

Student Learning Outcomes Assessment Plan

Department of Biology
Undergraduate Bachelor of Science Degree Program
California State University, Fresno
Revised, February 2, 2006

Mission Statement:

To provide a diverse undergraduate program that matches the breadth and excitement of modern biology, develops critical thinking skills, and prepares students for the hundreds of career opportunities that use biology as a foundation.

Goals:

1. Biology majors will gain a broad background in the fundamental concepts of the Biological Sciences.
2. Biology majors will gain knowledge and experiences in the basic methods, instrumentation and quantitative analytical skills used to conduct scientific research in biological science.
3. Biology majors will develop critical thinking and communication skills, both oral and written, for purposes of conveying biological information to both professional scientists and the lay public
4. Biology majors will develop intellectual independence, scientific literacy and an appreciation for the connections between biological science and society.

CSU Fresno Biology Graduates will develop the knowledge, abilities and attitudes portrayed in the Department's stated goals and objectives:

Goal 1:

Biology majors will gain a broad background in the fundamental concepts of the Biological Sciences.

Objectives

- 1.1 Conceptual knowledge in Biology
For each area Biology majors will understand characteristics, relationships and mechanisms of change

- 1.1A principles of: evolution
- 1.1.B " " ecology and environmental biology
- 1.1C " " cell biology
- 1.1D " " genetics
- 1.1E " " molecular biology
- 1.1F " " physiology
- 1.1G " " biochemistry and metabolism
- 1.1H " " biodiversity
- 1.1I " " developmental biology
- 1.1J " " organismal biology
- 1.1K " " history of science and biology
- 1.1L " " scientific method/process
- 1.2 Unifying themes
 - 1.2A evolutionary patterns and processes
 - 1.2B energy transformations and flow
 - 1.2C nutrient cycles
 - 1.2D homeostasis and equilibria
 - 1.2E molecular information flow
 - 1.2F structure-function relationships
 - 1.2G hierarchy of biological organization
 - 1.2H developmental patterns and processes
 - 1.2I complexity of interactions in biological systems

Goal 2

Biology majors will gain knowledge and experiences in the basic methods, instrumentation and quantitative analytical skills used to conduct scientific research in biological science.

Objectives:

- 2.1** Scientific Method
 - 2.1A knowledge of the hypothetico-deductive method of inquiry
 - 2.1B ability to apply the scientific method to biological questions
 - 2.1C ability to generate a hypothesis
 - 2.1D ability to design an experiments
- 2.2** Analytical and quantitative skills
 - 2.2A make appropriate measurements and create data sets
 - 2.2B graph and display data
 - 2.2C objectively analyze data
 - 2.2D interpret results of experiments
- 2.3** Biological information skills
 - 2.3A understand and evaluate primary biological literature
 - 2.3B integrate published information in oral and written communication
 - 2.3C use biological databases
- 2.4** Lab and field skills
 - 2.4B use appropriate equipment and instrumentation
 - 2.4C safety procedures
- 2.5** Teamwork skills
 - 2.5A work cooperatively in a group

2.5B solve problems in a group

Goal 3:

Biology majors will develop critical thinking and communication skills, both oral and written, for purposes of conveying biological information to both professional scientists and the lay public.

Objectives:

- 3.1** Critical thinking and problem solving skills
 - 3.1A develop an argument and support it
 - 3.1B recognize and uses deductive and inductive reasoning
 - 3.1C integrate concepts within and among disciplines
 - 3.1D solve problems
 - 3.1E distinguish between data and inferences based on data
- 3.2** Communication skills
 - 3.2A communicate effectively orally
 - 3.2B communicate effectively with scientific writing

Goal 4:

Biology majors will develop intellectual independence, scientific literacy and an appreciation for the connections between biological science and society.

Objectives:

- 4.1** Embraces lifelong learning, has career knowledge
 - 4.1A capable of self-directed learning
 - 4.1B possess a sustained interest in biology
 - 4.1C knowledge of potential career paths
- 4.2** Scientific literacy
 - 4.2A able to distinguish science from pseudoscience
 - 4.2B views science as a way of viewing the world and not just a collection of facts
 - 4.2C understands limitations of science
 - 4.2D applies scientific thinking to everyday problems
- 4.3** Biology and society
 - 4.3A helps public to make informed decisions about biodiversity and biological resources
 - 4.3B appreciates relevance of biology to society
 - 4.3C understands and appreciates connectedness of science, society and history
 - 4.3D can identify and evaluate ethical issues in biology

The Biology Department at CSU Fresno has a diverse program of instruction in Biology that spans organismal biology, ecology and evolutionary biology through physiology, cellular and molecular biology. Because of this tremendous diversity of instruction, the only courses in the instructional curriculum that all majors receive are the Biology Core courses. In addition, many of our students (perhaps as high as 60%) are transfer students from the California community colleges. Consequently, less than 50% of the department's majors experience the seven-course Core as delivered by the department and its faculty. Given these limitations, the focus of the department's outcomes assessment will primarily be the Core, but assessment will also occur in some non-core upper division Biology courses.

