

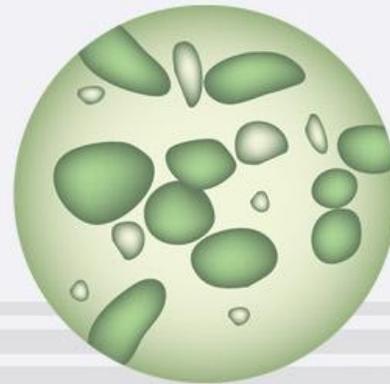


Pathophysiology

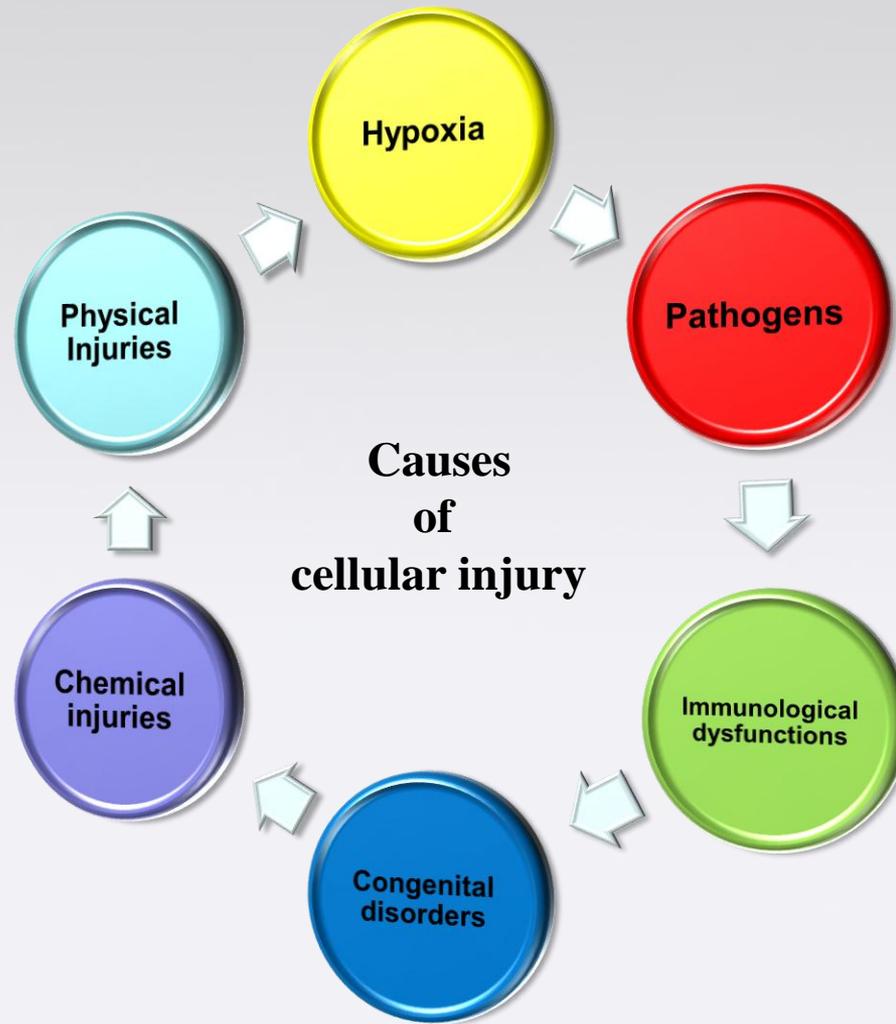
2nd Year, 2nd Semester
2025-2026



Lecture 2: Cellular Injury and Adaptation



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Cellular changes during injury

Cellular responses to injury include:

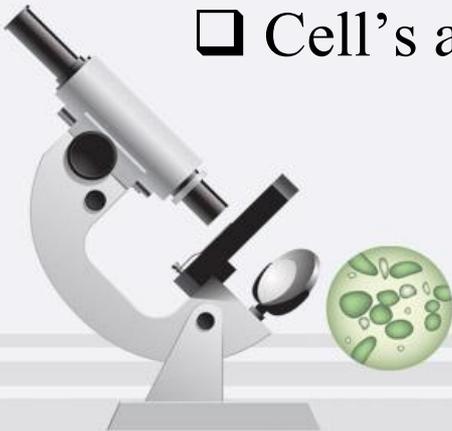
- Adaptation (hypertrophy or atrophy, hyperplasia or metaplasia).
- Reversible injury.
- Irreversible injury.
- Cell death (necrosis, apoptosis, or necroptosis, and autophagy).



