

Assessment Plan
Department of Biochemistry and Molecular Biology
College of Agricultural Sciences and Natural Resources
Oklahoma State University
Spring 2002

The Department of Biochemistry and Molecular Biology administers the following degree programs at Oklahoma State University:

- a. B.S. in Biochemistry in the College of Arts and Sciences (CAS),
- b. B.S. in Biochemistry and Molecular Biology in the College of Agricultural Sciences and Natural Resources (CASNR),
- c. M.S. in Biochemistry and Molecular Biology in CASNR, and
- d. Ph.D. in Biochemistry and Molecular Biology in CASNR.

Mission, objectives and goals of the department and its degree programs

The Department has adopted the following as its mission:

"The Department of Biochemistry and Molecular Biology (BMB) has long considered itself as the basic science department of the Division of Agricultural Sciences and Natural Resources (DASNR). As such, its mission is not directed towards any particular agricultural commodity or natural resource issue. Rather, its mission has been and continues to be "to add to and disseminate understanding of science related to the molecular basis of life".

Though BMB's mission is fundamental, the Department plays important roles in the more directed activities of DASNR. It does so in three ways. First, BMB contributes the expertise of its members to research endeavors in DASNR-supported projects. Though sometimes the contribution is through informal consultation, often it is by full collaborative participation in these projects. Second, BMB maintains facilities, equipment, and services essential for modern molecular biological research and makes these available to all DASNR-supported researchers and researchers throughout the university. Third, through its formal teaching program and its workshop program, BMB provides training in the molecular analysis of life processes that prepares students to join active research teams as productive members. BMB sees itself at the center of life science research, able to interact with researchers in many related fields.

Consistent with the above mission, BMB adopted the following goals:

1. "Conduct research and study in biochemistry and molecular biology to understand life and to improve its quality.
2. Educate students about our science and provide specialized training in biochemistry and molecular biology for future scientists and professionals.
3. Contribute to public awareness and understanding of current biochemical and molecular biological views of life.
4. Share our understanding of the molecular basis of life with other scientists."

These goals are interdependent. For example, by involving students in the conduct of research in these fields, we contribute to their education about the science and provide the specialized training. Further, by educating students about the science we contribute to

public awareness of the science. Clearly, objectives tailored to accomplish these goals impact multiple goals.

Given the overlapping and interdependent nature of the department's goals and consistent with these goals, the department faculty has set the following objectives for students in its degree programs:

- a. To gain and practice laboratory and computer skills in conducting biochemical and molecular biological research.
- b. To acquire wide factual knowledge of the principles of biochemistry and molecular biology. Included are assimilation of information, its integration with other knowledge, and its intelligent use.
- c. To achieve the ability to find and use prior knowledge in biochemistry and molecular biology (the literature).
- d. To acquire the ability to plan, execute, and interpret experiments in biochemistry and molecular biology. Included are abilities in experimental design, analysis of data, and critical evaluation.
- e. To develop problem-solving skills in biochemistry and molecular biology.
- f. To achieve the ability effectively to communicate biochemical information orally, in writing, and visually.
- g. To develop an attitude that will be continued in lifelong learning. The rapid changes occurring in biochemistry and molecular biology require any practitioner to be flexible and adaptable to new knowledge and opportunities.

Expected outcomes for the degree programs

The expected outcomes of the specific objectives listed above vary in degree with the level of the degree program. In general, they are:

- a. The ability to work productively in a commercial, institute, or university laboratory in biochemistry, molecular biology, and related fields.
- b. The possession of fundamental knowledge in biochemistry and molecular biology and understanding of the principles underlying these fields. Also, the possession of substantial understanding of the physical sciences of chemistry, physics, and mathematics, and of the biological sciences.
- c. The ability to find and synthesize observations and interpretations reported in a variety of articles in the literature of the field.
- d. The ability to understand, convey and utilize the scientific method as applied to biochemistry, molecular biology and related fields.
- e. The ability to solve complex problems, regardless of field.
- f. The ability effectively to communicate scientific findings and issues in writing and in oral and visual presentations.
- g. The possession of a commitment to continual learning. Be beginning a career in biochemistry, molecular biology or a related field through employment or further training (graduate or professional school, or postdoctoral positions).

Evaluation methods

The evaluation methods employed in this plan often do not target single specific expected outcomes, but provide indicators of multiple outcomes. Some methods, such as following enrollment trends, only gauge the overall success of the instructional program. The following list identifies the expected outcomes with the evaluation methods that are relevant. There follows, in a separate list, a description of each evaluation method.

