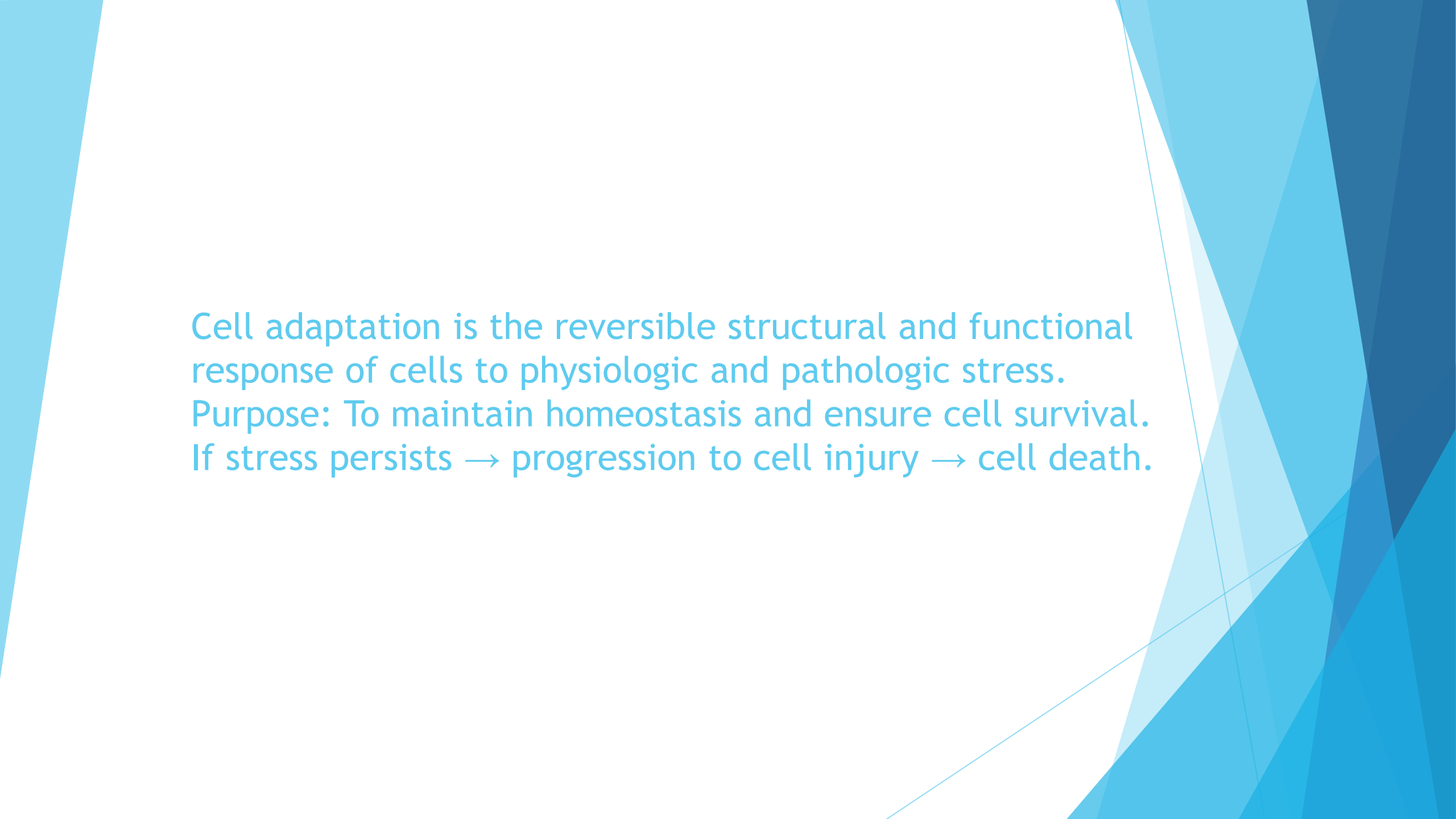


CELLULAR ADAPTATION

www.dentaltutor.in

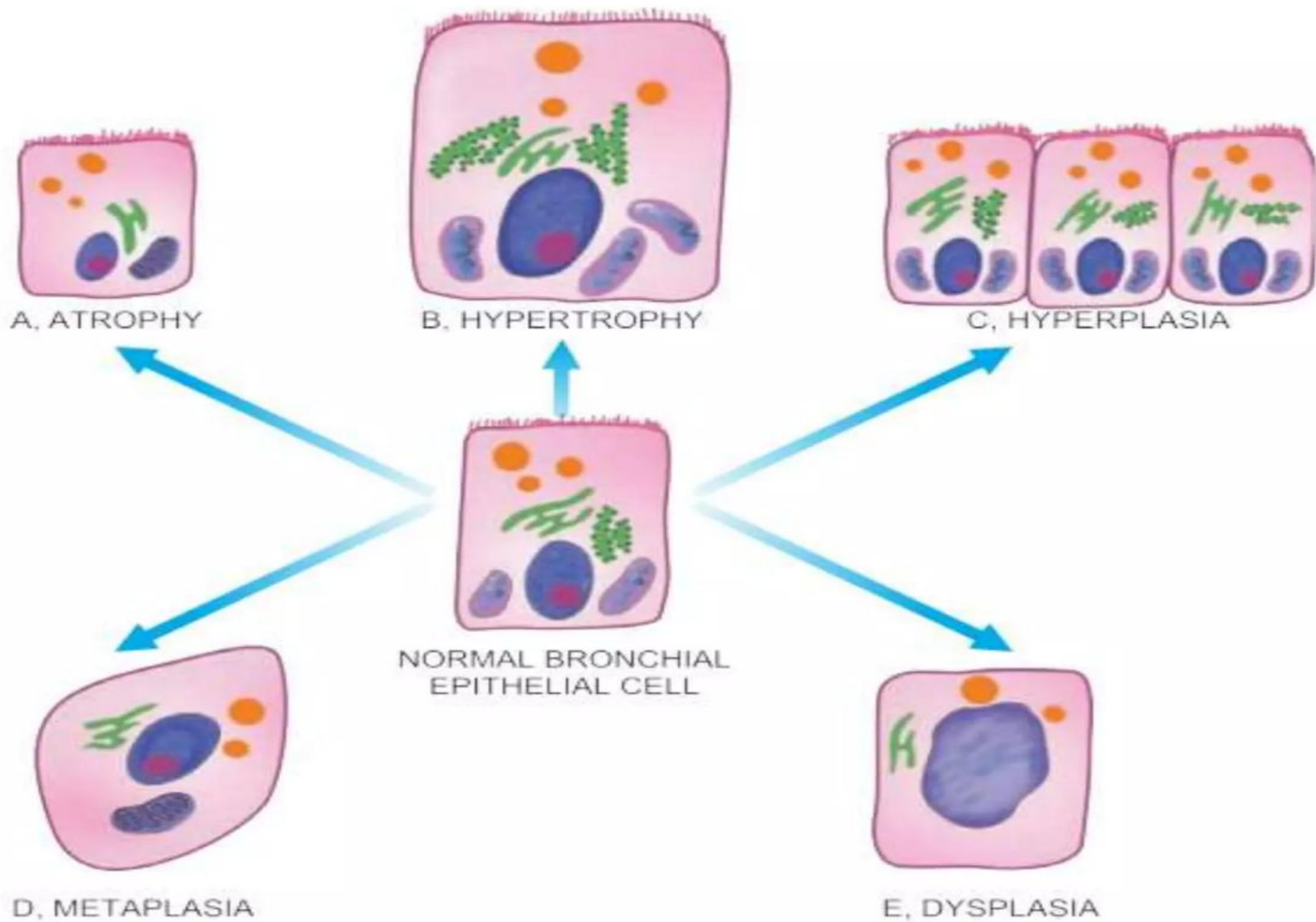


The background of the slide features abstract, overlapping geometric shapes in various shades of blue, ranging from light sky blue to deep navy blue. These shapes are primarily located on the right side and bottom of the slide, creating a modern, dynamic feel.

Cell adaptation is the reversible structural and functional response of cells to physiologic and pathologic stress.
Purpose: To maintain homeostasis and ensure cell survival.
If stress persists → progression to cell injury → cell death.

Types of Cell Adaptation

1. **Atrophy** - decrease in cell size.
2. **Hypertrophy** - increase in cell size.
3. **Hyperplasia** - increase in cell number.
4. **Metaplasia** - replacement of one cell type with another.
5. **Dysplasia** - disordered cell growth (pre-malignant).



