

Photosynthesis

Overview:

- Photosynthesis is the process by which plants produce carbohydrates (glucose) using light energy, carbon dioxide, and water, occurring in the chlorophyll.
- Glucose is converted to sucrose for transport or starch for storage due to its reactivity.

Limiting Factors:

- A limiting factor is something in short supply that restricts photosynthesis, such as carbon dioxide, light, or chlorophyll. If one is absent, photosynthesis is hindered.

Investigations:

- To test the necessity of chlorophyll, light, and carbon dioxide, plants can be deprived of these factors, and a starch test is used to determine if photosynthesis occurred.

- Example investigations:

- **Light:** Cover parts of a leaf, exposing the rest to sunlight.
- **Carbon Dioxide:** Use a CO₂ absorber (sodium hydroxide) to test its effect.
- **Chlorophyll:** Use variegated leaves to test the importance of chlorophyll.

Effects on Photosynthesis Rate:

- **Light Intensity:** Increases photosynthesis rate until another factor becomes limiting.
- **Carbon Dioxide Concentration:** Similar to light, the rate increases until it plateaus.
- **Temperature:** Photosynthesis increases with temperature until enzymes denature at high temperatures, reducing the rate.

Leaf Structure:

- **Cuticle:** Wax layer, waterproofs the leaf.
- **Upper Epidermis:** Transparent barrier for light entry.
- **Palisade Mesophyll:** Main photosynthesis site, rich in chloroplasts.
- **Spongy Mesophyll:** Loosely packed cells for gas exchange.
- **Vascular Bundle:** Transports water, minerals (xylem), sugars, and amino acids (phloem).
- **Stomata:** Control gas exchange and water vapor loss, regulated by guard cells.

Mineral Requirements:

- **Nitrate Ions:** Needed for amino acids and protein synthesis. A deficiency slows growth and causes yellowing of leaves.
- **Magnesium Ions:** Essential for chlorophyll production. Deficiency leads to chlorosis (yellowing of leaves) and reduced photosynthesis.



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