

## School of Sciences

### Biology Degree (B.A./B.S.) Assessment (2020-2025)

#### I. Mission statement

The mission of the School of Sciences is to provide students with the undergraduate academic, research, and experiential background that will enable them to pursue meaningful careers in science-, mathematics- and informatics-related fields or to meet general education or program requirements in their major. The purposeful combination of theoretical and practical educational experiences, coupled with the flexibility of the available degrees will enable students to prepare for a wide variety of graduate programs, professional schools, secondary school teaching careers, and/or entry into the workplace. Students graduating from the School of Sciences will be lifelong learners and able to make positive contributions in a world where quantitative and scientific literacy, sustainability, and environmental quality are being challenged.

As part of the broader mission of the School of Sciences, the mission of the biology program is to provide students with the opportunity to explore the broad range of basic disciplines and topics in the biological sciences including biodiversity and human interactions. Students will learn techniques and methods through experiential learning activities, experiments, and projects.

#### II. Student learning outcomes

##### **Learning outcomes related to “core content”**

Learning outcome 1: Students will describe the phylogenetic interrelationships between living organisms.

Learning outcome 2: The students will explain similar/identical features of living systems.

Learning outcome 3: Students will describe chemical and molecular processes fundamental to living organisms.

Learning outcome 4: Students will describe the interaction of various living organisms and their environment.

Learning outcome 5: Students will describe the cellular and molecular basis of genetics.

##### **Learning outcomes related to “methodology and techniques”**

Learning outcome 6: Students will demonstrate the basic laboratory methods biologists use to explore living organisms.

Learning outcome 7: Students will develop hypotheses and design experiments related to biological systems.

Learning outcome 8: Students will evaluate the outcomes of scientific experiments.

Learning outcome 9: Students will be able to effectively communicate scientific ideas and concepts.

##### **Learning outcomes related to “biodiversity and human interactions”**

Learning outcome 10: The students will explain biodiversity.

Learning outcome 11: The students will discuss the effect of the natural environment on humans.

Learning outcome 12: The students will evaluate the implications of human modification of the environment and assess consequences.

**Learning outcomes related to “diversity”** (these learning outcomes were approved by the School of Sciences faculty for use in all degree programs within the School and will be assessed annually)

Learning outcome 13: As future leaders, administrators, policymakers, and managers in pure and applied sciences, students will demonstrate an understanding of high impact practices and policies that foster greater diversity in these fields.

Learning outcome 14: Students will recognize the relevance and significance of the contributions of and collaborations with different cultural groups within various pure and applied sciences disciplines.

Learning outcome 15: Students will explain the disproportionate impacts of sustainability issues (e.g., climate change, population growth, waste disposal, loss of biodiversity, renewable energy, etc.) on various human populations and ecosystems.

[Outcomes] Students will :	BIOL L105 F	BIOL- L 105 lab F	BIOL- L 203 S	BIOL- L321 J,S	BIOL L 364 J,S	BIOL L345 J,S	BIOL- L 336 J,S	BIOL L367 J,S	BIOL- L 377 J,S	BIOL- L 379 J,S	BIOL-L 403 S (capstone)	BIOL L473 J,S	BIOL- L 474 J,S	BIOL L211 F	BIOL L213 F	MICR M310 J,S	MICR M315 J,S	PHSL P416 J,S	PHSL- P 418 J,S	ZOOL Z315 J,S
1. describe the phylogenetic interrelationships between living organisms.	I	I	I			D		D	D							D		M		D
2. explain similar/identical features of living systems	I	I	M		D	D		D	D	I	M	D		D		M		M	M	M
3. describe chemical and molecular processes fundamental to living organisms.	I	I			M			D						D		M		M	M	
4. describe the interaction of various living organisms and their environment.	I		D			D		D	D	I		M				M	D	M	M	D
5. describe the cellular and molecular basis of genetics.				D	M									I	I	D				
6. demonstrate the basic laboratory methods biologists use to explore living organisms.		I							D	D			D		I		M		M	I
7. develop hypotheses and develop experiments related to biological systems.		I							D				D		I		M		M	I
8. evaluate the outcomes of scientific experiments.	I	I	D		D		M	D		M	M	D	D	D	I		M	M	M	
9. effectively communicate scientific ideas and concepts.				M				D			M				I	M		M		
10. explain biodiversity.	I		D		D				D	I		M				D	D			D
11. discuss the effect of the natural environment on humans.			I				D			D	M	M								
12. evaluate the implications of human modification of the environment.	I		D		D		I		D	M	M	M			I	D				

