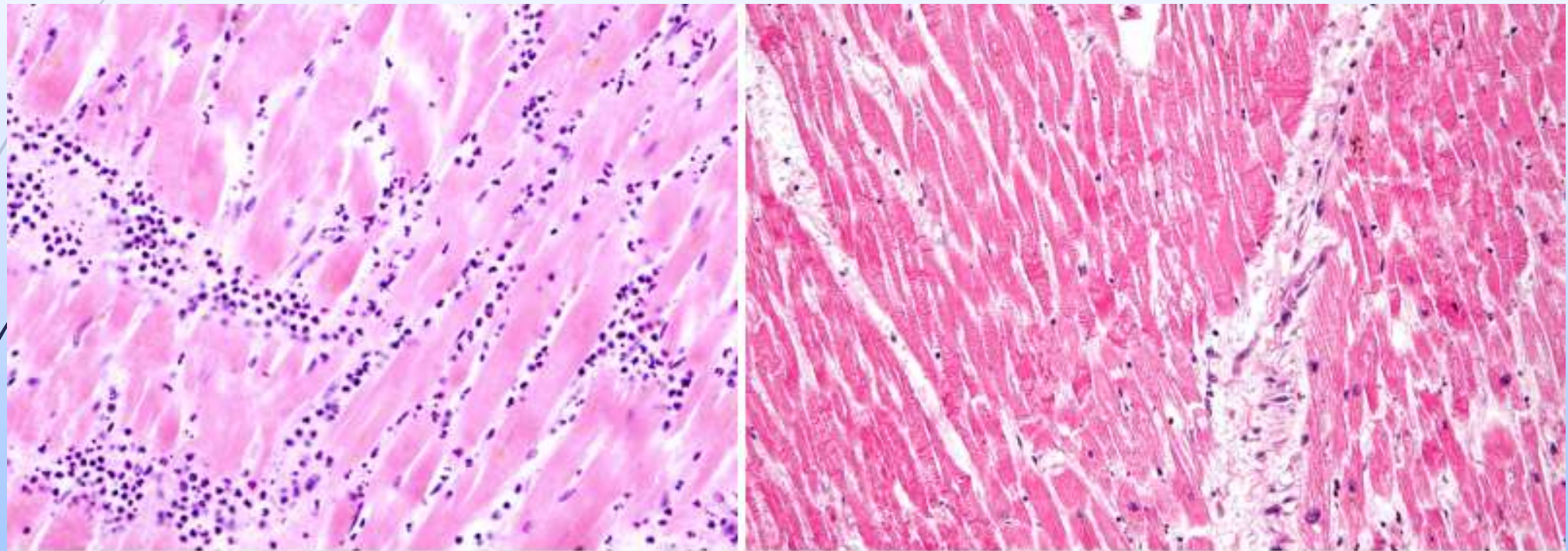
- ❖ Coagulative necrosis
 - ❖ Liquefactive necrosis
 - ❖ Caseous necrosis
 - ❖ Fat necrosis
 - ❖ Fibrinoid necrosis
- 