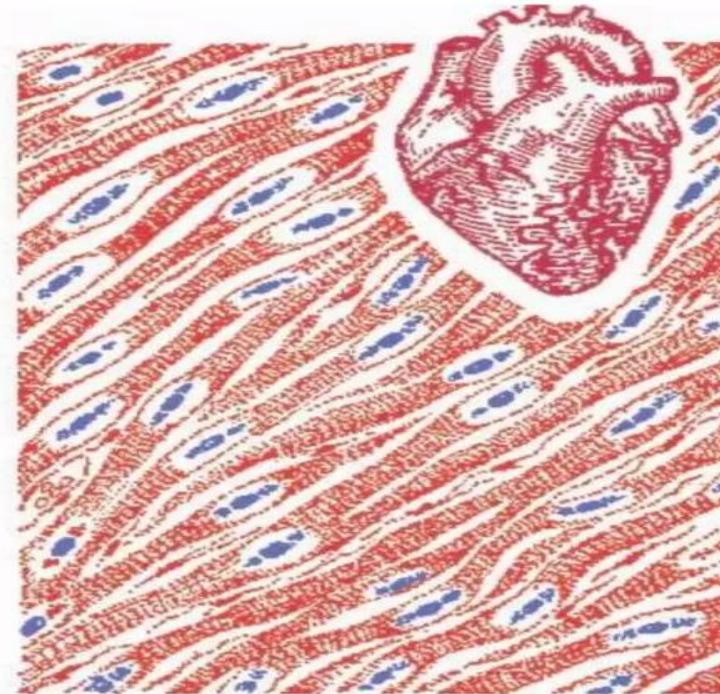
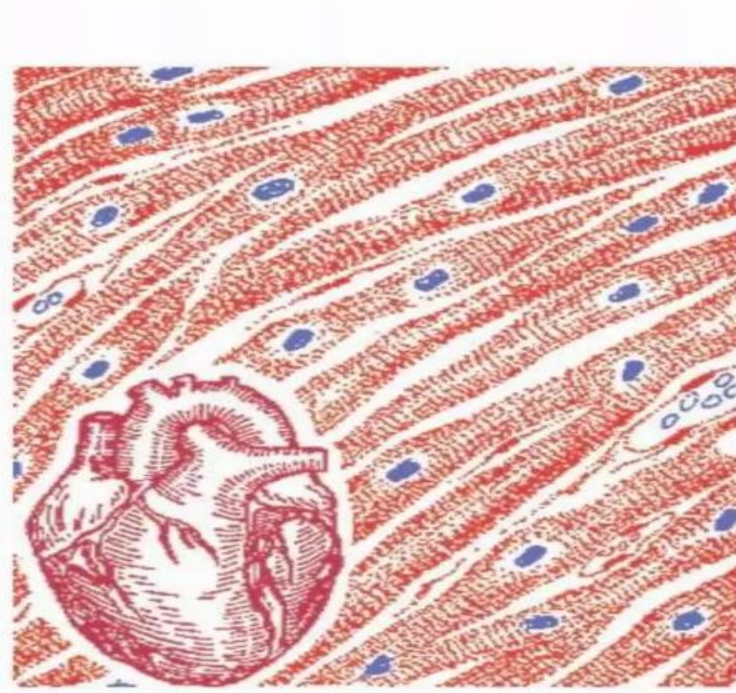
Atrophy

- **Definition:** Reduction in cell size and organ volume.
- **Causes:**
 - Decreased workload (immobilization).
 - Denervation.
 - Ischemia or poor nutrition.
 - Aging.
- **Examples:** Brain atrophy in Alzheimer's disease, muscle atrophy in limb immobilization.

Atrophy

Definition: Acquired loss of size due to reduction of cell size or number of parenchyma cells in an organ

Types: Physiologic or Pathological



Left Normal
Atrophy

Right

ATROPHY

Atrophy may occur from physiologic and pathologic causes:

PHYSIOLOGIC
ATRPOHY

Atrophy of brain with aging.

Atrophy of gonads after menopause.

Physiologic atrophy

- ▶ A normal process of aging in some tissues, which could be due to loss of endocrine stimulation or arteriosclerosis.
 - Atrophy of **lymphoid** tissue in lymph nodes, appendix and thymus.
 - Atrophy of **gonads** after **menopause**.
 - Atrophy of **brain** with **aging**.



Pathologic atrophy.