<p>13. demonstrate an understanding of high impact practices and policies that foster greater diversity in these fields. (diversity)</p>											D										
<p>14. recognize the relevance and significance of the contributions of and collaborations with different cultural groups within various pure and applied sciences disciplines.</p>												D								I	
<p>15. explain the disproportionate impacts of sustainability issues (e.g., climate change, population growth, waste disposal, loss of biodiversity, renewable energy, etc.) on various human populations and ecosystems.</p>												D								I	

III. Curriculum map

F (freshman), S (sophomore), J (junior), S (senior): Recommended academic year when the course is to be taken in the student curriculum.

IV. Assessment Plan

A plan that documents which outcomes will be assessed, the measures used to assess them, and the target achievement level for those measures. (Academic Years: 2020-2025)

<b>Academic Year (template)</b>	
<b>Student Learning Outcomes</b>	Which outcomes are being assessed this academic year? (All outcomes can be assessed each year.)
<b>Measure Description</b>	What assessment tools will be used? Why these tools? When/where will the assessments take place? How does this time and place align with the outcomes? What students are being assessed? Why these students?
<b>Benchmark/Target</b>	What level of performance will be considered acceptable? What performance criteria is used to determine mastery?

**Academic Year 2020-2021**

<b>Student Learning Outcomes</b>	
<p>Learning outcome 10: The students will explain biodiversity.            Learning outcome 11: The students will discuss the effect of the natural environment on humans.            Learning outcome 12: The students will evaluate the implications of human modification of the environment and assess consequences.</p>	
<b>Measure Description</b>	<p>What assessment tools will be used? Why these tools? When/where will the assessments take place? How does this time and place align with the outcomes?            What students are being assessed? Why these students?</p>
<p>The biology faculty are in the process of putting together a Canvas site for assessment of lower-level classes (multi-section courses, courses with specific sequences). The Canvas sites will be used to share resources such as assessment tool templates and to amalgamate assessment data.</p> <p>These learning outcomes will be assessed in BIOL-L 105, BIOL-L 364, BIOL-L 367, BIOL-L 211, ZOOL-Z 315, BIOL-L 379, MICR-M 310, and MICR-M 315. These courses are offered in 2020-21 and are mapped to these learning outcomes. These courses provide a broad range of lower-level and upper-level biology courses for the majors. The assessment will be done using exam questions. The exam questions will address fundamental principles related to the effect of the natural environment on humans. Questions of this nature tend to be course-specific and will typically relate to different aspects of the material with a focus on the learning outcomes.</p> <p>L.O. 11: Students will be assessed based on their understanding on these fundamental principles and the impact(s) they might have on human health and/or activities. For example, in MICR-M 310 Microbiology, the assessment will consist of evaluating the students' understanding of how climate change might impact the epidemiology of infectious diseases. Examples in classes will discuss seasonal patterns of cholera (related to oceans' global warming) and Hanta virus pulmonary disease (closely linked to El Nino patterns and seasonal rainfalls).</p>	
<b>Benchmark/Target</b>	<p>What level of performance will be considered acceptable? What performance criteria is used to determine mastery?</p>
<p>A benchmark of 70% of students successfully achieving the learning outcome will be considered satisfactory.</p>	

