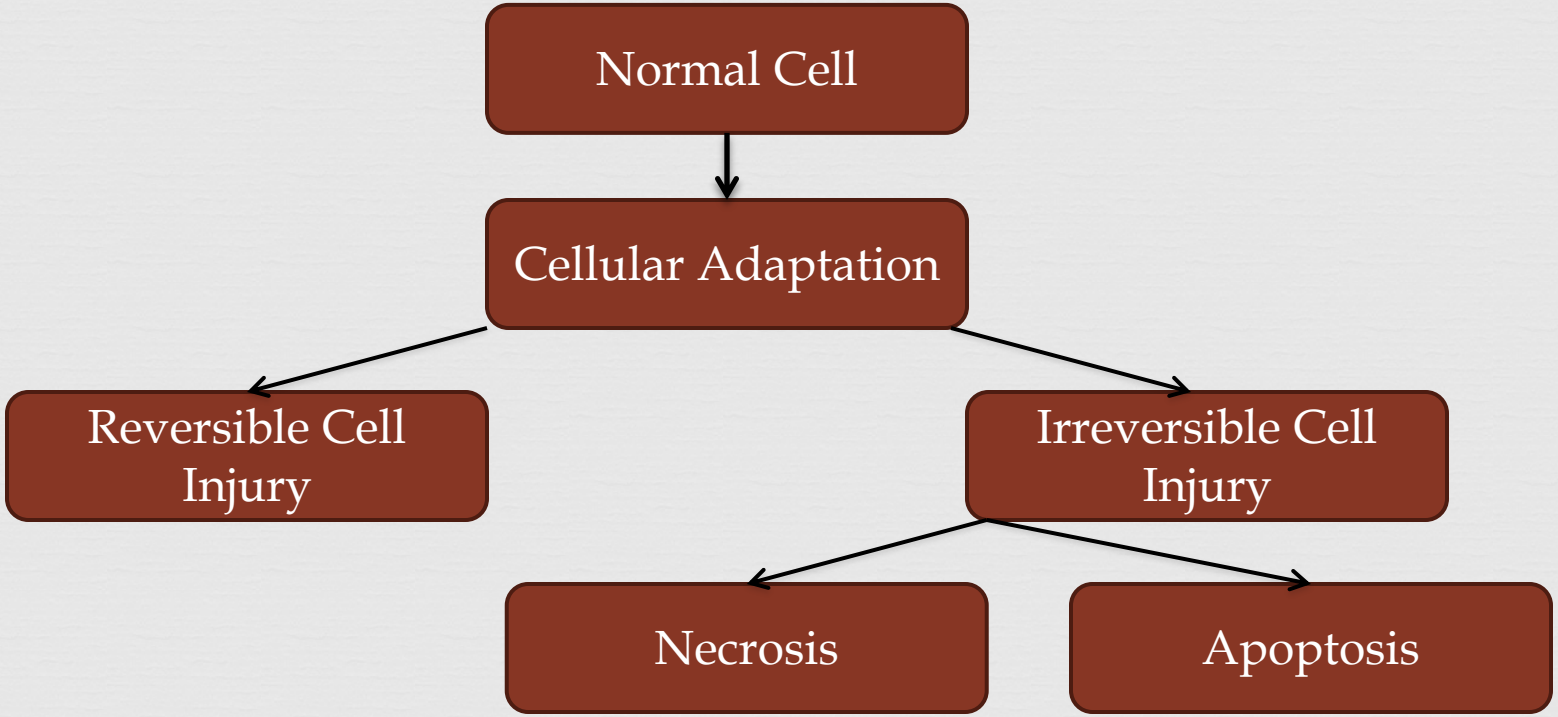
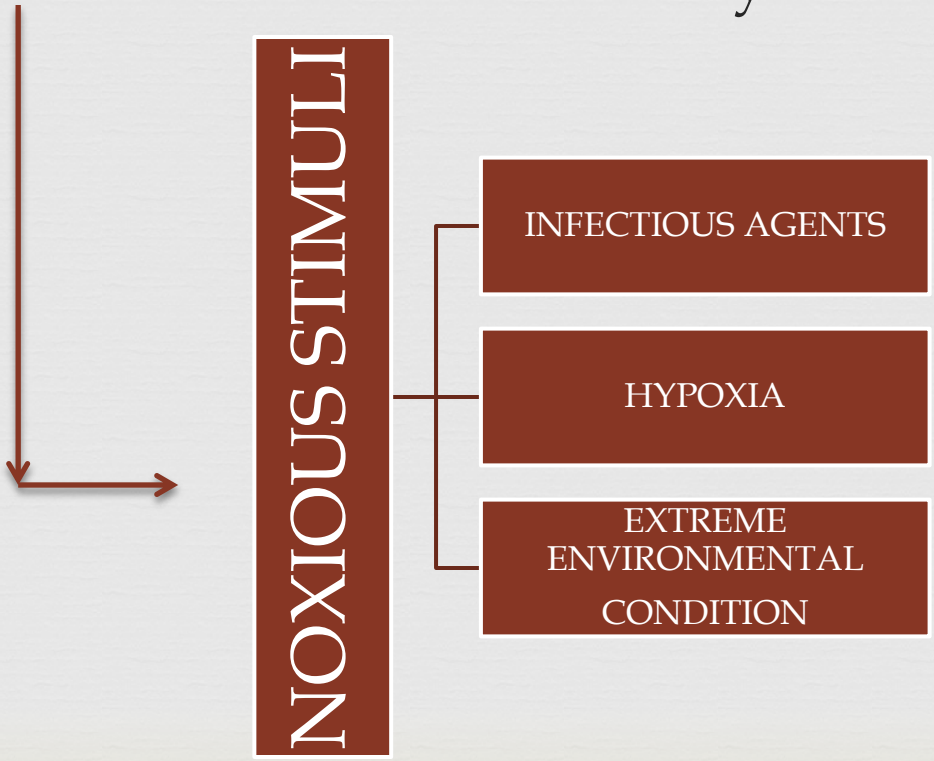
NECROSIS

TYBSC PAPER 2


Normal Cell
Cellular Adaptation
Reversible Cell Injury
Irreversible Cell Injury
Necrosis
Apoptosis

