Unit.1 - ORIGIN AND DEVELOPMENT OF BOTANY

1. The study of living organisms is called **BIOLOGY.** In Greek language Bios = Life Logos = discourse **Modern technology** helped biology to progress rapidly.
2. **Microchemical tests** - help to understand the functions and chemical reactions which occur in different cell organelles.
3. **Ultra Centrifugation** - helps to separate cell organelles.
4. **Chromatography** – Thin layer chromatography (TLC) and High Pressure Liquid chromatography (HPLC) made possible to separate the chemical compounds present in the living cells.
5. **Electron microscopy** - help to understand the ultra structure of the cell and cell organelles.
6. Recently developing branch gaining popularity is **Biotechnology.** Biotechnology deals with different aspects like repairing the genetic material, transferring the genetic material from one organism to another organism.
7. Biomolecules may be separated in an electric field if they are charged to different extents by **electrophoresis**
8. Biology in relation to physics and chemistry developed in to new branches called **Biophysics and Biochemistry and molecular biology.**
9. **We are in the Golden era of Biology**
10. The study of plants is called **BOTANY** and the study of animals is called **ZOOLOGY.**
11. The word' BOTANY' is derived from Greek word **BOUSKEIN** (Bous = cattle, Bouskein = cattle feed).
12. Bouskein gave rise to the term **BOTANE** which changed in due course into **BOTANY.**
13. Assyrians and Egyptians (4000 BC) recorded information related to crop plants and fruit trees in the form of pictures - **Hieroglyphics.**
14. **By 2500 BC** Chinese learned several details about plant cultivation
15. In **Atharvana Veda** (2000 BC) medicinal plants and their uses, were described.
16. **Parasara** (1300 BC) wrote a book on agriculture and weeds - **KRISHIPARASARAM.**
17. He also wrote another book describing 14 types of forests, the external and internal characters of plants and also medicinal plants-**VRIKSHAYURVEDA.**

18. Greek philosophers - **Socrates, Plato and Aristotle** contributed for the development of botany as a science.
19. **Theophrastus** (340 BC)is regarded as **Father of Botany.** He described external and internal characters of 480 plants in his book **de HISTORIA PLANTARUM**.
20. Renaissance period of **16"' and 17"' centuries** can be described as **period of Herbalists.**
21. Technical description of plants living in natural surroundings acquired significance. Important herbalists are **Brunfels, de L'Obel, and Fuchs.**
22. The books written by them were called **Herbals.** They identified and described **medicinal plants.**
23. **Gaspard Bauhin** (1623) introduced the **Binomial Nomenclature** for the first time. He published the description and identification of 6000 plants.
24. **Zacharias Janssen** (1590) constructed the first compound microscope.
25. **Robert Hooke** (1665) discovered the cell. He published the book MICROGRAPHIA.
26. **Anton van Leeuwenhoek** (1674) observed the bacterial cell for the first time in living condition.
27. **Nehemiah Grew and Marcello Malpighi** (17^{lh} century) described the plant tissues and laid foundation for Anatomy.
28. **Camera rius** (1694) gave a description of sexual reproduction in plants.
29. **Carolus Linnaeus** (18^{th} century Sweedish Botanist) popularised the Binomial Nomenclature. He also proposed the sexual system of classification. He was responsible for the development of Taxonomy.
30. **Stephen Hales** showed that water is conducted through Xylem. He also demonstrated **root pressure.**
31. **Joseph Priestly** discovered that green plants absorb toxic gases and release pure gas.
32. **Ingen Housz** (1779) showed that green parts of plants absorb CO_2 and release O_2 in the presence of sun light.
33. **Gregor Johann Mendel** (Czechoslovakia) conducted **hybridization experiments on pea plants** in 1856. It marked the beginning of **Genetics.** He introduced the **Laws of inheritance.** He became popular as **Father of Genetics.**
34. Works of scientists like **Haeckel** contributed for the beginning of **Ecology.**
35. **Endlicher, de Candolle, Bentham and Hooker** (Taxonomists) proposed different classifications.

