

## Assessment Cycle 2023 – 2024

**Program:** Bachelor of Science (BS) in Biology (618)

**Department of Biology and Microbiology**

**School of Science, Technology, Engineering, & Math**

**College: Arts and Sciences**

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**Date: 05/29/2024**

**Northwestern Mission.** Northwestern State University is a responsive, student-oriented institution committed to acquiring, creating, and disseminating knowledge through innovative teaching, research, and service. With its certificate, undergraduate, and graduate programs, Northwestern State University prepares its increasingly diverse student population to contribute to an inclusive global community with a steadfast dedication to improving our region, state, and nation.

**College of Arts and Sciences' Mission.** The College of Arts & Sciences, the largest college at Northwestern State University, is a diverse community of scholars, teachers, and students, working collaboratively to acquire, create, and disseminate knowledge through transformational, high-impact experiential learning practices, research, and service. The College strives to produce graduates who are productive members of society equipped with the capability to promote economic and social development and improve the overall quality of life in the region. The College provides an unequalled undergraduate education in the social and behavioral sciences, English, communication, journalism, media arts, biological and physical sciences, and the creative and performing arts, and at the graduate level in the creative and performing arts, English, TESOL, and Homeland Security. Uniquely, the College houses the Louisiana Scholars' College (the State's designated Honors College), the Louisiana Folklife Center, and the Creole Center, demonstrating its commitment to community service, research, and preservation of Louisiana's precious resources.

**School of Science, Technology, Engineering, and Mathematics Mission Statement.** The School of Science, Technology, Engineering and Math (STEM) at Northwestern State University serves to create a collaborative environment for natural and applied science education that inspires students and faculty to engage in an interdisciplinary approach to developing strong analytical skills in interpersonal communication, critical thinking, research, and data literacy as they become lifelong learners who are prepared for an ever-changing, global STEM community.

**Department of Biology and Microbiology Mission Statement.** The mission of the Northwestern State University Biology and Microbiology Department is to provide a comprehensive education in biology and microbiology for all of our majors and to create

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a unique training environment for students wishing to pursue graduate or professional education.

**Purpose (optional):** The primary goal of the Biology program is to prepare students to enter the job market competitively at the bachelor level or to further their education in either graduate or professional school.

**Methodology:** The assessment process for the Biology program is as follows:

(1) Data from assessment tools (both direct–indirect, quantitative, and qualitative) are collected and returned to the program coordinator.

(2) The Department Head will analyze the data to determine whether students have met measurable outcomes.

(3) Results from the assessment will be discussed with the program faculty.

(4) The Department Head, as well as the faculty, will propose changes to measurable outcomes and/or assessment tools for the next assessment period and, where needed, curricula and program changes.

### Student Learning Outcomes:

**SLO 1. Students will explain the basic concepts of the molecular basis of life.**

**Course Map:** Tied to the course syllabus objectives.

**BIOL1010:** Biological Principles I. All majors are required to complete BIOL1010.

#### Measure 1.1. (Direct – knowledge):

Throughout the course, students will learn about the molecular basis of life, including macromolecules, cellular structure, enzyme function, gene expression, cellular respiration, photosynthesis, DNA structure and function, genetics, and cellular division. Each student is required to pass a quiz covering these concepts. The target is to have 70% of students attain a quiz grade of  $\geq 70\%$ .

**Findings:** Target met.

**Analysis:** In AC 2022-2023, the target was met with 75% (75/100) of students scoring  $\geq 70\%$  on the assessment. This was due to switching to a Pearson text and the Mastering online platform. Based on the analysis of the AC 2022-2023 results in 2023-2024, class materials were altered to match the new textbook, which allowed students to grasp a better understanding of the structure of DNA and its function in the cell.

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As a result of the changes in AC 2022-2023, the AC 2023-2024 target was met with 80% (48/60) of students scoring  $\geq 70\%$  on the assessment. This target implies that students were able to demonstrate appropriate knowledge of the molecular basis of life. This is an increase of 5% from the previous AC. This suggests that the new class materials and the efforts of the faculty who focused on this material have led to an increasing number of students understanding the molecular basis of life.

