

## CELL INJURY

## Q.1

(a)

- Necrosis → Coagulative Type

(b)

## Pathogenesis:

## Hypoxia → Coagulative Necrosis

- Deficiency of oxygen leads to failure of many energy dependent metabolic pathways, and ultimately death of cell by necrosis
- Decreased synthesis of ATP → Mitochondrial Injury → Anaerobic glycolysis → Decreased synthesis due to detachment of ribosomes → Irreversible cell changes
- When cells die and undergo necrosis in vivo, the tissue site is rapidly infiltrated with leukocytes, consisting initially of neutrophils followed by accumulations of monocytes.

## Microscopic Appearance:

- Overt discontinuity in plasma and organelle membranes
- Myocardium with coagulation necrosis shows strongly eosinophilic anucleate myocardial fibers. Leukocytes in the interstitium. Mitochondrial swelling with amorphous densities. Amorphous osmiophilic debris.



## Q.2

(a)

- Hyperplasia i.e. increase in number of cells (cells adaptation)

(b)

### Physiological Hyperplasia:

- Increase in breast size during pregnancy
- Increase in endometrium thickness during menstrual cycle
- Liver growth after partial resection

### Pathological Hyperplasia:

- Excess ACTH i.e. Cushing disease Adrenal Gland
- Proliferation of endometrium due to prolonged estrogen stimulus

(c)

**Mechanism** Response to a specific stimulus → normal regulatory control mechanism to meet the demands → Hypertrophy and dividing cells → Increase in number of cells



## Q.3

(a)

**Apoptosis** is a pathway of cell death that is induced by a tightly regulated suicide program in which cells destined to die activate enzymes that degrade the cells own nuclear DNA and nucleus and cytoplasmic proteins.

(b)

### Apoptosis

- Cell Shrinkage
- Nucleus fragmentation into nucleosome-size fragments
- Plasma membrane intact
- Intact organelles may be released in apoptotic bodies
- No inflammation
- Often physiological, eliminating unwanted cells  
Maybe pathological e.g. DNA damage

### Necrosis

- Cell swelling
- Nucleus Pyknosis → Karyorrhexis → Karyolysis
- Plasma membrane disrupted
- Enzymatic digestion of organelles may leak out
- Frequent inflammation
- Invariably pathological (culmination of irreversible cell injury)

(c)