<b>Academic Year 2021-2022</b>	
<b>Student Learning Outcomes</b>	Which outcomes are being assessed this academic year? (All outcomes can be assessed each year.)
<p>Learning outcome 1: Students will describe the phylogenetic interrelationships between living organisms.</p> <p>Learning outcome 2: The students will explain similar/identical features of living systems.</p> <p>Learning outcome 3: Students will describe chemical and molecular processes fundamental to living organisms.</p> <p>Learning outcome 4: Students will describe the interaction of various living organisms and their environment.</p> <p>Learning outcome 5: Students will describe the cellular and molecular basis of genetics.</p>	
<b>Measure Description</b>	What assessment tools will be used? Why these tools? When/where will the assessments take place? How does this time and place align with the outcomes? What students are being assessed? Why these students?
<p>The biology faculty are in the process of putting together a Canvas site for assessment of lower-level classes (multi-section courses, courses with specific sequences). The Canvas sites will be used to share resources such as assessment tool templates and to amalgamate assessment data.</p> <p>These learning outcomes will be assessed in BIOL-L 105, BIOL-L 203, BIOL-L 364, BIOL-L 211/213, BIOL-L 379, BIOL-L 321, PHSL-P 416/418, BIOL-L 336, BIOL-L 403, MICR-M 310, and MICR-M 315. These courses will be offered in 2021-22 and are mapped to these learning outcomes. These courses provide a broad range of lower-level and upper-level biology courses for the majors. The assessment will be done using exam questions. The exam questions will address fundamental cellular or molecular mechanisms and their impact on function, development, and/or evolution. Questions of this nature tend to be course-specific and will typically relate to different aspects of the material with a focus on the learning outcomes.</p> <p>Students will be assessed based on their understanding on these fundamental concepts. For example, in BIOL-L 321 Human Immunology, the assessment will consist of evaluating the students' understanding of how random gene segment recombination produces diversity in the antigen-binding sites of antibodies (antibody repertoire).</p>	
<b>Benchmark/Target</b>	What level of performance will be considered acceptable? What performance criteria is used to determine mastery?
A benchmark of 70% of students successfully achieving the learning outcome will be considered satisfactory.	

**Academic Year 2022-2023**

<b>Student Learning Outcomes</b>	Which outcomes are being assessed this academic year? (All outcomes can be assessed each year.)
<p>Learning outcome 6: Students will demonstrate the basic laboratory methods biologists use to explore living organisms.</p> <p>Learning outcome 7: Students will develop hypotheses and design experiments related to biological systems.</p> <p>Learning outcome 8: Students will evaluate the outcomes of scientific experiments.</p> <p>Learning outcome 9: Students will be able to effectively communicate scientific ideas and concepts.</p>	
<b>Measure Description</b>	What assessment tools will be used? Why these tools? When/where will the assessments take place? How does this time and place align with the outcomes? What students are being assessed? Why these students?
<p>The biology faculty are in the process of putting together a Canvas site for assessment of lower-level classes (multi-section courses, courses with specific sequences). The Canvas sites will be used to share resources such as assessment tool templates and to amalgamate assessment data.</p> <p>These learning outcomes will be assessed in BIOL-L 105, BIOL-L 364, BIOL-L 211/213, BIOL-L 403, BIOL-L 474, BIOL-L 321, PHSL-P 416/418, BIOL-L 336, MICR-M 310, and MICR-M 315. These courses will be offered in 2021-22 and are mapped to these learning outcomes. These courses provide a broad range of lower-level and upper-level biology courses for the majors. The assessment will be done using final exam questions as they are typically more comprehensive in nature. In the lab courses (BIOL-L 105, MICR-M 315, BIOL-L 213, PHSL-P 418, BIOL-L 474), specific experiments and practical exercises will be assessed.</p> <p>L.O. 6: Specific laboratory skills will be assessed early in the semester and then reassessed a second time near the end of the semester. Depending on the course and level, it may consist of specific pipetting exercise, microscopic techniques, aseptic techniques in the microbiology lab, etc. Improvement (early vs. later in the semester) will be assessed for each student.</p> <p>L.O. 7: Students will develop hypotheses and experiments, and these hypotheses will be tested in lab courses. The students' work will be assessed as part of lab reports or lab worksheets depending on the course.</p> <p>L.O. 8: Students will generate and graph data (or tabulate) for specific experiments conducted in lab courses. Students will evaluate and interpret these data. The students' work will be assessed as part of lab reports or lab worksheets depending on the course.</p> <p>L.O. 9: Students will demonstrate an understanding of scientific terminology (e.g., theory, hypothesis, laws) and how they apply in a scientific context vs. non-scientific contexts. In lower-level courses, exam questions will be used to assess the accuracy of explanation of a biological concept. In upper-level courses, students will conduct a thorough review of the scientific literature on a specific topic related to a given course. Students will synthesize ideas and concepts and prepare a paper or a presentation on that topic (term paper, poster, and/or PowerPoint). Students will be assessed on content, presentation (written or oral communication skills), clarity, and originality.</p>	

<b>Benchmark/Target</b>	What level of performance will be considered acceptable? What performance criteria is used to determine mastery?
A benchmark of 70% of students successfully achieving the learning outcome will be considered satisfactory.	

