

## **BIOLOGY B.A./B.S. - SUMMARY OF ASSESSMENT**

### **A. Program Student Learning Outcomes**

Students graduating with a Biology B.A/B.S. from Cal State East Bay will be able to:

- 1 Demonstrate how evolutionary processes give rise to the diversity and unity of life, from genomes to ecosystems. (ILO 6)
- 2 Explain the relationship between structure and function across all levels of biological organization, from ions to ecosystems. (ILO 6)
- 3 Clearly communicate biological information in a variety of formats (written, oral, graphical, computational) using a style appropriate for the intended audience. (ILO 1, 2, 6)
- 4 Apply methods of scientific inquiry—specifically, students will be able to formulate testable hypotheses, collect and analyze data, and report conclusions. (ILO 1,6)
- 5 Gather, interpret, and evaluate published scientific information. (ILO 1,6)

### **B. Program Student Learning Outcome(s) Assessed**

This year, we focused on the content specific (rather than science skill based) SLOs.

- 1 Demonstrate how evolutionary processes give rise to the diversity and unity of life, from genomes to ecosystems. (ILO 6)
- 2 Explain the relationship between structure and function across all levels of biological organization, from ions to ecosystems. (ILO 6)

### **C. Summary of Assessment Process**

We developed a Biology B.S./B.A. Capstone Assessment, in which we selected questions aligned with SLOs 1 and 2 from four published, nationally validated concept assessment tools in the areas of molecular genetics, evolutionary biology, physiology, and the scientific method. We revised some of the questions for clarity and format. This test was comprised of 25 multiple-choice questions, the majority (88%) of which focused on molecular genetics (14 questions) and evolution (8 questions), and 12% on physiology (2 questions) and the scientific method (1 question). The test was administered to 79 biology seniors during week 10 of Spring 2015. These students were enrolled in either BIOL 3151 (Principles of Animal Physiology) or BIOL 3130 (Principles of Evolutionary Biology)—courses in which biology seniors predominate. A few additional graduating seniors volunteered to take the test. The sample set of 79 students of senior standing was fairly robust, considering about 120 students, on average, graduate per annum with

a B.S. or B.A. in biology.

#### **D. Summary of Assessment Results**

The mean overall score on the Biology Capstone Assessment was 15.4 out of 25 points, or 61.7%. Student performances were notably discrepant in the two major content areas, with a relatively strong performance on the evolution questions (mean 71.5%, SE 0.16) and a relatively poor performance on the molecular genetics questions (mean 55.4%, SE 0.26; Fig. 1). Student performances in the two minor content areas were also markedly discrepant, with an exceptional performance on the one scientific method question (mean 99%, SE 0.01)—all but one student answered this question correctly—and poor performances on the two physiology questions (mean 48%, SE 0.10; Fig. 1). There were 8 questions that more than half of the students answered incorrectly. A review of these questions did not reveal any shared pattern, e.g., they were all written unclearly or they all demanded a higher level of critical thinking. However, the low student performances on these particular questions shed light on how effectively these concepts are reinforced in the curriculum. The solid student performances on the evolution questions and the scientific method question are indicative of the positive effect of the infusion of these concepts in nearly all biology courses taught in the department. The weak student performances on the molecular genetics questions are not surprising and reflect the level of exposure of our biology majors to these concepts, which are far more limited for those students who take few to no upper division cell/molecular biology courses beyond the principles (3000-) level, e.g., students in the Conservation/Ecology or Physiology Options. Molecular genetics is not woven through the biology curriculum as clearly and easily as evolutionary processes are. After all, evolution is the unifying principle of biology.

The results from the Biology Capstone Assessment tool have provided the following insights and informed the following changes to or ideas for improvement of the assessment plan for the B.S./B.A. in Biology:

- Continue to integrate and reinforce evolutionary biology in all courses in the curriculum;
- Improve the capstone assessment tool to include a more direct assessment of SLO 2;
- Administer the assessment tool to incoming biology majors to obtain a baseline measure of student competency in biology;
- Develop an additional assessment tool for measuring all B.A./B.S. Biology SLOs, e.g., key signature assignments administered in what we would call “Capstone Certified Courses,” which will be assessed using a standardized/shared rubric designed

specifically for programmatic assessment of biology program SLOs;

-- Continue to administer a Biology Capstone Assessment test that would be taken by each graduating senior in their "Capstone Certified Course;"

-- Designate specific courses as potential "Capstone Certified Courses" and develop robust assignment and rubrics that will enable assessment of program SLOs.

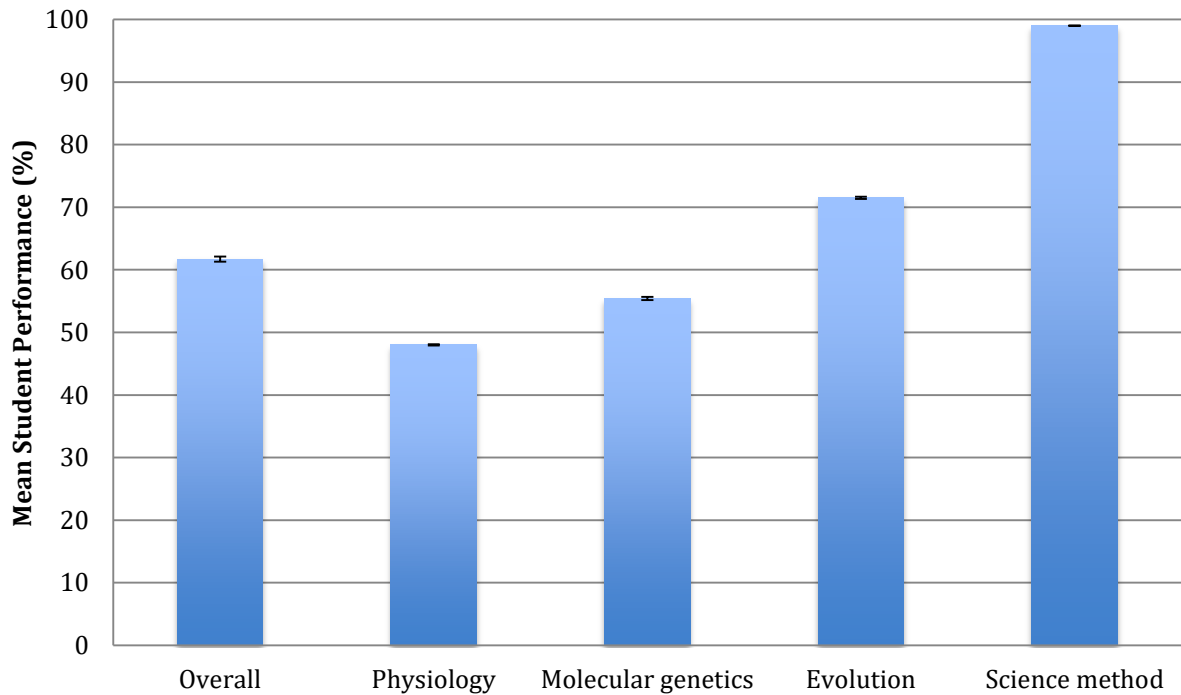


Figure 1. Student performance on the Biology B.S./B.A. Capstone Concept Assessment. Overall score and scores divided by content area are shown for N= 79 senior biology majors. Error bars represent standard errors.