36. **Darwin** put forward the **theory of Evolution.**
37. **Buchner** (1898) discovered the enzyfne **Zymase** in living cells.
38. **Sutton and Boveri** (1902) explained the role of chromosomes in heredity.
39. **Hugo de Vries (1**901) discovered mutations in plants
40. **Watson and Crick** (1953) proposed the double helical model for DNA.
41. **Fraenkelin - Conrot** (1957) described the chemical nature of RNA.
42. **Nircnberg, HarGovind Khorana and Holley**contributed to the understanding of Genetic' code.
43. **H.G. Khorana** artificially synthesized the gene.
44. **Hanning, Shimakura, White, Skoog, Nitsch and Maheswari** have helped the development of tissue and organ culture.
45. **Knoll and Ruska** (1932) invented electron microscope.
46. **J.B. Sumner** for the first time crystallized the enzyme.
47. **Robert Hill, Ruben, Arnon and Emerson** contributed to the understanding of light reaction in photosynthesis.
48. **Melvin Calvin, Benson and Bassham** discovered the C, - path of carbon assimilation.
49. **Hateh and Slack** (1937) discovered C_4 path of carbon.
50. **Hans Krebs.** (1937) discovered citric acid cycle in respiration.
51. **F.W. Went** (1928) identified the. presence of auxins.
52. **Wodehouse, P.K.K. Nair, Vishnu Mitre, C.G.K. Ramanu jam and Sunirmal Chanda** developed **palynology.**
53. **Bessey, Rendle, Takhtajan, Hutchinson and Cronquist** are **taxonomists.** They proposed phylogenetic classification.

Scope of Botany:

5,50,000 plant species are know but only a few are used as food sources

The problem of decreasing resources and increasing population can be solved to a great extent by enhancing crop yield through Green Revolution and also develop disease resistant and pest resistant crop by utilizing principles of Biotechnology

Hybridization and genetic engineering helped the applied sciences like Agriculture, Forestry, horeticulture and floriculture.

Knowledge of plant physiology helped the development of agriculture by providing information about the role of Minerals and hormones in plant nutrition and plant growth.

Auxins at low concentrations induces root formation and hence used in agriculture and Horticulture.

Axins have herbicidal effects and can be used against dicotyledonous weeds

Gibberillins induce seed germination

Cytokines can enhance shelf life of leafy vegetables like spinach, lettuce etc.

Abscisic acid (ABA) is used for delaying sprouting of potato tubers under storage

Ethylene to accelerate ripening of the fruits

Phyto pathology and tissue culture experiments helped in developing disease resistant plant varieties in short duration of time.

Botany helps in obtaing commercially important and medicinal plants

Natural fossil fuels are produced by the the palnt fossils. Recently biodiesel is produced from Jatropa of family euphorbiaceae.

Fungi help in producing antibiotics

Algae like spirulina and chlorella are good sources of proteins and vitamins

Biofertilizers (Azolla, Nostoc, anabaena, Rhizobium) help in reducing hazardous chemicals added to soil through chemical fertilizers

Chlorella used as food for Astronauts in space researchsand binding plants help in controlling floods

Several sea weed help in extracting Iodine and agar-agar

Classification of plant Kingdom:

Plant classification is essential to facilitate better communication and precise identification of plants.

Classification of plants is needed Because 5,50,000 plants of diverse habitat, habit, mode of nutition and methods of reproduction.

All the plants were placed in Kingdom Plantae

A.W. Eichler (1875-78) divided plant kingdom in to two sub kingdoms

I. Cryptogamae
II. Phanerogamae

Cryptogamae:

Non-flowering, seed less and spore bearing plants are included in this.

Sub kingdom cryptogamae divided in to three divisions

a) Thallophyta
b) Bryophyta
c) Pteridophyta

A)Thallophyta :

This is the most primitive and largest division of cryptogamae

Plant body is not differentiated into root stem and leaves such is called **Thallus**

Thallus may be unicellular or multi cellular

Thallophyta is divided in to two subdivisions

i) Algae ii) Fungi

i) Algae: Chlorophyllous and autotrophic thallophytes and largely aquatic plants are algae

Eg: spirogyra

ii) Fungi: Nonchlorophyllous heterotrophic thallophytes are placed under fungi. Some fungi live in association with roots of vascular plants forming mycorrhizae.

