

# Introduction to pathology and cell injury -1




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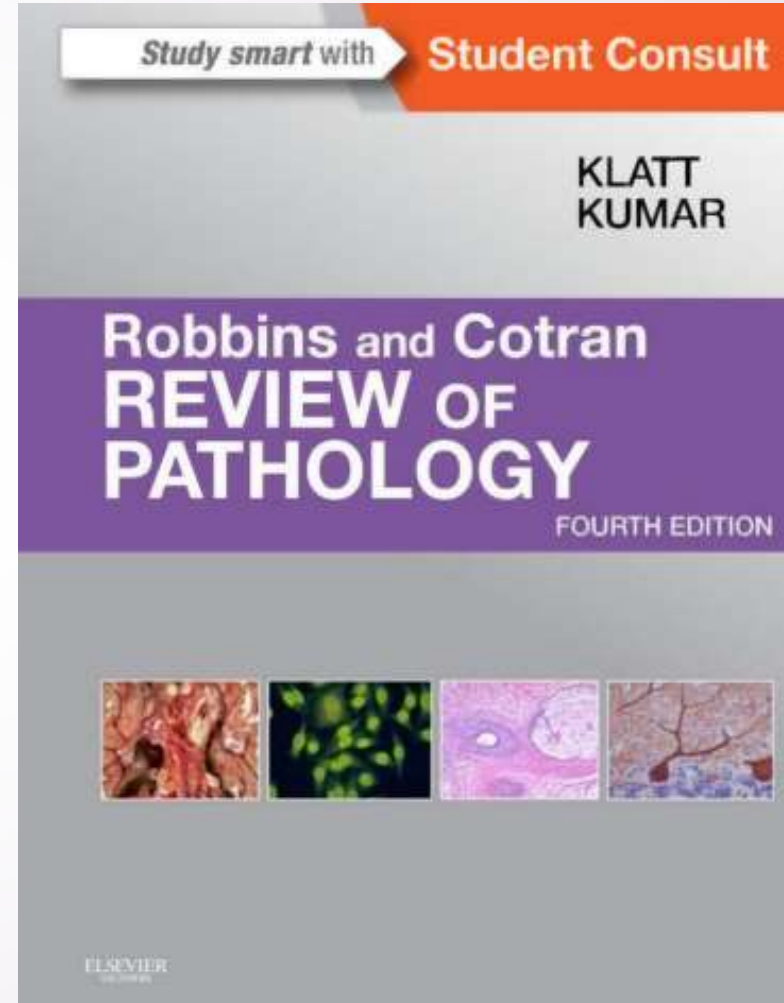
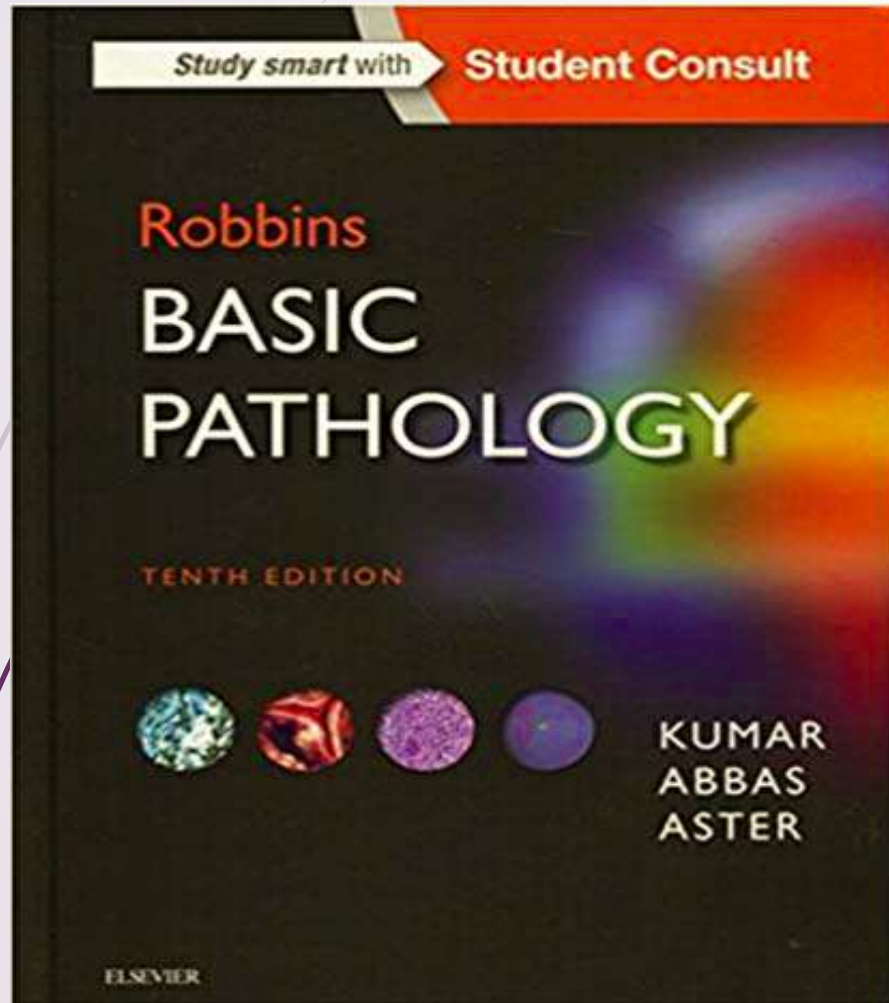
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# General pathology course

- 22 lectures, two lectures per week.
  - Major chapters:
    - Cell Injury, Cell Death, and Adaptations.
    - Inflammation and Repair.
    - Hemodynamic Disorders, Thromboembolism, and Shock.
    - Neoplasia.
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# The books...




