Cellular Change (Cellular degeneration)

Cell injury results when cells are stressed so severely that they are no longer able to adapt or when cells are exposed to inherently damaging agents or suffer from intrinsic abnormalities (e.g., in DNA or proteins). Different injurious stimuli affect many metabolic pathways and cellular organelles.

Injury may progress through a reversible stage and culminate in cell death.

• Reversible cell injury (Degeneration)

In early stages or mild forms of injury the functional and morphologic changes are reversible if the damaging stimulus is removed.

At this stage, although there may be significant structural and functional abnormalities, the injury has typically not progressed to severe membrane damage and nuclear dissolution.

• Cell death

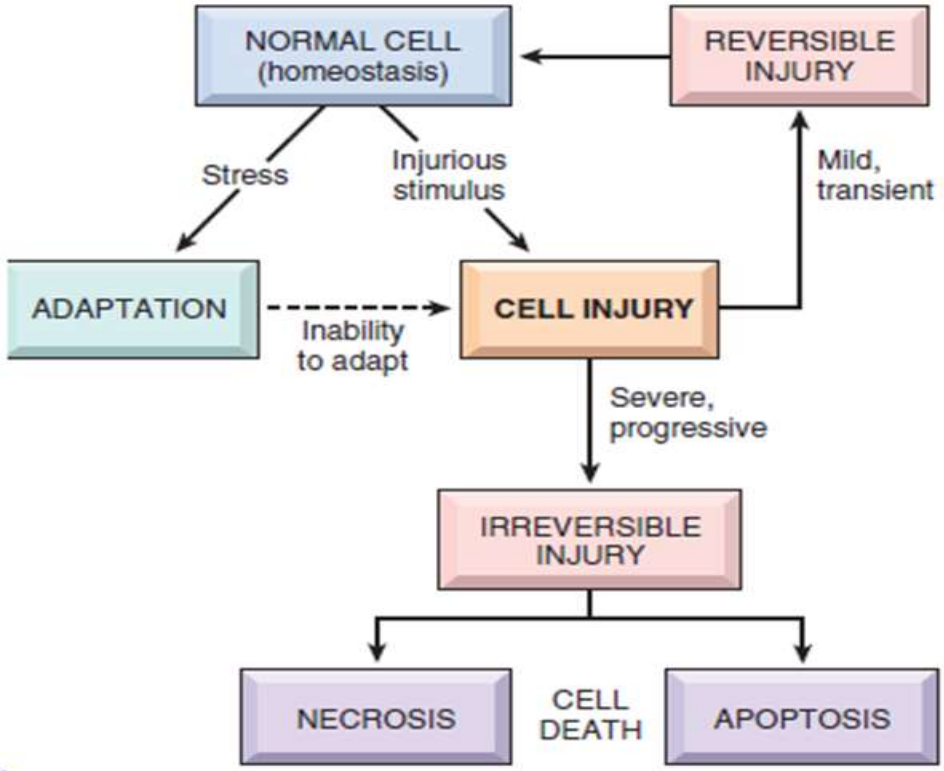
With continuing damage, the injury becomes irreversible, at which time the cell cannot recover and it dies. There are two types of cell death—necrosis and apoptosis—which differ in their mechanisms, morphology, and roles in disease and physiology.

When damage to membranes is severe, enzymes leak out of lysosomes, enter the cytoplasm, and digest the cell, resulting in necrosis.

Reversible change: The cell return to normal function or structure such as cellular change (Degeneration).

Degeneration =deterioration: change of tissue to a less functionally form.

Irreversible change: The cell doesn't return to the normal function or structure such as necrosis.



Types of degeneration

1. **Cloudy swelling (granular degeneration)**: Few amounts of water are introduced in the cell organelles (Mitochondria, Golgi apparatus, Nucleus, and E.R).

Ex / Cloudy swelling of liver and kidney.

Mechanism of cloudy swelling:

Injury of the cell due to toxic material or irradiation or chemical or bacteria decrease of oxidative phosphorylation process decrease in ATP and cause pores in the cell wall and cause increase permeability of cell membrane and cause H_2O, Na^+ enters inside cell with the exit of k^+.

2. Hydropic degeneration: Too much water Introduce in the cytoplasm.

Ex/ kidney and liver.

Causes of hydropic degeneration

a) Lack of nutrition.
b) Old age.
c) Virus disease ex: pox virus, herpes simplex.
d) Friction.

3. Fatty change (Fatty degeneration): fat droplets introduce in the cytoplasm of the cell.

Ex /cardiac muscle, liver , kidney.

Causes of fatty change

a) Increase release of fatty acid from fatty tissue in malnutrition.
b) Failure protein synthesis in case of bacterial toxins.
c) Decrease methionine and choline.
d) Failure synthesis of phospholipid and lipoprotein due to toxicity by phosphorus (Po_4) or carbon tetrachloride (Ccl_4).
e) Disturbance the conversion of fatty acids to triglyceride due to ethanol poisoning.

4. Fibrinoid degeneration:

Fibrinoid:-is a protein material composed of **fibrin** and **immunoglobulin** it occurs following severe damage of endothelial cells by immune_complexes.

Fibrin: - protein material present around damaged blood vessels such as injury of the skin, pleura of lung or intestine.

Origin of Fibrin:

a) Degeneration of collagen.

b) Occur following Ag-Ab reaction during collagen disease such as rheumatic arthritis.

c) Activation of fibrinogen into fibrin in the coagulating system**.**

Ex/ kidney nephritis.

5. Amyloid degeneration (amyloidosis):

Amyloidosis is a disease that occurs when a substance known as amyloid builds up in tissues and organs. Amyloid is a protein material secreted from blood and present adjacent blood vessels.

Types of amyloidosis

a -Localized:-The buildup may happen in a single organ

b-Systemic :-amyloid deposits can affect any organ or tissue throughout the body.

Causes of Localized amyloidosis

Localized amyloidosis is associated with aging, as the body seems to naturally make amyloid as it ages. The conditions associated with localized amyloidosis are:-

1- Diabetes (where protein builds up in the pancreas) .
2- Alzheimer's disease (where protein builds up in the brain).
3- Beta2-microglobulin amyloidosis due to kidney failure .

Causes of Systemic amyloidosis

1- Primary amyloidosis: occurs when bone marrow produces too much of certain fragments of antibody proteins, which build up in the blood stream and can deposit in body tissues.
2- Hereditary: is a genetic form passed down in families that often affects nerves and kidneys.
3- Secondary: develops along with a chronic infectious or inflammatory disease, such as tuberculosis or rheumatoid arthritis.

Ex/ spleen, liver and kidney

6. Glycogen degeneration

Glycogen particles or droplets aggregation in the cell and organ of the body except in liver and muscle.

Causes of Glycogen degeneration

1) Metabolic disease (diabetes mellitus)**.**

2) Glycogen storage disease lack of co enzyme which responsible for catabolism of glycogen.

7. Mucin degeneration

Mucous or mucin clear watery like substance slimy, slippery, white transient the formed from mucoprotien and water.

8. Hyaline degeneration the term "hyaline" describes pink-staining homogenous glassy cytoplasmic droplets in cells. It is due to degeneration of cell protein. Included also is the accumulation of protein(Hyaline) within cells following abnormal metabolism.