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REMEDIAL BIOLOGY

UNIT 4

TOPIC :

- **Photosynthesis**

  Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

PHOTOSYNTHESIS

Autotrophic Nutrition

- Autotrophic nutrition is the mode of nutrition in which organisms prepare their own food using simple inorganic materials like CO_2 and water, in the presence of sunlight.
- Organisms using this method are called autotrophs.
- Green plants, algae, and some bacteria (cyanobacteria) perform autotrophic nutrition via photosynthesis.

Photosynthesis

→ Photosynthesis is the process by which green plants, algae, and certain bacteria convert light energy into chemical energy.

→ In this process, carbon dioxide (CO_2) and water (H_2O) are converted into glucose ($C_6H_{12}O_6$) and oxygen (O_2) in the presence of sunlight and chlorophyll.

General Equation

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6O_2$$

Site of Photosynthesis

- Photosynthesis occurs in **chloroplasts**, which are mainly found in the **mesophyll cells** of leaves.
- Inside the chloroplast:
  - **Thylakoids** contain pigments and are the site of **light reactions**.
  - **Stroma** is the site of **dark reactions (Calvin cycle)**.

Photosynthetic Pigments

- These are molecules that absorb light energy for photosynthesis. They are located in the thylakoid membranes of chloroplasts.

Major Pigments

Pigment	Color	Function
Chlorophyll-a	Blue-green	Main pigment; essential for light absorption
Chlorophyll-b	Yellow-green	Accessory pigment; broadens absorption spectrum
Xanthophylls	Yellow	Accessory pigment; absorbs blue light
Carotenes	Orange	Accessory pigment; protects from photooxidation

Phases of Photosynthesis

1. Light Reaction (Photochemical Phase)

Occurs in: **Thylakoids**

- Light is absorbed by chlorophyll.
- Water is split into **H^+, O_2, and electrons** (Photolysis).
- Formation of:
  - **ATP** (via photophosphorylation)
  - **NADPH**
  - **O_2 is released**

2. Dark Reaction (Biosynthetic Phase / Calvin Cycle)

Occurs in: **Stroma**

- Does not require light directly.

- Uses **ATP and NADPH** from light reactions to convert **CO_2 into glucose.**
- Main enzyme: **RuBisCO** (Ribulose bisphosphate carboxylase-oxygenase)

Factors Affecting Photosynthesis

- Photosynthesis is affected by both internal and external (environmental) factors.

External Factors

Factor	Effect
Light intensity	Increases photosynthesis up to a point; too much can damage pigments.
CO_2 concentration	Rate increases with CO_2; limiting factor in many cases.
Temperature	Optimal range is 25–35°C; very high or low temp inhibits enzymes.
Water availability	Essential for photolysis; deficiency causes stomatal closure.

Internal Factors

- Age of leaf
- Type of plant (C_3 vs C_4)
- Chlorophyll content

Importance of Photosynthesis

- ✓ Main source of oxygen in the atmosphere.
- ✓ Basis for all food chains on Earth.
- ✓ Converts solar energy into chemical energy.
- ✓ Removes carbon dioxide from the atmosphere, reducing global warming.