Hulda Grobman

# A New Curriculum in Biological Sciences

*Will national studies mean a national curriculum?*

A GREAT deal has been written about curriculum development and research within the individual school or school system. However, there has been less analysis of the distinction between the curriculum activities suitable to the individual school, school system and state, and those problems requiring broader activity. There are cries of "national curriculum" when suggestions are made that national action is needed to upgrade curricula, but there has not been careful analysis of the point at which national action might be needed and the area in which local activity is most suitable and effective.

This question is no longer an academic one, since several national curriculum studies, financed by National Science Foundation grants, are now developing curricula in specific areas of science and mathematics. The Physical Sciences Study Committee, the School Mathematics Study Group, the Biological Sciences Curriculum Study, the Chemical Bond Approach, and the Chemistry Education Material Study represent a new dimension in curriculum development. Though they are all still in an experimental stage, and we cannot tell how successful a device they will be, it is not too soon to consider such questions as: What, if any, is the proper role of such national curriculum groups in American education? Who is involved? Do local curriculum specialists and teachers have a role in this process? Will such studies stifle local experimentation? Are they developing "national curricula"?

Before considering these questions, it may be well to examine how such studies operate, using one—the Biological Sciences Curriculum Study (BSCS)—as a case in point.

**Hulda Grobman** ***is Consultant, Biological Sciences Curriculum Study, University of Colorado, Boulder.***

## Experimental Approach

The BSCS was organized by the American Institute of Biological Sciences, a professional society representing 84,000 biologists, to seek the improvement of biological education. Bentley Glass of Johns Hopkins University is Chairman of the Study, while headquarters for the study are on the University of Colorado campus in Boulder. The BSCS has a small staff and works primarily through com-

mittees and consultants. To date, over 1,200 persons—educators, research scientists, psychologists, editors and others interested in biological education—have contributed to its work.

The BSCS is using the individual classroom as the focus for its research, and the individual teachers and students as integral participants in the writing and rewriting of course materials. The process is this: After 18 months of background work, 69 carefully selected high school biology teachers and collegiate research biologists met at a Summer Writing Conference. The writers worked in three teams, with each team producing an experimental version of a high school biology course, complete with text, laboratory materials, teacher's commentaries and guides, and brief films on techniques.

There were several reasons for the decision to prepare three versions, rather than a single version. First, the BSCS wished to assure the flexibility that three versions would permit; it wished to give schools a choice among several good curricula, rather than offering them a single course. Second, by preparing three independent versions, a better base for experimentation is obtained. There are many ways of approaching the subject of biology and now there is no evidence to indicate that any single way is best in all situations. By comparing experience with three versions, possibly we will find that one works best in certain school circumstances or with certain kinds of students.

While the Summer Writing Conference was in process, a group of 20 high school students, under the supervision of three high school teachers, pretested materials and discussed their reactions with the members of the writing teams. This was only the first of a series of experimental trials for the materials.

During the current school year, 118 teachers and their 14,000 students are using these materials experimentally. Fifteen Testing Centers are organized throughout the country with from six to nine teachers each; one teacher is the Center leader and is responsible for Center management. Each Center also has a research biologist to act as a resource person on questions of biological content. All 30 of the Testing Center Leaders and Consultants helped write the materials, as participants in the Summer Writing Conference.

All participating teachers send periodic reports to the headquarters office. Many teachers are inviting students to give their reactions and criticisms of the materials, and these are included in the reports.

Teachers at each of the Testing Centers meet weekly to discuss their experience and that of their students with BSCS materials and to plan for the work of the coming week. Reports of these meetings are also sent to the BSCS. Other feedback on the testing experiences is obtained through regular visits from BSCS staff members who talk with principals, supervisors, teachers and students, and through tests (prepared in cooperation with Educational Testing Service) that are administered to all students.

The information obtained in these ways will be used in revising the materials at the Second BSCS Writing Conference in the summer of 1961. In 1961-62, the revised editions will again be used on an experimental basis, but in a larger number of schools, and again detailed feedback will be obtained. Further tests will be administered to students and more detailed analyses will be made of student achievement in each of the three versions, as well as in traditional courses. This testing will be followed by a final rewriting

of the materials before they become generally available in the fall of 1962.

