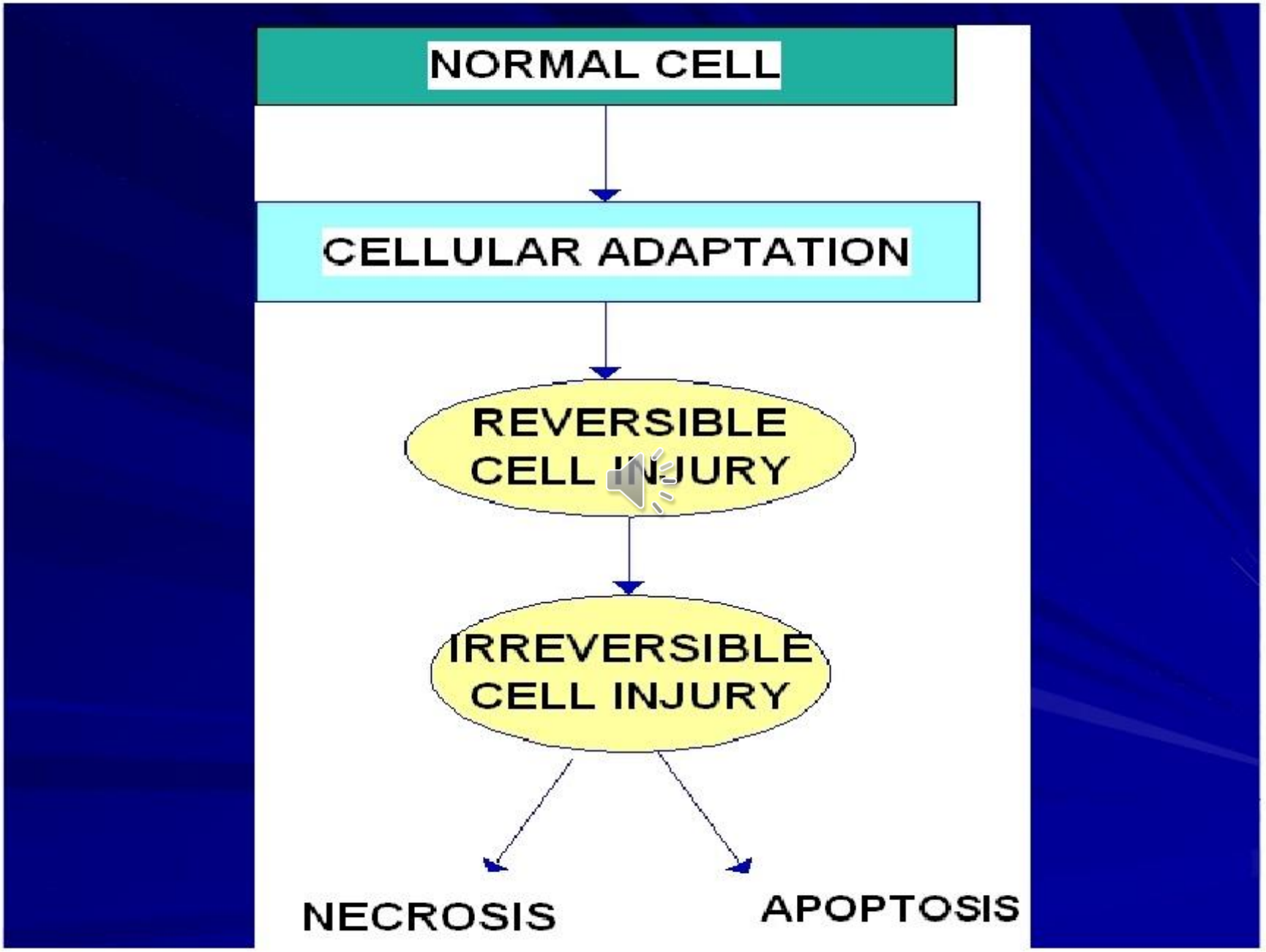
NECROSIS & APOPTOSIS

DR Saima Nadeem


NORMAL CELL
CELLULAR ADAPTATION
REVERSIBLE CELL INJURY
IRREVERSIBLE CELL INJURY
NECROSIS
APOPTOSIS

DEFINITION OF NECROSIS

Spectrum of morphologic changes that follows cell death in living tissues.

CAUSES OF NECROSIS

- ISCHEMIA
- PHYSICAL AGENTS
- CHEMICAL AGENTS
- IMMUNOLOGICAL INJURY

PATHOGENESIS OF NECROSIS

1. Denaturation of intracellular proteins.
2. Enzymatic digestion of the cell.

MORPHOLOGY

CYTOPLASMIC CHANGES

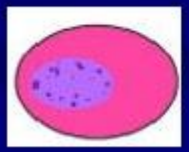
- Increased eosinophilia of cytoplasm
- Glassy homogeneous appearance
- Cytoplasm is vacuolated,moth eaten
- Calcification of dead cells.
- Appearance of myelin figures
- Generation of calcium soaps

NUCLEAR CHANGES

1. KARYOLYSIS

Fading of basophilia of chromatin

Due to DNAase activity.

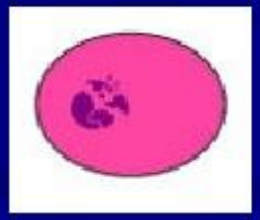


2. PYKNOSIS

Nuclear shrinkage and increased basophilia

3.KARYORRHEXIS

Fragmentation of pyknotic nucleus



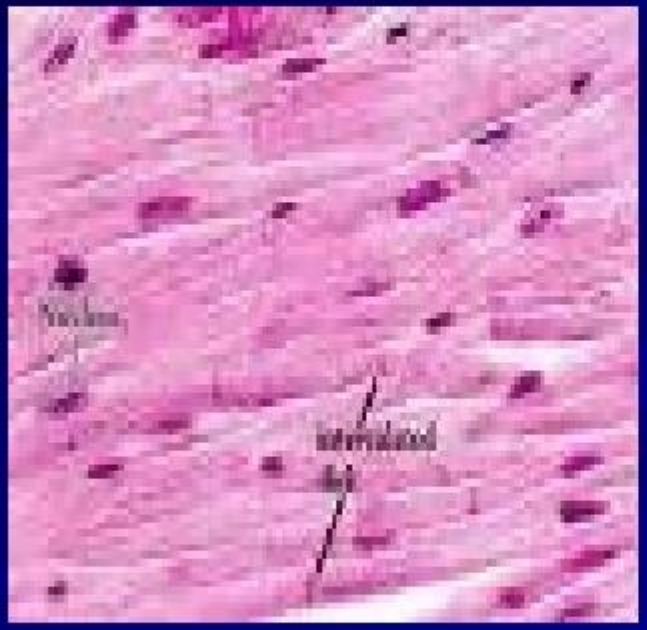
TYPES OF NECROSIS

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

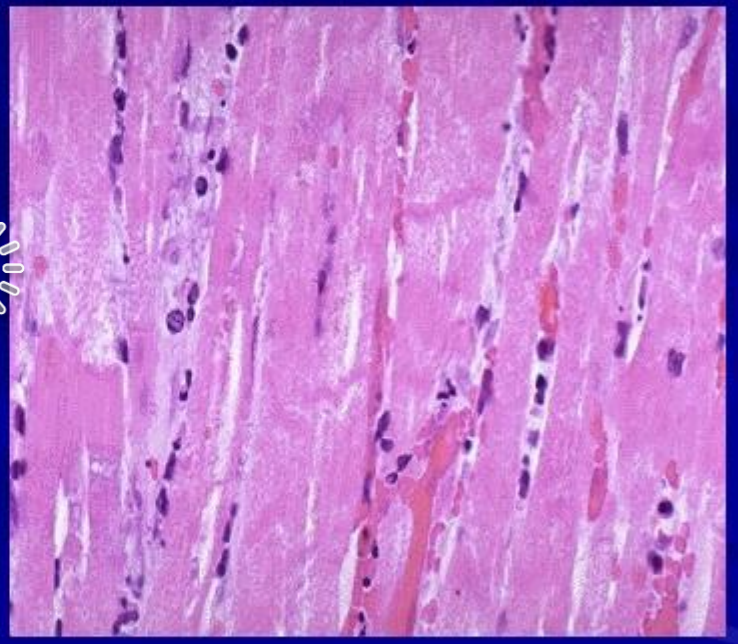
COAGULATIVE NECROSIS

- Preservation of general tissue architecture-tombstone appearance of the cells.
- Affected tissue is firm
- Denaturation of structural proteins and enzymatic digestion of cells.
- Example – Heart, kidney,spleen.

