

BRANCHES OF BOTANY

Botany deals with the study of plants. In this branch of science we study their size, external and internal form, cell structure, cell division, physiological processes e.g., respiration, photosynthesis etc., their life cycles, heredity, adaptations to environment, reproduction, interrelationship between different plants and plants and animals, and their geographical distribution etc.

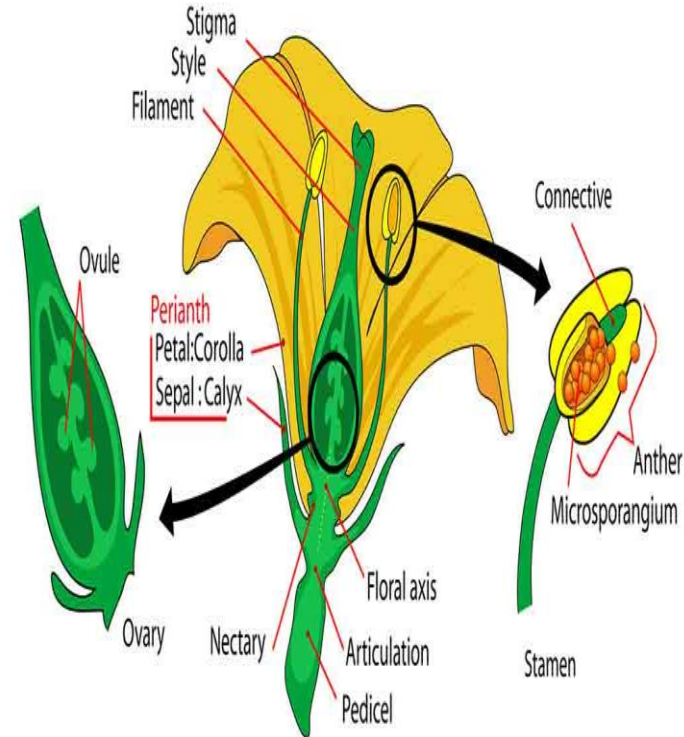
On the basis of above mentioned facts botany can be divided into the following branches.

26 branches of botany

1. MORPHOLOGY: (MORPHE=FORM, LOGOS=SCIENCE)

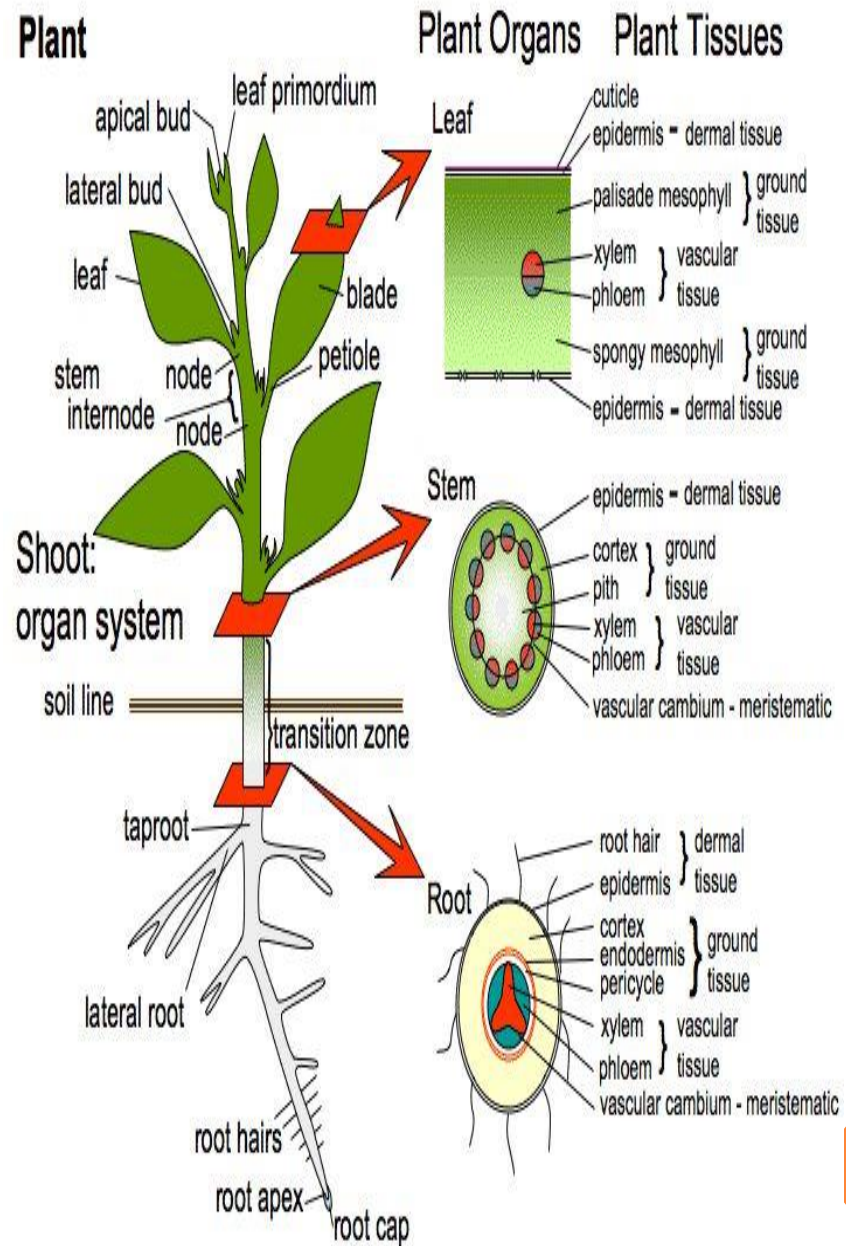
- Under this branch we study the form and structure of plants. That branch of morphology which is based upon the external form and structure of plant is called External Morphology.

