Growth & Development

Syllabus

Growth & Development

Plant Growth & Growth hormones

Name : _____ Contact No. _____

PLANT GROWTH & GROWTH HORMONES

INTRODUCTION

- Growth is defined as **permanent and irreversible change** in the size or volume of cell organ or whole organism, usually accompanied by an **increase** in **fresh** or **dry weight**.
- Growth is a **biological reaction**, occuring in protoplasm of all living cells.
- Growth is a basic feature of all living organisms.

Features of Plant growth

- Seed germination is the first step of plant growth. Almost all the plants face a period of suspended growth.
- If the suspension of growth is due to **exogenously cotrolled factors** (environmental factors) then it is called **quiescence.**
- When the suspension of growth is due to the **endogenously controlled factors** (hormonal, genetics) then it is termed as **dormancy.**
- Growth is **diffused in animals,** but in **plants growth is localised & irregular** (nail in plant stem, occupies same height till several years of growth).
- Growth in plant is both **limited/determinate** and **unlimited/Indeterminate.**
  - → Limited/Determinate growth - In annuals & biennials. Growth activities are restricted for a determined period of time.
  - → Unlimited/Indeterminate growth - In perennials. Growth activities occurs through out the life.
- **Differentiation :** Cell derived from active meristem tissue, become mature to perform specific function.
- **Development :** Sum of morphogenesis and differentiation activities in livings is called as development.
- **Dedifferentiation :** In plants the living differentiated cell which lost the capacity of cell division, regain the capacity of cell division under certain conditions called Dedifferentiation.

  Ex.: Formation of meristems intrafascicular cambium and cork from differentiated parenchyma cells.
- **Redifferentiation :** The regain of differentiation by losing the capacity of cell division for performing specific function by a dedifferentiated cells.

MEASUREMENT OF PLANT GROWTH

Main base for growth measurement :

- Increase in number of cells
- Increase in weight
- Increase in volume and area of fruits and leaves
- Increase in length of roots and shoot - This is the general basis for growth measurement.

Instruments used for measurement of growth

- **Auxanometers –** Arc auxanometer and Pfeffer's auxanometer
- **Horizontal microscope**
- **Bose's Crescograph** - It is **most sensitive** apparatus. If magnify growth as 10,000 times.
- **Space maker disc** - It is maximally used instrument to determine the area of leaves.
- **Efficiency index (E.I.) :-**

  Growth can be measured by an increases **in size** or **area of an organ** of the plant (leaf, flowers, fruits etc.) in a unit time is called as **efficiency index (E.I.)** may be same or different in species to species and organ to organ.

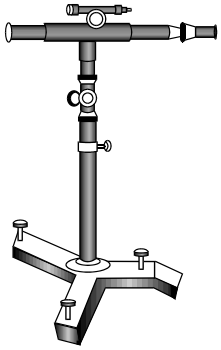


Fig.: Horizontal Microscope

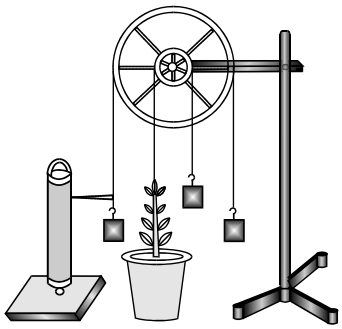


Fig.: Pfeffer's Auxanometer

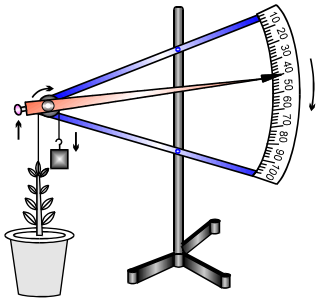


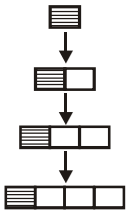
Fig.: Arc Auxanometer

Growth rate

Increased growth per unit time. Plant growth is of two types :

(A) Arithmetic growth : From dividing cell two new cells are formed (by mitotic division) out of them one daughter cell continues to divide while other differentiate and mature (stop dividing).

Arithmetic growth

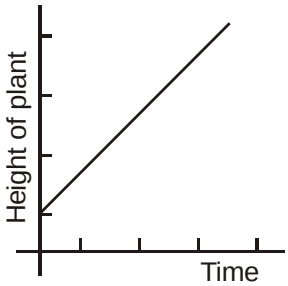


Meristematic Cell
Differentiated Cell

Ex. **Root** & **Shoot elongation** at constant rate.

- It is methematically expressed as
- It's curve is **linear**

$L_t = L_0 + rt$ where L_t - length at time 't'
L_0 - length at time 'zero'
r - growth rate / elongation per unit time.



(B) Geometric / Exponential growth : From dividing cell (by mitotic division) both doughter cells retains the ability to divide and continue to do so.

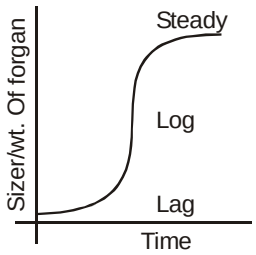
Ex. All cells, **tissue**, **organs**, **developing seed**, **germinating seed**, **seasonal activities** etc.

It is mathematically represented as

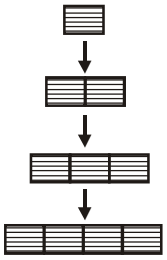
It's curve is **sigmoid**

$W_1 = W_0 e^{rt}$

Where W_1 - final size (Weight, height, number etc.)
W_0 - initial size at the beginning of period.
r - growth rate
e - base of natural logarithms.



Arithmetic growth



Meristematic Cell

(C) Absolute and relative growth rates : Absolute growth rate : Measurement and the comparision of total growth per unit time in plant or plant parts.

or

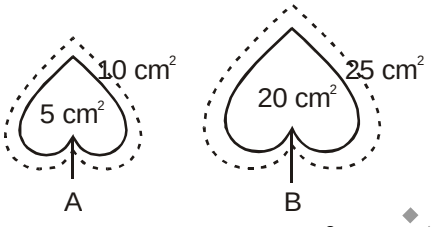
Total growth occurs in unit time in plant or plant parts.

Relative growth rate : The growth of the given system per unit time expressed in a common basis i.e., per unit initial parameter in plant parts.

or

Total growth occurs in unit time in comparision to initial growth in plant or plant parts. Relative growth rate is generally high in young developing plant parts.

Ex.



Unit time = 7 days

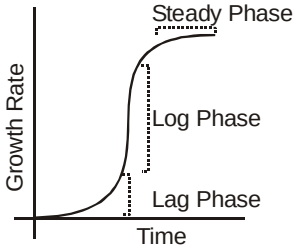
- Both passes same absolute growth rate i.e., 5 cm^2 in 7 days.
- But high relative growth rate in leaf 'A' about 100%, while in leaf 'B' it is about 25%.

COURSE OF GROWTH

Growth Activities and Phases of Growth :

- **Cell division or cell formation :** Number of cells is increases by cell division.
- **Cell enlargement or cell elongation :** Size of cells increases due to **vacuolization** & T.P. (turgor pressure).
- **Cell maturation or differentiation phase :** (Also called as **morphogenetic, organogenic** or differentiation phase) Development or qualitative change is important feature of this phase.
- Growth in size or weight of a specific part in a definite time is known as rate of growth.
- Rate of growth is not uniform. In all parts of a plant, rate of growth in initial stages is more, then it increases more, becomes slow and finally stops.
- If rate of growth of a plant is plotted against time, a **'S'** shaped curve is obtained. This is known as **sigmoid curve**.
- So, growth curve is the graphic representation of the total growth against time.
- Sigmoid curve or total time period can be divided into **three phases** :–

(I) Lag Phase (II) Log Phase (III) Stationary or Steady Phase



(I) Lag Phase :

- It is initial phase of slow growth.
- It is a phase of formation of cells.

(II) Log Phase :

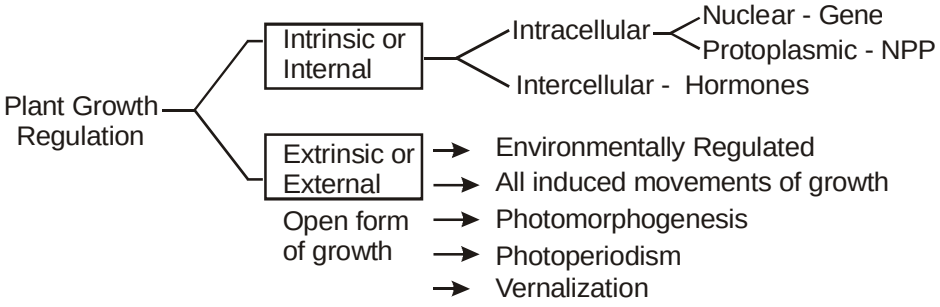
- It is middle phase of rapid growth
- Growth increases rapidly to a maximum during elongation phase.
- It represents **grand period of growth.**

(III) Stationary or Steady Phase :

- Finally rate of growth becomes almost zero.

FACTORS AFFECTING GROWTH / REGULATION OF PLANT GROWTH

Growth is affected by **external** and **internal** factors -



Photoperiodism

- The relative length of day and night is called **photoperiod.**
- The response of plants to the photoperiod, expressed in the form of flowering is called as **Photoperiodism.** "Effect or requirement of relative length of day **(photoperiod)** & night **(dark phase)** on flowering of plants is called as **Photoperiodism.**"
- The phenomenon of photoperiodism was first dicsovered by **Garner & Allard.** They experiment on **Maryland mammoth** (a mutant variety of **tobacco**). They study the **Biloxy soyabean**.
- **Garner** & **Allard** classified the plants in following groups.

(1) SDP (Short Day Plants) : "These plants give flowers on exposure to photoperiod **equal** or **shorter than their critical day length."**

- They need a continuous (uniterrupted) dark period for flowering. Thus SDP also called as **LNP (Long Night Plants).**

- Example of SDP :- **Tobacco, Soyabean, Viola, Xanthium (Cocklebur), Chrysanthemum, Cannabis, Coleus, Chenopodium, Mustard, Dahlia, Sugarcane, Strawberry, Cosmos, Rice etc.**
- In SDP the **dark period is critical** and **must be continuous.** If this dark period is breaks by a brief exposure to red light, then SDP will not flowers.
- Maximum inhibition of flowering with red light occur at about the middle of critical dark period.
- Prolongation of the continuous dark period, initiates early & good flowering in SDP.

(2) LDP (Long Day Plants) : "These plants flowers only when they exposed to critical photoperiod or photoperiod longer than their critical day length".

The **light period is critical for LDP.**

Ex.: **Henbane** (Hyoscyamus) **Spinach, Sugarbeet, Radish, Carrot, Wheat, Larkspur, Barley, Avena, Potato.**

- A brief exposure of red light in the dark period stimulates flowering in LDP.

