2. How could one adequately determine which pigments dissolve in methanol?

3. Using different laboratory groups, determine the pigment compositions of as many different leaves and plant foods as possible.

4. It is possible to obtain commercially β-carotene and other plant pigments. Dissolving these in benzene and chromatographing as above would provide interesting qualitative and quantitative comparisons.

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An Experiment with Color Adaptation

The manner in which protective coloration ensures the survival of a species is a topic dealt with in most biology classes. Usually, examples of organisms that display this evolutionary adaptation to their environment are presented to students through pictures or through the use of preserved specimens and samples of their environments. Both methods fail to involve the student actively and do little to further his understanding of the dynamic nature of the process.

The experiment described here enables students to discover for themselves, in the classroom, the principle of survival through color adaptation. This experiment requires a tame bird of any species, a chessboard, brown pebbles, gray pebbles, and equal quantities of birdseed dyed gray and brown. The birdseed can be dyed by using conventional food coloring and referring to the color charts printed on the package.

The bird is fed dyed birdseed for a week and then is given no food for the six hours preceding the actual experiment. The chessboard is placed in the center of a large table, and the brown and gray pebbles are placed on the dark and light squares, respectively. The students then place 20 grains of seed (10 brown and 10 gray) randomly on the 16 squares of the board. During the experiment the bird is tied with a light string approximately 1 m long that has one end fastened to the corner of the board and one end attached to its leg. The bird is allowed to eat any birdseed it can find on the board during a two-minute trial. After the trial the student should determine and record the number of color-adapted seeds (brown seeds on brown squares or gray seeds on gray squares) and non-color-adapted seeds (brown seeds on gray squares or gray seeds on brown squares) the bird has eaten.

The student should randomly place a total of 10 brown and 10 gray seeds on the board for each trial. The data obtained from a series of 10 trials can then be used to determine the survival value of color adaptation.

Students may wish to extend the procedures to an experiment that uses insect larvae of different colors placed on the appropriate backgrounds.

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"What If . . ."

As a biology teacher, how often have you been asked a question by your students beginning with those all-encompassing words, "What if"? What if no humans died on earth? What if man found a cure for all diseases? What if man could create life? What if life is found on Mars? What if scientists were able to control all environmental conditions on earth?

Most students are concerned with "what if" questions, but quite often teachers treat these questions lightly. Some teachers probably recognize that much class time could be spent discussing this kind of question, at the expense of "covering" the prescribed course-content. Other teachers may assume that many questions asked by students are irrelevant within the framework of the present-day curriculum. Still others may feel unsure of themselves in dealing with broad, open-ended questions.

An analysis of various "what if" questions would reveal a futuristic quality among them. There is an apparent contrast between (i) the questions asked by teachers, those written by curriculum writers, and the ones found in biology textbooks and curriculum guides and (ii) the questions proposed by students. If one surveys popular biology textbooks and curriculum guides, the absence of future-directed questions becomes quite obvious. I believe that teachers deal almost exclusively with the past; but students, with their "what if" questions, look to the future.

Neil Postman and Charles Weingartner (1969: *Teaching as a Subversive Activity*, Dell Publishing Co., New York) have said that "future-orientation is essential for everybody. Its development in schools is our best insurance against a generation of 'future shock' sufferers" (p. 203). Paul DeHart Hurd recently pointed out: "Students should leave a biology course feeling that their future will not be like the past—recognizing they will never live in the kind of world in which their teachers were educated and knowing they will never experience the world of their parents" (1971: "Biology as a Study of Man and Society," *American Biology Teacher* 33 [7]: 397-400, 408). Alvin Toffler, in *Future Shock* (1970: Random House, Inc., New York), has said: "If our children are to adapt more successfully to rapid change . . . We must sensitize them to the possibilities and probabilities of tomorrow. We must enhance their sense of the future" (p. 423).

What can biology teachers do to guard against a generation of future-shock sufferers? We may begin by asking and encouraging questions that are directed toward the future. A typical question in the study of genetics, for example, might be "How are the physical characteristics of a child determined?" This question is fine, but why not follow it with the futuristic question, "What if individuals could select characteristics, such as sex, intelligence, and hair color, of their offspring?" Postman and Weingartner stressed the importance of using futuristic questions in all classes, especially with young children. "After all," they said, "by the time they [young children] have finished school the future you have asked them to think about will be the present" (p. 233).

Additional questions that deal with the future might take the form "If —— is achieved, what effect will it have upon society?" The dash might be filled with "curing cancer," "being able to feed the entire world's population adequately," "developing test-tube babies," or "increasing man's life expectancy to 125 years."

Discussions of these questions will also cause students to consider aspects of civics and government, of sociology and psychology. In this way futuristic questions can serve to introduce interdisciplinary studies in the biology classroom.

Many science educators sincerely hope that the integration of science and the humanities will be the main thrust in the development of the biology curriculum. Hurd declared: "In general education a biology course that endeavors to respond to biosocial questions must draw its subject matter from several fields of study. The curriculum-maker's task is to search out the integrative concepts found within the human sciences—concepts that can be focused on problems that, as part of the social process, represent aspects of man's biologic nature" (p. 399).

Technologic developments have had a tremendous impact on society. What if teachers, science consultants, and curriculum writers do not consider the possibility of alleviating "future shock" among our present school age generation? What effect will this oversight have upon society in the future?

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Cottontail Behavior

With the exception of females with young, cottontails are tolerant of each other, even sharing feeding territories with very little friction. A mother rabbit, however, will not allow any other grown-up on her home range.

SUGGESTIONS FOR CONTRIBUTORS

STYLE. *American Biology Teacher* would rather receive an ill-written article containing worthwhile ideas than a stylistic masterpiece that says little: our editors can mend bad writing in a good cause. However, we do hope for clear terse prose, free of jargon. Sensible advice for writers will be found in the Conference of Biological Editors' *Style Manual for Biological Journals,* 2nd ed., published by the American Institute of Biological Sciences; and *How to Write Scientific and Technical Papers,* by Sam F. Trelease.

In matters of punctuation, enumeration, and the like we follow generally the above-mentioned C.B.E. manual and the University of Chicago *Manual of Style.* Our spellings are usually those preferred by *Webster's Third New International Dictionary* (G. & C. Merriam Co., 1965) and its abridgments.

Technical measurements are in metric, not English, units.

Avoid footnotes of any kind. References to the literature are made on-line (not by means of superscripts) within the text. If only one, two, or three works are cited, each is given in full, in the form "A. B. Smith, 1969: *Elements of Biology,* 4th ed., Jones Publishing Co., New York" for a book and "W. X. White and Y. Z. Green, 1965: 'The Inquiry Process,' *Journal of Pedagogy* 7 (2): 53-56" for an article. If four or more works are cited, they are presented at the end of the article as a bibliography arranged alphabetically by (principal) authors' last names, in the following forms for books and journals.

SMITH, A. B. 1969. *Elements of biology,* 4th ed. Jones Publishing Co., New York.

WHITE, W. X., and Y. Z. GREEN. 1965. The inquiry process. *Journal of Pedagogy* 7 (2): 53-56.

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