# *SNS COLLEGE OF ALLIED HEALTH SCIENCES*
# *SNS KALVI NAGAR,COIMBATORE-35*
# *AFFILIATED TO Dr MGR UNIVERSITY,CHENNAI*

## *DEPARTMENT OF OPERATION THEATRE AND ANAESTHESIA TECHNOLOGY*

## *1st YEAR*

## *SUBJECT:PATHOLOGY*

## ***TOPIC:CELLULAR ADAPTATION***

## DEFINITION:

- Adaptation is a reversible change in:

1. Size
2. Number
3. Phenotype
4. Metabolic activity or function of cell in response to physiological changes or mild injurious agents in their micro environment resulting in new steady state preserving structure and function of the cell

# TYPES:

Various types of adaptations are:

- Change in size of cells - atrophy & hypertrophy
- (it affect all types of cells.eg:labile,stable & permanent cells)
- Change in number of cells - hyperplasia
- (affects only liable & stable cells)
- Change in phenotype - metaplasia
- (affects only liable & stable cells)

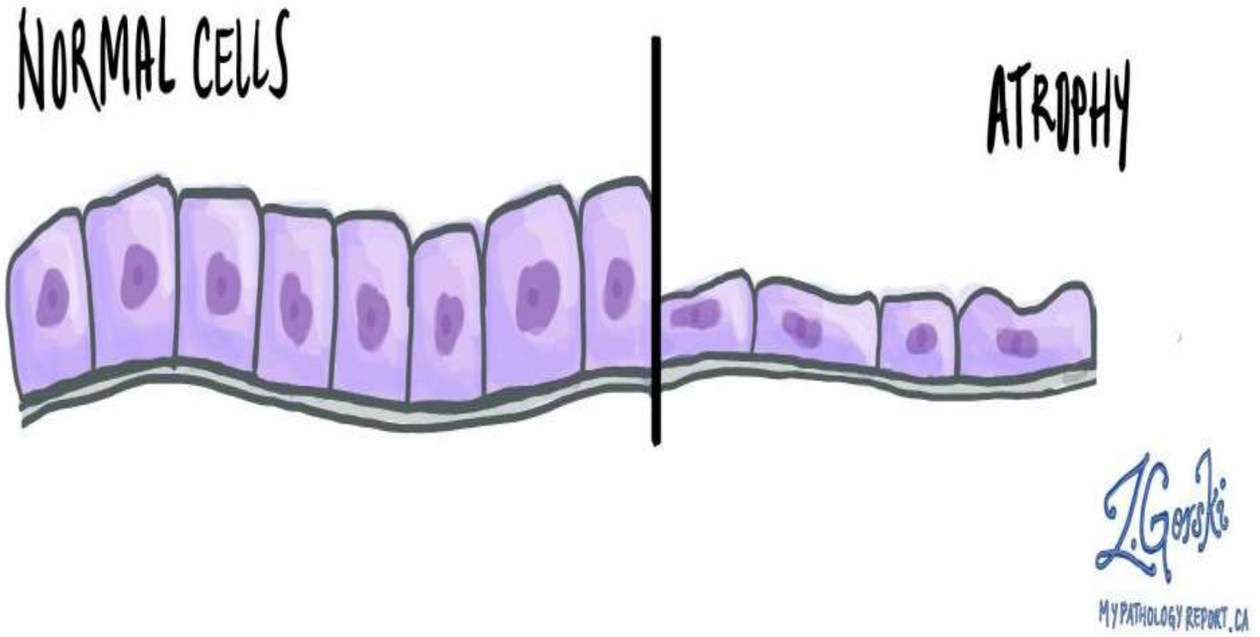
1. Atrophy:

- Decrease in cell size,may lead to decreased organ size,depending on number of cells affected.

Etiology:

Physiological:

- Notochord
- Thyroglossal duct
- Many other embryonic /fetal structures during embryogenesis or shortly after birth.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Pathological:

- Decrease in:
- Nutrition
- Blood flow
- Neural stimulation
- Hormones
- Work load(Increase in external pressure)

<u>Pathogenesis:</u>

- Decrease in protein synthesis
- Increase in protein synthesis
- Autophagy

## C/f Prognosis:

- Decrease in size of cells & organs
- Decrease function of cell & organ
- Withdrawl of initiating cause is followed by recover to normal
- Persistence of cause leads to cell death

## 2.HYPERTROPHY:

- Decrease in size of cell

### Etiology:

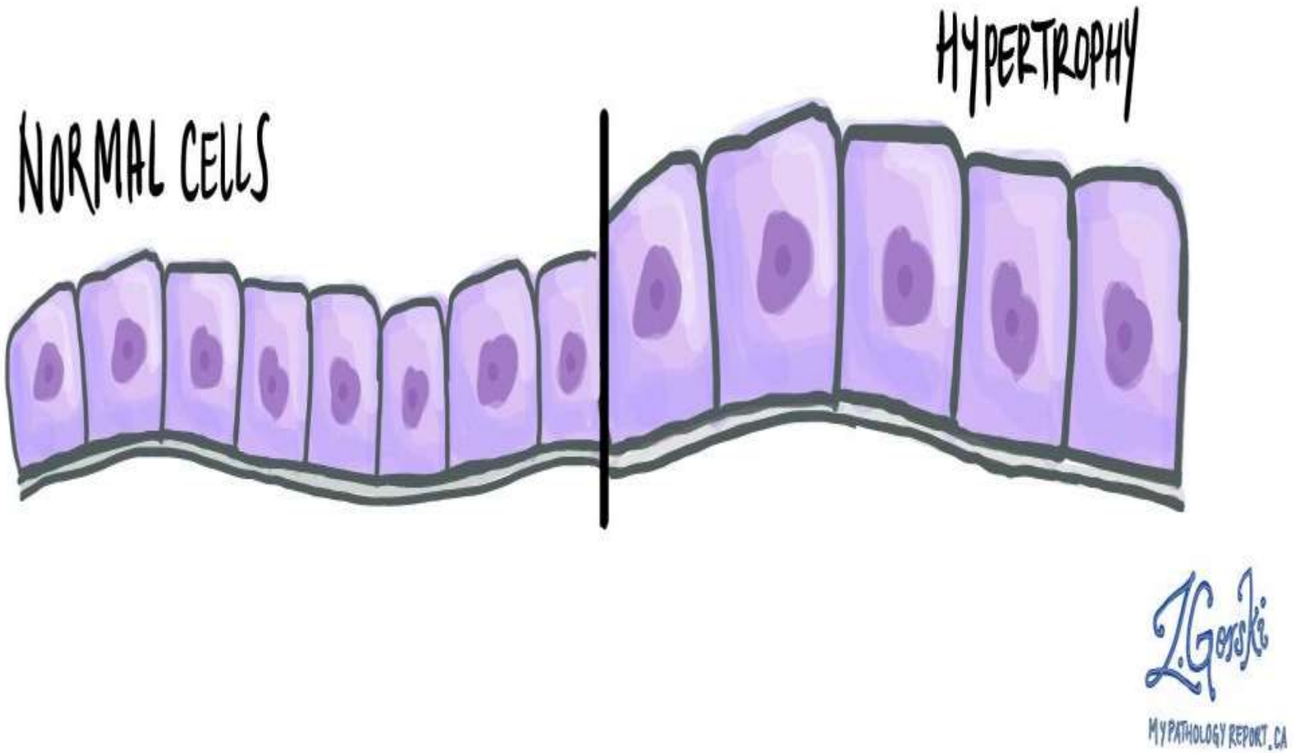
Physiological:

- Increased workload(Hypertension)
- Hormonal changes
- Workout
- Enlargement of uterus in pregnancy

Pathological:

- Hyertrophy of cardiac muscle

(Aortic valve disease)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## Pathogenesis:

- Mechanical stretch
- Increase in growth factors & adnergenic hormones
- Increased protein synthesis
- Change to featl or neonatal type

eg:Alpha myosin of adult muscle replaced by beta myosin as it is more energy efficient

## Morphology:

- Increase size of cell & organ ,increase protein in each cell

## Clinical Features:

- Increase work done per cell
- Return to normal if stimulus is withdrawn
- Degenerative changes or cell injury occurs if cause persists

## 3.Hyperplasia:

- Increase in number of cells by proliferative of cells.

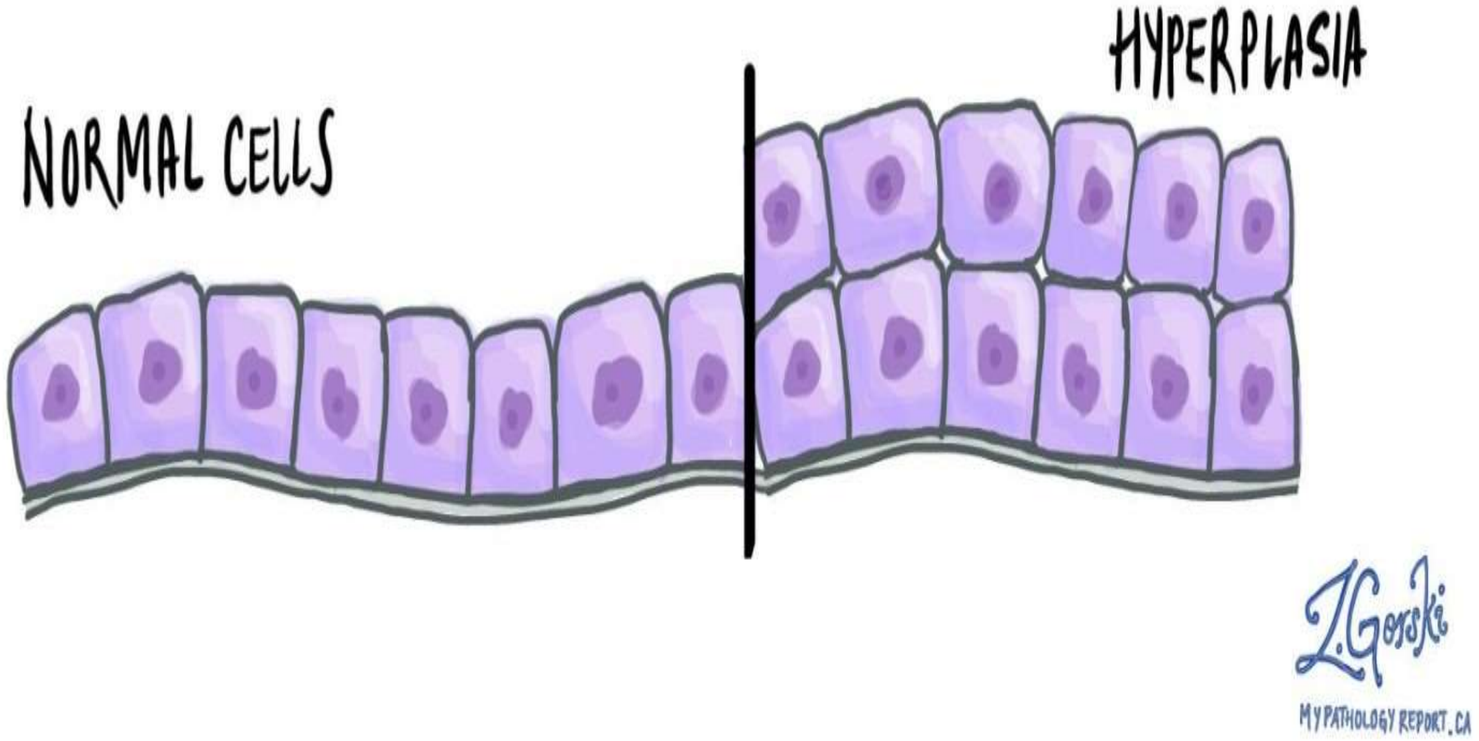
## Etiology:

1.Physiological:

- Hormonal changes - eg:Lactation
- Compensatory changes Following loss of tissue - eg:Nephrectomy

2.Pathological:

- Excess hormones
- Excess growth factors
- Some viral infections


HYPERPLASIA
NORMAL CELLS
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## Pathogenesis:

- Growth factors are increased leading to increase in mitotic activity of cell

## Morphology:

- Associated hypertrophy is usually present
- Increase in number of cells & size of cells
- Increase in size of organ if sufficient number of cells are affected

## C/F prognosis:

- Increase number of cells leads to increase work done by the organ

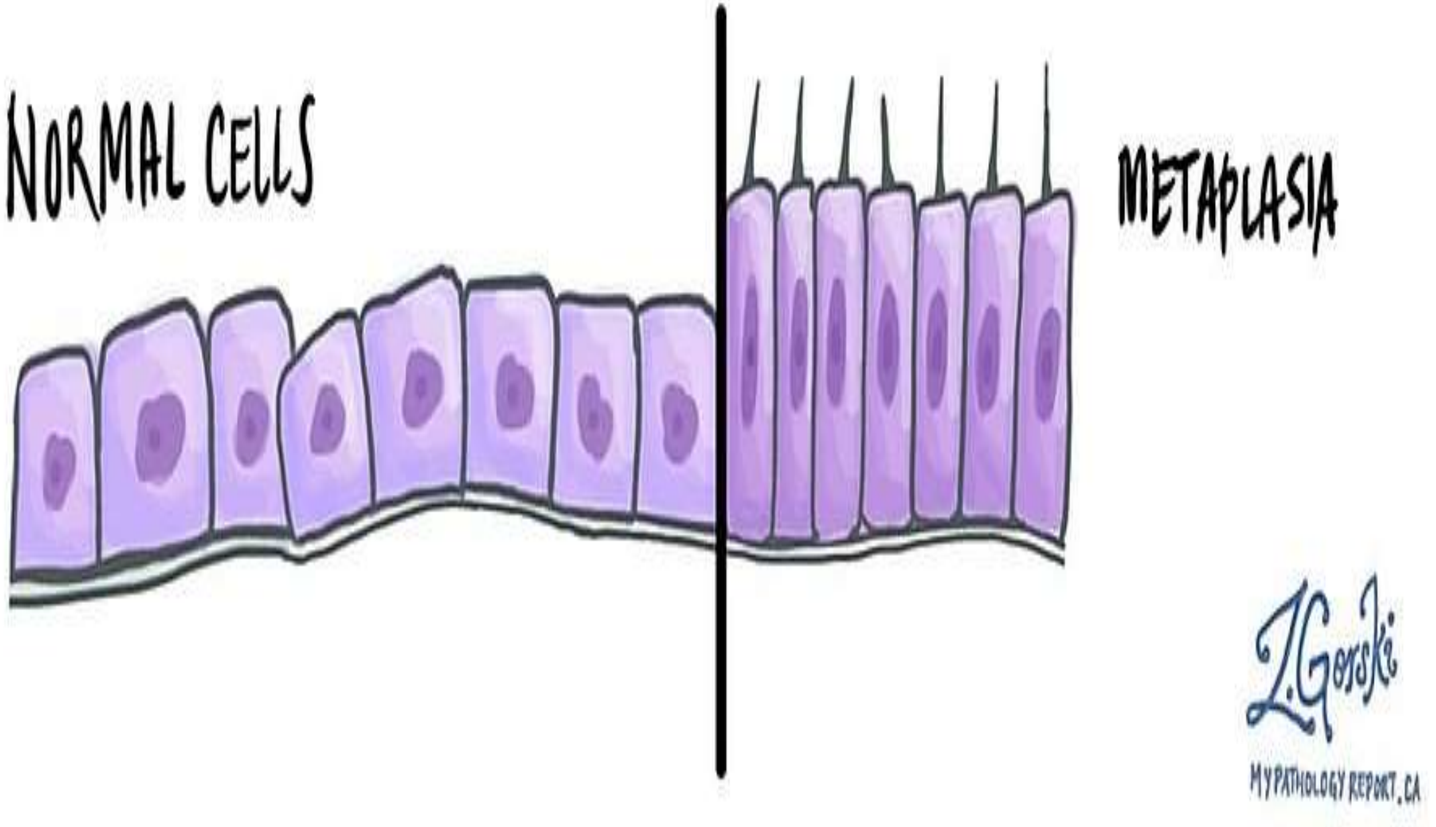
- Returns to normal on withdrawl of stimulus
- If cause & increased mitotic activity persist ,it increases mitotic activity persist,it increases chances of mutations and may lead to dysplasia & Neoplasia.

## 4.Metaplasia:

- Reversible change of one type adult cell to other type of adult cell

## Etiology:

- Chemicals - Tobacco smoke,GI secretions in inappropriate site eg:gastric secretions in esophagus
- Mechanical - Calculi eg:gall bladder & bladder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- Vitamin A deficiency
- Chronic infection eg:H Pylori(helicobacteri)

## Pathogenesis:

- Reprogramming of stem cells to differentiate to cells better able to withstand stress
- Accompained by loss of specialized cellular function

## Morphology:

- Ciliated columnar cells in bronchus change to squamous cells due to tobacco smoke
- Squamous epithelium in esophagus changes to intestinal/gastric type due to reflux of gastric secretions

- Transitional urothelium of bladder changes to squamous epithelium due to mechanical trauma of calculus
- Mesenchymal tissues also show features of metaplasia, though less commonly than epithelial tissues,eg:fibrous tissue may change to bony tissue ,following repeated mild trauma.

C/F Prognosis:

- Loss of normal function with survival advantages ,eg:loss of ciliary function in bronchial mucosa
- Returns to normal on withdrawl of stimulus
- Increase in incidence of malignancy

## 5.Dysplasia:

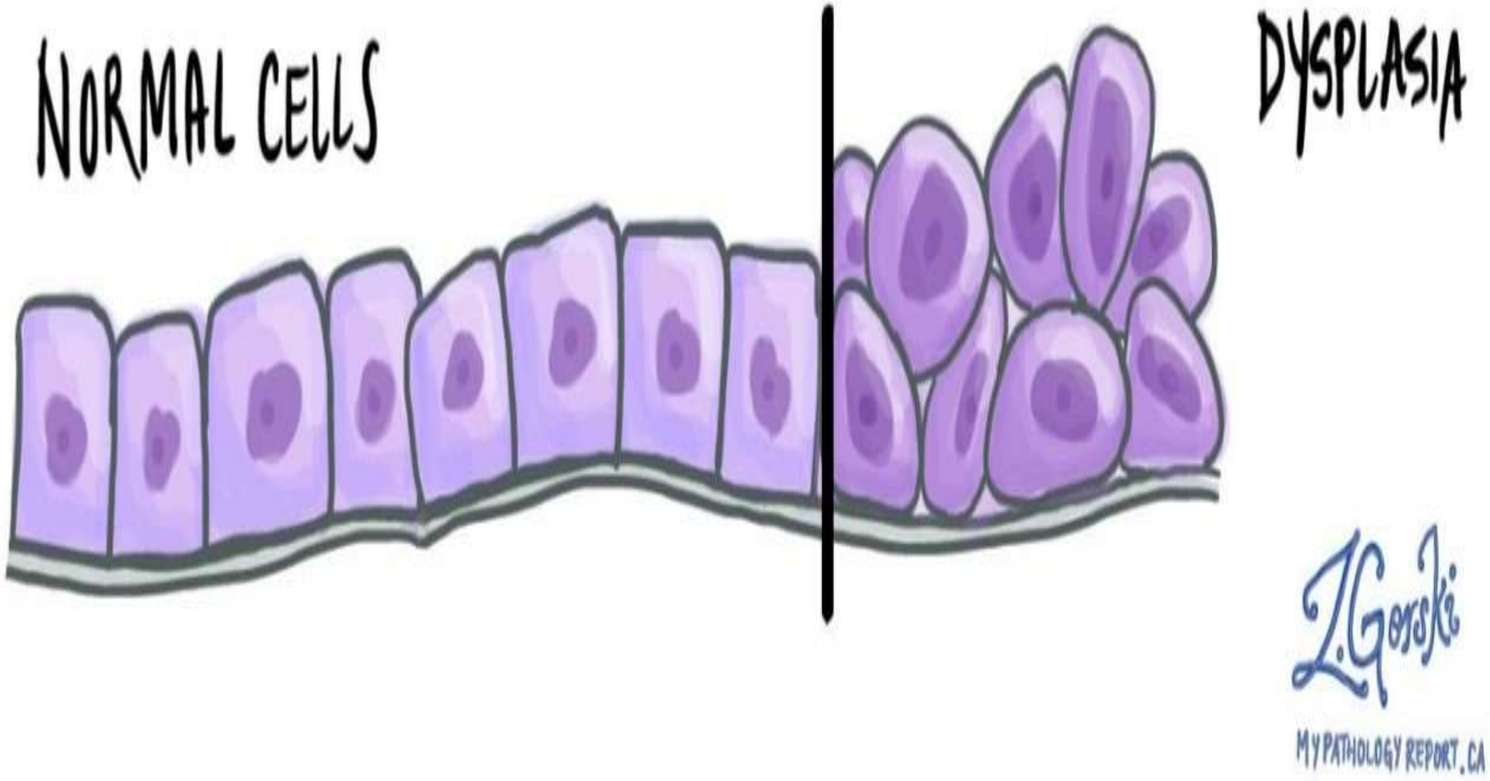
- Dysplasia is a growth disorder,charecterized by loss of uniformity of cells & loss of normal cellular architecture.
- It ususally affects the epithelium cells,eg:uterine,cervix

## Etilogy:

- Chronic inflammation due to any cause:
- Chemical-Smoking
- Infection-Human papilomma virus
- Mechanical-Calculi

## Pathogenesis:

- Changes in basal cells,which promote mitosis with decrease differentiation & maturation of cells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## Classification of Dysplasia:

- Mild dysplasia - affects lower 1/3 of epithelium
- Moderate dysplasia - affects 2/3 of epithelium
- Severe dysplasia also known as carcinoma - affects all layers of epithelium ,however basement membrane is intact & there is no invasion

## Clinical Features:

- Dysplasia are usually asymptomatic or may present with non specific symptoms

## Prognosis:

- It is reversible in the early,mild,moderate stages
- The later severe stage,if untreated may progress to invasive cancer

# *THANK YOU*