— Morphology of Flowering Plants —



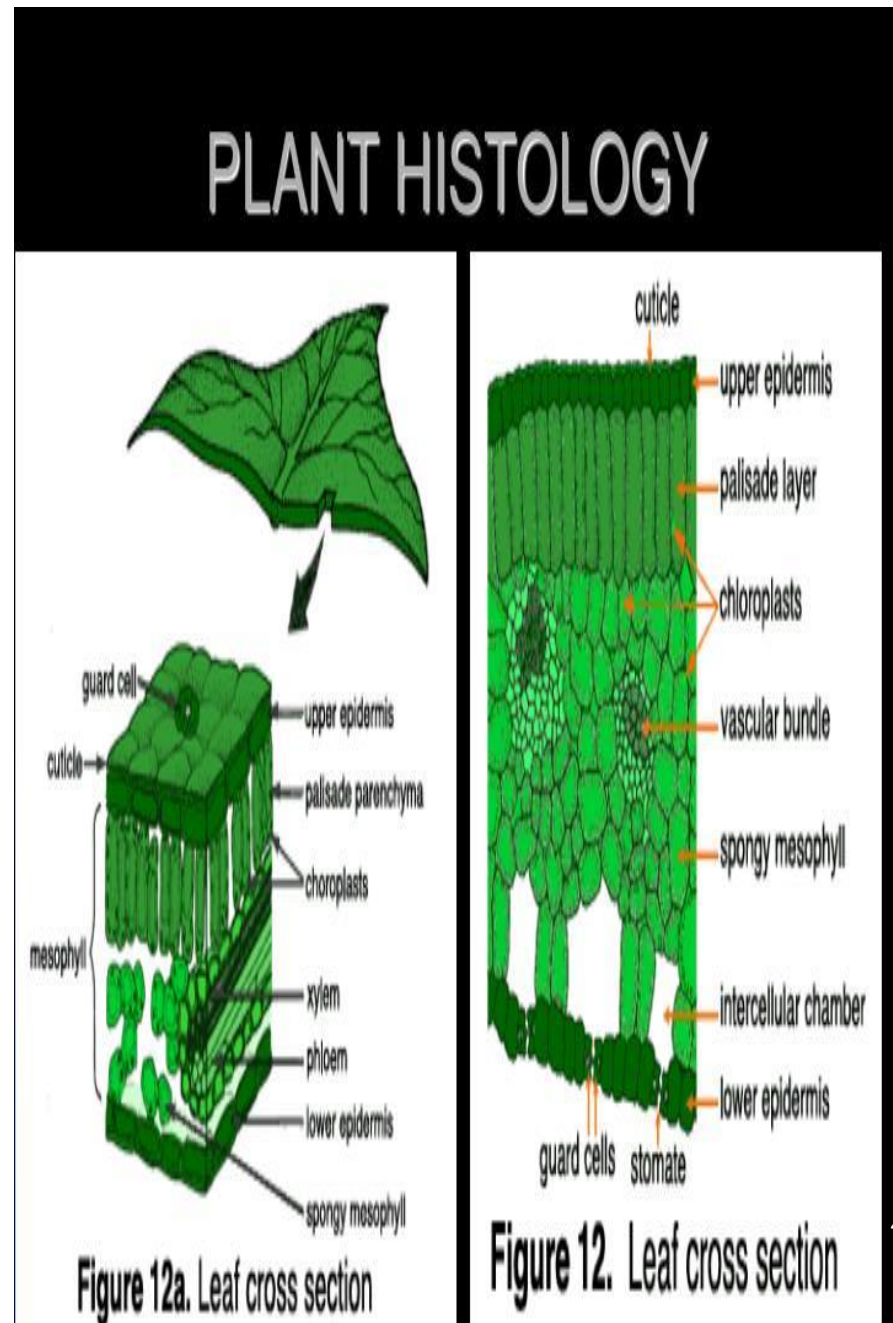
2. ANATOMY

- The study of internal structure of the plants with the help of section cutting, is called Internal Morphology or Anatomy.



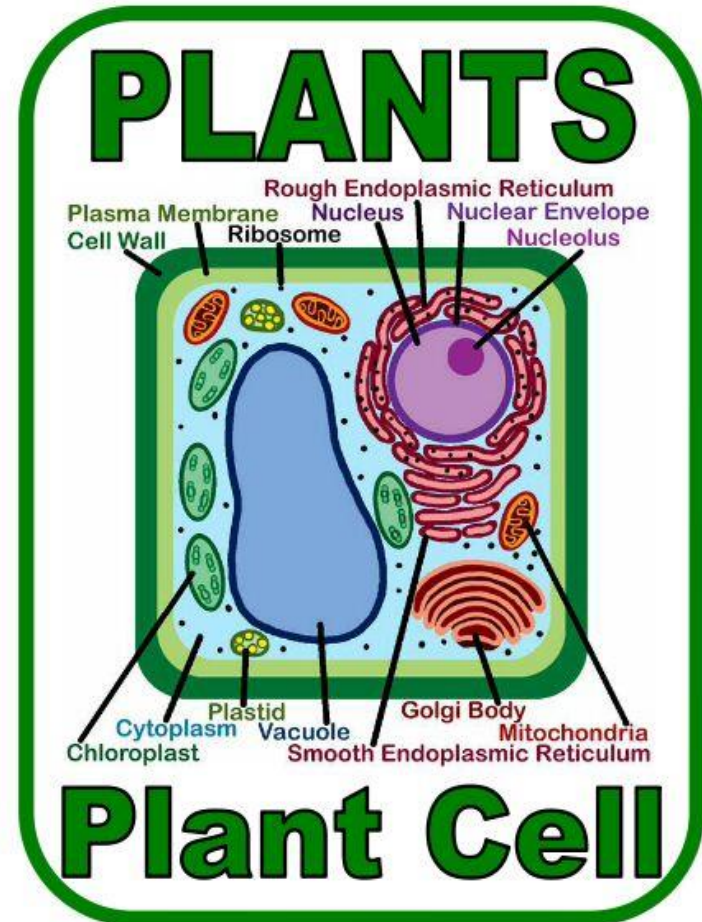
3. HISTOLOGY

- The study of cells and tissues with the help of microscope is called histology,



4. CYTOLOGY

- Detailed study of the cells is called cytology. It includes structure, function of different cell organelles, nucleus and cell inclusions. Different types of cell divisions are included in this branch. The study of this branch has become possible only with the help of electron microscope



5. PLANT PHYSIOLOGY :

- This branch includes the study of various vital activities of the plant. All chemical and physical changes taking place in the cell and any exchange of substances between the cell and its environment are called vital activities of the cell, e.g., photosynthesis, respiration etc.

