Annual Departmental Report
2021-2022

Program Information

Program/Department: Biology/Biology and Chemistry Department
Department Chair: Michael Nosek (chair), Erin Rehrig (interim chair)
Department Assessment Committee Contact: Eric Williams

This document is to be kept in the department and an electronic file is due to the AVP of Institutional Research & Planning by June 1, 2022.

A. Departmental Special Section for AY2021 -22

Department Lessons Learned and Accomplishments

In the past year, we assessed our capstone students for (1) content knowledge, (2) ability to conduct original biological research, and (3) the ability to communicate science. We continue to identify strengths and weaknesses in these areas and plan to report the results to the department in Fall 2022. In addition, the department has undertaken a number of noteworthy initiatives to increase the effectiveness of our program. These include the mapping of career competencies, pursuing an internship coordinator position, aligning our courses with the new LA&S/Gen Ed program, the adoption of OERs, the application of a number of grants, and a number of initiatives designed to decrease declining enrollments.

B. Program Learning Outcomes (PLOs) (Educational Objectives)

I. List of PLOs and the timeline for assessment.

PLO #	PLO – Stated in assessable terms	Where are the learning outcomes for this level/program published?	Timing of assessment	When was the last assessment of the PLO completed?
1.	Demonstrate content knowledge of the AAAS BioCore, with topics in: ● Evolution ● Transformations of Energy and Matter ● Information Flow, Exchange and Storage ● Structure and Function ● Systems	Program assessment plan	Annual	Fall 2021 & Spring 2022 Capstone Assessment
2.	Conduct original biological research. ● Clearly articulate testable questions and hypotheses ● Design and execute experiments ● Analyze data using appropriate statistical methods ● Summarize data concisely with graphs, tables or images ● Draw appropriate conclusions ● Demonstrate safe practices in laboratory and field	Program assessment plan	At least once in a five-year period	Fall 2021 & Spring 2022 Capstone Assessment
3.	Communicate science orally and in writing. ● Present information in a clear and organized manner ● Write well-organized and concise reports in a scientifically appropriate style ● Use relevant technology in communications. ● Communicate to a general audience	Program assessment plan	At least once in a five-year period	Fall 2021 & Spring 2022 Capstone Assessment

4.	Use scientific literature. ● Retrieve information efficiently and effectively by searching the biological literature ● Evaluate scientific articles critically ● Cite sources appropriately	Program assessment plan	At least once in a five-year period	Fall 2020 Capstone Assessment

Learning outcomes published at: https://www.fitchburgstate.edu/academics/programs/biology-babs

II. PLO Assessment (Please report on the PLOs assessed and/or reviewed this year. Programs should be assessing at least one each year.)

Using the table below, list and briefly describe the **direct method(s)** used to collect information assessing whether students are learning the core sets of knowledge (K), skills (S) and attitudes (A) identified as essential.

PLO #	**Assessment description (exam, observation, national standardized exam, oral presentation with rubric, etc.)**	**When assessment was administered in student program (internship, 4th year, 1st year, etc.)**	**To which students were assessments administered (all, only a sample, etc.)**	**What is the target set for the PLO? (criteria for success)**	**Reflection on the results: How was the "loop closed"?**
1	Standardized test we developed based on the AAAS BioCore concepts in our learning outcomes.	Capstone course (3rd or 4th year)	All in each course who attended	"Proficient" scores are questions in which students earn >75% correct OR show significant improvement (>25%) from the pre-test. "Sufficient" areas earn 50-75% with some improvement (5-25%). "Deficient" areas score <50% in the post-test, OR earn 50-75% with no improvement from the pre-test.	Summary test results are included below, and will be discussed at a department retreat in September 2022.

2-4	Presentations made by Capstone students	Capstone course (3rd or 4th year)	All	Two-thirds (>66%) of our students will score as sufficient or proficient in each of the elements defined by our scoring rubric for each of the following PLOs 2) conducting original research; 3) reporting results orally and in writing; and 4) using scientific literature effectively.	Results exceeded target criteria for all scored elements. Assessment committee will report at a department retreat in September of 2022.

You may use this comment box to provide any additional information, if applicable:

Summary of Findings: Briefly summarize the results of the PLO assessments reported in Section II above combined with other relevant evidence gathered and show how these are being reviewed/discussed. How are you "closing the loop"?