1. Coagulative necrosis

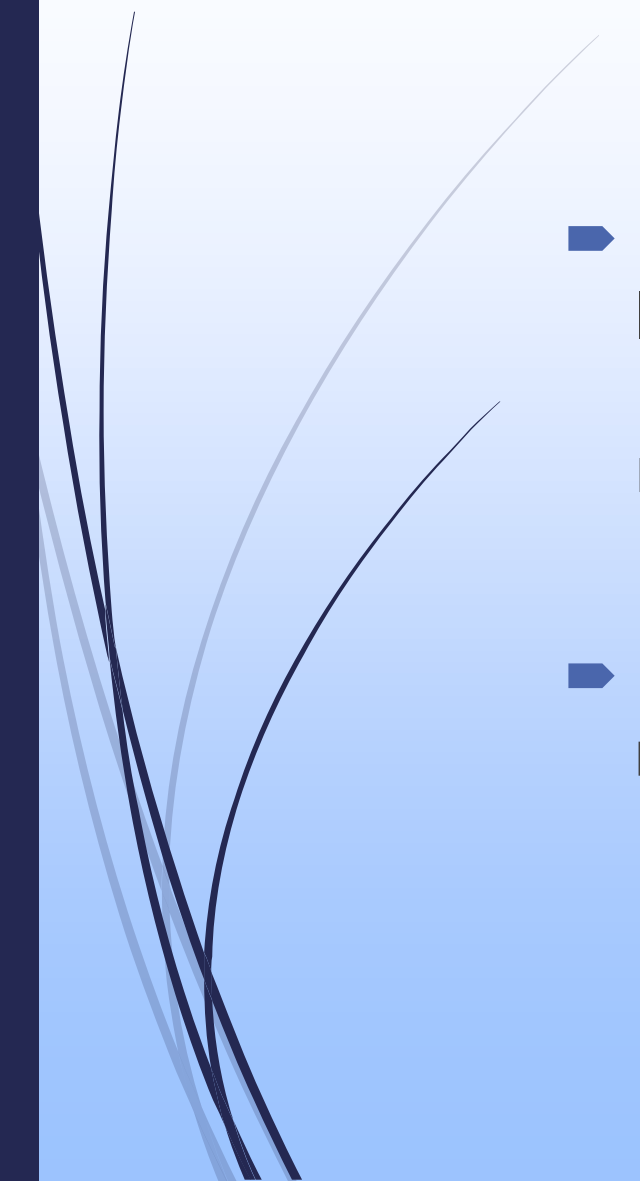
- ▶ proteins can denature (coagulate) to leave 'ghost' outlines behind. The dead cells lose their nuclei and may stain more intensely.
- ▶ The most common form of necrosis (particularly in myocardium, liver, kidney)
- ▶ characteristic of hypoxic cell death in all tissues except in the brain