- ▶ Starvation atrophy.
- ▶ Ischaemic atrophy
- ▶ Disuse atrophy.
- ▶ Neuropathic atrophy.
- ▶ Endocrine atrophy
- ▶ Pressure atrophy.
- ▶ Idiopathic atrophy

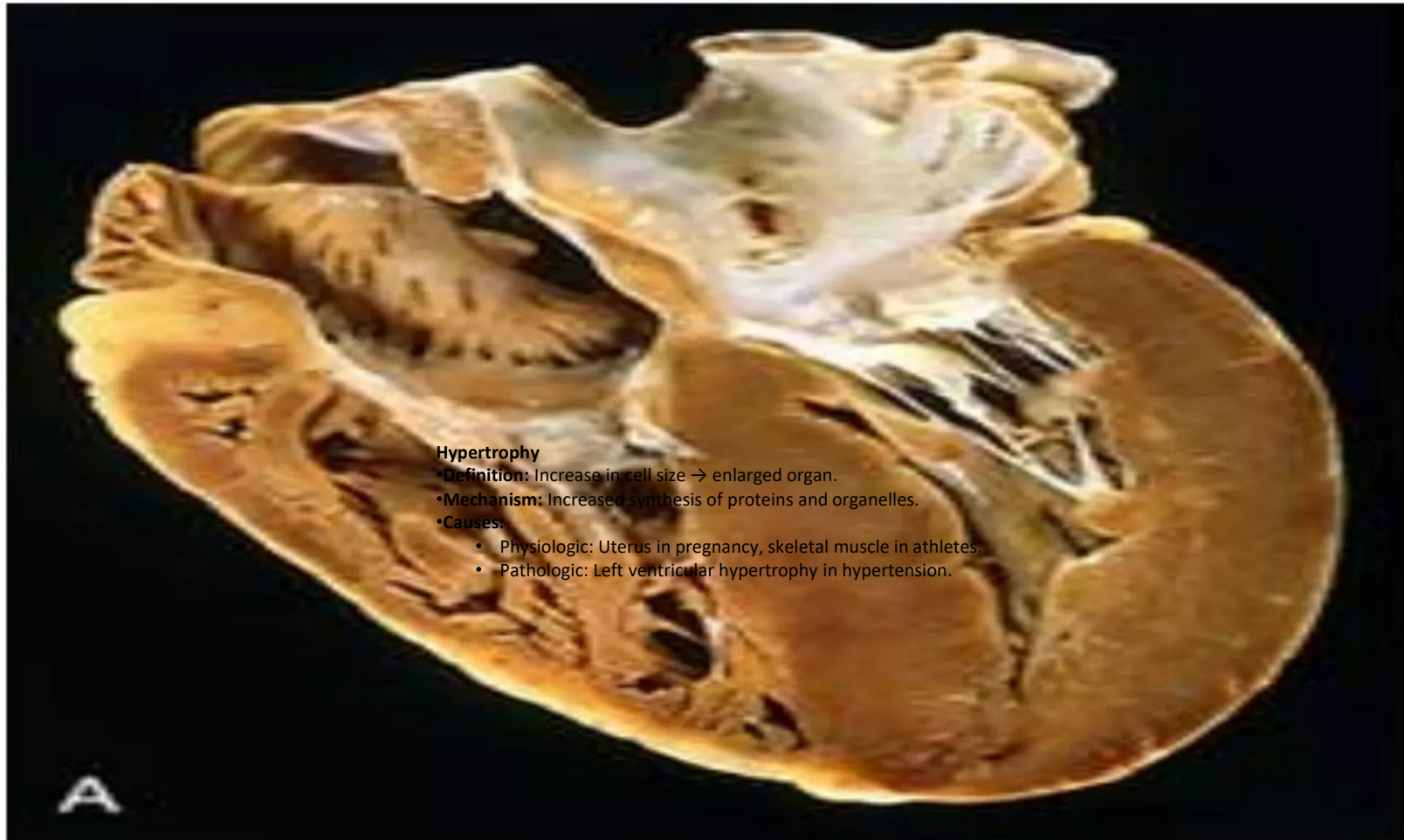
Hypertrophy

- **Definition:** Increase in cell size → enlarged organ.
- **Mechanism:** Increased synthesis of proteins and organelles.
- **Causes:**
 - Physiologic: Uterus in pregnancy, skeletal muscle in athletes.
 - Pathologic: Left ventricular hypertrophy in hypertension.

HYPERTROPHY

- Hypertrophy is an increase in the size of parenchymal cells resulting in enlargement of the organ or tissue, without any change in the number of cells.





Hypertrophy

• **Definition:** Increase in cell size → enlarged organ.