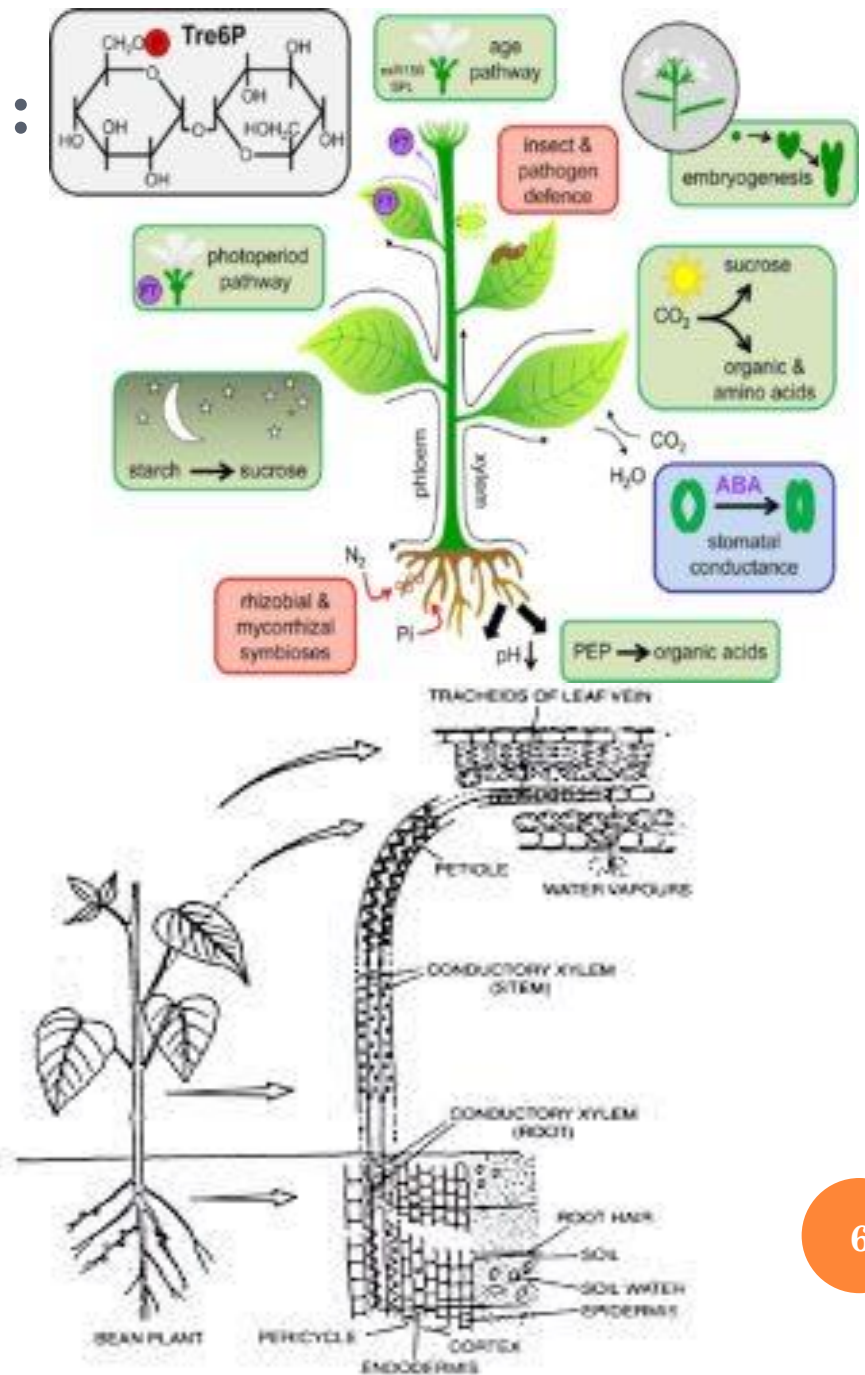
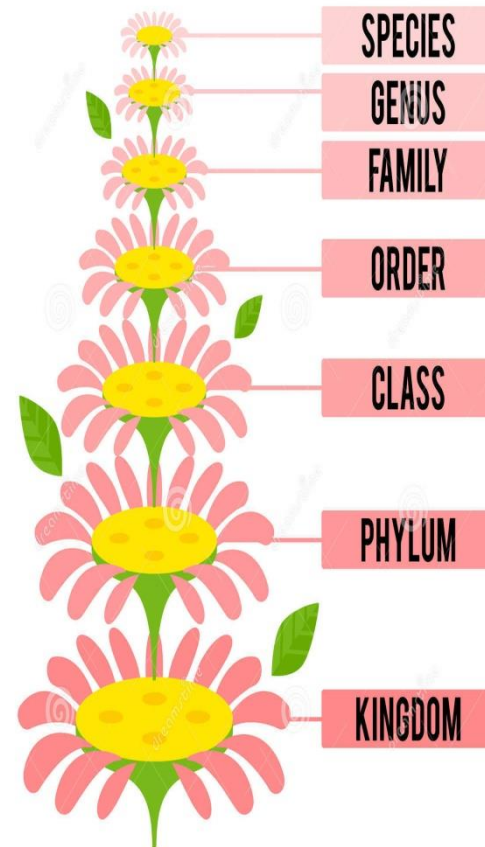
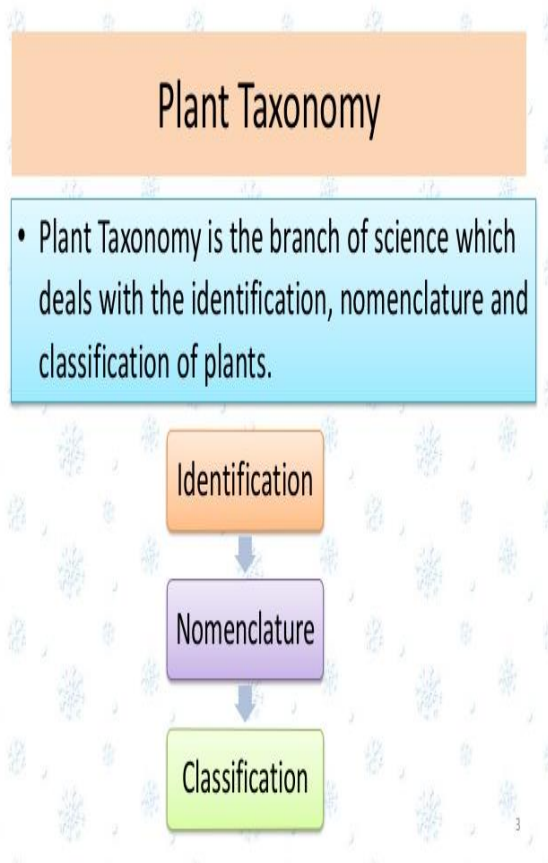


Fig. 3-7. Absorption and translocation of water through different tissues of root, stem and leaves in a bean plant.

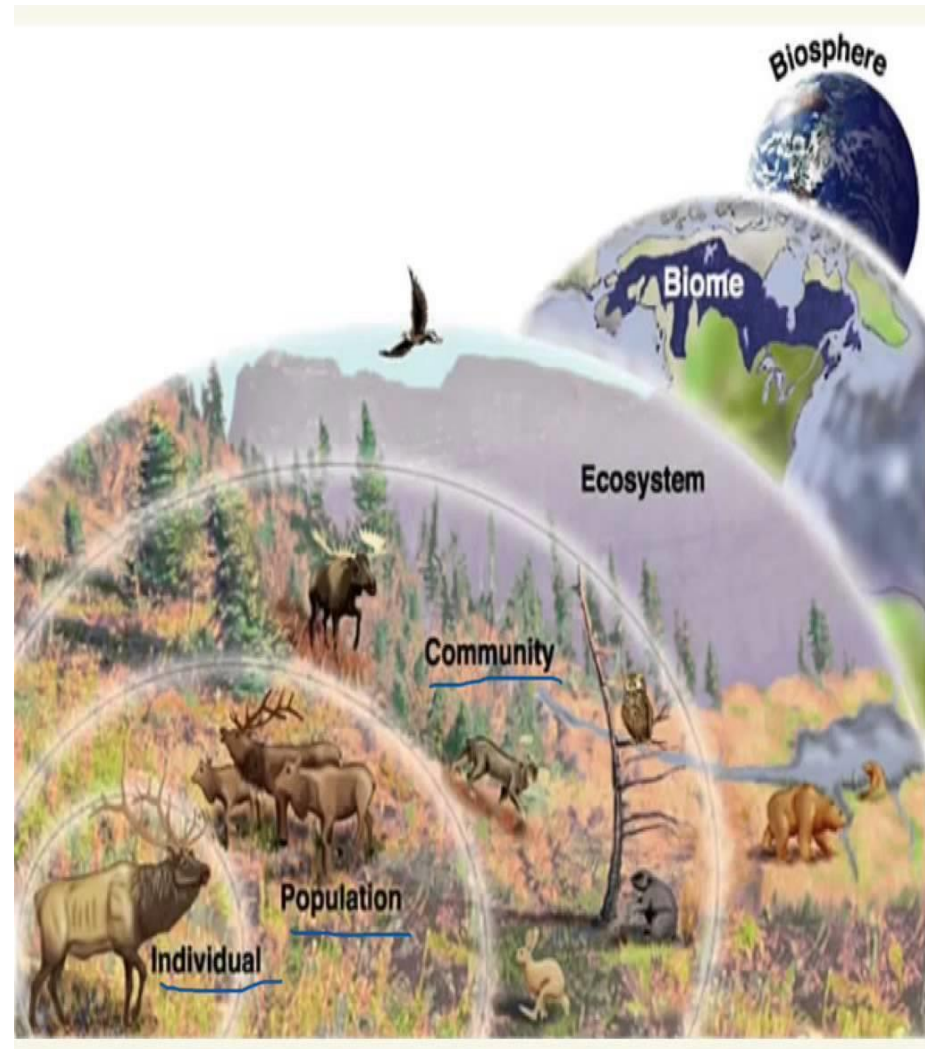
6. TAXONOMY

- In this branch the plants are classified according to their characteristics and interrelationship. With the help of plant taxonomy we are able to identify the plants and know their characters.