Cellular changes during injury

The cellular response to injury depends on several important factors including:

- Type of injury.
- Duration (including pattern) of injury.
- Severity and intensity of injury.
- Type of cell injured.
- Cell's metabolic state.
- Cell's ability to adapt.

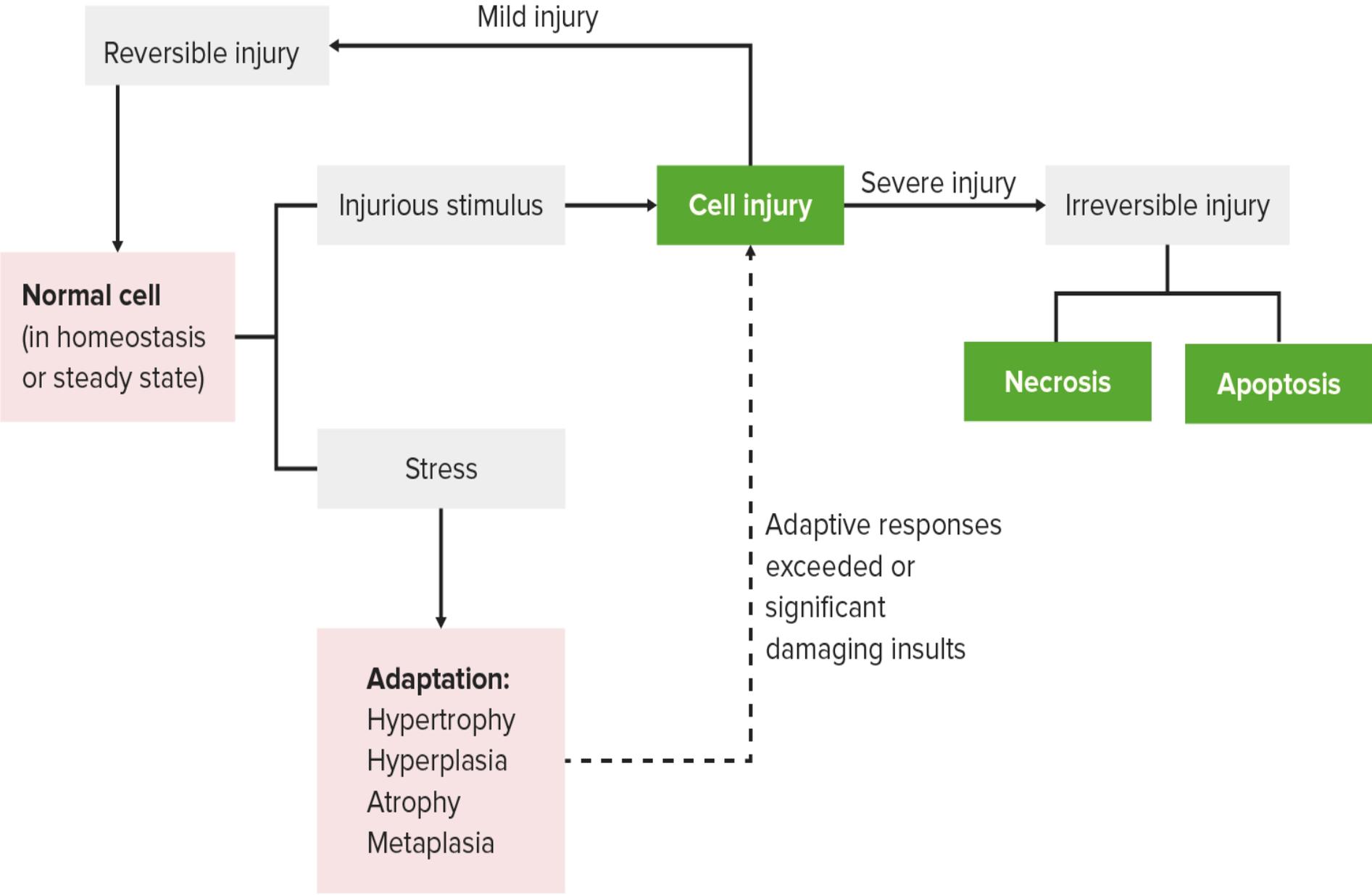


Cellular changes during injury

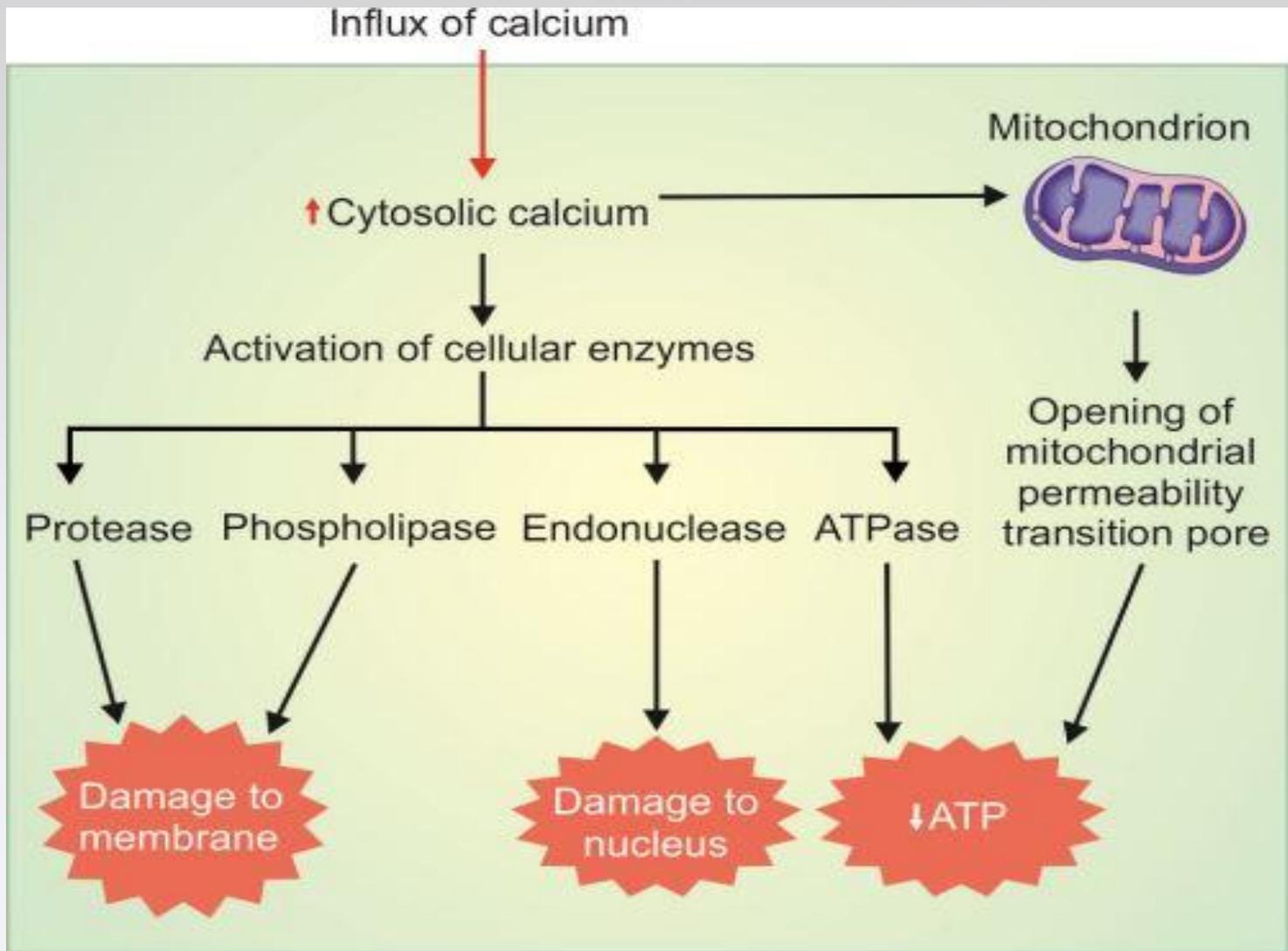
The critical intracellular targets that are susceptible to injury are:

- ✓ DNA, proteins, lipid membranes, and circulating lipids.
- ✓ Production of ATP via aerobic respiration.
- ✓ Cell membranes.
- ✓ Protein synthesis.





Cellular Response to Stress and Injurious Stimuli.



Mechanisms of cellular injury



Protective Factors against free radicals include:

❖ **Antioxidants, Vitamins A, E, and C**

❖ **Superoxide dismutase,**

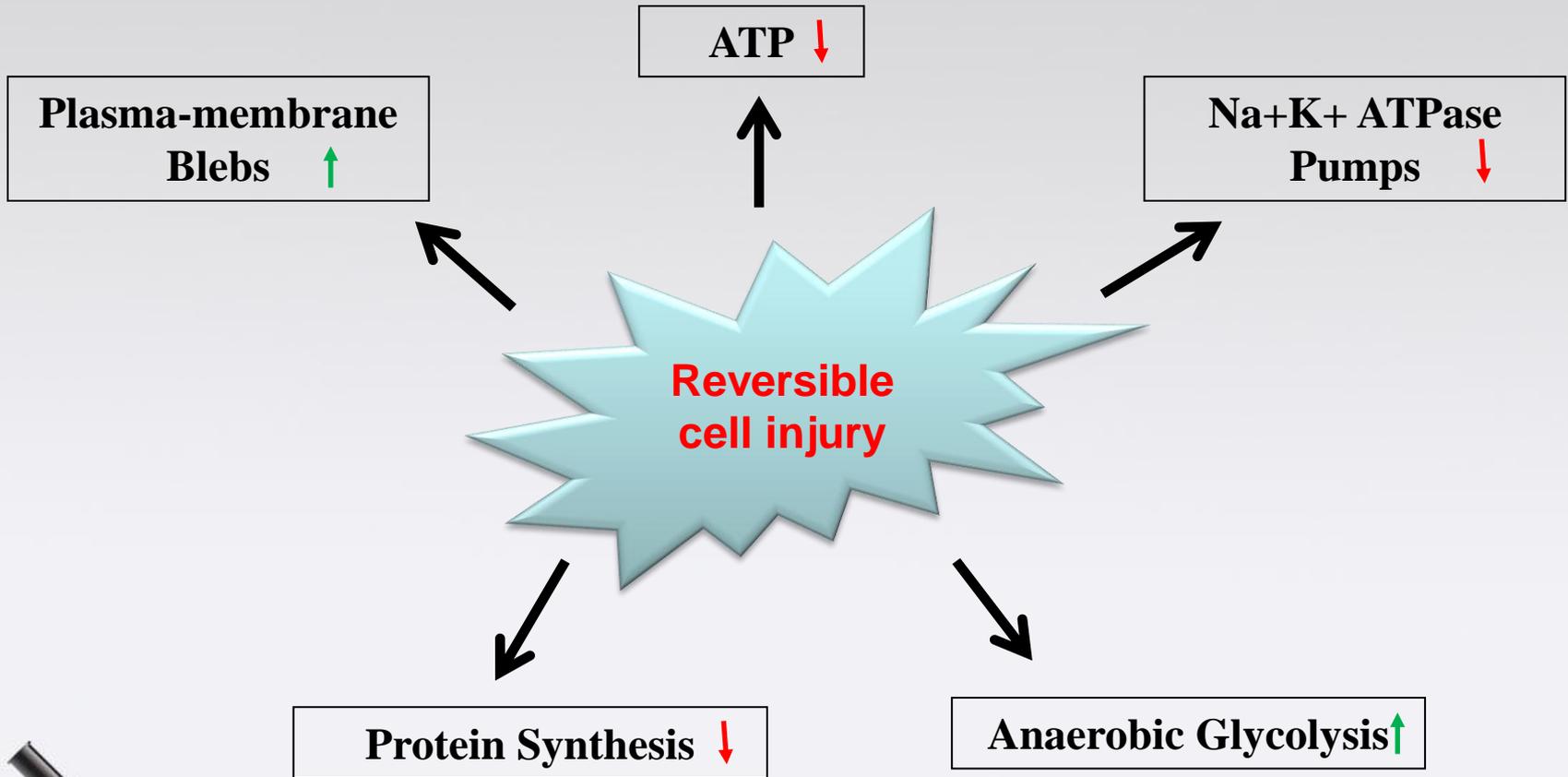
Superoxide \rightarrow hydrogen peroxide

