Department of biology

2025-2026

((Plant Physiology))

Stage (3)

((Lecture -1-))

Introduction of Plant Physiology

By

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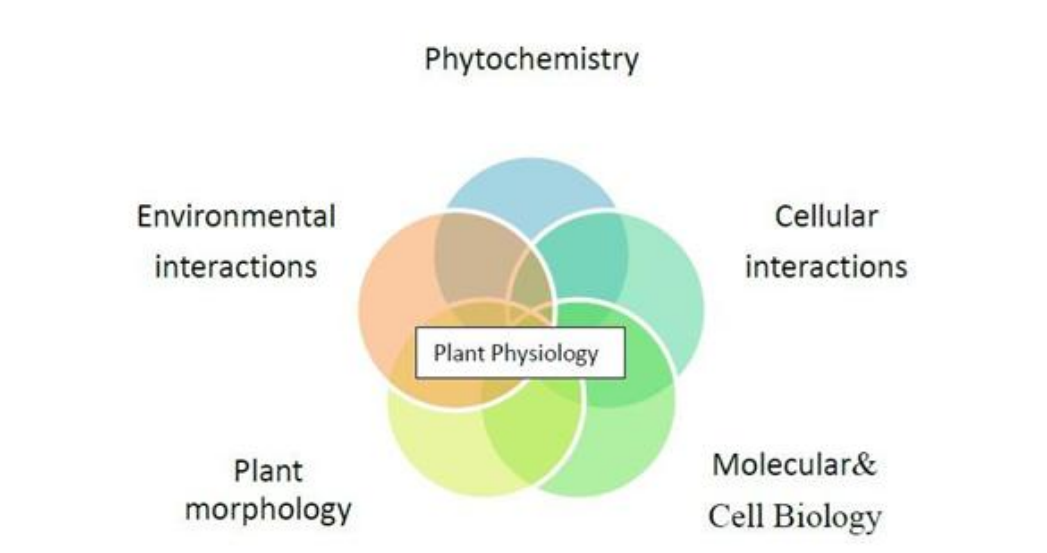
Plant Physiology

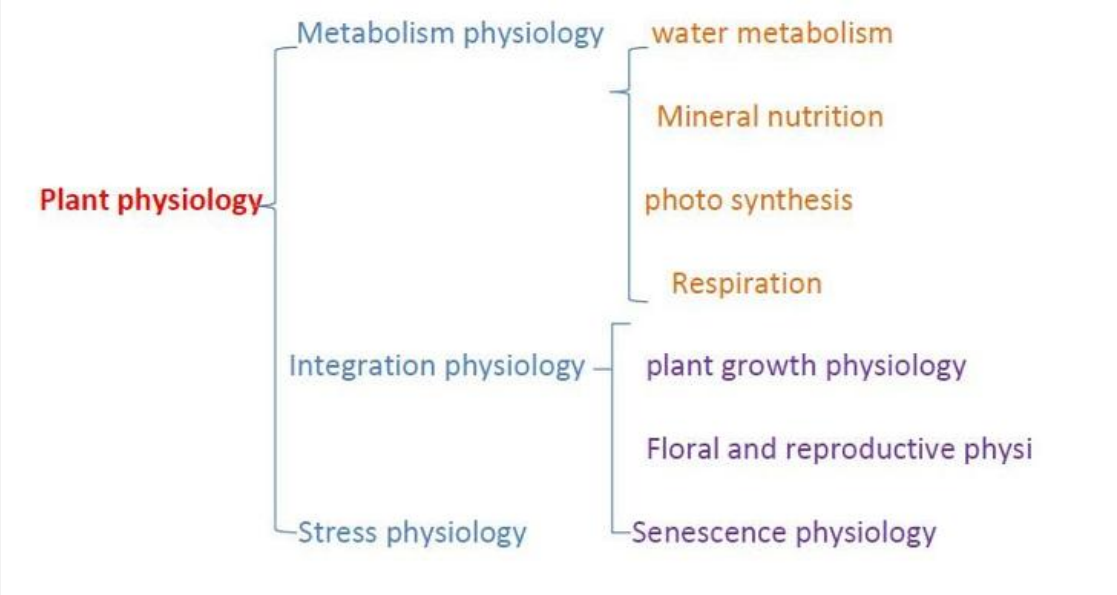
In this course will emphasize the physiological and biochemical functions of plants, but it is important to recognize that these functions depend on structures, whether the process is gas exchange in the leaf, water conduction in the xylem, photosynthesis in the chloroplast, or ion transport across the plasma membrane.