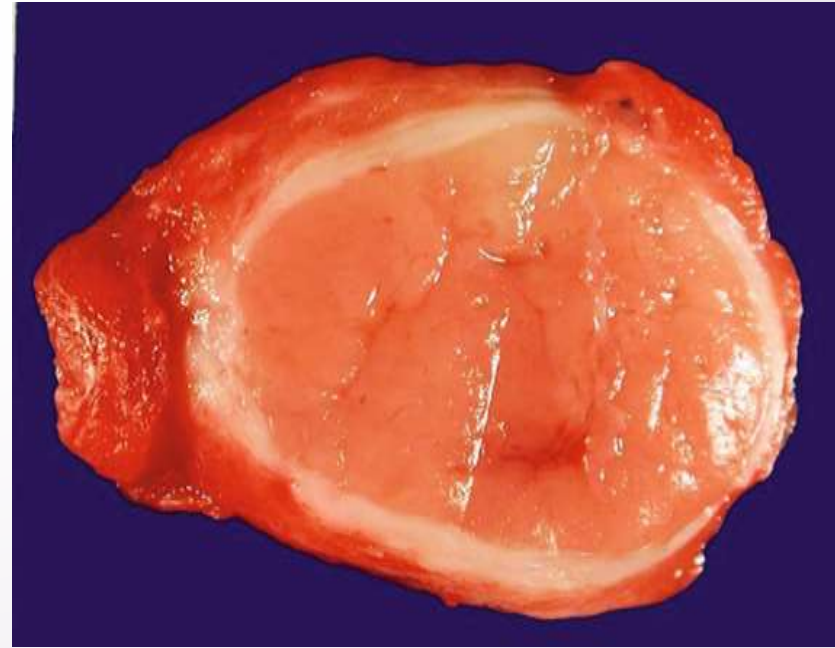
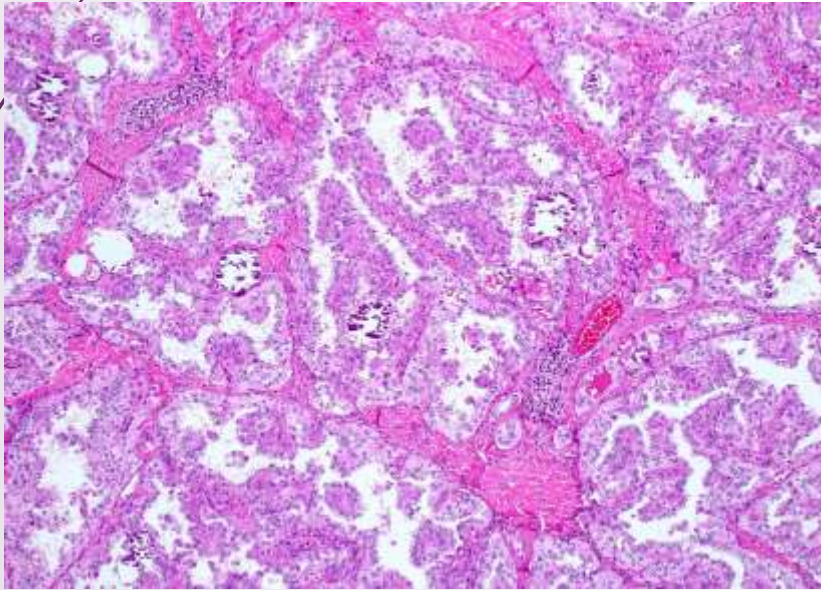
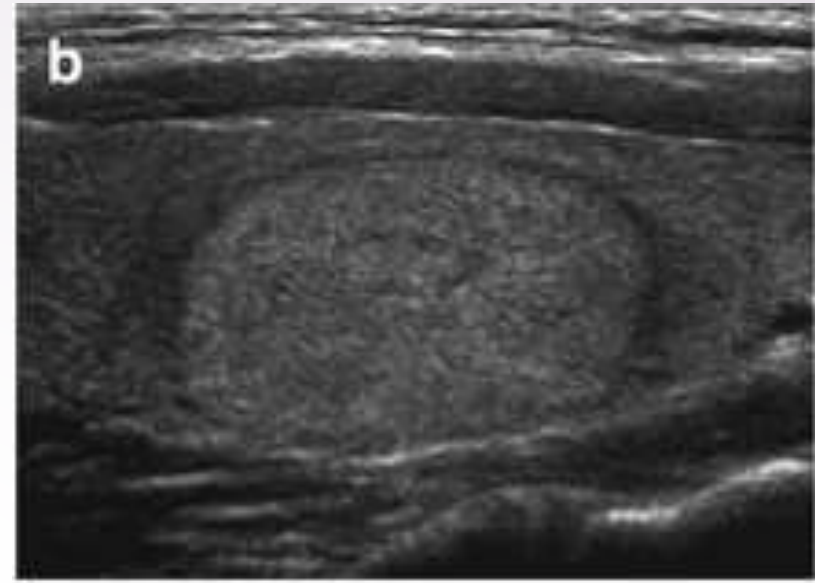
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# Introduction to pathology



# what is pathology ?

- ▶ The study of the structural & functional changes in cells, tissues, & organs that underlies diseases.
  - ▶ It involves the examination of surgically removed organs, tissues (biopsy samples), bodily fluids, and, in some cases, the whole body (autopsy).
- 



+ **General pathology:**

basic concepts that are shared among various disease in multiple organs/systems (Ex: Inflammation, cell injury and neoplasia)

+ **Systematic Pathology:**

discuss pathology of diseases of a specific organs/systems

**Anatomical pathology**

- +Cytopathology
- +Dermatopathology
- +Forensic pathology
- +Histopathology
- +Neuropathology
- +Pulmonary pathology
- +Renal pathology
- +Surgical pathology

**Clinical pathology**

- +Hematopathology
- +Immunopathology
- +Radiation pathology

**Molecular pathology**



▶ pathology addresses components of disease:

