

High yield



Cell Injury and Necrosis-3 Apoptosis

- **APOPTOSIS:** PROGRAMMED CELL DEATH
- IS A PATHWAY OF CELL DEATH IN WHICH CELLS ACTIVATE ENZYMES THAT DEGRADE THE CELLS' OWN NUCLEAR DNA AND NUCLEAR AND CYTOPLASMIC PROTEINS.
- REGULATED PROCESS INVOLVING ENZYME ACTIVATION
- CAN BE PATHOLOGIC OR PHYSIOLOGIC
- DOES NOT ELICIT INFLAMMATION

PHYSIOLOGIC APOPTOSIS:

- OCCURS DURING EMBRYOGENESIS AND TISSUE TURNOVER [LOSS OF GROWTH FACTOR SIGNALING]
 - INVOLVES LOSS OF HORMONE DEPENDENT TISSUES [DECREASED HORMONE LEVELS]
 - DECLINE OF LEUKOCYTE NUMBERS AT THE END [LOSS OF SURVIVAL SIGNALS]
 - ELIMINATES POTENTIALLY HARMFUL SELF-REACTIVE LYMPHOCYTES
- DURING EMBRYOGENESIS: SEPARATION OF DIGITS

PATHOLOGIC APOPTOSIS:

- TRIGGERED BY DNA DAMAGE, MISFOLDED PROTEINS, AND CERTAIN INFECTIONS

MECHANISMS OF APOPTOSIS: DEATH- AND SURVIVAL-INDUCING SIGNALS..

1. INTRINSIC (MITOCHONDRIAL) PATHWAY

- TRIGGERING CASPASE 9
- + MITOCHONDRIA CONTAIN SEVERAL PROTEINS CAPABLE OF INDUCING APOPTOSIS CYTOCHROME C.
- + ↑ MITOCHONDRIAL PERMEABILITY → PERMEABLE MEMBRANE
- CYTOCHROME C LEAKS → TRIGGERING CASPASE 9 → ACTIVATE APOPTOSIS

PROAPOPTOTIC → BAX & BAK.
PROTEINS (SENSOR) → BH3

ANTIAPOPTOTIC → BCL-2 & BCL-XL [MAINTAIN THE INTEGRITY OF MITOCHONDRIAL MEMBRANES]

2. Extrinsic (Death Receptor) Pathway

- Activated by TNF receptor family
 - Involves Fas ligand and T lymphocytes
- activate caspase 8

Clearance of apoptotic cells. ("eat-me" signals)
flips" phospholipid to the outer leaflet
secrete soluble factors that recruit phagocytes.

—Other Cell Death Pathways

- Necroptosis: Features of both necrosis and apoptosis
- Pyroptosis: Involves inflammasome activation
- Autophagy: Lysosomal digestion of cell components

Morphology of Apoptosis

- Cell shrinkage and fragmentation
- Formation of apoptotic bodies
- Rapid phagocytosis without inflammation

ستعلم يقيناً..
أن رحمة الله أخرجتك من ألف عثرة كادت تقصم ظهرك، تُتعب قلبك، تُعيق خُطاك! ستعلم أن الطافه الخفية؛ هي هدية السماء، برد الدواء، ماء السقاء لروحك! ما كان لك فهو لك! ملائكتك، ستأخذه ولو بعد حين، فاطمئن.