

## **1. Mission**

The Biology Department's **mission** is to provide students with an understanding of, and an appreciation for, the fundamental mechanisms that underlie all living systems from molecular biology through ecosystem ecology. Students should understand the ways in which they are affected by living organisms and how their lives in turn have an impact on other living organisms and the biosphere. They should become proficient in the methods of science and aware of the processes that lead to discoveries in science. In course work, they should develop observational, analytical, and communication skills, regardless of their chosen career path. Ultimately, biology is best understood by active involvement with organisms and the systems of life in laboratory and field settings, and in collaborative student-faculty research.

## **2. Goals/outcomes.**

**We have identified the following learning goals for our students:**

### **I. Content goals**

**Goal 1.** Our students will understand and apply fundamental biological principles from each of the following four major areas of biology - cell biology, molecular biology and genetics, organismal biology, and ecology and evolution.

**Goal 2.** Our students will acquire in-depth knowledge of the major areas of biology and be able to integrate principles from these areas.

**Goal 3.** Our students will acquire scientific investigation skills in laboratory and field courses necessary to apply the methods that biologists use to answer biological questions.

### **II. Process goals**

**Goal 1.** Our students will develop enhanced critical thinking skills.

**Goal 2.** Our students will engage in the scientific process.

**Goal 3.** Our students will communicate effectively in written and oral forms.

### **3. Program Components**

*Required courses, elective courses, out-of-classroom or other experiences that are designed to achieve each educational objective. NOTE: Every class will not, nor is it expected to, achieve each outcome. The goal is to get an even distribution of experiences that achieve the outcomes.*

The Biology Department offers three different minors: Cell and Molecular Biology (CMB); Environmental Biology (EB); and Secondary Education minor in Biology (SEB). The requirement for each minor is listed below.

CMB – Students in this minor are required to take both of our core courses, BIOL 195 (Ecology, Evolution, and Biodiversity) and BIOL 210 (Cell and Molecular Biology; has CHEM 121 as pre- or co-requisite). CMB students are introduced to each of our listed student learning outcomes in one of those two core courses. All CMB minors must successfully complete a minimum of five units in biology. The remaining courses must come from the following list (at least two must have labs): 301, 317, 321, 324, 332, 337 (may be taken as CHEM 337), 341, 362, 365, 367.

EB – Students in this minor are required to take our first core course, BIOL 195. They are required to take at least four additional courses, including two from BIOL 215, 216, 225, 227, and 248, and two from 206, 210, 237, 365, and 368. Students may complete this minor without having any courses in chemistry, but several courses listed do require CHEM 121 as pre- or co-requisite (BIOL 210, 365, and 368).

SEB – Students in this minor are required to take both of our core courses, BIOL 195 and 210 (BIOL 210 has CHEM 121 as pre- or co-requisite). In addition, students must take at least three other BIOL courses as follows: one plant course (215 or 216), one animal course (225, 227, 248, 314), and one unit at the 200-level or above, with laboratory, selected in consultation with Biology faculty and with written approval of the Chair of the Biology Department.

The minors in Biology are not open to Biology majors, and students may not choose more than one minor in Biology. All courses for a minor in Biology must be taken for numerical grades.

A grid of our goals and student outcomes in biology courses we offer is available as a **PDF file**. We do not include any BIOL x89 courses, our topical seminars (BIOL 401/402) or our research courses (BIOL 411/412) in the list. At this time, we do not include BIOL 366, which has not been offered in several years, as it will be revised soon.

### **4. Methods/data sources and instruments**

*...that you will use to gather information about whether expected outcomes and learning objectives are being achieved. NOTE: You do not need to collect data from the same sources every year. Rather, some kind of assessment rotation will be sufficient (e.g. Years 1 & 3, collect data from graduating seniors, Years 2 & 4, collect data from employers and alumni, etc.).*

We currently use several assessment techniques in courses in the Biology Department, including (but not limited to):

- exams (variety: factual recall, data analysis and interpretation, short answer, and/or essay)
- quizzes (variety: factual recall, data analysis and interpretation, short answer, short essay)
- data analysis (including statistical analysis, data presentation in tables or figures)

- critical analysis of primary literature
- research papers from class lab or field projects (experimental [E] or observational [O])
- research papers from independent (small group or individual) lab or field projects (E or O)
- oral presentations from independent lab or field projects
- poster presentations from independent lab or field projects
- research proposals
- oral presentation of literature
- participation in discussion
- lab notebooks
- lab exercises
- problem sets

We have developed or borrowed rubrics for use by the department for several of these items (**writing rubric PDF**, **oral research presentation rubric PDF**), and we will be working to develop department-wide rubrics for other items. We will assess understanding of biological principles of senior biology minors from ETS Field Test in Biology (subscores reported in each of the four areas of cell biology, molecular biology and genetics, organismal biology, and ecology and evolution). We have been giving this test to our senior majors since 2000, and to our minors since 2005. We would like to continue to give this test each year to seniors, if possible. If additional funding is available, every several years we will use the ETS Major Field Test to assess levels of knowledge of incoming first-year students who plan to major in biology and of senior majors. We will compare percentile scores between first-year and senior students. We expect that seniors should show an average of an increase of at least 25% in their percentile scores in each area over those of first-year students.

As a department, we will discuss other ideas for assessment, such as developing a short student self-assessment tool that can be used for all students at the end of each of BIOL 195, 210, and another self-assessment tool for all majors and minors in their last semester on campus. We will keep track of students who carry out research with faculty members, and we will document student presentations at national and regional meetings and students who are co-authors on publications. In addition, we hope to begin collecting data from alumni.

