Amended Form May 2020 for use in Academic Year 2019-2020

Biology Program Plan Report

Amended for 2019-2020 Academic Year to Accommodate and Reflect Disruptions due to Pandemic

There are amended instructions through this document to reflect the special circumstances of this academic year (AY19-20), you will find these in red. As an institution and as departments we have learned that we can use our creativity to deliver learning even in the most difficult of circumstances. Some of the amended instructions ask you to reflect on this for this report. This year's annual report should also serve as a memorialization of the lessons learned.

Program Information

Program/Department: Biology / Biology and Chemistry Department
Department Chair: Meledath Govindan
Department Assessment Committee Contact: Chris Picone, John P. Ludlam, and Eric Williams

This file is to be kept in the department and an electronic file is due to the Director of Assessment by July 15 of 2020.

Special section for Spring 2020
Department Lessons Learned and Accomplishments
In thinking through the change this semester report back on how the department adapted to mid-semester disruption. Reflect on actions that surprised you, on lessons learned that will help in the future, and major accomplishments before or after the disruption.

The sudden transition from a regular face-to-face interaction to completely online modality due to Covid-19 pandemic was a significant adjustment for faculty and students alike. Although the department as a whole had not set a blueprint for addressing situations such as this, the disruption did not prevent faculty and staff in the department from exhibiting great levels of ingenuity to help meet student learning outcomes. Many of our biology courses have associated labs, which require face-to-face interactions in the laboratory settings to give students hands-on experience in order to meet several of our learning outcomes. This initiated a "think-outside-the-box" approach from the faculty to find alternative means of effectively delivering their lecture and especially lab content remotely. During this challenging time of social distancing, faculty continued to enjoy the camaraderie and all stepped up to help each other in adapting remote teaching and learning materials for the common goal of student success. Email chains with questions and suggestions on both synchronous and asynchronous teaching delivery strategies were shared among faculty. At the forefront of these discussions was how to engage students and to accommodate many in this new teaching and learning modality, at the same time maintaining academic rigor. The disruption has forced the department to begin discussions on putting in place a formal plan to address our lab courses for any future disruptions. The discussion is still ongoing.

Two of the challenges we encountered were the difficulties students found in scheduling their time, and increased work schedules. Without face-to-face contact and regular schedules, students seemed to struggle more than usual in completing assignments or remaining focused. The pandemic exacerbated the difficulty of keeping focused in a purely online setting. Second, while many faculty included some synchronous activities to make more engaging learning, some students could not attend because their work schedules increased. Some employers required increased hours once they knew that classes had been moved online, and other students had to work more hours to compensate for lost family wages. These challenges to engaged learning will likely continue into the next academic year.

Program Learning Outcomes (PLOs) (Educational Objectives)

I. List all PLOs and the timeline for assessment.

For the Spring of 2020 you may leave this blank, unless you have had a major change that you feel requires reporting otherwise previous reports will be used for this year.

PLO #	PLO – Stated in assessable terms.	Where are the learning outcomes for this level/program published? (please specify) Include URLs where appropriate.	Timing of assessment (annual, semester, bi-annual, etc.)	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 2019 (none in spring 2020)

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	Annual	Fall 2019 (Ecology posters only; no 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	Annual	Fall 2019 (Ecology posters only; no 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	Annual	Not assessed in AY 2019-2020

II. PLO Assessment (Please report on the PLOs assessed and/or reviewed this year, programs should be assessing at least one each year.) Please report on at least one PLO for AY19-20.

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. Note: This assessment tool was revised in fall of 2019.	1st year (General Biology I labs) and in two Capstone courses (3rd or 4th year)	All in each course (or all who attended the lab or final exam.)	"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.	We have been using a multiple-choice test we developed to assess knowledge of BioCore concepts described in past annual reports. In early fall of 2019 the Assessment Committee mapped this test onto the BioCore concepts and realized we were not testing some areas that we had deemed important. The department also reviewed the test during our annual retreat, and discussed problems with a few questions. In response, the Assessment Committee modified the annual test and added a few new questions. In fall 2019 we gave this test to students in General Biology I (mostly 1st year), which are considered "pre-test" data, and we gave the test in two capstone courses (Plant Biology and Animal Physiology), which are considered "post-test" data.