Plant physiology is a lab science, an experimental science and relies heavily on chemistry and physics. Plant physiology is the study of :

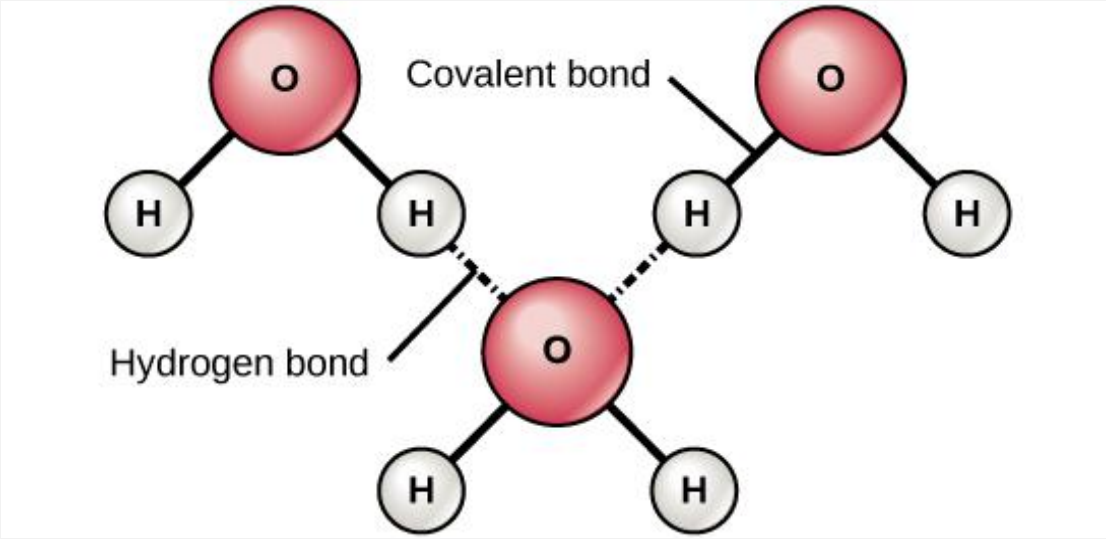
1- The functions and process occurring in plants .
2- The vital processes occurring in plants .
3- How plant work .