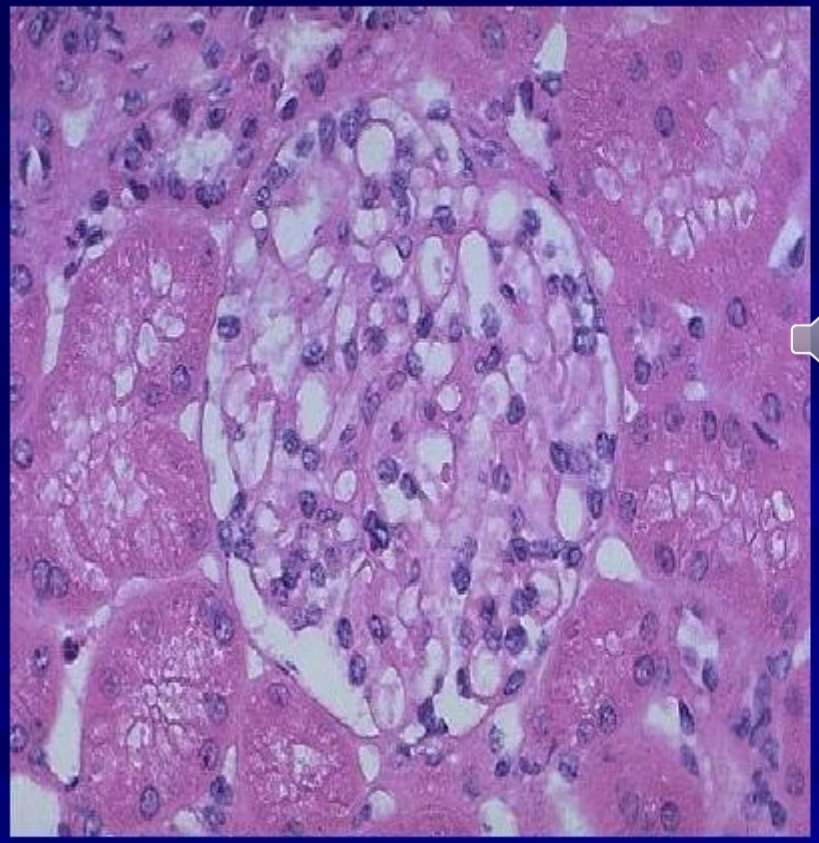
NORMAL HEART



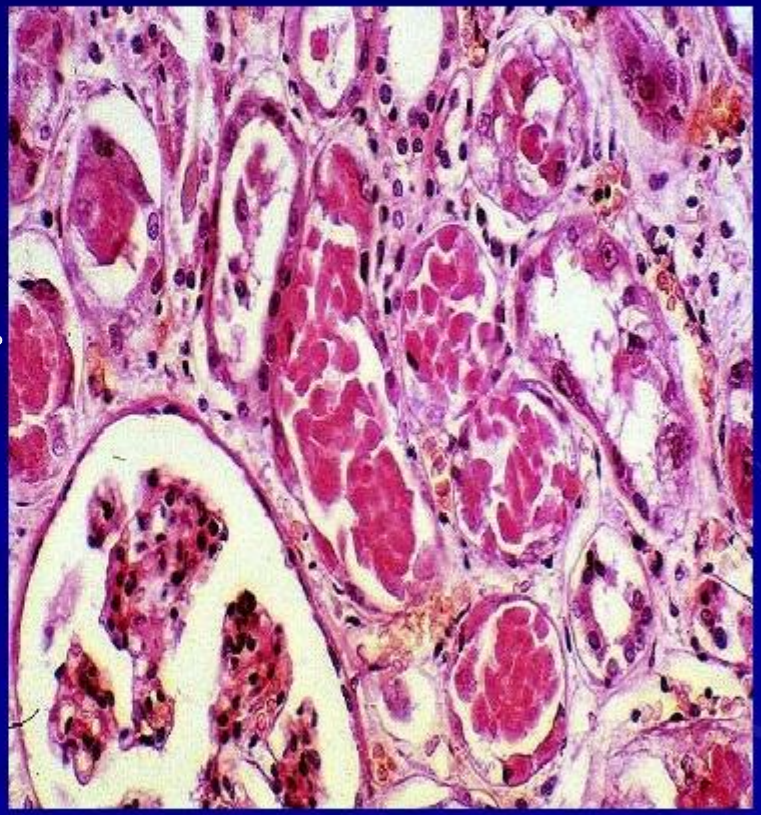
COAGULATIVE NECROSIS



NORMAL KIDNEY



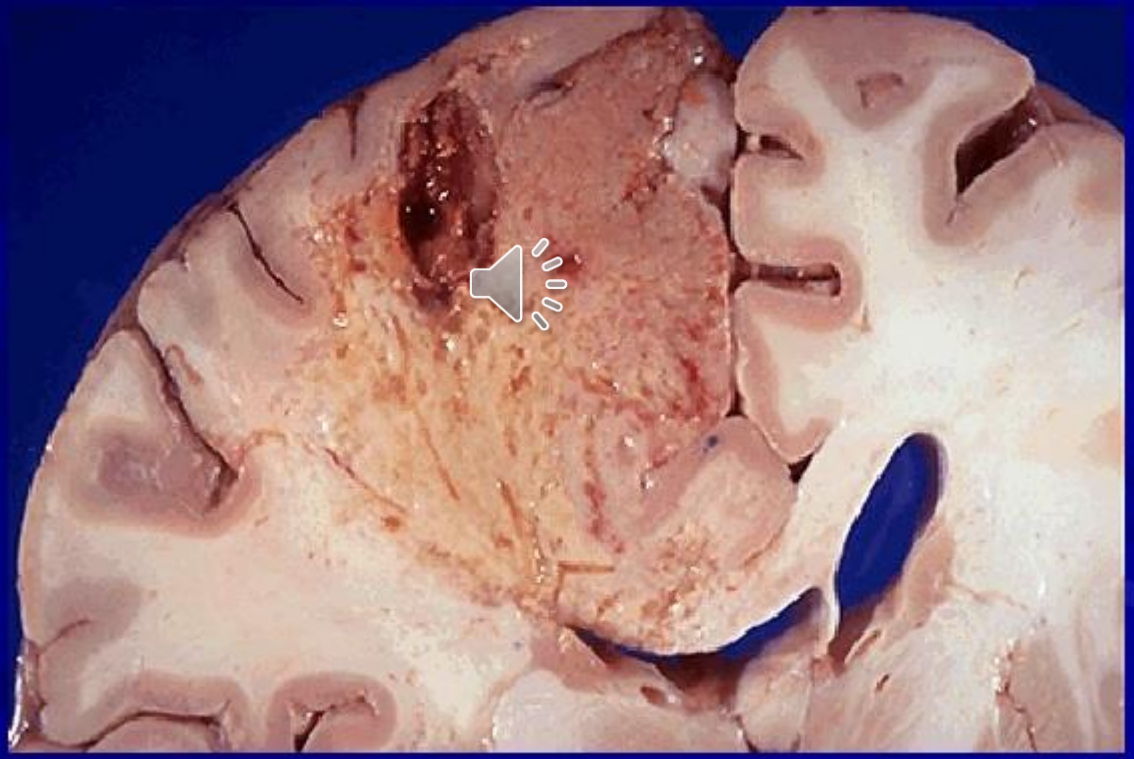
COAGULATIVE NECROSIS



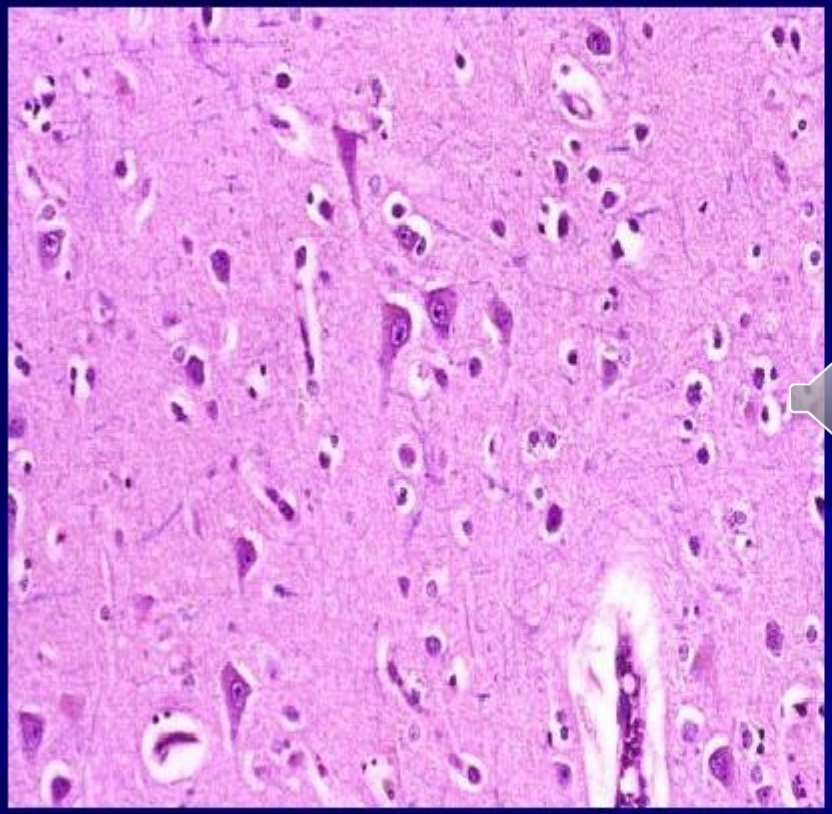
LIQUIFACTIVE NECROSIS

- The tissue becomes liquid viscous mass
- Material is creamy yellow in color
- Seen in brain, abscess.

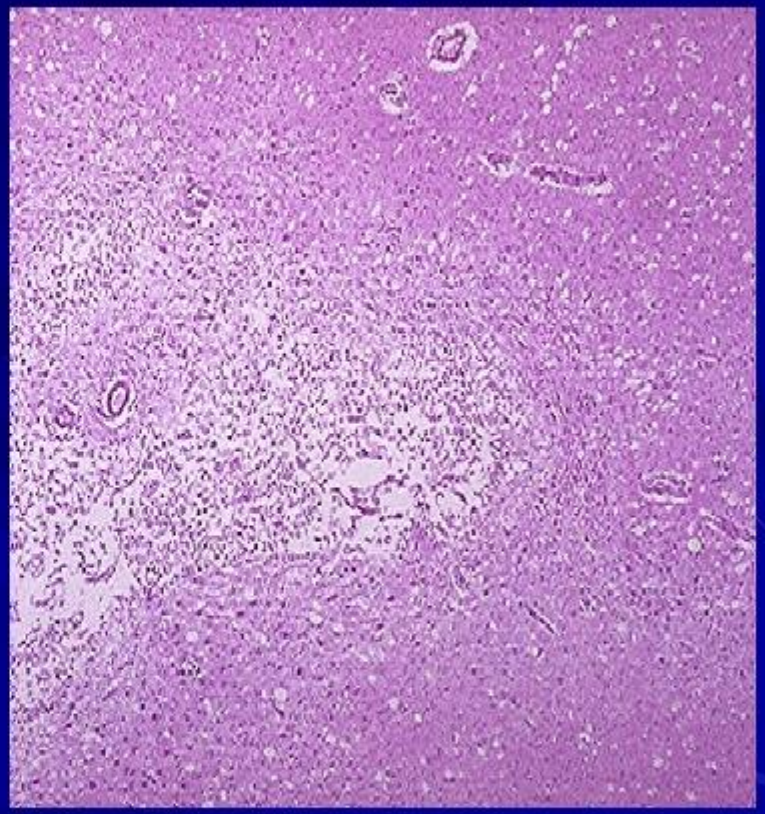
LIQUEFACTIVE NECROSIS BRAIN



NORMAL BRAIN



LIQUEFACTIVE NECROSIS



GANGRENOUS NECROSIS

- Gangrene is the necrosis of tissue with superadded putrefaction (enzymatic decomposition).