Eg: rhizopus

- Saprophytes: absorbs soluble organic matter from dead substrates
- Parasites: obtain food from other living organisms
- Mycorrhiza: association between fungal members and roots of vascular plants
- Lichens are fungal and algal associations

B. Bryophyta: chlorophyllous, autotrophic, embryophytic and atracheophytic cryptogams.

They are called amphibians of the plant kingdom

Eg: Funaria

- Embryophytes are plants capable of producing embryo
- Tracheophytes are plants with vascular tissues like xylem and phloem

C. Pteridophyta: chlorophyllous, autotrophic embryophytic cryptogams are placed in pteridophyta

These are non flowering plants with vascular tissue and hence called vascular cryptogams

Eg: Pteris

II Phanerogams: flower bearing seed producing tracheophytes are placed in this subkingdom

This subkingdom has only one division **Spermatophyta**

Division Spermatophyta: these are seed plants with or without fruits

This is divided in to two sub divisions

i) Gymnospermae: these are phanerogams with out ovary and fruit. Seeds are naked without fruit wall
   eg: Cycas, Pinus, Gnetum
ii) Angispermae: flowering plants with seeds enclosed by fruits. These are divided into two classes
   a) Dicotyledons: with two cotyledons in the seed eg: Bean, Pea
   b) Monocotyledons: they possess only one cotyledon in their seeds eg: Maize, sorghum

Parts of a Typical angiospermic plants:

Angiosperms are a group of highly evolved flowering plants which constitute the dominant vegetation among the plant kingdom of present era

The plant body has two parts

a) **Root system**:
   i. grows positively geotrophic manner
   ii. developed from radical of the embryonal axis
   iii. non chlorophyllous and brown colored

Tap root system: in dicots the radical develops in to tap root which inturn produce lateral roots in acropetal succession. The lateral roots posses rootlets for absorption of water.

Fibrous root system or **Adventitious root system**: in monocots radical is short lived and after its disintegration many long roots are developed at the base of the stem called adventious roots or fibrous roots.

At the apices of tap root and lateral root protective sheath called **root cap** is present

Functions of root system

i. fixation of the plants
ii. absorption and conduction of water and minerals

b) **Shoot system**: main axis of the plant that grows positively phototrophic manner. In shoot system stem, branches leaves and buds act as vegetative organs. Flowers acts as reproductive organs.

   The upper part between leaf and stem called **Axil**

   In shoot system leaf is organ of photosynthesis and transpiration where as flower organ of reproduction

   The stalk of the flower is called **pedicel**

   Condenced tip of the pedicel is called **thalamus**

Branches of Botany:

During the 19th and 20th century botany progressed rapidly accumulating various aspects of plant life.

Important branches are outlined here

1. **Morphology** is the branch of science deals with Description of different plant organs (two parts) (Fundamental prerequisite for classification of plants)
2. **External Morphology** deals with Description of external characters of plant organs
3. **Internal Morphology** deals with Internal structure of different plant organs (2 branches)
4. **Histology** deals with Different tissues present in the plant body.
5. **Anatomy** deals with Gross internal details of the plant organs.
6. **Cytology** Structure and functions of cell and cell organelles and their multiplication.
7. **Embryology** deals with Development of male and female gametophytes, formation of gametes, process of fertilization, development of embryo, endosperm and seed. **P. Maheswari** made significanr contributions to Embryology
8. **Palynology** deals with All aspects of microspores or pollen grains including their structure and development.
9. **Plant Taxonomy** Identification, Nomenclature and classification of plants into related groups based on the information obtained from other fields of Botany.
10. **Plant Physiology** deals with Different vital activities of plants like absorption of water and minerals, photosynthesis, transpiration, Nitrogen metabolism, growth etc.
11. **Plant Ecology** deals with Reciprocal relationship between the plants and the environment
12. **Palaeobotany** deals with Fossil plants. (This study helps in understanding the process of evolution) Birbal.Sahni institute of paleobotany at Lucknow.
13. Genetics deals with All aspects related to genes such as structure, synthesis, inheritance, mutations etc.
14. **Phytogeography** deals with Distribution of plants in different parts of the globe during past and present.
15. **Phycology** deals with all aspects related to algae which are Chlorophyllous and autotrophic thallophytes (algae)
16. **Mycology** deals with all aspects of fungi which are Nonchlorophyllous heterotrophic thallophytes (fungi)
17. **Lichenology** deals with Lichens special group of plants in which an algal member and a fungal member live together as symbionts. (Lichens mostly grow on rocks)
18. **Bryology** deals with study of bryophytes. These are the first Embryophytes of plant kingdom. Mostly grown on damp and shady places.
19. **Pteridology** deals with the study of Pteridophytes - first vascular plants, known as vascular cryptogams.

20. **Microbiology** deals with Micro organisms like algae, fungi, protozoa, bacteria and viruses.
21. Bacteriology deals with study of Bacteria.
22. Virology deals with the study of Viruses.