(3) DNP (Day Neutral Plants) or Intermediate Plants : These plants do not need specific critical day length for the flowering. Ex. **Zea, Cotton, Tomato, Sunflower, Cucumber.**

- **L-SDP :** These are SDP but must be exposed to long day during early stage of their growth. Ex. Bryophyllum.
- **S-LDP :** These are LDP but must be exposed to short photoperiod during early stage of growth. Ex. **Wheat & Rye.**
- **Cajlachjan :** Reported that stimulation of critical photoperiod is percepted by **leaves**.
- **Chailakhyan :** Discovered **"Florigen"**. It has been not isolated, thus called as **Hypothetical hormone.**

Phytochrome

- **Borthwick & Hendricks :-** Discovered a light sensitive pigment responsible for flowering .
- **Butler :-** Given term **"phytochrome"** for this pigment and isolated it.
- Pigment phytochrome is a chromophore billiprotein, which have open tetrapyrrolic structure similar to phycobilin.
- Phytochrome mainly located on cell membrane of all type of plants.
- Phytochrome :- exists in two different forms

  Pr (Phytochrome red) - Red light absorbing from (**630-670 nm**, Peak-**667 nm**), **Blue colour, stable** form, **Physiologically inactive,** induce **flowering in SDP,** inhibits flowering in LDP.
- **Pfr (Phytochrome far red) -** This is **far-red light absorbing** form **(720 - 740 nm, Peak-735 nm), Yellow colour, unstable** form, **Physiologically active** form, induce **flowering in LDP,** inhibits flowering in SDP.
- Both forms of phytochrome are photobiochemically show **photochromicity** and **interconvertibility.**
- The **Pfr** (Yellowish) form, gradually changed into **Pr** (Bluish) form in dark.
- During the day both Pr and Pfr form are accumulated in the plants.
- Control of morphogenesis by light and phytochrome is called **Photomorphogenesis.**
- Now phytochrome is considered as universal distribution in plant kingdom.

Photomorphogenesis in plants appear to be under control of three phtoreceptors.

(i) Phytochrome - Which absorbs red and far red region of light.

(ii) Cryptochrome - Which absorbs blue and UV-A (380 nm) light.

(iii) UV-B-Receptors - Which absorb UV-B (290 nm) light.

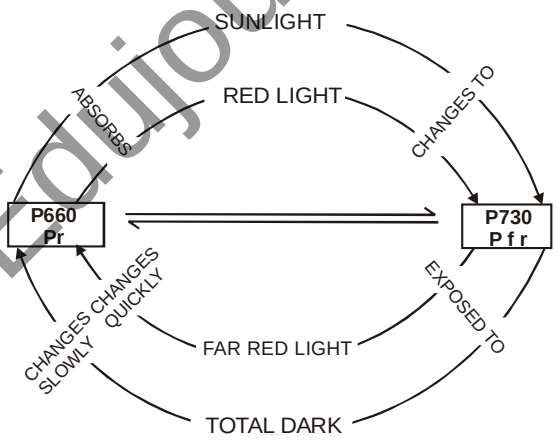


Fig : The Phytochrome concept

- In SDP, during critical dark period P_{fr} form gradually changes into P_r form which results in flowering.
- If critical dark period is interuptted by red light for short duration then P_r form is again converted to P_{fr} form, thus inhibiting flowering.
- The **inhibitory** effect can be **reversed** by subsequent far red light exposure.
- In SDP, whether flowering will be promoted or inhibited will **depend** on the exposure given in the last when the two types of radiations (Red and far red) are given **successively** –

  SDP + R $\rightarrow$ Inhibits flowering

  SDP + R + FR $\rightarrow$ Promotes flowering

  SDP + R + FR + R $\rightarrow$ Inhibits flowering

- In LDP, **prolongation** of light period or interruption of dark period by red light result in **accumulation** of P_{fr} form which stimulates flowering.
- P_{fr} form is biologically active form which is responsible to initiate a number of physiological process such as -

(a) Seed germination (b) Photoperiodism

(c) Stomatal opening & closing (d) Photomorphogenesis

Vernalization

- Effect of low temperature on the initiation and development of flower, was first realised by **Klippart 1857** (Experiment on winter & $\rightleftharpoons$ Spring wheat)
- Detail study and term - **"Vernalisation"** by **Lysenko** (Credit of discovery).
- **Chourad** defined as **'acceleration of ability to produce flower by chilling treatment is called vernalisation'.**
- Mainly **embryo tip, shoot apex and leaves percept** induction of low temperature on plants.
- Concept of hormone **'vernalin'** in vernalisation was given by **Melcher et. al.** This is a **hypothetical plant hormone,** because not has been isolated till today.
- Vernalisation of **seeds or plant progagule** in laboratory can be induced at 1ºC to 10ºC in presence of O_2 and H_2O. Proper photoperiodic induction also required after vernalization.
- If vernalized plant prapagules are kept in high temperature, just after the low temperature treatment then effect of vernalization is reverse, this effect is called as **devernalization.**

Significance :-

(i) Better and early flowering

(ii) Vernalization increases the resistance to fungal diseases.

(iii) Protects natural precocious reproductive development.

Growth regulators :

Growth is mainly regulated by small amount of chemical substances present at growth points in plants. These are known as **Growth regulators** or **Growth hormones**.

GROWTH REGULATORS OR PLANT GROWTH HORMONES

- Term 'hormone' was first of all used by **Starling** (1902).
- **Sachs** (1948) first suggested the presence of **growth regulating substances** in the plants.
- **Thimann** (1948) gave the term **Phytohormone**.
- **Thimann** defined Phytohormones as organic substances produced naturally in minute quantities in one part of plant body and transported to another parts where they are active and produce effect on growth.
- Growth regulators = Phytohormones + Synthetic Substances

so, all phytohormones are growth regulators but **all growth regulators are not phytohormones**.

Special features of plant growth Hormones / Chemicals :

- Plants hormones works in concentration based manner.
- Synthetic hormones or chemical are not transported by plants, so provided at the target sites.
- Synthetic hormones or chemical only induce the somatic changes not the genetic changes. So, treatment should be provided every year.
- Supra optimum concentration of any synthetic hormone/chemical leads to death of plant.

(i) Fruit Thinning : All the measures which are used to obtain the commercially valuable fruits are collectively known as Fruit thinning. Like increase in number and size of flower and fruit etc.

- **Bolting effects :** Elimination of Rosette growth (extreme dwarfism) by the application of gibberellins.
- **Lodging :** Falling of crops or plants due to less mechanical strength. Auxin prevents **lodging.**
- **Gibberellin** treatement elongates the internodes of dwarf plants (Genetic, mutational, environmental dwarf plants) not works in normal plants.
- **Auxin** and **Cytokinin** both hormones naturally and synthetically works together.
- **Richmond lang effect :** Delay in senescence due to effect of **cytokinin.**
- **Climacteric Respiration :** Ethylene is highly effective in fruit ripening. It enhance the respiration rate during ripening of the fruits. This rise in rate of respiration is called **Respiratory Climacteric**. Rapid rise in rate of respiration which later decrease during starting of ripening of fruits and senescence is due to ethylene production.
- Growth regulators are of two types -

  (a) Growth **promoters** (b) Growth **Inhibitors**

GROWTH PROMOTERS

- Those hormones which increases the rate of growth are called **growth promoters**.
- Growth promoters are of following 3 types -

  (1) Auxin (2) Gibberellin (3) Cytokinin

(b) Growth inhibitors - ABA and Ethylene

AUXIN

History :

(A) Charles Darwin & Francis Darwin (1887) :

- They first of all reported the presence of first growth hormone in the **coleoptile** tip of canary grass **(*Phalaris canarensis*).**
- They described the effect of **light** and **gravity** in the book "Power of movement in plants".
- **Darwin** reported that coleoptile tip of canary grass bend towards light. Thus it shows phototropism.
- Thus, Darwin concluded that certain kind of substance is generated at the tip which is then transmitted to the base where growth takes place.

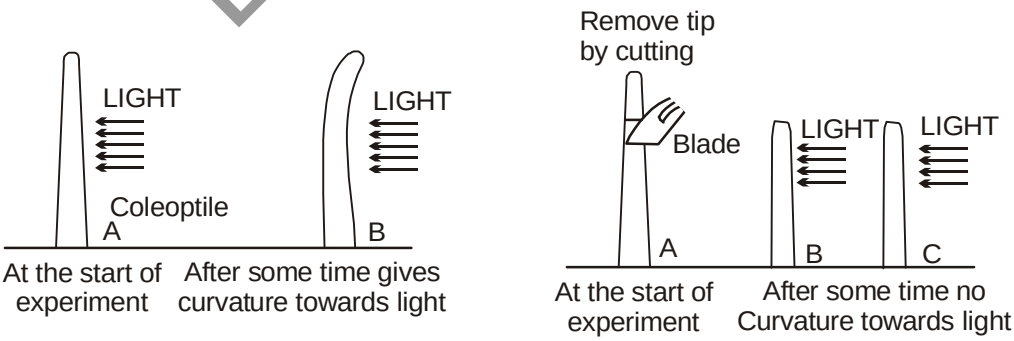


Fig.: Discovery of Auxins (Darwin's Experiment)

(B) Boysen-Jenson (1913) :

- After performing an experiment on **Avena Sativa** coleoptile they found that if its tip was **cut** then its phototrophic sensitivity is **destroyed**.
- But they found that when an excised coleoptile tip was **replaced without** or **with gelatin**, **bending** resulted as in normal coleoptile.
- He further found that insertion of **mica plate prevents** curvature following **unilateral** illumination of the tip.

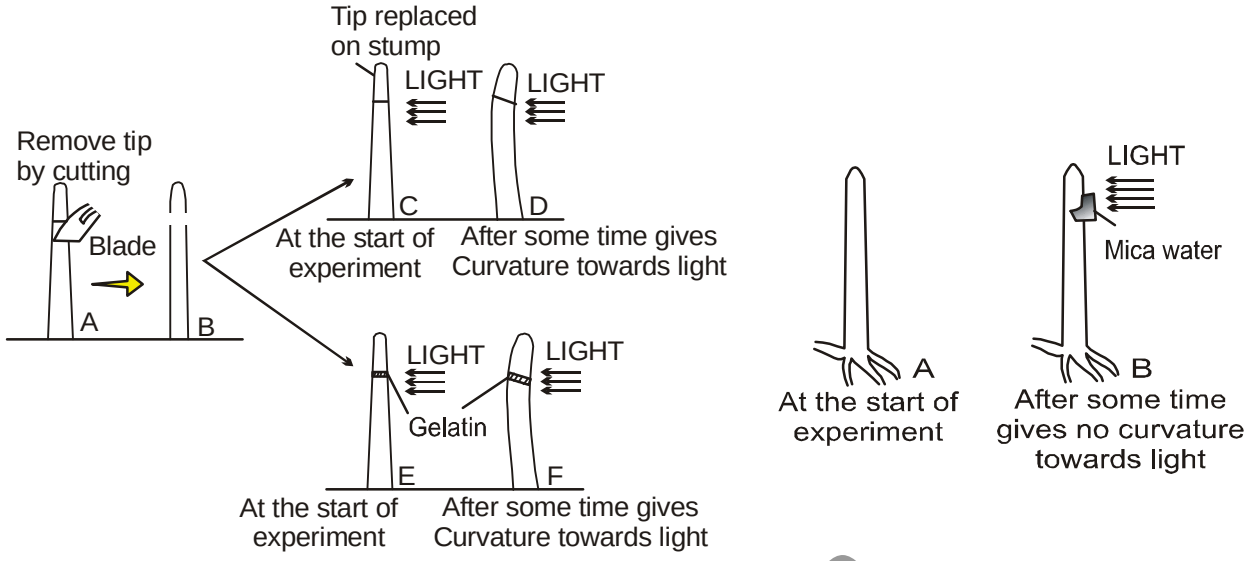
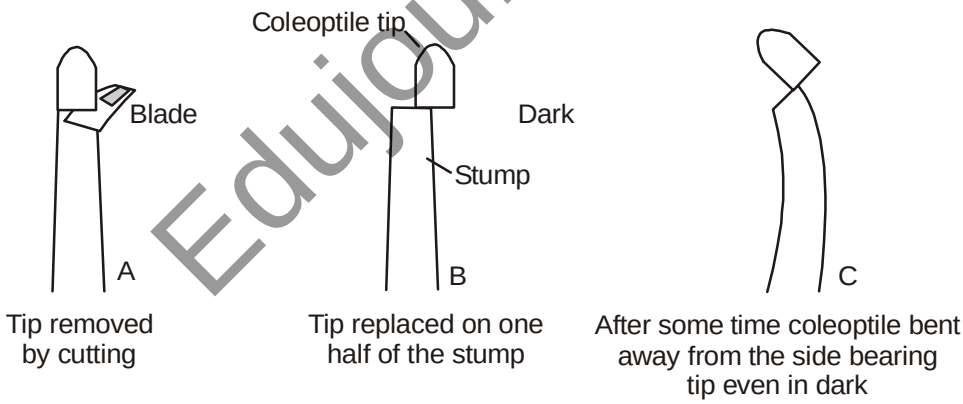