					Summary test results are included below, and will be discussed at a department retreat in August of 2020. The test used in fall 2019 is attached as an Appendix.
2-3	Posters made by Ecology students in groups of 3-4.	*Mid-level (mostly 2nd year). We did not assess any Capstone courses in AY2020*	*All, but posters were made in groups of 3-4 students.*	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 A) conducting original research; B) reporting results orally and in writing; and C) using scientific literature effectively.	Greater than 80% of students scored as sufficient or proficient on competencies related to hypotheses, summarizing data, and conclusions, but only 53.9% of students scored as sufficient or proficient for "Analyzed data with appropriate statistical methods" These results suggest that students were generally able to state hypotheses, make appropriate graphs using computer software, and explain the conclusions of the analysis. However, many students struggled to use appropriate statistical tests like linear regression. Students are exposed to statistical analyses in General Biology I and II and Ecology (part of core sequence in the Biology major) but anecdotal evidence from other upper-level biology courses indicates that majors often have difficulty conducting statistical analyses to test hypotheses. This pilot feasibility study of assessing mid-level students will be reviewed at the August 2020 departmental retreat.

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If applicable report on a PLO affected by the remote teaching disruption. You may report on this in a narrative using the space below, please address as many of the questions on the table as possible.

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"?
Please reflect on changes that the department has had to engage in given changes to teaching modality and especially capstone experiences.

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. In AY2020 we did not assess proficiencies in capstone courses. We continued to develop a generic rubric that will be used to assess capstone projects in the future. As a feasibility study, we started using a Capstone Skills rubric to assess poster projects in a mid-level class, Ecology, for PLOs 2-3. Results are presented in Table 2 below.
Who interprets the evidence? What is the process? (e.g. annually by the curriculum committee)	PLO-1. The test was analyzed by members of the Assessment Committee using data from Akindi. PLOs 2-3: The Ecology poster projects were assessed by one member of the Assessment Committee who also taught two of the four sections of Ecology. When applying the rubric to capstone projects annually in the future, scoring will be conducted by faculty teaching the capstone with the support of the Assessment Committee members.
What changes have been made as a result of using the data/evidence? (close the loop)	The department retreat in August 2019 re-evaluated the test of content knowledge (PLO-1), and it was revised in fall 2019. At the retreat we thoroughly evaluated the specific learning outcomes that would be incorporated into a rubric of student skills. The Assessment Committee re-wrote a generic rubric to assess PLO 2-4. We will report the results of the feasibility study from Ecology posters at our next retreat in August 2020.

Table 1. Results from our pre-post assessment test of BioCore content knowledge. Most questions were administered in 2017 and 2019, with a total N=135 for pre-test, N=91 for post-test. A few questions were added in fall of 2019, in which case N=81 for the pre-test, and 29 in the post-test. The overall average score was 44% on the pre-test, and 61% on the post-test.

	Proficient content areas	**Mixed content areas**	**Deficient content areas**
	Post-test ≥75%	**Post-test 50-75%**	**Post-test < 50%**
Improved >25%	· Evolution: insect **allele frequency** · Information flow: **Gene expressed** definition · Systems: forest **diversity**	**Proficient (significantly improved)**: · **Energy: food web** · Systems: forest **competitive exclusion**	
Improved 5-25%	· Evolution: **Phylogeny** · **Energy** source in cell = **ATP** · **Energy** in cell: **Active transport** · Experiments: **Hypothesis**	**Sufficient (some improvement)** · **Energy** sources used by **plants** · Evolution: natural selection to **adaptation** · Systems/Information flow: **Different genes expressed** in skin, bones, muscle (*wide variation across test years*) · Information flow: **Heredity** of skin cancer	· **Energy** is respired away and **does not cycle**; matter cycles (rainforest) · Evolution: **Fitness** definition · Physiology: **SA/Vol ratios** · Physiology: **Negative Feedback** (F2019 data)
Did not improve		**Deficient-For each test question and content area, we measure the % correct answers and the % change from introductory students to capstone students.** · Evolution: **variation** from **mutation** (*post test avg only 52%*) · Experiments: Independent/Dependent **variables**	· **Structure/Function**: muscle cells · **Structure/Function**: various (*enzyme binding sites improved, others did not)*

Table 2. Summary of results for group poster presentations from four Ecology lab sections (Fall 2019, two different instructors) assessed for PLO 2-3 by one instructor. A total of 27 posters were assessed but actual sample size varied for each outcome because "Not Applicable" values were excluded from analysis.

Learning outcome	% Sufficient or proficient	Average score* ± standard deviation
Developed testable hypotheses	84.7	2.27 ± 0.83
Summarized data concisely with graphs, tables, or images	96.3	2.81 ± 0.48
Analyzed data with appropriate statistical methods	53.9	1.54 ± 1.27
Draw appropriate conclusions	81.5	2.37 ± 0.79

* Score categories were 3 = proficient, 2 = sufficient, 1 = deficient, 0 = no attempt.

