

# **Institutional Effectiveness Report**

**Name of Program/Department:** Department of Biology  
**Year:** 2015-2016  
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## **Program Mission Statement**

The mission of the Department of Biology is to produce scientifically literate graduates who display robust knowledge of biological principles from molecules to ecosystems. We train our undergraduate students to utilize their critical thinking skills and mastery of biological principles to perform inquiry into the biological world and effectively convey biological information. We are committed to experiential learning including laboratory, field, and research experiences. Students graduating from this program will be well prepared for a variety of professional careers or entry into graduate school programs.

## **Program Learning Outcomes (PLOs)**

The Biology Department prepares students that:

1. understand major concepts in the biological sciences.
2. think critically and apply scientific principles to reach conclusions.
3. use the scientific approach and cogently communicate findings.

In support of the University's mission of excellence in teaching and learning through encouraging scholarly pursuits the Biology program:

4. supports scholarly pursuits of the faculty.

## **Executive Summary of Report**

Presented in this report are the Biology Department's Mission, Program and Student Learning Outcomes, the assessment and results of each, and action items. Achievement of our senior biology majors on concept knowledge and critical thinking skills was assessed with exit exams administered in our Senior Seminar courses. The department updated and revised the exam this year to include more application and critical thinking questions. We successfully administered the exams in both semesters. Results show low achievement and room for improvement in the area of Plant Biology. The department implemented several changes to improve student performance in this area and in the assessment process. For example, the department will begin to use of validated questions from Concept Inventories for the exams in 2016-2017. In addition, the Department will ensure that certain core principles and concepts in Plant Biology are reinforced in upper level classes where plant biology principles are included (to be taught in 2016-2017: Bio 206 Fall Flora, Bio 207 Spring Flora, Bio 306J Plant Evolution and Diversity, Bio 308 Aquatic Ecology, Bio 303 Plant Kingdom, Bio 307 Plant Structure and Function, Bio 317 Marine Ecology, Bio 411 Ecology).

We measured student learning outcomes on use of the scientific approach and communication through course assignments and student research projects. Achievement in these areas met or exceeded our expectations.

Based on data collected in 2015-2016, the Department will move beyond a reliance on a common Biology exit exam and utilize a more diverse process to assess student learning outcomes. In 2016-2017, the Department has implemented a process that utilizes rubrics, case studies, selected items from examinations, and laboratory projects. We will also continue to use indirect methods, where appropriate, to improve assessment of our Student Learning Outcomes.

### **Student Learning Outcomes**

SLO 1.0: Biology majors will identify key concepts at the 60% level on the Biology Exit Exam.

SLO 2.0: Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at the 60% level as evaluated by the Biology Exit Exam.

SLO 3.0: Students will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results.

### **Assessment Methods**

SLO 1.0: Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell, Genetics, and Evolution at an overall average of 60% as measured by a common Biology Exit Exam.

SLO 2.0: Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at the 60% level as evaluated by a common Biology Exit Exam.

SLO 3.0: 75% of Biology majors will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at an overall average of 70% as measured by obtaining an aggregate score on all assignments that apply the process of the scientific approach in written assignments and presentations.

## Assessment Results

**SLO 1:** Biology majors identified key concepts at the 59% level on the Biology Exit Exam. Since the goal was 60%, this target was not achieved. Table 1 lists the questions in each exam that pertain to student learning outcome 1 and summarizes the results for the outcome.

Table 1. Summary of results of the cumulative exam

Learning Outcome	Assessment (Exam question that pertains to each learning outcome)		Results (Mean percent correct)		
	Fall 2015	Spring 2016	Fall 2015	Spring 2016	Year
1. Biology majors will identify key concepts at the 60% level on the Biology Exit Exam.	1, 2, 5, 6, 10, 11, 12, 15- 17, 21, 22, 26, 28, 32, 34, 36, 40, 41, 43, 47, 48, 49	1, 2, 5-7 9, 10, 12, 14-17, 20-23, 26, 28, 32, 34-36, 41, 43, 47-49	61.4%	57.3%	59.4%
Number of students			51	40	45.5

**SLO 2:** Biology majors demonstrated competence in critical thinking and the application of the scientific approach at the 54% level as evaluated by the Biology Exit Exam. Since the goal was 60%, this target was not achieved. Table 2 lists the questions in each exam that pertain to student learning outcome 2 and summarizes the results for the outcome.