Fig : Experiments of Boysen-Jensen

(C) Paal (1919) :

- He found that when the excised tip is replaced on one side of **Avena** coleoptile stump then accelerated growth beneath the tip, which results in curvature, in dark.
- He gives the idea of unequal distribution of the chemical responsible for phototropism.



(D) F.W. Went (1920) :

- He first isolated a substance from the coleoptile tip of **Avena sativa** (Oat) and named it **auxin**.
- He placed the cut end of coleoptile tip of Oat on agar block.
- Then he placed one of the agar block on stump in eccentric position and kept it in dark for 2 hrs. He observed that **curvature** resulted in **oppsite** direction to agar block.
- Went discovered **auxin** in tip of coleoptile.
- He also stated that auxin concentration towards **non-illuminated** side is 57% and towards **illuminated** side is 27% because -

  About 16% auxin is **destroyed by light**.

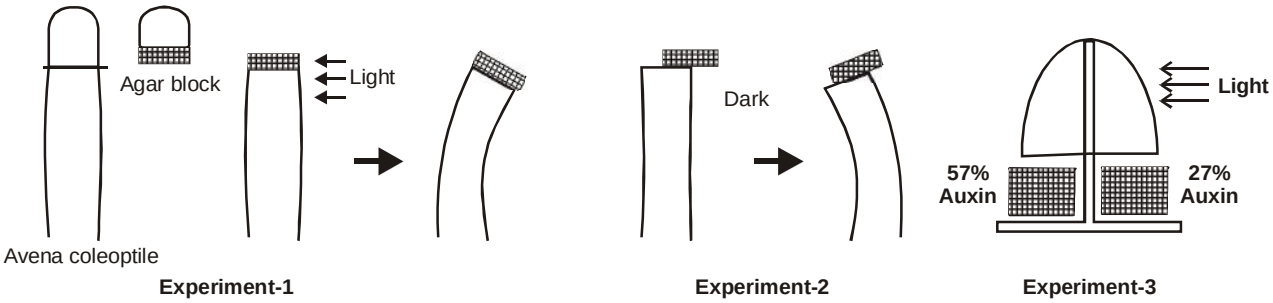


Fig.: F.W. Went's Experiment

Conclusion :- (1) Growth is directly proportional to concentration of Auxin in agar block in limit

(2) Transport of auxin is Polar and Basipetal.

(3) High concentration of auxin towards dark side (57%) and less auxin concentration towards light side (27%). Rest of auxin is Photoxidised (16%).

(E) Kogl, Haagen Smit and Erxleben (1931) :

They discoveresd 3 types of auxin like substances from different sources -

(a) Auxin-a : It was isolated from **human urine** and was named as **Auxenotriolic acid ($C_{18}H_{32}O_5$)**.

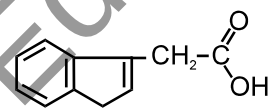
(b) Auxin-b : It was isolated from **corn endosperm** (corn germ oil) and named as **Auxenolonic acid ($C_{18}H_{30}O_4$)**.

(c) Heteroauxin ($C_{10}H_9O_2N$) : It was also isolated from **human urine** which is now known as **Indole-3-Acetic acid (IAA)**.

(F) Thimann (1935) : isolated IAA from cultures of **Rhizopus** species.

Introduction of Auxin :

- **Precursor** = Tryptophan {'**Zn**' is essential for biosynthesis}
- **Biosynthesis** = Shoot and Root apex
- **Transportation** = Polar and Basipetal, By parenchyma cells.
- **Structure of IAA is -**



IAA

Forms

- Natural Auxins = **IAA**(Indole Acetic Acid), **IBA**(Indole Butyric Acid), **PAA** (Phenoxy Acetic Acid)
- Synthetic Auxins = α, β-**NAA** (Nepthelene Acetic Acid), **IPA** (Indole Propionic Acid), **PAA**, **2**, **4-D**, **2**, **4-5-T**
- Free Auxins = Diffusible Auxin
- Bound Auxins = Binded with esters at the site of synthesis
- Antiauxin = TIBA, Morphectin, MH
  - {Inhibits polar transport of Auxin}
  - Decrease apical dominance. Increase Lateral branches
  - Decrease phototropism
  - Shortening of internodes
  - Decrease laminar area of leaves

- **Oxdation** = **Photooxidation**, **IAA oxidase**
- **Bioassay** = **Avena Curvature test, Root growth inhibition test.**

Physiological effects and applications of Auxin :

(i) **Cell elongation Morphogenesis Apical dominanace** →
- Pruning increase lateral branching
- Shortening of internodes → Use of NAA, MH in Apple, Pear
- Potato Dormancy → Use of NAA, MH

(ii) **Root formation and root growth inhibition** →
- Increase adventitious branching of roots
- Prevents lodging - IBA - Rooting hormone

(iii) Prevents abscission →
- Fruit thinning in mango.
- Collection of cotton bolls - TIBA

(iv) **Flowering and Parthenocarpy** →
- Flowering - **Femaleness** in **Bromeliaceae,** (Pineapple, Litchi) and **Cucurbitaceae.**
- Parthenocarpy in **solanaceae** and **cucurbitaceae.**

(v) **Phototropism**

(vi) Selective weed killer = Dicots weeds/broad leaf weed killer = 2, 4-D and 2, 4-5-T,
= **Dioxin/Agent orange/Jungle defoliant**

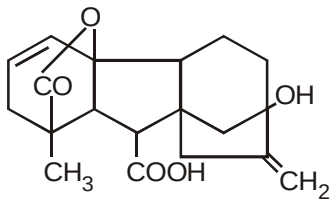
GIBBERELLIN (GA)

History :

- Japanese farmers noted that some plants in rice fields were taller, thinner and paler than the normal plants and named this disease as **'bakanae disease or foolish seedling disease'**.
- **Kurosawa** and **Swada** (1926) reported that this disease was due to a fungus **Gibberella fujikuroi** (Ascomycetes) whose incomplete state is **fusarium moniliformae** (Duteromycetes).
- **Yabuta**, **Sumuki** and **Hyashi** (1938) isolated gibberellin from this fungus and named it as **Gibberellic acid**. It was **GA_3**.
- Untill now more than 50 GA have been discovered.

Introduction of Gibberellin :

- **Precursor** = Acetyl-CoA {By Mevalonic acid Pathway} / Kaurene.
- **Biosynthesis** = Germinating seed, Bud, Shoot, Root, Leaves.
- **Transports** = Non Polar, By xylem and phloem.
- **Chemical structure** of Gibberellic acid is –



GA

- **Form** = GA_3 - First discovered and most common GA [Commercially]
  GA_1 and **GA_{20}** = **GA_1** first discovered GA of higher plants. Most common **GA's** of higher plants.

- **Anti GA** - Phosphon - D, Cycocel, Chlormquet, Ancymidol [A-Rest], Alar-85 (B-Nine), AMO - 1618. All are used in Bonsi.
- **Oxidation**
- **Bioassy** = **(i) α-amylase activity test in Barley endosperm.**
  (ii) Dwarf pea and Maize test.

Physiological effects and application of GA :

- **Stem and internode elongation**
  - Elongation of genetic dwarf plant.
    Ex.: Pisum, Vicia, Maize, Sugarbeet.
  - **Bolting effect :** Elimination of rosette growth in cabbage.
  - Increase malting in sugarcane.
- **Seed germination**
  - Breaking seed dormancy
  - Germination of photoblastic seeds, Ex. Lettuce, Tobacco

  Increase activity of stored food hydrolysing enzymes like Amylase, Lipase, Protease.
- **Flowering and Parthenocarpy**
  - Flowering
    - Maleness in Bromeliaceae and Cucurbitaceae
    - In LDP during short day condition.
    - In vernalisation requiring plants (winter annuals, biennials) without vernalisation.
  - Parthenocarpy - In solanaceae and Cucurbitaceae.
- **Fruits and flower enlarger-** Thompson grapes / Table graps, geranium flower.
  Pomalin (Apple enlarger) = mixture of GA (GA_4 and GA_7) + Cytokinin

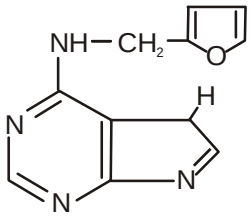
CYTOKININ

History

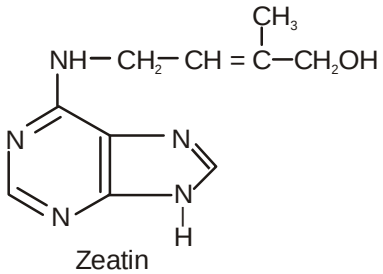
- **Miller** (1956) first isolated them from **herring fish sperm DNA** and named them as **kinetin**.
- **Letham** (1953) isolated and characterised a cytokinin called **zeatin** from **immature maize kernels.(corn grain oil)**
- Cytokinin name given by **F. Skoog.**
- Phytokinin term by **Osborne**.

Introduction of Cytokinin

- **Precursor -** Acetyl CoA [By Mevalonic acid pathway] Adenin derivatives.
- **Biosynthesis -** Root and shoot apex.
- **Transport -** Polar and Basipetal, By xylem.
- **Structure -**



Kinetin



Zeatin

- **Form -**

  Kinetin - First discovered Ck. (Only in animals).

  Zeatin - First discovered CK and most common CK of plants. Coconut milk factor - Zeatin.

  Synthetic CK - BAP (Benzyl Amino Purine), Diphenyl Urea, thidiazuron.

- **Oxidation -** Cytokinin oxidase.
- **Bioassay -** **(i) Chlorophyll preservation test.**

  (ii) Tobacco pith cell division test.

