PLANT GROWTH DEVELOPMENT

Development = Growth + Differentiation

GROWTH

- Growth is an irreversible permanent increase in size of an organ/part/a cell at expense of energy. The metabolic process involved may be catabolic/anabolic.

Characteristics

Indeterminate	Measurable
• Unlimited growth in plants (1° & 2°)	• Increased amount of protoplasm/number/size/ surface area
• Open growth - new cells added to plant body (due to meristem)	• Measured by-fresh weight, dry weight, length, area, volume, cell

PHASES OF GROWTH

1.Meristematic	2.Elongation
• root/shoot apex • rich in protoplasm • large nucleus • 1° cell walls(cellulose) • plasmodesmata(+)	• increased vacuolation • enlarged cells • cell wall with deposition
	3.Maturation
	• max wall thickenings • protoplasmic modifications

Growth Rates- Increasing growth per unit time

Geometrical growth (characteristic to plants)

- The cells mitotically dividing & the progeny cells all continue to divide.
- Sigmoid curve

$W_1 = W_0 e^{rt}$

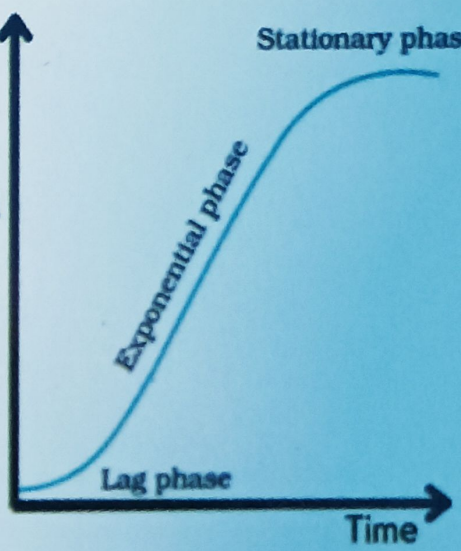
W_1 = final size (weight, height, number etc.)

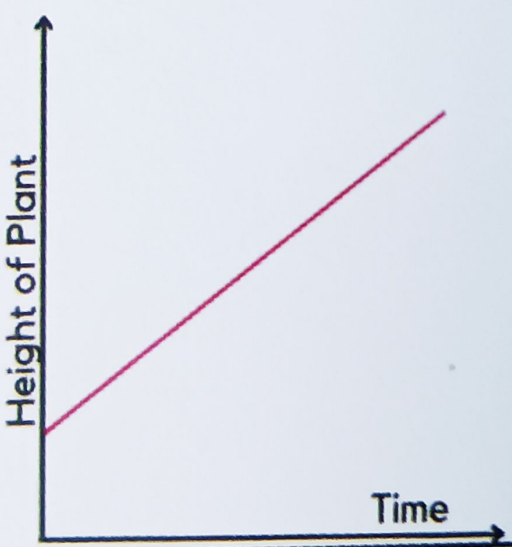
W_0 = initial size at the beginning of the period

r = growth rate

t = time of growth

e = base of natural logarithms





$L_t = L_0 + rt$

L_t = length at time 't'

L_0 = length at time 'zero'

r = growth rate / elongation

Arithmetic growth

- Mitotic divisions
- Only 1 daughter cell divides, other differentiate & mature
- e.g.-Root elongation(constant rate)

Conditions for normal growth

- Turgidity of cells, water, oxygen, light, gravity, nutrients, optimum temperature

Qualitative analysis	
Absolute growth rate (Total growth per unit time)	Relative growth rate (growth per unit)

PROCESS OF MATURATION

1.Differentiation(Open Type)

- Cell loses ability to divide & perform specific functions
- Structural changes in cells such as formation of treachery elements and lose of protoplasm
- 2° cell wall forms(Lignocellulosic)

2.Dedifferentiation

- Mature cells regaining their capacity to divide, under specific conditions
- e.g.-Formation of interfascicular & cork cambium from differentiated parenchyma cells.

3.Redifferentiation

- When dedifferentiated cells again lose ability to divide

DEVELOPMENT

- Sequence of events occurring in the life cycle of an organism from germination of seed till senescence

Plasticity

- Diff. pathways, that a plant adopts in order to sustain environment, different phases of life forming varied structures. e.g.heterophylly in cotton, coriander & larkspur

Development depends on

Intrinsic factors	Extrinsic factors
Genetic (intracellular)	Light , Temperature
Intercellular (chemicals)	Water, O_2 , Nutrition

PLANT GROWTH REGULATORS
(Basis- Chemical Constitutents)

Indole	Adenine	Carotenoid	Terpenes	Gases
Indole-3-acetic acid (IAA)	Kinetin	Abscisic acid (ABA)	Gibberellic acid (GA_3)	C_2H_4

Basis-Function

Growth Promoters	Growth Inhibitors
• Auxin • Gibberellins • Cytokinins	• Abscisic acid • Ethylene(majorly an inhibitor)

FOOD PLANTS

Spring Variety

Spring (planted) ⟶ Growing Season (flower)

