

## Biology Major Assessment Report PLO 4: Fall 2018

### Program Learning Outcomes (PLOs)

The program learning outcomes were revised since our last full assessment report in Spring 2015, approved by the Department of Biology on 11 September 2015.

Upon completion of the Biology Program, students will be able to:

1. Recognize the multiple levels of complexity at which biological systems operate, from molecules to ecosystems and the biosphere, and explain the emergent properties and processes characteristic of each level.
2. Describe mechanisms for the continuity of life, including the processes of inheritance, development, and evolution.
3. Demonstrate proficiency in the methods and philosophy of science, including articulation and application of the Scientific Method, collection and analysis of biological data, and application of professional ethics.
4. Critically evaluate and synthesize biological information from multiple sources, including the primary scientific literature, and communicate biological knowledge to both professional and non-professional audiences.
5. Articulate the application of biological science to meeting the needs of society, including basic research, stewardship of biodiversity, human health, and entrepreneurial innovation.

Our focal program learning outcome for this report is PLO 4.

**Commented [GD1]:** All of the PLOs are listed. In general, we aim for 3-7 PLOs to concisely delimit the scope of a program and reflect the knowledge (in this case, #1-2), skills (#3-4), and dispositions (#5) students are expected to acquire.

**Commented [GD2]:** The focal PLO for this report is made explicit. Each PLO should be evaluated at least once per five-year cycle, as determined by the five-year assessment plan.

According to the Handbook, "Each program learning outcome should be evaluated in turn before being evaluated again, as part of a program-specific cycle."

## Curriculum Map

The Biology curriculum map depicts the required courses for the Biology major. Courses indicated with an 'M' provide mastery for achievement of some component of a learning outcome. By completing the Biology Curriculum, it is expected that students should meet all five Program Learning Outcomes.

	BIOL (110 & 111)   (130 & 160)	CHEM 220   325	MATH 111   225   255	BIOL 210	BIOL 270	BIOL 302   (314 & 320)	BIOL 351   381   385	BIOL 305 & 306	BIOL 490
PLO1	PR	PR				M			
Molecules	PR	PR				M			
Cells	PR					M			
Organisms	PR						M		
Ecology	PR							M	
PLO2	PR								
Reproduction	PR								
Genetics	PR								
Evolution	PR								
PLO3	PR								
Scientific Method	PR								
Data Analysis	PR	PR	PR						
PLO4	PR								
Communication	PR								
PLO5	PR								
Valuing Biology	PR								

PR = pre-requisite      D = developing      M = mastery

**Commented [GD3]:** A typical curriculum map has the courses that students will take to achieve the PLOs on one axis and the PLOs on the other axis.

For the Biology Major, many courses provide content knowledge in different areas (e.g., genetics, ecology) that do not necessarily follow a progression. For that reason, the various components of the PLOs are listed separately to depict the contributions of individual courses. In other programs, courses may follow a progression, and these can be indicated as "introductory/pre-requisite," "developing", and "mastery" (or other equivalent titles).

**Commented [GD4]:** In general, the curriculum map should list only those courses or course clusters that are required for the program. Clusters of equivalent courses are expected to equivalently serve the PLOs.

**Commented [GD5]:** The curriculum map is both a plan and an assessment tool. It is analogous to the syllabus of a courses: it summarizes the variety of experiences that comprise a program of study.

It should be clear from the plan how the course curriculum is expected to result in students achieving the PLOs.

### Summary of Previous Results

Our assessment process has been revised since our last report to the Assessment Subcommittee in our *HLC Progress Report: Interim Assessment Reports for 2013-2014* and our last full assessment report (2015), and our previous results were not reported in a format compatible with our current methods. However, in the Fall 2015, we assessed students in BIOL 490 *Senior Seminar* for achievement in PLO 4 using a rubric similar to our current one (see attached). Those results are presented in the table below.

Student achievement in Knowledge, Skills, and Dispositions related to PLO 4 was assessed separately, with each category of achievement corresponding to an ordinal Likert score from 1-4, as described below. A score of 3 (*met*) was considered meeting the learning outcome for each category.

The median score in each category was a 3 (*met*) and the mode 4 (*exceeded*). Overall, between 50% and 67% of students met each category of PLO 4.

#### Summary of Previous Results from Fall 2015.

Categories	1 not met	2 partially	3 met	4 exceeded	median	% met
Knowledge	9	23	8	24	3	50%
Skills	5	16	13	30	3	67%
Dispositions	9	16	12	27	3	61%

### Brief Description of Previous Actions

Since Fall 2015, the Biology Department has revised our program curriculum, instruction, and assessment methods in order to improve student achievement with regard to PLO 4 and how we measure it.

