

**Assessment Report for the 2021-2022 Academic Year**  
**Natural Science Minor**

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***Mission Statement:***

The core mission of the University of San Francisco is to educate students in the knowledge and skills required to succeed as professionals and as persons, while also teaching the sensitivity and values necessary to participate in a world shared by all people. The Department of Biology particularly emphasizes the core Jesuit value of advancing the freedom and responsibility to pursue truth and to follow evidence to its conclusion. In pursuit of these values, the faculty of the Department of Biology educates undergraduate students in current biological concepts, methodologies, and ethical practices in the laboratory and the natural environment to prepare them to succeed personally and professionally with the potential for advanced training in the sciences.

(No changes since last report)

***Program Learning Outcomes:***

The Natural Science Minor prepares students to:

1. Demonstrate broad knowledge of the concepts that comprise the natural sciences of biology, chemistry, and physics
2. Perform laboratory techniques used to evaluate and explore scientific problems
3. Apply the scientific process

(No changes since last report)

***Curriculum Map:***

See attached.

***Schedule for Assessment of Program Learning Outcomes (PLOs):***

- 2021-2022: PLO #2
- 2022-2023: PLO #1

- 2023-2024: PLO #3
- 2024-2025: PLO #2
- 2025-2026: PLO #1
- 2026-2027: Assessment Reflection

### ***Methods for 2021-2022 Assessment:***

In this report we assess **PLO #2**: Perform laboratory techniques used to evaluate and explore scientific problems.

A total of 23 lab assignments were combined from spring and summer sections of the laboratory portion of BIOL 105L: General Biology I. The assignments were rated by a panel of three members of the assessment committee (Leslie Bach, Scott Nunes, Brian Young) using the rubric shown below. The rubric had three criteria for assessing the learning outcome. Raters scored each criterion on a scale of 1-4, with scores indicating the following: 4—exceeds expectations, 3—meets expectations, 2—needs improvement, and 1—below expectations. Ratings of faculty members were averaged for each student lab report, and then these values were averaged across reports to determine an overall score for each criterion.

### ***Results and Findings of 2021-2022 Assessment:***

As can be seen in table I below, students showed strength in describing the methods they used and in explaining the connection between the experiments they performed and a given scientific problem. The average rating for description of methods was 3.01 and more than 90% of students score at or above expectation. The average rating for explaining the connection between an operational method and a larger scientific question was again 3.01 with more than 90% of students scoring at or above expectation.

Students seem to struggle more with the physical gathering of data, criteria 3. Here the average rating was 2.66, somewhat below expectation, and only ~32% of students scored at or above expectations.

Table I: Average scores and percentage of score above 3.0 for each criteria.

Criteria	Average rating	% of rating above 3
1. Describes methods used to assess a scientific problem.	3.01	90.9%
2. Explains how a set of methods and protocols generate data that address a scientific problem.	3.02	90.9%
3. Applies methods to gather data useful in evaluating scientific problem.	2.66	31.8%

### ***Department Discussion and Response to Results***

Assessment of PLO#2 generated mixed results. Encouragingly, in two of the three criteria for this objective students performed relatively well. Importantly, this was the case for students developing the critical understanding linking an operational experimental technique with a more broadly defined scientific question (criteria #2). Less encouraging was student wet lab performance (criteria #3). Clearly, students are still developing skills at the laboratory bench, as might be expected in this initial course.

These results were distributed to all biology faculty in advance of a monthly meeting and discussed as a department. It was discussed that the COVID19 pandemic of the last few years likely has limited exposure of this cohort of students to laboratory experience.

### ***Response to Previous Year's Report Feedback***

The most significant feedback to the previous year's (AY20-21) Natural Science Assessment Report was a suggestion to update the curricular map to reflect levels of development expected in each course. We have updated the curricular map with these changes and the new map is attached. As one might expect for a Minor, students are expected to be introduced and develop skills but not achieve the level of mastery expected for a Bio Major.