7. ECOLOGY (OIKOS = HOUSE; LOGOS = SCIENCE)

- This branch deals with the study of environment of plants and their communities and vice-versa. Included in this branch are the studies of adaptations of plants with reference to their environment. This branch also includes the studies of soil erosion, soil conservation and pollution.

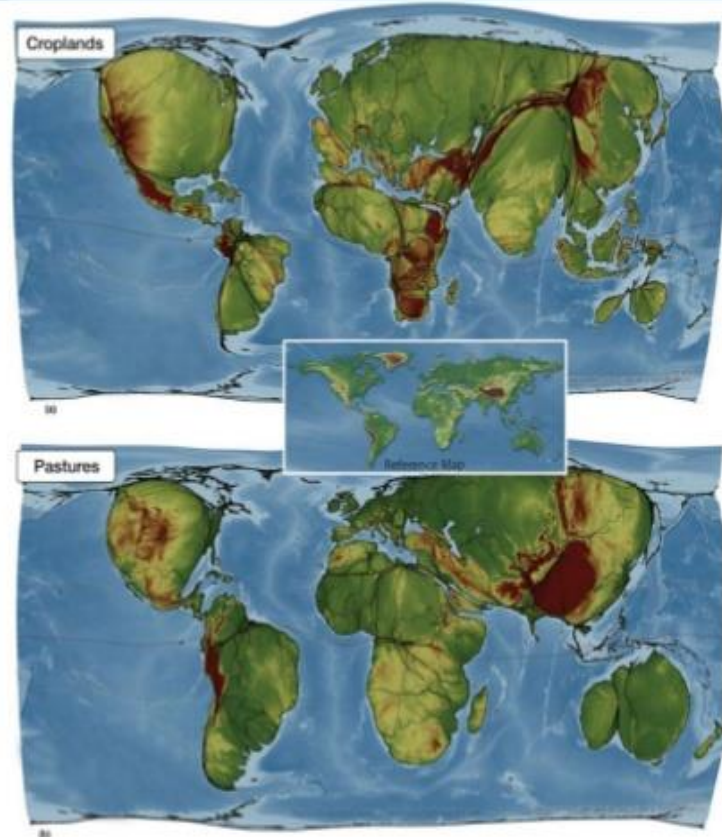


8. PLANT GEOGRAPHY :

- This branch deals with the distribution of plants on the earth and reasons thereof.

Geography and Agriculture

Figure 9.2 Cropland and pastures cartograms.



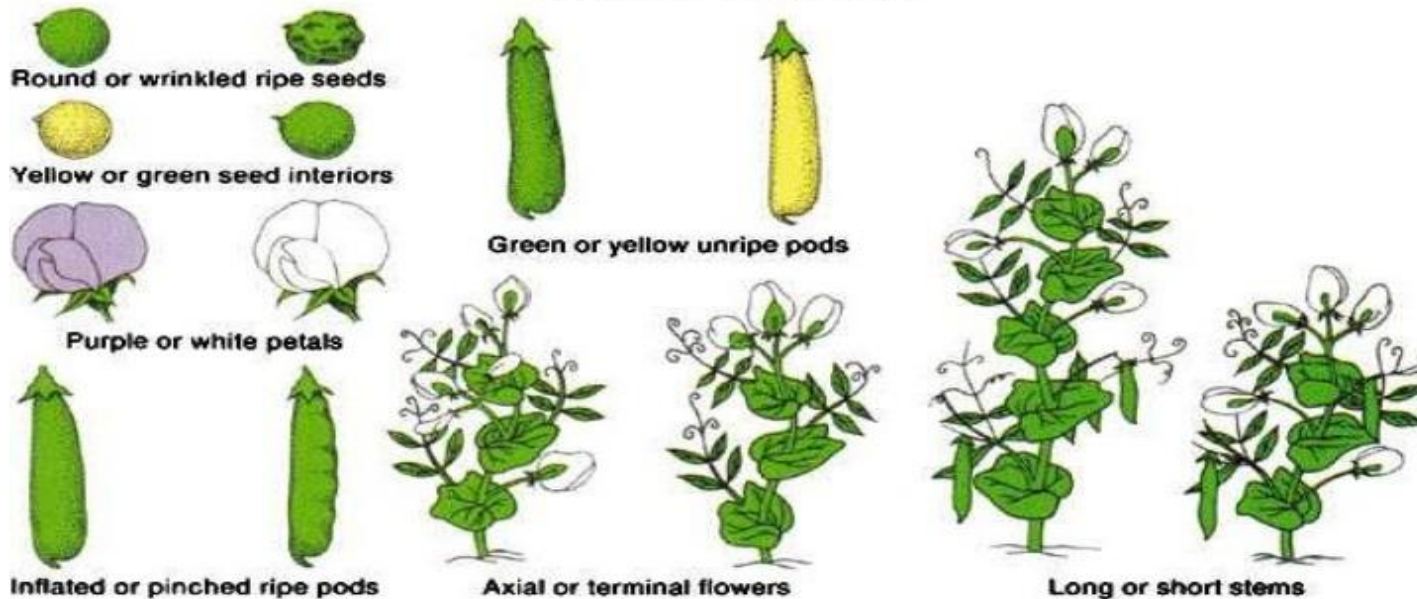
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9. GENETICS

- Is the study of heredity and variations. What are the Laws of inheritance and why the offspring resembles or differs from the parent are studied under this branch.

GENETICS

Mendel's pea plants



He observed **2 traits** for each part of the plant

10. PLANT BREEDING

- Branch of botany dealing with the development of improved varieties of plants.



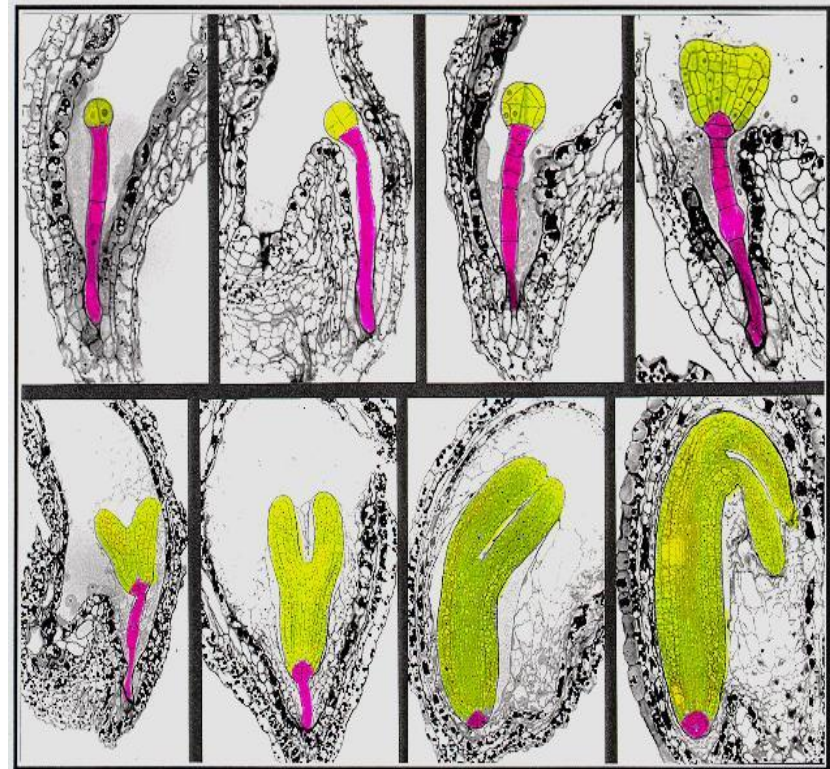
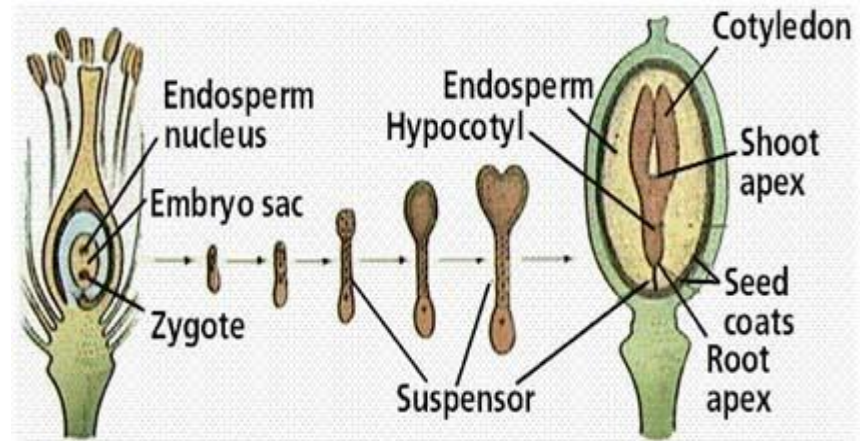
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11. EMBRYOLOGY :