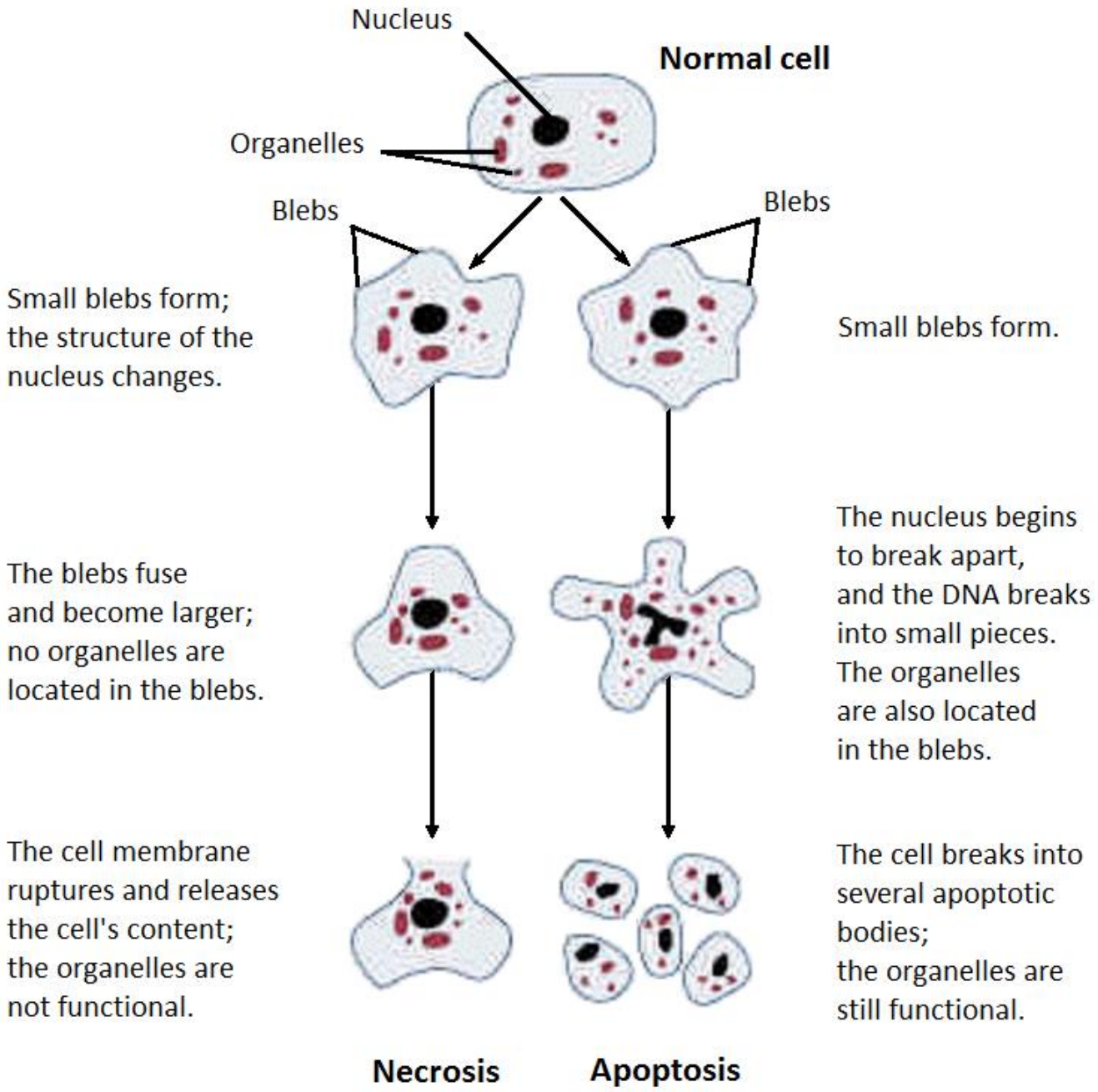
NECROSIS

- Irreversible injury to cells when the cell encounters noxious stimuli and invariably leads to cell death.

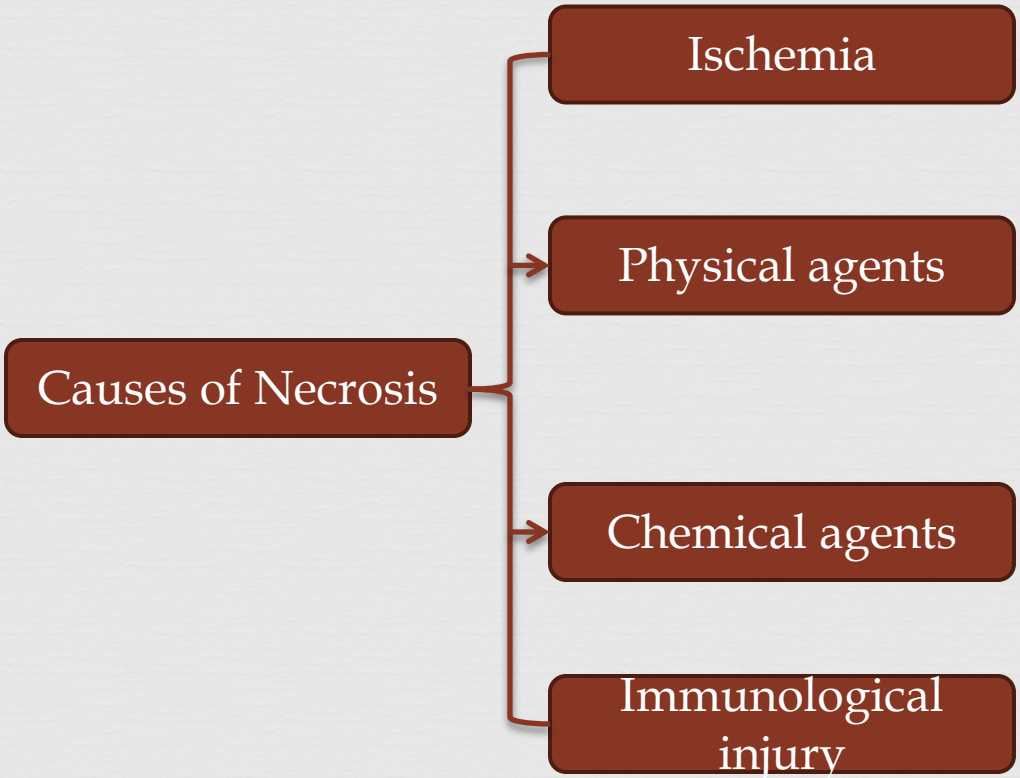


NECROSIS & APOPTOSIS

- **Necrosis** is caused by factors external to the cell or tissue, such as infection, toxins, or trauma which result in the **unregulated digestion of cell components.**
- Necrosis as a form of cell death is almost always associated with a **pathological process**
- In contrast, **apoptosis** is a **naturally occurring programmed and targeted cause of cellular death**
- Apoptosis is a programmed or organized cell death which could be **physiological or pathological**


Nucleus
Normal cell
Organelles
Blebs
Blebs
Small blebs form;
the structure of the
nucleus changes.
Small blebs form.
The blebs fuse
and become larger;
no organelles are
located in the blebs.
The nucleus begins
to break apart,
and the DNA breaks
into small pieces.
The organelles
are also located
in the blebs.
The cell membrane
ruptures and releases
the cell's content;
the organelles are
not functional.
The cell breaks into
several apoptotic
bodies;
the organelles are
still functional.
Necrosis
Apoptosis