coagulative necrosis in the myocardium after infarction

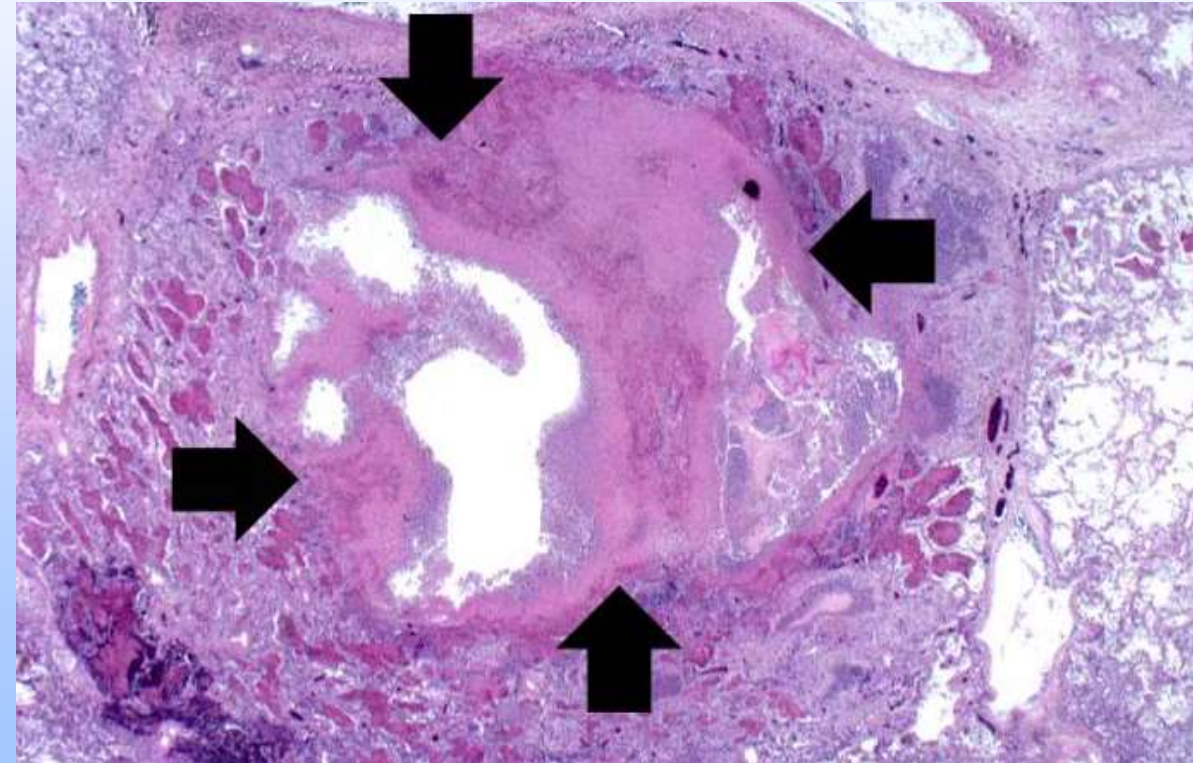
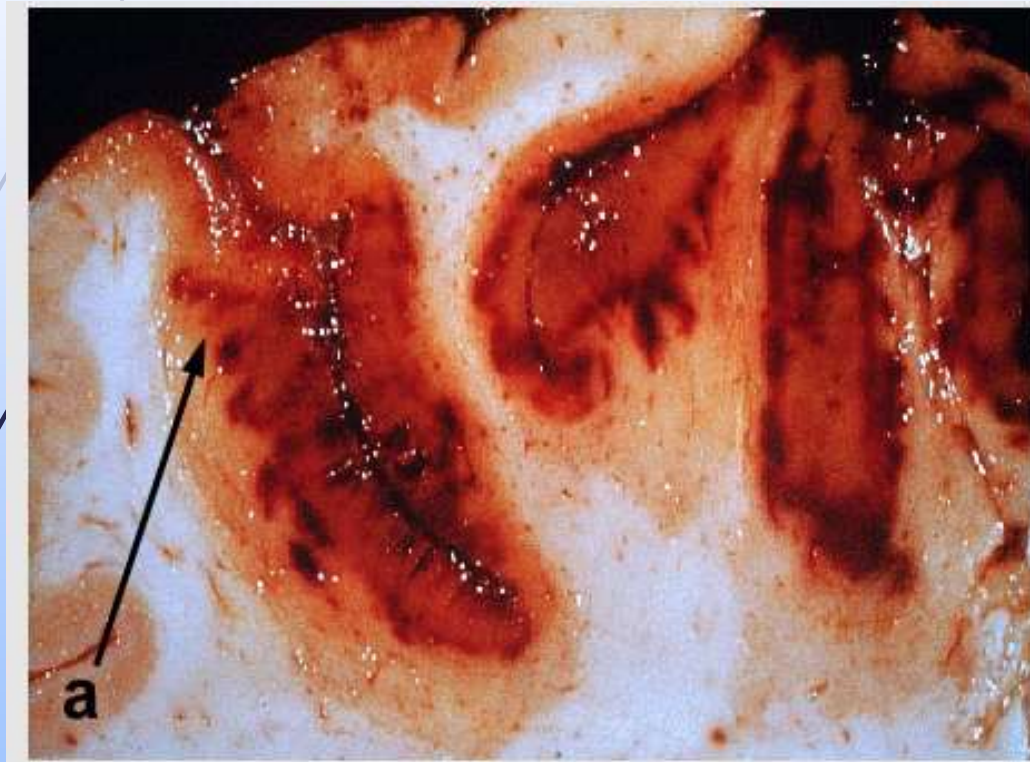




2. Liquefactive necrosis

- ▶ Infiltration of dead tissue by large numbers of neutrophils leads to digestion of cell proteins. This leads to loss of normal tissue architecture and is known as **liquefactive necrosis**.
 - ▶ Liquefactive necrosis is common after cell death in lipid-rich tissue such as the brain (cerebral infarction).
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Liquefactive necrosis