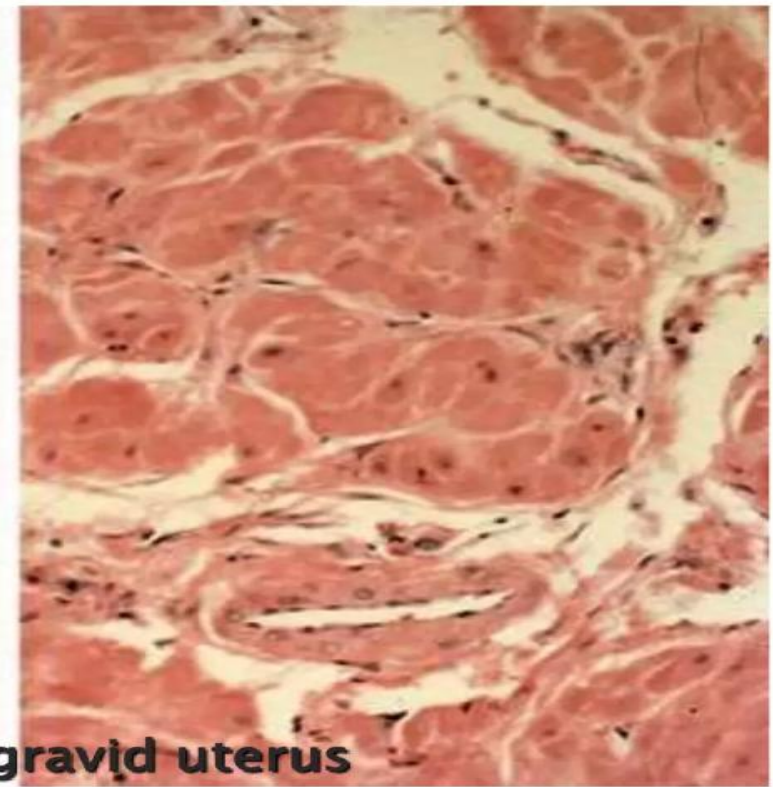
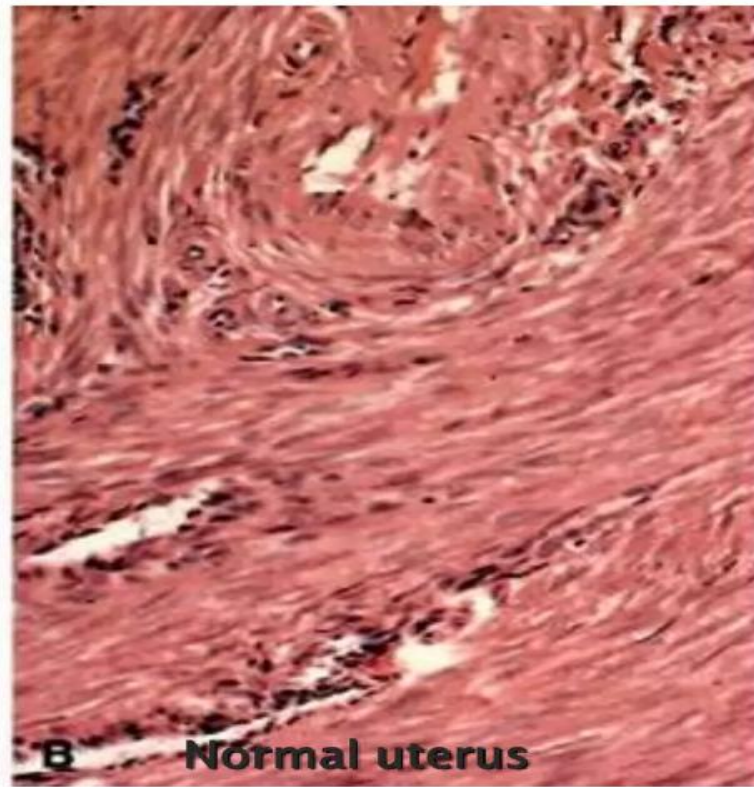
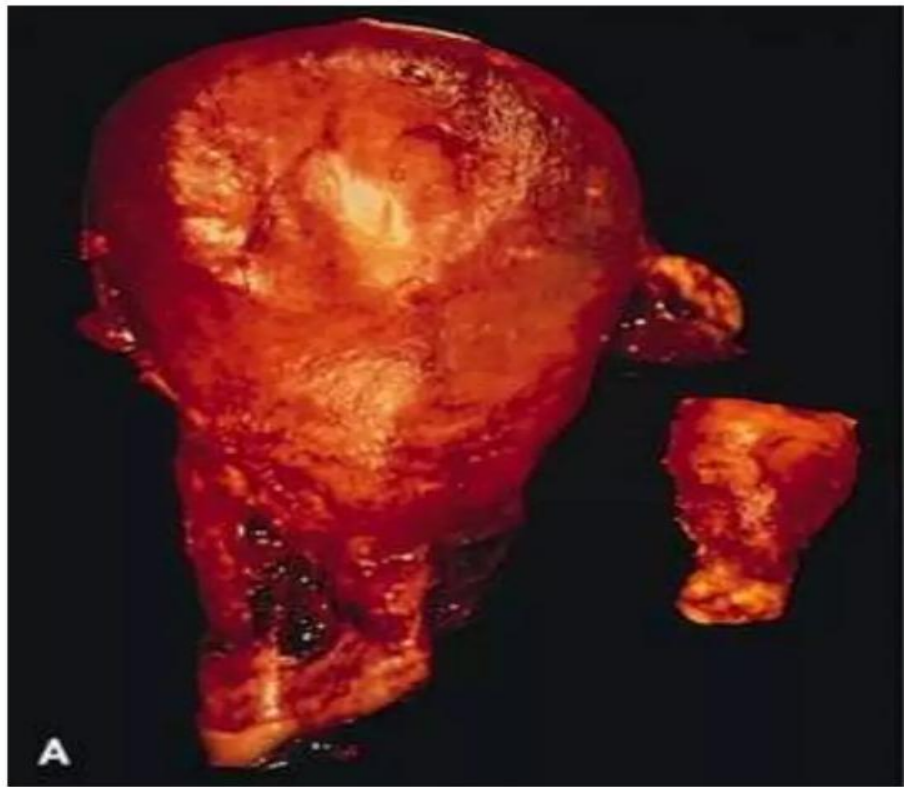
• **Mechanism:** Increased synthesis of proteins and organelles.