- The male and female gametes of a plant fuse to form the zygote. Zygote develops into an embryo (in embryophyta) with plumule, cotyledons and radicle. When germination of seed takes place, the entire plant develops from these organs. We study all these developments in embryology.



12. PALEOBOTANY :

- Paleobotany is the study of fossil plants. Plants which flourished and lived on the surface of globe several million year ago but are not living now and are found as rocks. In which rocks and parts of the world they are found, what is their structure and how they are interrelated to the plants of the present day.



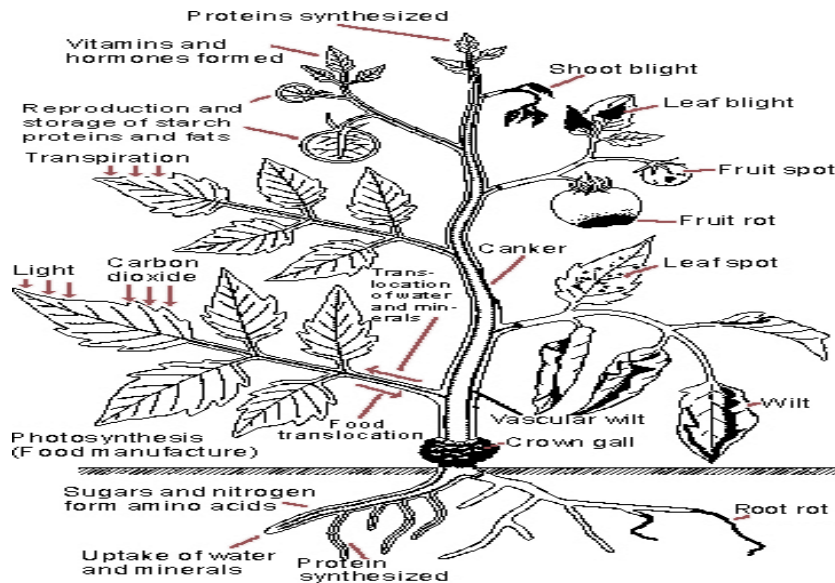
13. ECONOMIC BOTANY

- In this branch of Botany we study the plants with reference to their products. Which plants produce medicines, gums, oils, fibers, fuel, wood etc., are studied under this branch.



14. PLANT PATHOLOGY

- This branch includes different types of disease of plants, their symptoms, causal agent and methods of control.



Introduction to plant pathology

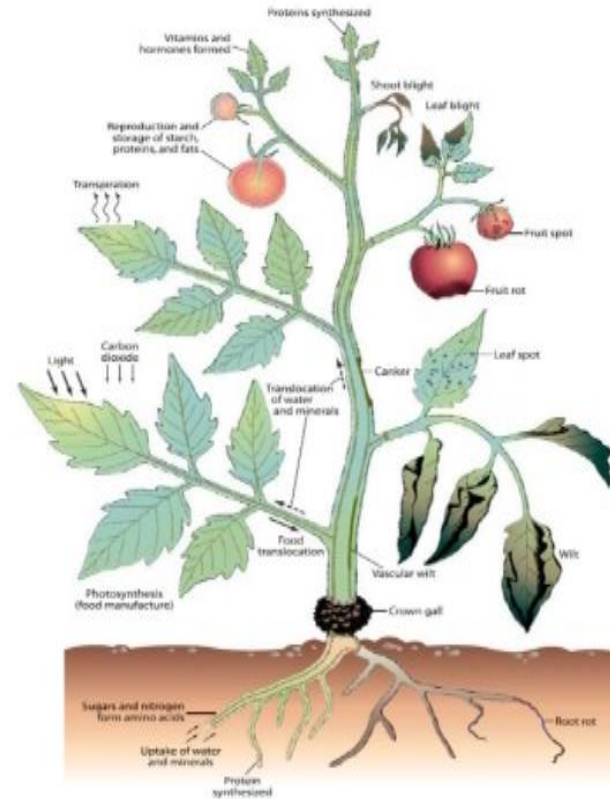
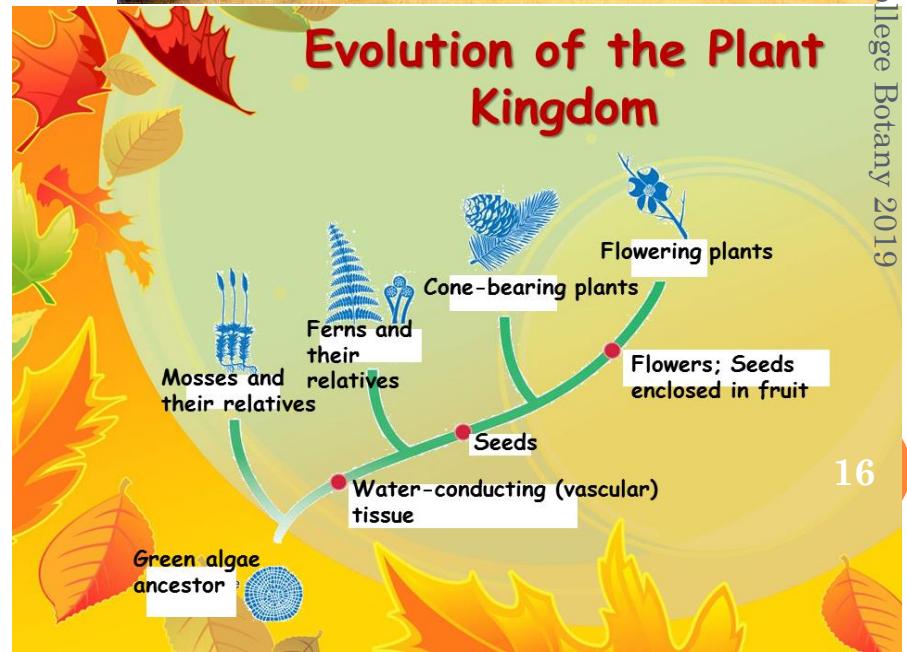
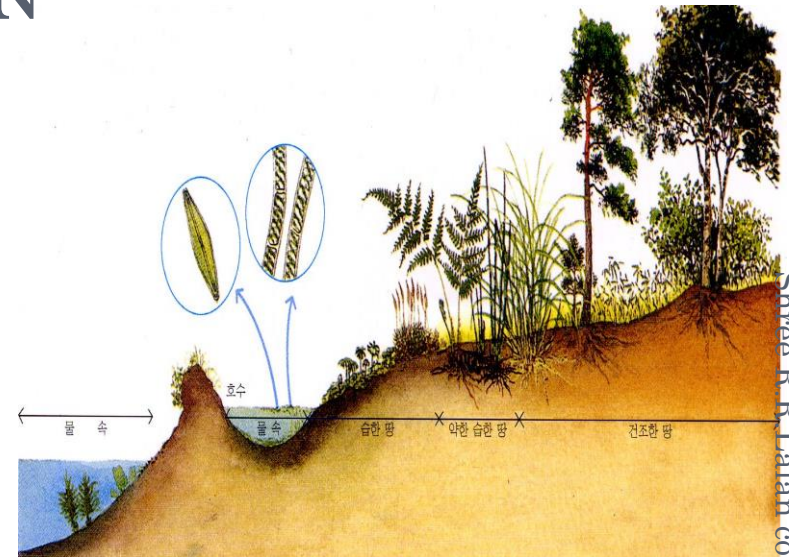


