Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
2000 Volume VI: The Chemistry of Photosynthesis

Introduction

Plants are often the focus of science teaching, beginning in elementary school and continuing through high school. They are familiar, easy to bring into a classroom setting, and can be subjected to various growth conditions in order to teach the scientific method. Plants are also amazing chemical factories, but this is often not appreciated. The focus of this seminar was to provide some answers to the question of how plants make food in the process of photosynthesis. The goal was to develop materials that could be incorporated into the science curriculum of the New Haven Public Schools. My own interest in science stems from my hands-on experiences as a child. Therefore, many demonstrations were included in this seminar. These demonstrations were chosen so that they could actively involve the students and at the same time illustrate many of the chemical processes that occur during photosynthesis.

The book by David Walker entitled *Energy, Plants and Man* was used as the primary text for the seminar. *Photosynthesis* by D.O. Hall & K.K. Rao was used as a supplementary text. The discussions in the seminar largely followed the sequence of topics in Walker's book. The seminar began with a historical discussion of the key scientific advances leading to the understanding that plants use light to convert carbon dioxide and water into sugar and oxygen gas. A demonstration on the production of oxygen gas by plants was done under conditions similar to those used in the 18th century. This was followed by discussions on the nature of light and the fundamental steps by which light is absorbed by plants and converted into chemical energy. Demonstrations of chemiluminescence, lasers and holograms aided these discussions. Plant pigments were discussed next, together with demonstrations on light absorption/emission by pigments extracted from plants and algae, and on pigment separation by using paper chromatography. The process of carbon fixation was discussed and was "photographically" illustrated by making starch pictures on geranium leaves. The role of photosynthesis in the evolution of the earth's atmosphere was discussed along with current concerns over the greenhouse effect and ozone depletion. The seminar ended with a discussion of energy use in the future that included progress in development of systems for artificial photosynthesis and fuel cells.

The curriculum units developed from this seminar are suitable for elementary to middle school students. In all of the units, the science content is integrated with language arts, mathematics and social studies to provide a balanced program that meets the literacy requirements of the New Haven Public School system. The Fellows have prepared extensive lists of materials that can be used in the classroom or as resources. These materials include books that the children can read, textbooks that the teachers can use, demonstration sourcebooks, suppliers of equipment, useful computer software, and addresses of sites on the World Wide Web. Several of the Fellows developed units around a theme or activity related to photosynthesis. These include a fact-finding effort on the importance of plants to the atmosphere that culminates in a court case over urban development, studies of plants in order to develop urban gardens, and responses to a letter from Mr. McGregor requesting

help with his garden. The units include a number of excellent activities that will engage the students' interest and teach them about the processes of photosynthesis. This is especially important for students in elementary school.

I would encourage all teachers of elementary through middle school students to review these curriculum units. These materials provide a valuable resource for incorporating the *Chemistry of Photosynthesis* into the classroom.

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