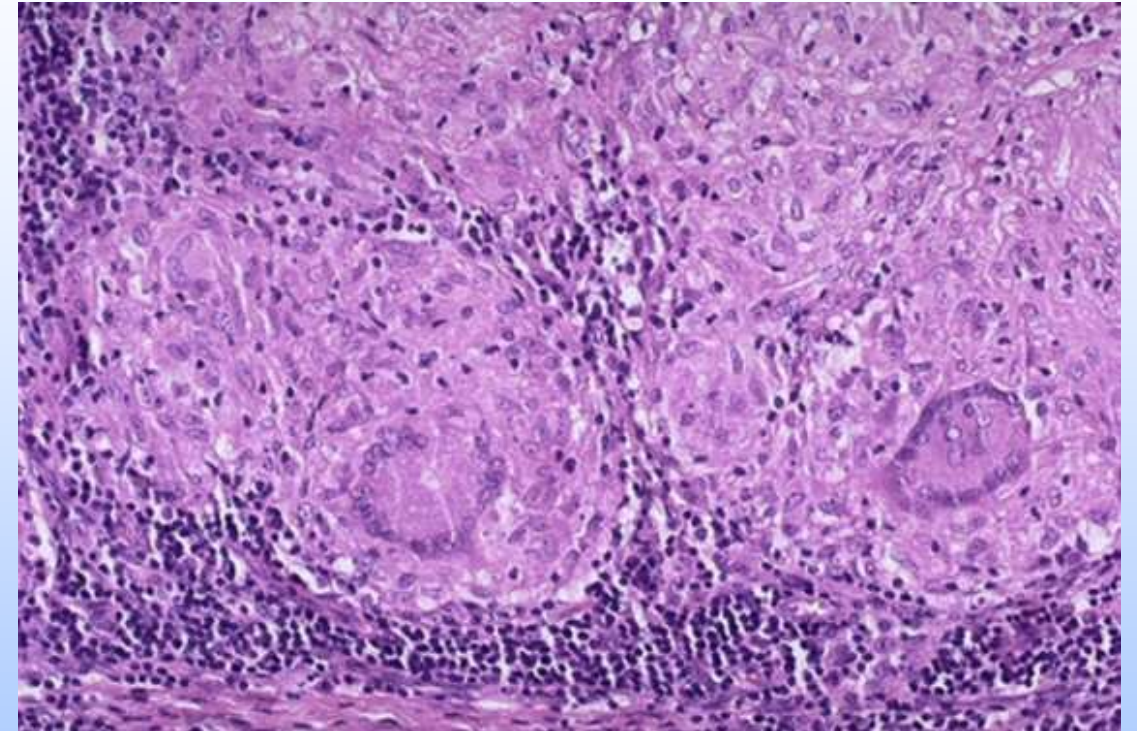
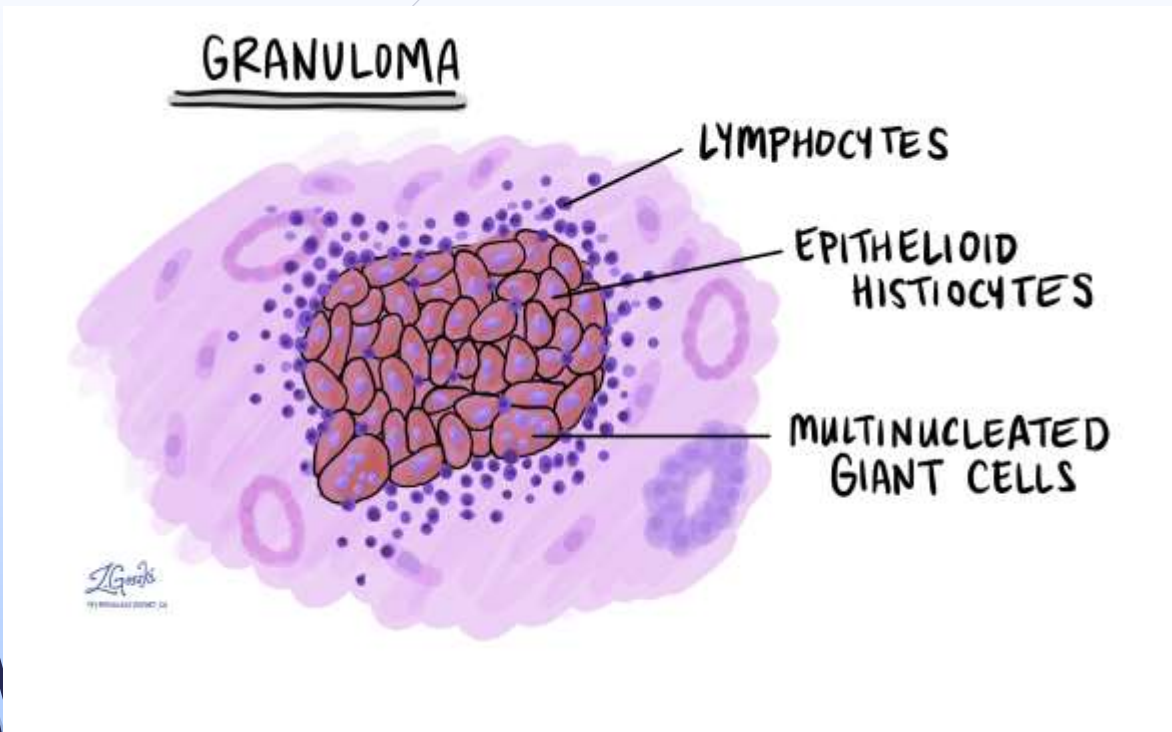




