

CHAPTER 10

PHOTOSYNTHESIS

Learning objectives:

The Process that Feeds the Biosphere

1. Distinguish between autotrophic and heterotrophic nutrition.
2. Describe the structure of a chloroplast, listing all membranes and compartments.
3. Write a summary equation for photosynthesis.
4. Explain van Niel's hypothesis and describe how it contributed to our current understanding of photosynthesis. Describe the evidence that supported his hypothesis.
5. In general terms, explain the role of redox reactions in photosynthesis.

The Pathways of Photosynthesis

6. Describe the two main stages of photosynthesis in general terms.
7. Describe the relationship between an action spectrum and an absorption spectrum. Explain why the action spectrum for photosynthesis differs from the absorption spectrum for chlorophyll *a*.
8. Explain how carotenoids protect the cell from damage by light.
9. List the wavelengths of light that are most effective for photosynthesis.
10. Explain what happens when a solution of chlorophyll *a* absorbs photons. Explain what happens when chlorophyll *a* in an intact chloroplast absorbs photons.
11. List the components of a photosystem and explain the function of each component.
12. Trace the movement of electrons in linear electron flow. Trace the movement of electrons in cyclic electron flow.
13. Explain the function(s) of linear electron flow. Explain the function(s) of cyclic electron flow.
14. Describe the similarities and differences in chemiosmosis between oxidative phosphorylation in mitochondria and photophosphorylation in chloroplasts.
15. State the function of each of the three phases of the Calvin cycle.
16. Describe the role of ATP and NADPH in the Calvin cycle.

Alternative Mechanisms of Carbon Fixation

17. Describe what happens to rubisco when O₂ concentration is much higher than CO₂ concentration.
18. Describe the major consequences of photorespiration. Explain why it is thought to be an evolutionary relict.
19. Describe two important photosynthetic adaptations that minimize photorespiration.
20. List the possible fates of photosynthetic products.