

CELLULAR INJURY AND ADAPTATION

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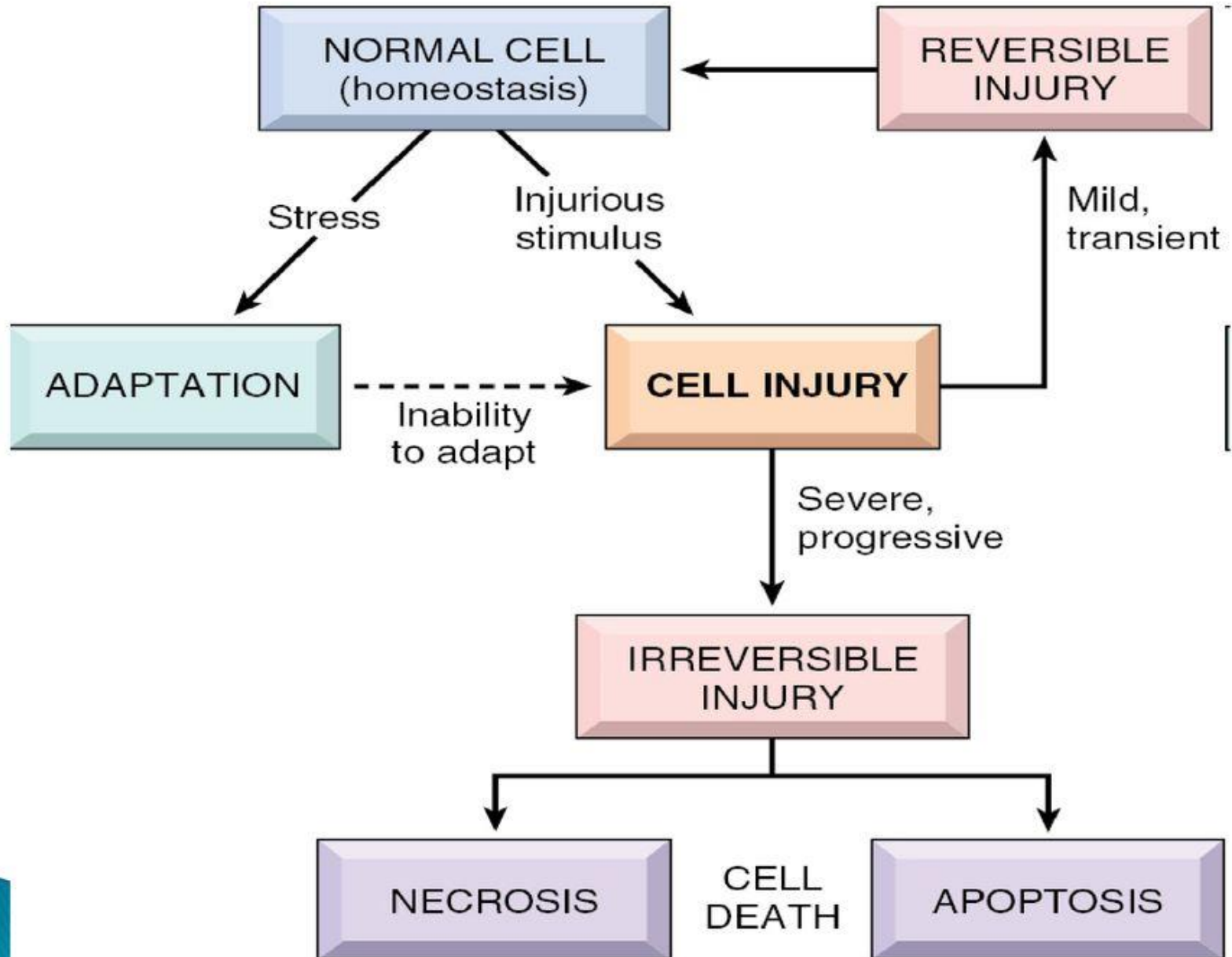
SLO's

- 1-Recognize cell response to injury
- 2-Define adaptation
- 3-List forms of adaptation
- 4-Describe each form of adaptation
- 5-Identify causes for each form of adaptation
- 6-Relate each form of adaptation to clinical context