NECROSIS


Causes of Necrosis
Ischemia
Physical agents
Chemical agents
Immunological injury

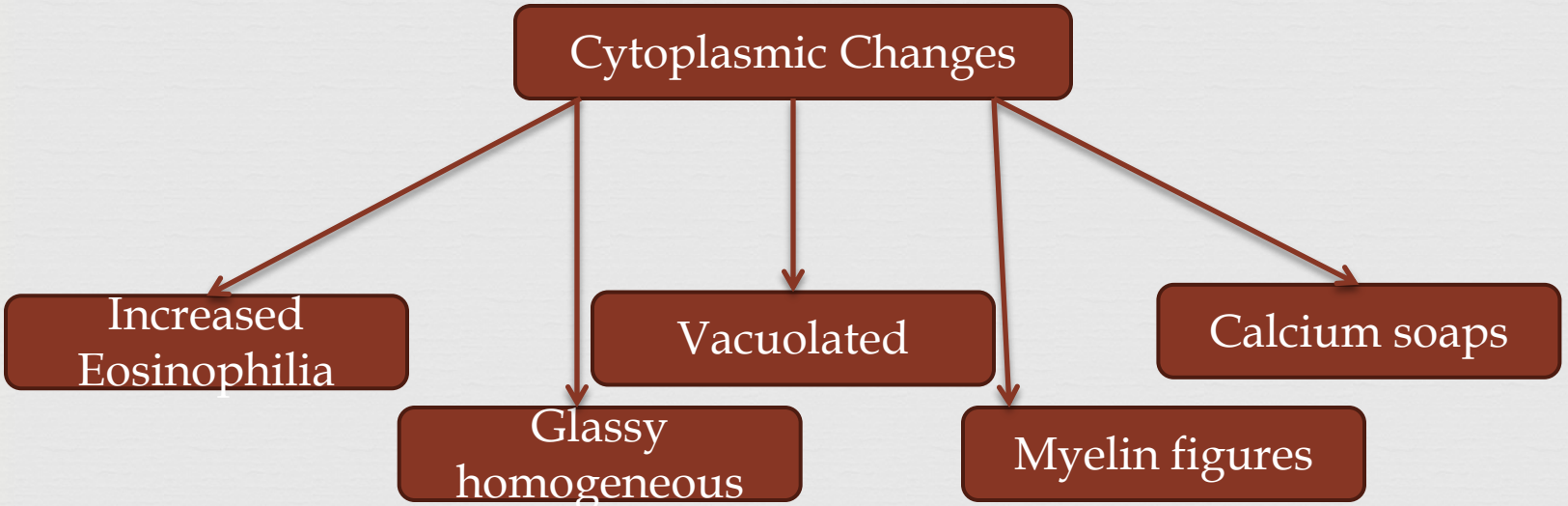
NECROSIS

- What happens to the cell when it undergoes necrosis?