Reflection Prompt	Narrative Response
Other than GPA, what data/ evidence is used to determine that graduates have achieved the stated outcomes for the degree? (e.g., capstone course, portfolio review, licensure examination)	PLO-1. Table 1 below summarizes the results from our pre-post assessment test of BioCore content knowledge. As found in the past, weakest areas include physiology (structure/function, surface area/volume ratios, negative feedbacks), and a few specific concepts about evolution and energy flow. Students show strengths and significant improvement across many areas of Biology, including cell biology, genetics, phylogeny and ecology. PLOs 2-4. We used a Capstone Skills rubric to assess presentations in a capstone course. Results are presented in Table 2 below.
Who interprets the evidence?	PLO-1. The test was analyzed by members of the Assessment Committee

What is the process? (e.g. annually by the curriculum committee)	PLOs 2-4: One to two members of the Assessment Committee assessed student presentations in the capstone course using a rubric developed with the input of the faculty member teaching the course.
What changes have been made as a result of using the data/evidence? (close the loop)	We plan to report the results to the department in Fall 2022. The weakness in physiology was identified in previous assessments and resulted in the creation of a new course sequence: Human A&P I & II (BIOL 2004, BIOL 2005). These courses began in Fall 2018.

Table 1: In 2021/22 we administered our standardized test of BioCore concepts to two upper-level capstone courses with 9 Plant Biology and 25 Developmental Biology students, and added their results to our compiled data since 2017. The test questions are found in Appendix 1. Results were summarized above under PLO-1. We will discuss these data at our September 2022 retreat, and review results from individual questions again.

	PRE-test Average (n=135)	**POST-test Average (n=145)**	
	Intro Bio 2017-2019	***Capstone courses 2017-2022***	
Question Topic	**% Correct**	**% Correct**	
Energy: Rainforest	**14**	**35**	Blue: "**Proficient**" scores are questions in which students earn >75% correct OR show significant improvement (>25%) from the pre-test. Yellow: "**Sufficient**", i.e., earn 50-75% with some improvement (5-25%).
Energy: Food web	**25**	**53**	
Energy source use by plants	**53**	**63**	
Systems: Forests: Less diverse	**42**	**71**	
Systems: Forests: Compet Excl	**27**	**60**	
Evolution: Fitness	**14**	**33**	

Evolution: Insect allele G	**44**	**74**	Red: "**Deficient**" areas score <50% in the post-test, OR earn 50-75% with no improvement from the pre-test.
Evolution: Variation	**52**	**52**	
Evolution: Adaptation	**56**	**64**	
Evolution: Phylogeny	**70**	**79**	
Systems: Physiol: Ectotherm SA/Vol	**41**	**38**	
Systems: Physiol:			
homeostasis-negative feedback	**28**	**40**	
thermoregulation-negative feedback	**25**	**49**	
Structure/Function: Muscle properties	**31**	**34**	Blue: "**Proficient**" are questions in which students earn >75% correct OR show significant improvement (>25%) from the pre-test. Yellow: "**Sufficient**", i.e., earn 50-75% with some improvement (5-25%). Red: "**Deficient**" areas score <50% in the post-test, OR earn 50-75% with no improvement from the pre-test.
Structure-Function (Enzyme/teeth etc)	**37**	**40**	
Inform Flow: Cell: Gene expressed	**60**	**92**	
Cell: Energy store/used ATP	**85**	**94**	
Cell: Input energy (active transport)	**62**	**87**	
Systems/Inf Flow: Cell: Bone, muscle, skin	**37**	**73**	
Inf Flow: Heredity of skin cancer	**39**	**54**	

Exper: corn variables			
Corn: Indep Var	**67**	**67**	
Corn: Depend Var	**59**	**64**	
Exper: corn hypothesis	**62**	**84**	
Exper: control	**56**	**88**	

Table 2. Summary of results for capstone presentations in Fall 2021 (Plant Biology) and Spring 2022 (Developmental Biology). Score categories were 3 = proficient, 2 = sufficient, 1 = deficient, 0 = no attempt.