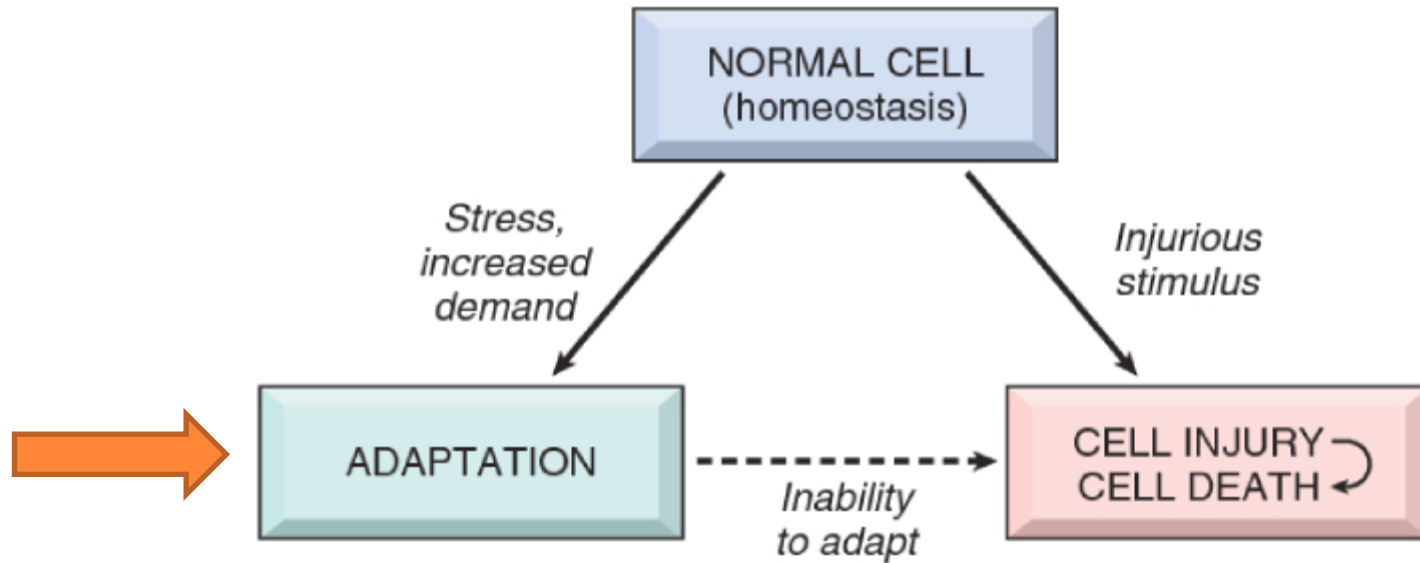


SMALL GROUP DISCUSSION

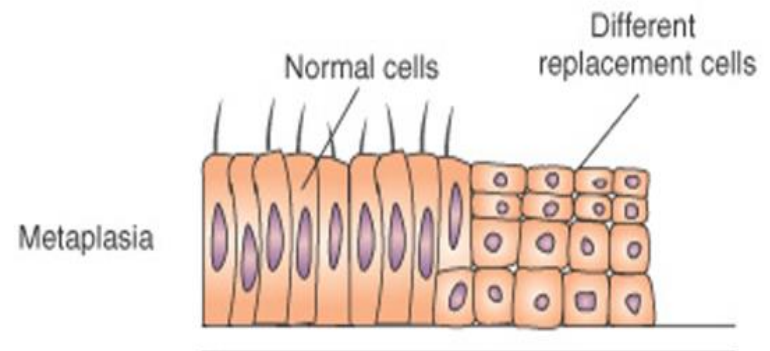
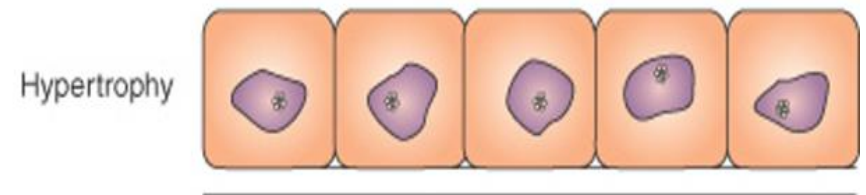
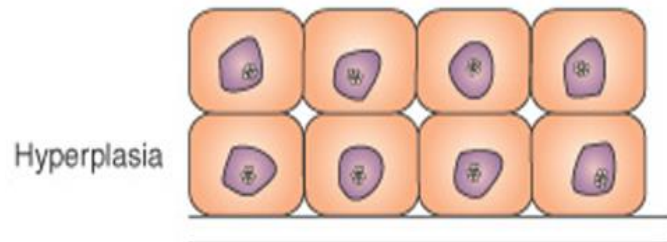
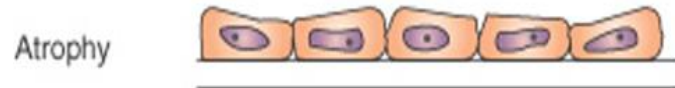
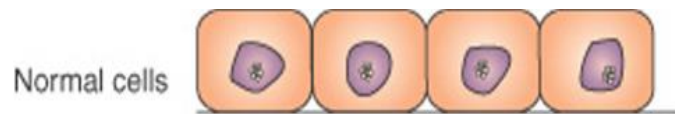