3. Caseous necrosis

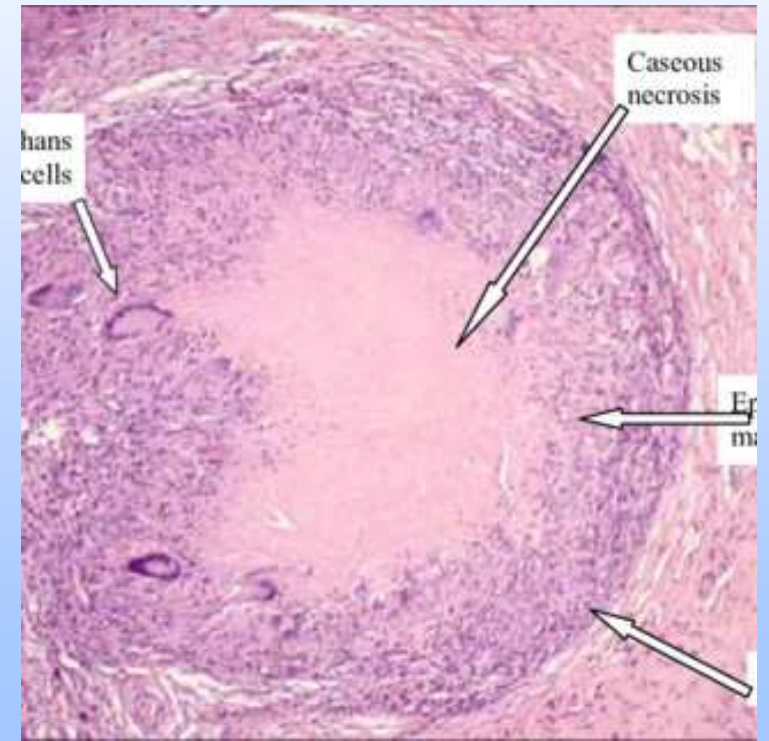
- ▶ Type of necrosis that occur in the center of granulomas, typically seen in mycobacterial infection.
- ▶ Granulomas are aggregates of epithelioid macrophages and giant cell macrophages, often surrounded by lymphocytes.
- ▶ Granulomas are found as a response to foreign bodies, in some autoimmune diseases, and in mycobacterial infection (e.g. M.tuberculosis).
- ▶ Gross morphology of caseous necrosis appear as cheese-like.