Plant physiology considered under the following main headings: -

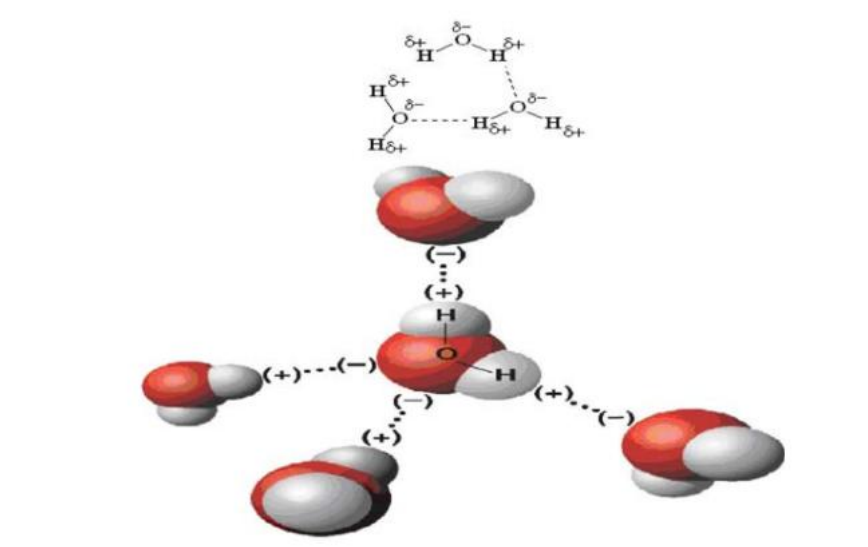


*** Structure of water ***

Water (H2O) is normal oxide of hydrogen in which the two hydrogen atoms are joined to oxygen atom by covalent bonds forming an angle of 105◦.



Oxygen atom is more electronegative than hydrogen atom, the electrons of the covalent bonds tends to be attracted towards oxygen atom. This results in partial negative charge (-) on oxygen and equal partial positive charges (+) on each hydrogen atom in water molecule. Because the partial negative and positive charges are equal, water molecule carries no net charge and is neutral. However, partial negative and positive charges on two sides of water molecule make it a polar molecule with the result that positive side of one water molecule is attracted towards negative side of another water molecule forming a weak electro static chemical bond between the polar water molecules which is called as a hydrogen bond and is represented by dotted line. The hydrogen bonds present in between the water molecules provide water with unique physical properties. *The hydrogen bonds are of tremendous biological importance, especially the N-H..N bond that enables complex proteins and nucleic acids to be built up.



*** Physical properties of water ***

1- Natural water (rain, spring, river etc.): - is never pure and contains dissolved substances in it. However, pure water is colorless, odorless, and

liquid with mol.wt. 18 dalton, m.p.0C◦, b.p. 100 C◦ and maximum density of 1 gm per Cm3 at 4C◦.

2- Specific heat: - The amount of heat energy required to raise the temperature of unit mass of a substance, 1 C◦ is called as specific heat. For 1 gm of pure water, this value is 1 calorie (4.184 joules). The high specific heat of water is of great importance to plants in protecting them from potentially harmful temperature fluctuations.

3-Latent heat of vaporization: - It is the energy required to convert liquid into gas (vapors) phase at constant temperature. For water, the latent heat of vaporization is 44 kj.mol-1 at 25C◦ and is highest known value among all the liquids. The higher latent heat of vaporization of water enables the plants to cool themselves by dissipating heat through foliar transpiration.

4- Latent heat of fusion: - It is the heat energy required to convert unit mass of a solid to a liquid at the same temperature. To melt 1 gm of ice at 0 C◦, 80 Cali. (335j) of energy is needed.

5-Water expansion & density: - Water has a tendency to expand as it freezes and its density is decreased. Therefore, ice has lower density than water and it floats on top of oceans, lakes, rivers.In winters and provides a shield to life forms growing underneath it.

6-Cohesion & adhesion properties: - Mutual force of attraction between like molecules such as in water (due to H- bonds) is called as cohesion. On the other hand, attraction of water to a solid phase such as cell wall or glass surface is called as adhesion. These properties of water are of great significance in ascent of sap in plants.

7-Surface tension: - Surface tension results due to forces of attraction existing between the molecules of a liquid at the open boundary surface of that liquid and is measured by the force per unit length (newton/meter). The water molecules at the air-water interface are continuously being pulled into liquid due to cohesion than to the gas (vapor) phase on the other side of the surface. This unequal attraction of water molecules tends to minimize surface area at air-water interface and exerts a force or surface tension on the latter.

8- Tensile strength: - It is the ability to resist pulling without breaking and is measured as force per unit area (newton/m2). Cohesion of water molecules gives water a high tensile strength which enables water column in xylem elements of stem to be pulled to the top of tall trees without breaking.

9- Water as solvent: - The polarity of water makes it an excellent solvent. Water dissolves greater amounts and wider variety of substances than any other common solvent.