Before Fall 2015, our 2 credit BIOL 490 *Senior Seminar* had as its only prerequisites to be a Biology Major with Senior Standing. As part of our program Communication in Major course sequence, we subsequently added a prerequisite 4 credit BIOL 270 *Ecology & Evolution* specifically to provide instruction in the knowledge, skills, and dispositions associated with PLO 4.

After our 2016 GEP assessment of BIOL 490 as a Communication in the Major and Capstone course, we also standardized the written and oral communication assignments among the various instructors.

To comply with reporting requirements from the Assessment Subcommittee, an "overall" category was appended to the assessment rubric to evaluate student achievement across all categories simultaneously.

**Commented [GD6]:** Our objective with assessment is to improve student achievement. To document whether or not that has been achieved, the current results can be compared to previous assessment results.

If there are no previous results because it is the first time a PLO has been measured or because a new assessment method has no comparable predecessor, then it is perfectly acceptable to not have previous results to report.

**Commented [GD7]:** The most convenient and comparable way to summarize assessment results is to report the number of students that met the PLO and the number that did not. From those tallies, the total number of students and percentage meeting the PLO can be calculated. Our rubric (attached) divides achievement among four categories, but it is still clear what constitutes meeting the PLO (met and exceeded) and not meeting (partially and not met).

**Commented [GD8]:** The purpose of this section is to describe the changes to the curriculum, methods of instruction, and/or assessment methods that are related to or resulted from previous assessment of the focal PLO. A general description of the department changes related to other PLOs, enrollment, retention, staffing, etc. is not necessary. If no changes were made, then simply report that.

This section is important because it documents the actions that were taken to improve student achievement. The assessment results reported below document whether or not those actions led to improvement. In assessment parlance, this is known as "Closing the Loop."

**Commented [GD9]:** In our previous assessment, we assessed students according to their knowledge, skills, and disposition separately without making an overall assessment for each student. For compliance reporting purposes, those values are desirable, and we have added that row to our rubric (see below).

### Assessment Strategies/Measures/Techniques/Methods

PLO 4 was assessed for Fall 2018 in BIOL 490 *Senior Seminar*, the course serves to complete the GEP Capstone and Communication in the Major requirements for Biology majors. Senior standing is required for BIOL 490.

A single document with assessment rubrics (see attachment) for PLOs 4 & 5 were distributed to all seven BIOL 490 instructors to evaluate student achievement based on their Capstone/Communication in the Major projects. The rubrics have four achievement levels: *not met*, *partially met*, *met*, and *exceeded*, and these correspond to ordinal Likert values of 1-4. The PLO 4 rubric breaks down the outcome into specific knowledge, skills, and dispositions, and students have met the PLO (overall) if they achieved a level of *met* or higher in two of the three categories.

It is expected that almost all students that have taken both BIOL 270 and BIOL 490 (i.e., completing the Communication in the Major requirement) should meet the learning outcome, but increasing the percentages of students meeting each category (and overall) to above 67% would be an improvement.

### Assessment Results/Findings/Interpretation

Six of the seven BIOL 490 instructors returned completed rubrics for PLOs 4 & 5. Sixty-eight total students were assessed. Four instructors based their assessments on individual student papers and presentations, one assessed a only final paper, and one assessed group papers and presentations. Only results for PLO 4 are reported herein.

Sixty-four of 68 (94%) of the students met or exceeded PLO 4 based on the Overall assessment. Forty-five exceeded the expected outcome (66%), resulting in a median score of 4.

Results for each of the three categories of Knowledge, Skills, and Dispositions have improved since Fall 2015 since the addition of BIOL 270 to the curriculum. Across the three categories, the percentage of students meeting expectations ranged from 79%-88%, representing increases of 18%-29%. For the Knowledge and Overall categories, median student achievement exceeded expectations.

#### Summary of Current Results from Fall 2018.

	1	2	3	4		
Categories	not met	partially	met	exceeded	median	% met
Knowledge	1	13	19	35	4	79%
Skills	1	9	28	30	3	85%
Dispositions	1	7	30	30	3	88%
Overall	0	4	19	45	4	94%

**Commented [GD10]:** It should be clear at what point(s) in the curriculum the PLO was assessed. Assessment for program-level achievement is summative. That is, the PLO should not be assessed before the curriculum has provided an opportunity to achieve it, as indicated by the Curriculum Map.

Including formative assessments to document student learning over the course of the curriculum is encouraged, but it is the summative assessment that measures the outcome of the program.

