2018-19 Student Learning Assessment Report, Academic

Program:	**Degree:**	**Department Head:**	**Submitted By:**	**Date Submitted:**
Biology (BS)	Major	Christopher Harbison	Tom Giarla	10/14/2019

Mission:

The Biology Department seeks to develop in each student an appreciation of the science of biology at all levels of study (molecular, cell, whole organism, and populations), which is understood and integrated in terms of Darwinian evolution. This is accomplished through a rigorous, broadly based, laboratory-intensive curriculum taught by faculty who are dedicated, first and foremost, to enriching the learning experience of their students. In addition to a biology core curriculum, all students take additional courses in the areas of cell/molecular biology, physiology, morphology, and organismic/population biology. A major emphasis of our program is to encourage critical thinking and an active engagement in the biological sciences. We do this by keeping class sizes small and including a laboratory experience as an integral component of most courses. Many laboratories incorporate independent research projects where students creatively build on fundamental concepts and techniques to address interesting biological questions. The program further encourages and reinforces independent research skills by offering credit for on-campus Independent Research courses mentored by departmental faculty or off-campus Science internships in Biology. In order to accomplish these pedagogical goals, the department hires only broadly-trained faculty who also possess expertise in a particular biological discipline. Faculty members are encouraged to establish and maintain active research programs in order to remain current in their disciplines, enthusiastic about their courses, and to provide independent study opportunities for students.

1. Major/Program Student Learning Outcomes Students will be able to...	**2. Phase**	**3. Assessment Procedures** (Planning/ determining)	**Criteria:** (How do you know students are achieving learning outcome?)
1. Demonstrate an understanding of the process of science and develop an appreciation of contemporary issues in biology.	Planning Collecting Discussing	Method: (ex. tests, presentations, research paper) Evaluate results of Biol 190 Final Exam and other assignments in various classes. Focus is on understanding the process of science, including data analysis, presentation, and statistics. Using a Sample of Students? Yes If yes, describe your sample. All students in 4 sections of Biol 190 When does assessment occur? At the end of the semester How often does assessment occur?	At least 80% of students scoring 70% or greater on Final Exam or assignment.

		Every year	

4. Assessment Results
(Collecting/ analyzing)

Spring 2018
Course: Research and Writing Skills for Biologists BIOL-190 (two sections taught by Stephanie Vernooy and Tom Giarla)
Assessment: Final quiz in this course assesses a basic understanding of topics covered throughout the semester, which focus on the scientific method. Specific topics that students learn about include scientific hypotheses and models, experimental design, basic statistics, methods of data analysis and presentation, understanding and searching scientific literature, writing a primary research paper in the sciences, and oral presentation of research findings.
N=40 students
100% met the standard.
16/40 scored in the A range
18/40 scored in the B range
6/40 scored in the C range

Fall 2018
Course: Research and Writing Skills for Biologists BIOL-190 (one section taught by Jim Angstadt)
Assessment: Final quiz in this course assesses a basic understanding of topics covered throughout the semester, which focus on the scientific method. Specific topics that students learn about include scientific hypotheses and models, experimental design, basic statistics, methods of data analysis and presentation, understanding and searching scientific literature, writing a primary research paper in the sciences, and oral presentation of research findings.
N=17 students
100% met the standard.
5/17 scored in the A range
8/17 scored in the B range
3/17 scored in the C range

Spring 2019
Course: Biol260 (two sections of Molecular Genetics taught by Stephanie Vernooy)
Assessment: Oral presentation on a primary paper (selected by students) relevant to topics discussed in class.
N=49 students
100% met the standard
37/49 scored in the A range
12/49 scored in the B range

Fall 2018
Course: Biol440 (one section of Neurobiology taught by James Angstadt)
Assessment: Laboratory Report (Results and Discussion sections). Assessed student's ability to analyze data and create appropriate graphs. Also assessed general writing skills and student's ability to discuss results in the context of current scientific literature. Scores represents final grade following revisions made after detailed instructor feedback on the first draft.
N=11
100% met the standard
3/11 scored in the A range
8/11 scored in the B range

Fall 2018
Course: Biol225 (one section of Ecology taught by Tom Giarla)
Assessment: Combined grades of three ecology case study homework assignments + in-class discussion. Students must answer a series of questions about three primary literature articles, demonstrating their

understanding of the study's methods, results, and theoretical background. Then, the students form groups in class and discuss different aspects of the papers, becoming experts on different components (i.e., "jigsaw" activity)
N=29
97% met the standard
25/29 scored in the A range
2/29 scored in the B range
1/29 scored in the C range
1/29 scored in the D range

Learning Outcome Met?