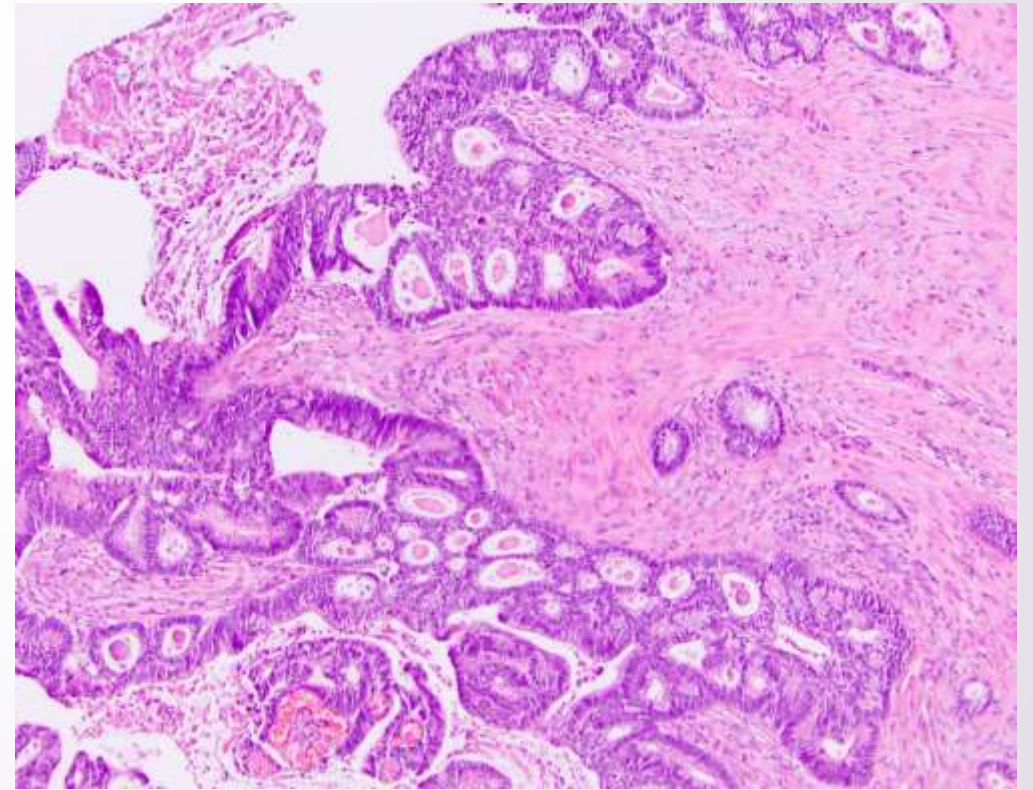
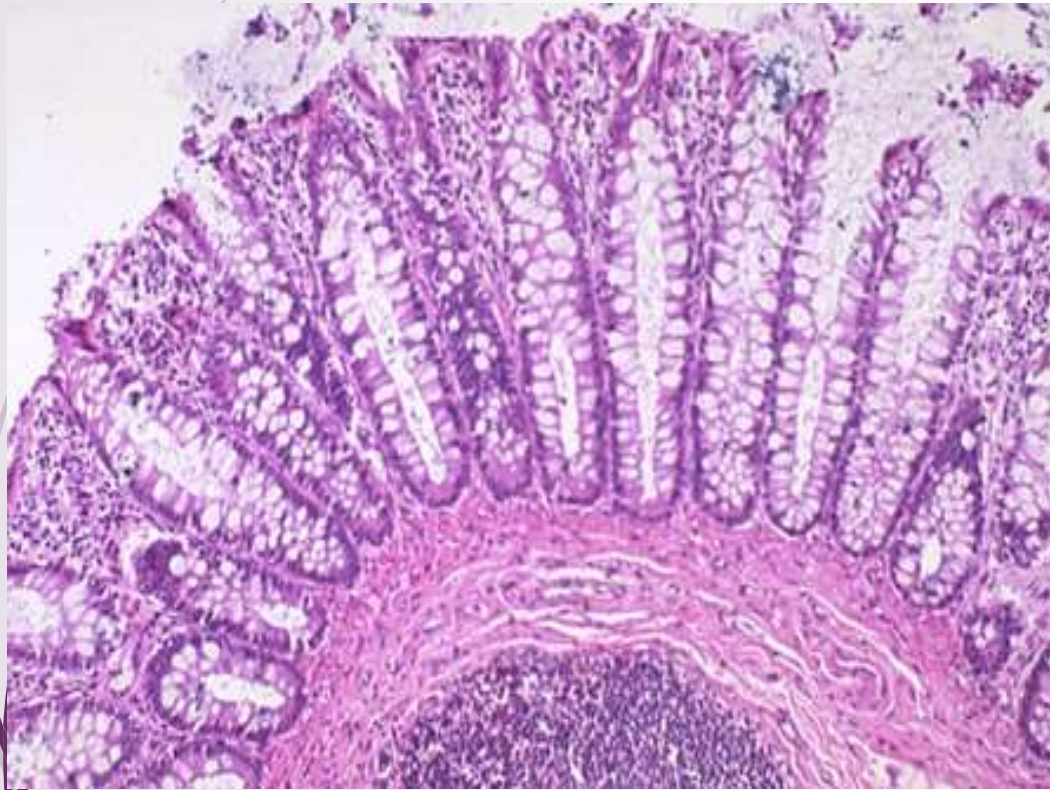
- cause: why.
- mechanisms of development (pathogenesis): how
- structural alterations of cells (morphologic changes):?????
- the consequences of changes (clinical manifestations).



structural alterations of cells (morphologic changes):  
either by naked eye: Gross morphology