**Attachments:**

- Rubric for Direct Assessment
- Curriculum Map for the Natural Sciences Minor

**Natural Sciences Minor Assessment Rubric for PLO 2 (2021-2022 AY)**

Students will be able to

2. Perform laboratory techniques that assess scientific problems.

RUBRIC CRITERIA	PERFORMANCE STANDARDS			
	<i>Exceeds Expectations (4)</i>	<i>Meets Expectations (3)</i>	<i>Needs Improvement (2)</i>	<i>Below Expectations (1)</i>
1. Describes methods used to assess a scientific problem.	Describes methods in comprehensive detail so that investigation can be easily replicated. Identifies materials and quantities used. Does not include superfluous or unimportant details.	Provides adequate but not extensive description of methods. Identifies materials and quantities. Unimportant details are minimal.	Explains methods, but omits some important details. OR does not include complete description of materials and quantities. OR includes many unimportant details.	Does not provide sufficient detail to replicate investigation AND omits description of materials and quantities.
2. Explains how a set of methods and protocols generate data that address a scientific problem.	Clearly relates methods to scientific problem, thoroughly explains rationale for using methods, and discusses possible limitations of methods.	Clearly relates methods to scientific problem and provides rationale adequate for understanding relationship between methods and scientific problem.	Relates methods to scientific problem but omits some elements needed to understand rationale linking methods to scientific problem.	Does not provide sufficient rationale to explain how the methods will gather information germane to assessing the scientific problem.
3. Applies methods to gather data useful in evaluating scientific problem.	Presents highly accurate data and clearly, accurately, and comprehensively explains how data elucidate scientific problem.	Presents accurate data and correctly explains how data elucidate scientific problem.	Presents inaccurate data OR incorrectly explains how data elucidate scientific problem.	Presents inaccurate data AND incorrectly explains how data elucidate scientific problem.

	PLO1	PLO2	PLO3
<b>Institutional Learning Outcomes X Program Learning Outcomes</b>	Demonstrate broad knowledge of the concepts that comprise the natural sciences of biology, chemistry, and physics.	Perform laboratory techniques used to evaluate and explore scientific principles.	Apply the scientific process.
<b>Institutional Learning Outcomes</b>			
1. Students reflect on and analyze their attitudes, beliefs, values, and assumptions about diverse communities and cultures and contribute to the common good.			
2. Students explain and apply disciplinary concepts, practices, and ethics of their chosen academic discipline in diverse communities.	X		X
3. Students construct, interpret, analyze, and evaluate information and ideas derived from a multitude of sources.	X		X
4. Students communicate effectively in written and oral forms to interact within their personal and professional communities.			
5. Students use technology to access and communicate information in their personal and professional lives.		X	X
6. Students use multiple methods of inquiry and research processes to answer questions and solve problems.		X	X
7. Students describe, analyze, and evaluate global interconnectedness in social, economic, environmental and political systems that shape diverse groups within the San Francisco Bay Area and the world.			

	PLO1	PLO2	PLO3
Program Learning Outcomes X Courses	Demonstrate broad knowledge of the concepts that comprise the natural sciences of biology, chemistry, and physics.	Perform laboratory techniques used to evaluate and explore scientific principles.	Apply the scientific process.
<b>Courses or Program Requirement</b>			
BIOL 105-General Biology I/Lab	I	I	I
BIOL 106-General Biology II/Lab	I	I	I
CHEM 230 -Organic Chemistry I	M		
CHEM 231 - Organic Chemistry II	M		
CHEM 232 - Organic Chemistry I Lab		M	
CHEM 233 - Organic Chemistry II Lab		M	
PHYS 100 - Introductory Physics I/Lab	I	I	I
PHYS 101 - Introductory Physics II/Lab	I	I	I

Key:

Key:

I = Introductory

M = Intermediate

A = Advanced