Fig-1

15. ORGANIC EVOLUTION

- This is the branch of Botany in which we study the evolution of complex organisms from simple ones and the principles involved in it. Some new aspects of Botany based on modern technology are as follows.



16. BIOCHEMISTRY (PHYTOCHEMISTRY)

- Study of chemistry of plants.

How does biochemistry impact you?

- **Medicine**
- **Agriculture**
- **Industrial applications**
- **Environmental applications**



17. BIOPHYSICS

- Study of plant activities on the basis of principles of physics

$$V(\vec{R}) = \frac{1}{4\pi\epsilon} \left[\frac{q_i q_j}{R} + \frac{q_i (\vec{\mu}_i \cdot \hat{R}) - q_j (\vec{\mu}_j \cdot \hat{R})}{R^2} + \frac{\vec{\mu}_i \cdot \vec{\mu}_j - 3(\vec{\mu}_i \cdot \hat{R})(\vec{\mu}_j \cdot \hat{R})}{R^3} + \sum_{\alpha, \beta=1}^3 \hat{R}_\alpha \hat{R}_\beta (q_i Q_{j, \alpha\beta} + q_j Q_{i, \alpha\beta}) \frac{1}{2R^3} + \dots \right]$$

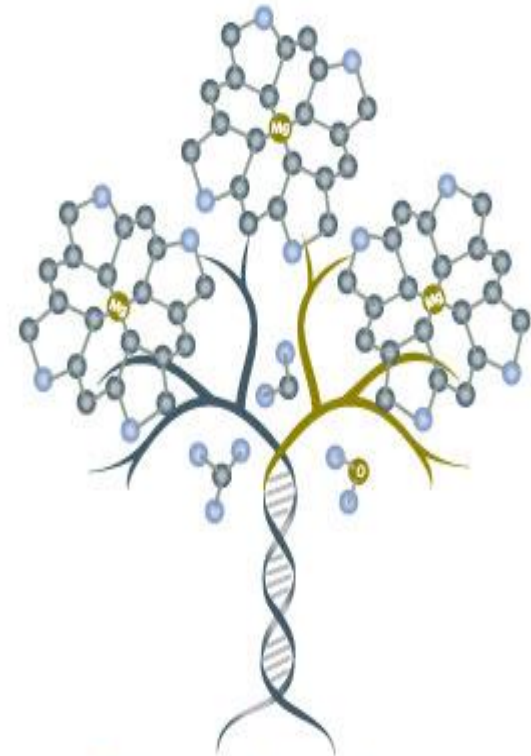
$$\frac{\partial}{\partial t} \rho_e(t)_{mn} = -\frac{i}{\hbar} [H_e, \rho_e]_{mn} - 2\delta_{mn} \sum_r \gamma_{nr} \rho_e(t)_{nr} \left[\sum_r (\gamma_{nr} + \gamma_{rn}) \rho_e(t)_{nn} - \bar{\gamma}_{mn} \rho_e(t)_{mm} \right]$$

$$R_{mn, pq} = \sum_{rs} c_{rn} c_{rm} c_{sq} c_{sn} J_{mn, pq} \langle v_r v_s \rangle$$

$$\dot{\rho}_e(t)_{nm} = -\frac{i}{\hbar} [H_e, \rho_e(t)]_{nm} - \sum_{pq} R_{mn, pq} \rho_e(t)_{pq}$$

$$g_{kk'k''k'''}(t) = -\int_{-\infty}^{\infty} \frac{d\omega}{2\pi\omega^2} J_{kk'k''k'''}(\omega) \left[\coth \frac{\omega}{2k_B T} (\gamma_{kk'}(\omega) - i) - \coth \frac{\omega}{2k_B T} (\gamma_{k''k'''}(\omega) + i) \right]$$

$$OD(\omega) = \omega \sum_k \mu_k^2 \text{Re} \int_0^{\infty} A_k(t) dt$$

$$FL(\omega) = \omega \sum_k p_k \mu_k^2 \text{Re} \int_0^{\infty} F_k(t) dt$$


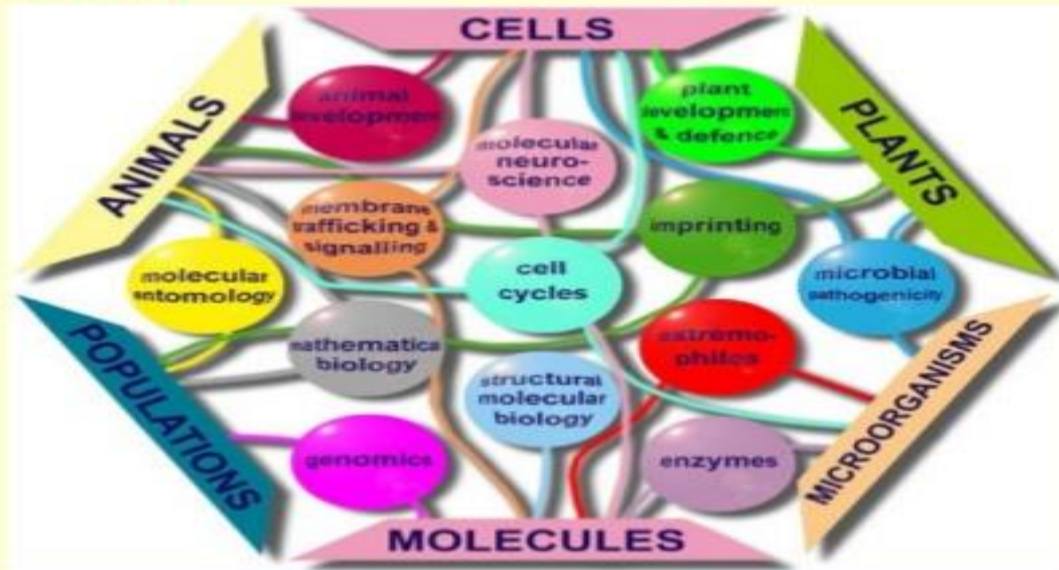
Biophysics:
Different Perspectives on Life

18. MICROBIOLOGY

- Study of microorganisms. It includes the study of viruses, bacteria, micro fungi, microalgae and protozoa in relation to plants.