• **Causes:**

- Physiologic: Uterus in pregnancy, skeletal muscle in athletes.
- Pathologic: Left ventricular hypertrophy in hypertension.

Hypertrophied heart

(From ROBBINS BASIC PATHOLOGY, 2003)



Physiologic hypertrophy of the uterus during pregnancy. A, gross appearance of a normal uterus (right) and a gravid uterus (left) that was removed for postpartum bleeding,

(From ROBBINS BASIC PATHOLOGY, 2003)

Hyperplasia

- **Definition:** Increase in the number of cells.
- **Causes:**
 - Physiologic: Hormonal (endometrial proliferation in menstrual cycle), compensatory (liver regeneration).
 - Pathologic: Endometrial hyperplasia, benign prostatic hyperplasia (BPH).
- **Note:** Controlled process, but can predispose to cancer.

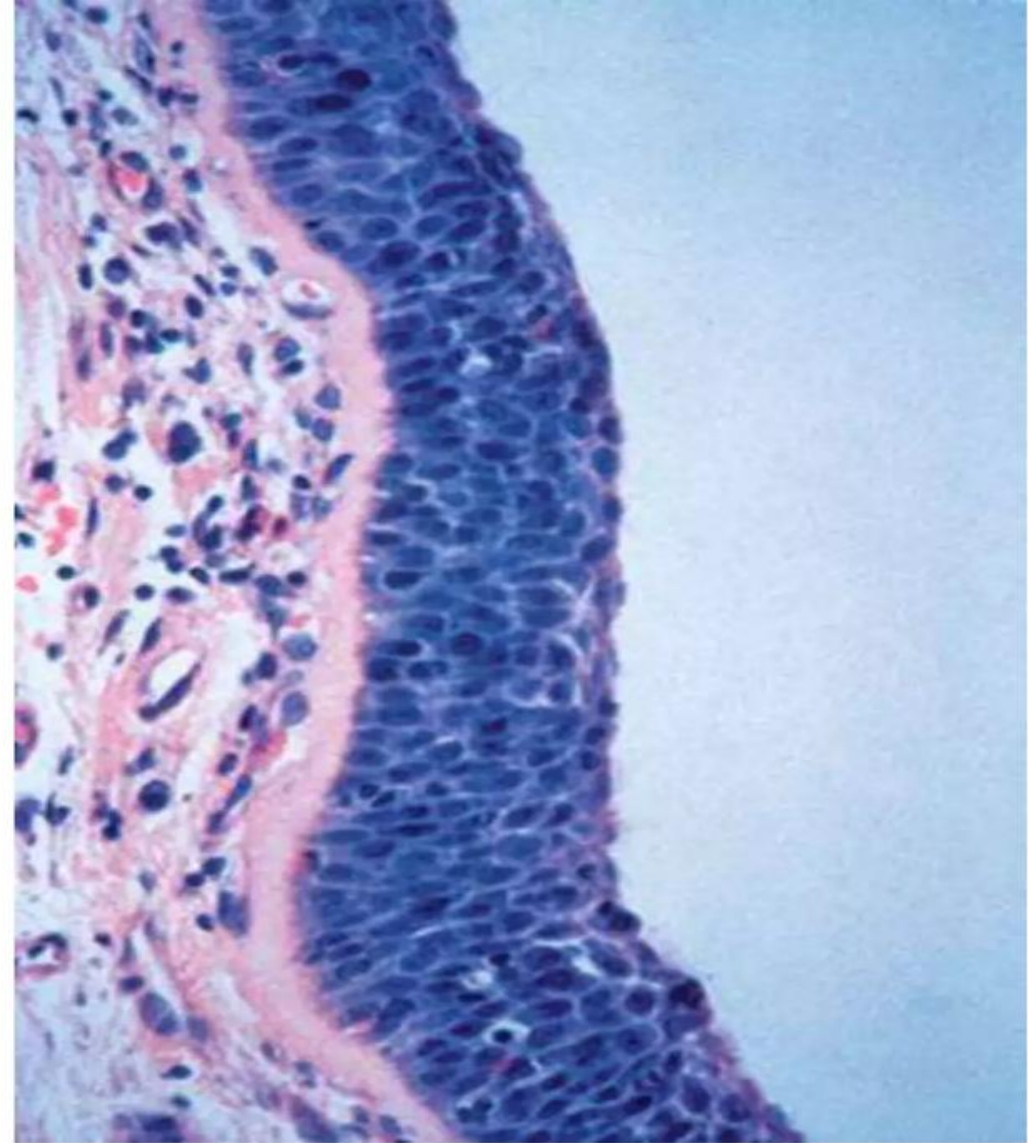
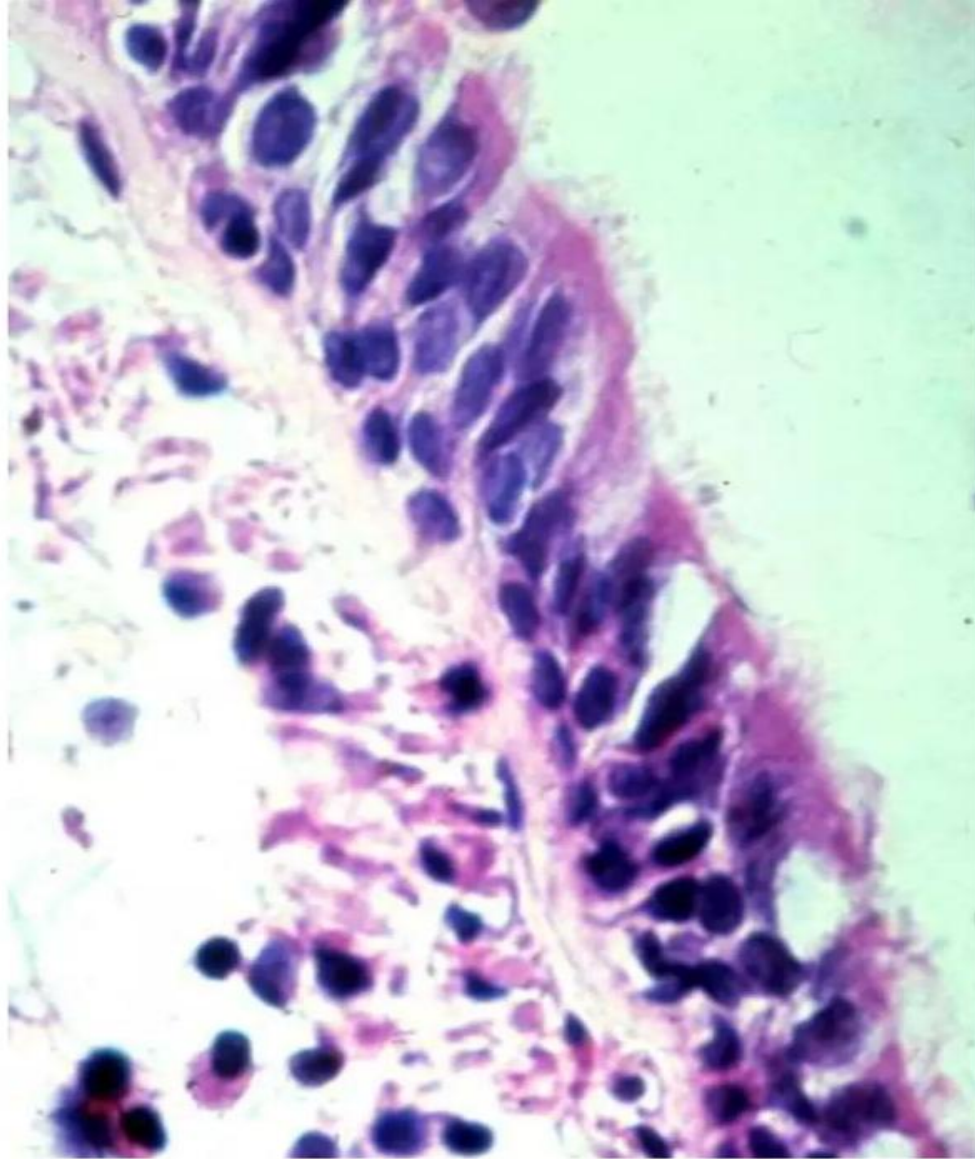
Metaplasia