**Decision:** In AC 2023-2024, the target was met. Based on the analysis of AC 2023-2024, in AC 2024-2025, the faculty will implement the following changes to drive the cycle of improvement. The Department Head will meet with the faculty prior to the start of the next academic cycle to discuss how data is being tracked and will ask the course stewards to help track data. The faculty will enhance time spent on these topics in lectures and discuss the types of assignments on the Mastering platform that were effective at teaching the molecular basis of life. This class switched to the Mastering platform last year. The expectation is that in AC 2024-2025, these changes will further promote growth and understanding of difficult concepts in the molecular basis of life, such as photosynthesis and cell respiration.

### **Measure 1.2. (Indirect – survey):**

At the end of the course, a survey is administered to students to gauge their appraisal of their understanding of the basic concepts covered in the course. The target is to have 70% of the students report an above average or excellent knowledge of the indicated concepts.

**Findings:** Target not met.

**Analysis:** The target was not met for AC 2022-2023, with 27% (22/82) of students reporting that they had an above-average or excellent understanding of basic cellular structure. Additionally, 34% (28/82) of students reported that they had an above-average or excellent understanding of basic cellular function. This is surprising since the students did possess the knowledge as illustrated in Measure 1.1 from that academic cycle. Based on the analysis of the AC 2022-2023 results in 2023-2024 the Department Head met with faculty prior to the start of AC 2023-2024 to discuss the new qualifiers on the survey questions and to discuss the timing of the survey questions. The qualifiers were added to describe the expectation of an above-average understanding of the molecular basis of life. The survey was provided with the final to ensure that all material had been covered.

As a result of the changes in AC 2022-2023, the target was not met for AC 2023-2024, with 45% (27/60) of students reporting that they had an above-average or excellent understanding of basic cellular structure. Additionally, 50% (30/60) of students reported that they had an above-average or excellent understanding of basic cellular function. This is an increase of 11% and 14%, respectively, from AC 2022-2023. This is the second consecutive year that this measure has increased in both areas, yet still falls short of the target. While students have mastered the content in measure 1.1, they do not feel confident that they possess this knowledge.

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**Decision:** In AC 2023-2024, the target was met. Based on the analysis of the AC 2023-2024 assessment results, in AC 2024-2025, the faculty will implement the following changes to drive the cycle of improvement. The Department Head will meet with the faculty prior to the start of the AC 2024-2025 to discuss how we have seen an improvement over the past couple of years, but students are not confident. We will discuss how best to move forward to continue growth in this area and reach the target. The qualifiers that were provided for each answer in the quiz seem to help and will be used moving forward. The faculty will discuss the proper time to deliver the survey in coordination with the content quiz and how to enhance student confidence in the classroom.

**SLO 2. Students will describe the role of evolution and ecology in the diversity of life.**

**Course Map:** Tied to the course syllabus objectives.

**BIOL 1020:** Biological Principles II. All majors are required to complete BIOL 1020.

**Measure 2.1. (Direct – knowledge):**

Throughout the course, students will learn about evolution and ecology. The topics covered include natural selection, evolution, ecology, population genetics, taxonomy, and the diversity of prokaryotes, protists, fungi, plants, and animals. Each student is required to pass a quiz covering these concepts. The target is to have 70% of students attain a quiz grade of  $\geq 70\%$ .

**Findings:** Target not met.

**Analysis:** In AC 2022-2023, the target was not met, with 51% (42/83) of students in BIOL 1020 attaining a quiz grade of 70% or higher. The students struggled with the topics of evolution and ecology. The percentage of those who have mastered the material has improved for the second consecutive year. Based on the analysis of the AC 2022-2023 results in 2023-2024, instructors restructured class material to focus on these topics in this AC cycle.