(Based on Criteria)

Yes

5. Use of Results

(Discussing/ using results)

We are pleased that 100% of our students have met the learning outcome and plan to continue implementing this same assessment tool in the coming year. However, we recognize the need to add other assessment tools for this Learning Outcome. For the 2019-2020 school year, we plan to include various other assessments that focus on contemporary issues in biology. In upper-level courses we will assess how students are able to interpret and synthesize results from newly published research articles. In Ecology (Biol-225), for example, students are reading three primary literature articles over the course of the semester and meeting in groups to digest the results and discuss their meaning. For that project, students are being assessed with exam questions and homework assignments.

Going forward, the department is starting discussions of revising our learning outcomes and assessment procedures. We recognize that our approach up until now has been somewhat haphazard. Starting next summer, we will convene a subcommittee that will make some decisions about how to gather more useful data for this learning outcome and the others.

1. Major/Program Student Learning Outcomes Students will be able to...	**2. Phase**	**3. Assessment Procedures** (Planning/ determining)	**Criteria:** (How do you know students are achieving learning outcome?)
2. Demonstrate competence with equipment and experimental methods.	Planning Collecting	Method: (ex. tests, presentations, research paper) Lab skills test and lab practical exams and assignments in various courses, both upper-level and introductory courses. Using a Sample of Students? Yes If yes, describe your sample. Students in lab courses When does assessment occur? Throughout the semester	At least 80% of students scoring 70% or greater on lab intensive, graded tasks.

		How often does assessment occur? Every other year	

4. Assessment Results
(Collecting/ analyzing)

Fall 2018
Course: Biol190 (One section of Writing and Research Skills for Biologists taught by Stephanie Vernooy)
Assessment: Experimental effort grades, awarded based on ability to design and execute experiments in small groups. Involves the use of many specialized pieces of lab equipment (varies depending on the particular experiment).
N=20
100% met the standard
14/20 scored in the A range
6/20 scored in the B range

Learning Outcome Met?
(Based on Criteria)
Yes

1. Major/Program Student Learning Outcomes Students will be able to...	**2. Phase**	**3. Assessment Procedures** (Planning/ determining)	**Criteria:** (How do you know students are achieving learning outcome?)
3. Develop independent research skills and an ability to apply basic mathematical techniques in the biological sciences.	Planning Collecting	Method: (ex. tests, presentations, research paper) One or both of the following: A) assess performance on selected exam questions that test for competence in this skill B) Evaluate student performance on projects, written assignments, or exam questions that require math (e.g., statistical analysis) Using a Sample of Students? Yes If yes, describe your sample. Students in various biology courses. When does assessment occur? Throughout the academic year.	At least 80% of students scoring 70% or greater on selected tasks.

		How often does assessment occur? Every year	

4. Assessment Results
(Collecting/ analyzing)

Fall 2018
Course: Biol440 (one section of Neurobiology taught by James Angstadt)
Assessment: Laboratory Quiz. Assessed knowledge and understanding of key methods and concepts in neurophysiology, including quantitative reasoning skills.
N=11
91% met the standard
1/11 scored in the A range
7/11 scored in the B range
2/11 scored in the C range
1/11 scored in the D range

Spring 2019
Course: Biol260 (one section of Molecular Genetics Lab taught by Rachel Sterne Marr)
Assessment: During lab, students are asked to properly use N/No = e^RT equation to dilute a cell culture to a desired log phase cell density for overnight growth.
N=14
64% met the standard
8/14 scored in the A range
1/14 scored in the B range
1/14 scored in the C range
1/14 scored in the D range
3/14 scored in the F range

Fall 2018
Course: Biol225 (one section of Ecology taught by Tom Giarla)
Assessment: Combined laboratory post-lab grades for nine quantitative lab projects. These projects all involve statistical analysis. Some involve direct use of mathematical models, and fitting experimental data using models.
N=29
100% met the standard
17/29 scored in the A range
10/29 scored in the B range
2/29 scored in the C range