OUR MISSION TODAY

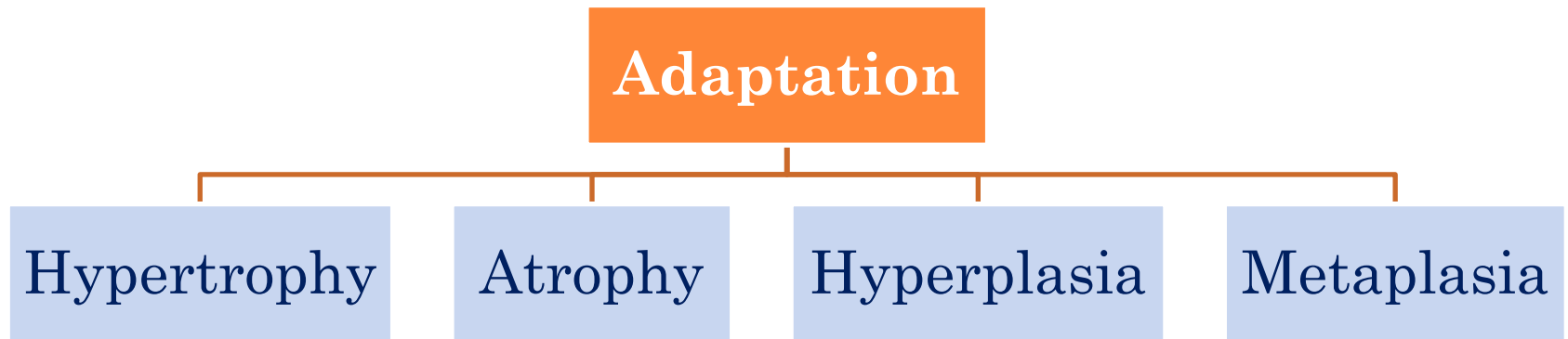


TYPES OF CELLULAR ADAPTATION

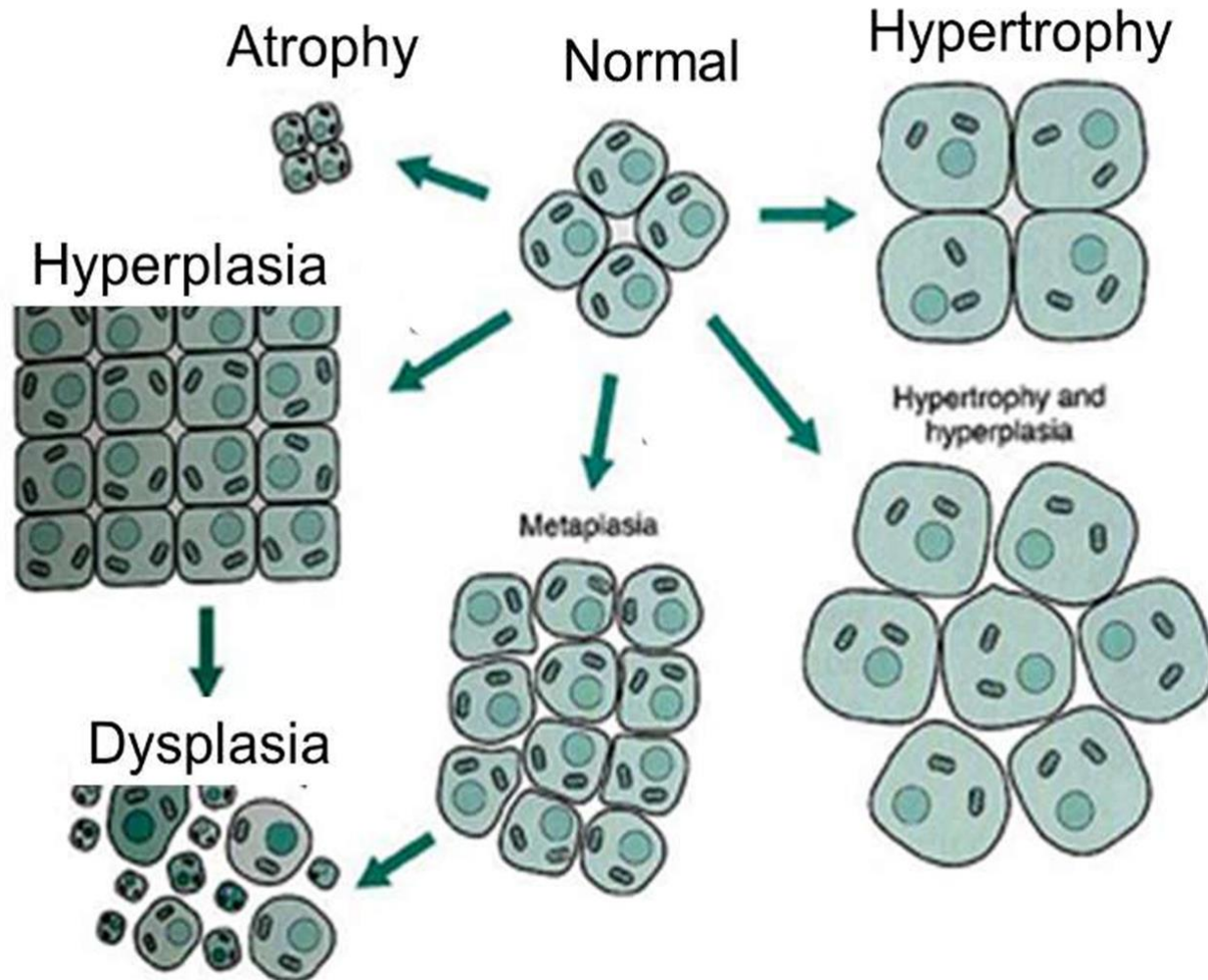


WHAT IS ADAPTATION ?

It is a reversible change of cell morphology to maintain its function and preserve its viability



TYPES OF CELLULAR ADAPTATION

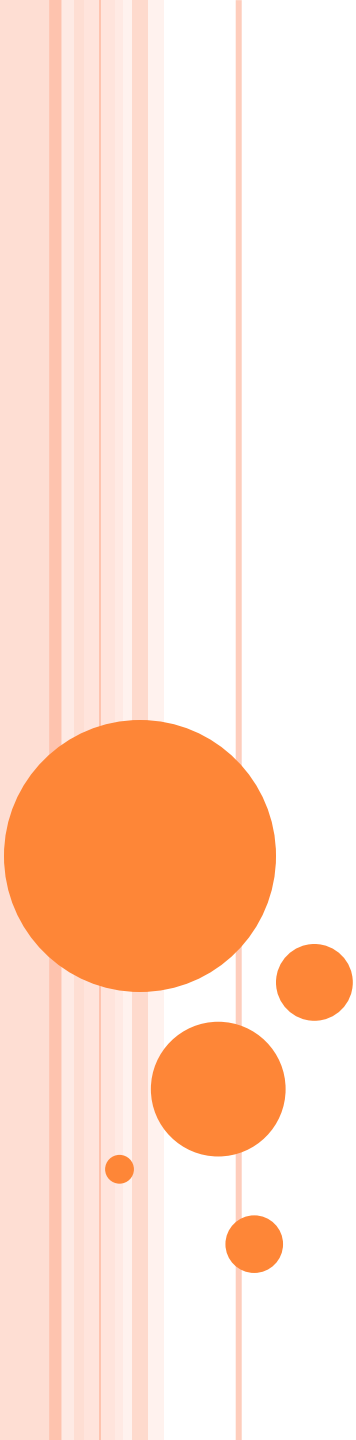


CASE 1

A 43-year-old man has complained of mild burning epigastric pain following meals for the past 3 years. Upper GI endoscopy is performed, and biopsies are taken from the lower esophageal mucosa. The biopsies demonstrate the **change** of the normal squamous esophageal mucosa to columnar epithelium with goblet cells. Which of the following mucosal alterations is most likely represented by these findings?