We will focus on different goals in different years. We have some data on content goals from ETS Field Tests in Biology (see Table 1). We will begin collecting self-assessment from students in 2010-2011, and we can begin to use those data in future years.

## 5. Analyze and interpret data

The Biology Department has been administering the ETS Major Field Test to all senior minors since 2005. Summary data for our Biology minors for 2007-2010, four years with exam Biology 4BMF, are presented in Table 1. We cannot compare those data with earlier years, when there was a different version of the exam. (ETS reports percentiles to nearest value of 5, from low of 1 to 95.)

Table 1. ETS Major Field Test (Biology 4BMF) Scores for Albion Senior Biology Minors, 2007-2010. Total scores (possible range 120-200) and subscores (possible range 20-100) are reported as scaled scores.

	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>
<b>Number of Students Tested (minors)</b>	16	14	16	19
<b>Mean Score</b> for Albion BIOL Minors	153.3	150.1	153.1	150.5
AC BIOL minors Mean Score as percentile (n = 30,854 individuals for comparison)	45	35	45	35
AC Institutional Mean Score as percentile (n = 425 institutions for comparison)	45	30	45	30
<b>Cell &amp; Molecular Biology (CMB) minors</b>	n=14	n=11	n=16	n=16
Mean Score for CMB minors	153.6	151.1	153.1	150.1
<b>Subscores</b> (score/Inst. percentile)				
Cell Biology	59.9/85	56.5/60	56.8/60	52.4/35
Molecular Biology & Genetics	57.1/70	55.1/60	53.9/55	55.6/60
Organismal Biology	52.1/40	45.8/15	50.8/30	47.9/20
Pop. Biology/Evolution/Ecology	47.9/20	51.2/35	52.7/40	50.0/30
<b>Environmental Biology (EB) minors</b>	n=2	n=1	n=0	n=2
Mean Score for EB minors	151.0	144.0	na	157.0
<b>Subscores</b> (score/Inst. percentile)				
Cell Biology	55.5/55	42.0/5		46.5/10
Molecular Biology & Genetics	48.5/20	43.0/5		35.0/1
Organismal Biology	48.0/20	50.0/30		66.5/95
Pop. Biology/Evolution/Ecology	54.0/50	45.0/10		68.5/95
<b>Secondary Education (SEB) minors</b>	n=0	n=2	n=0	n=1
Mean Score for SEB minors	na	147.5	na	133.0
<b>Subscores</b> (score/Inst. percentile)				
Cell Biology		46.5/10		24.0/1
Molecular Biology & Genetics		35.0/1		30.0/1
Organismal Biology		51.0/35		35.0/1
Pop. Biology/Evolution/Ecology		56.0/65		49.0/25
# minors with scores > 175 (95 <sup>th</sup> percentile;	0	0	0	1
# with scores 171-175 (90-94%)	0	0	1	0
# with scores 166-170 (80-89%)	1	0	2	1
#with scores 161-165 (70-79%)	0	3	1	1
% of minors in 70 <sup>th</sup> percentile or higher	6	21	25	16
# minors with scores < 151 (lowest 35%)	6	8	6	9
% minors with scores in lowest 35%	37	57	37	47

The majority of students who minor in Biology choose the Cell & Molecular Biology (CMB) minor (57 out of 65 minors in 2007-2010). Many of these students are pre-health students who are majoring in Chemistry or Psychology, but other majors are represented. Due to the course requirements for the CMB minor and the fact that many of these students are taking several courses in Chemistry, including Biochemistry, for professional school admission, we expect that these students would score higher on subscores for Cell Biology and Molecular Biology and Genetics than for Organismal Biology and Population Biology, Evolution, and Ecology. Generally that pattern has been borne out (we do not know why the low score in Cell Biology in 2010).

The students who minor in either Environmental Biology (EB) or Secondary Education (SEB) take at least one course in organismal biology and often choose to take specific courses in Ecology or Evolution. These students have less science background and take fewer science courses than most of the CMB minors; the students who graduated with EB or SEB minors in 2007-2010 have had majors in areas such as Art, Economics and Management, English, History, and Philosophy. Due to course requirements for the EB and SEB minors, we would expect students in these minors to score higher on subscores for Organismal Biology and Population Biology, Evolution, and Ecology than on Cell Biology and Molecular Biology and Genetics. Due to small sample sizes, it is difficult to discuss any other patterns.

We plan to continue offering our three minors. Many pre-health students who do not major in Biology complete the CMB minor, and it adds to their preparation for professional schools. The minors in EB and SEB offer opportunities for students in a wide variety of majors to complete a set of courses in Biology, and they are some of our most interesting students in terms of being able to pull together material from different programs on campus.

#### **6. Any proposed curricular changes based on data.**

In Fall 2009, we began discussing a return to a three-course introductory sequence for our majors. We would retain our first two courses (BIOL 195: Ecology, Evolution, and Biodiversity, and BIOL 210: Cell and Molecular Biology) but would modify some material in BIOL 210. Our third introductory course would be a 200-level Genetics course (without lab). We consider an understanding of genetics to be critical to all areas of biology, and becoming increasingly so with an increase in areas of genetics related to both molecular biology and to population and conservation biology.

Based on scores of our students in several areas, including subscore in Molecular Biology & Genetics and Assessment Indicators 2 and 3, we are strongly interested in pursuing a required course in Genetics for all of our majors. We anticipate that almost all of our Cell and Molecular Biology minors would take such a course as well. We would still offer a 300-level Genetics course with lab for students who want more work in this area.