Granuloma structure

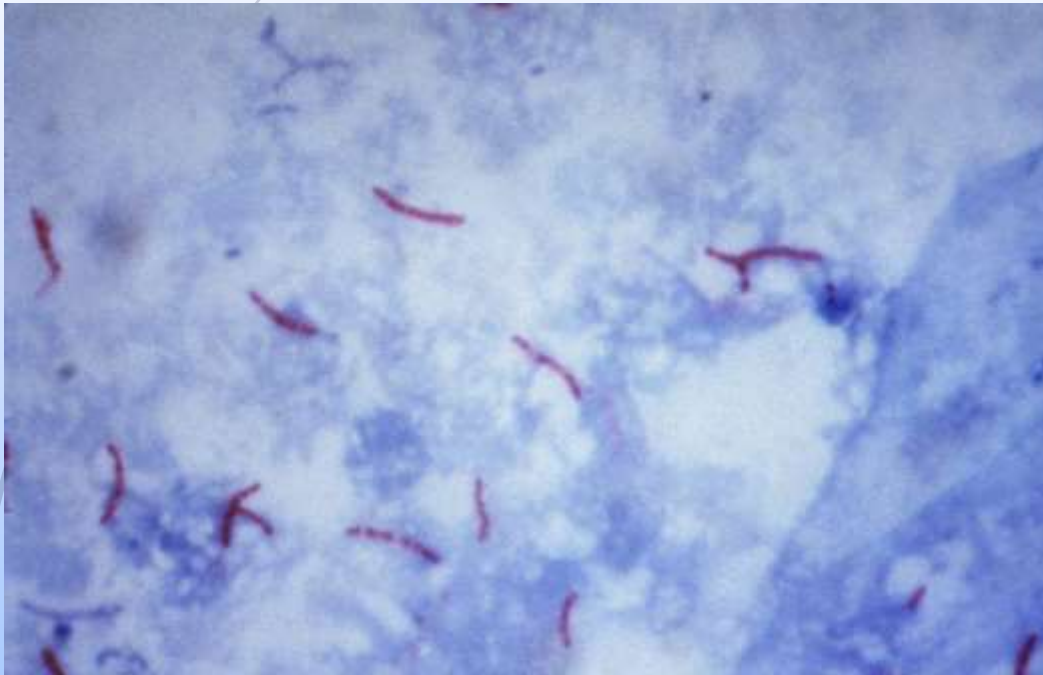


Does all type of granuloma contain necrosis?