Fall 2021 Plant Biology		
Learning outcome	% Proficient or Sufficient	Average
LO2 Conduct original biological research: 2B. Design and execute experiments	100%	2.5
LO2 Conduct original biological research: 2C-1. Summarize results concisely with graphs, tables, or images	93%	2.29
LO2 Conduct original biological research: 2C-3. Use words and sentences to communicate results and describe patterns from data or observations.	86%	2.43
LO2 Conduct original biological research: 2D Draw appropriate conclusions:	100%	2.50
LO3 Communicate science orally: 3B. Present information in a clear and organized manner (Oral presentation or Poster)	100%	2.46
LO3 Communicate science orally: 3C. Use relevant technology in communications	100%	2.64

Spring 2022 Developmental Biology		
Learning outcome	% Proficient or Sufficient	Average
LO2 Conduct original biological research: 2A Clearly articulate testable questions and hypotheses	100%	2.9
LO2 Conduct original biological research: 2B. Design and execute experiments	100%	2.0
LO3 Communicate science orally: 3B. Present information in a clear and organized manner (Oral presentation)	100%	2.4

C. Assessment Plan for Program/Department

I. Insert the program or department Assessment Plan- Attached as Appendix

II. Explain any changes in the assessment plan including new or revised PLOs, new assessments that the program/department plans to implement and new targets or goals set for student success.

The Assessment Committee submitted the Biology Plan in June of 2020 and no changes were made in 2021-2022.

D. Program Review Action Plan or External Accreditation Action Letter/Report

Annual Reflection/Follow-up on Action Plan from last Program Review or external accreditation (only complete the table that is appropriate for your program)

I. Programs that fall under Program Review:

i. Date of most recent Review: **2018 (Biology)**

ii. Insert the Action Plan table from your last Program Review and give any progress towards completing the tasks or achieving targets set forth in the plan.

						department will reassess

		Department	Finished			Resolved in 2019. The diverse needs of our students make the implementation of this requirement problematic. Since Applied Statistics has been a recommended course for many years it was felt that the students are best served by advisor recommendation

						The department is in the process of creating an internship coordinator position. Dr. Awasibisah was appointed by the Dean & Chair to fill the position. We have applied for an AIF Grant for AY22-23. In AY21 the Student Affairs Committee held virtual workshops on resumes and finding jobs. Seminars for Intro to Health Science Professions were open to

						pandemic and Gen Ed proposals, the department informally and frequently shares teaching strategies, especially for engaging online students. Biology and Chemistry faculty members have also been active participants in the formation of a General Education learning community focused on the STEM related learning outcomes of Quantitative Reasoning and Procedural and

						Science, Engineering Technology and Mathematics to develop and submit an S-STEM NSF grant proposal to support recruitment and retention of academically talented low income students from underrepresented populations. The Biology & Chemistry department is submitting a proposal to the Balfour Foundation in AY22 to create a research fellows program that is targeted

						Ongoing.

						Ongoing.

iii. If you do not have an action plan, would you like help in developing one based on your last program review and needs of the program?

II. Programs with external Accreditation:

i. Professional, specialized, State, or programmatic accreditations currently held by the program/department.
ii. Date of most recent accreditation action by each listed agency.
iii. Date and nature of next review and type of review.

List key issues for continuing accreditation identified in accreditation action letter or report.	**Key performance indicators as required by agency or selected by program (licensure, board or bar pass rates; employment rates, etc.)(If required.)**	**Update on fulfilling the action letter/report or on meeting the key performance indicators.**

E. Departmental Strategic Initiatives

Accomplished Initiatives AY 21-22 Add more rows as needed	**Corresponding Strategic Plan Goal & Strategy** Goal # followed by Strategy # ex: 1.3	**Indicate if a Diversity, Equity and Inclusiveness (DEI) Goal**
Workforce Development Programming: Academic roadmap/Career competencies mapping (Davis Fdtn/C. Cratsley)	2.5 - Student-ready university - career advising	
Responsive Academic Portfolio: **UG-Grad Pathways**: LECOM and Husson articulation agreements (*Ongoing*)	2.5 - Student-ready university - career advising	
Coordination and marketing of **internships and careers** with Career Center (*Ongoing*)	2.5 - Student-ready university - career advising	X
Applied Learning: undergraduate research. Especially reaching out to minority students (*Ongoing*)	2.1 - Student-ready university - cultural shift for underrepresented students	X
Implementation of LA&S/Gen Ed program: Aligning Bio and Chem courses to new LA&S with AUC proposals	NA	
Open Educational Resources: now adopted in both intro Bio classes, some upper level electives, and some non-majors classes. A list of courses and faculty using OERs in our department can be found here.	5.7-Affordability	X
Inclusive Excellence for Student Success: With substantial help from the grant center, we are applying for a Balfour grant to provide stipends for student research.	2.1 - Student-ready university - cultural shift for underrepresented students 2.3 - Equity and inclusion	X