Cytoplasmic Changes

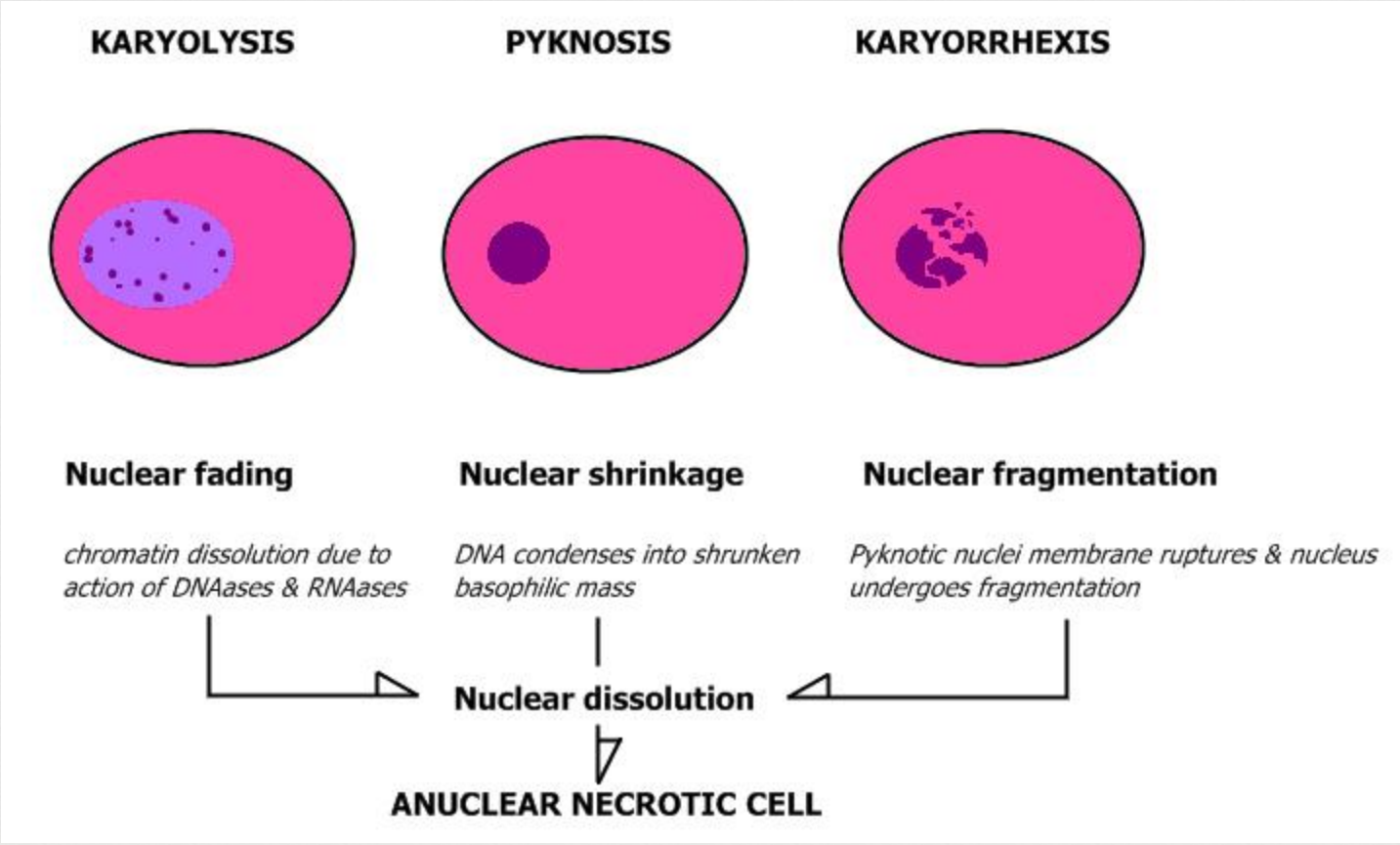
Nuclear Changes

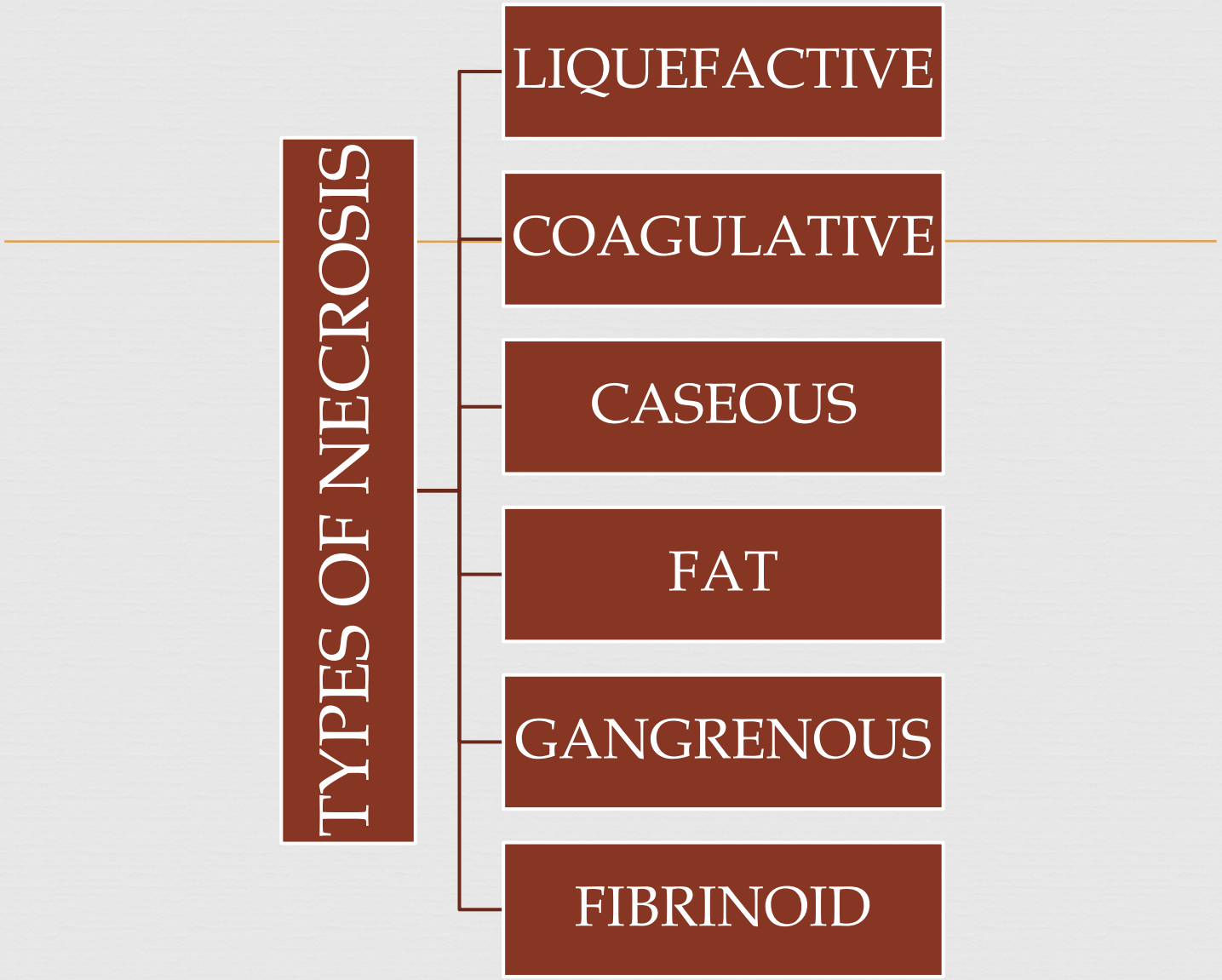
NECROSIS


Cytoplasmic Changes
Increased Eosinophilia
Glassy homogeneous
Vacuolated
Myelin figures
Calcium soaps

NECROSIS

Nuclear Changes




TYPES OF NECROSIS
LIQUEFACTIVE
COAGULATIVE
CASEOUS
FAT
GANGRENOUS
FIBRINOID

LIQUEFACTIVE NECROSIS

- **Colliquative necrosis**

- Occurs within hours of injury

Characterized by:

- **Partial or complete dissolution** of dead tissue and transformation into a liquid, viscous mass

- **Loss of tissue and cellular profile**

LIQUEFACTIVE NECROSIS

- **Gross Appearance**: The tissue is in a liquid form and sometimes creamy yellow because of pus formation.

- **Microscopic:** Inflammatory cells with numerous neutrophils.

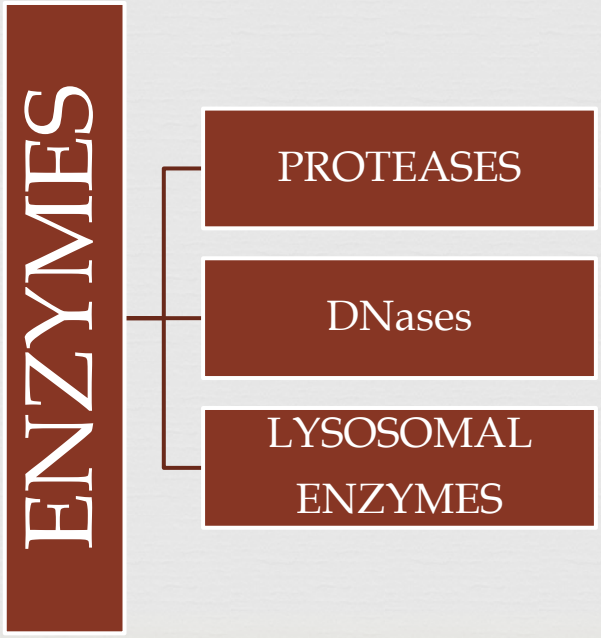
- The pattern of necrosis seen with **infections, ischemic injury in brain**

LIQUEFACTIVE NECROSIS

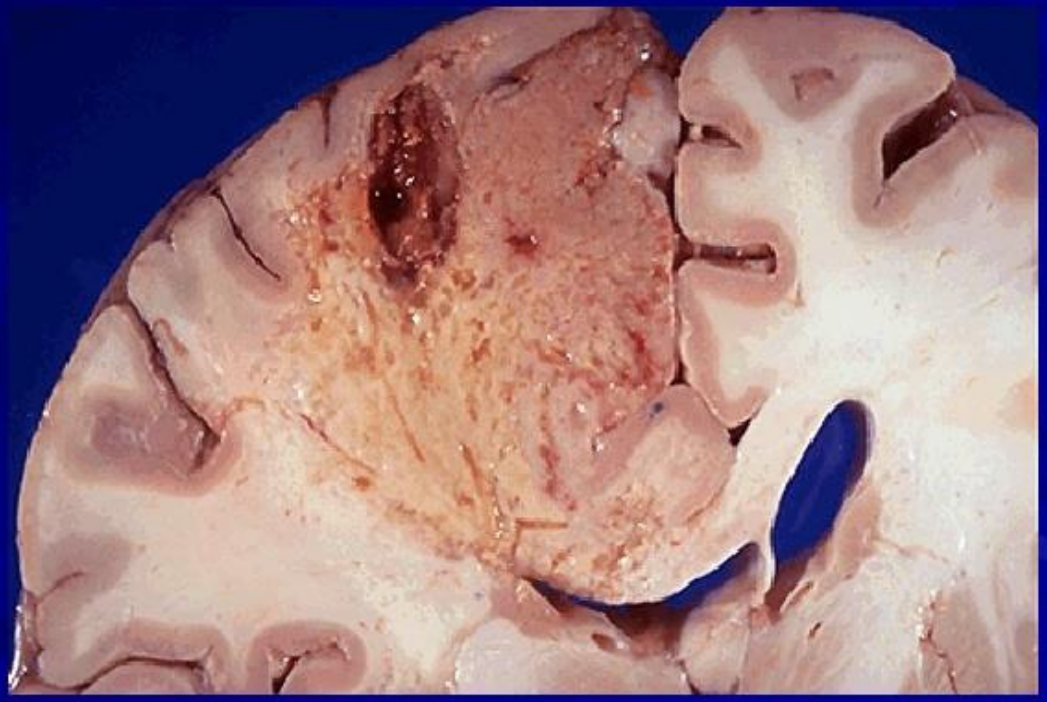
- What exactly happens to the cell or tissue, when liqufactive necrosis occur?
- Autolysis
- Heterolysis
- Protein Denaturation

LIQUEFACTIVE NECROSIS

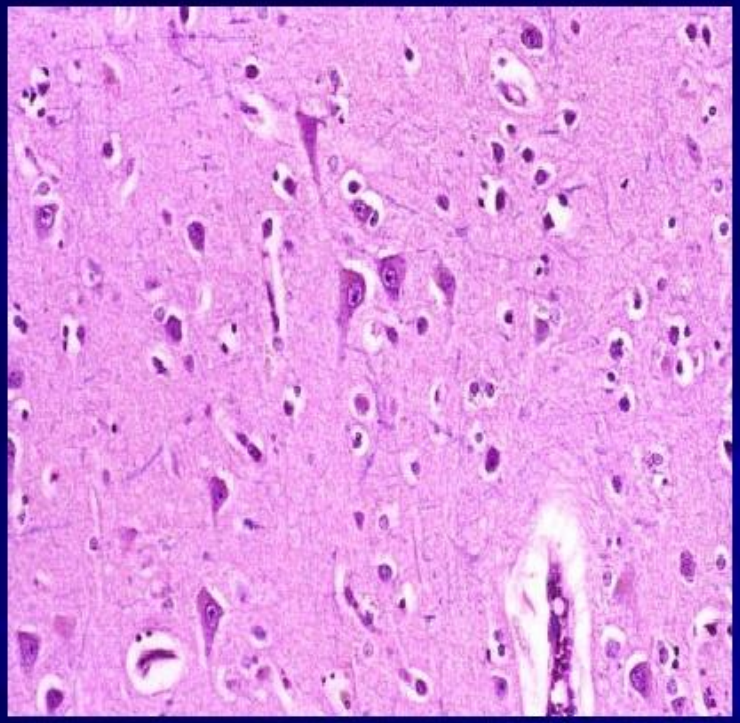
- **Enzymatic digestion of surrounding tissues.**