- It is the clinical condition in which extensive tissue necrosis is complicated to a variable degree by secondary bacterial infection.

- Gangree= Necrosis + infection + putrefaction

GANGRENOUS NECROSIS

- Wet gangrene
- Dry gangrene 
- Gas gangrene

Wet (moist) Gangrene

- It is a type of gangrene in which tissue appears moist.
- It results from severe bacterial infection superimposed on necrosis

Pathogenesis

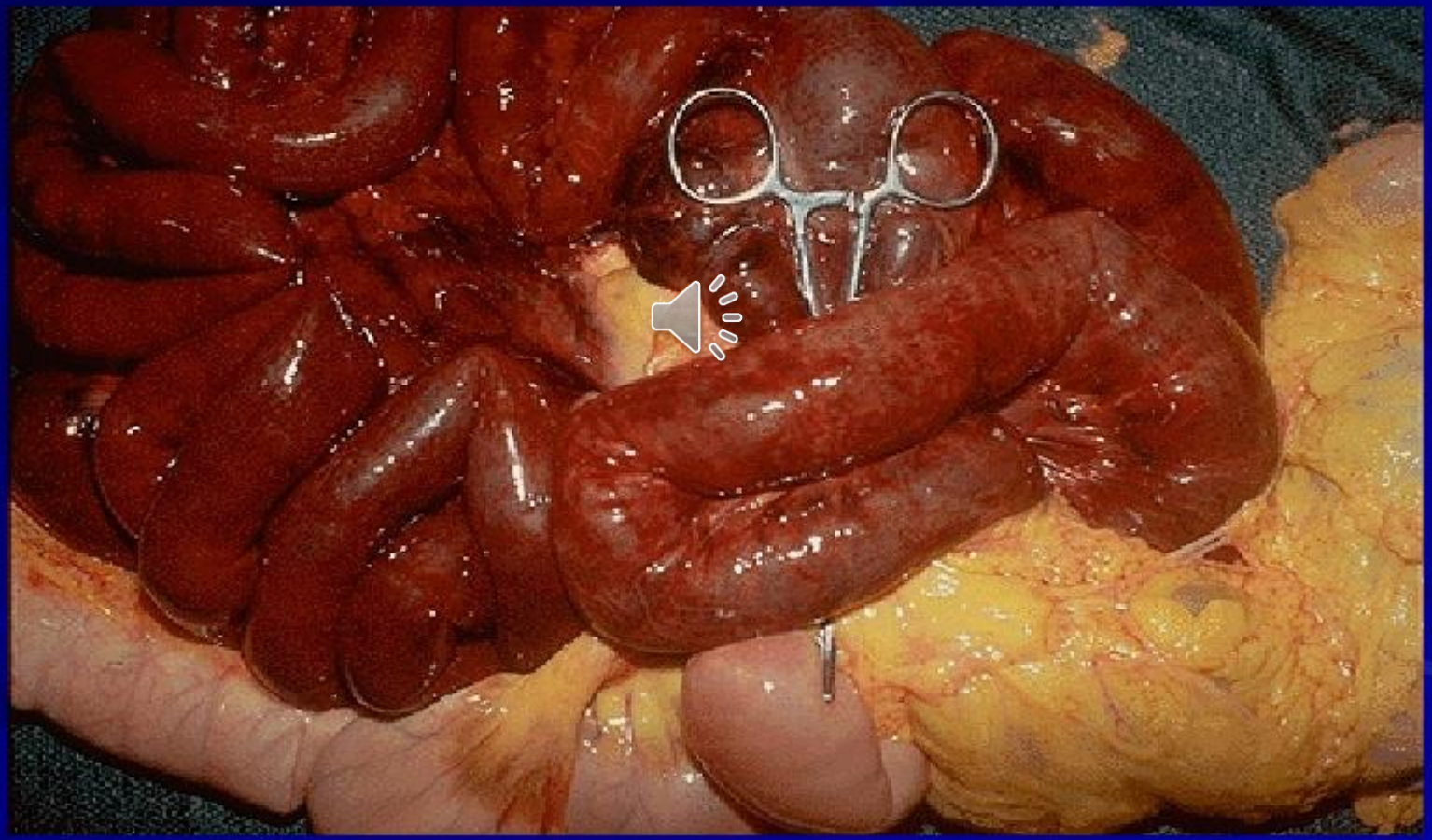
- It is a true gangrene because it shows the severe infection and putrefaction of tissue with edema and foul smell.
- Arterial obstruction present.
- blackening of the tissue is due to formation of iron sulphide

It is not clearly demarcated from adjacent healthy tissues.

Common sites

- ✓ Intestine
- ✓ Appendix
- ✓ Limbs

WET GANGRENE INTESTINE



Dry gangrene

It is usually secondary to slow occlusive vascular disease

Etiology

Gradual loss of arterial supply to an organ or tissue as happens in

- Arteriosclerosis
- Atherosclerosis
- Trauma
- Ergot poisoning

Common sites

- limbs; especially foot

DRY GANGRENE

WET GANGRENE

- Bowel
- Venous obstruction
- Moist,swollen,dark
- No clear line of demarcation
- Bacteria present
- Prognosis poor

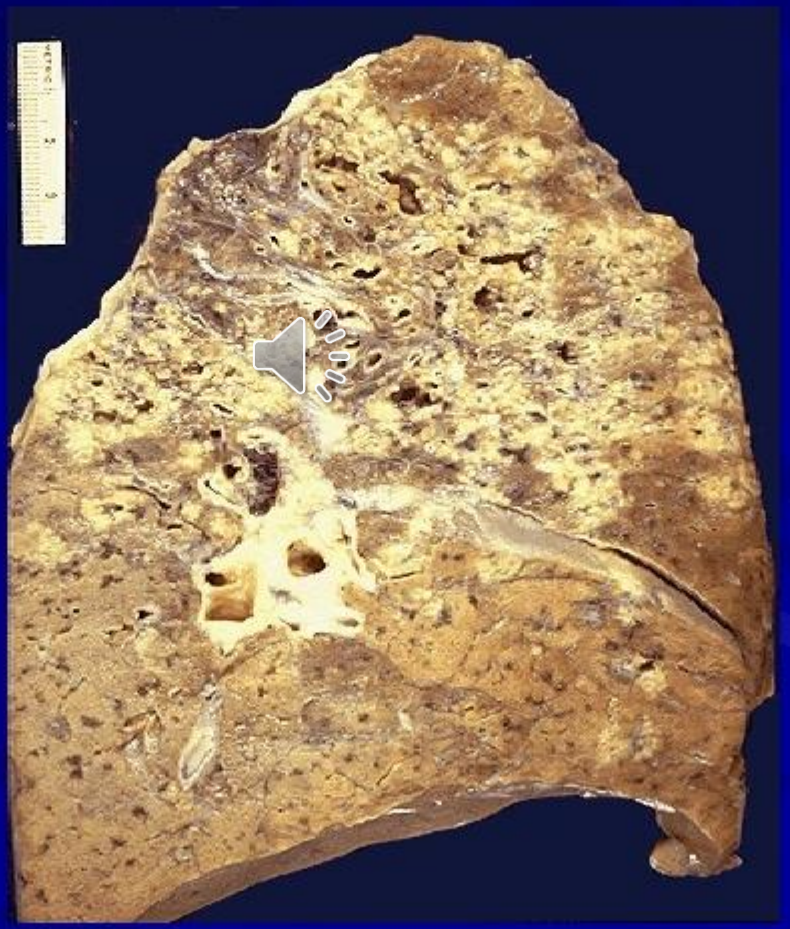
DRY GANGRENE

- Limb
- Arterial obstruction
- Dry, shrunken, black
- Presence of line of demarcation
- No bacteria
- Prognosis better