Reverse declining enrollment. Faculty outreach to accepted students; Virtual Open Houses, etc. (*Ongoing*). Held MassBioEd Teacher Workshop on campus. Created a document, "Talking Points for Admissions" and shared with Admissions Staff and departmental faculty as a Google Doc.	5.6 - Marketing	

Planned Initiatives for AY 2021-22 Add more rows as needed	**Associated Strategic Plan Goal & Strategy** Goal # followed by Strategy # ex: 1.3	**Indicate if a Diversity, Equity and Inclusiveness (DEI) Goal**
See all "Ongoing" initiatives above for AY'21.		
Focus more on enrollment strategies. Improve 4-year plans with career competencies and Alumni stories. Check our website: how inviting is it? Consider another video with a tour?	5.6 - Marketing	
Coordinate **sustainability curriculum** across departments. (Initiative with Sustainability Advisory Committee).	**4.6 -**Promote environmentally sustainable values	
Work with MassLife Sciences (focused on life sciences workforce development) to create internship pipelines, upgrade laboratory equipment, and coordinate curriculum to fulfill demand for industry competencies.	**1.2 -** Forge innovative paths to career readiness	

F. Departmental Reflection:

Take this section to reflect on--

1) *Initiatives that you may be considering for 22-23 academic year that you did not already capture above.*

Please refer to section A

Appendices

1. PLO 1: Assessment test
2. PLO 2 - 4: Capstone presentation assessment rubric
3. Assessment Plan June 2020

Appendix 1. PLO 1: Assessment test questions used in Fall 2019 (General Biology I in first 2 weeks as pre-test, Animal Physiology, Plant Biology) and Spring 2021 (Developmental Biology)

Biology Program Assessment Test

This test is a way to measure how much biological knowledge students have when they start at Fitchburg State, and how much they learned when they are done. We do NOT expect you to know most of the answers when you arrive!

- Please enter all answers on a bubble sheet. Choose only one answer unless indicated otherwise.
- Please do NOT write on this test, so we can reuse this paper.

1. Are you a Biology Major? A. Yes B. No

2. Please select any courses you have already completed at Fitchburg State. You can select any number of answers, or none.

A. General Biology I (or equivalent)
B. General Biology II (or equivalent)
C. Genetics
D. Ecology

3. Please select any courses you have already completed at another college. You can select any number of answers, or none.

A. General Biology I (or equivalent)
B. General Biology II (or equivalent)
C. Genetics
D. Ecology

4. Which of the following are a source of energy used by plants? Choose ANY that are correct; there can be more than one.

A. Carbon dioxide (CO_2)
B. Phosphate (PO_4^-)
C. Sunlight
D. Water (H_2O)
E. ATP

5. A tropical rainforest is an example of an ecosystem. Which of the following statements about matter and energy in a tropical rainforest is the most accurate?

A. Energy is recycled back into the ecosystem, but most matter is released and not re-used.
B. Most matter is recycled back into the ecosystem, but most energy is eventually respired away and not re-used.
C. Both matter and energy are mostly recycled back into the ecosystem.

D. Both matter and energy are eventually respired away and not re-used.

6. The organisms at the top of a food web:
A. accumulate all of the energy that existed in the consumed organisms that were lower in the food web.
B. have less available energy than trophic levels below it.
C. have the same amount of accumulated energy as each of the trophic levels below it.
D. have available to it all of the energy of the food web.