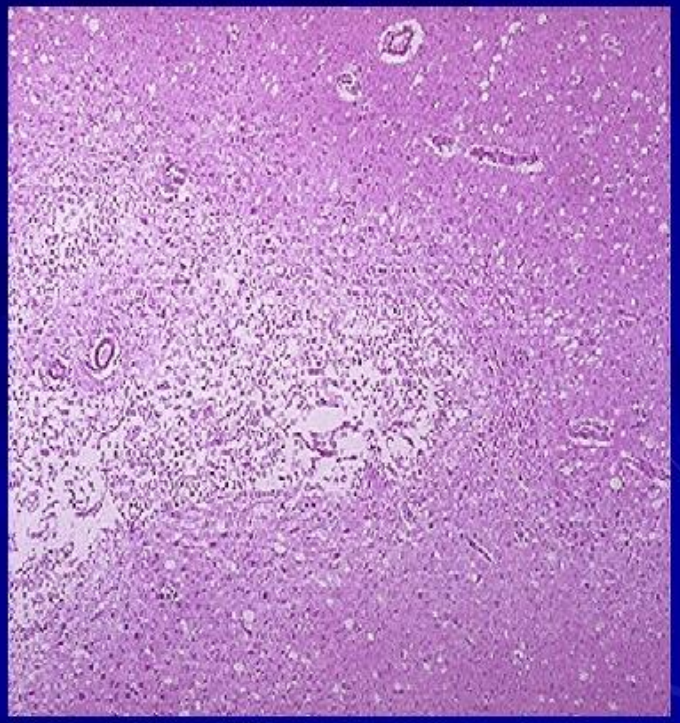
LIQUEFACTIVE NECROSIS BRAIN



NORMAL BRAIN



LIQUEFACTIVE NECROSIS



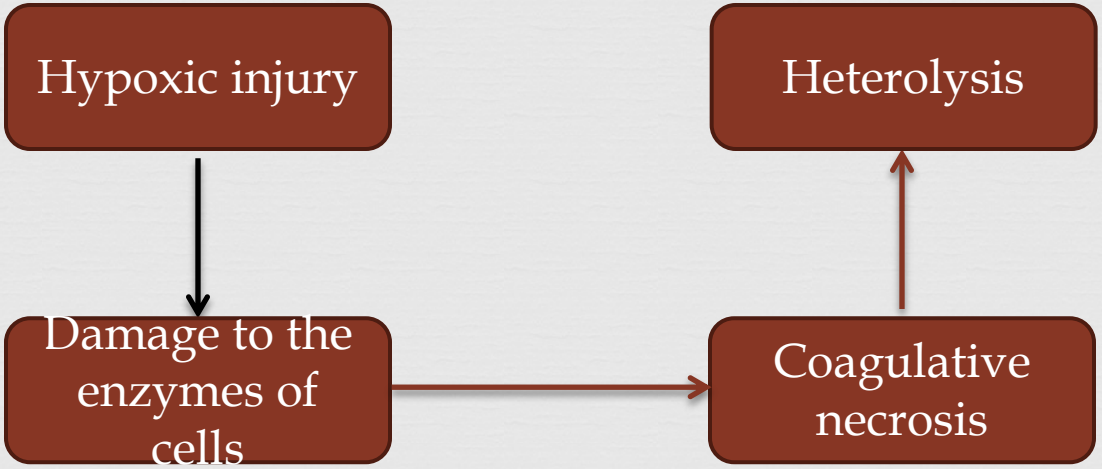
COAGULATIVE NECROSIS

- **Gross appearence:** Characterized by the maintenance of normal architecture of necrotic tissue for several days after cell death.

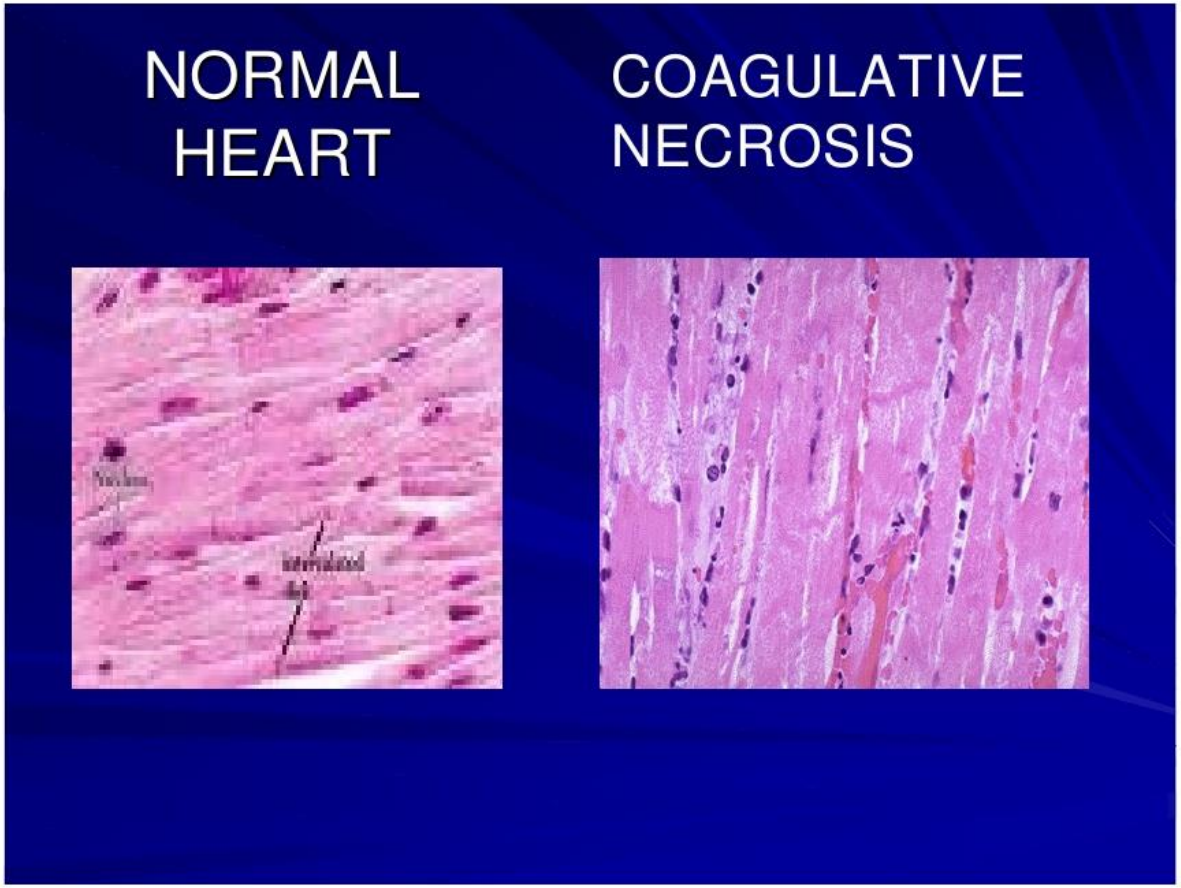
- **Microscopic:** Preserved cell outlines without nuclei.