**Academic Year 2023-2024**

<b>Student Learning Outcomes</b>	
<p>Learning outcome 10: The students will explain biodiversity.            Learning outcome 11: The students will discuss the effect of the natural environment on humans.            Learning outcome 12: The students will evaluate the implications of human modification of the environment and assess consequences.</p>	
<b>Measure Description</b>	<p>What assessment tools will be used? Why these tools? When/where will the assessments take place? How does this time and place align with the outcomes?            What students are being assessed? Why these students?</p>
<p>The biology faculty are in the process of putting together a Canvas site for assessment of lower-level classes (multi-section courses, courses with specific sequences). The Canvas sites will be used to share resources such as assessment tool templates and to amalgamate assessment data.</p> <p>These learning outcomes will be assessed in BIOL-L 105, BIOL-L 364, BIOL-L 367, BIOL-L 211, ZOOL-Z 315, BIOL-L 379, MICR-M 310, and MICR-M 315. These courses are offered in 2020-21 and are mapped to these learning outcomes. These courses provide a broad range of lower-level and upper-level biology courses for the majors. The assessment will be done using exam questions. The exam questions will address fundamental principles related to the effect of the natural environment on humans. Questions of this nature tend to be course-specific and will typically relate to different aspects of the material with a focus on the learning outcomes.</p> <p>L.O. 11: Students will be assessed based on their understanding on these fundamental principles and the impact(s) they might have on human health and/or activities. For example, in MICR-M 310 Microbiology, the assessment will consist of evaluating the students' understanding of how climate change might impact the epidemiology of infectious diseases. Examples in classes will discuss seasonal patterns of cholera (related to oceans' global warming) and Hanta virus pulmonary disease (closely linked to El Nino patterns and seasonal rainfalls).</p>	
<b>Benchmark/Target</b>	<p>What level of performance will be considered acceptable? What performance criteria is used to determine mastery?</p>
<p>A benchmark of 70% of students successfully achieving the learning outcome will be considered satisfactory.</p>	

**Academic Year 2024-2025**

**Student Learning Outcomes**

Which outcomes are being assessed this academic year? (All outcomes can be assessed each year.)

- Learning outcome 1: Students will describe the phylogenetic interrelationships between living organisms.
- Learning outcome 2: The students will explain similar/identical features of living systems.
- Learning outcome 3: Students will describe chemical and molecular processes fundamental to living organisms.
- Learning outcome 4: Students will describe the interaction of various living organisms and their environment.
- Learning outcome 5: Students will describe the cellular and molecular basis of genetics.

**Measure Description**

What assessment tools will be used? Why these tools? When/where will the assessments take place? How does this time and place align with the outcomes? What students are being assessed? Why these students?

The biology faculty are in the process of putting together a Canvas site for assessment of lower-level classes (multi-section courses, courses with specific sequences). The Canvas sites will be used to share resources such as assessment tool templates and to amalgamate assessment data.

These learning outcomes will be assessed in BIOL-L 105, BIOL-L 203, BIOL-L 364, BIOL-L 211/213, BIOL-L 379, BIOL-L 321, PHSL-P 416/418, BIOL-L 336, BIOL-L 403, MICR-M 310, and MICR-M 315. These courses will be offered in 2021-22 and are mapped to these learning outcomes. These courses provide a broad range of lower-level and upper-level biology courses for the majors. The assessment will be done using exam questions. The exam questions will address fundamental cellular or molecular mechanisms and their impact on function, development, and/or evolution. Questions of this nature tend to be course-specific and will typically relate to different aspects of the material with a focus on the learning outcomes.

Students will be assessed based on their understanding on these fundamental concepts. For example, in BIOL-L 321 Human Immunology, the assessment will consist of evaluating the students' understanding of how random gene segment recombination produces diversity in the antigen-binding sites of antibodies (antibody repertoire).

**Benchmark/Target**

What level of performance will be considered acceptable? What performance criteria is used to determine mastery?

A benchmark of 70% of students successfully achieving the learning outcome will be considered satisfactory.