Teachers participating in the Testing Program are encouraged to use a variety of materials to supplement the BSCS texts and laboratory manuals. Actually the BSCS texts include less detail than do the traditional texts, so that the teacher has a greater opportunity to adapt the course to his own needs through more extensive use of supplementary materials. The BSCS is preparing some supplementary materials, and the teacher is free to use these or any other materials he considers suited to the course. One type of BSCS supplementary material is a series of 12 major problem units, each of which requires six weeks of class time. Any of them can be used in conjunction with any of the three BSCS courses. In addition, the BSCS is initiating a pamphlet series, with each issue presenting information on a particular area of biology. These pamphlets may be used as supplementary materials for highly motivated students and, after a number of the pamphlets are issued, they can also be used by the teacher as a basis for developing his own course in biology.

Thus, high school teachers and research biologists working in teams are developing three independent versions of a high school biology program, plus several other types of materials which can be used to modify any of these versions. These materials are being tested in a variety of school situations and all teachers and students participating in the Testing Program are actively helping in the rewriting of the experimental versions.

So much for what the BSCS is doing. What is the biology curriculum revision job that needs to be done and why can't an individual school or school system do this job and do it as well or better?

## Revising the Curriculum

Each year, almost 2 million senior high school youths take a basic course in biology. For a majority of them, it is the last formal study of science, since less than half the students take another science course or go on to college. Thus, on the high school biology course falls a major responsibility for giving students an understanding of science and scientific processes that will enable them to be intelligent citizens in a society where science has a major influence on everyday life. That the biology courses have failed to do this to date is obvious from the degree of public misinformation, emotional reactions, or lethargy on such problems as fluoridation, patent medicines, radioactive fallout and conservation of natural and human resources.

Clearly we need major curriculum change in high school biology. But building a completely new curriculum is not a job to be accomplished in a teacher's one free period a day, on weekends, or in a two-week preplanning session. It is a task that requires many people with many skills and with blocks of free time. It also takes money—for personnel, for materials, for printing books, for experimental testing. And it requires an opportunity to test on a broad experimental base. While some teachers and systems have been able to develop complete new course materials, as a general practice this is difficult because of the limited resources of most schools.

In biology, the difficulty in building a new curriculum is compounded by the Twentieth Century explosion of scientific knowledge. Our fund of scientific knowledge is doubling each decade. More and more information is becoming available; whole new fields of science—fields unknown 20 or 30 years ago—are opening

up. At the same time, some areas that were considered important in past years are now less significant. This means that we have a mass of facts and theories to choose from. We are faced with the difficulty of re-evaluating the whole field of biology in terms of the frontiers of scientific development, in order to choose the ideas and information that will best give the student an understanding of modern science and of his own place in the universe. This choice is a job that requires the assistance of outstanding research scientists who are specialists in each of the various fields of biology. Few school systems have sufficient resources to obtain this type of help and such scientists are rarely available to a single school or school system; however, many have been willing to participate in a study with a broader base.

## A National Curriculum?

Will national study materials result in a single national curriculum, with all schools frozen into the same mold?

In high school biology, we already have what might be considered a national curriculum, with two current traditional texts commanding 75 percent of the market. While there are two dozen other texts available, none provides a really new approach to the subject. Moreover, the chances of having a radically new approach in a textbook by individual authors is slim. Even if a publisher takes a chance and publishes such a volume, few school systems are likely to gamble a major investment of money and students on an untried approach.

On the other hand, the BSCS is offering not one but four different sets of basic course materials—three complete versions plus pamphlets which can be used for building a course. These will be supplemented by a dozen units which can be used to make major adaptations in any of the four sets of basic course materials. Furthermore, when these sets of materials are in final form, they will be available—just as any other textbook is available—to be judged on their merits. The choice of whether or not to adopt any or all of the BSCS texts will, of course, remain with the schools.

While it is hoped that there will be adoption by many school systems, the primary intent of the BSCS is *not* to sell textbooks. Its purpose is to prepare *models* of what representatives of the best high school teachers and research biologists in the country consider a good, usable modern biology course. These models may then stimulate the production of other equally good biology textbooks by individual authors. In this way, a new level of excellence in biology course materials may be promoted.

If it is accepted that the national curriculum studies have a function that cannot be handled by the local schools, what then are the areas left for local curriculum development?

The local schools and school systems that have been able to develop their own materials can continue to do so, using the work of national study groups as models, if they care to. Others will continue to choose among available texts. This will include a choice between national study materials and those from other sources. Whatever texts they choose, these must still be adapted to the local classroom situation by the schools and teachers involved, and supplemented with other resource materials developed locally or by outside sources. And the individual teacher, school and system will retain the fundamental responsibility for classroom experimentation with whatever materials and teaching techniques are used.