  (iii) Radish and soyabean cotyledon cell division test.

Physiological effects and applications of Cytokinins

- **Cell division, Morphogenesis, Vascular differentiation :**

  - Increase cell division in culture medium.
  - Increase secondary growth, by increasing activity of interfascicular cambium
  - Morphogenesis in culture medium.

$\frac{\text{High CK}}{\text{Low Auxin}}$ = Shoot, $\frac{\text{Low CK}}{\text{High Auxin}}$ = Root, $\frac{\text{CK}}{\text{Auxin}}$ = 1 callus.

- **Promotes growth of lateral branches.**
- **Nutrients Mobilisation and delayes Senescence. Richmond Lang effect.**

  Increase Proplastid formation, Increase phloem/food conduction, increase lignin biosynthesis. Seed germination in parasitic plants without host plants. (Striga)

- **Stomatal opening.**

GROWTH INHIBITOR :

Abscisic Acid /ABA

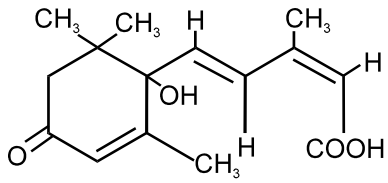
History

- First indication of growth inhibitors was given by **Osborne.**
- **First growth inhibitor** was identified by Bennet-Clark and Kefford (1953) from dormant potato tuber and called it **β-inhibitor**.
- **Addicott and Okhuma (1963)** obtained from mature **Cotton fruits** and named as **Abscisin II. ($C_{15}H_{20}O_4$)**
- **Waring and Robinson -** Isolated a growth inhibitor from old Betula leaves and called it **Dormin**.
- Later established that β-inhibitor, Abscisin-II and Dormin are same and called as Abscisic acid.

Introduction of ABA

- **Precursor** - Acetyl Co-A {By Mevalonic acid pathway}. **Oxidation of β-carotene**.
- **Biosynthesis -** In any plants part where required.
- **Transpotation -** Not transported

- **Structure**



Chemical Structure of ABA

- **Oxidation.**
- **Bioassay.**

Physiological effects and applications of ABA

- **Induced bud and seed dormacy**
  - Tuberisation of potato.
  - Inhibits activity of amylase, lipase, protease.
  - Prevents vivipary
  - Growth inhibition in duck weeds (Lemna).
- **Regulates abscission and senescence**
  - Inhibits cells divisionand cell elongation.
  - Increase activity of polysaccharide hydrolysing enzymes, pectinase, cellulase.
- **Stomatal Closing**
- **Increase geotropism in root of xerophytes.**
- **Flowering delay in LDP.**

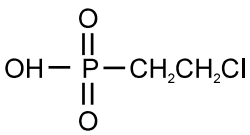
ETHYLENE

History

- **H.H. Cousin** (1910) first suggested that ripened oranges are responsible for ripening of unripen banans.
- **R.Gane** identified volatile subsence as ethylene.
- Ethylene is a **gaseous** pollutant **hydrocarbon,** But **Burg** reported it as a **fruit reipening hormone.**
- **Pratt Goeschl -** Recognized ethylene as a natural plant growth regulator.

Introduction of Ethylene

- **Precursor - Methionine.** Auxin induced ethylene production.
- **Bisynthesis -** Ripening fruits, Senescent plant parts. Roots, Shoots,
- **Transport - Diffusion**
- **Structure : $CH_2 = CH_2$**
- **From =** Ethephone/CEPA (2-Chloroethyl phosphoric acid). - Artificial fruit ripener.
  Ascorbic acid and iodoacetate also induces its synthesis. O_2 is essential.



Ethephone

- **Oxidation -** Autocatalytic.

Physiological effects and applications of Ethylene

- **Fruit Ripening =** Natural - Climacteric respiration.
  Artificial - Ethephone / CEPA used.
- **Regulates senescence and abscission.**
- **Flowering - Femaleness -** In *Bromeliaceae* (Pineapple, Litchi) and cucurbitaceae.
- **Root-shoot growth -** Root (Like Auxin) : Increase formation of roots, Root hair, inhibits root growth.
  Shoot (Antiauxin : inhibits transports of auxin) : Decrease apical dominance, decrease stem elongation, Increase radial swelling of stem.
- **In hydrophytes -** Increase gaseous diffusion.
- **Abnormal effects :**
  - Increase radial swelling or horizontal growth of stems.
  - Epinasty of leaves.
  - Tightening of hooks of epicotyl and hypocotyl.

ABSCISSION

- Detachment of senescent or mature plant organs like leaves, fruits, flowers due to change in hormonal activity.
- There is a separation layer **(abscission layer)** is formed within the region of attachement of these parts. Cell wall layers and middle lamella are dissolved by the activity of **cellulase** and **pectinase** (Polysaccharide hydrolysing enzymes) during **abscission.**
- Hormone **ABA and Ethylene are main controllar** of abscission process.

PLANT SENESCENCE

- Period from reproductive maturity to degredative changes during the death of an organ or plant is known as **Senescence.**
- During senescence a gradual destruction occurs in protoplasm, cell, tissue, organ or plant and functioning of the plant and plant parts.
- During the senescence, higher rate of catabolism starts, under the control of growth hormones like **ABA, ethylene.** Senescence occurs as a result of ageing and leads to death of plant parts or whole plant. (Senescence and ageing - studied in **phyto-gerontology**)
- Senescence may be of following types :
  (a) **Whole plant senescence :** Ex. Tomato, Wheat, Mustard, Rice, Beans.
  (b) **Organ senescence :** When plant part above ground dies (shoot) each year and root & rhizome system alive. Ex. Alfa-alfa, Sugarcane, Banana, Ginger.
  (c) **Sequential or progressive leaf senescence :** Evergreen perennials show progressive or sequential senescence of older leaves, lateral organs, branches, flowers, fruits and shoot. Ex. Eucalyptus, Mango.
  (d) **Simultaneous or Synchronous leaf senescence :** In perennial deciduous plants all the leaves undergo senescence and abcission at a time.
  Ex. : *Dalbergia siso, Azadirachta indica, Ficus religeosa*

EXERCISE - I

Q.1 Avena coleoptile test to find out the quantity of growth promoting hormones was discovered by –
(1) F,W, Went (2) L.J. Oudus
(3) K.V. Thimann (4) F. Skoog

Q.2 Primary precursor or I.A.A. is–
(1) Phenyl alanine (2) Tyrosine
(3) Tryptophan (4) Leucine

Q.3 The biological activity of I.A.A. is tested by–
(1) α - amylase test
(2) Avena curvature test
(3) Soybean callus test
(4) Xanthium leaf disc test

Q.4 Indole, 3 acetic acid, called as auxin was first isolated from–
(1) Human urine (2) Corn germ oil
(3) Fusarium (4) Rhizopus

Q.5 Which of the following effects of auxins is of wide application?
(1) Induction of fruit development
(2) Induction of root initiation
(3) Prevention of abscission
(4) All of the above

Q.6 Stem elongation is affected by–
(1) Gibberellin and florigen
(2) Auxin and gibberellin
(3) Florigen and kinin
(4) Kinin and auxin

Q.7 Apical dominance means–
(1) Suppression of growth of apical bud by axillary buds
(2) Suppression of growth of axillary buds by the presence of apical bud
(3) Stimulation of growth of axillary buds by removal of apical bud
(4) Inhibition of growth of axillary buds by removal of apical bud

Q.8 Auxin inhibits the growth of–
(1) Apical bud
(2) Lateral axillary buds
(3) Roots on stem cutting
(4) Parthenocarpic development of fruits

Q.9 Induction of rooting in stem cutting by auxin treatment would be beneficial in which of the following–
(1) Marchantia (2) Wheat
(3) Cuscuta (4) Bougainvillea

Q.10 Which of the following is not natural occuring plant hormone?
(1) 2, 4-D (2) GA_2
(3) Gibberellin (4) I.A.A

Q.11 Seedless fruits can be obtained by treating the unpollinated ovaries with–
(1) Colchicine (2) Sucrose solution
(3) Hormones (4) Pure lanolin

Q.12 Leaf fall occurs when the content of–
(1) Auxin increase
(2) Auxin decreases
(3) Abscisic acid decreases
(4) Gibberellic acid decreases

Q.13 Substance which originate at the tip of stem to control growth–
(1) Vitamins (2) Enzymes
(3) Food materials (4) Auxins

Q.14 Which of the growth substance acts as a stimulant during nodule formation in leguminous plant–
(1) Ethylene (2) ABA
(3) IAA (4) Morphactin

Q.15 Auxanometer is meant for measuring–
(1) Respiratory activity
(2) Photosynthetic activity
(3) Growth activity
(4) Osmotic pressure

Q.16 Apical dominance in higher plants is due to–
(1) Phytohormones (2) Enzymes
(3) Carbohydrates (4) Photoperiodism

Q.17 Parthenocarpy is the production of–
(1) Fruits with pollination
(2) Fruits with out fertilization
(3) Seeds with fertilization
(4) Only seeds and no fruits

Q.18 Auxin is mainly produced by–
(1) Apical root meristem
(2) Root cambium
(3) Apical shoot meristem
(4) Phloem in shoot tip

Q.19 Indole acetic acid generally inhibits the growth of –
(1) Roots (2) Leaves
(3) Shoots (4) Plants in general

Q.20 Fruit drop is caused by–
(1) From the shoot tip in the downward direction
(2) From the root tip in the upward direction
(3) Through vascular systems in plants
(4) By a special transport system in the root

Q.21 Fruit drop is caused by–
(1) Less auxin in fruit than in stem
(2) More auxin in fruit than in stem
(3) Equal distribution of auxin in stem and fruit
(4) Absence of auxin in stem and fruit

Q.22 In plants growth is–
(1) Restricted to certain regions or structure
(2) Irreversible
(3) Change in size
(4) All the above

Q.23 Which one of the following is motivation force for growth–
(1) Turgor pressure
(2) Root pressure
(3) Atmospheric pressure
(4) Osmotic pressure

Q.24 Growth is primarily affected by two climatic factors which are?
(1) Light and temperature
(2) Temperature and relative humidity
(3) Light and wind
(4) Rainfall and temperature

Q.25 Which of the following instrument can be used to record plant growth by seconds?
(1) Arc auxanomemter
(2) Arc indicator
(3) Space marker disc
(4) Crescorgraph

Q.26 In a growing plant, the first phase during the process of growth is–
(1) Cell division
(2) Cell enlargement
(3) Cell differentiation
(4) Cell maturation

Q.27 The classical experiments on growth were performed by–
(1) Lamarck & Boysen Jensen
(2) Boysen Jensen & Darwin
(3) Darwin and Lamarch
(4) Darwin and Paal

Q.28 The natural plant hormones were first isolated from–
(1) Cotton fruits, spinach leaves and rice plant
(2) Avena coleoptiles, spinash leaves and fungus Gibberella
(3) Human urine and corn germ oil
(4) Human urine and rice plant

Q.29 Which one of the following nutrients is concerned with the growth of the plants in view or their role in synthesis of auxin–
(1) S (2) Mn
(3) Zn (4) K