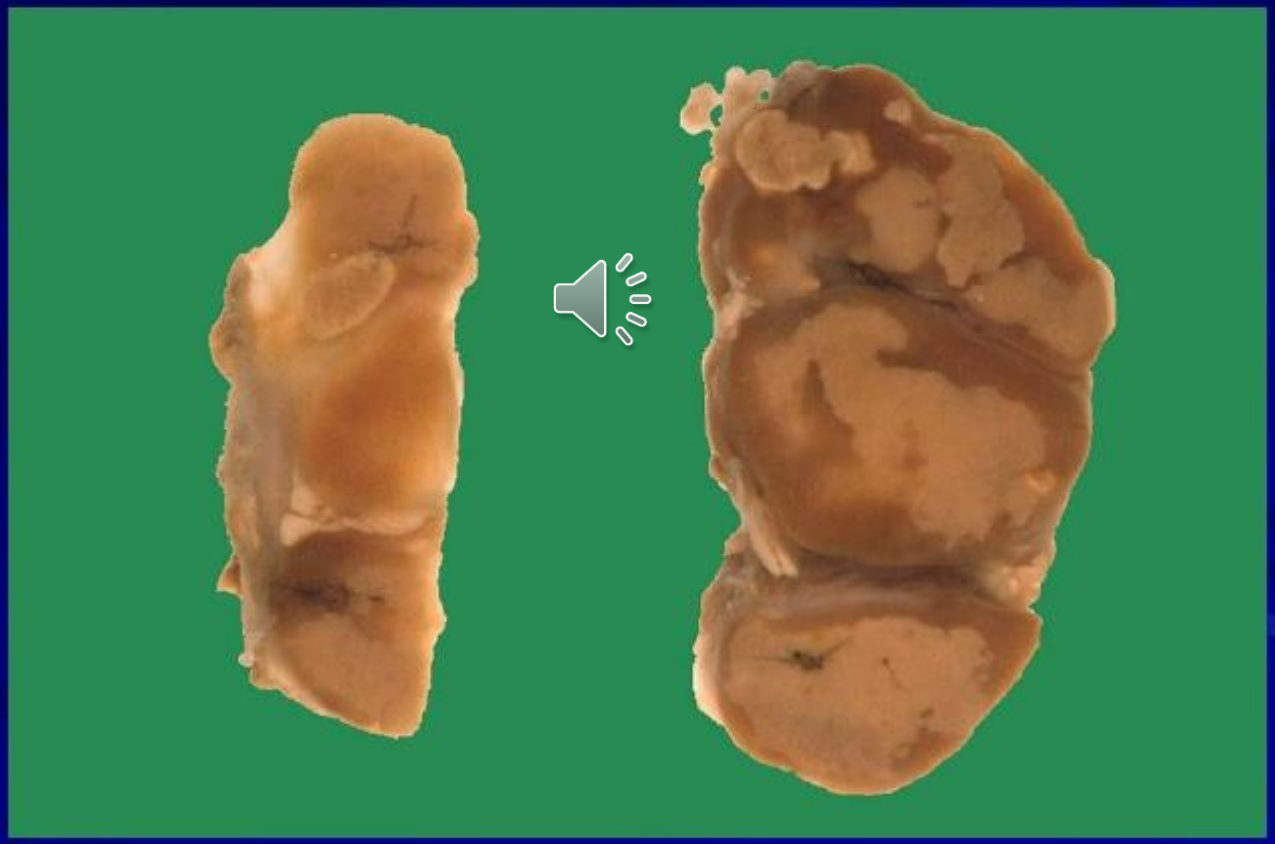
CASEOUS NECROSIS

- Type of coagulative necrosis
- Seen in tuberculous infections
- Tissue is cheesy white in appearance
- The tissue architecture is preserved