7. If an organism has a greater evolutionary fitness than other individuals of the same population, then the organism _____. [*Choose only the ONE best answer.*]
A. lives longer than others
B. competes for resources more successfully than others
C. mates more frequently than others
D. utilizes resources more efficiently than others
E. leaves more offspring than others

8. In an imaginary insect species, the dominant allele G codes for dark green color and the recessive allele g codes for light green color. Suppose a population of these insects moves into a habitat with light-colored leaves, such as a grassland. The lighter insects are better camouflaged and can escape predators. What changes would you expect in subsequent generations?
A. No change in frequencies of alleles or phenotypes.
B. Increase of the recessive allele frequency, but no change of phenotype because that allele is recessive
C. Increase of the frequency of the dominant allele and the dark color
D. Increase of the frequency of the recessive allele and light color
E. Increase of the recessive allele and eventually genetic co-dominance

The process of 9._____ generates new genetic variation, while 10._____ can act on this variation to produce adaptations to the environment.
A. natural selection
B. mutation
C. genetic drift
D. gene flow

11. This is a phylogenetic tree of the bear family, the Ursidae. Of the following pairs of species, which should have the most similar DNA to each other?
A. Giant panda and spectacled bears
B. Sun bears and black bears

C. Brown bears and polar bears
D. Brown bears and Giant panda bears
E. The answer cannot be inferred from an evolutionary tree like this.

12. Consider the following three species of mammals that are trying to stay warm.

	Species A	Species B	Species C
Surface Area =	10,200 cm^2	1728 cm^2	2400 cm^2
Volume =	63,000 cm^3	4320 cm^3	3000 cm^3
Surface Area/Volume =	0.16 cm^2/cm^3	0.4 cm^2/cm^3	0.8 cm^2/cm^3

Write the letter (A, B or C on your bubble sheet) of the species that would cool down the fastest, or have the most trouble trying to stay warm.

13. If the body is too warm, glands in the skin secrete sweat to cool the body, and then the body stops sweating. This is an example of: *[Choose ANY correct answers.]*
A. homeostasis using negative feedback
B. homeostasis using positive feedback
C. thermoregulation using negative feedback
D. thermoregulation using positive feedback

14. What does it mean for a gene to be "expressed"?
A. It is mutated to a different form
B. It is inserted into a bacterial plasmid
C. It is inactivated using methyl groups
D. It is transcribed to RNA and then translated into a protein
E. It is quickly replicated during cell division

15. A main source of energy for immediate use inside a cell is:

A. DNA
B. ATP
C. RNA
D. Ribosome
E. CO_2

16. Choose the process that requires an input of energy

A. Active transport
B. Osmosis (diffusion of water) through a plasma membrane
C. Facilitated diffusion of glucose across a plasma membrane down a concentration gradient
D. Diffusion of oxygen across the plasma membrane

17. Your bone cells, muscle cells, and skin cells look different because

A. They contain different numbers of genes
B. Each cell contains different kinds of genes
C. Each cell has a different mutation
D. Different genes are active in each kind of cell

18-20. You want to measure the effect of light waves on plant photosynthesis. You design an experiment that exposes corn plants to light at 4 different wavelengths and measure O_2 production as an indicator of photosynthesis. In this experiment…

18. What is the independent variable?

A. The control
B. Corn
C. Wavelength of light
D. Amount of light
E. O_2 production

19. What is the dependent variable?

A. The control
B. Corn
C. Wavelength of light

D. Amount of light
E. O_2 production

20. Which of the statements below best describe the hypothesis being tested in the experiment described above?
A. There is a relationship between O2 production and the variety of corn.
B. There is a relationship between the growth of corn plants and the amount of O2 they produce.
C. There is a relationship between the growth of corn plants and the amount of light to which they are exposed.
D. There is a relationship between the amount of O2 produced by corn plants and the wavelength of light to which they are exposed.
E. There is no relationship between photosynthesis and production of O2 in corn plants.

If the forests around Fitchburg State <u>are not</u> affected by a significant disturbance over the next century, then the tree community is likely to become 21._____ diverse due to 22._____.