**Physiological Atrophy** i) Uterus after parturition  
ii) Embryonic notochord and thyroglossal duct **Pathological**

**Atrophy** i) Aging ii) Starvation, Cushing disease



Q4

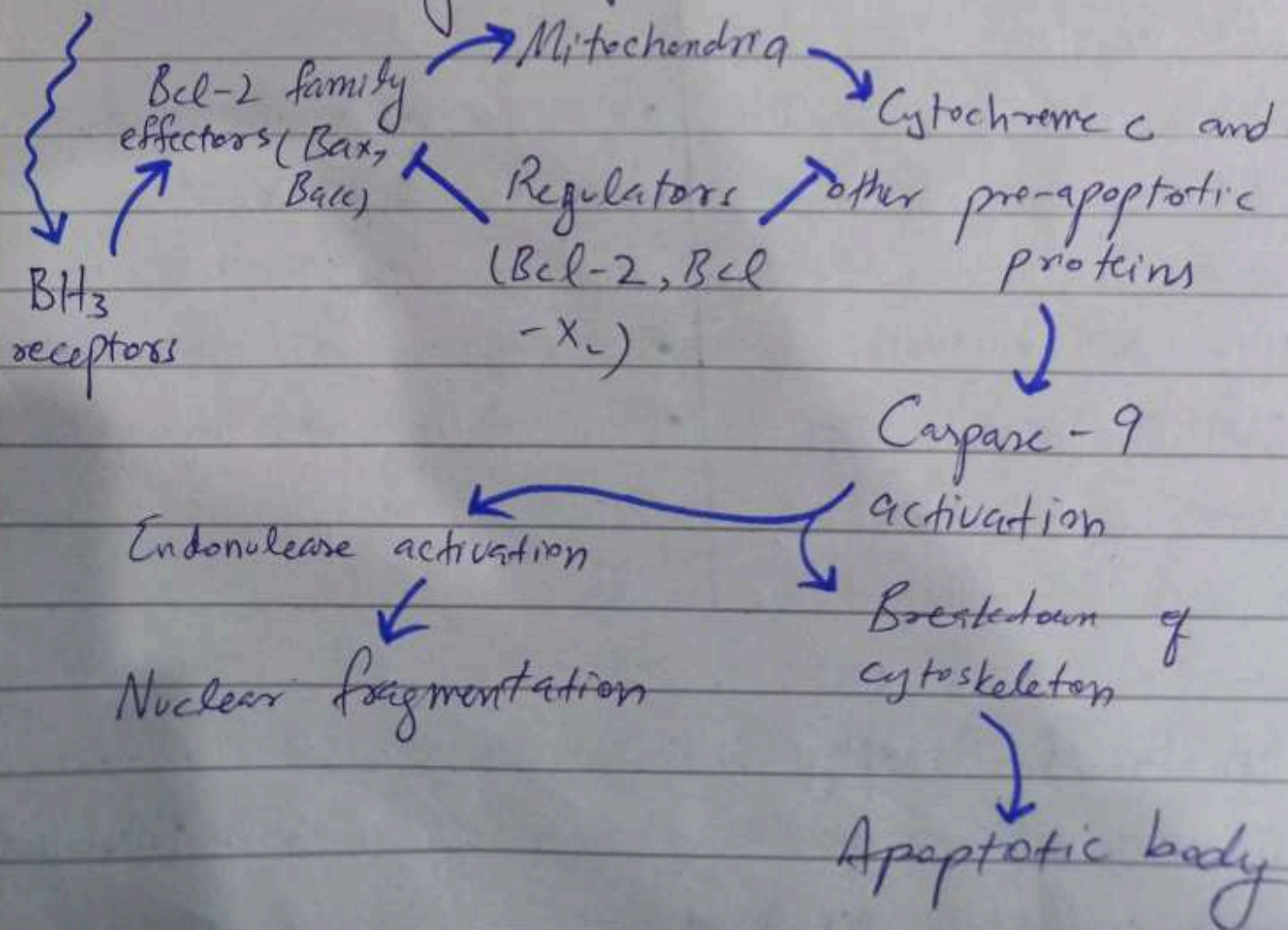
## Two pathways of Programmed Cell Death

- i) Mitochondrial (Intrinsic Pathway)
- ii) Death receptor (Extrinsic pathway)

### Intrinsic Pathway (Mitochondrial):

#### Cell Injury

- Growth Factor Withdrawal
- DNA damage (by radiation, toxins, free radicals)
- Protein misfolding (Endoplasmic Reticulum stress)





## Q.5

(a)

- Metaplasia is a change in which one adult cell type (epithelial or mesenchymal) is replaced by another adult cell type.

(b)

- The morphological manifestation of accidental cell death is necrosis.

(c)

- Pyknosis is Nuclear shrinkage → DNA condenses into shrunken basophilic mass  
→ Nuclear dissolution → Anuclear necrotic cell

(d)

- Process by which tissue degenerates into a translucent glass-like substance, or the state of being hyaline
- Non-specific accumulation of proteinaceous material in cell
- Appears homogenous, pink, glassy and eosinophilic on hematoxylin and eosin staining

(e)

- **Karyolysis**: Nuclear fading → chromatin dissolution due to DNAses and RNAses → Nuclear dissolution
- **Karyorrhexis**: Nuclear fragmentation → pyknotic nuclei  
nuclear dissolution ← ruptures ← membrane



Q6

## Pathological Calcification:

- Abnormal deposition of calcium salts with small amounts of iron and magnesium

### Dystrophic Calcification

- Deposition occurs in dead or dying tissues
- Occurs in absence of calcium metabolic derangements i.e. with normal serum Ca levels
- Atherosclerosis

### • Examples

- Aging
- Atherosclerotic plaques
- Tuberculosis lymph nodes

### Metastatic Calcification

- Deposition of calcium salts in normal tissues
- Always reflects some derangement in calcium metabolism (hypercalcaemia)
- Normal tissues - kidney, lungs etc.

### • Examples

- Renal failure
- Hyperparathyroidism
- Sarcoidosis

(b)

Y Gram Bacteria stain purple  
on Gram Staining

- This is because the thick layers of Peptidoglycan retains purple crystal violet stain.

— THE END —