

Biology

Results of the first two of a three-phase comprehensive review of the undergraduate major in Biology. The review was initiated and undertaken by the Department faculty. While not directly related to the AQAD process, the review intersects with the Department's preparations for its upcoming AQAD review in the 1999-2000 cycle, and the results of this review process will inform the Departmental AQAD self-study. This effort represents the kind of program-based focus on student learning outcomes that AQAD is intended to stimulate.

■ Purpose and Goals

The decade of the nineties saw a dramatic increase in student interest in Biology during a period of significant faculty attrition. The department faced difficult choices in the deployment of teaching effort, and there was a growing consensus among some members of the faculty that the existing curriculum was failing to meet the Department's needs. Several opportunities for improvement were identified: 1) many faculty were dissatisfied with the quality of the undergraduate experience, especially the strong reliance on large lecture courses with multiple choice examinations; 2) some faculty were concerned that student dissatisfaction with their experience in the major was leading them to transfer into other majors (such as Microbiology, Biochemistry, or Psychology); 3) a growing number of faculty felt that the introductory courses did not adequately prepare students for upper-level study in the major, and that material was consequently being repeated a second or even third time; 4) faculty were aware that increasingly graduates of the program were moving directly into the job market, in some cases without adequate preparation in critical thinking and application of biological concepts; and 5) the existing structure of the curriculum provided little opportunity or incentive to undertake curricular reform.

To address these concerns, the Department developed a three-phase review process. In the first phase, a faculty committee developed learning goals for undergraduate biology which were then adopted by the faculty as a whole following a period of discussion and revision. In the second phase, a committee proposed specific revisions of the curriculum designed to better achieve the identified learning goals. The final phase was designed to provide support to faculty as they adapted their teaching to the goals and the new curricular environment.

■ Outcomes

In the first phase, the faculty committee drew on existing work in the field by the American Association for the Advancement of Science, the National Research Council, and others. The committee's fundamental aim was to "reframe the debate on the department curriculum from a content focus toward a greater emphasis on student skills and abilities." This shift would, the committee hoped, permit a sharper focus on "student-active learning, peer and instructor feedback, and alternative forms of assessment."

A draft of the committee's report was circulated among the faculty, and individual committee members met with each member of the faculty to solicit feedback. This discussion resulted in the following set of learning goals, organized around skills and perspectives appropriate to the major:

I. Skills

- a. Ability to observe and describe nature accurately.
- b. Ability to construct logical arguments in biology.
 - i. Generate and state testable hypotheses.
 - ii. Develop and elaborate models.
- c. Ability to critique logical arguments in biology.
 - i. Design experiments to test hypotheses.
 - ii. Recognize possible outcomes and assess the probability of occurrences.
 - iii. Collect, organize, and analyze relevant data.
 - iv. Draw conclusions and evaluate their relative quality.
- d. Ability to communicate ideas and arguments effectively both orally and in writing.
- e. Ability to work effectively in a team.
- f. Ability to apply problem-solving to learning.
 - i. Develop strategies for identifying deficits in knowledge.
 - ii. Acquire information gathering and study skills.
 - iii. Self-assess progress in learning.
- g. Ability to apply quantitative reasoning to biological questions.
 - i. Construct and interpret graphs and plots.
 - ii. Analyze data using statistical methods.

II. Perspectives

- a. Appreciation that learning changes "how one thinks" as well as "what one knows."
- b. Appreciation for self-motivated, curiosity-driven learning.
- c. Ability to approach novel problems with flexibility, creativity, and confidence.
- d. Appreciation for the interconnectedness of knowledge.
- e. Appreciation that the pursuit of science can be exciting and fulfilling.
- f. Confidence in oneself as a college-trained biologist.
- g. Appreciation for the diversity of living things and the diversity of approaches used to study them.
- h. Appreciation for the impact of biological science on the environment and society.

In the second phase, biology undergraduates were surveyed to determine the extent to which they encountered activities related to these learning goals in their courses. The analysis suggested that learning goal-related activities were rarely found in 100 and the larger 200 level courses, but were much more common in the smaller 200 level and 500 level courses. The committee therefore proposed shifting the curriculum so as to reduce class size at the 200 level, thereby creating an environment in which introduction of more learning-goal oriented activities could be encouraged.

■ Future Action

In Phase III, the focus will turn to supporting faculty in their efforts to incorporate the learning goals into the modified curriculum. This will involve continuing evaluation of class size, exploration of effective teaching methods in smaller courses, and assessment of student achievement of the learning goals.