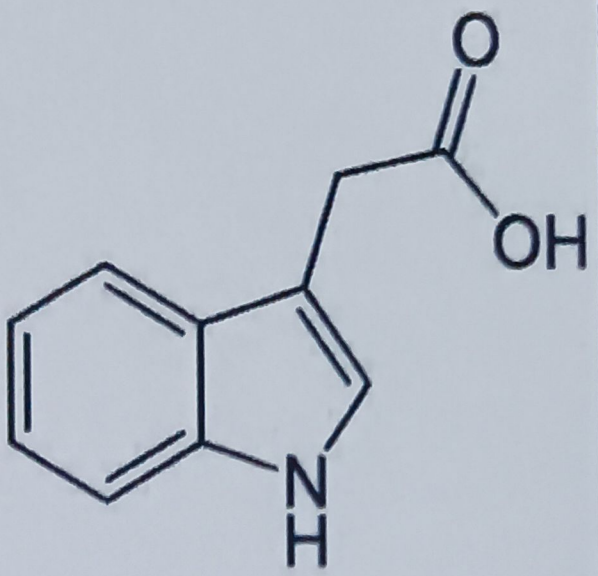
Winter Variety

Autumn ⟶ Winter ⟶ Spring ⟶ Summer
(plant) (germination) (resume growth) (harvesting)

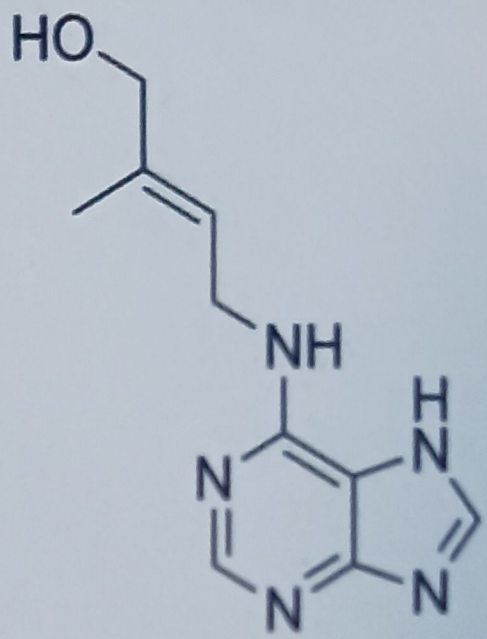
- In Biennials (sugar beet, cabbage, carrot), cold treatment stimulates flowering.

STRUCTURES OF PLANT HORMONES

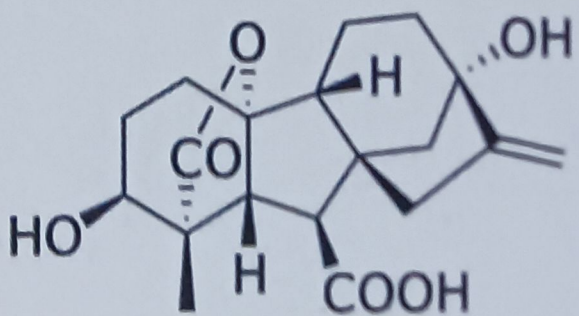
AUXINS



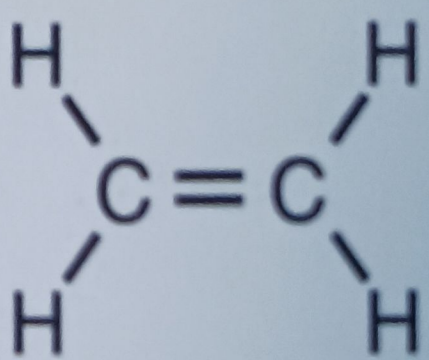
CYTOKININS



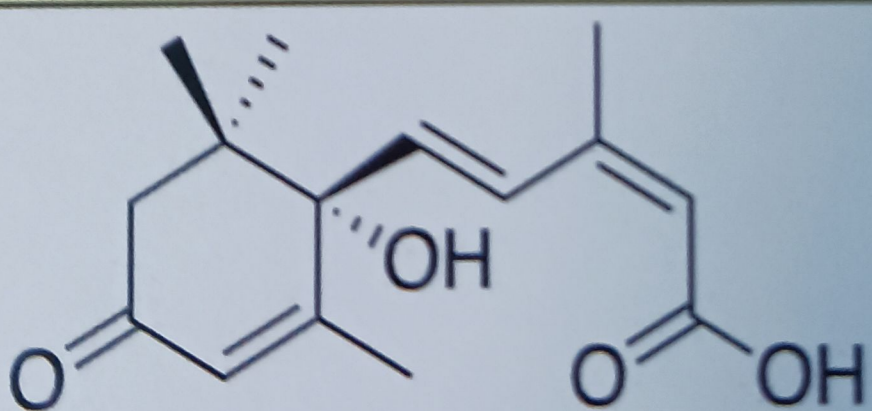
GIBBERELLINS



ETHYLENE



ABSCISIC ACID



*hormones and their functions explained in the book