Q.30 Plants bend toward the light because–
(1) They need light for photosynthesis
(2) They need light for respiration
(3) Light attracts them
(4) Cells on the shaded side elongate more

Q.31 Auxins are abundantly produced in–
(1) Root
(2) Meristematic region of root
(3) Shoot
(4) Meristematic region of shoot

Q.32 Clinostat is used in study for–
(1) Photosynthesis
(2) Respiration
(3) Geotropism
(4) Osmosis

Q.33 Which of the following exerts profound effect on the reproductive growth of a flowering plant–
(1) Quality of light
(2) Quantity of light
(3) Direction of light
(4) Duration of light cycles

Q.34 What is the cause of excurrent habit in pinus–
(1) Presence of gibberellin
(2) Presence of apical dominance
(3) High concentration of cytokinin
(4) High concentration of ABA

Q.35 Which of the following hormone is concerned chiefly with root initiation?
(1) IBA (2) GA_3
(3) ABA (4) Kinetin

Q.36 If the tip of a seeding is cut off growth as well as bending ceases because it hampers–
(1) Respiration
(2) Photosynthesis
(3) Perception of light stimulus
(4) Transpiration

Q.37 What causes a green plant to bend towards light as it grows ?
(1) Because green plants need light to carry on photosynthesis
(2) Because green plants are phototropic
(3) Light stimulates plant cells on the lighted side to grow faster
(4) Auxin accumulates on the shaded side

Q.38 An apparatus used to demonstrate phototropism is–
(1) Luxmeter
(2) Solarometer
(3) Clinostate
(4) Heliotrophic chamber

Q.39 phytohormone term was coined by–
(1) Gregory and Purvis
(2) F.W. Went
(3) Thieman
(4) L.J. Audus

Q.40 Growth hormone acts–
(1) Always as growth promotors
(2) Always are growth inhibitors
(3) Some as promotors and some as inhibitors
(4) Rarely as growth inducers

Q.41 The movement of auxin is largely–
(1) Acropetal (2) Basipetal
(3) Lateral (4) Centripetal

Q.42 The formula of Auxin-A is–
(1) $C_{18}\ H_{30}\ O_7$
(2) $C_{18}\ H_{22}\ O_5$
(3) $C_{12}\ H_{30}\ O_6$
(4) $C_{20}\ H_{30}\ N_5$

Q.43 Which growth hormone is responsible for apical dominance–
(1) Auxin (2) Cytokinin
(3) Gibberellin (4) Ethylene

Q.44 2, 4-D is a synthetic–
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) Florigen

Q.45 Which of the following induces femaleness in plants?
(1) Auxin & ethylene
(2) Ethanol
(3) ABA
(4) Gibberellin

Q.46 Which of the following prevents the fall of fruits?
(1) GA_3 (2) NAA
(3) Ethylene (4) Zeatin

Q.47 Which of the following is weed killer?
(1) 2, 4-D (2) NAA
(3) GA (4) ABA

Q.48 Which one is prevents over-ripening of banana and browning of cut fruits?
(1) Gibberellic Acid
(2) Indole-3 Acetic Acid
(3) Ascorbic Acid
(4) Abscisic Acid

Q.49 Which weedicide can defoliate the complete forest?
(1) 2, 4-D (2) MH
(3) AMO - 1618 (4) ABA

Q.50 Agent orange is–
(1) Biodegradable insecticide
(2) Dioxin weedicide
(3) Biofertilizer
(4) Biopesticide

Q.51 Phytotron is a device by which?
(1) Induce mutation breeding in wheat
(2) Electron bombarding system
(3) Plants are grown in controlled environment
(4) Heavy water plants

Q.52 Lateral axillary buds are not allowed to grow by–
(1) Auxin (2) Ethylene
(3) Gibberellin (4) Cytokinin

Q.53 Richmond– Lang effect is due to
(1) Cytokinin (2) Auxin
(3) ABA (4) All the above

Q.54 A hypothetical chemical believed to be involved in flowering is–
(1) Gibberellin (2) NAA
(3) Florigen (4) IAA

Q.55 DCMU is a herbicide which kills the plant by–
(1) Inhibiting photolysis of water as it is a strong inhibitor of pigment system II
(2) Inhibiting CO_2 function as it is a strong inhibitor of pigment system II
(3) Checking respiration
(4) Destroying Chloroplast

Q.56 Supra optima (more than 10 PPM) concentration of Auxins–
(1) Promotes flowering
(2) Kill the plant
(3) Prevents shortening of the internodes
(4) Promotes growth in both stem and roots apex

Q.57 Growth curve is–
(1) S-shaped (2) Sigmoid
(3) L-Shaped (4) Both 1 & 2

Q.58 Which of the following auxins are widely used as herbicides–
(1) 2, 4-D and 2, 4, 5-T
(2) 2, 4-D and cytokinin
(3) 2, 4-D and 2, 4-T
(4) 2, 4, 5-T and GA

Q.59 The compounds that inhibit the action of auxin are known as–
(1) Antiauxins
(2) Auxins promotors
(3) Auxin precursors
(4) Both 1 & 2

Q.60 Premature fall of fruit can be stopped by–
(1) Auxin (2) GA_3
(3) ABA (4) None of these

Q.61 Photoperiodic stimulus is picked up by–
(1) Phytochrome (2) Phytohormone
(3) Enzyme (4) Vernalin

Q.62 Parthenocarpy can be achieved by–
(1) Zeatin (2) ABA
(3) Auxins (4) Kinetin

Q.63 IAA was isolated by–
(1) Kogl and Erxleben
(2) Kogl and Haagen Smit
(3) Erxleben and Haagen Smit
(4) Kogl, Darwin and Haagen Smit

Q.64 Maximum of growth occurs in–
(1) Exponential phase (2) Decline phase
(3) Stationary phase (4) Lag phase

Q.65 Cholodnyl-Went theory is related with–
(1) Turgor movement
(2) Chemotropism
(3) Phot-tropism
(4) Phototropism & Geotropism

Q.66 Which of the following plant hormone substitutes for long photoperiod in flowering plant–
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) Ethylene

Q.67 Gibberellin stimulates flowering in–
(1) The plants growing in japanese farms
(2) The short day plants
(3) The long day plants
(4) Day neutral plants

Q.68 Internodal elongation is stimulated by–
(1) Auxin (2) Cytokinin
(3) Gibberellin (4) Phenol

Q.69 Cytokinin–
(1) Is a hormone whose main function is to induce the cell division
(2) Is the process of cell division
(3) Refers to cell division
(4) Causes dormancy

Q.70 The excised leaf does not turn yellow if it is induced to root. The is attributed to synthesis in the root of–
(1) Ethylene (2) Cytokinins
(3) Gibberellins (4) Auxins

Q.71 Hormone involved in photoperiodism is–
(1) IAA (2) Gibberellin
(3) Kinetin (4) 2, 4-D

Q.72 Gibberellin was first extracted from–
(1) Fusarium moniforme = Gibberella fujikuroi
(2) Gellidium
(3) Gracillaria
(4) Aspergillus

Q.73 Bolting hormone is–
(1) Auxin (2) Gibberellin
(3) ABA (4) Ethylene

Q.74 The plant hormone, which synthesized in root and translocated to aerial parts is–
(1) Auxin (2) Cytokinin
(3) Traumatin (4) Morphactins

Q.75 The elongation of genetically dwarf plants is brought about by application of–
(1) Cytokinins (2) Gibberellins
(3) X-Rays (4) Vitamin-C

Q.76 Gibberellin was isolated from–
(1) An alga (2) A fungus
(3) A bacterium (4) A virus

Q.77 Gibberellins could be extracted from–
(1) Rice
(2) Fungus/Fusarium moniliformis
(3) More healthy plants
(4) Diseased plants

Q.78 Gibberellins are–
(1) Growth inhibitors
(2) Growth promotor
(3) Not concerned with growth at all
(4) Of little potential in agriculture

Q.79 Gibberellins do not cause–
(1) Shortening of genetically tall plants
(2) Stimulation of seed germination
(3) Promotion of parthenocarpy
(4) Induction of α-amylase synthesis in barley

Q.80 Gibberellic acid has been successfully employed to induce flowering in–
(1) Short day plants under long day condition
(2) In long day plants under short day condition
(3) For some plants
(4) None of the above

Q.81 The growth regulator that retards ageins of plant organ is-
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) Abscisic acid

Q.82 Which of the following hormones can replace vernalization ?
(1) Cytokinins (2) Auxins
(3) Ethylene (4) Gibberellin

Q.83 Which of the following breaks the dormancy of seeds ?
(1) IAA (2) GA_3
(3) Ethylene (4) All the above

Q.84 First natural cytokinin was discovered by-
(1) Miller (2) Letham
(3) Calvin (4) Govindii

Q.85 The firs cytokinin was discovered by-
(1) Skoog (2) Went
(3) Addicot (4) Miller

Q.86 Richmond lang effect is-
(1) The effect of kinetins in delaying senescence
(2) The effect of auxin on root and shoot formation
(3) The effect of traumatic acid in wound formation
(4) None of these

Q.87 Which of the following is a coconut milk factor ?
(1) Auxin (2) ABA
(3) Morphactin (4) Cytokinin

Q.88 Which of the following induces morphogenesis in tissue culture ?
(1) Gibberellin (2) Cytokinin
(3) IAA (4) Ethylene

Q.89 The habit of Cabbage plant can be changed drastically by the application of -
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) ABA

Q.90 In germinating seeds Amylase, Proteases, Lipases are stimulated by)-
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) Ethylene

Q.91 Which of the following hormones is known to promote maleness in flowering plants ?
(1) Gibberellic acid (2) Kinetin
(3) IAA (4) 2, 4-D

Q.92 Richmond lang effect due to cytokinins pertains to
(1) Root formation
(2) Apical dominance
(3) Delay of senescence
(4) Leaf formation

Q.93 The gibberellin which is of wide distribution in higher plants are-
(1) GA_{29} (2) GA_{32} (3) GA_1 (4) GA_{22}

Q.94 The most common cytokinin is-
(1) IAA
(2) Kinetin
(3) Isopentanyl adenine
(4) Dehydrozeatin

Q.95 Which one of the following is a gaseous plant hormone ?
(1) Auxin (2) Gibberellin
(3) Ethylene (4) Cytokinin

Q.96 Pomalin is sprayed over apple to increase fruit size, it is-
(1) Auxin
(2) Mixture of auxin and gibberellin
(3) Mixture of auxin and cytokinin
(4) Mixture of cytokinin and gibberellin

Q.97 Apical dominance can be overcome by application of-
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) Florigen

Q.98 In plants natural cytokinin was discovered by-
(1) Skoog & Miller (2) Letham
(3) Benson & Calvin (4) Thimann & went

Q.99 The activity of α-amylase in the endospore of barley germinating seed is induced by-
(1) Ethylene (2) Cytokinin
(3) IAA (4) Gibberellin

Q.100 Dormancy of seed is broken by-
(1) Auxin (2) Gibberellins
(3) Ethylene (4) Cytokinin

Q.101 Which breaks dormancy of potato tuber ?
(1) Gibberellin (2) IAA
(3) ABA (4) Zeatin