## 2. Morphology under microscope: Microscopic





Fixing



Processing



Embedding

RM2235 Rotary Microtome



VT1000S Vibrating-blade Microtome

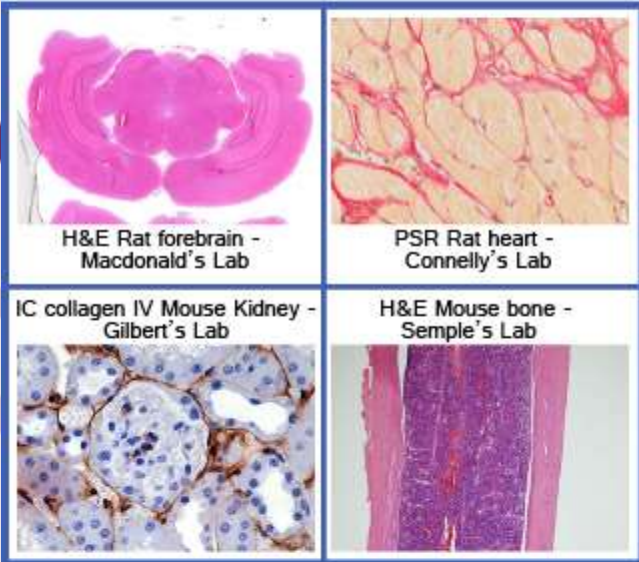


Cutting

Leica CM 1900 Cryostat



Specimen journey in pathology lab



H&E Rat forebrain - Macdonald's Lab

PSR Rat heart - Connelly's Lab

IC collagen IV Mouse Kidney - Gilbert's Lab

H&E Mouse bone - Semple's Lab

Microscopy



Olympus IMT-2 Microscope


Staining



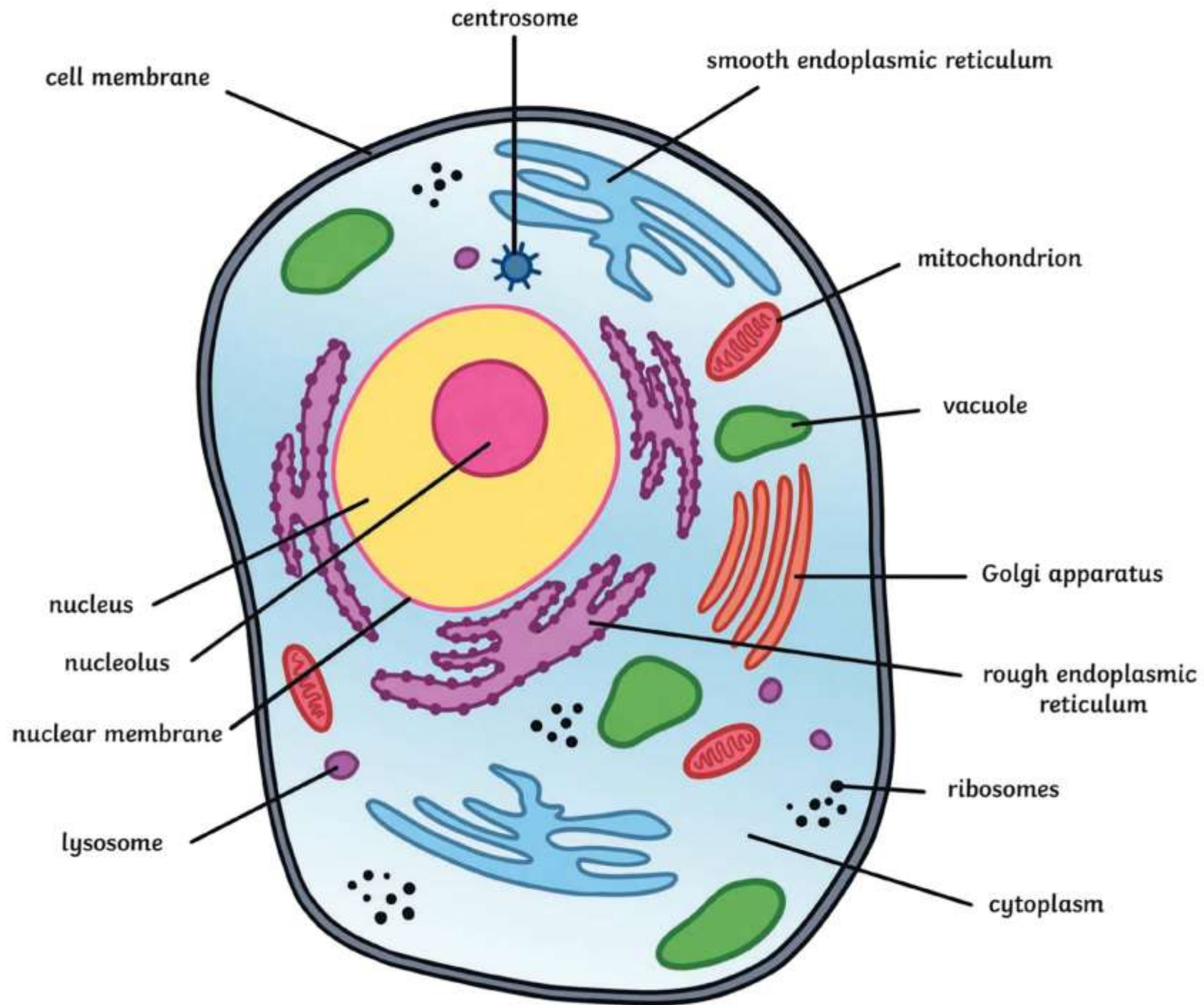
Leica AutoStainer XL




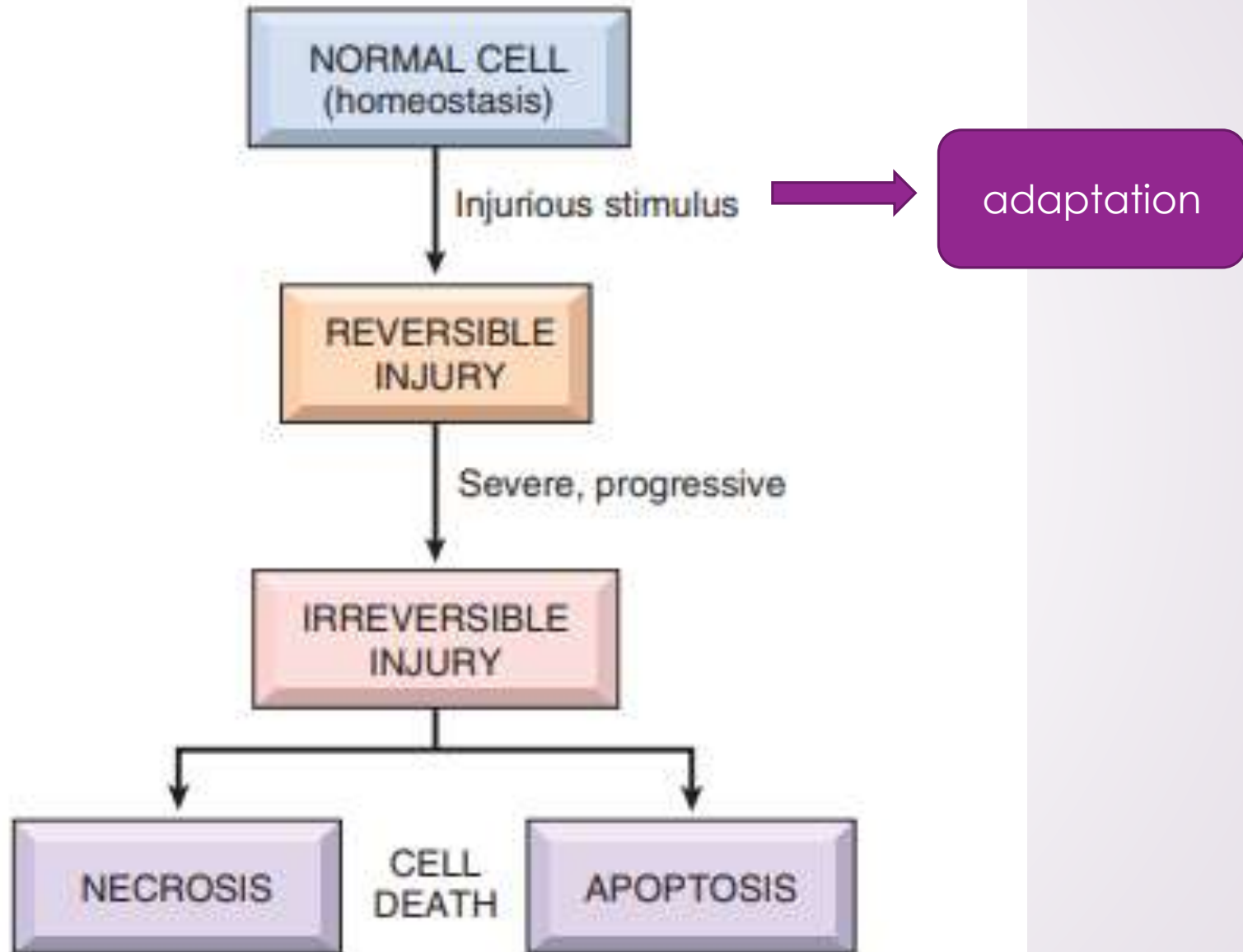
# Cell injury -1

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- ▶ Cells actively interact with their environment, constantly adjusting their structure and function to accommodate changing demands and extracellular stresses.
  - ▶ The intracellular milieu of cells is normally tightly regulated such that it remains fairly constant, a state referred to as homeostasis.

# Normal cell component



- 
- ▶ So in any:
    - physiologic stresses (such as increased workload in the heart)
    - potentially injurious conditions (such as nutrient deprivation).
- ↓
- The cells undergo adaptation: new steady state with preserving viability and function.
- ↓
- If the adaptive capability is exceeded or if the external stress is inherently harmful or excessive, cell injury develops







# Causes of cell injury

- Oxygen Deprivation (Hypoxia Vs ischemia) : most common causes of injury
- Toxins: smoking, alcohol
- Infectious Agents
- Immunologic Reactions :autoimmune disease
- Genetic Abnormalities
- Nutritional Imbalances :
- Overintake: obesity, diabetes
- Insufficiency: protein, vitamins
- Physical Agents : trauma, burn
- Aging

# Ischemia and Hypoxia

- ▶ Ischemia is insufficient blood flow to provide adequate oxygenation.
- ▶ Usually caused by arterial thrombus formation or vasospasm.
  
- ▶ hypoxia : oxygen deficiency, can be caused by:
  - Ischemia, anemia, lung disease, CO poisoning.
  
- ▶ Ischemia results in hypoxia; however, hypoxia can occur with normal (or elevated) blood flow if, for example, the oxygen content of the arterial blood is decreased by anemia.



# SEQUENCE OF EVENTS IN CELL INJURY AND CELL DEATH..

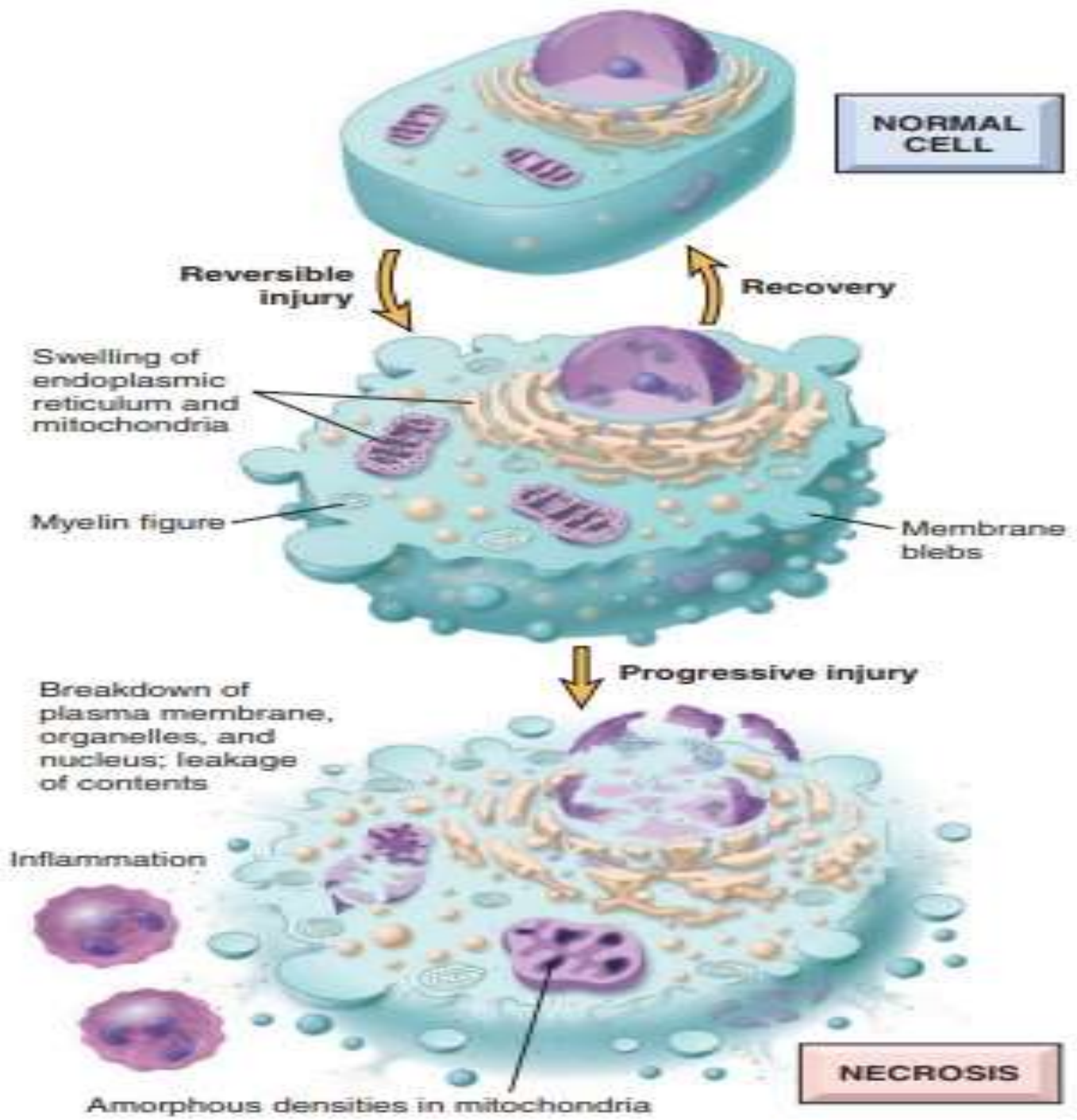
## ► **Reversible Cell injury:**

- the stage of cell injury at which the deranged function and morphology of the injured cells can return to normal if the damaging stimulus is removed

## ► **Irreversible Cell injury:**

- the stage of cell injury at which the injured cells pass a nebulous “point of no return” and undergo cell death.
- Occur if the stress is severe, persistent, or rapid in onset.

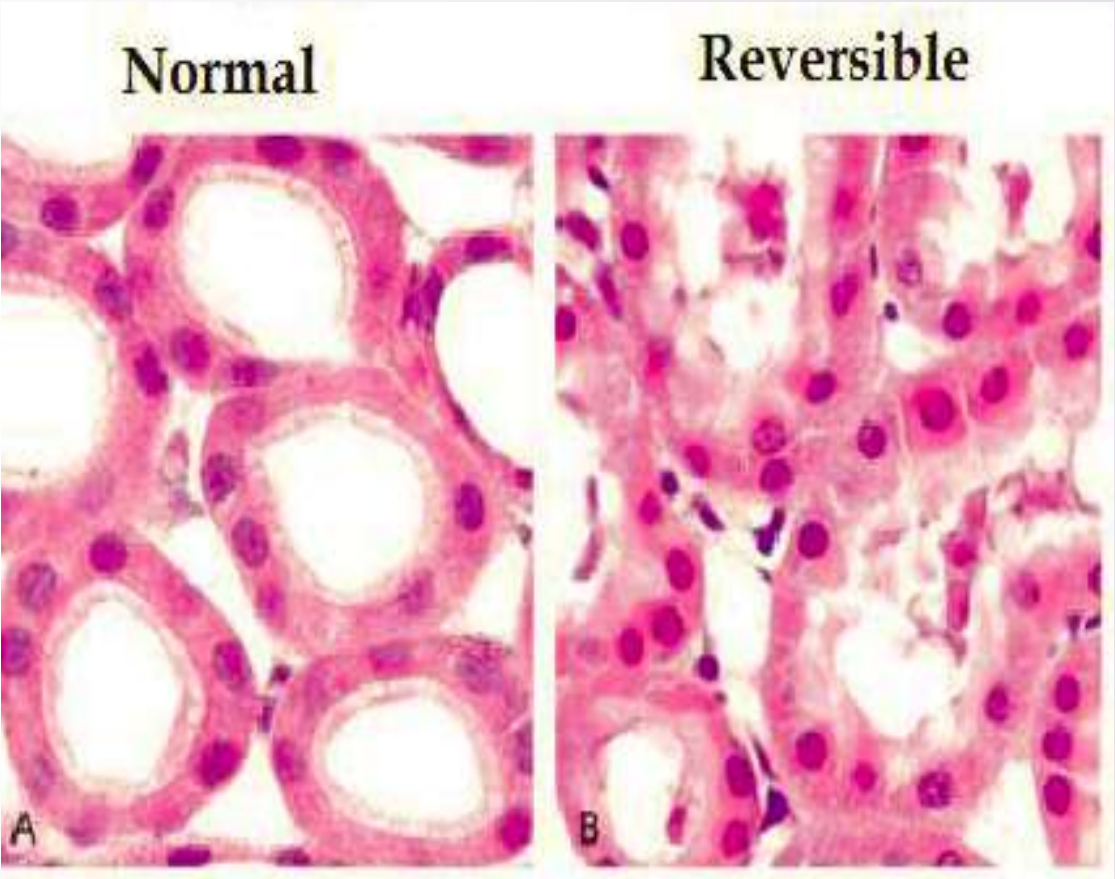
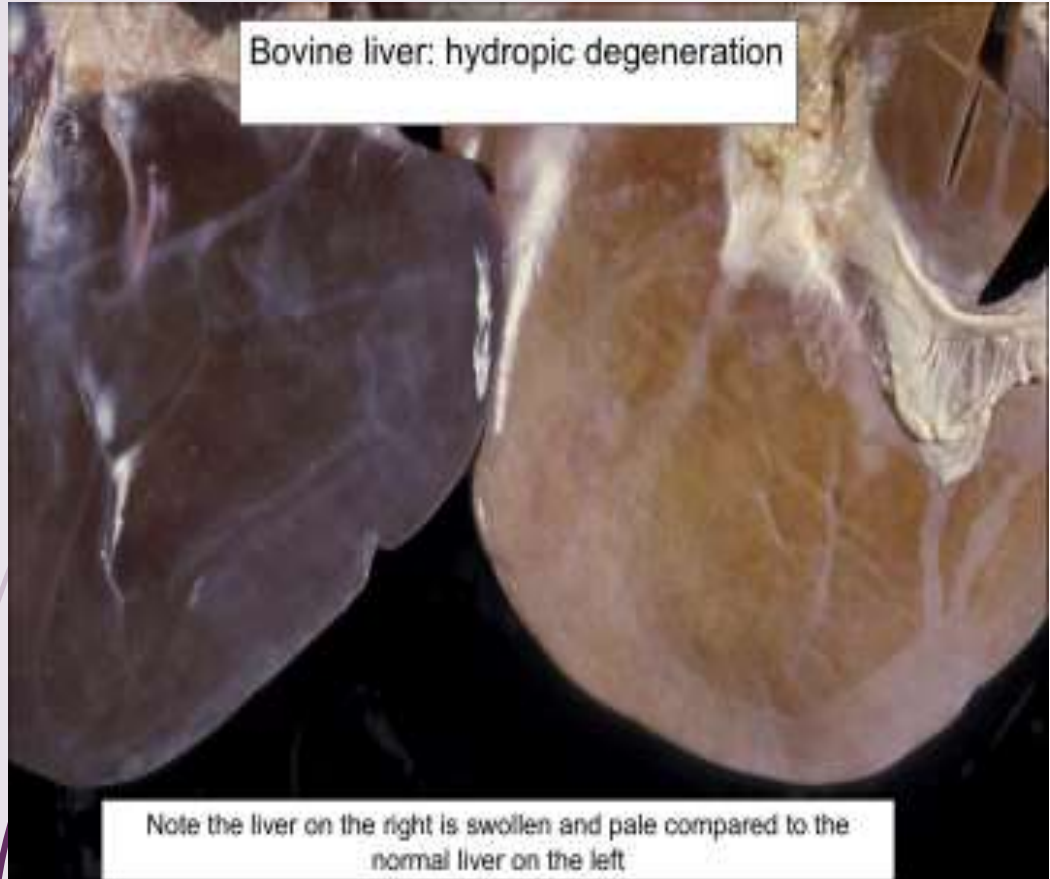
# 1. Reversible Cell injury:



# Morphological of reversible cell injury;

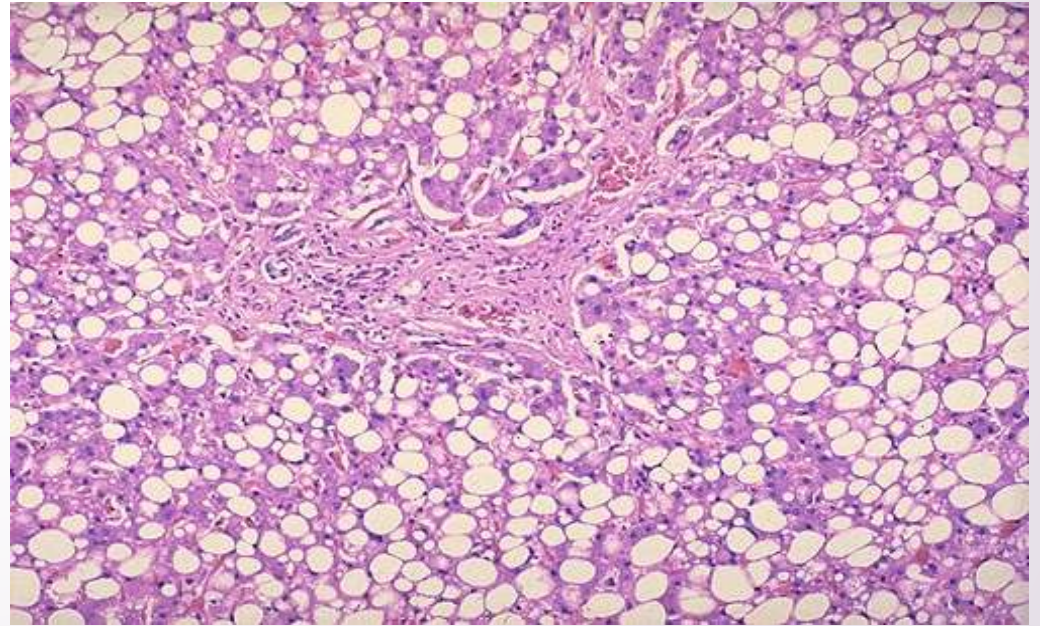
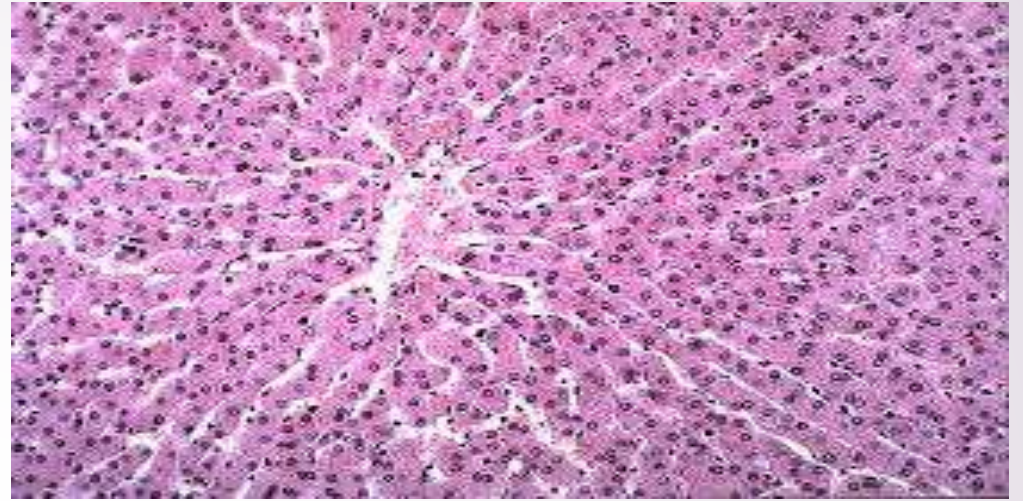
## ➤ 1. Cellular Swelling

