

PLANT GROWTH AND DEVELOPMENT

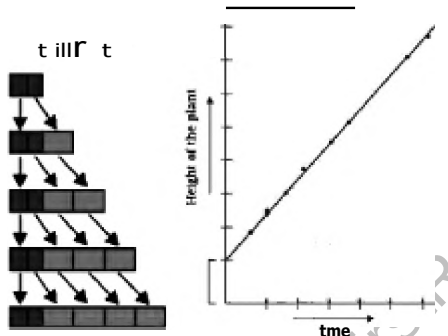
- **Definition** It is the sum of two processes growth and differentiation-
growth is a permanent or irreversible increase in dry weight, size, mass or volume of cell organ or organism. It is internal or intrinsic in living things.
- In plants growth is accomplished by cell division, increase in cell number and cell enlargement. So, growth is a quantitative phenomenon which can be measured in relation to time.
- Plant growth is generally indeterminate due to capacity of unlimited growth throughout the life. Apical meristematic tissue is present at the certain locality of plant body.
- The plant growth in which new cells are always being added to plant body is due to meristem is called open form of growth.
- Root apical meristem and shoot apical meristem are responsible for primary growth and elongation of plant body along the axis.
- Intercalary meristem located at nodes produce buds and new branches in plants.
- Secondary growth in plants is the function of lateral meristem that is vascular cambium and cork cambium.

Phases Of Growth

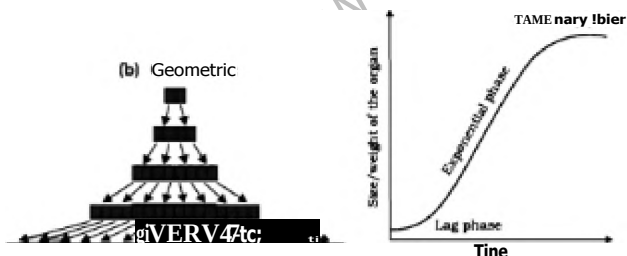
- **Formative phase** is also called as the phase of cell formation or cell division. It occurs at root apex, shoot apex and other region having meristematic tissue. The rate of respiration is very high in the cells undergoing mitosis division in formative phase.
- **Phase of Enlargement**- newly formed cells produced in formative phase undergo enlargement. Enlarging cells also develop vacuoles that further increase the volume of cell. Cell enlargement occurs in all directions with maximum elongation in conducting tissues and fibres.
- **Phase of maturation**. The enlarged cells develop into special or particular type of cells by undergoing structural and physiological differentiation.

Growth Rate- increase in growth per unit time is called .growth rate. Growth rate may be arithmetic or geometrical.
Arithmetic Growth - the rate of growth is constant and increase in growth occurs in arithmetic progression . 2,4,6,13
..., It is found in root and shoot elongation.

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Length after time = length at beginning + growth rate $\times$ (time).



1. **Geometric Growth**. here initial growth is slow and increase rapidly thereafter. Every cell divides. The daughter cell grows and divides and the granddaughter cells that result into exponential growth. Geometrical growth is common in unicellular organisms when grown in nutrient rich medium,



Sigmoidal growth curve consists of fast dividing exponential phase and stationary phase. It is typical of most living organisms in their natural environment.

Exponential growth can be represented as follows-

$V_t = W_0 e^{rt}$ = final size, W_0 = Initial size, r = growth rate, t = time of growth and e is the base

of natural logarithms 2.71828.

■ Cells produced by apical meristem become specialized to perform specific function. This act of maturation is called differentiation.

■ The living differentiated cells that have lost ability of division can regain the capacity of division. This phenomenon is called dedifferentiation. For example intercalary meristem and cork cambium.

■ Dedifferentiated cells mature and lose the capacity of cell division again to perform specific functions. This process is called redifferentiation.

■ Different structures develop in different phases of growth as well as in response to environment. The ability to change under the influence of internal or external stimuli is called plasticity. Heterophylly is the example of plasticity.

Plant Growth Regulators are simple molecules of diverse chemical composition which may be intiole compounds_ adenine derivatives or derivatives of carotenoids.

- Auxin was isolated by 1.W. Went from tips of coleoptiles of oat seedlings.
- The 'bakane disease' of rice seedlings is caused by fungal pathogen *Gibberella fujikuroi*. E. Kurosawa found that this disease is caused due to presence of Gibberellin.
- Skoog and Miller identified and crystallized the cytokinins, promoting active substance called kinetin.

Auxin- It is commonly called indole-3-acetic acid (IAA). It is primarily produced at stem and root apex.

Functions-

- Cell enlargement and cell division
- Apical dominance
- Inhibition of abscission
- Induce Parthenocarp

Gibberellins- The most common one is GA_1 (Gibberellic Acid).

Functions-

- Cell elongation
- Breaking of dormancy
- Early maturity
- Seed germination

Cytokins- Most common forms include kinetin, zeatin etc. They are mainly synthesized in roots.

Functions-

- Cell division and cell differentiation
- Overcome apical dominance
- Promote nutrient metabolism

Ethylene. — It is a gaseous hormone which stimulates transverse or isodiametric growth but retards the longitudinal growth.

Functions.

- Inhibition of longitudinal growth
- Fruit ripening
- Senescence
- Promote apical dominance

Abscissic Acid — It is also called stress hormone or dormin. It is mainly produced in chloroplast of leaves.

Functions-

- Bud dormancy
- Leaf senescence
- Induce Parthenocarp
- Seed development and maturation

Photoperiodism- is the effect of photoperiods or day duration of light hours on the growth and development of plants, especially flowering is called Photoperiodism. On the basis of photoperiodic response to flowering, plants have been divided into the following categories.

- Short Day Plants
- Long Day Plants
- Day Neutral Plants

Vernalisation - is the process of shortening of the juvenile or vegetative phase and hastening flowering by a previous cold treatment.