- A Dysplasia
- B Hyperplasia
- C Carcinoma
- D Ischemia
- E Metaplasia



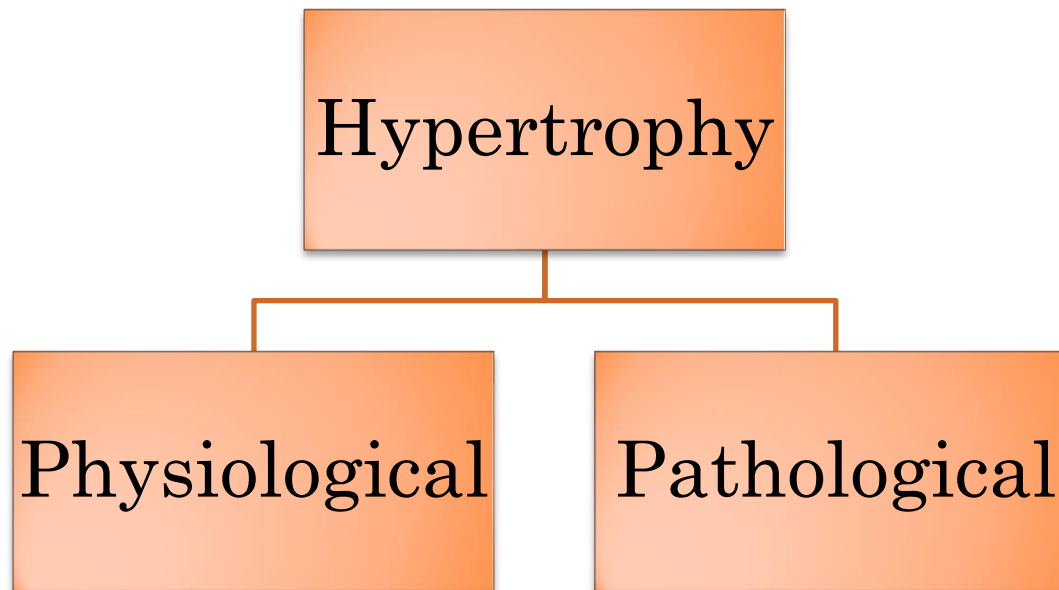


**NOW WE WILL STUDY EACH TYPE
OF ADAPTATION**

Prepare

HYPERTROPHY

- Definition: It is the increase in the size of the cell



HYPERTROPHY

Physiological



- Skeletal muscles of athletes
- Uterus during pregnancy



Pathological

- Left ventricle hypertrophy in aortic stenosis
- Stomach hypertrophy in pyloric stenosis

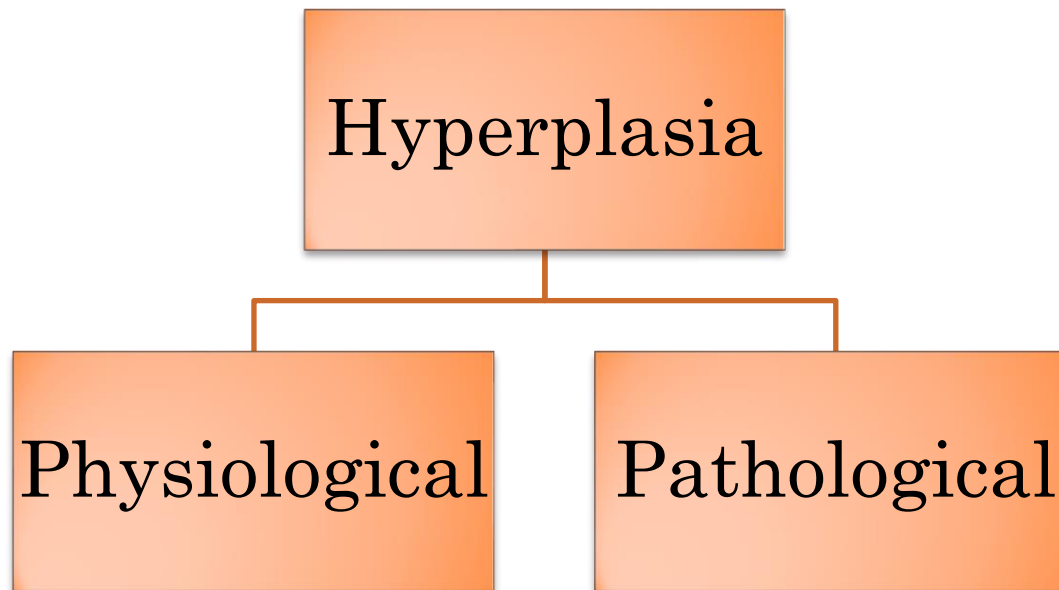


HYPERTROPHIED LT VENTRICLE



HYPERPLASIA

- Definition: Increase in the **number** of the cells. It occurs only in the cells that can divide.