As a result of the changes in AC 2022-2023, the target was not met for AC 2023-2024. However, for the third consecutive year, results have improved, with 65% (37/57) of students in BIOL 1020 attaining a quiz grade of 70% or higher. This is an increase of 14% from AC 2022-2023 but 5% below the target of 70%. Students primarily struggled with topics involving ecology, which is further evident by having looked at their confidence levels regarding the topic in Measure 2.2. There is concern in the department that all of these questions may not align appropriately with how this has been built.

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**Decision:** In AC 2023-2024, the target was not met. The target has not been met for 4 consecutive academic cycles. Based on the analysis of AC 2023-2024, the faculty will implement the following changes in AC 2024-2025 to drive the cycle of improvement. The Department Head will create a committee of BIOL 1020 faculty who will review the content quiz and make adjustments to ensure that there are appropriate questions that align with this class that was created four years ago when we updated our Biology program. The faculty will also discuss the amount of time spent on topics in ecology, confirming adequate coverage of this topic. This is important since students are struggling in this area and reporting a lack of confidence in Measure 2.2.

### Measure 2.2. (Indirect – survey)

At the end of the course, a survey is administered to students to gauge their appraisal of their understanding of the basic concepts covered in the course. The target is to have 70% of the students report an above average or excellent knowledge of the indicated concepts.

**Findings:** Target not met.

**Analysis:** In AC 2022-2023, the target was not met, with 41% (29/71) of students in BIOL 1020 reporting an above-average or excellent understanding of basic concepts in evolution and 32% (23/71) of biology majors reporting an above-average or excellent understanding of basic concepts of ecology. Based on the analysis of the AC 2022-2023 results, in 2023-2024 the Department Head met with the faculty to discuss the qualifiers that were added to the survey questions to define how above-average knowledge on these topics manifests. The switch to a Pearson text and updated course materials (i.e., the online Mastering platform) has helped although we are falling short of the target. This provided new types of assignments that students could engage in to learn the material and promote self-confidence.

As a result of the changes in AC 2022-2023, the target was not met, with 54% (27/50) of students in BIOL 1020 reporting an above-average or excellent understanding of basic concepts in evolution and 36% (24/50) of biology majors reporting an above average or excellent understanding of basic concepts of ecology. This performance is below (-16% and -34%, respectively), the goal of 70% of students reporting above average or excellent understanding of the basic concepts in evolution and ecology. This is an increase of 13% and 4%, respectively, from the AC 2022-2023 assessment, where students did not understand concepts in evolution and ecology. Students did not feel confident about their knowledge in this content area, which is supported by the fact that they did not demonstrate sufficient knowledge on these topics in Measure 2.1, where the target was also not met. Adding the qualifiers did promote an increase in confidence in these areas.

**Decision:** In AC 2023-2024, the target was not met. Based on the analysis of the AC 2023-2024 results and to drive the cycle of improvement in AC 2024-2025, efforts to enhance the learning of class concepts and the assessment will be made. The Department Head will meet with the faculty prior to the start of AC 2024-2025 to improve

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the questions in Measure 2.1 and discuss the timing of when it is best to provide this survey and to enhance the focus on evolution and ecology. Particular emphasis will be placed on ecology, where there is the biggest gap in confidence in knowledge. The qualifiers seemed to help and will also be used for AC 2024-2025.

**SLO 3: Students will be able to communicate scientific information.**

**Course Map:** Tied to the course syllabus objectives.

**BIOL 4995:** Scientific Communication. All majors are required to complete BIOL 4995.

**Measure 3.1. (Direct – ability):**

Throughout all sections of Scientific Communication courses, students will learn about the various aspects of communication in the sciences. Each student will write a scientific article which will be assessed using a standard rubric. The target is to have 70% of students attain a final assessment grade of  $\geq 70\%$ .

**Findings:** Target met.

**Analysis:** In AC 2022-2023, the target was met with 97% (63/65) of biology majors scoring  $\geq 70\%$  on the assessment. Based on the analysis of the AC 2022-2023 results in the 2023-2024 course, stewards were tasked with checking rubrics being provided to students and providing them where they were not available. Students learned the parts of scientific communication and could write effectively in this manner.