❖ **Glutathione peroxidase,**

Hydroxyl ions or hydrogen peroxide \rightarrow water

❖ **Catalase, Hydrogen peroxide \rightarrow oxygen and water**





Severe membrane damage ↑

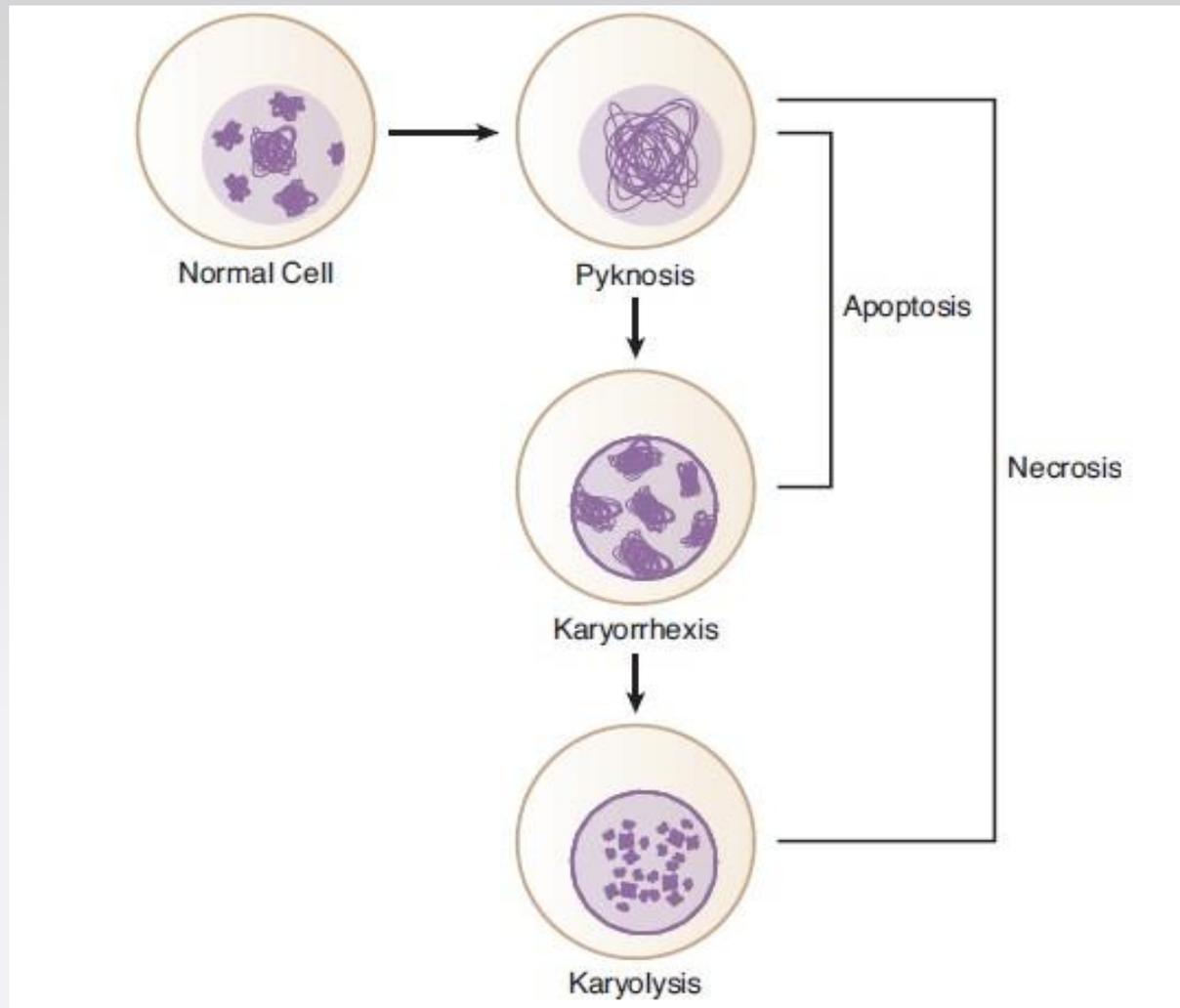
Marked mitochondrial dysfunction ↑

**Irreversible
cell injury**

Nuclear changes ↑

Rupture of the lysosomes ↑





Nuclear Changes in Irreversible Cell Injury.