- a. Alumni surveys that reveal present position should reveal whether the student has achieved productive employment in the field. Possession of the ability to be so employed can be assessed partially earlier by the students' performances in laboratory courses.
- b. Standard examinations allow comparison from year to year of the extent to which students have acquired the basic knowledge in the field. Their grades in courses should also reflect their success in acquiring the knowledge. Outside experts may in interviews with our students be able to gauge the depth of their knowledge relative to comparable students at other institutions.
- c. The best indication of competence in reading the scientific literature and synthesizing the information obtained is the writing of high quality scientific papers. Such papers may be produced in certain classes, as honors theses, as M.S. and Ph.D. theses, and as the introductions in scientific papers. Evaluation of the number of scientific papers produced is feasible given literature databases. Evaluating the production and quality of term papers seems less feasible. Exit interviews can determine the number of such writing experiences undergraduates have had.
- d. Mastery of the scientific method is best demonstrated by the publication in peer-reviewed journals of the results of application of the method. Presentation of the results at scientific meetings may also demonstrate mastery. Alumni surveys may also approach evaluation of achievement of this objective, provided a properly phrased question is presented.
- e. BIOC 4113 is a problem-solving oriented course. Thus grades in this course can be used to evaluate how well students can solve problems. For graduate students, performance on cumulative examinations can provide a similar measure. Employment status as revealed in alumni surveys or by direct reporting is also relevant. If the graduate is in a position where solving problems is important, the assumption is that the student has acquired the relevant skill.
- f. Communication ability can be assessed by monitoring publications, presentations and honors.
- g. Exit interviews can determine whether the excitement of learning is likely to continue. Alumni surveys can reveal whether it has and whether the individual is still learning. Continued publication can also reveal a continued interest in learning.

The methods of evaluation used in this plan are:

Exit interviews. The current exit interview questionnaire administered to graduating seniors gauges primarily student satisfaction with the educational experience. It will be modified by addition of questions that will assess whether the students have had adequate experiences in problem solving, literature reading, the various types of presentation.

Alumni Surveys. By the addition of properly worded questions to surveys conducted by the assessment system we hope to assess whether the students' OSU educations prepared them well for their careers.

Alumni self-reporting. Voluntary submission by alumni of updates to their addresses and employment status will allow us to determine what kind of employment they have and perhaps whether it is employment for which they were prepared by their education at OSU.

Grades in selected courses, and overall. Certain courses concentrate on specific outcomes, such as laboratory skills and problem solving. Grades in these courses can measure how effective we are in these particular educating tasks. Overall, an examination of grades can identify problem courses and judge overall how good students are in learning.

Standardized examination performance. The American Chemical Society examination in Biochemistry has routinely been administered to graduating seniors. Yearly averages have been tracked. They show no statistically significant changes from year to year, or any significant trends. Thus, continued administration of the exam may detect significant variations that require serious attention. Additionally, many students take GRE and/or MCAT exams. The possibility of obtaining those scores for statistical comparisons should be explored.

Enumeration of publications of student work. Publications from OSU labs with students in the author list are excellent indications that the students have achieved multiple objectives. It is hoped that the number of students with publications and the publications per student will increase.

Enumeration of publications of alumni. The publication of scientific papers after leaving OSU is an indication that the individuals have received the training desired. It also is an indication of a continued interest in learning. Quality of such publications can be assessed by following their citation rate.

Enumeration of presentations. The department's annual report includes a list of presentations made by department members. These will be scanned to identify those that involve students. Separately, those presented by students will be tallied. Trends over years will be watched.

Outside evaluators. Outside evaluators will be the equivalent of our faculty but in related fields at other institutions. They should be able to compare our students with equivalent students at other locations. The comparison will not be quantitative, but quantitative.

Statistics on enrollment, years to degree and retention rates. Declines and increases in enrollment, to some extent, reflect the reputation of the department for educating its students. When it takes longer than generally accepted to graduate from our programs, the programs will need reevaluation. Similarly, a higher than normal dropout rate is an indicator of problems in the program.

Cumulative exam progress. Our graduate students take a series of cumulative examinations. They are to pass five of them. The number of examinations it takes for them to reach the five is an indication of how well they have been educated. The exams emphasize literature analysis and problem solving, as well as test fundamental knowledge in biochemistry and molecular biology.

Integration of assessment results into curriculum planning and program improvement

Assessment Reports are prepared annually using the above evaluation methods. Copies are given to faculty and to the department head. The department head uses the report as one input in making decisions about curriculum and other matters affecting the instructional program and students' learning. Occasionally, matters raised by the report become topics of discussion at faculty meetings.