21.
A. More
B. Less

22.
A. dispersal of seeds
B. co-evolution with herbivores
C. stress from herbivores
D. some species out-competing others
E. differentiation of tree niches

23*. Muscle cells have the ability to change shape in response to external stimuli. Which of the following properties allows muscle cells to perform this specialized function? *Choose ANY that apply.*
A. the cytoskeletal proteins within the cell
B. the organelles within the cell
C. the receptor proteins present on the cell's membrane
D. the shape of the cell
E. the high abundance of mitochondria in each cell

24*. Which of the following is an example in which structure determines function? Choose ANY that apply.
A. Neurons have receptor proteins on their membranes that respond to external stimuli

B. Herbivores have flat teeth to grind fibrous plant materials
C. Plant leaves are coated with a waxy layer perforated by tiny holes
D. Enzymes have binding pockets that are specific for their substrates

25*. A young man, due to his exposure to the sun, acquired a mutation in his skin cell DNA that increases his future risk of developing skin cancer. Should he be concerned that he will pass this mutation on to his future children? Choose the BEST answer.
A. Yes because his children will inherit all of his DNA.
B. Yes but only if he develops skin cancer in his lifetime.
C. Yes, because his children will inherit half of his DNA.
D. No because only mutations present in gametes (egg, sperm) are passed to children.
E. No because his children will inherit only half of his DNA.

26*. Have you have already taken this assessment in another course this year?
A. No
B. Yes

* Inadvertently omitted in Spring 2021

Appendix 2. PLO 2 - 4: Fall 2020 Capstone presentation assessment rubric

	Proficient =3	**Sufficient** =2	**Deficient** =1	**No attempt =0**
2C-1. Summarize results concisely with graphs, tables or images	Skillfully converts relevant information into an insightful portrayal that contributes to a further or deeper understanding.	Portrayal is only partially appropriate or accurate. For example, a graph might be missing units, or the relevance of an image may be unclear.	Portrayal is mostly inappropriate as a way to summarize results.	Only raw data is shown
2C-3 Use words and sentences to communicate results and describe patterns from data or observations.	Provides thorough and accurate descriptions of patterns or trends in data. Skillfully incorporates statistics into sentences. For example, differences in means are quantified, with units. Or the slope of a line is used to describe a pattern in a graph. Or P-values are included appropriately in the writing.	Provides simple and mostly accurate descriptions of patterns or trends in data. A simple description would be qualitative but not quantitative. Or there are occasional, minor errors in computations, units, etc.	Draws fundamentally incorrect interpretations about what the data mean.	
3B. Present information in a clear and organized manner (Oral presentation or Poster)	Presentation is consistently well-organized, professional, and coherent. Images and text are clearly readable by the audience.	Delivery is mostly (but not completely) organized, professional, and coherent. Images and text are mostly readable.	Presentation lacks organization or is often not coherent. Images and text are often difficult for an audience to read or understand.	
3C. Communicate to a general audience	Poster or presentation could be easily understood by non-experts.	Poster or presentation could be understood by most Biology majors, but non-science majors would struggle to understand the main ideas.	The main ideas of the Poster or presentation could not be understood by people outside of that course.	

4A. Retrieve information efficiently and effectively by searching the literature	Retrieves appropriate, focused sources from primary literature. Scholarly review papers are acceptable.	Presents information from relevant sources, but including some less-scholarly sources, or representing limited points of view/approaches.	Presents information from mostly irrelevant sources.	No resources provided when they were expected in the assignment

Appendix 3. Assessment Plan June 2020

Programmatic Assessment Plan

Program Name: ___Biology_____ Created By: ____Assessment Committee_____ Date: ___5/12/20_____

School of Health and Natural Sciences Mission

The mission of the School of Health and Natural Sciences is to help students develop the skills and habits of mind necessary for scientific inquiry and analysis in their professional, personal and civic lives. Faculty experts and engaged staff in the fields of biology, chemistry, earth and geographic sciences, exercise and sports science, mathematics, physics, psychological science, and nursing support students via foundational learning in the general education curriculum and mastery of content in a variety of majors. Our faculty offer classroom, laboratory, and clinical instruction as well as research opportunities in the sciences and health professions. Faculty and staff collaborate across the University and beyond to offer interdisciplinary learning opportunities.

Department of Biology and Chemistry Mission

The Biology and Chemistry Department believes that every student deserves a first-class education. We are educators at Fitchburg State because our personal values align with the campus values of equity and excellence. We strive to ensure that our students have the best of what we can offer them as they gain an in-depth knowledge of science that is part of a larger interdisciplinary, multicultural liberal arts and sciences education.