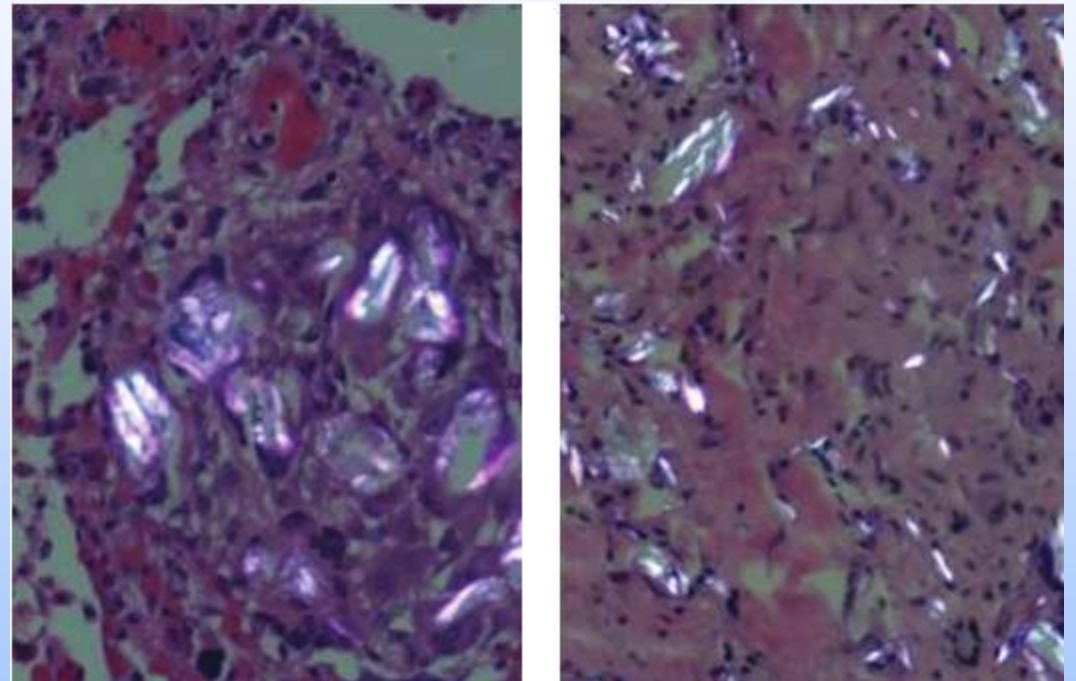
Caseous necrosis



Caseous necrosis

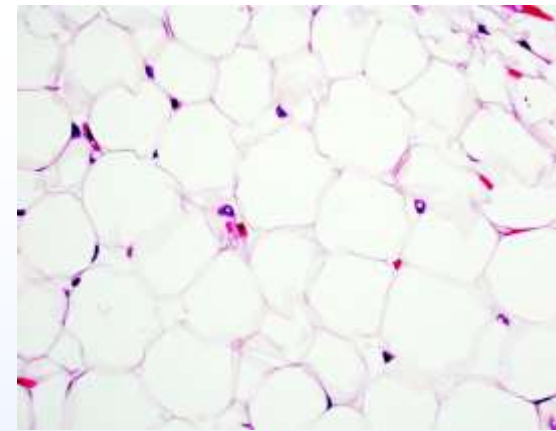


M.tuberculosis



foreign bodies

4. Fat necrosis



- ▶ a pattern of necrosis that occurs due to degradation of fatty tissue by lipases (released from dead cells) to form chalky deposits.
- ▶ This can be seen in acute pancreatitis (acute inflammation of the pancreas causing necrosis of pancreatic acinar cells and lipase release), or from trauma to fatty tissues.

Fat necrosis

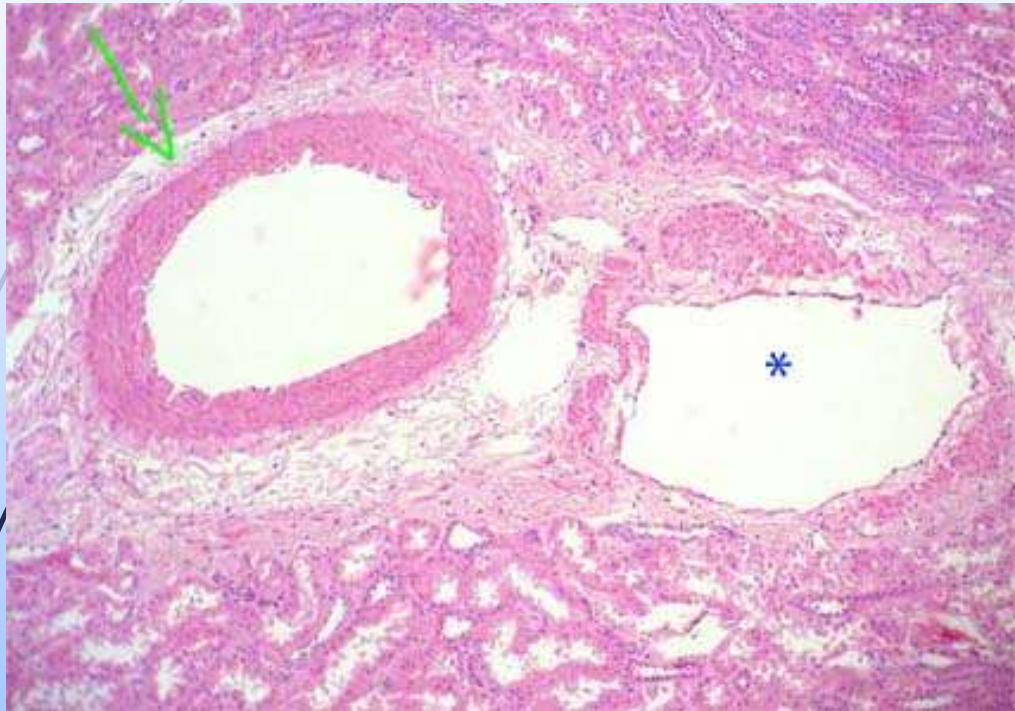


* fatty acids bind and precipitate calcium ions, forming insoluble salts. * foamy macrophages adjacent to adipose tissue