HYPERPLASIA

Physiological

- Breast during pregnancy and lactation
- Thyroid at puberty and at pregnancy

Pathological

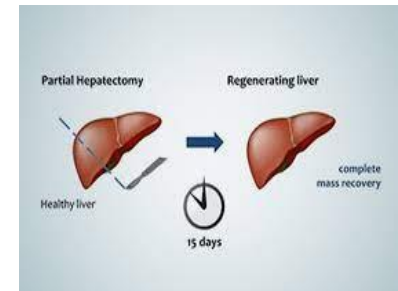
- Compensatory
- Hormonal
- Irritative



PATHOLOGICAL HYPERPLASIA

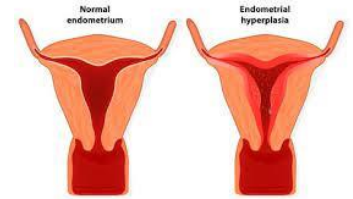
- **Compensatory :**

Liver after partial hepatectomy



- **Hormonal**

Endometrium: under effect of estrogen

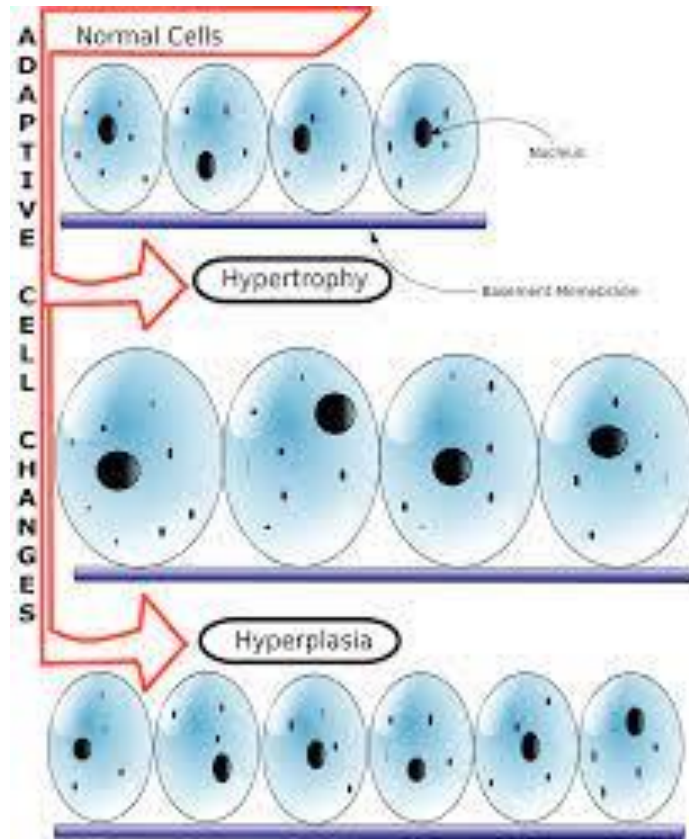


- **Irritative**

Lymph nodes in response to infection



HYPERTROPHY VS HYPERPLASIA



CASE 2

A 22-year-old woman gives birth to her first child. She begins breast feeding the infant. She continues breast feeding for almost a year with no difficulties. Which of the following cellular processes that occurred in the breast during pregnancy allowed her to nurse the infant for this period?

- A Stromal hypertrophy
- B Epithelial dysplasia
- C Steatocyte atrophy
- D Ductal epithelial metaplasia
- E Lobular hyperplasia



ATROPHY

- **Definition:** Decrease in the size or the number of the cells

- **Physiological**

Generalized : Senility(aging)

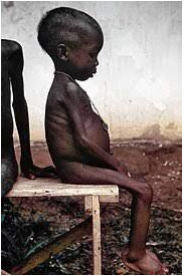
Localized: Adenoid in adult

Thymus in adults



PATHOLOGICAL ATROPHY

Generalized



Starvation

Cancer

Localized

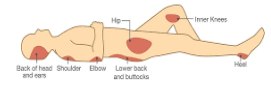
Disuse: muscles of immobilized limb



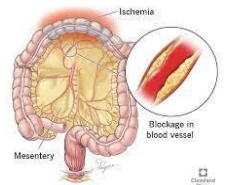
Neuropathic: muscle supplied damaged nerve



Pressure: bed sores



Ischemic



Endocrinal: uterus after menopause



CASE 3

A 23-year-old male has a right leg fracture for 2 months. After removal of the cast, he observed that his right leg is smaller in size than the left one. Which of the following can explain this atrophy?

