

THE PROJECT METHOD IN BIOLOGY

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The biology laboratory period is essentially a supervised study period. This imposes a difficulty on both the student and instructor. Ordinarily, a student will study until he feels that he knows the material. If he is a good student, he will finish in a short time; if he is a poor student, he will take a longer time. In the laboratory, however, all study for the same length of time. The good student will finish in a shorter time than the poor student, or he will soon learn to work at a lower efficiency. In the first case the student is apt to become a trouble maker. In the second case he becomes an idler.

I developed a method of handling this situation, which we have gradually come to call the project method. At first these projects were very simple affairs designed to occupy the ten or fifteen minutes spare time of some of the students. For instance, in studying the leaf the student might be given two or more leaves from which the epidermis is to be stripped. The problem is to determine the occurrence of stomata on one or both surfaces of the leaf. One requiring slightly longer time would be to count the number of stomata in several fields to determine the relative frequencies in different leaves. Gradually a large number of these items was accumulated for daily use.

From time to time, more ambitious projects requiring more time were undertaken. At the same time definite credit was given to the student for the work he had done. This credit is given in the form of project points, a certain number of points being equivalent to a percentage which is added to the final grade. In practice, projects are evaluated at the time they are completed. However, near the end of the course, each student is examined orally or in writing to determine what he has actually learned from his work, and the various projects are again evaluated in the light of these examinations. No one is allowed to raise his mark in this manner by more than

one-half letter or four percentage points.

It is difficult to prevent the poorer student from neglecting the regular work in an ill-advised attempt to improve his mark by working on projects. This problem is partly solved by limiting the amount of credit. Students whose mark is below C (the average grade) are sometimes not permitted to work on projects if this seems advisable. Another difficulty is encountered with the good student who has nothing to gain in a material way from doing such extra work. Special effort is made to reach these students by offering them things of an especially attractive nature.

A group of projects is usually centered around each exercise in the course. In this group are all types from those which require five minutes to some which extend over several months. This is a typical group of projects based on the study of the liverworts. The following require only a few minutes. Find a median section of a chimney pore; find young stages in the antheridium, archegonium, sporophyte, study a young gemma. These take more time: study the complete development of the antheridium, the archegonium, the sporophyte; Bower's theory of progressive sterilization as shown in the sporophytes of *Riccia*, *Sphaerocarpus*, *Marchantia*, *Aneura*, and *Anthoceros*. Students who draw well are encouraged to make wall charts. Collection of material for life cycles is often difficult because of shortness of time and distances which must be traveled. Groups are, however, taken to Starved Rock and White Pines State Parks for the purpose of studying liverworts in their natural surroundings.

Problems which require reading, growing of plants, and original thinking are proposed to the entire class, or to selected groups. Three examples are given. The gemma has two growing points. Does it develop two thalli? What are the heavily stained cells in the lower layer of cells in the thallus? The class is shown the

usual antheridial and archegonial material with elongated stalks. How does the sperm reach the egg?

Within recent years a definite type of project has been selected for study for each year. Two years ago, wall charts were concentrated on. Last year, taxonomic collections were selected, and this year photography is being emphasized. Much of the work done is fragmentary or of such poor quality that it cannot be used. In spite of this, a valuable collection of teaching materials has resulted.

The advantage of the project method is that the student takes an active part in the courses having some choice as to what he will study. Sometimes the student develops an enduring interest in some phase of the subject which he first became acquainted with as a project. The free and informal use of the department's materials, and the close and almost constant association with the instructor make the student feel that he is a real part of the department.