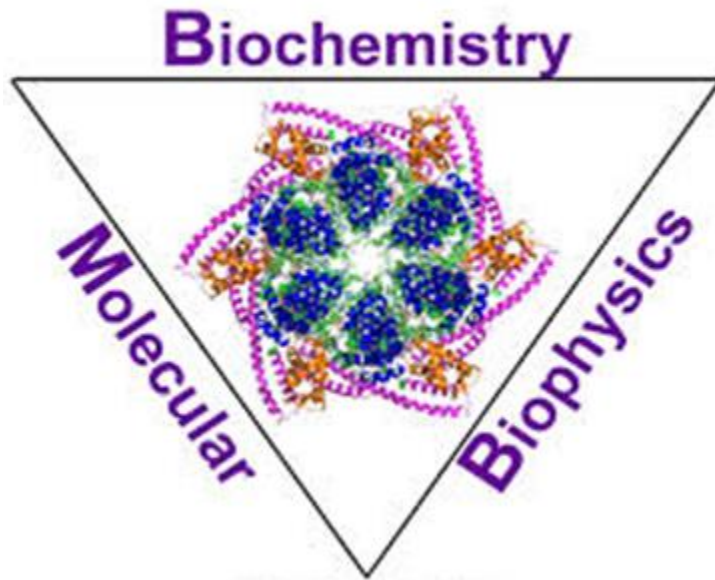
Molecular biology: definition

- Molecular biology is the study of molecular underpinnings of the process of replication, transcription and translation of the genetic material.



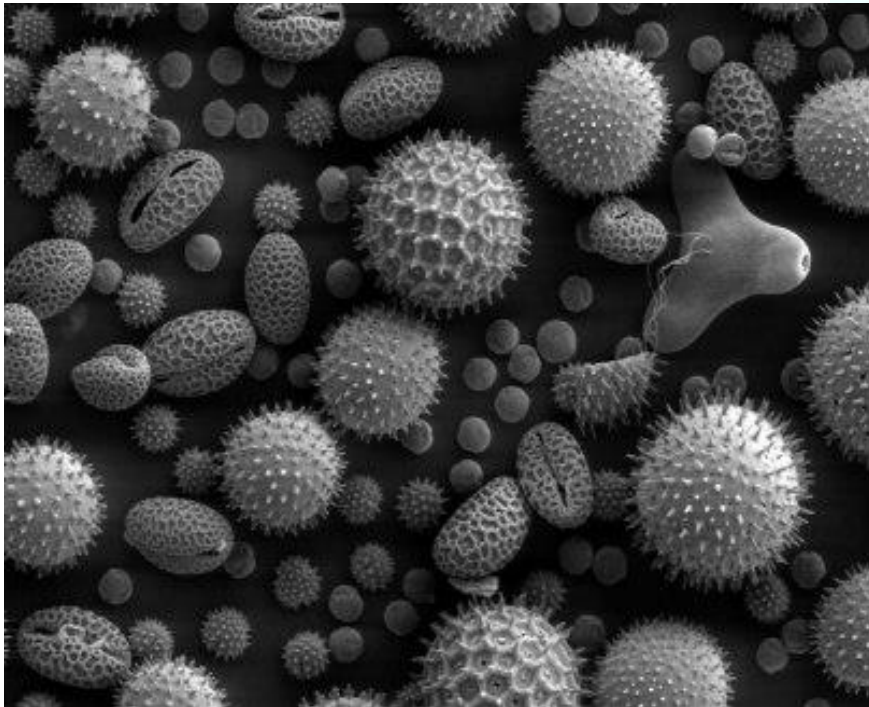
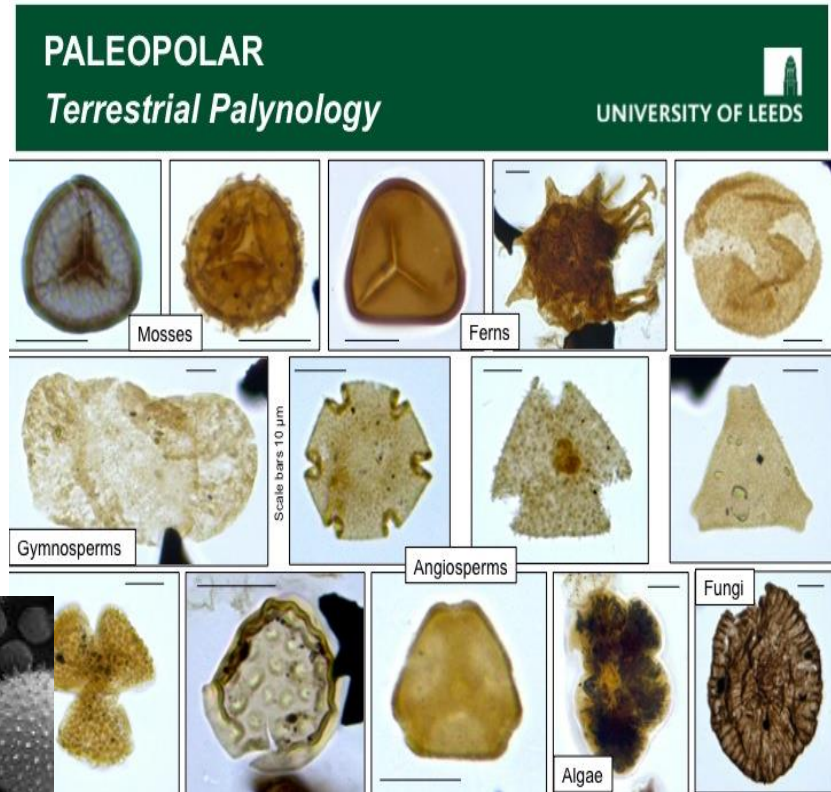
19. MOLECULAR BIOLOGY

- Study of biochemistry at molecular level



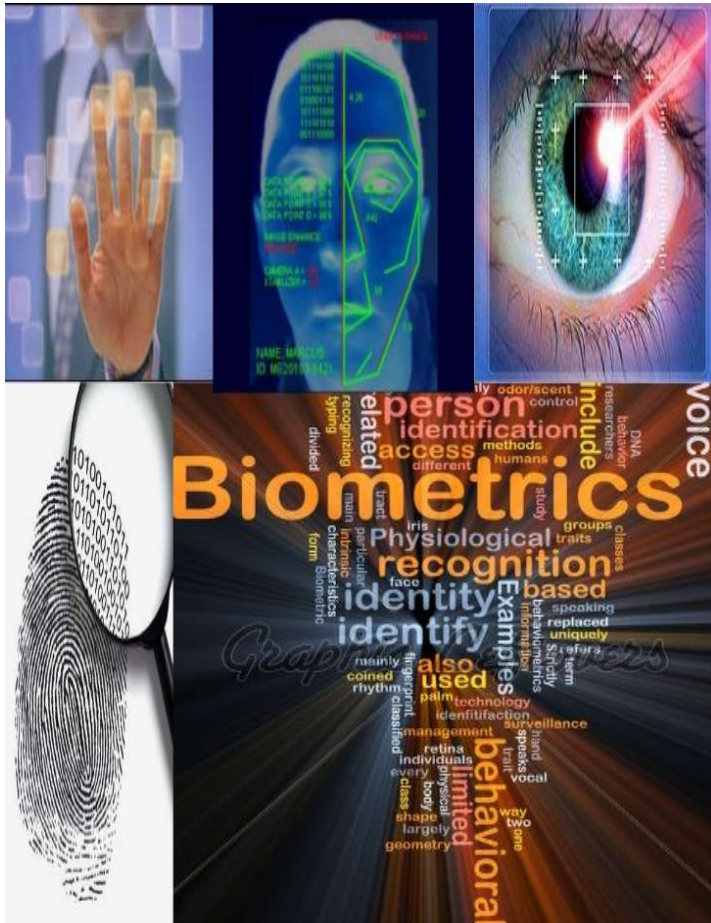
20. PALYNOLOGY

- Study of pollen grains in relation to taxonomy and evolution etc.