In order to achieve our mission, we undertake to:

- Produce students who are well prepared for diverse careers or advanced study in the biological and chemical sciences or related disciplines as well as gain the skills necessary to successfully adapt to future changes within their disciplines.
- Build lasting relationships with students that will advance their professional growth by recognizing the unique needs of each individual and reflecting our passion for engagement in authentic learning experiences.
- Maintain a high level of scholarly activity in a variety of fields associated with biology, chemistry and science education.
- Serve the needs of the university and specific academic departments through our curricular offerings and involvement in the university community.
- Endeavor to demonstrate leadership as stewards of the environment.

- Provide state of the art pedagogical approaches as well as utilize appropriate equipment, technology, and resources for teaching, learning and research in the sciences and science education.
- Work to support the University's mission of providing leadership and support for the economic, environmental, social, and cultural needs of North Central Massachusetts and the Commonwealth.

PART I: STUDENT LEARNING OUTCOMES

University Level

ILP Code	Institutional Learning Priorities (ILPs)
ILP 1	**Graduates have a deep understanding of the world.** **ILP 1A. Foundational Skills and Disciplinary Breadth** – Students will demonstrate attainment of the Learning Outcomes of the **ILP 1B. Mastery in a Defined Body of Knowledge** – Students will attain the specialized academic objectives of their major or **ILP 1C. Engagement with Campus and Community** – Students will develop personal and professional skills, goals, and ethical
ILP 2	**Graduates know how to learn and how to apply their knowledge.** **ILP 2A. Creative and Critical Thinking** – Students will use evidence and context to increase knowledge, reason ethically, assess **ILP 2C. Integrative Learning** – Students will apply their breadth and depth of knowledge, skills, and experience to address
ILP 3	**Graduates are engaged citizens who demonstrate integrity and continuous personal growth.** **ILP 3A. Respect for People and Cultures** – Students will appreciate the contributions and needs of diverse individuals and **ILP 3B. Civic Participation in Wider Communities** – Students will demonstrate their ability to work within and across communities, to apply their knowledge in the service of others, and to promote social justice.

	ILP 3C. Continuous Learning and Personal Growth – Students will approach the world with confidence and curiosity, appreciate the complex identities of themselves and others, and reflect critically on their experiences throughout life to make informed choices that advance their own well-being and that of the larger community.

Division Learning Outcomes (DLOs) *

LO Code	Division Student Learning Outcomes	Alignment to LA&S LOs or ELOs
DIV 1	Develop the skills and habits of mind necessary for scientific inquiry and analysis in professional, personal and civic lives.	
DIV 2	Support students via foundational learning in the general education curriculum and mastery of content in a variety of majors.	
DIV 3	Offer classroom, laboratory, and research opportunities in the sciences and health professions.	
DIV 4	Offer interdisciplinary learning opportunities.	

*** These divisional learning outcomes are unofficial. To our knowledge, the school of health and natural sciences has yet to create officially stated learning outcomes. These divisional learning outcomes are derived from the school's mission statement.**

Department Learning Outcomes

LO Code	(Biology) Learning Outcomes (LOs)	Alignment to Division/LA&S LOs or ELOs
PLO 1	*Demonstrate content knowledge of the AAAS BioCore, with topics in:* ● *Evolution* ● *Transformations of Energy and Matter* ● *Information Flow, Exchange and Storage* ● *Structure and Function* ● *Systems*	DIV 1, DIV 2,
PLO 2	***Conduct original biological research.***	DIV 1, DIV 3

	· *Clearly articulate testable questions and hypotheses* · *Design and execute experiments* · *Analyze data using appropriate statistical methods* · *Summarize data concisely with graphs, tables or images* · *Draw appropriate conclusions* · *Demonstrate safe practices in laboratory and field*	
PLO 3	***Communicate science orally and in writing.*** · *Present information in a clear and organized manner* · *Write well-organized and concise reports in a scientifically appropriate style* · *Use relevant technology in communications.* · *Communicate to a general audience*	DIV 2
PLO 4		DIV 1