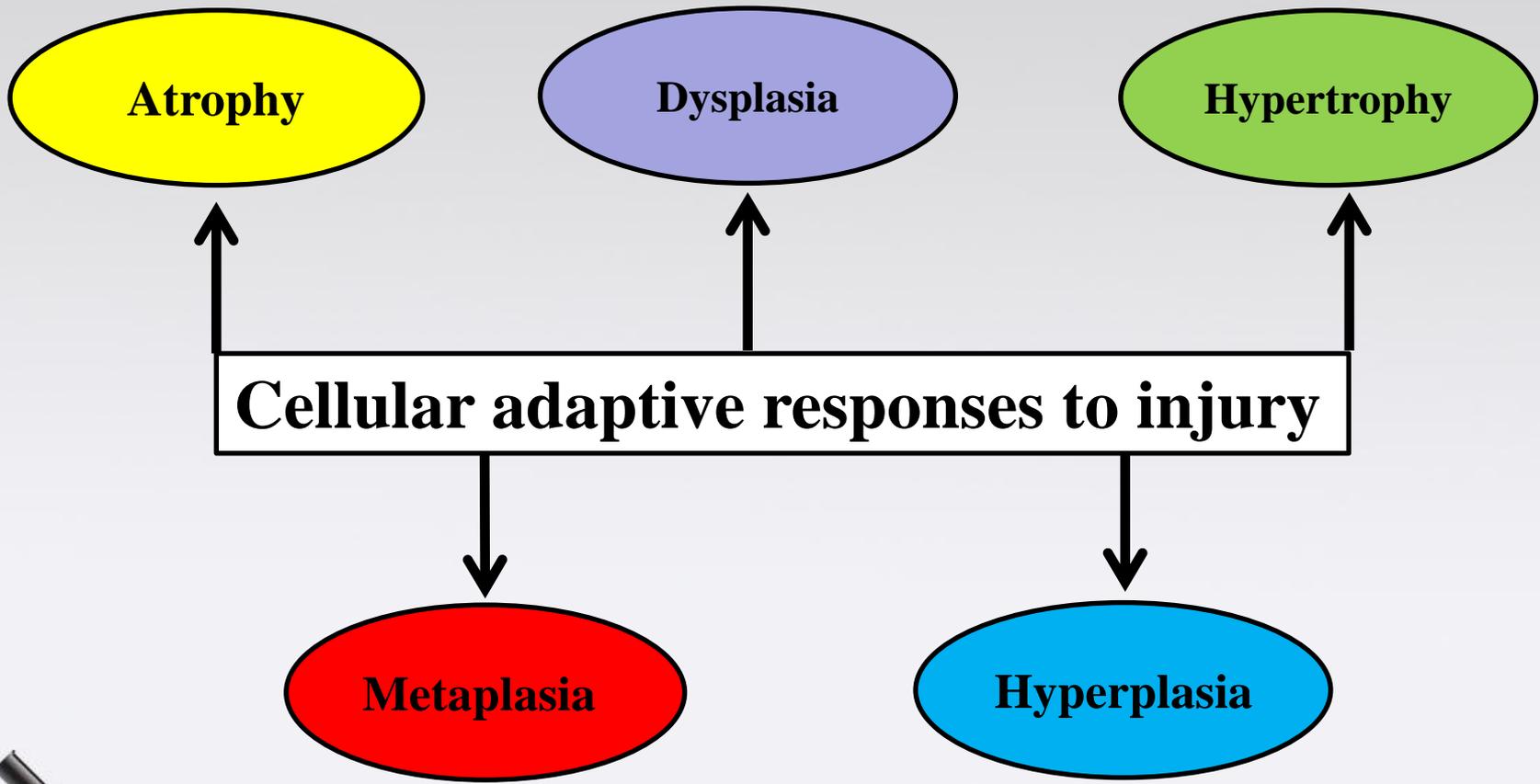


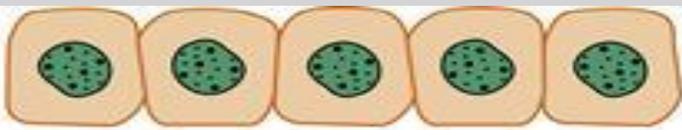
Assignment:

What are the main differences between the nuclear changes of irreversible cell injuries:

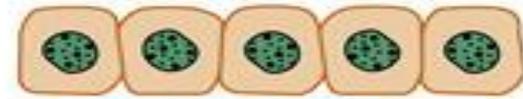
- Pyknosis
- Karyorrhexis
- Karyolysis



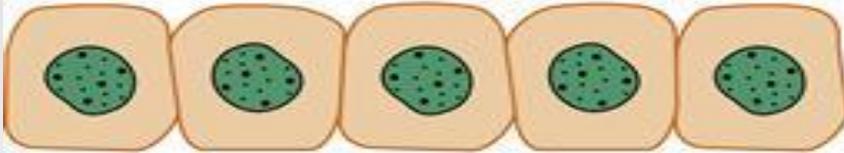




