Apoptosis

It is a process of programmed cell-death that is necessary for several physiological and pathological processes , to maintain cellular homeostasis.

Examples: **Physiological**:
During organogenesis
Physiological involution of uterus during menstrual cycle
Physiological involution of lactating breast during weaning
Pathological:
Death of virus-infected or damaged cellsc(eg tumor cells)

Apoptosis	Necrosis
In single cells/clusters of cells	In tissue
No inflammation	Inflammation of surrounding tissues
Cellular condensation/shrinkage	Cellular swelling

Pathology:

- Condensation of nuclear chromatin
- Karyorrhexis (DNA fragmentation)
- Cellular shrinkage
- Formation of apoptotic bodies (membrane-bound vesicles of cytosol and organelles). These are then quickly phagocytosed and degraded by macrophages.

Mechanism:

Injury (RT/toxins/free radicals)
Intrinsic pathway→ → Mitochondrial signal
Withdrawal of growth factors or hormones

OR

Extrinsic pathway→ Receptor-ligand interactions (FAS,TRAIL & other members of the TNF superfamily)

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Cysteine Aspartate Protease (Caspase) activation
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DNA fragmentation Catabolism of cytoskeleton
↓ ↓
Apoptotic bodies

BCL-2 gene is the main gene involved in apoptosis. The BCL-2 family of proteins comprises both pro-apoptotic (eg BAX and BAK) and anti-apoptotic (eg BCL-2 and BCL-XL) members.
BCL-2 gene mutation is seen in 85% of FL and 25 % of DLBCL.
Caspases function in initiation in response to pro-apoptotic signals and in the subsequent effector pathway to disassemble the cell.
The mitochondrion is the central regulatory organelle involved in the process of apoptosis.
Other factors involved in apoptosis include the p53 gene, which promotes apoptosis, by inducing the expression of pro-apoptotic factors, after irrepairable cell damage.