Conservation field days and fairs
Conservation, science, or biology clubs
Experiments and demonstrations—in and out-of-doors
Special units; group work experiences
Use of research in projects, and classroom exhibits
Wise use of audio-visual materials (encourage students to evaluate these)
Live plants and animals
Landscaping program for school grounds
School gardens; school or community forests
Field trips; nature trails; nature centers
School camping—pre, at, and post-camp activities and projects.

It may be difficult at present to evaluate all of the intangible returns from the investment we need to make in a good conservation education program. However, the spiritual and aesthetic enjoyments one may experience are among the most effective, valuable, and lasting dividends accruing from wise resource-use.

Rex Conyers, Senior High School
University City, Missouri
Recorder

Summary of the Scientists' Contributions

CHESTER A. LAWSON
Head, Department of Natural Science,
Michigan State University

The initial sessions of the North Central Conference on Biology Teaching were concerned with the relation of fundamental biology to applied biology in the training of high school teachers. Specialists from the applied areas of (1) Plants and Man, (2) Man's Food Supply, (3) Health and Disease, (4) Conservation, and (5) Human Genetics served as consultants and presented their views concerning the kind of training needed to produce qualified biology teachers. The participants of the conference were divided into five groups, with each consultant presenting a paper on his subject to each group. This was followed by group discussion directed at two objectives. The first was an elaboration, evaluation, and supplementation of the consultant's contribution. The second was a determination of practical ways of effectively implementing in the classroom the recommendations of the consultant.

A distillation of the specialist's papers produced a list of essential elements recommended in the training of biology teachers. Some of these elements may be classified as objectives and others as means of attaining objectives.

The conclusion must not be made that the following list of objectives was exhaustive, nor that it was subscribed to by all consultants:

1.) "A clear concept of man's position in the community of living things and his relation to environment." The intended consequence of this concept was a proper humility concerning man's position in nature.
2.) "To give students certain fundamental facts and induce in them certain habits and attitudes of thought and certain interests which will form the basic stock-in-trade of would-be teachers."
3.) "An understanding of the relationship between the pure sciences, and the applied sciences; that the applications of science are, in the final analysis, the extensions of pure science discoveries to immediate human problems; discoveries made by men who have sought to explain the phenomena and the objects which surround them, and who have not been directly attempting to invent light bulbs, antibiotics, weed-killers, and atomic bombs."
4.) To produce broadly educated persons rather than narrow specialists.

5.) A teacher who has imagination, inventiveness, the ability to reorganize biological information into new patterns, and to pursue up-to-the-minute knowledge as it becomes available in new books and in current scientific journals.

In addition to the broad objectives listed above, each consultant stated or implied that prospective teachers should be familiar with the particular applied field that the specialist represented.

To produce a well-trained teacher, experience in the following areas of biological knowledge was recommended. It was not intended that each area mentioned should constitute a course, nor that some of the areas could not be incorporated as parts of others. The list included: biology as an integrated course, botany, zoology, classification, systematics, comparative morphology, plant physiology, evolution, genetics, ecology, bacteriology, entomology, physiology, human anatomy, human reproduction, human growth and development, embryology, and growth and development of plants.

Courses in related areas were recommended. They were: geography, conservation, physical sciences, biochemistry, horticulture, anthropology, hygiene, psychology, and statistics.

The conference was cautioned that narrow specialists should not be produced. To prevent this, courses in the humanities and social studies should not be neglected. But this is not all. "The teacher must, if he is to be a wise and percipient teacher, build upon the foundation of facts and attitudes which he has acquired as an undergraduate student. This post-college growth may develop in several ways: through membership in biological organizations and attendance at their meetings, through a definite program of reading new biological books and biological periodicals, through travel, through a continuing interest in fields such as anthropology, sociology, and geography, and through occasional college refresher courses in the biological sciences."

Each consultant made further recommendations concerning knowledge necessary for teaching aspects of his specialty to high school students.

The consultant for "Plants and Man" recommended that high school teachers be familiar with (1) the significance of the domestication of plants and animals for the early development of human culture, and (2) the energy relations among the sun, green plants, man and other animals, and bacteria and fungi.

An understanding of the relation of biology to man's food supply is essential for any biology teacher. "The provision of adequate supplies of food for the earth's rapidly increasing human population is one of the major problems of biology. Failure to solve this problem and to provide adequate food-increases will doubtless lead to further demand for *Lebensraum* and will inevitably produce grave international crises of a social, political, and military nature."

Biological investigations aimed at increasing the world's food supply were reported to be in the following areas:

1.) The development of crop varieties of superior yield-capacity through plant breeding and selection
2.) The development of animal varieties of superior yield-capacity through breeding, selection, and improved animal feeding
3.) Weed control
4.) Insect control
5.) Plant disease control
6.) Increased knowledge of plant nutrition and soil structure and behavior
7.) Introduction of new crops
8.) Conversion of arid lands into agricultural areas
9.) Improved soil conservation methods
10.) Increased utilization of food products from lower plants
11.) Developments in the study of photosynthesis
12.) Changing social and religious attitudes to permit available foods to be eaten that are prohibited by social and religious taboos.

The promotion of health and the discouragement of disease are laudable human objectives that can be realized largely through the application of biology. The consultant on "Health and Disease" recommended that instruction in this area should include:

1.) Growth and development of the individual in the areas of physical, mental, and emotional health
2.) Anatomy and physiology
3.) General understanding of communicable diseases
4.) A knowledge of chronic diseases
5.) An understanding of the organization of health resources in the community, the state, the nation, and the world.

Because of the high standard of living and the habits of waste practiced by our culture future generations may inherit a destitute and ravished earth. To forstall this possibility, instruction in conservation and the development of new attitudes toward the use of natural resources are essential.

The consultant on Conservation recommended that such instruction should include an understanding of:

1.) The necessity for man to comply with natural laws
2.) The principle of sustained yield
3.) The production of better quality in natural products
4.) The principle of multiple use
5.) The management of water, soil, and mineral resources
6.) The relation of engineering to conservation
7.) The economic, social, and political aspects of conservation.

Knowledge of genetics may be of immediate personal concern to man, or it may be of general social concern. The prospective parent faced with the probability of producing abnormal, handicapped children needs the advice of the human geneticist, and the socially minded citizen needs to know the possible consequences of indifference to the genetic potentialities and inadequacies of human populations and of disregard for the possible genetic effects of atomic radiation.

To prepare a citizenry capable of understanding the relation of genetics to human welfare the consultant recommended that high school teachers have knowledge of a minimal core which would include the mastery of such topics as Mendel's laws, polygenic inheritance, multiple alleles, autosomal and sex-linkage, mutations, the nature of gene action and genic interactions, and the relating of the foregoing to the structure and behavior of chromosomes.

In addition, the teacher should be acquainted with the unique problems in human heredity resulting from human habits of reproduction and the impossibility of performing breeding experiments. In order to understand how the geneticist circumvents these difficulties the teacher should have a knowledge of statistics, population genetics and the theory and practice of determining the heritability of human traits.

Alfred Stockard pilots the University boat on one of the numerous trips around Douglas Lake.