Spring 2019
Course: Biol230 (one section of Biology of the Vertebrates taught by Tom Giarla)
Assessment: Laboratory assignment in which students must design and implement a mammal ecology project using publicly available camera trap data. Involves database queries and statistics.
N=29
93% met the standard
19/29 scored in the A range
5/29 scored in the B range
3/29 scored in the C range
1/29 scored in the D range
1/29 scored in the F range

Learning Outcome Met?
(Based on Criteria)
Yes

1. Major/Program Student Learning Outcomes Students will be able to...	**2. Phase**	**3. Assessment Procedures** (Planning/ determining)	**Criteria:** (How do you know students are achieving learning outcome?)
4. Know the important facts and concepts relevant to the discipline.	Planning Collecting Discussing	Method: (ex. tests, presentations, research paper) Evaluate student performance on exams, papers, or projects. Using a Sample of Students? Yes If yes, describe your sample. Students in various biology courses. When does assessment occur? Throughout the academic year How often does assessment occur? Every year	At least 80% of students scoring 70% of greater on selected tasks.

4. Assessment Results
(Collecting/ analyzing)

Spring 2019
Course: Biol260 (one section of Molecular Genetics with Lab taught by Rachel Sterne Marr)
Assessment: 27 multiple choice questions on cumulative final exam focusing on facts and concepts in genetics.
N=14
57% met the standard
0/14 scored in the A range
3/14 scored in the B range
5/14 scored in the C range
2/14 scored in the D range
4/14 scored in the F range

Spring 2019
Course: Biol260 (two sections of Molecular Genetics taught by Stephanie Vernooy)
Assessment 1: Exam #1 grades. Exams are a mix of demonstrating knowledge of facts/concepts and ability to apply them.
N=49
76% met the standard
14/49 scored in the A range
16/49 scored in the B range
7/49 scored in the C range
8/49 scored in the D range
4/49 scored in the F range
Assessment 2: Exam #2 grades. Exams are a mix of demonstrating knowledge of facts/concepts and ability to apply them.
N=49
76% met the standard
12/49 scored in the A range
14/49 scored in the B range
11/49 scored in the C range
4/49 scored in the D range
8/49 scored in the F range
Assessment 3: Exam #3 grades. Exams are a mix of demonstrating knowledge of facts/concepts and ability to apply them.
N=49
78% met the standard
15/49 scored in the A range
14/49 scored in the B range
9/49 scored in the C range
5/49 scored in the D range
6/49 scored in the F range

Spring 2019
Course: Biol120 (one section of General Biology II taught by Dan White)
Assessment: Final exam question focused on concept of form/function. Exam question text: "We studied the giraffe as an example of a biological challenge that results from an evolutionary process. Giraffes face multiple biological challenges based on their height. Discuss at least two biological challenges faced by the giraffe. Discuss how the form and function of their anatomy and physiology cope with the challenge. Provide at least one measurement or experiment that you would propose to support your understanding of the solutions to the challenges."
N=15
67% met the standard
1/15 scored in the A range
2/15 scored in the B range
7/15 scored in the C range
3/15 scored in the D range
2/15 scored in the F range

Spring 2019
Course: Biol460 (one section of Immunology taught by Ellen Duffy)
Assessment: Short-answer/essay quiz. Students demonstrated knowledge of how the immune system is activated by foreign material in preparation for understanding how the immune system breaks down and responds to self molecules leading to autoimmunity.
N=23
57% met the standard
9/23 scored in the A range
4/23 scored in the B range
2/23 scored in the C range
4/23 scored in the D range
4/23 scored in the F range

Fall 2018
Course: Biol225 (one section of Ecology taught by Tom Giarla)
Assessment: Weekly online quizzes testing knowledge of material covered in the preceding textbook chapters.
N=29
83% met the standard
6/29 scored in the A range
19/29 scored in the B range
0/29 scored in the C range
2/29 scored in the D range
2/29 scored in the F range

Spring 2019
Course: Biol400 (one section of Genomics taught by Tom Giarla)
Assessment: average grade across three in-class quizzes testing students understanding of facts and concepts covered in the textbook and lectures.
N=14
79% met the standard
3/14 scored in the A range
4/14 scored in the B range
4/14 scored in the C range
2/14scored in the D range
1/14 scored in the F range

Learning Outcome Met?