Physiological

Thermal

Pressure

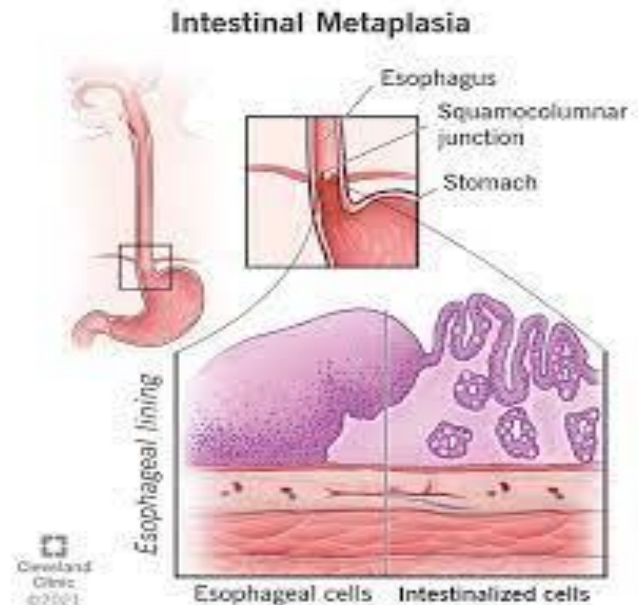
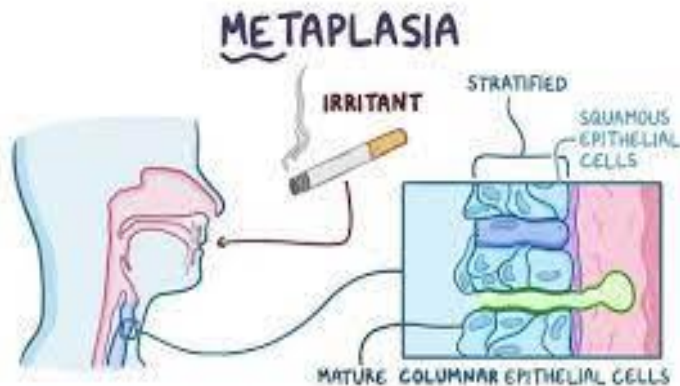
Disuse