The target was met in AC 2023-2024, with 90% (17/19) of biology majors scoring  $\geq 70\%$  on the assessment. This is a decrease (-7%) from the previous AC. This is the second year in a row that there has been a decrease, although the target has been consistently met. This decline is of note, and needs will be addressed by the Department Head and faculty for AC 2024-2025. Students are graduating with the ability to communicate science to other scientists in written form within their respective fields.

**Decision:** In AC 2023-2024, the target was met. Based on the analysis of AC 2023-2024, the faculty will implement the following in AC 2024-2025 to drive the cycle of improvement. The Department Head will meet with faculty to discuss possible reasons for the 2-year decline seen in the number of student meeting the target for the assessment. There will be an open meeting for faculty to drive resource sharing of effective materials and assignments while discussing what has been working and removing materials that have not been effective.

**Measure 3.2. (Direct – ability):** Throughout all sections of Scientific Communication courses, students will learn about the various aspects of communication in the sciences. Each student will present to the public a non-traditional communication of a scientific article/project developed by the student; the communication will be assessed using a

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standard rubric. The target is to have 70% of students attain a final score on this assignment of  $\geq 70\%$ .

**Findings:** Target met.

**Analysis:** In AC 2022-2023, the target was met with 95% (62/65) of biology majors scoring  $\geq 70\%$  on the assessment. Based on the analysis of the AC 2022-2023 results in 2023-2024, the Department Head met with faculty to discuss content and material that was most effective for generating non-traditional communication and shared this material with all instructors. As a result, the students' creativity blossomed as they generated a diverse type of communication, including podcasts, websites, short videos, pamphlets, etc., to deliver scientific information in a manner that was easy to absorb and interesting to engage.

The target was met in AC 2023-2024, with 100% (19/19) of biology majors scoring  $\geq 70\%$  on the assessment. This is an increase (+5%) from AC 2022-2023. Instructors used materials that were effective in driving the generation of non-traditional communications. This result demonstrated that students could effectively communicate science in a non-traditional manner, such as through a podcast, infographics for social media (*i.e.*, Instagram, *etc.*), or some other manner that effectively targets the general public.

**Decision:** In AC 2023-2024, the target was met. Based on the analysis of AC 2023-2024 and to drive the cycle of improvement in AC 2024-2025, the faculty will meet to discuss what has worked best and share these materials with other professors. The Department Head will meet with the faculty before the start of AC 2024-2025 to determine what the least and most effective material is to drive the student generation of non-traditional communication. Based on those conversations, course content will be adjusted as needed.

**SLO 4: Students will employ critical thinking to interpret scientific literature.**

**Course Map:** Tied to the course syllabus objectives.

**BIOL 4970:** Capstone Course for Biology. All majors are required to complete BIOL 4970.

**Measure 4.1. (Direct - ability):** Throughout all sections of capstone courses, students will read the same scientific article from the primary literature and be required to pass quizzes over the material. The target is to have 70% of students attain a final average quiz grade of  $\geq 90\%$ .

**Findings:** Target not met.

**Analysis:** In AC 2022-2023, the target was not met with 49% (33/68) of biology majors scoring  $\geq 90\%$  on the assessment. Based on the analysis of the AC 2022-2023 results in 2023-2024 the Department Head discussed expectations with the faculty to ensure that students and instructors are focused on the proper content to drive success in this area.

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As a result of this meeting, instructors used the same question banks and literature articles for the critical thinking exam that was readily consumed by a diverse group of Biology students.

In AC 2023-2024, the target was not met, with 52% (17/33) of biology majors scoring  $\geq 90\%$  on the assessment. This is below (-18%) the target of 70% but above the prior AC (+3%). Students struggled to critically analyze a scientific article and effectively communicate this information when required. Faculty shared rubrics with one another to improve them and provided those to students. The literature article being used was evaluated but was deemed to be suitable for this critical thinking exam.

**Decision:** In AC 2023-2024 the target was not met. Based on the analysis of AC 2023-2024, the faculty will implement the following to drive the cycle of improvement in AC 2024-2025. The Department Head will meet with the faculty prior to AC 2024-2025 to discuss the amount of time spent on critical analysis skills in this class. Further discussion will focus on determining effective material being used by instructors to ensure everyone has this material. The exam will also be re-evaluated.