**Commented [GD11]:** It should also be clear how the assessment was done. These could be direct assessment methods such as assessment of course-embedded exam questions, comprehensive exams, portfolios, papers, oral presentations. Indirect assessment methods, such as student or third-party surveys, are suitable as well.

Rubrics, sample questions, etc. should be attached to the report.

**Commented [GD12]:** In this case, we have assessed this PLO previously, and so we can establish a benchmark for achievement based on those previous results. Our goal is to do better.

If the PLO has not been assessed previously, then this round of assessment will serve to establish that benchmark for future iterations. In the absence of previous data, it is still instructive to report an expected benchmark for achievement.

**Commented [GD13]:** It should be evident from the reported results how many students met the PLO and how many did not. Other concise details that provide context are encouraged.

The sample of students should be large enough to reflect the size of the program.

**Commented [GD14]:** The results should be interpreted in the context of the benchmark set by previous results (if available) or based on expectations for a first round of assessment.

**Commented [GD15]:** Tables and charts are helpful for summarizing quantitative data. If they are large or complex, they can be attached rather than embedded in the text.

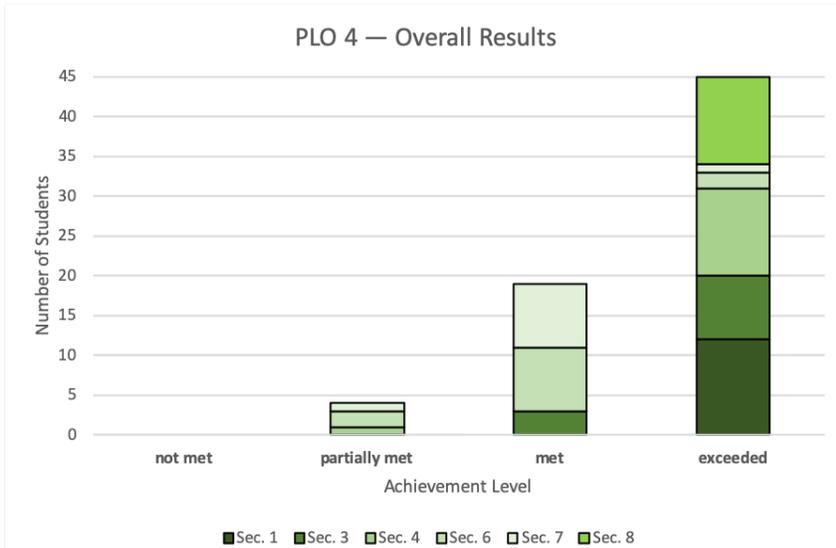


Chart of Current Results by Section for Overall Achievement in Fall 2018.

**Implications / Actions**

Having developed a curriculum sequence that resulted in improved student achievement for PLO 4, it was suggested by the Biology Department Assessment and Program Review Committee that the rubric be revised to refine expectations for student achievement. Specifically, the Overall category rubric could be revised to raise the criteria for meeting and exceeding expectations. The current standards leave little room for improvement.

In addition, it was also recommended that specific achievement goals be developed for BIOL 270 in preparation for higher achievement in BIOL 490.

**Dissemination of Findings**

These results were presented to the Department of Biology on 25 January 2019.<sup>1</sup> The document will be stored on the Biology SharePoint site.

**Commented [GD16]:** If current assessment results offer insights into how curriculum or instructional methods might be changed to improve student achievement, or how assessment methods might be refined to better measure achievement, those implications can be discussed here. Presumably, these are the changes that will be assessed the next time this PLO is reported.

In this case, Biology had very high overall achievement — 94% met the PLO. It might be reasonable in such a situation to propose no changes to curriculum, instruction, or assessment. There are other PLOs to work on that might not assess at such a high level.

**Commented [GD17]:** At minimum, besides reporting results to the Assessment Subcommittee, program assessment results should be archived in the respective departments. Presumably, this assessment report will be useful during future rounds of assessment and perhaps as part of Department Review.

<sup>1</sup> Actually, a version of this report was approved by the Department of Biology for the 2018-2019 Interim Campus Labs Assessment Report. This sample report was streamlined for the purpose of discussion.

### Updated Five-Year Plan

The Department of Biology five-year assessment plan is simple: we assess all five PLOs each semester in BIOL 490. PLOs 1-3 are assessed using a comprehensive exam. All BIOL 490 Biology Majors (i.e., not Biochemistry majors) are required to take the exam or receive an Incomplete for the course. Otherwise, the outcome of the exam has no impact on the students' grades. PLOs 4-5 are assessed using common rubrics (attached) based on students' Capstone/Comm. in the Major projects, and PLO 5 is also indirectly assessed via an exit survey administered to all BIOL 490 students.

