

Thought Lab 5.2: Adaptations and Applications of Photosynthesis

Purpose: To investigate, synthesize, and present information about photosynthesis and its possible technological applications.

Procedure

1. Working in a small group, use print and electronic resources to investigate the following topics and their relationship to one another. Use the Analysis questions to help you focus your research.
 - photorespiration
 - C_4 photosynthesis
 - CAM photosynthesis
2. Decide how group members can share the tasks of researching information and presenting your findings, ideas, and decisions.



Wheat (A) is a C_3 plant. Sugar cane (B) is a C_4 plant. A pineapple (C) is a CAM plant. Why do these three types of plants have different adaptations for synthesizing sugars?

Analysis

1. a) Identify at least three examples each of the following groups of plants: C_3 , C_4 , and CAM.

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b) Select one plant from each group. Explain the environmental limiting factors affecting the plant, and describe the adaptations that enable the plant to survive in its typical environment.

2. Illustrate, using pathway diagrams, the essential similarities and differences in the light-independent stage of C_3 , C_4 , and CAM photosynthesis.

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3. In what ways can our understanding of photosynthesis enhance practices in the following areas:
 - growing desired crops
 - protecting desired crops from disease and disease-causing organisms

Extension

4. Biologists and plant technologists have long viewed photorespiration as a wasteful leftover from the evolutionary past of photosynthetic organisms. Thus, biotechnology research into improving efficiency of photosynthesis in crop plants has tended to work from the assumption that photorespiration must be engineered out of the genetic makeup of the plants. However, researchers at the University of California-Davis published a study, in 2004, that suggests the desire to minimize or remove photorespiration may be wrong-headed. Plants, they discovered, may need photorespiration to absorb and process inorganic nitrogen (as nitrate) from the soil. This discovery, if satisfactorily confirmed, has implications for global warming and our assumptions about how plants will, and won't, respond to elevated temperatures and rising concentrations of atmospheric carbon dioxide. Investigate the findings of the UC-Davis researchers as well as the implications of these findings for global warming scenarios. Write a paragraph outlining your opinion of the following statement: "Despite our good intentions, where biotechnology is concerned, our ignorance may lead to unhealthy, harmful consequences to the biosphere and, thus, to ourselves."

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