Q.102 In tissue culture, differentiation of shoot is controlled by-
(1) Light Intensity
(2) Temperature shock
(3) Low Auxin + High CK $\left(\text{High } \frac{\text{Cyto}}{\text{Auxin}} \text{Ratio}\right)$
(4) None

Q.103 Pineapple can made to uniform flowering by the application:-
(1) Zeatin (2) Ethylene
(3) Short day (4) Low temperature

Q.104 A natural growth regulator is-
(1) Ethylene (2) NAA
(3) 2, 4-D (4) Benzyladenine

Q.105 Among the following which helps in early ripening of fruits ?
(1) Methane (2) Ethylene
(3) CO_2 (4) CO

Q.106 Abscisic acid induces-
(1) Shoot elongation
(2) Cell elongation and cell wall formation
(3) Cell division
(4) leaf fall and dormancy

Q.107 In autumn leaf fall occurs, because-
(1) Formation of abscission layer at the base
(2) Leaf becomes heavy
(3) Leaf does not remain green
(4) Of low temperature

Q.108 The hormone produced during adverse environmental condition is-
(1) Abscisic acid
(2) N^6-Isopentanyl adenine (CK)
(3) Dichlorophenoxy acetic acid (2, 4-D)
(4) Gibberellic acid (GA)

Q.109 The which of the following is growth inhibitor-
(1) IAA (2) ABA
(3) NAA (4) GA_3

Q.110 During adverse environmental condition plants develop a stress hormove, which is ?
(1) Abscisic acid
(2) Ethylene
(3) Benzyl amino purine
(4) Dichlorophenoxy acetic acid

Q.111 Abscisic acid treatment results in-
(1) Leaf expansion (2) Stem elongation
(3) Stomatal closure (4) Root elongation

Q.112 Natural cell division inducing factor occurs in-
(1) Coconut milk
(2) Immature maize seeds
(3) Both
(4) Heated t - RNA

Q.113 Recognition of ethylene as a natural plant hormone was done by-
(1) Pratt Goeschl (2) Richmond Lang
(3) Sorokin (4) Haberlandt

Q.114 Seeds of Tomato do not germinate in its pulp due to-
(1) Presence of excess salts
(2) Presence of ferulic acid
(3) Absence of oxygen
(4) Presence of ABA

Q.115 Fruits ripening hormone is-
(1) Kinetin (2) Gibberellin
(3) Ethylene (4) IAA

Q.116 Morphactins are-
(1) Auxins
(2) Natural growth regulators
(3) Synthetic growth inhibitor
(4) Metabolic inhibitors

Q.117 What is a stress hormone ?
(1) Benzyl aminopurine
(2) Dichlorophenoxy acetic acid
(3) Ethylene
(4) Abscisic acid

Q.118 A fungus which secretes abscisic acid is-
(1) Aspergillus (2) Gibberella
(3) Cercospora (4) Alternaria

Q.119 Seed dormancy is due to the-
(1) Ethylene (2) Abscisic acid
(3) IAA (4) Starch

Q.120 Hormone responsible for senescence-
(1) ABA (2) Auxin
(3) GA (4) Cytokinin

Q.121 Hormone responsible for vernalization-
(1) Florigen (2) Caulocaline
(3) Abscisin (4) Vernalin

Q.122 Effect of day length on plant development is called
(1) Phototropism (2) Photoperiodism
(3) Chemotropism (4) Photosynthesis

Q.123 The phenomenon of photoperiodism in plants was discovered by-
(1) Garner and Allard
(2) Steward and Salisbury
(3) Thiman and Skoog
(4) Hendricks and Borthwick

Q.124 Selaginella sperms swims towards the archaegoina, this movement is-
(1) Chemotropic (2) Chemotactic
(3) Chemonastic (4) Archaenastic

Q.125 Active form of phytochrome for seed Germination is-
(1) P_{fr}–form (2) Pr–form
(3) Both (4) None

Q.126 Long day plant's produces flowers when they exposed to-
(1) Any duration of light
(2) Light period longer than a critical day length
(3) Light period longer than 12 hrs.
(4) None of these

Q.127 Which of the following is a hypothetical hormone ?
(1) Gibberellin (2) Auxin
(3) Cytokinin (4) Florigen

Q.128 Which plant is LDP ?
(1) Tobacco (2) Glycine max.
(3) Mirabilis (4) Spinach

Q.129 In red-far red treatment response of plant depends upon-
(1) First treatment
(2) Last treatment
(3) Middle treatment
(4) Sum total of all the treatment

Q.130 Phytochrome is found in-
(1) Algae (2) Fungi
(3) Gymnosperms (4) Angiosperms

Q.131 Wheat, potato & henbane are-
(1) SDP (2) DNP (3) LNP (4) LDP

Q.132 In short day plants (SDP) flowering is induced by
(1) Long night
(2) Photoperiod less than 12 hours
(3) Photoperiod shorter than critical value and uniterrupted long night.
(4) Short photoperiod and interrupted long night

Q.133 Which one shows red far red interconversions ?
(1) Carotenoids (2) Cytochromes
(3) Chlorophyll (4) Phytochrome

Q.134 Physiologically active form of phytochrome is-
(1) P_{730} (2) P_{660} (3) P_{700} (4) P_{680}

Q.135 Pneumatophore are-
(1) Positively geotropic
(2) Negative phototropic
(3) Negatively geotropic
(4) Hydrotropic

Q.136 Which one prevents photooxidation and pigment destruction-
(1) Carotene (2) Phytohormone
(3) Phycocynin (4) Phycoerythrin

Q.137 If a tree flowers thrice in a year in October, January and July in northern India, the plant is-
(1) Photo and thermo sensitive
(2) Photo and thermo insensitive
(3) Photosensitive but thermo insensitive
(4) Thermo sensitive but photo insensitive

Q.138 A long day plant is -
(1) Xanthium (2) Chrysanthemum
(3) Radish (4) Tomato

Q.139 Which is not a plant hormone-
(1) Phytochrome (2) Florigen
(3) GA (4) IAA

Q.140 A pigment concerned with both floral induction and seed germination is-
(1) Florigen (2) Chlorophyll
(3) Plastocyanin (4) Phytochrome

Q.141 Which pigment absorbs the red and far-red ligh ?
(1) Cytochrome (2) Phytochrome
(3) Carotenoids (4) Chlorophyll

Q.142 Mimosa pudica shows-
(1) Chemotropism (2) Nyctinasty
(3) Seismonasty (4) All the above

Q.143 The style in ***Arachis*** before fertilization is-
(1) Positive phototropic
(2) Negative phototropic
(3) Positive geotropic
(4) None of the above

Q.144 Rhizomes and runner stems are-
(1) Diageotropic (2) Apogeotropic
(3) Plagiotropic (4) Aerotropic

Q.145 Physiologically active from of phytochrome is-
(1) P_{730} (2) P_{660} (3) P_{700} (4) P_{680}

Q.146 Low temperature is harmful for plants, because it has-
(1) Dessication effect (2) Chilling effect
(3) Freezing effect (4) All of these

Q.147 Greater growth on the lower surface of a bifacial leaf is-
(1) Nyctinasty (2) Photonasty
(3) Hyponasty (4) Epinasty

Q.148 Opening of flower is example of-
(1) Curvature movement
(2) Epinasty
(3) Hyponasty
(4) Autonomus

Q.149 Mimose (touch me not plant) shows-
(1) Thigmotropism movement
(2) Chemotactic movement
(3) Thigmonasty
(4) Seismonasty

Q.150 Movement of tendrils is-
(1) Hydrotropism (2) Chemotropism
(3) Thigmotropism (4) Geotropism

Q.151 Movement of pollen tube is-
(1) Chemotropism (2) Hydrotropism
(3) Phototropism (4) None

Q.152 Movement of male gametes in lower plants (Fern, Bryophytes) is-
(1) Thermotactic (2) Chemotropism
(3) Chemotactic (4) Phototactic

Q.153 Phototactic movements found in-
(1) Plants (2) Some Algae
(3) Bryophytes (4) Male gametes

Q.154 Negatively geotropic roots present in-
(1) Bryophytes (2) Mangrooves
(3) Pteridophytes (4) Xerophytes

Q.155 Movement can see in fungal hyphae-
(1) Chemotactic (2) Chemotropic
(3) Thigmotropism (4) None

Q.156 Cucurbitaceae is good example of-
(1) Haptotropism (2) Thigmotropism
(3) Both (4) None

Q.157 Diurnal change in flower & leafs is known as-
(1) Nyctinasty or sleep movement
(2) Haptonasty
(3) Photonasty
(4) None

Q.158 Movement of Indian telegraph plant (Desmodium) is–
(1) Movement of variation (Turgor movement)
(2) Geotropism
(3) Phototropism
(4) Movement of cyclosis

Q.159 Hydrotropism have seen in-
(1) Flowers (2) Seedlings
(3) Stem (4) None

Q.160 ***Crocus*** and ***Tulip*** flow shows response to-
(1) Water (2) Light
(3) Temperature (4) Touch

Q.161 ***Mimosa pudica*** (Sensitive plant) leafs movement due to-
(1) Nerve impulsion
(2) Delicate leafs
(3) Loss of tissue
(4) Turgor change in leaf base

Q.162 Plant hormone associated with Climacteric respiration is-
(1) Auxin (2) Cytokinin
(3) Ethylene (4) Gibberellin

Q.163 Movement of Spirogyra gametes is-
(1) Ciliary (2) Cyclosis
(3) Amoeboid (4) None

Q.164 Movement in peristome teeth is-
(1) Hydrochasy (2) Xerochasy
(3) Chemotactic (4) Chemotropism

Q.165 Haustorial movement in Cuscuta-
(1) Hapto/thigmotropism
(2) Aerotropism
(3) Hydrotropism
(4) Thermotropism

Q.166 Drosera tentacles shows-
(1) Chemonasty (2) Thigmonasty
(3) Chemotropism (4) Both (1) & (2)

Q.167 Scototropic movements induced by-
(1) Light (2) Night
(3) Touch (4) Heat

Q.168 Motor or bulliform cells In grasses shows-
(1) Growth movement (2) Tropism
(3) Nastic movement (4) Turgor movement

Q.169 The coiling of tendril around some base in response to touch is called:
(1) Hydrotaxis (2) Chemotaxis
(3) Thigmotaxis (4) Geotaxis

Q.170 Prunning of plants promotes branching, because the axillary buds get sensitized to- **[AIIMS - 2004]**
(1) Ethylene (2) Gibberellin
(3) Cytokinin (4) IAA

Q.171 Cell elogation in internodel regions of the green plants takes place due to- **[AIPMT - 2004]**
(1) Ethylene (2) Indole acetic acid
(3) Cytokinin (4) Gibberellins

Q.172 One set of a plant was grown at 12 hrs. day and 12 hours night period cycles and it flowered. While in the other set night phase was interrupted by flash of light and it did not flower. Under which one of the following catagories will you place this plant **[AIPMT - 2004]**
(1) Short day (2) Long day
(3) Darkness neutral (4) Day neutral

Q.173 The maximum growth rate occurs in- **[AIPMT - 2004]**
(1) Exponential phase (2) Stationary phase
(3) Senescent phase (4) Lag phase

Q.174 The ability of the Venus Flytrap to capture insects is due to- **[AIPMT - 2005]**
(1) Chemical stimulation by the prey
(2) A passive process requiring no special ability on the part of the plant
(3) specialized "muscle-like" cells
(4) rapid turgor pressure changes

Q.175 Why is vivipary an undesirable character for annual crop plants ? **[AIPMT-2005]**
(1) It reduces vigour of the plant
(2) The seeds cannot be stored under normal conditions for the next season.
(3) The seeds cannot exhibit long dormancy
(4) It adversely affects the fertility of the plant.

