Cell damage

Cell damage can occur as a result of an adverse stimulus which disrupts the normal homeostasis of affected cells. Among other causes, this can be due to physical, chemical, infectious, biological, nutritional or immunological factors. Cell damage can be reversible or irreversible. Depending on the extent of injury.

Causes

- Physical agents such as heat or radiation can damage a cell .
- Impaired nutrient supply, such as lack of oxygen or glucose, or impaired production of adenosine triphosphate (ATP) .

Targets

The most components of the cell that are targets of cell damage are the DNA and the cell membrane.

- DNA damage: In human cells, both normal metabolic activities and environmental factors such as ultraviolet light and other radiations can cause DNA damage.
- Membrane damage: damage to the cell membrane disturbs the state of cell electrolytes, e.g. calcium, which when constantly increased, induces apoptosis.

Types of damage

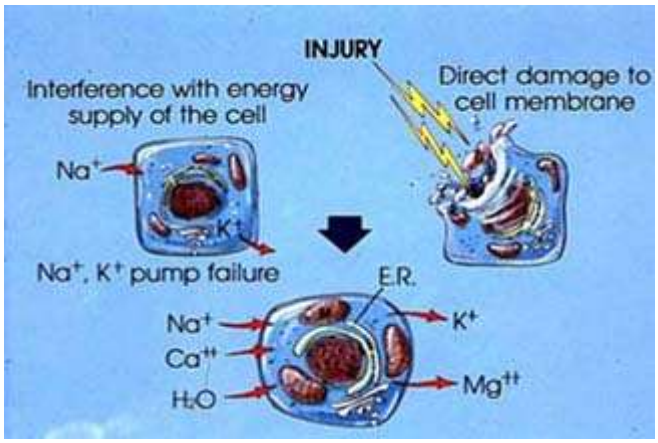
Some cell damage can be reversed once the stress is removed or if compensatory cellular changes occur. Full function may return to cells .

A-reversible:

1-Cellular swelling:

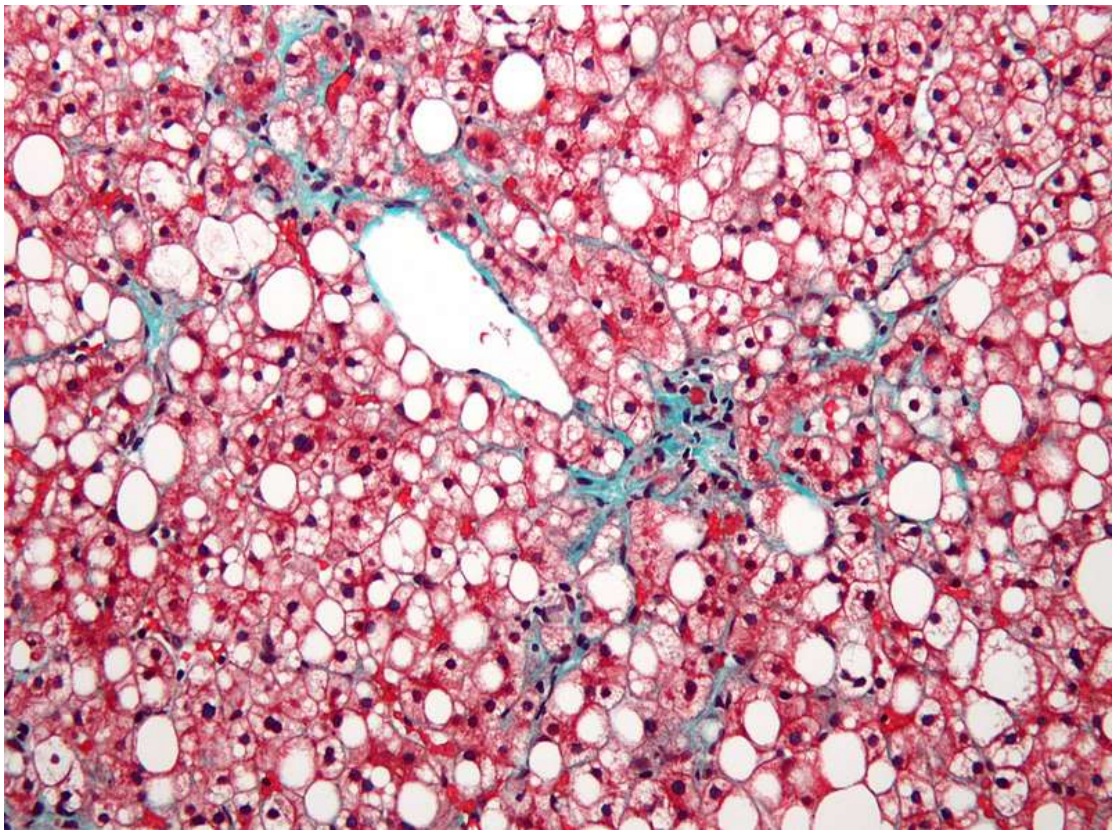
Interacellular accumulation occur in cytoplasm or nucleus of cell, accumulation may be temporary or permanent and cause cell injury.