Assessment Plan for Program/Department

I. Insert the program or department Assessment Plan- Attached as appendix-3

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 Biology Assessment Plan was introduced as a draft at our Department Retreat in Aug 2020. We made changes in response to faculty feedback concerning:

- The standardized test given each year
- Learning outcomes for specific skills and proficiencies
- Timing and assessment strategies.
- Mid-level assessment of PLO 2-3 added Fall 2019.

The revised plan was discussed with Cathy Kaluzny in October of 2019. Then Eric Williams attended a workshop on developing Assessment Plans and aligning them with mission statements. The Assessment Committee submitted the Biology Plan in June of 2020.

III. If you do not have a plan, would you like help in developing one?

University Data

I. SSC Data Complete only if significant interventions were completed.

Indicate **at least one** Student Success Performance Measure that the department/program has identified for planned change or improvement. Freshman retention, bottleneck courses, graduation rates, at risk student retention etc.

As above when you reflect on what the department implemented during this disrupted semester, are there any interventions that may have impacted a student success measure?

a. What was the focus this year?

Student Success Measure (data point from SSC)	**Implemented Intervention**	**Update on Implemented Intervention (i.e. change in target, satisfied with outcome, not satisfied, will continue or not)**
Graduation rates within the major in Biology (six year, transfer & non-transfer) calculated from SSC for students first enrolled between Fall 2008 – Spring 2012 by ethnicity. White (n = 216) 26.4% in Biology, 50.4% Institutional Non-white (n = 95) 30.5% in Biology, 44.8% Institutional Black/African American (n = 27) 37% in Biology, 50.2% Institutional Hispanic (n = 33) 27.3% in Biology, 39.1% Institutional Asian (n = 11) 36.4% in Biology, 49.4% Institutional	Students who did not graduate with a major in Biology at FSU may have graduated with a different major at FSU, graduated from a different institution, or never graduated. We focused on strategies for inclusion at our department retreat and various subsequent meetings, including CTL workshops and an application for a HHMI grant on improving inclusivity in STEM. In the short term, we included more pictures of minority students doing independent studies and research in our slide shows for prospective students as well as a show for welcoming new students each September. After Work-to-Rule ended, Faculty also volunteered to attract students at Open Houses and – after Covid-19 restrictions – later several Google Meet sessions with prospective students	These interventions are too new to expect any measurable effect. We will monitor enrollment and retention next year, but those data will be confounded by the pandemic. Anecdotally, the number of minority students doing independent projects seems to be higher in the last 2 years, but we have not quantified that.

b. What will your focus be for the upcoming year?*

Student Success Measure (data point from SSC)	Rationale for selection	Planned or Implemented Intervention	Current score/ Target Score	This measure was selected because of last Program Review or Accreditation (yes/no)

*Note: Since a department can monitor or review the same data point over multiple years, if this table is left blank the assumption will be made that the same data point will be monitored next year.

II. Trend Data

Indicate **at least one** Department Performance Measure that the program/department identified for change or improvement. Number of graduates, number of majors, credit production, substitutions etc.

Reflect on what the department did this disrupted semester you may identify interesting interventions.

a. What was the focus this year?

Department Performance Measure (data point from Trend Data)	Implemented Intervention	Update on Implemented Intervention (i.e. change in target, satisfied with outcome, not satisfied, will continue or not)
Retention rate: On average (AY2013-2020) the retention rate in major for Biology was 5% below that for the institution. For AY 2020 overall retention was 56%, and was higher for white (74%) than black (43%) or hispanic (33%) students.	See above	See above

What will be the focus next year?*

Department Performance Measure (data point from Trend Data)	**Rationale for selection**	**Planned or Implemented Intervention**	**Current score/ Target Score**	**This measure was selected because of last Program Review or Accreditation (yes/no)**

*Note: Since a department can monitor or review the same data point over multiple years, if this table is left blank the assumption will be made that the same data point will be monitored next year.

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: Program to complete its first review in 2024.

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.

Specific area where improvement is needed	**Evidence to support the recommended change**	**Person(s) responsible for implementing the change**	**Timeline for implementation**	**Resources needed**	**Assessment Plan**	**Progress Made this Year**
*"Clarify expectations and assessment in **capstone courses**."*		Curriculum and **Assessment Committees**	AY 20-21	*"Assessment Committee along with ad-hoc members of capstone courses will generate a draft of expectations and assessments by the end of AY20. The curriculum committee will then review the recommendations and both committees will then bring to entire department for discussion and approval."*		We developed a list of capstone proficiencies as LOs. This list was discussed at the retreat of August 2019, and formed the basis for a generic rubric of student skills.