Hormonal

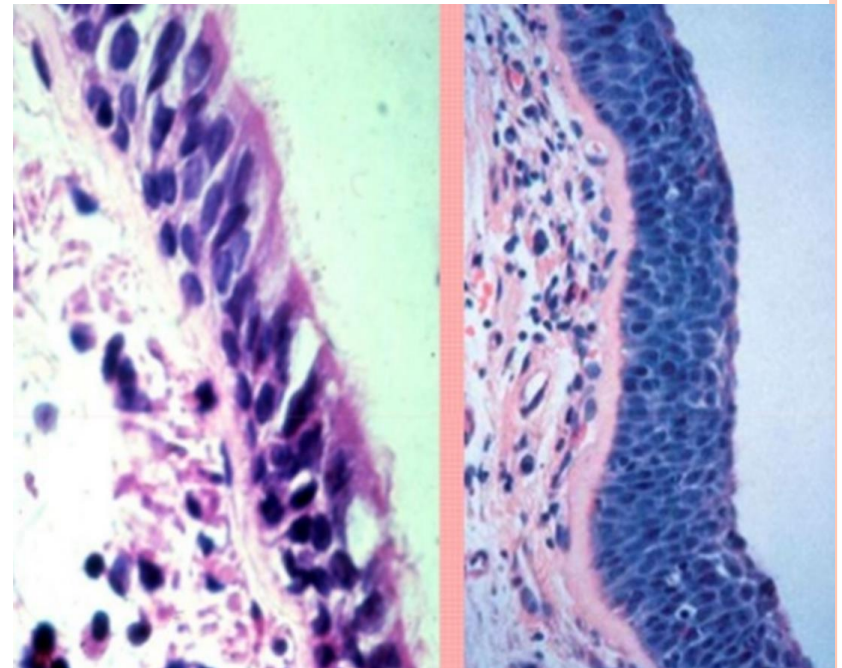
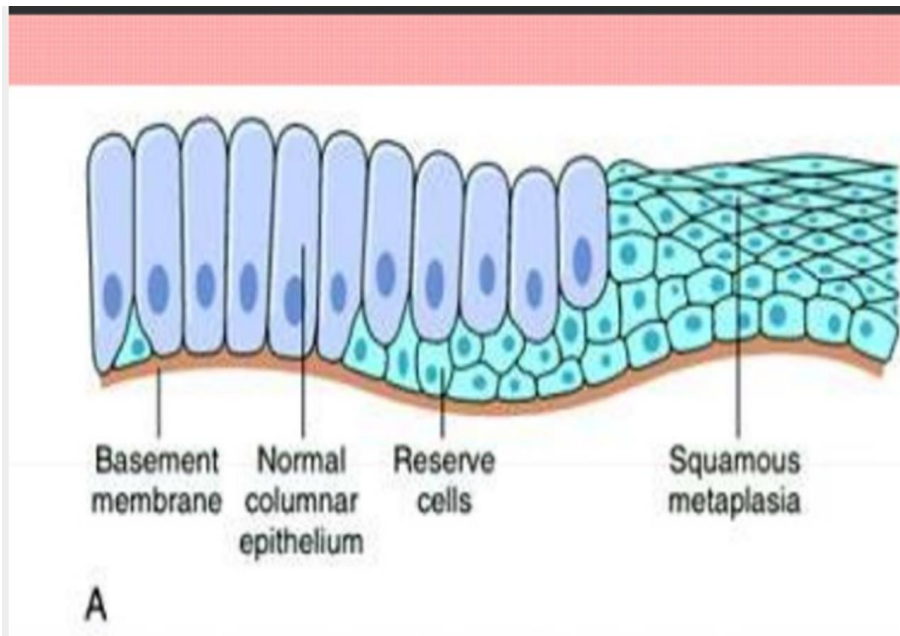


METAPLASIA

- **Definition:** A reversible change in which one mature/adult cell type (epithelial or mesenchymal) is **changed** to another mature cell type of the same category



METAPLASIA



EPITHELIAL METAPLASIA

In smoker



- Columnar epithelium of bronchus

Squamous epithelium

In reflux esophagitis



- Squamous epithelium of the esophagus

Columnar epithelium

Chronic cystitis



- Transitional epithelium of UB

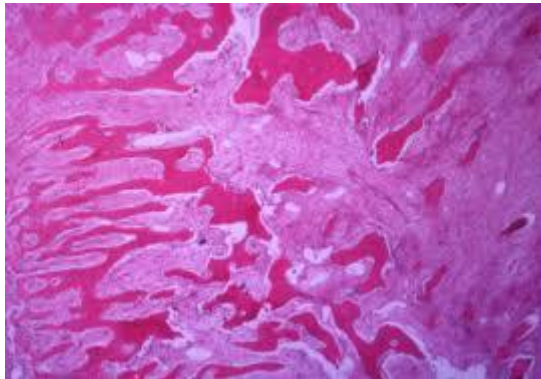
Squamous epithelium



MESENCHYMAL METAPLASIA

Myositis ossificans: occurs after trauma to muscle

- Fibroblasts change to osteoblasts which lay down osteoid tissue



CASE 4

A 45-year-old female has severe trauma with dark colored hematoma in her arm after car accident. 3 months later, she presented with hard nodule in her elbow. Which of the following is the most common cause?

- Physiological hypertrophy
- Pathological hyperplasia
- Mesenchymal metaplasia
- Epithelial metaplasia
- Compensatory hyperplasia



TAKE HOME MESSAGE



CELLULAR RESPONSES TO CELL INJURY

NORMAL CELL

Increased functional demand

ADAPTATIONS

ATROPHY,
HYPERTROPHY,
HYPERPLASIA,
METAPLASIA,
DYSPLASIA

Stress removed

**NORMAL CELL
RESTORED**

Mild to moderate stress

REVERSIBLE CELL INJURY

DEGENERATIONS,
SUBCELLULAR
ALTERATIONS,
INTRACELLULAR
ACCUMULATIONS

Stress removed

**REPAIR AND
HEALING**

Severe, persistent stress

IRREVERSIBLE CELL INJURY

CELL DEATH