- Reversible process results from failure of the sodium potassium pump (energy-dependent ion pumps) due to ATP depletion.
- ❖ Gross: pallor, turgor.
- ❖ Microscopy:
  - Cellular swollen.
  - hydropic change.



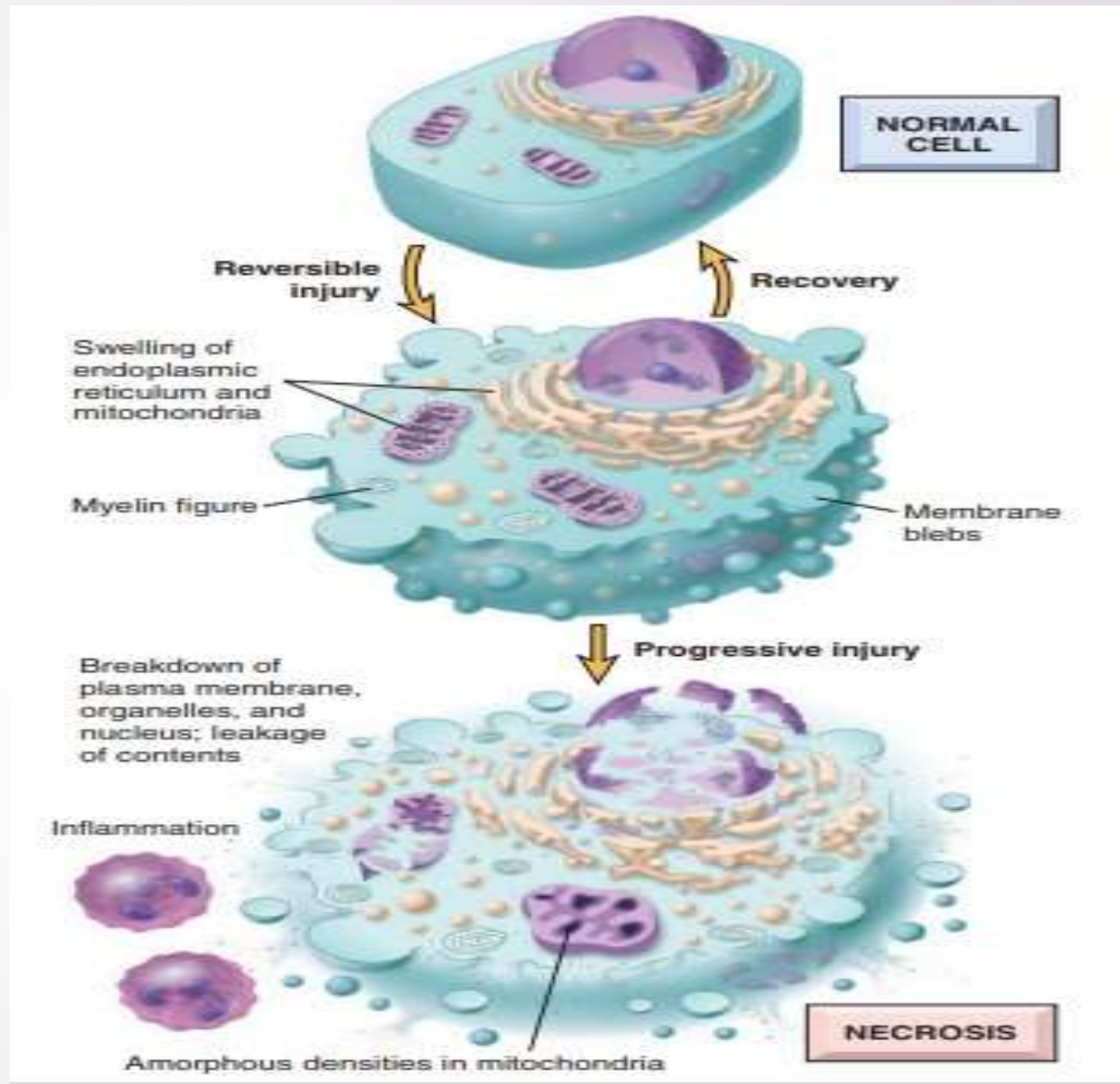
## 2. Fatty change

- It is reversible process, seen mainly in organs that involved in fat metabolism like Hepatocytes and myocardial cells .
- Occurs mainly in hypoxic injury, toxic and metabolic injury.
- Microscopy:
  - lipid (triglyceride) vacuoles in the cytoplasm





## II. Irreversible cell injury





# Irreversible cell injury consistently characterized by three phenomena:

- ▶ The inability to restore mitochondrial function even after resolution of the original injury
- ▶ Loss of structure and functions of the plasma membrane and intracellular membranes
- ▶ Loss of DNA and chromatin structural integrity.



Depending on the nature and severity of the insult, cellular death may in form of:

- ▶ Necrosis
- ▶ Apoptosis
- ▶ necroptosis

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Any Question?