- Associated with **ischemia or hypoxia** in every organ in the body except the brain.

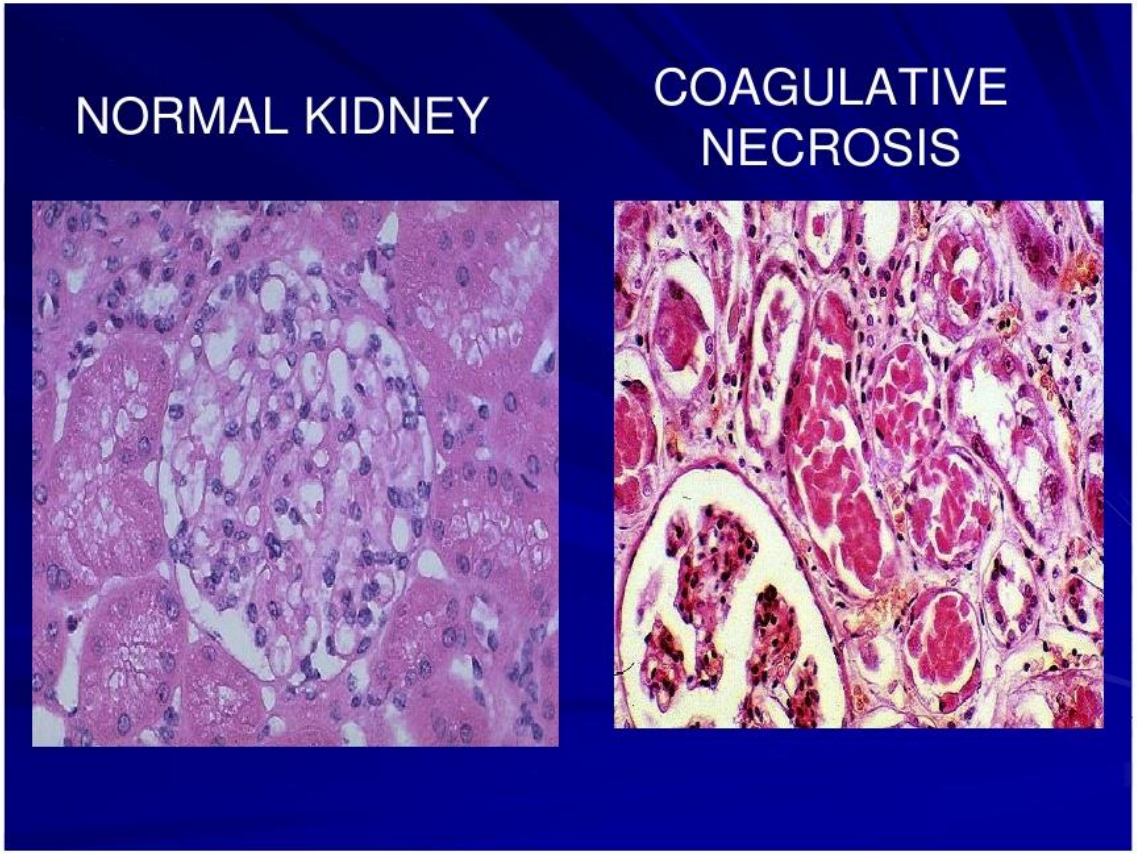
COAGULATIVE NECROSIS



COAGULATIVE NECROSIS



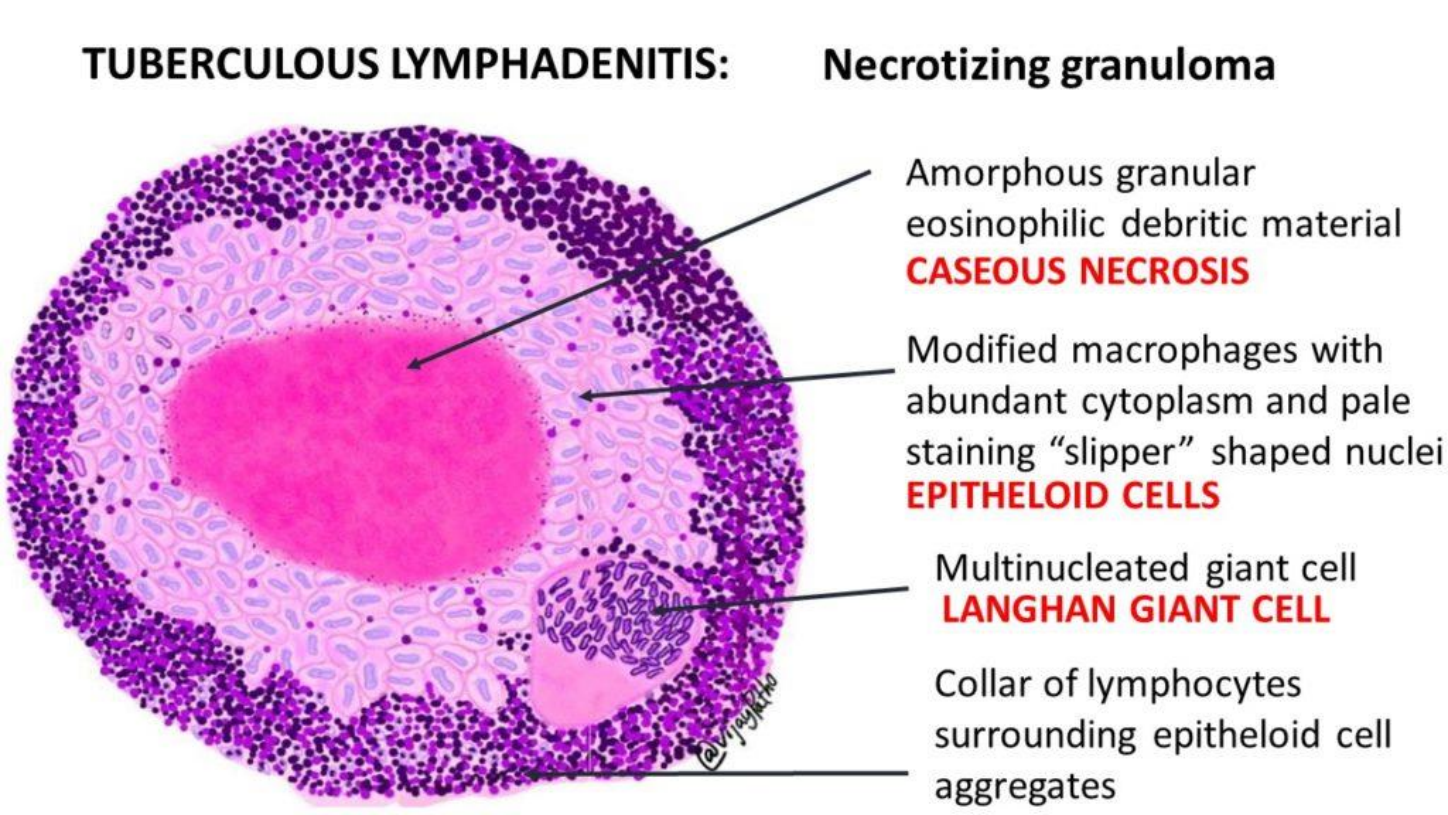
COAGULATIVE NECROSIS



CASEOUS NECROSIS

- A unique type of cell death seen with **tuberculosis** or **fungal infection.**
- **Gross Appearance:** White, soft, cheesy-looking (caseating) material
- **Microscopic:** A uniformly eosinophilic center (necrosis) surrounded by a collar of lymphocytes and activated macrophages (giant cells, epithelioid cells). The entire structure formed in response to tuberculosis is known as a **granuloma**.