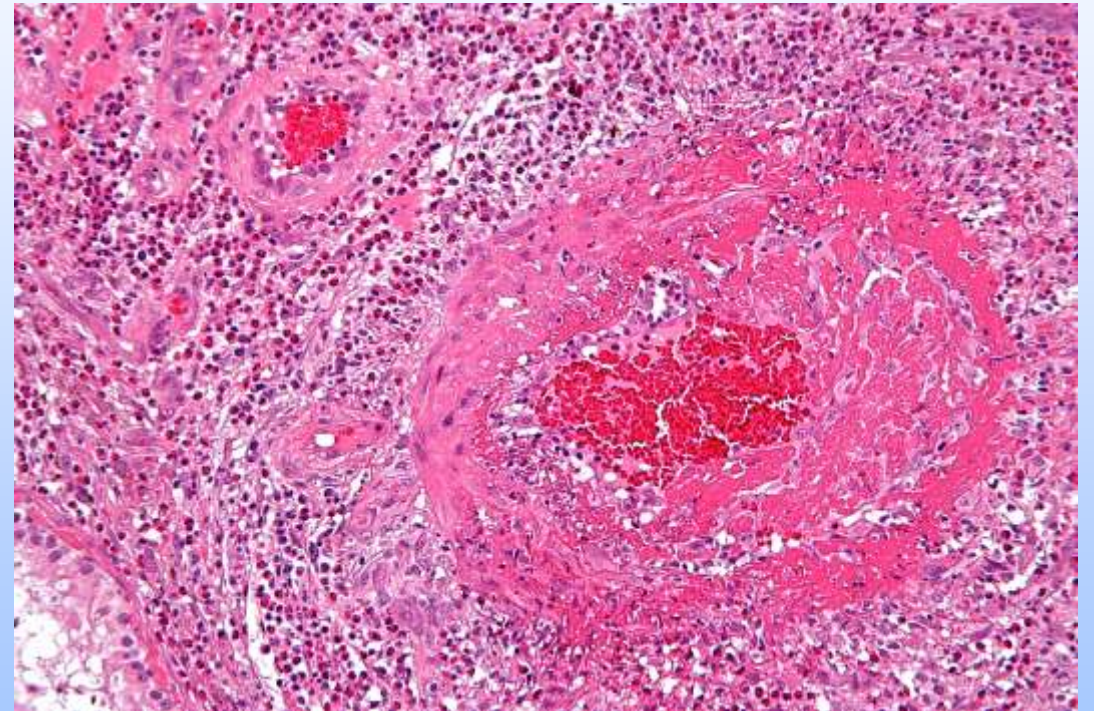
5. Fibrinoid necrosis

- ▶ specific pattern of cell death that occurs when antigen-antibody complexes are deposited in the walls of blood vessels along with fibrin.
- ▶ Usually seen in immune reactions, when complexes of antigens and antibodies are deposited in the walls of blood vessels as seen in Severe hypertension.
- ▶ Deposited immune complexes and plasma proteins that leak into the wall of damaged vessels produce a bright pink, amorphous appearance.....**FIBRIN**

Fibrinoid necrosis



Normal B.V



Fibrinoid necrosis



Fate of Necrosis

- Most of necrotic tissue is removed by leukocyte (Phagocytosis) combined with extracellular enzyme digestion
- If necrotic tissue is not eliminated → it attracts Ca^{++} salts → dystrophic calcification

Leakage of intracellular proteins through the damaged cell membrane and ultimately into the circulation provides a means of detecting tissue-specific necrosis using blood or serum samples:

