

## PLANT GROWTH /

- ✦ Growth is fundamental feature of living being.
- ✦ Irreversible permanent increase in size of organ.
- ✦ Plant growth is indeterminate.
- ✦ Growth is measurable.

## Phases of Growth /

- ✦ **Meristematic** → constantly dividing cells at root & shoot apex.
- ✦ **Elongation** → Cell enlargement, cell wall deposition;
- ✦ **Maturation** → Away from apex; cells attain their maximum size & maximum thickening.
- ✦ Cells of meristematic zone are rich in protoplasm with large nuclei.

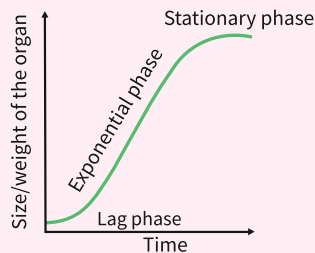
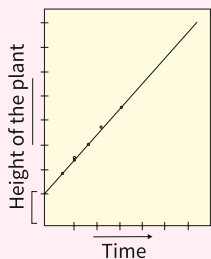
## Growth Rate /

Growth rate is increase in growth per unit time.

# 13. PLANT GROWTH AND DEVELOPMENT

## Patterns of Growth Rate /

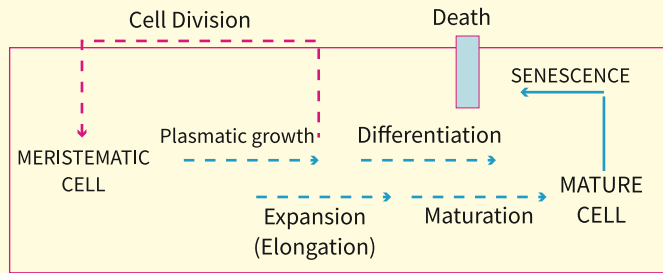
- ✦ **Arithmetic Growth** → One cell divides only; other matures.
- ✦ **Geometric Growth** → Both the cells divide.
- ✦ Arithmetic Growth occurs in root elongation.
- ✦ Geometric Growth occurs in all cells (embryo development).
- ✦ Geometric Growth follows sigmoid curve; Arithmetic growth follows linear curve.



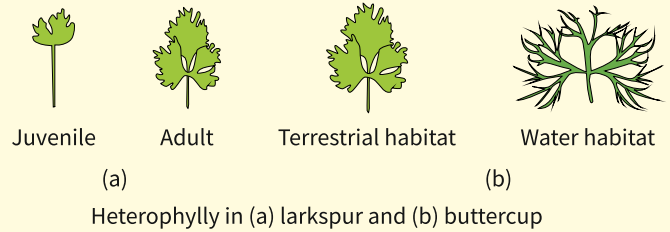
## Differentiation, Dedifferentiation, Redifferentiation

- ✦ **Differentiation** → cells differentiate become mature to do, specific function; lose capacity to divide.
- ✦ **Dedifferentiation** → cells regain capacity to divide
- ✦ **Redifferentiation** → Dedifferentiated cells again lose capacity to divide & matures.

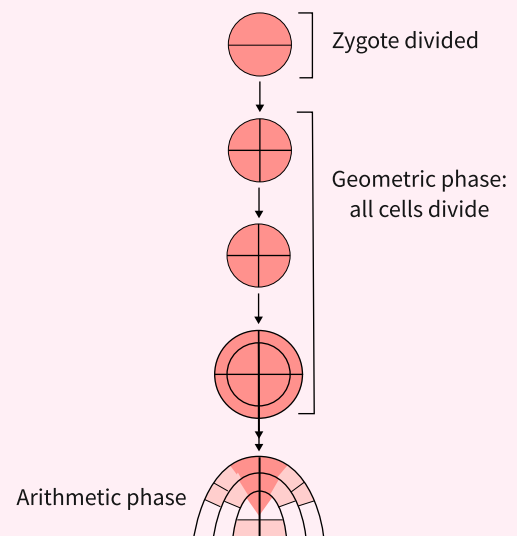
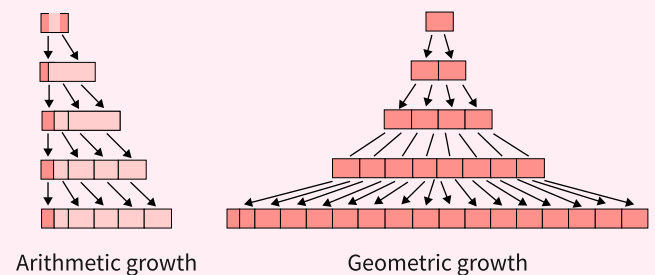
## Development Process of Plant Cell /



Sequence of the developmental process in a plant cell



## GROWTH + DIFFERENTIATION = DEVELOPMENT

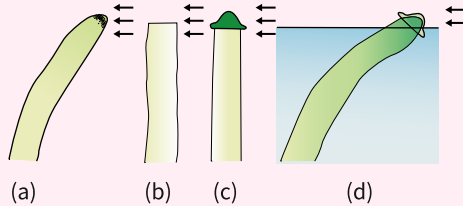


- = Cells capable of division
- = Cells that lose capacity to divide

Stages during embryo development showing geometric and arithmetic phases

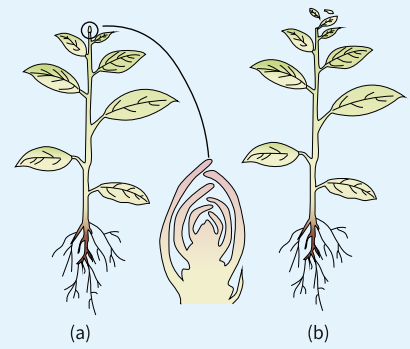
## Discovery

- ✦ Auxin observed by Darwin in coleoptiles of canary grass.
- ✦ Auxin isolated by F.W.Went from tips of coleoptiles of oat.
- ✦ Kurosawa identified gibberellic acid from *Gibberella fujikuroi*. He observed foolish seedling disease (bakanae) in rice.
- ✦ Skoog and Miller discovered cytokinin.
- ✦ H.H Cousins discovered Ethylene.



Experiment used to demonstrate that tip of the coleoptile is the source of auxin. Arrows indicate direction of light.

## Auxin



Apical dominance in plants : (a) A plant with apical bud intact (b) A plant with apical bud removed. Note the growth of lateral buds into branches after decapitation.

- ✦ Auxin first isolated from human urine.
- ✦ Bioassay of auxin → Avena – curvature
- ✦ IAA (Indole – 3- acetic acid)
- ✦ Initiate rooting; prevent fruit & leaf drop at early stage.
- ✦ Induces parthenocarpy in tomatoes.
- ✦ Produced at root & shoot apices.

## Cytokinins

- ✦ Discovered as kinetin.
- ✦ Effects cytokinesis.
- ✦ Does not found naturally in plants.
- ✦ Naturally found as Zeatin in coconut milk.
- ✦ Synthesized at regions of rapid cell division.

## PLANT GROWTH REGULATORS

- ✦ Plant growth regulators are plant hormones (phytohormones).
- ✦ There are chemical compounds.
- ✦ Can be growth promoters or growth inhibitors.
- ✦ Auxin, gibberellins, cytokinins are growth promoters.
- ✦ Abscissic acid is growth inhibitor
- ✦ Ethylene is growth inhibitor but also a promoter.

## Ethylene

- ✦ Gaseous hormone.
- ✦ Synthesized by ripening fruits & tissue undergoing senescence.
- ✦ Promotes abscission of leaves and flowers.
- ✦ Breaks seed dormancy; sprouting in potato.
- ✦ Promotes root hair formation. Brings about triple response.

## Gibberellins

- ✦ GA<sub>3</sub> first gibberellins to be discovered.
- ✦ Gibberellins are acidic.
- ✦ Increase the stem length (sugarcane).
- ✦ Improves fruit Shape (apple).
- ✦ Delays senescence.
- ✦ Promotes bolting in plants with rosette habit (cabbage).
- ✦ Used in malting process.

## Abscissic Acid

- ✦ Shortly called as ABA.
- ✦ Regulates abscission & dormancy.
- ✦ Plants growth & metabolic inhibitor.
- ✦ Important for seed development, maturation & dormancy called as stress hormone.
- ✦ Act against gibberellins.
- ✦ Stimulates closure of stomata in stress conditions.