Q.176 Gibberellins can promote seed germination because of their influence on: **[AIPMT-2005]**
(1) Rate of cell division
(2) Production of hydrolyzing enzymes
(3) Synthesis of abscisic acid
(4) Absorption of water through hard seed coat.

Q.177 I.A.A. mainly inhibits growth of- **[RPMT-2005]**
(1) Root (2) Leaf
(3) Shoot
(4) Generally whole plant

Q.178 Movement due to external stimuli is known of-
(1) Autonomic movement **[RPMT-2005]**
(2) Paratonic movement
(3) Ameboid movement
(4) Excretory movement

Q.179 How does pruning help in making the hedge dense **[AIPMT-2006]**
(1)The apical shoot grows faster after pruning
(2)It releases wound hormones
(3) It induces the differentiation of new shoots from the rootstock
(4) It frees axillary buds from apical dominance

Q.180 Parthenocarpic tomato fruits can be produced by? **[AIPMT-2006]**
(1)raising the plants from vernalized seeds
(2) treating the plants with phenylmercuric acetate
(3) removing androecium of flowers before pollen grains are released
(4) treating the plants with low concentrations of gibberellic acid and auxins

Q.181 An enzyme that can stimulate germinationof barley seeds is- **[AIPMT-2006]**
(1) Prptease (2) Invertase
(3) α-amylase (4) Lipase

Q.182 Opening of floral buds into flowers, is a type of: **[AIPMT-2007]**
(1) Autonomic movement of growth
(2) Autonomic movement of locomotion
(3) Autonomic movement of variation
(4) Paratonic movement of growth

Q.183 Which one of the following pairs, is not correctly matched ? **[AIPMT-2007]**
(1) IAA - Cell wall elongation
(2) Abscisic acid - Stomatal closure
(3) Gibberellic acid - Leaf fall
(4) Cytokinin - Cell division

Q.184 The wavelength of light absorbed Pr form of phytochrome is- **[AIPMT-2007]**
(1) 620 nm (2) 640 nm
(3) 680 nm (4) 720 nm

Q.185 "Foolish seeding" disease of rice led to the discovery of - **[AIPMT-2007]**
(1) IAA (2) GA
(3) ABA (4) 2, 4-D

Q.186 Senescence as an active developmental cellular process in the growth and functioning of a flowering plant, is indicated in- **[AIPMT-2008]**
(1) Annual plants
(2) Floral parts
(3) Vessels and tracheid differentiation
(4) Leaf abscission

Q.187 Importance of day length in flowering of plants was first shown in- **[AIPMT-2008]**
(1) Cotton (2) Petunia
(3) Lemna (4) Tobacco

Q.188 What is the speciality of Crescograph ?
(1) Growth can be measured at the rate of per hour
(2) Growth can be measured at the rate of per minute
(3) Growth can be measured at the rate of per second
(4) Growth can be measured at the rate of per day

Q.189 Short days plants should be actually called–
(1) Long night plants
(2) Day neutral plants
(3) Photo neutral plants
(4) Light unaffected plants

Q.190 The effect of red light in short day plants can be nullified by –
(1) Orange light (2) Far red light
(3) Blue light (4) All the above

Q.191 Which is the critical period in short day plants ?
(1) Duration of light
(2) Duration of darkness
(3) Duration of both
(4) None of the above

Q.192 Which pigment induces formation of florigen in short day plants ?
(1) P_r (2) P_{fr}
(3) Both of above (4) None of above

Q.193 Which pigment induces synthesis of florigen in long day plants ?
(1) P_r (2) P_{fr}
(3) Both of above (4) None of the above

Q.194 Which plant harmone is effective for inducing flowering in LDP under short day conditions ?
(1) Auxin
(2) Gibberellin
(3) Cytokinin
(4) None of the above

Q.195 Which is active form out of P_r and P_{fr} ?
(1) P_r
(2) P_{fr}
(3) Both equally active
(4) None of the above

Q.196 Phytochrome is related to –
(1) Seed germination in salad
(2) Inhibition of albinism and development of chloroplast
(3) Expansion of leaves in dicots
(4) All the above

Q.197 Who discovered vernalization ?
(1) Lysenko (2) Went
(3) Boysen & Jenson (4) Darwin

Q.198 Went found that curvature of coleoptile is –
(1) Directly proportional to concentration of auxin
(2) Inversely proportional to concentration of auxin
(3) Not affected by concentration of auxin
(4) None of the above

Q.199 In which plant Went discovered auxin ?
(1) Phalaris canarienses
(2) Avena sativa
(3) Mirabilis jalapa
(4) Oryza sativa

Q.200 How the polar transport of auxins occurs ?
(1) From tip towards base
(2) From base towards tip
(3) From centre towards lateral side
(4) From lateral side towards centre

Q.201 Dormancy in potato can be induced by –
(1) IBA (2) NAA
(3) Maleic hydrazide (4) All the above

Q.202 Parthenocarpy can be induced by –
(1) IAA (2) NAA
(3) IBA (4) All the above

Q.203 Testing of biologically active substances on living beings is called –
(1) Biological testing (2) Utility testing
(3) Bio-assay (4) Active assay

Q.204 The auxins which can't diffuse are called –
(1) Unbound/free (2) Bound
(3) Dependent (4) None of these

Q.205 What was used by the name "Agent Orange" by America to defoliate forests of Vietnam ?
(1) 2-4 D (2) 2-4-5T
(3) Both (1) and (2) (4) None of these

Q.206 It is essential for synthesis of auxin –
(1) Mn (2) Zn
(3) Ca (4) Mg

Q.207 What is the reason of bakane disease of rice ?
(1) Bacteria (2) Mycoplasma
(3) Fungus (4) Virus

Q.208 Gibberellins are found in –
(1) Algae, fungi and bacteria
(2) Bryophytes, pteridophytes and gymnosperms
(3) Angiosperms
(4) All the above

Q.209 Gibberellin is synthesized in –
(1) Rhizome & root tip
(2) Young developed leaves
(3) Young expanded leaf
(4) All the above

Q.210 Gibberellin is formed from –
(1) Acetyl CoA (2) Methionine
(3) Isoprene (4) None of these

Q.211 Which of these effect is due to gibberellins ?
(1) Internode elongation
(2) Bolting
(3) Breaking of dormancy
(4) All the above

Q.212 In which plants, flowering can be induced by gibberellins even in the absence of appropriate photo period required for them ?
(1) In LDP (2) In SDP
(3) In LDP & SDP (4) None of these

Q.213 Due to the effect of which substance flowering can be induced even in the absence of vernalisation ?
(1) Gibberellin (2) Auxin
(3) Cytokinin (4) Ethylene

Q.214 Which enzyme is synthesized de-novo in aleurone layers of germinating seeds due to the effect of gibberellins ?
(1) α-Amylase (2) Protease
(3) Lipase (4) None of the above

Q.215 What is the chemical name of Kinetin ?
(1) 6-(4 hydroxy 3-methyl trans 2-butene aminopurinol)
(2) 6-furfuryl aminopurine
(3) Dimethyl allyl adenine
(4) None of the above

Q.216 Which one acts as cytokinins ?
(1) Diphenyl urea
(2) Indoleacetic acid
(3) Phosphon-D
(4) None of the above

Q.217 Due to which hormone effect, seeds of Striga asiatica can be germinated without coming in contact with their host ?
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) Ethylene

Q.218 Delay of senescence is called –
(1) Richmond effect
(2) Lang effect
(3) Richmond–Lang effect
(4) None of the above

Q.219 What happens during delay of senescence ?
(1) Chlorophyll breakdown stops in the treated area
(2) Transfer of proteins, amino acids and auxins towards the treated area
(3) More protein synthesis in the treated area
(4) All the above

Q.220 Who gave the name cytokinin ?
(1) Miller (2) Letham
(3) Skoog (4) None of the above

Q.221 Which is called the fruit ripening hormone ?
(1) Auxin (2) Gibberellin
(3) Ethylene (4) All the above

Q.222 Ethylene synthesis occur in –
(1) Fruit (2) Stem
(3) Leaf (4) All the above

Q.223 What is the precursor of ethylene ?
(1) Tryptophan (2) Ethene
(3) Methionine (4) None of the above

Q.224 Which are the climactric fruits ?
(1) Fruits forming auxins in more quantity during fruit ripening
(2) Fruits forming ethylene in more quantity during fruit ripening
(3) Fruits forming gibberellin in more quantity during fruit ripening
(4) Fruits forming cytokinin in more quantity during fruit ripening

Q.225 Ethylene synthesis is induced by –
(1) Auxin (2) Gibberellin
(3) Cytokinins (4) ABA

Q.226 Which of the following effects is related to ethylene ?
(1) Origin of root from graft
(2) Origin of lateral root
(3) Origin of root hair
(4) All the above

Q.227 The increase in rate of respiration during ripening of fruits is called –
(1) Fruit ripening respiration
(2) Climactric respiration
(3) Maturation respiration
(4) Climax respiration

Q.228 Chemically abscisic acid is –
(1) Terpenoid
(2) Fatty acid
(3) Precursor of typical fat
(4) Steroid

Q.229 Synthesis of abscisic acid occurs in –
(1) Leaves (2) Stem
(3) Seeds and fruits (4) All the above

Q.230 Abscission in leaves occurs due to –
(1) Abscissic acid
(2) Ethylene
(3) Combined effect of both
(4) None of the above

Q.231 Which effect is due to abscisic acid ?
(1) Induction of dormancy in buds and seeds
(2) Inhibition of growth
(3) Senescence
(4) All the above

Q.232 Which type of movement is exhibited by male gametes of Bryophytes and Pteridophytes when moving towards archegonial neck ?
(1) Photonastic (2) Chemonastic
(3) Chemotropic (4) Chemotactic

Q.233 What is it called when the plant remains fixed and the organ/part changes its position ?
(1) Fixed movement
(2) Curvature movement
(3) Tactic movement
(4) Nastic movement

Q.234 What is the special feature of growth movements ?
(1) They are irreversible
(2) They are reversible
(3) They are found only in flat organs
(4) None of the above

Q.235 In which organ circumnutation found ?
(1) In stem (2) In tendril
(3) In leaves (4) In flowers

Q.236 What is the reason of phototropism ?
(1) More distribution of auxin
(2) Less distribution of auxin
(3) Uneven distribution of auxin
(4) Rapid synthesis of auxin

Q.237 How is distribution of auxin affected by light ?
(1) Less toward dark, more towards light
(2) Less toward light, more towards dark
(3) More toward light, zero towards dark
(4) None of the above

Q.238 Which type of geotropic effect is exhibited by secondary roots ?
(1) Orthogeotropism (2) Plageotropism
(3) Dia geotropism (4) All the above