**Measure 4.2. (Direct – ability):** Throughout all sections of capstone courses, students will write a proposal about their capstone project. The target is to have 70% of students attain a final average written assignment grade of  $\geq 90\%$  based on a standard rubric.

**Findings:** Target not met.

**Analysis:** In AC 2022-2023, the target was not met, with 68% (45/68) of biology majors scoring  $\geq 90\%$  on the assessment. Faculty adjusted the time and content on this topic to improve the outcome for this academic cycle. Based on the analysis of the AC 2022-2023 results in 2023-2024, students were provided five weeks to work on the proposal and then tested by the faculty. Some students did not understand all the components that go into a project proposal, leaving gaps in their ideas and writing.

The target was not met in AC 2023-2024, with 60% (20/33) of biology majors scoring  $\geq 90\%$  on the assessment. This is 10% below the target of 70% and 8% below the score in AC 2022-2023. The outcome of this measure decreased for the second year. Students struggled to devise a research project and produce a research proposal. There was an increased focus on how to draft a proposal where faculty provided a rubric that included all of the essential components. However, some students did not generate drafts of the proposal for review prior to submitting the final version. As a result, the students struggled.

**Decision:** In AC 2023-2024, the target was not met. Based on the analysis of AC 2023-2024, the faculty will implement the following in AC 2024-2025 to drive the cycle of improvement. The Department Head will meet with the faculty to discuss materials to help students draft proposals. Some faculty are more successful than others, so we will discuss what has worked in that particular section and what has not worked in others. The faculty will enhance the time and effort spent on this topic in the class.



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### **SLO 5: Students will demonstrate professional development.**

**Course Map:** Tied to the course syllabus objectives

**BIOL 4970:** Capstone Course for Biology. All majors are required to complete BIOL 4970.

**Measure 5.1. (Direct – skill):** Students will be required to give a final presentation graded by a standard rubric across all sections of capstone classes. The target is to have 100% of students give a final presentation that meets  $\geq 70\%$  of the prescribed guidelines.

**Findings:** Target not met.

**Analysis:** In AC 2022-2023, the target was not met with 99% (73/74) of biology majors scoring  $\geq 70\%$  on the assessment. One student failed to meet this requirement. Based on the analysis of the AC 2022-2023 results in 2023-2024 the Department Head required students be graded using rubrics and devoted ample classroom time to this topic.

As a result, the target was not met, with 88% (14/16) of biology majors scoring  $\geq 70\%$  on the assessment. This result is 12% below the target of 100%. Two students failed to meet this requirement, demonstrating that they could not give an effective presentation and reflect on their experiences and data for their project. New faculty taught this course, and some have only taught the class once before. Thus, faculty are gaining experience in this area. More seasoned faculty in this class have 100% biology majors scoring  $\geq 70\%$  on the assessment. The Department Head ensured that newer faculty were properly prepared to teach this course.

**Decision:** In AC 2023-2024, the target was not met. Based on the analysis of AC 2023-2024, the faculty will implement the following in AC 2024-2025 to drive the cycle of improvement. The Department Head will meet with the faculty prior to the start of the 2024-2025 cycle to allow the faculty to discuss what works in their class. A particular focus will be the discussion of where the students are failing and what can be done to ensure their compliance.

**Measure 5.2. (Direct – skill):** At the end of the course, students will find a current entry-level job in a field of biology related to their Capstone experiment. This will allow them to relate their “research” with the current state of the workforce and the needs of society. The target is to have 100% of the students meet the requirements of the grading rubric.

**Findings:** Target not met.

**Analysis:** In AC 2022-2023, the target was not met, with 94% (64/68) of biology majors scoring  $\geq 90\%$  on the assessment. In the prior AC, some students said that they were not aware of this requirement. Thus, the Department Head had this requirement placed on the rubric for this course. As a result, the faculty provided and reviewed the rubrics with students. Of the four students who did not fulfill this requirement, three did not provide all

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of the information as required by the rubric, and one student “forgot” to include the information.