PLOs will be reported sequentially over the 5-year cycle.

#### Overview Biology Program Assessment Plan for Fall and Spring Semesters in BIOL 490.

PLO	Comprehensive Exam	Embedded Assessment	Exit Survey
1	X		
2	X		
3	X		
4		X	
5		X	X

year	PLOs to be Assessed	PLO to be Reported
2018	all PLOs, Fall and Spring	PLO4 (current)
2019	all PLOs, Fall and Spring	PLO1
2020	all PLOs, Fall and Spring	PLO2
2021	all PLOs, Fall and Spring	PLO3
2022	all PLOs, Fall and Spring	PLO5
2023	all PLOs, Fall and Spring	PLO4

**Commented [GD18]:** The five-year plan should make explicit when, where, and how each PLO will be assessed and when it will be reported.

For the Biology Program, we assess all five PLOs in both Fall and Spring semesters each year, but that was when we were aiming for a single, 5-year report. It has worked well for maintaining assessment momentum and lessening the need for administrative decisions about what is being done when.

It would also be reasonable to assess each PLO once every five years, in accordance with the reporting cycle.

**Rubric for Assessment of Program Learning Outcome #4**

	<b>Expectations Not Met</b>	<b>Partially Met</b>	<b>Met</b>	<b>Exceeded</b>
<b>Knowledge</b>	<ul style="list-style-type: none"> <li>Recognizes and describes the format and components of a scientific paper.</li> <li>Understands the differences between primary, secondary, and tertiary sources.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Recognizes and describes the format and components of a scientific paper.</li> <li>Understands the differences between 1°, 2°, and 3° sources.</li> <li>Beginning to recognize different types of experimental designs and ways of representing data.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Recognizes and describes the format and components of a scientific paper.</li> <li>Understands the differences between 1°, 2°, and 3° sources.</li> <li>Recognizes different types of experimental designs and explains best practices in data presentation.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Recognizes and describes the format and components of a scientific paper.</li> <li>Understands the differences between 1°, 2°, and 3° sources.</li> <li>Articulates different types of experimental designs and evaluates experimental approaches in various fields of biology.</li> </ul> <input type="checkbox"/>
<b>Skills</b>	<ul style="list-style-type: none"> <li>Able to comprehend technical writing beyond the textbook.</li> <li>Able to identify the main points of a reading when prompted to do so.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Interprets charts &amp; tables that summarize data.</li> <li>Summarizes main points when prompted to do so.</li> <li>Recognizes online literature databases are available for research.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Able to comprehend primary scientific literature.</li> <li>Independently summarizes major findings from published works.</li> <li>Searches databases for articles of interest.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Critically evaluates primary scientific literature.</li> <li>Independently summarizes and articulates major findings from published works to peers.</li> <li>Uses references cited as well as databases to find literature. Synthesizes information from various sources.</li> </ul> <input type="checkbox"/>
<b>Dispositions</b>	<ul style="list-style-type: none"> <li>Appreciates the value of peer review in scientific writing.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Appreciates the value of peer review in scientific writing.</li> <li>Applies knowledge to analysis of data presentation.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Appreciates the assets and liabilities of peer review.</li> <li>Begins to apply knowledge of experimental design to analysis of scientific articles.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Appreciates the value of giving and receiving peer review.</li> <li>Applies knowledge of experimental design to critically evaluate scientific articles.</li> </ul> <input type="checkbox"/>
<b>Overall</b>	<ul style="list-style-type: none"> <li><b>Did not meet expectations of a single aspect of PLO #4 (i.e., knowledge, skills, or dispositions).</b></li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li><b>Met or exceeded expectations in only a single aspect of PLO #4.</b></li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li><b>Met or exceeded expectations in two aspects of PLO #4.</b></li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li><b>Met or exceeded expectations in all three aspects of PLO #4.</b></li> </ul> <input type="checkbox"/>

**Rubric for Assessment of Program Learning Outcome #5**

	<b>Expectations Not Met</b>	<b>Partially Met</b>	<b>Met</b>	<b>Exceeded</b>
<b>Overall</b>	<ul style="list-style-type: none"> <li>Can do no more than distinguish applied and basic biological research.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Acknowledges the value to society of some aspect of biological knowledge.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Clearly states the broader impacts and value to society of some aspect of biological knowledge.</li> </ul> <input type="checkbox"/>	<ul style="list-style-type: none"> <li>Compellingly argues the broader impacts and value to society of biological knowledge using examples and other evidence.</li> </ul> <input type="checkbox"/>