CASEOUS NECROSIS



CASEOUS NECROSIS

Tuberculosis

↓

Organism is partially resistant to digestion and phagocytosis by tissue macrophages

↓

This leads to activation of the macrophages to form **giant cells** and **epithelioid cells**

↓

This sets off several steps which lead to **recruitment of more macrophages and inflammatory cells**

↓

Production of **cytokines** and slow **degradation of the mycobacteria.**

↓

Mycolic acid and other lipid constituent of the mycobacteria cell wall confers a characteristic "**cheese-like**" appearance on the tubercle of tuberculosis hence the descriptive term,"**caseous.**"

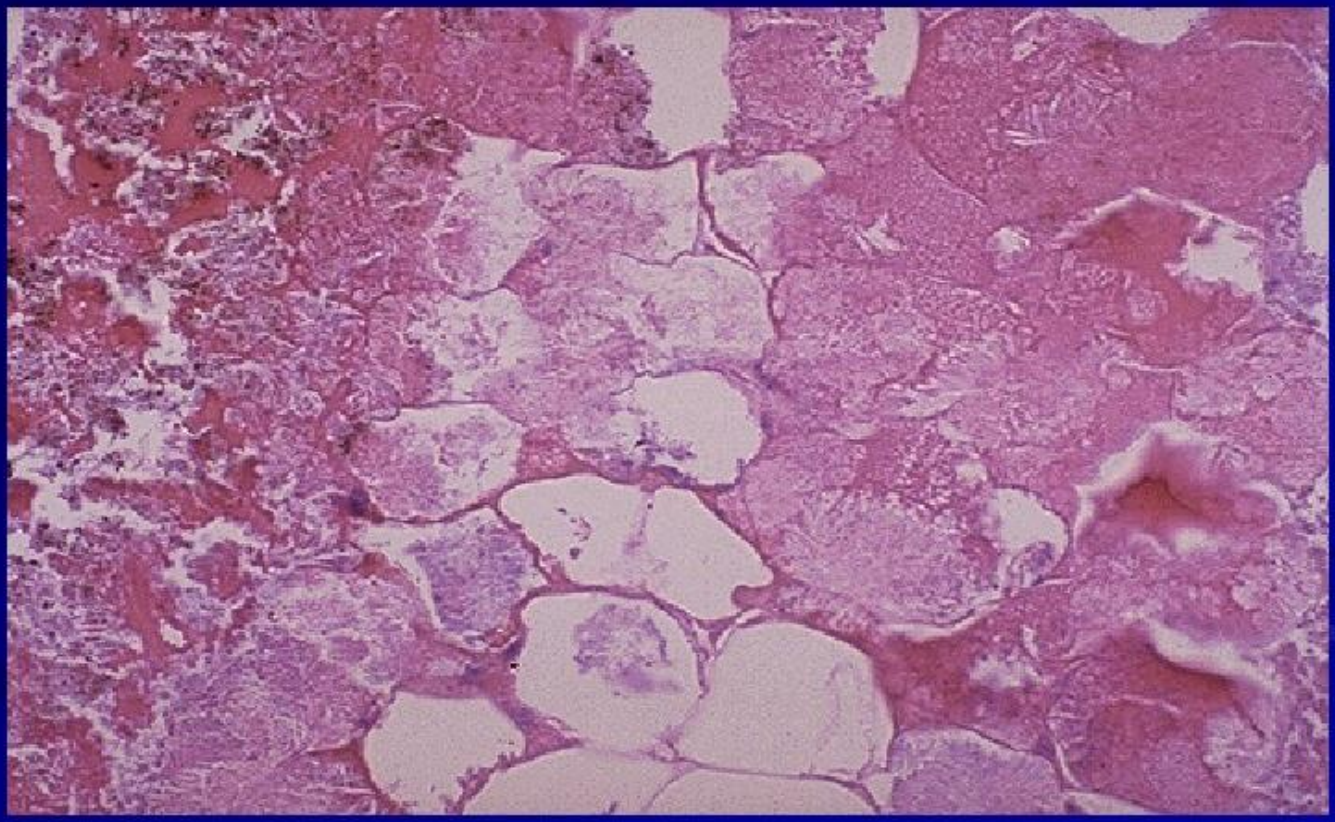
FAT NECROSIS

- Fat necrosis occurs in **acute inflammation** affecting tissues with numerous **adipocytes** such as **pancreas and breast tissue**.
- Damaged cells release digestive enzymes which **break down lipids** to generate **free fatty acids.**
- **Gross Appearance:** Whitish deposits as a result of the formation of **calcium soaps**.
- **Microscopic: Anucleated adipocytes** with deposits of calcium

FAT NECROSIS

- The release of lipases and amylases from the pancreatic cells is the major trigger for fat necrosis in the pancreas.
- **Pancreatitis**.
- Acute pancreatitis → alcohol, gall bladder stones, poisoning, and insect bites.
- Since fat necrosis in the pancreas is triggered by an inadvertent release of enzymes, this process is also referred to as **enzymatic fat necrosis**.
- Breast tissues can also give rise to fat necrosis. The trigger for this is usually **trauma**.