The target was not met in AC 2023-2024, with 75% (12/16) of biology majors scoring  $\geq 100\%$  on the assessment. This result is 25% below the target of 100%. Four students failed to meet this requirement and thus could not match their project with the needs of society and the workforce. The Department Head met with the faculty to discuss this measure since some are new to this class. Some faculty were unaware of this workforce requirement. This may be why some students did not fulfill or forget to complete this measure fully. Very little time is being devoted to discussing this in class.

**Decision:** In AC 2023-2024, the target was not met. Based on the analysis of AC 2023-2024, the faculty will implement the following in AC 2024-2025 to drive the cycle of improvement. Prior to the start of the next AC, the Department Head will meet with faculty to enhance time spent on this topic and ensure that rubrics reflect the expectations of how students must report a workforce requirement based on their project. The faculty will discuss how best to address this topic and will discuss what has worked to meet this target.

**Comprehensive summary of key evidence of improvements based on analysis of results.** The following reflects all the changes implemented to drive the continuous process of seeking improvement in AC 2023-2024. These changes are based on the knowledge gained through the analysis of AC 2022-2023 results.

- In Measure 1.1, class materials were altered to match the new textbook, which allowed students to grasp a better understanding of the structure of DNA and its function in the cell.
- In Measure 1.2, the Department Head met with faculty prior to the start of AC 2023-2024 to discuss the new qualifiers on the survey questions and to discuss the timing of the survey questions. The qualifiers were added to describe the expectation of an above-average understanding of the molecular basis of life. The survey was provided with the final to ensure that all material had been covered.
- In Measure 2.1, the instructors restricted class material to focus on these topics in the AC cycle.
- In Measure 2.2, the Department Head met with the faculty to discuss the qualifiers that were added to the survey questions to define how above-average knowledge on these topics manifests. The switch to a Pearson text and updated course materials (i.e., the online Mastering Platform) helped, although we fell short of the target. This provided new types of assignments that students could engage in to learn the material and promote self-confidence.
- In Measure 3.1, the course stewards were tasked with checking rubrics being provided to students and providing them where not available. Students learned the parts of scientific communication and could write effectively in this manner.

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- In Measure 3.2, the Department Head met with faculty to discuss content and material that was most effective for generating non-traditional communication and shared this material with all instructors. As a result, the students' creativity blossomed as they generated a diverse type of communication, including podcasts, websites, short videos, pamphlets, etc., to deliver scientific information in a manner that was easy to absorb and interesting to engage.
- In Measure 4.1, the Department Head discussed expectations with the faculty to ensure that students and instructors are focused on the proper content to drive success in this area. As a result of this meeting, instructors used the same question banks and literature articles for the critical thinking exam that was readily consumed by a diverse group of Biology students.
- In Measure 4.2, students were provided five weeks to work on the proposal and then tested by the faculty. Some students did not understand all the components that go into a project proposal, leaving gaps in their ideas and writing.
- In Measure 5.1, the Department Head required students to be graded using rubrics and devote ample classroom time to this topic.
- In Measure 5.2, the Department Head placed the requirement that students relate their “research” to the current state of the workforce and society's needs on the rubric for this course. As a result, the faculty provided and reviewed the rubrics with the students.

### Plan of action moving forward.

- The faculty will enhance time spent on essential topics for all measures.
- The Department Head will meet with the faculty prior to the start of the next academic cycle to discuss how data is being tracked and will ask the course stewards to help track data for Measures 1.1 and 2.1.
- The faculty will meet to discuss how to promote confidence in Measures 1.2 and 2.2 and determine which class materials best drive confidence.
- Rubrics should be used and aligned along all sections of classes in Measures 3, 4, and 5.
- A meeting to share materials and ideas that are successful will be held regarding SLOs 3, 4, and 5.
- The course steward will be more hands-on to check that rubrics are available to students and have proper expectations in SLOs 4 and 5.