"Continue to address challenges in ***our assessment plans."***		Assessment Committee		*"The committee will develop an action plan to address specific deficiencies within the assessment plan. This plan should include timeline and required resources. Resources may include funding for summer working groups."*		The Assessment Committee completed the following steps this year: 1A. At our department retreat, we reviewed the AAAS BioCore concepts that form our "knowledge" LOS. 1B. The department agreed to a standard set of test questions for those BioCore concepts. (Attached) 2A. The department decided on list of proficiencies that are required in every Biology student. That list is in our Assessment Plan, and articulated in detail in the generic rubric. (Attached) 2B. The department decided how to assess those proficiencies with a generic rubric in capstone courses, which can also be used in mid-level classes like Ecology and Genetics. 3. We submitted a Biology Assessment Plan in June of 2020.

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.**

APPENDICES:

1. PLO 1: Assessment test used in Fall 2019

2. PLO 2-3: Fall 2019 Ecology poster assessment rubric

3. Assessment Plan June 2020

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PLO1: Biology Assessment Test *used in fall 2019. Given to General Biology I students in their first 2 weeks as a pre-test, and given to all students in two capstone courses (Animal Physiology and Plant 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

PLO 2-4: Fall 2019 **Ecology poster assessment rubric**

Developed testable hypotheses
(3) Proficient: Testable hypothesis clearly stated and explained
(2) Sufficient: Testable hypothesis somewhat clearly stated and explained
(1) Deficient: Hypothesis not clearly stated and explained
(0) No attempt
Not applicable

Summarized data concisely with graphs, tables, or images
(3) Proficient: Results clearly displayed in a way that contributes to further or deeper understanding of results
(2) Sufficient: Results displayed in a way that is only partially appropriate or accurate
(1) Deficient: Results displayed in a way that is inappropriate or inaccurate
(0) No attempt
Not applicable

Analyzed data with appropriate statistical methods
(3) Proficient: Used appropriate statistical methods (linear regression, t-test, etc)
(2) Sufficient: Used appropriate statistical methods but analysis incomplete (linear regression, t-test, etc)
(1) Deficient: Used inappropriate statistical methods (linear regression, t-test, etc)
(0) No attempt
Not applicable

Draw appropriate conclusions
(3) Proficient: Uses the quantitative analysis of data as the basis for thoughtful judgements to draw conclusions from results
(2) Sufficient: Uses the quantitative analysis of data as the basis for judgements to draw conclusions. No attempt to qualify the conclusions, or minor errors exist in the conclusions
(1) Deficient: Conclusions are not appropriate or are clearly incorrect for the data
(0) No attempt: May restate a result but no attempt is made to draw any conclusions or judgements from the patterns
Not applicable

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.** ***Accomplished through:*** **ILP 1A. Foundational Skills and Disciplinary Breadth** – Students will demonstrate attainment of the Learning Outcomes of the Liberal Arts and Sciences program. **ILP 1B. Mastery in a Defined Body of Knowledge** – Students will attain the specialized academic objectives of their major or program. **ILP 1C. Engagement with Campus and Community** – Students will develop personal and professional skills, goals, and ethical standards of behavior though co-curricular experiences.
ILP 2	**Graduates know how to learn and how to apply their knowledge.** ***Accomplished through:*** **ILP 2A. Creative and Critical Thinking** – Students will use evidence and context to increase knowledge, reason ethically, assess the quality of information, solve problems, and innovate in imaginative ways. **ILP 2B. Effective Communication** – Students will carefully consider and clearly articulate ideas for a range of audiences and purposes in written, spoken, technology-mediated, visual, or other forms of communication. **ILP 2C. Integrative Learning** – Students will apply their breadth and depth of knowledge, skills, and experience to address complex issues.
ILP 3	**Graduates are engaged citizens who demonstrate integrity and continuous personal growth.** ***Accomplished though:*** **ILP 3A. Respect for People and Cultures** – Students will appreciate the contributions and needs of diverse individuals and groups and understand themselves in solidarity with others locally, nationally, and globally. **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***. · *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*	DIV 1, DIV 3
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	***Use scientific literature.*** · *Retrieve information efficiently and effectively by searching the biological literature* · *Evaluate scientific articles critically* · *Cite sources appropriately.*	DIV 1

COMMON (Program Name) CORE

	PLO 1	PLO 2	PLO 3	PLO4
General Biology I	1A	1	1	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 and Storage, Structure and Function Systems)	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 and students enrolled in a subset of capstone courses (e.g Developmental Biology).	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 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

Five-Year Assessment Plan

Program Learning Outcome	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.