FAT NECROSIS

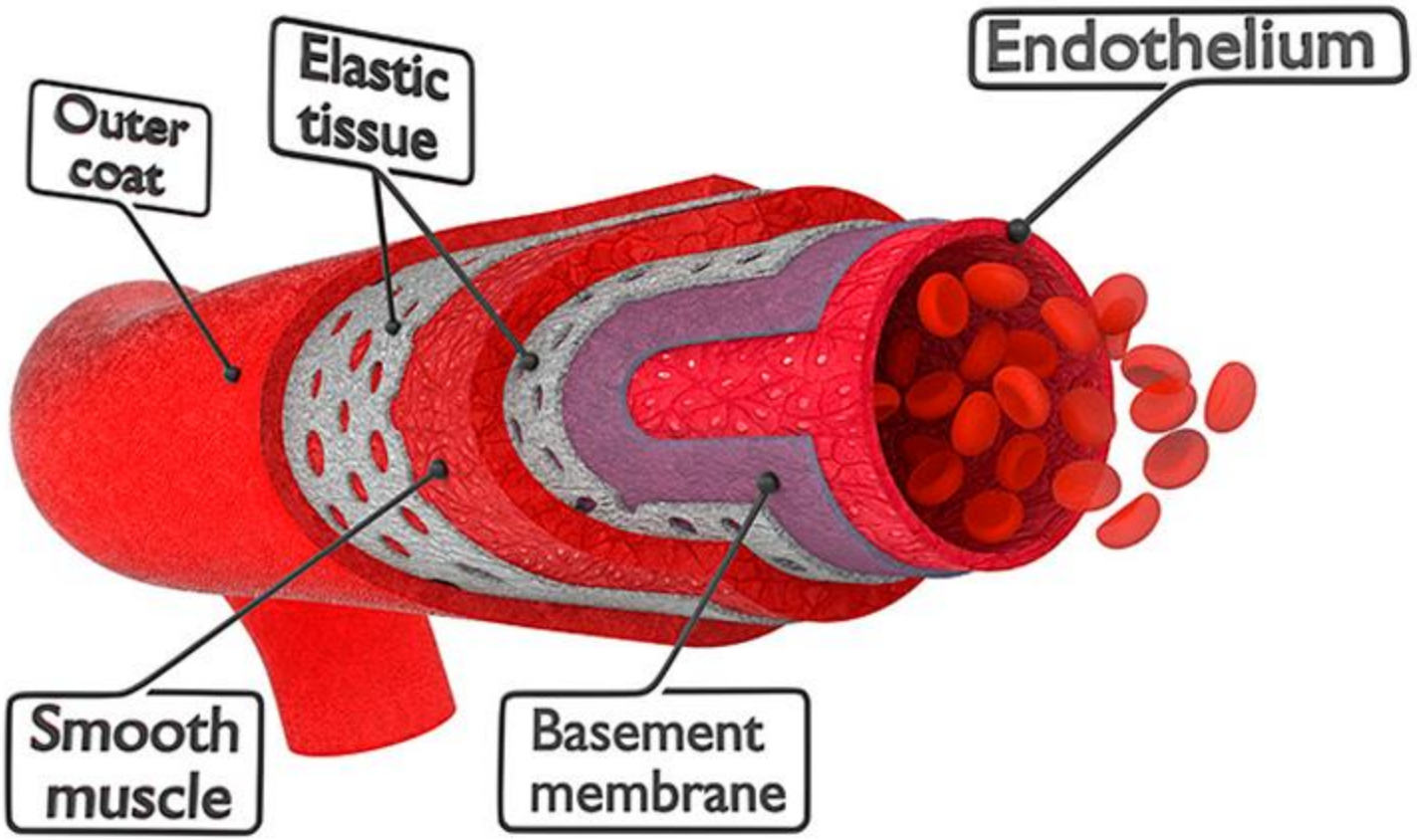


FIBRINOID NECROSIS

- Fibrinoid necrosis is a pattern of cell death characterized by **endothelial damage** and **exudation of plasma proteins** (especially fibrin).

- **Vascular damage**
- **Autoimmunity**, I**mmune-complex deposition**,
- **Infections**
- **Malignant Hypertension: BP→ 180/120**

Let's talk about CARDIOVASCULAR HEALTH

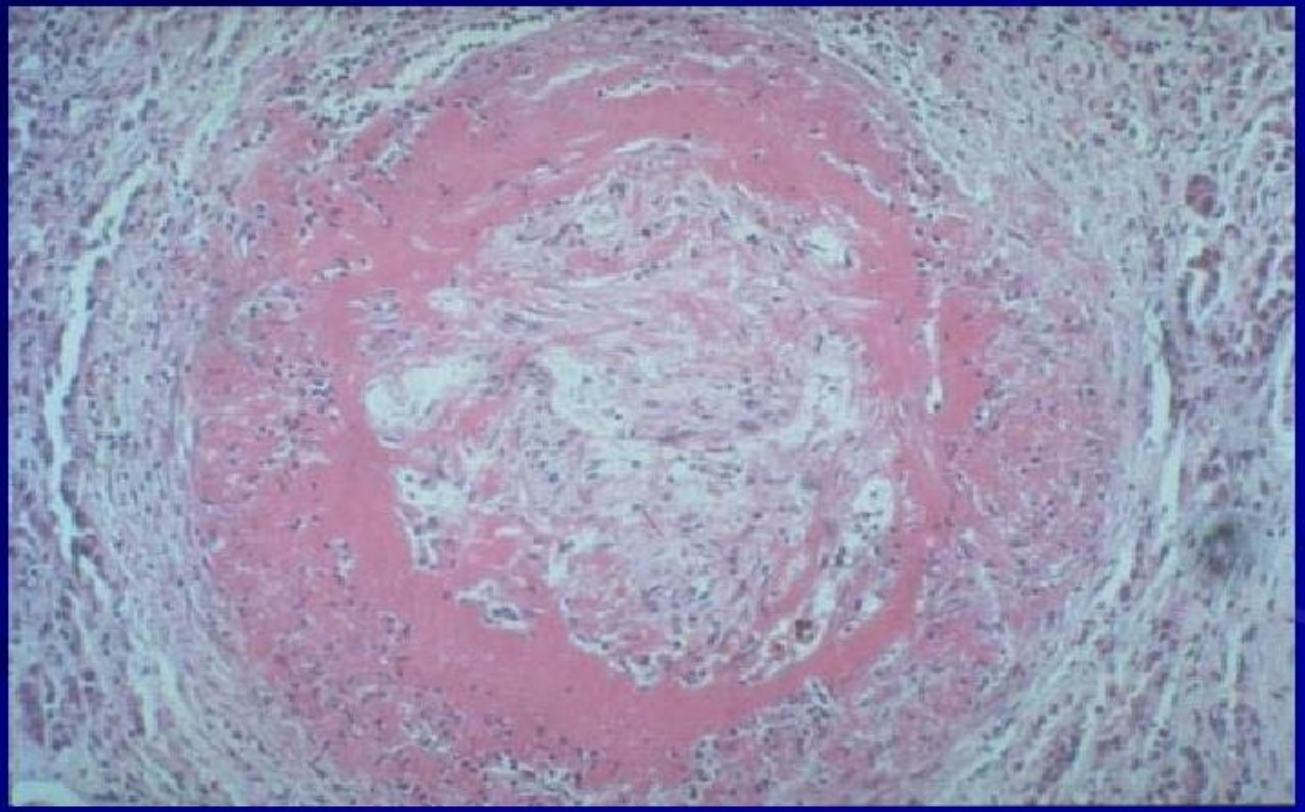


FIBRINOID NECROSIS

- **Gross Appearance:** Usually not grossly discernible.

- **Microscopic: Deposition of fibrin** within blood vessels.
- Fibrinoid necrosis is usually visible only microscopically.

FIBRINOID NECROSIS



GANGRENOUS NECROSIS

- Ischemic necrosis of the lower limbs.(sometimes upper limbs or digits).
- Gross Appearance: Black skin with varying degree of putrefaction.
- Microscopic: Combination of coagulative necrosis, due to ischemia (dry gangrene); and liquefactive necrosis (wet gangrene) if a bacterial infection is superimposed.

CLINICAL EXAMPLES NECROSIS

Infections

Abscesses (brain, lungs, liver, skin)

Lung infections

Skin Infections

Wet Gangrene

Fournier's gangrene

Hypoxic Injury

Cerebrovascular accident (Stroke) (liquefactive necrosis)

Acute Tubular Necrosis (Kidneys) (coagulative necrosis)

Acute Myocardial infarction (coagulative necrosis)

DIAGNOSIS

- Physical examination, including monitoring vital signs
- Laboratory investigations such (complete blood count, blood culture, urine culture, urinalysis)
- Imaging studies such as x-Rays
- Venous Doppler Scan
- CT
- Blood electrolytes

TREATMENT & CARE

- **Management of Infectious Processes**
- **Antibiotics** are the mainstay of managing infectious processes.
- The choice of antibiotic would be guided by clinical findings and antibiotic susceptibility.
- **Surgical management** is also often indicated and includes:
  - Drainage of abscesses
  - Wound debridement
  - Amputation

TREATMENT & CARE

- **Management of Ischemic Processes/Stroke**
- **Myocardial infarction** -→ coagulative necrosis which requires urgent management.

  Early removal of the obstructive lesions in the coronary arteries is a very important step in the management of myocardial infarction.

  Medically or by an invasive procedure.

- **Stroke management**

TREATMENT & CARE

- **Management of Caseous Necrosis**

  Management for tuberculosis, including the use of combination antibiotics and close laboratory and clinical monitoring.

- **Management of Gangrenous Necrosis**

  Antibiotics and sometimes necessitates the removal of dead tissues (debridement). In severe, life-threatening cases, an amputation may be required.

- https://slideplayer.com/slide/8589647/
- https://www.slideshare.net/drtbalu/necrosis-presentation
- https://www.slideshare.net/kavyabhola/gangrene-114421661