PART II: CURRICULUM MAPPING

COMMON (Program Name) CORE

	PLO 1	PLO 2	PLO 3	PLO4
General Biology I				1
General Biology 2	1-2	1	1	1
Ecology	1-2	2	2	2
Genetics	2	2	2	2
Capstone Course	2-3A	3A	3A	3A

0	1	2	3	A
Not Addressed	Introducing	Broadening	Fulfilling	Assessed for Program

Key

PLO = Program Learning Outcome
Not Addressed = PLO is not addressed within the specific course
Introducing = PLO is covered at an introductory level within the specific course
Broadening = PLO is covered in the course so as to reinforce the students' learning of it within the specific course
Fulfilling = Demonstration of proficiency of the PLO occurs within the specific course
Assessed for Program = There will be a Direct Assessment activity to be used in Program Level Assessment in all sections of this course.

PART III: ASSESSMENT MEASURES, TIMELINES AND TARGETS

Direct Assessment

PLO #	Assessment description (written project, oral presentation with rubric, etc.)	Timing of Assessment	When assessment is to be administered in student program	To which students will assessments administered	What is the target set for the PLO? (criteria for success)
1	Students take a quiz with questions that are mapped to the AAAS BioCore content areas (Evolution, Transformations of Energy and Matter, Information Flow, Exchange	Annual	General Biology I (1st year) & Capstone Course (3rd or 4th year)	A subset of students will be tested. Students enrolled in General Biology I	For each test question and content area, we measure the % correct answers and the % change from introductory students to capstone students. Our aspirational, "Proficient" target is to see scores of at least 75% correct on every post-test question, OR at

	and Storage, Structure and Function Systems)			and students enrolled in a subset of capstone courses (e.g Developmental Biology).	least 50% correct with improvement of at least 25% from the pre-test. Because some questions are designed to be challenging and address common misconceptions, we can accept "Sufficient" scores of 50-75% provided there was improvement (5-25%) compared to the pre-test. "Deficient" areas that require discussion at our annual retreat are questions that score <50% in the post-test, OR areas that score 50-75% without any improvement.
2-4	Students complete a poster, oral presentation, or a lab report. Members of the Assessment Committee will evaluate criteria based on a rubric adopted by the department in 2020. The generic rubric will be adapted for each assignment with the help of the course instructor, to guide the Assessment Committee in scoring.	Annual	Capstone Course (3rd or 4th year)	A subset of students enrolled in capstone courses (e.g. Developmental Biology)	A majority of students (>66%) demonstrate sufficiency in one or more of the following areas: A) conducting original research; B) reporting results orally and in writing; and C) using scientific literature effectively.

Indirect Assessment

- Anonymous Student Survey- The Student Affairs Committee will administer an anonymous student survey bi-anually. The Assessment along with the Student Affairs Committees will compile the results and report the findings to the department. Past surveys have not explicitly asked about student perceptions of their skills in our learning outcomes, but we should consider adding that in the future. Identification of strengths and challenges of the Biology program will be discussed at an annual retreat held before the start of the academic year.

- Other indirect methods the committee is considering for the future are (1) measures from SSC and Dashboard data around retention and completion, especially among minority students, (2) survey data from local employers for skills they seek in our majors, and (3) placement data of our graduating students with employment and graduate school.

PART IV: ASSESSMENT CYCLE TIMELINE

Explanation:

- Programmatic student learning outcomes are assessed on a five-year cycle, which means each one is to be FULLY analyzed at least once in a five-year period.

Five-Year Assessment Plan

	Year 1	Year 2	Year 3	Year 4	Year 5
Demonstrate content knowledge of the AAAS BioCore, with topics in: ● *Evolution* ● *Transformations of Energy and Matter* ● *Information Flow, Exchange and Storage* ● *Structure and Function* ● *Systems*	X				X
Conduct original biological research.				X	
Communicate science orally and in writing.			X		
Use scientific literature.					X

PART V: INTENDED ANALYSIS, RESPONSIBILITY, AND COMMUNICATION

The AY 2019-2020 departmental assessment committee developed this assessment plan. The data created from the assessments described above will be analyzed and evaluated by future members of the assessment committee. The chair (and other members) of the assessment committee will communicate these results at an annual retreat held before the start of the academic year. Feedback from the department at these retreats will be compiled by the assessment committee into an action plan.