Assessment will be conducted in the Department of Biology that continues to have two major questions in mind: 1) Do the content and delivery in the Core courses adequately address the goals and objectives of the department? and 2) Do the instruments used to assess student learning (term papers, laboratory reports, mid-term lecture exams etc.) appropriately measure the learning goals and objectives of the department? In the event that assessment activities do not adequately measure learning objectives, the Department will strive to identify other assessment instruments and/or activities that do.

Assessment activities for the undergraduate majors program in the Department of Biology will consist of six direct measures and two indirect measure of student learning. These include analysis of Pre- and Post-tests, primary traits analysis of assignments in two upper division Core courses and one upper division microbiology course, pipeline analysis of student status and demographics and an alumni survey.

Assessment Activities:

Direct Measures of Student Learning:

1. Pre and Post Test

A pre- and post-test to assess how well biology majors learn and retain general biology content knowledge covered in the Biology Core (Objectives 1.1A-L and 1.2A-I) will be given each year. The pre test will be given to lower division biology majors in BIOSC 1A and the post test will be given to seniors in BIOSC 180. Students will be asked in the post test whether they have had all or just a portion of their Biology Core courses at CSU Fresno so that performance comparisons can be made between students who have had all Biology core courses at CSU Fresno vs. transfer students who have not.

2. Primary Trait Analysis of BIOSC 130 Ecology Lab Reports

This assessment activity will measure student development in data collection (Objective 2.2A), graphing (Objective 2.2B), data analysis (Objective 2.2C), interpretation of results (2.2D) and scientific writing (Objective 3.2B).

3. Primary Trait Analysis of the Microbiology Poster Session

This embedded assessment activity will implement scoring rubrics to assess elements of student application of scientific method, hypothesis testing (Objectives 2.1A-D), ability to work in a team (Objective 2.5A-B) and oral communication (Objective 3.2A). Faculty and student peers that observe poster presentations will fill in the rubric scoring.

4. Primary Trait Analysis of the Evolution Term Paper

Evolution (BIOSC 180) is considered a culminating course in the Biology Core that provides a means for students to synthesize their Biological knowledge in an evolutionary perspective. Each student in the course will write a term paper on a topic in evolutionary biology. To complete the assignment, each student must select a topic in biology, research the topic through the primary scientific literature, and synthesize and summarize the information on that topic in an evolutionary perspective. Primary trait analysis of Evolution term papers will be used to ascertain students' abilities to interpret the primary literature (Objective 2.3A) and integrate concepts (Objective 2.3B), as well as their understanding of evolution (Objectives 1.1A and 1.2A) and their scientific writing skills (Objective 3.2B).

5. Primary Trait Analysis of Core Course Test Questions

Each year, a different core course will be identified in which a specific learning objective (not addressed in other assessment activities) can be addressed in a specific essay test question planted in the course final exam. These primary traits analyses will primarily occur in lower division core courses (BIOSC 1A and 1B) to serve as formative assessment of Biological content learning (Objectives 1.1A-L and 1.2A-I).

6. Tabulation of student research activity

Although it is obvious that not all undergraduates will have the opportunity to conduct research with Biology faculty, the fact that a significant number of undergraduates are involved in this activity is a sign of a healthy and engaged Department. Each year, as part of the Department's annual report, faculty will tabulate the number of student publications, poster and oral presentations at scientific meetings, funding awards and honors. Faculty will also estimate the level of new funding made available to student researchers working in their lab. These findings should provide direct evidence that some students have mastered the process of scientific inquiry and communication.

Indirect Measures of Student Learning

7. Pipeline Analysis:

Pipeline analysis (conducted at the end of the review period) will follow the progress of students that become Biology majors in Fall 2005. This assessment activity is entirely dependent upon assistance from The Office of Institutional Research and Planning, and their ability to provide us with the appropriate data. We will carry out detailed analyses of student records data to answer questions such as:

- Are students taking CORE courses in sequence?

- At what points do we lose students from the major?
- Do they leave the university or transfer to other majors?
- Do we disproportionately lose minority students?
- Does the success of transfer students differ from that of continuing students?
- Can we identify predictors of success (or failure) that will allow us to provide more effective support to at-risk students?

8. Alumni Survey

Surveys will attempt to measure:

- How graduates feel about the currency, breadth and depth of their Biology education
- student satisfaction with various aspects of the Biology undergraduate program (e.g., courses, faculty, etc.).
- Relevance of degree to, and level of preparation for, current occupation
- Whether students continued with advanced degrees
- Survey will be mailed to past graduates a minimum of one year after graduation, and at the end of the Department's review cycle.

Timeline of assessment activities:

Assessment Activity	Year 1	Year 2	Year 3	Year 4	Year 5
1. Pre and Post Test	X	X	X	X	X
2. Ecology Lab Reports		X			
3. Microbiology Poster			X		
4. Evolution Term Paper				X	
5. Test Questions	X	X	X	X	X
6. Student Research	X	X	X	X	X
7. Pipeline Analysis					X
8. Alumni Survey					X