Cellular swelling (or cloudy swelling) may occur due to cellular hypoxia, which damages the sodium-potassium membrane pump; it is reversible when the cause is eliminated.



2-Fatty change

The cell has been damaged and is unable to adequately metabolize fat. Small vacuoles of fat accumulate and become dispersed within cytoplasm.



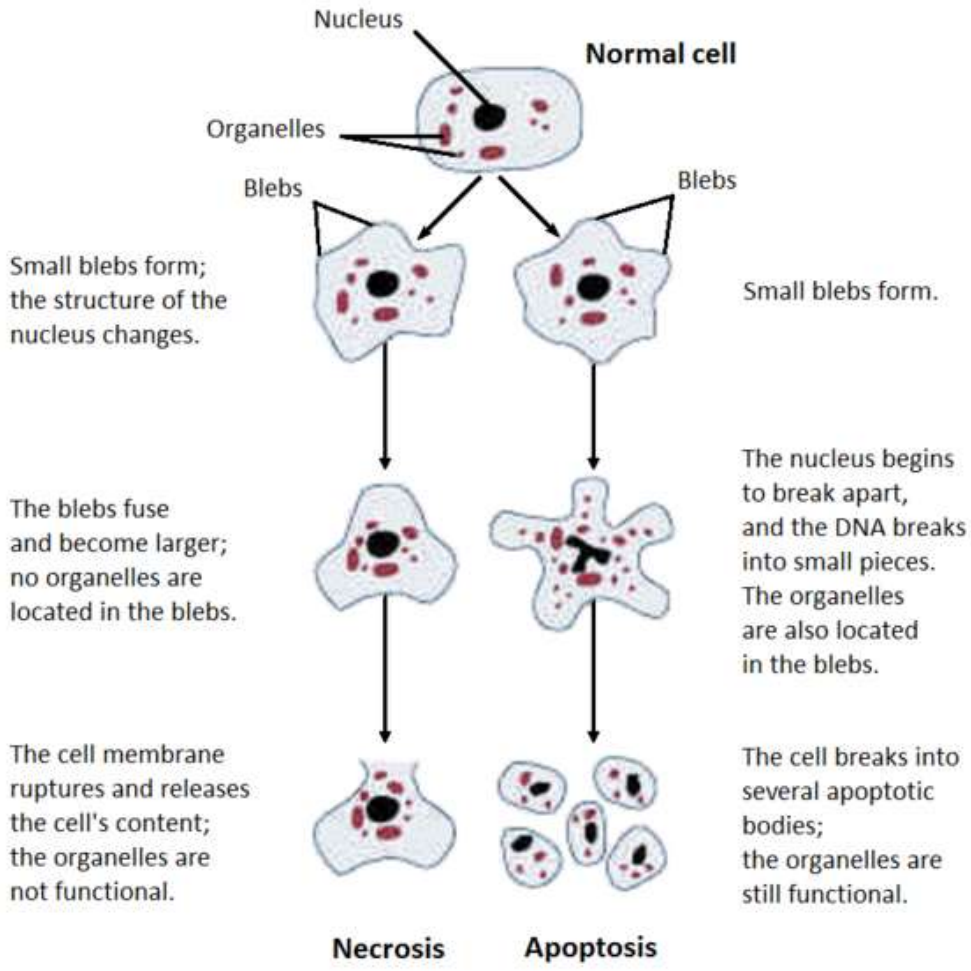
B-Irreversible:

1-Necrosis

Necrosis is characterised by cytoplasmic swelling, irreversible damage to the plasma membrane, and organelle breakdown leading to cell death.

2-Apoptosis

Apoptosis is the programmed cell death of superfluous or potentially harmful cells in the body. It is an energy dependent process mediated by proteolytic enzymes called caspases, which trigger cell death through the cleaving of specific proteins in the cytoplasm and nucleus. The dying cells shrink and condense into apoptotic bodies. The cell surface is altered so as to display properties which lead to rapid phagocytosis by macrophages or neighbouring cells.


Nucleus
Normal cell
Organelles
Blebs
Blebs
Small blebs form;
the structure of the
nucleus changes.
Small blebs form.
The blebs fuse
and become larger;
no organelles are
located in the blebs.
The nucleus begins
to break apart,
and the DNA breaks
into small pieces.
The organelles
are also located
in the blebs.
The cell membrane
ruptures and releases
the cell's content;
the organelles are
not functional.
The cell breaks into
several apoptotic
bodies;
the organelles are
still functional.
Necrosis
Apoptosis