(Based on Criteria)

No

5. Use of Results

(Discussing/ using results)

It is clear from these results that all students do not always understand the important facts and concepts presented in our courses. On the one hand, this is not unexpected. Biology classes are often designed to be challenging, so as to prepare our students for graduate school (e.g., medical school) or important careers in business or government. Nonetheless, we think there are some steps that we can take to improve the number of students that meet this learning outcome. To that end, I am leading an effort in the School of Science to apply for a grant from the Howard Hughes Medical Institute (HHMI) focused on "Inclusive Excellence". As part of the grant writitng process, faculty in Biology have been thinking a lot about the content of our courses and strategies to improve our teaching. Over the next year, these discussions will continue. If he receive the grant, we will have funds to pay for professional development (e.g., workshops on new pedagogy strategies) and teaching additional classes that will help improve student learning of facts and concepts in biology (e.g., a "ramp-up" pre-semester mini-course for students before the start of their freshman year; Or a "fundamentals" course similar to the model developed by the Chemistry department in the past few years).

1. Major/Program Student Learning Outcomes Students will be able to...	**2. Phase**	**3. Assessment Procedures** (Planning/ determining)	**Criteria:** (How do you know students are achieving learning outcome?)
5. Demonstrate critical thinking by successfully applying fundamental biological concepts to novel scenarios.	Planning Collecting Discussing	Method: (ex. tests, presentations, research paper) Track performance on selected exam questions and projects from a course in one of the three major course areas or genetics.	At least 50% of students meet or exceed standard (Score 70% or greater).

		Using a Sample of Students? Yes If yes, describe your sample. Evaluate students in selected courses, with an emphasis on upper level courses When does assessment occur? Throughout the academic year. How often does assessment occur? Every other year	

4. Assessment Results
(Collecting/ analyzing)

Spring 2019
Course: Biol260 (one section of Molecular Genetics with Lab taught by Rachel Sterne Marr)
Assessment: Lab assignment using a novel scenario: students asked to identify a genetic mechanism (suppression) from experimental data distinct from data they had seen.
N=14
29% met the standard
3/14 scored in the A range
0/14 scored in the B range
1/14 scored in the C range
3/14 scored in the D range
7/14 scored in the F range

Spring 2019
Course: Biol260 (two sections of Molecular Genetics taught by Stephanie Vernooy)
Assessment 1: Final exam multi-part question that asked students to analyze a variety of different kinds of data and synthesize it to describe the gene mutations or misregulations that were contributing to a hypothetical patient's cancer.
N=48
63% met the standard
12/48 scored in the A range
14/48 scored in the B range
11/48 scored in the C range
8/48 scored in the D range
4/48 scored in the F range
Assessment 2: Final exam multi-part question that asked students to analyze data about parental and fetal genotypes for the CFTR gene and then calculate various probabilities related to those genotypes and describe how genome editing could be used to correct the disease-causing mutation.
N=48
75% met the standard

21/48 scored in the A range
9/48 scored in the B range
6/48 scored in the C range
5/48 scored in the D range
7/48 scored in the F range

Spring 2019
Course: Biol400 (one section of Genomics taught by Tom Giarla)
Assessment 1: Find-a-Gene project final grade. Required students to apply their knowledge of BLAST and bioinformatics to search for a novel (unannotated) gene in publicly available databases. Students were allowed to revise their projects based on initial feedback.
N=14
100% met the standard
6/14 scored in the A range
7/14 scored in the B range
1/14 scored in the C range
Assessment 2: Final Annotation project narrative grade. Students worked on a novel research project over the second half of the semester. They needed to identify genes and regulatory elements in a chunk of a Drosophila genome, requiring the use of software they had applied in other scenarios.
N=14
86% met the standard
7/14 scored in the A range
4/14 scored in the B range
1/14 scored in the C range
2/14 scored in the D range

Learning Outcome Met?

(Based on Criteria)

Yes

5. Use of Results

(Discussing/ using results)

Faculty in the Biology Department are pleased with the results of this assessment. Our courses are rigorous, often forcing students to think outside the box. One example is the newly developed Genomics and Bioinformatics course. In that course, students complete their own research project over the course of the semester, a task that requires critical thinking. C.U.R.E. courses (course-based undergraduate research) like this have been shown to be quite effective at challenging students to think critically because they are confronted with a real research problem (not just a "cook book" lab with preordained answers). Students have expressed some level of frustration with the open-ended nature of this course, but, ultimately that frustration can be put to good use. Students persist through it and become satisfied with their final project. In the coming years, we hope to implement more CURE courses in Biology, recognizing that they will help us do even better with regard to this learning outcome.