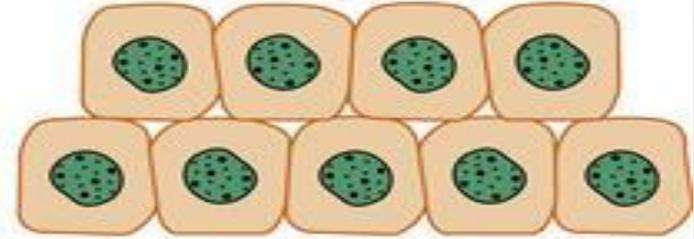
Normal



Atrophy
(decreased cell size)



Hypertrophy
(increased cell size)



Hyperplasia
(increased cell number)

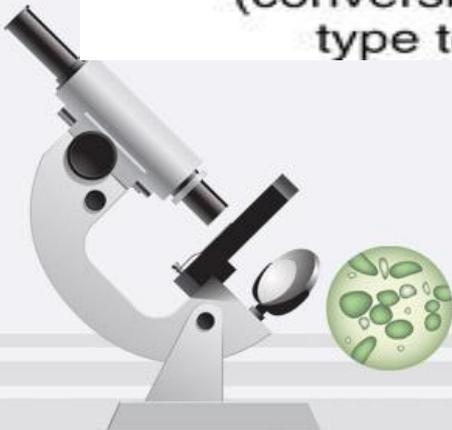


Metaplasia
(conversion of one cell
type to another)



Dysplasia
(disorderly growth)

Cellular Adaptive Responses to Cell Injury.



Thank you