21. BIOMETRICS

- Statistical analysis of different results of biological experiments.



22. GENETIC ENGINEERING

- Adding, removing or repairing part of genetic material, thereby changing the phenotype of organism as desired



BRANCHES ALLIED TO BOTANY

23. **Agronomy** : Is the science which deals with the crop plants.



BRANCHES ALLIED TO BOTANY

24. **Horticulture** : Is the science which deals with the study of flowering and fruiting plants.



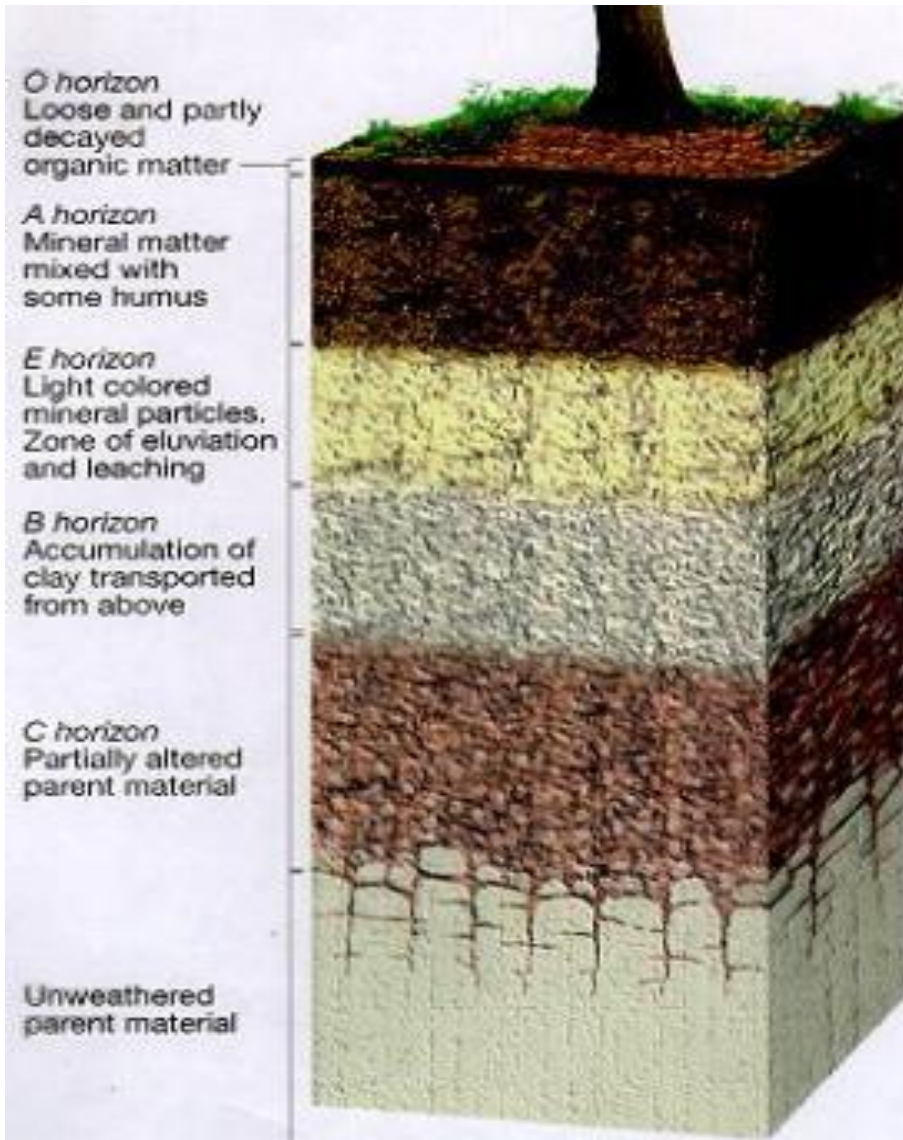
BRANCHES ALLIED TO BOTANY

25. Pharmacognosy : Is the branch of science dealing with the medicinal plants.



BRANCHES ALLIED TO BOTANY

26. **Pedology** : Is the science dealing with the study of soils.



THE PURE BRANCH OF BIOLOGY IS ALSO DIVIDED INTO SOME BRANCHES, SUCH AS

- i) **Morphology**: This branch deals with the shape external structures of living organism.
- ii) **Anatomy**: This branch deals with the gross structure of the internal organs.
- iii) **Cytology**: This branch studies with the structure and functions of the cell.
- iv) **Histology**: This branch deals with the structure and composition of tissues.
- v) **Physiology**: It is the branch deals with the functional activities of leaving body.
- vi) **Ecology**: This branch studies about the relationship between the organism and their environment.
- vii) **Embryology**: The formation and development of embryo is the matter of study here.
- viii) **Genetics**: In the branches of biology the genetic branch deals with the heredity and variation of living body.
- ix) **Palaeontology**: This deals with the principles of formation of fossils, its evaluation and its time scale.
- x) **Taxonomy**: This branch works with the principles of classification of organism and their nomenclature.
- xi) **Evolution**: The origin and gradual complexities of animals and plants are deal by this branch of biology.
- xii) **Pathology**: Pathology deals with the diseases of the living organism.

Applied Branches of Biology

Agronomy – Application of plant science to crop production

- Arboriculture – Culture and propagation of trees
- Biotechnology – Use of plants to synthesize products
- Dendrology – Study of woody plants, shrubs, trees and lianas
- Economic botany – Study of plants of economic use or value
- Ethnobotany – Plants and people. Use and selection of plants by humans
- Forestry – Forest management and related studies
- Horticulture – cultivation of garden plants
- Marine botany – Study of aquatic plants and algae that live in seawater
- Micropropagation – rapid propagation of plants using cell and tissue culture
- Pharming (genetics) – Genetic engineering of plants to produce pharmaceuticals
- Plant breeding – Breeding of plants with desirable genetic characters
- Plant pathology (Phytopathology) – Plant diseases
- Plant propagation – propagation of plants from seed, bulbs, tubers, cuttings and grafting
- Pomology – Fruit and nuts

Organismal topics

- Agrostology – Grasses
- Batology – Brambles
- Bryology – Mosses, liverworts, and hornworts
- Lichenology – Lichens
- Mycology, or fungology – Fungi
- Orchidology – Orchids
- Phycology or algology – Algae
- Pteridology – Fern and their allies
- Rhodology – Roses
- Synantherology – Compositae

- In Some different branches of science biology has become very importance in this millennium. With the above idea of the branches of biology, let us have some idea of the biological importance in other branches of science.
- 1) **Biotechnology**: It means technical manipulation of living organism. Genetically modified and improved variety of crops and successfully clone animals and plant has been produced by the biotechnology.
- 2) **Bioinformatics**: It is the systematic development and application of computing system in biological process.
- 3) **Genetic Engineering**: Extracting of selected genes from an organism or synthesizing of selected genes is inserted of to another organism and as a result, an organism develops with a new combination of gens by the genetic engineering. Bad gens may replaced by good genes and the scope of rectification of hereditary diseases has become open.