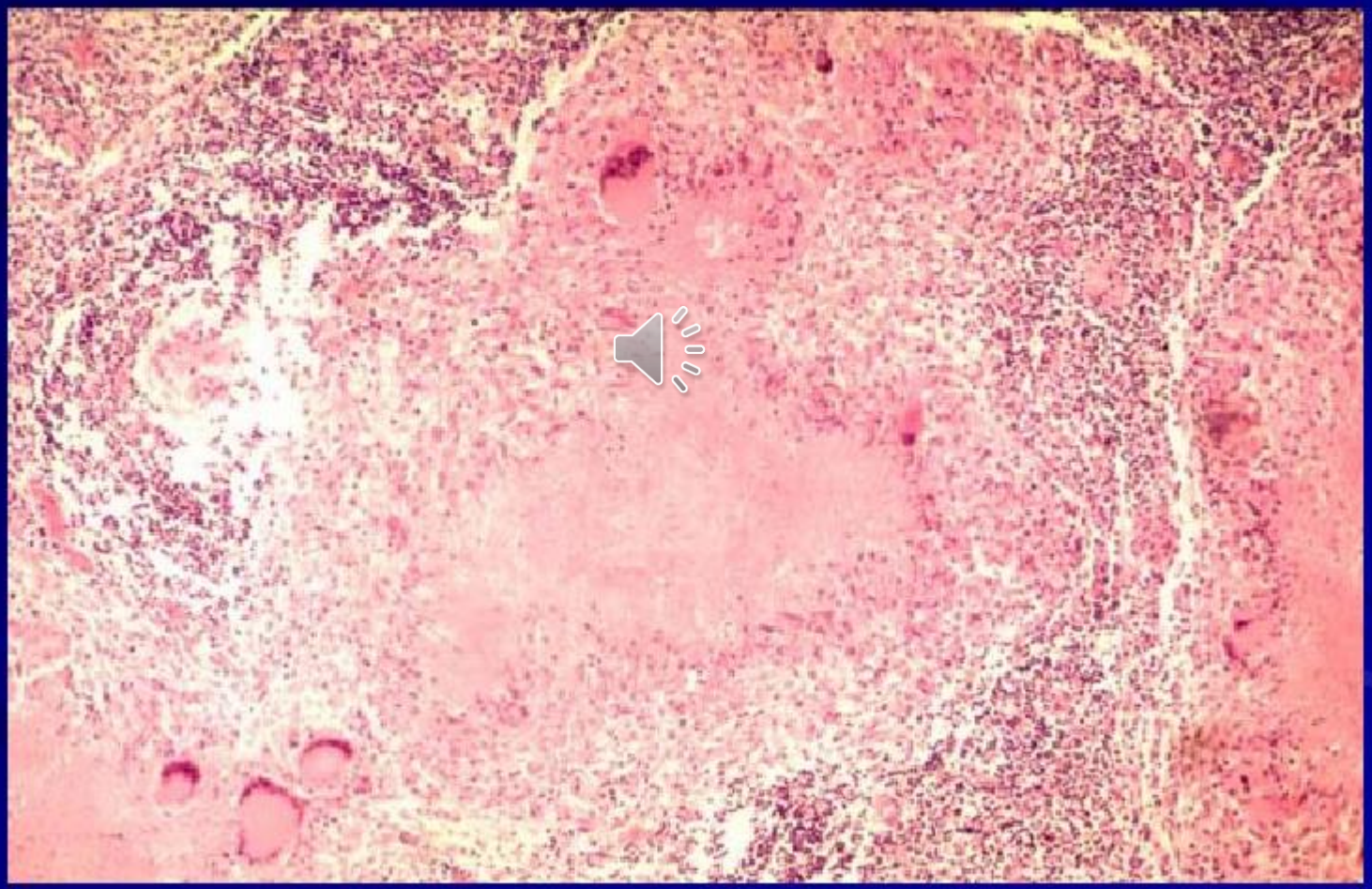
CASEOUS NECROSIS LUNG



CASEOUS NECROSIS LYMPHNODE



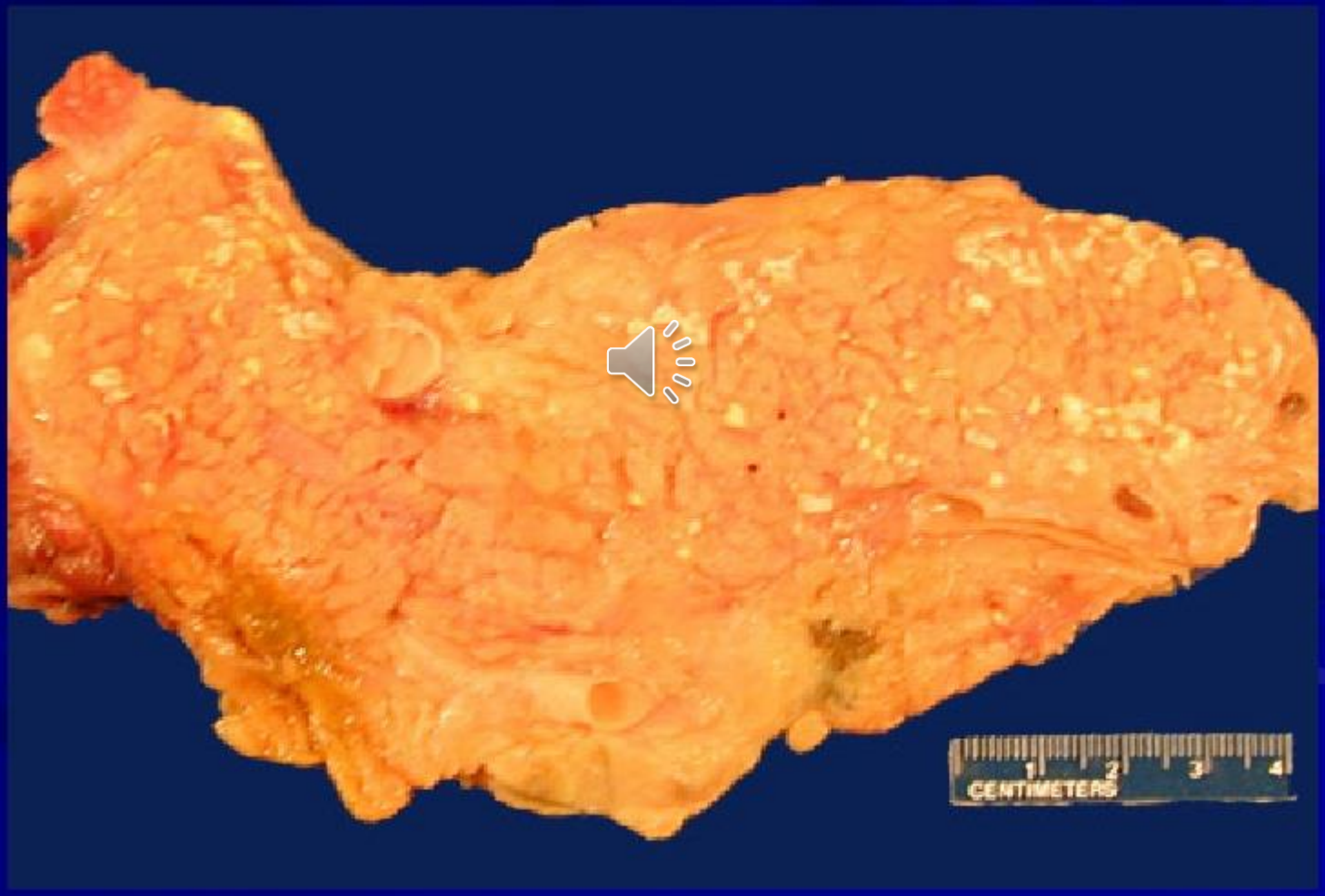
CASEATION NECROSIS LYMPH NODE



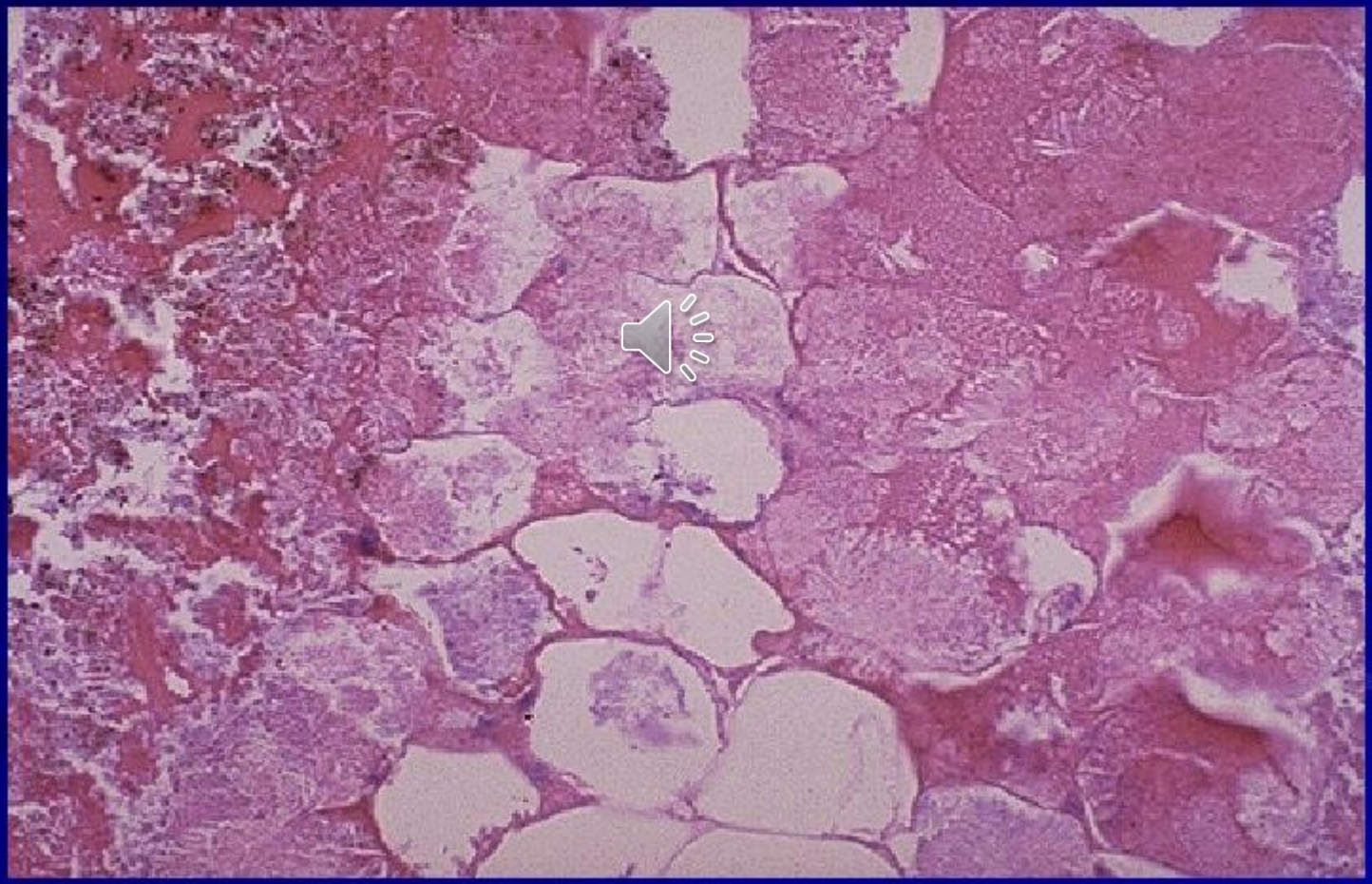
FAT NECROSIS

- Seen in pancreas, breast
- In acute pancreatitis ,activated lipase causes fat necrosis.
- Grossly visible chalky white areas.
- Presence of shadowy outlines of necrotic cells.