Q.239 Which type of geotropism is shown by ginger (rhizome) –
(1) Diageotropism (2) Ortho-geotropism
(3) Plageotropism (4) All the above

Q.240 Which of the following structures have negative geotropism ?
(1) Coralloid roots of Cycas
(2) Pneumatophores
(3) Most stems (4) All the above

Q.241 The coiling of tendril around the support is a type of –
(1) Thigmonastic movement
(2) Thigmotropism
(3) Geotropism (4) Phototropism

Q.242 The reason for automatic movement of variation is –
(1) Osmosis (2) Turgor
(3) Imbibition (4) All the above

Q.243 Automatic movement of variation can be seen in–
(1) Mimosa pudica (2) Desmodium gyrans
(3) Both of above (4) Acacia arabica

Q.244 Turning of sunflower head towards sun is –
(1) Photonastic movement
(2) Phototatic movement
(3) Phototropic movement
(4) None of the above

Q.245 What is it called, when there is no effect of the direction of the stimulus on movements ?
(1) Tactic movement (2) Tropic movement
(3) Nastic movement (4) None of the above

Q.246 Which type of movement is found in leaves of members of Leguminosae ?
(1) Thermonastic (2) Photonastic
(3) Nyctynastic (4) All the above

Q.247 Which movements occur to capture insects in insectivorous plants ?
(1) Thigmotropic (2) Chemotropic
(3) Chemonastic (4) Seismonastic

Q.248 Chemonasty is found in –
(1) Drosera (2) Dionea
(3) Nepenthes (4) All the above

Q.249 Which is called the compass plant ?
(1) Lactuca sativa (2) Lactuca scariola
(3) Sunflower (4) All the above

Q.250 Sleep movements (nyctinasty) of legume plants is–
(1) Turgor movement
(2) Growth movement
(3) Hygroscopic movement
(4) Movement of locomotion

Q.251 One of the synthetic auxin is- **[AIPMT-2009]**
(1) IBA (2) NAA (3) IAA (4) GA

Q.252 Which one of the following acids is a derivative of carotenoids ? **[AIPMT-2009]**
(1) Abscisic acid (2) Indole butyric acid
(3) Indole-3-acetic acid (4) Gibberellic acid

Q.253 Phototropic curvature is the result of uneven distribution of- **[AIPMT-2010 (Pre)]**
(1) Cytokinins (2) Auxin
(3) Gibberellin (4) Phytochrome

Q.254 Photoperiodism was first characterised in- **[AIPMT-2010 (Pre)]**
(1) Tomato (2) Cotton
(3) Tobacco (4) Potato

Q.255 Coiling of garden pea tendrils around any support is an example of- **[AIPMT-2010 (Pre)]**
(1) Thigmotropism (2) Thermotaxis
(3) Thigmotaxis (4) Thigmonasty

Q.256 One of the commonly used plant growth hormone in tea plantations is- **[AIPMT-2010 (Mains)]**
(1) Absicisic acid (2) Zeatin
(3) Indole-3-acetic acid (4) Ethylene

Q.257 Root development is promoted by : **[AIPMT-2010 (Mains)]**
(1) Auxin (2) Gibberellin
(3) Ethylene (4) Absicisic acid

Q.258 One of the commonly used plant growth hormone in tea plantations is - **[RPMT-2011]**
(1) ABA (2) Zeatin
(3) IAA (4) Ethylene

ANSWER KEYS

EXERCISE - I

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	3	2	1	4	2	2	2	4	1	3	2	4	3	3	1	2	3	1	1
Ques.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	4	1	1	4	1	2	3	3	4	4	3	4	2	1	3	4	4	3	3
Ques.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	2	1	1	1	2	1	3	1	2	3	1	1	3	1	2	4	1	1	1
Ques.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	1	3	2	1	4	2	3	3	1	2	2	1	2	2	2	2	2	2	1	2
Ques.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	3	4	2	2	4	1	4	2	2	2	1	3	3	3	3	4	3	2	4	2
Ques.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	1	3	2	1	2	4	1	1	2	1	3	3	1	2	3	3	4	3	2	1
Ques.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
Ans.	4	2	1	2	1	2	4	4	2	4	4	3	4	1	3	1	2	3	1	4
Ques.	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
Ans.	2	4	1	1	1	4	3	2	4	3	1	3	2	2	2	3	1	1	2	3
Ques.	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
Ans.	4	3	3	2	1	4	2	4	3	3	4	1	1	4	2	2	1	2	4	4
Ques.	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
Ans.	3	1	3	2	2	4	4	3	1	2	2	1	2	2	2	4	1	1	2	1
Ques.	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
Ans.	4	4	3	2	3	2	3	4	4	1	4	1	1	1	2	1	3	3	4	3
Ques.	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
Ans.	3	4	3	2	1	4	2	1	4	3	4	4	2	1	2	3	2	2	1	4
Ques.	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258		
Ans.	2	2	2	3	3	4	3	4	2	1	2	1	2	3	1	2	1	2		

EXERCISE - II

Q.1 Plant hormones are : -
[Uttaranchal PMT 2004]
(1) Growth regulators
(2) Growth promoters
(3) Growth inhibitors
(4) None of above

Q.2 The most common auxin is : -
[Uttaranchal PMT 2004]
(1) GA (2) ABA (3) Kinetin (4) IAA

Q.3 Gibberellin promotes cell division and elongation in : - **[Uttaranchal PMT 2004]**
(1) Leaves (2) Roots
(3) Shoots (4) All of these

Q.4 The deteriorative processes in plants, that naturally terminate their functional life, are collectively called : -
[Uttaranchal PMT 2004]
(1) Wilting (2) Abscission
(3) Plasmolysis (4) Senescence

Q.5 Which of the following is used for ripening of fruits **[Uttaranchal PMT 2004]**
(1) Auxin (2) ABA
(3) Ethylene gas (4) Cytokinin

Q.6 Induction of flowering is plants by low temperature treatment is called :
[Uttaranchal PMT 2005]
(1) Vernalization (2) Photoperiodism
(3) Cryobiology (4) Chilozology

Q.7 Plant growth is : **[Uttaranchal PMT 2004]**
(1) Limited (2) Unlimited
(3) Diffused (4) Both (1) & (2)

Q.8 Hormore produced during leaf fall is :
[Uttaranchal PMT 2005]
(1) IAA (2) ABA
(3) Florigen (4) Kinetin

Q.9 Climacteric fruit shows :
[Uttaranchal PMT 2004]
(1) High respiration rate at ripening
(2) Sudden change in taste
(3) Sudden change in colour and shape
(4) None of the above

Q.10 Phytochrome is present in :
[MP PMT 2007]
(1) Vascular cryptogams (2) Prokaryotes
(3) Brain cell (4) Kidney cell

Q.11 Genetically dwarf plant can be converted into a plant of normal height with the application of : **[Uttaranchal PMT 2006]**
(1) Auxin (2) Gibberellin
(3) Cytokinins (4) Auxin

Q.12 A phytohormone involved in the de novo synthesis of α-amylase in germinating seeds is : **[Uttaranchal PMT 2006]**
(1) Auxin (2) Gibberellin
(3) Ethylene (4) Cytokinin

Q.13 Phytochrome is responsible for :
[West Bengal JEE 2007]
(1) Photosynthesis (2) Flowering
(3) Fruit formation (4) Respiration

Q.14 Which of the following is a gaseous hormone :
[West Bengal JEE 2007]
(1) Ethylene
(2) Cytokinin
(3) Both ethylene and auxin
(4) Gibberellin

Q.15 The pineapple which under natural conditions is diffcult to blossom has been made to produce fruits throughout the year by the application of : **[West Bengal JEE 2007]**
(1) IAA, IBA
(2) NAA, 2,4-D
(3) Phenyl murcuric acid
(4) Cytokinins

Q.16 Most of the plants are seasonal due to :
[C.G. PMT 2004]
(1) Photoperiodism (2) Phototropism
(3) Photosynthesis (4) Photolysis

Q.17 Certain chemical susbtances having profound effect on plant growth are called :
[C.G. PMT 2004]
(1) Catalyic agents (2) Phytohormones
(3) Enzymes (4) Compost

Q.18 Phytochrome was discovered by : **[C.G. PMT 2005,06]**
(1) W. Went
(2) Garner and Allard
(3) F.F. Blackman
(4) Borthwick and Handricks

Q.19 The activity of α-amylase in the endosperm of barley germinating seed in induced by : **[C.G. PMT 2005]**
(1) Ethylene (2) Cytokinin
(3) IAA (4) Gibberellin

Q.20 A pigment concerned with floral induction is **[C.G. PMT 2005]**
(1) Florigen (2) Chlorophyll
(3) Plastocyanin (4) Phytochrome

Q.21 Gibberellins were first discovered in fungal genus **[C.G. PMT 2006]**
(1) Mucor (2) Rhizopus
(3) Agaricus (4) Fusarium

Q.22 The presence of auxins in a solution could be tested **[C.G. PMT 2006]**
(1) Avena sativa stem tip test
(2) Carbon tetrachloride test
(3) Iodine test
(4) Defoliation test

Q.23 Auxanometer is used to measure : **[Jharkhand 2005]**
(1) Length (2) Width
(3) Depth (4) Growth

Q.24 The pigment sensitive for red and far red light is **[Jharkhand 2005]**
(1) Chlorophyll (2) Phytochrome
(3) Cytochrome (4) Carotene

Q.25 Hormone which breaks seed dormancy is : **[Jharkhand 2005]**
(1) Auxin (2) Gibberellin
(3) Ethylene (4) Cytokinin

Q.26 Which one of the following is not a synthetic auxin **[Jharkhand 2002]**
(1) 2, 4-D (2) 2-4-5-T
(3) NAA (4) IAA

Q.27 Which plant hormone causes fruit ripening : **[Bihar 2004]**
(1) IAA (2) Cytokinin
(3) Ethylene (4) GA

Q.28 Which hormone is responsible for apical growth **[Bihar 2004]**
(1) IAA (2) ABA
(3) GA (4) All of these

Q.29 Abscisic acid controls : **[Bihar 2002]**
(1) Cell elongation and cell wall formation
(2) Shoot elongation
(3) Leaf fall and dormancy
(4) Cell division

Q.30 Which hormone is used to induce ripening in banana **[Bihar 2002]**
(1) Cytokinin (2) Ethylene
(3) ABA (4) GA_3

Q.31 Which among the following is a synthesis plant hormone : **[Bihar 2001]**
(1) IAA (2) GA
(3) 2, 4-D (4) ABA

Q.32 Richmond-Lang effect is shown by : **[UP CPMT 2001]**
(1) Auxins (2) Sugars
(3) Zeatin (4) Gibberellins

Q.33 Ethylene gas is used for : **[UP CPMT 2001]**
(1) Growth of plants
(2) Delaying fruit's abscission
(3) Ripening of fruits
(4) Stopping the leaf abscission

Q.34 Auxanometer is used to detect : **[UP CPMT 2002]**
(1) Respiration (2) Transpiration
(3) Plant movement (4) Growth

Q.35 Which of the following plant hormone is extracted from fungus : **[UP CPMT 2003]**
(1) Ethylene (2) Gibberellin
(3) Cytokinin (4) 2, 4 D