•**Definition:** Replacement of one differentiated cell type by another more resilient type.

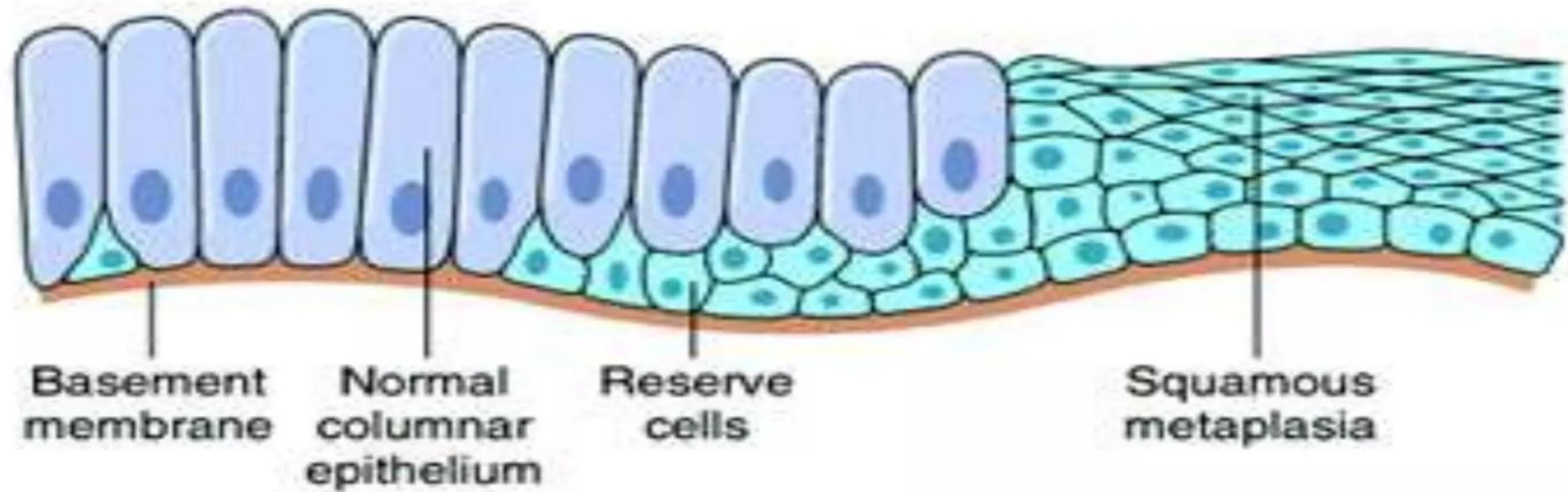
•**Examples:**

- Bronchial squamous metaplasia in smokers (columnar → squamous).
- Barrett's esophagus (squamous → columnar epithelium).

•**Significance:** May progress to dysplasia and malignancy.



Squamous metaplasia in bronchitis
(offered by Prof.Orr)



Schematic diagram of columnar to squamous metaplasia

(From **ROBBINS BASIC PATHOLOGY**, 2003)

Dysplasia

- **Definition:** Disordered growth and maturation of cells with loss of uniformity.
- **Causes:** Often due to chronic irritation or infection (e.g., HPV in cervix).
- **Examples:** Cervical intraepithelial neoplasia (CIN).
- Considered a **precancerous lesion**.