FAT NECROSIS



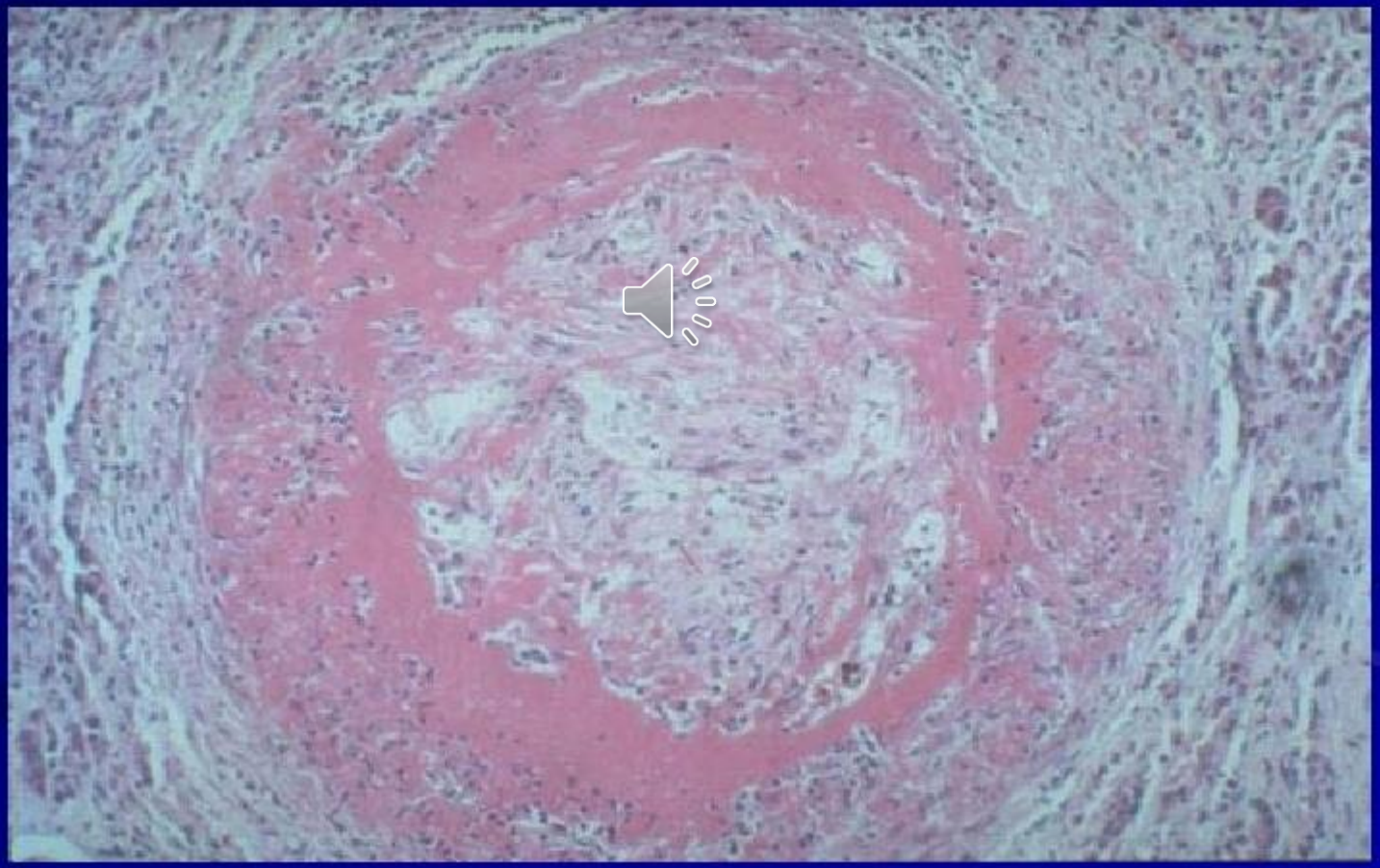
FAT NECROSIS

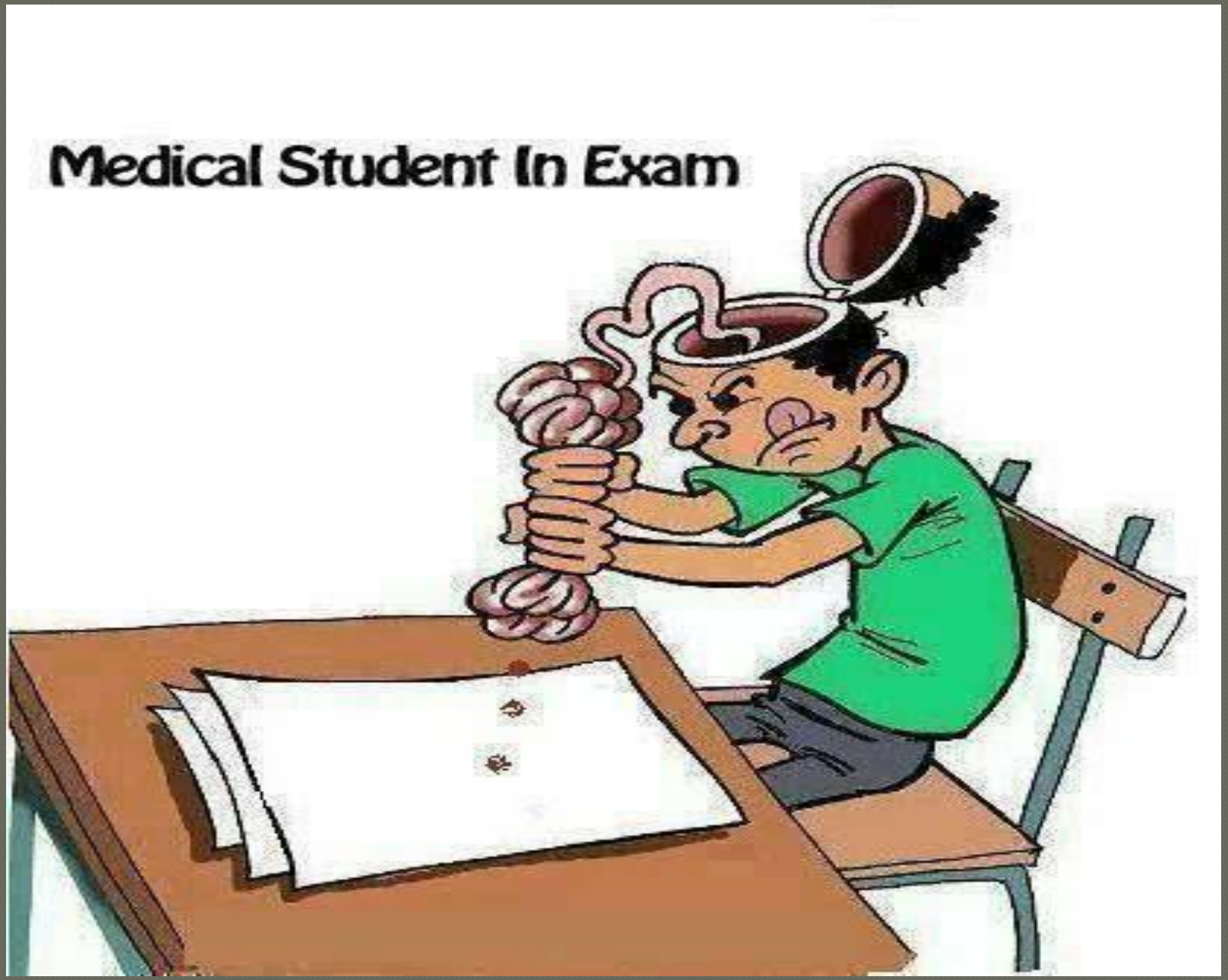


FIBRINOID NECROSIS

- Deposition of fibrin like material
- Seen in immunologic cell injury, hypertension ,peptic ulcer.

FIBRINOID NECROSIS




Medical Student In Exam

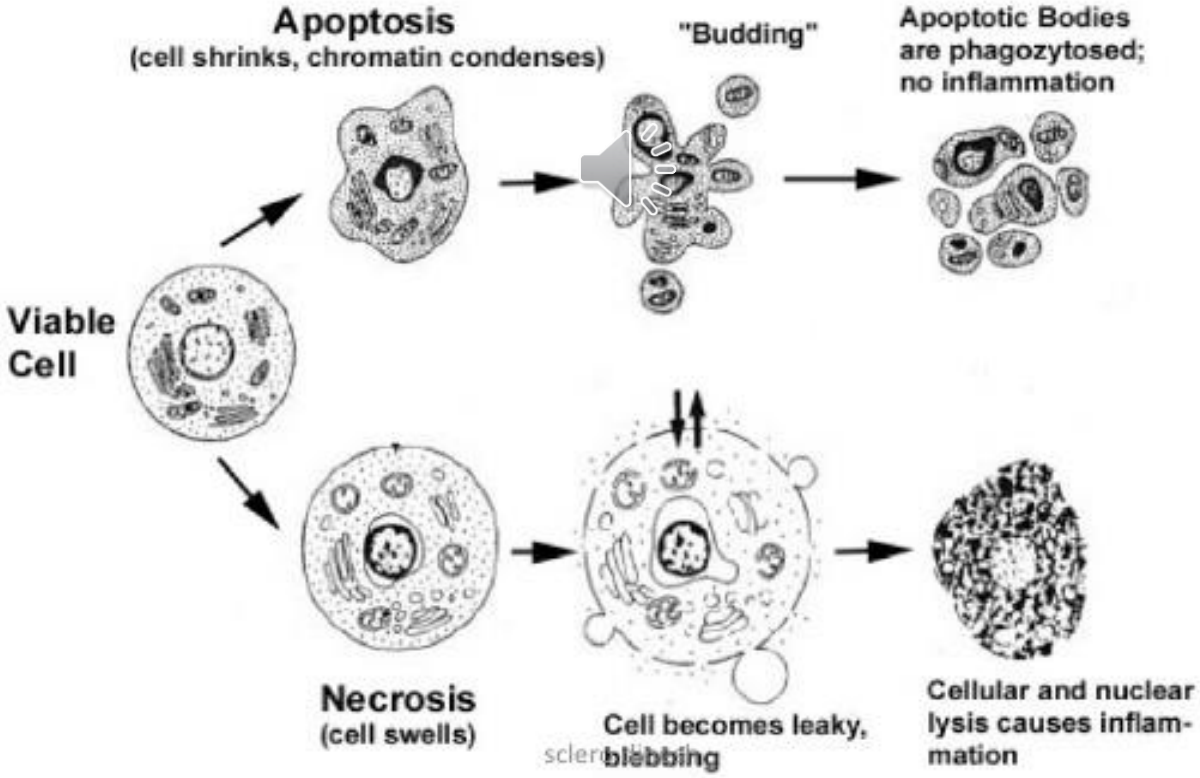
Apoptosis - Definition

- A pathway of cell death induced by a tightly regulated suicidal program, in which the cells destined to die activate enzymes that degrade cells own nuclear DNA and nuclear, cytoplasmic proteins.

Cell death mechanisms

Death by suicide

Death by injury



Apoptosis in physiologic situations

- Programmed destruction during embryogenesis
- Involution of hormone dependent tissues
- Cell loss in proliferating cell populations
- Elimination of harmful self- reactive lymphocytes
- Death of host cells

Apoptosis in pathological conditions

- DNA damage

- Accumulation of misfolded proteins

- Cell death in certain infections

- Pathological atrophy in parenchymal organs

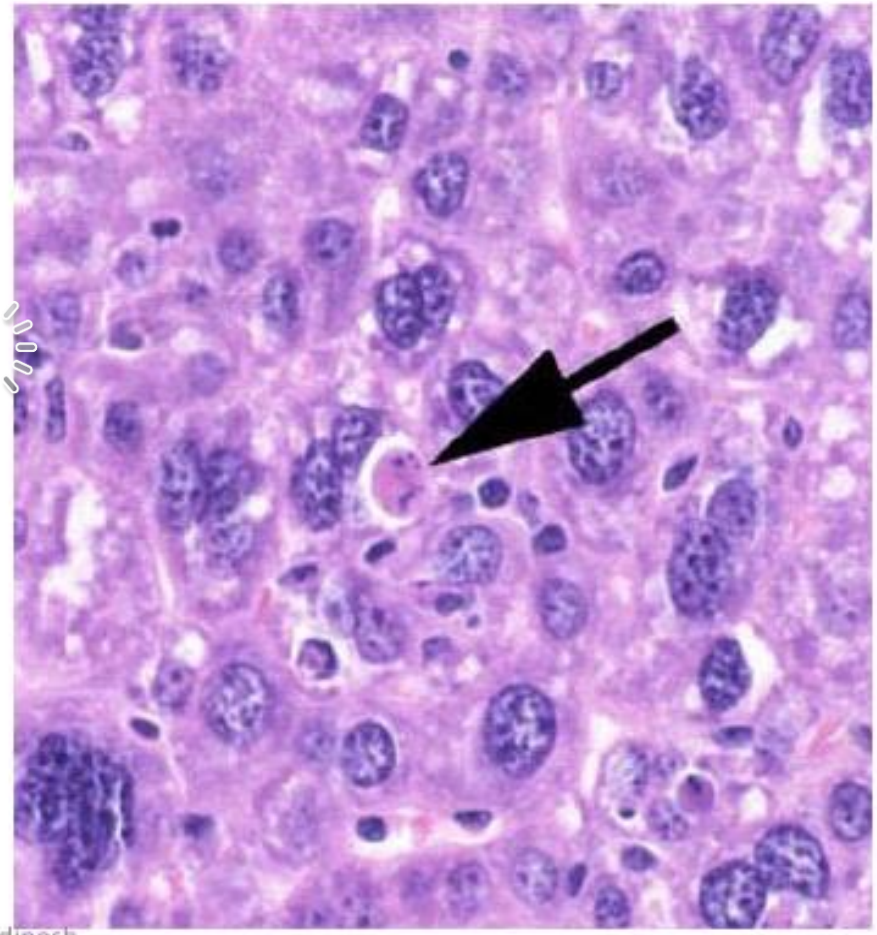
Classic changes

- ✓ Cell shrinkage
- ✓ Nuclear fragmentation
- ✓ Chromatin condensation
- ✓ Chromosomal DNA fragmentation
- ✓ Formation of cytoplasmic blebs& apoptotic bodies
- ✓ Phagocytosis