Table 2. Summary of results of the cumulative exam

Learning Outcome	Assessment (Exam question that pertains to each learning outcome)		Results (Mean percent correct)		
	Fall 2015	Spring 2016	Fall 2015	Spring 2016	Year
2. Biology majors will demonstrate competence in critical thinking and the application of the scientific approach as evaluated by the Biology Exit Exam.	3, 4, 7, 8, 9, 13, 14, 18, 19, 20, 23, 24, 25, 27, 29, 30, 31, 33, 35, 37, 38, 39, 42, 44, 45, 46, 50	3, 4, 8, 11, 13, 18-19, 24, 25, 27, 29-31, 33,27, 28, 40, 42, 44-46, 50	52.1%	55.6%	53.9%
Number of students			51	40	45.5

**SLO 3.0:** 75% of Biology majors will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results.

Data collected during the 2015-2016 academic year indicated that eighty-four percent (84%) of Biology majors were able to explain and demonstrate proficiency in applying the scientific approach. Since our stated benchmark was 75%, this target was achieved. Table 3 provides a summary of the course assignment used to evaluate this SLO.

Table 3. Courses and assignments

Topic	Course	Number of sections (reporting)	2015-2016 Enrollment (approximate)	Average number of assignments	Average Proportion of students that earned $\geq 70\%$
Non-majors	103 & 104	2	50	3	81
Majors courses	115	7	151	2.7	83
Ecology	317	2	21	1.5	90
	318	1	3	1	100
	308	2	26	2	81
	402	1	25	5	70 <sup>1</sup>
	411	2	28	4	82 <sup>2</sup>
Cell	301	2	32	1	90
Genetics	401	2	34	2	76
	409	1	14	2	93
Plant biology	307	2	25	1	80
Electives	236	5	142	2	86
	210	1	14	1	79
	215	3	65	1	88
	311	3	66	1.5	91
	406	1	18	1	78

1: averages on each of the reports in the order they were completed during the semester: 40, 40, 84, 84, 100

2: averages on each of the reports in the order they were completed during the semester: 64, 88, 85, 91

## Action Items

**SLO 1.0:** Biology majors will identify key concepts in the core areas of Plant Biology, Ecology, Cell, Genetics, and Evolution at an overall average of 60% as measured by a common Biology Exit Exam.

Data collected during the fall of 2015 and the spring of 2016 using selected questions from a departmental common exit exam indicated an overall average of fifty-nine percent (59%). The department set a target of 60%. Since the target was not achieved, the department made changes to bring about improvement in Student Learning Outcomes. First, a breakout of the four core areas (Plant Biology, Ecology, Cell, Genetics and Evolution) suggested a need to enhance instruction in the area of Plant Biology. In order to improve performance in this area, the Biology Department will ensure that certain core principles and concepts in this area are reinforced in upper level classes where plant biology principles are included (to be taught in 2016-2017: Bio 206 Fall Flora, Bio 207 Spring Flora, Bio 306J Plant Evolution and Diversity, Bio 308 Aquatic Ecology, Bio 303 Plant Kingdom, Bio 307 Plant Structure and Function, Bio 317 Marine Ecology, Bio 411 Ecology).

**SLO 2.0:** Biology majors will demonstrate competence in critical thinking and the application of the scientific approach at the 60% level as evaluated by a common Biology Exit Exam.

Data collected during the fall of 2015 and the spring of 2016 using selected questions from a departmental common exit exam indicated an overall average of fifty-four percent (54%). The department set a target of 60%. Since the target was not achieved, the department made changes to improve Student Learning Outcomes. In order to improve performance in this area, the Biology Department has incorporated additional critical thinking practice problems and case studies in all classes across the curriculum.

Based on data collected during the 2015-2016 academic year, the department decided to move beyond reliance on the common Biology exit exam to assess student learning outcomes germane to the identification of key concepts in the core areas and the application of the scientific approach. Starting in 2016-2017, to better assess the extent to which identified program modifications impact student learning, the Department has implemented a process that utilizes rubrics, case studies, selected items from examinations, and laboratory projects.

**SLO 3.0:** 75% of Biology majors will explain and demonstrate how to 1) ask a question, 2) generate a credible literature review, 3) generate hypotheses, 4) execute hypothesis testing procedures, 5) organize and analyze data or information, 6) draw conclusions, and 7) produce a report to cogently communicate results at an overall average of 70% as measured by obtaining an aggregate score on all assignments that apply the process of the scientific approach in written assignments and presentations.

This target was achieved.