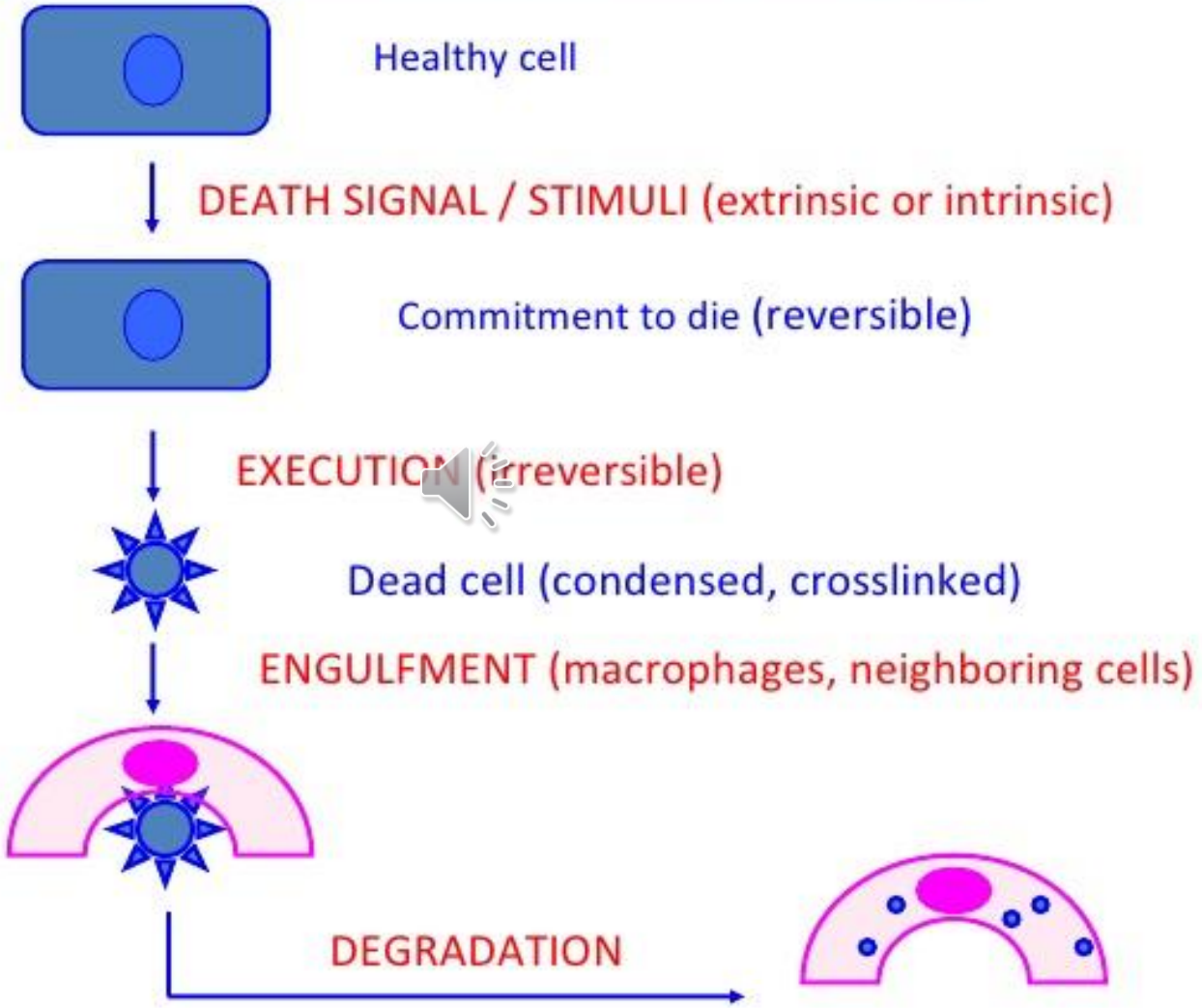
Histology

Apoptotic bodies

- Round oval mass of intensely eosinophillic cytoplasm
- Fragments of dense nuclear chromatin



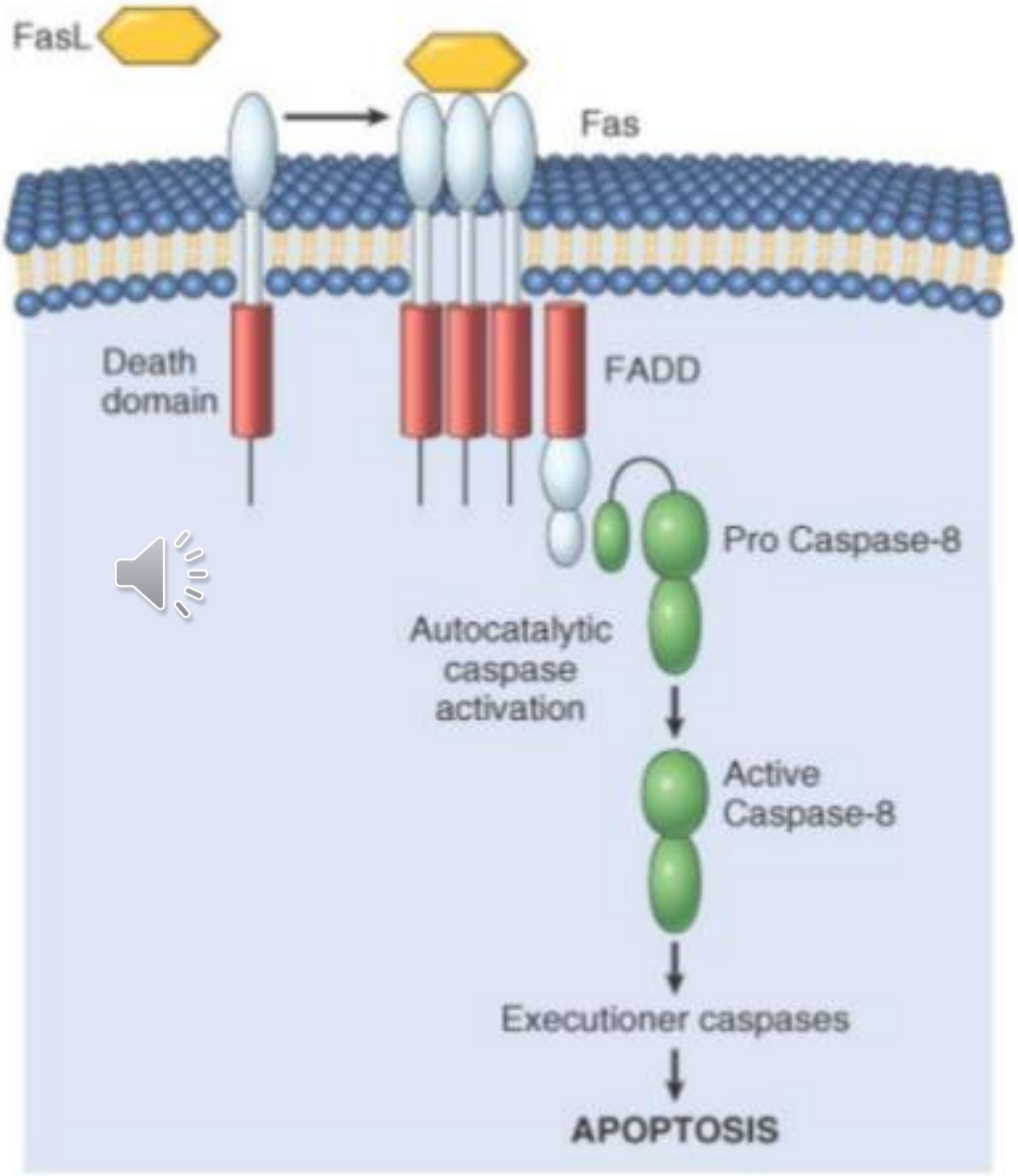
STAGES OF CLASSIC APOPTOSIS



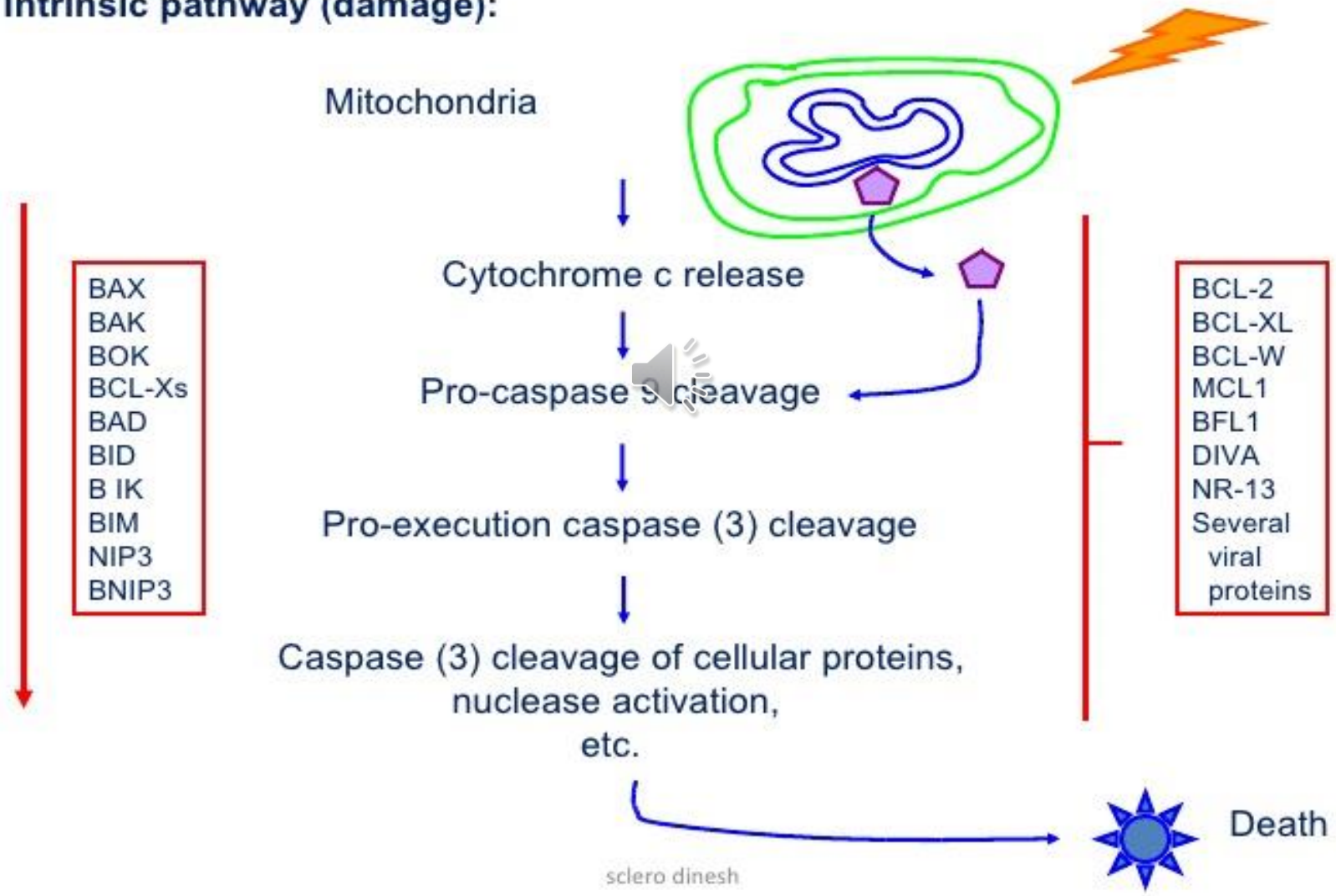
sclero dinesh

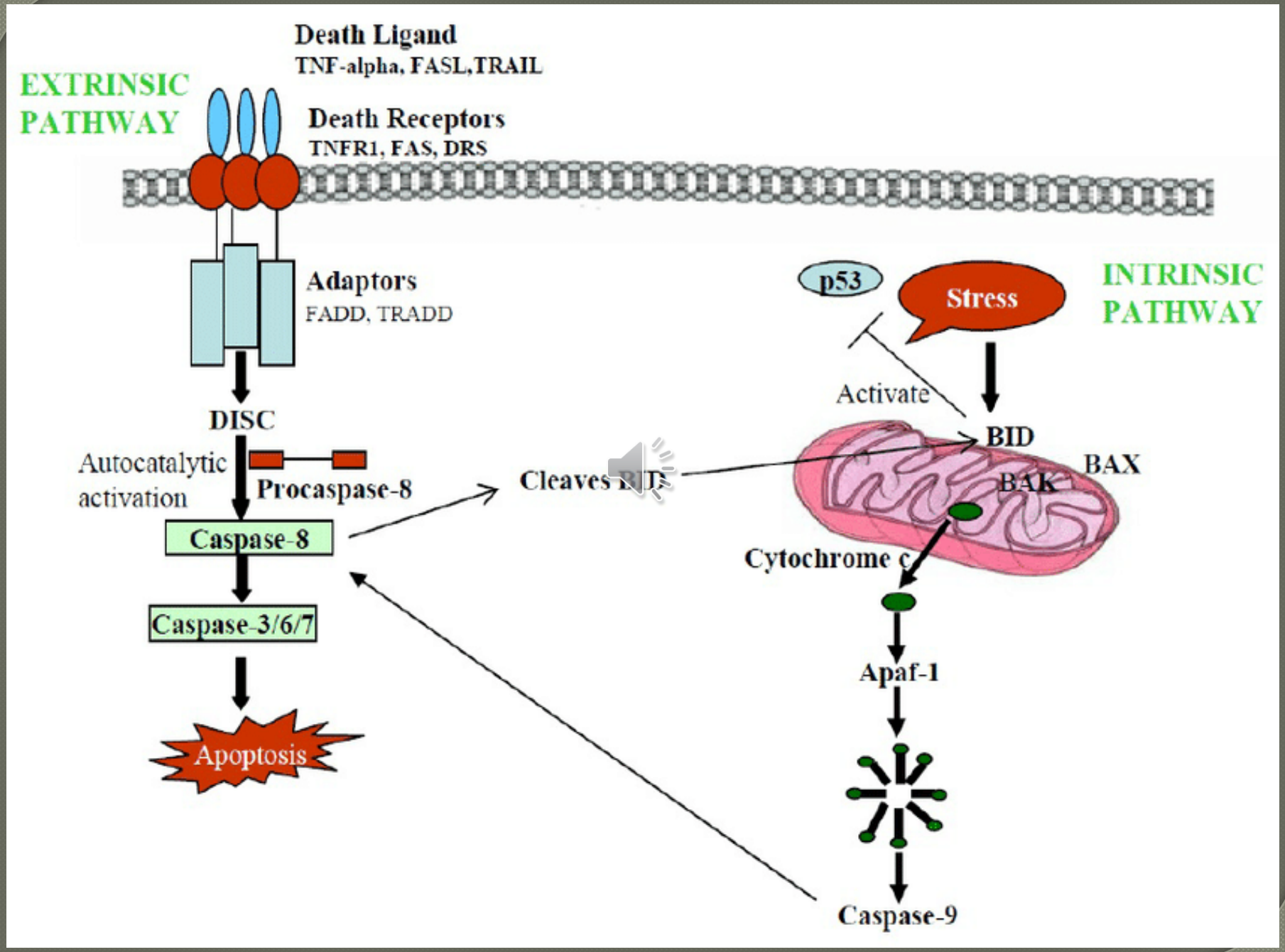
- Extrinsic pathway

The death receptor pathway



Intrinsic pathway (damage):




Death Ligand
TNF-alpha, FASL,TRAIL
EXTRINSIC PATHWAY
Death Receptors
TNFR1, FAS, DRS
Adaptors
FADD, TRADD
DISC
Autocatalytic activation
Procaspase-8
Caspase-8
Caspase-3/6/7
Apoptosis
p53
Stress
INTRINSIC PATHWAY
Activate
BID
BAX
BAK
Cytochrome c
Apaf-1
Caspase-9

Apoptosis: Role in Disease

TOO MUCH: Tissue atrophy

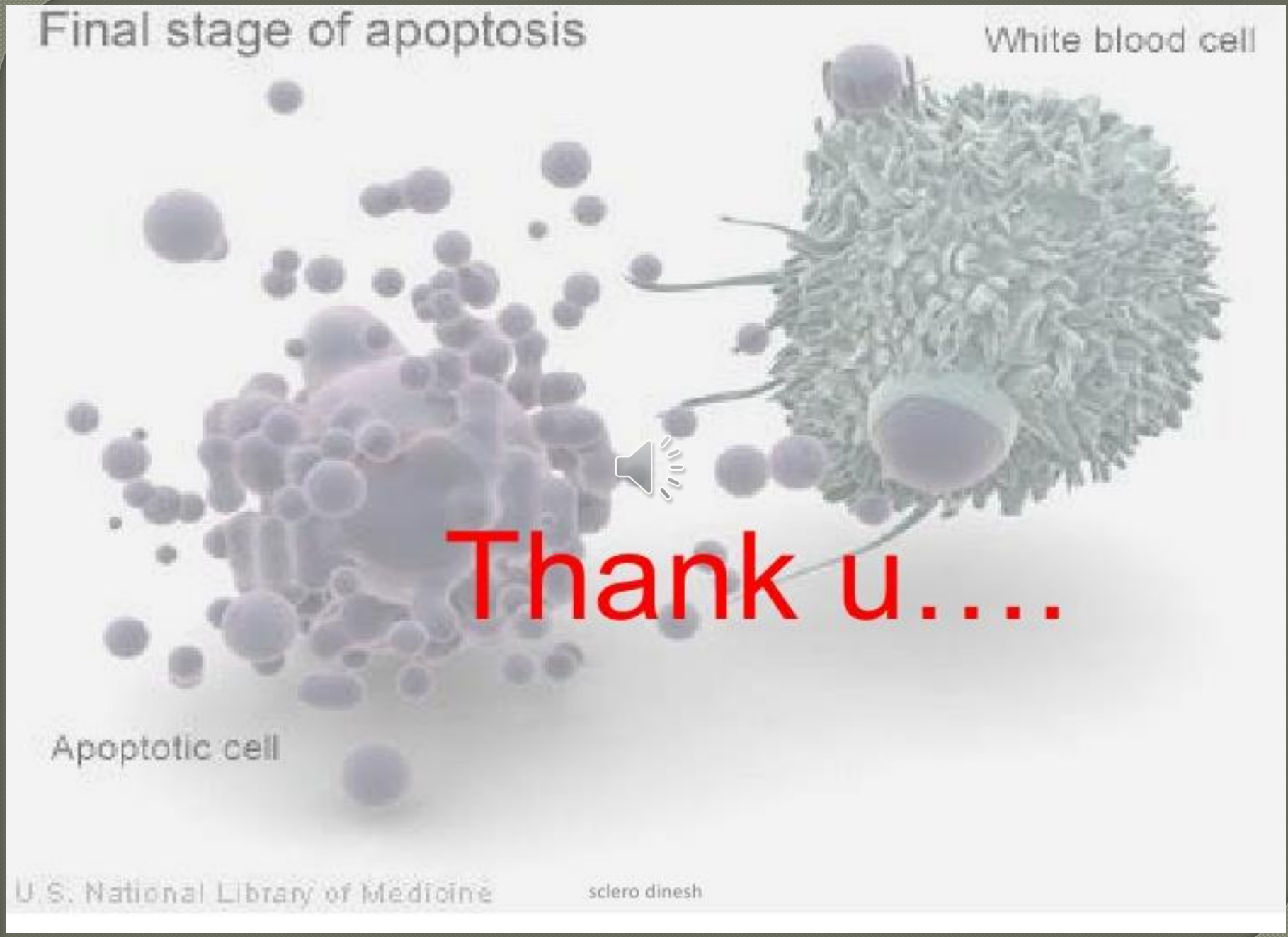
Neurodegeneration
Thin skin
etc

TOO LITTLE: Hyperplasia

Cancer
Athersclerosis
etc

	APOPTOSIS	NECROSIS
NATURAL	YES	NO
EFFECTS	BENEFICIAL	DETRIMENTAL
	Physiological or pathological	Always pathological
	Single cells	Sheets of cells
	Energy dependent	Energy independent
	Cell shrinkage	Cell swelling
	Membrane integrity maintained	Membrane integrity lost

APOPTOSIS	NECROSIS
Role for mitochondria and cytochrome C	No role for mitochondria
No leak of lysosomal enzymes	Leak of lysosomal enzymes
Characteristic nuclear changes	Nuclei lost
Apoptotic bodies form	Do not form
DNA cleavage	No DNA cleavage
Activation of specific proteases	No activation
Regulatable process	Not regulated
Evolutionarily conserved	Not conserved
Dead cells ingested by neighboring cells	Dead cells ingested by neutrophils and macrophages


Final stage of apoptosis
White blood cell
Thank u….
Apoptotic cell
U.S. National Library of Medicine
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