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| **Assurance of Student Learning Report**  **2022-2023** | | |
| *Ogden College of Science and Engineering* | | *Department of Biology* |
| *Molecular Biotechnology (738)* | | |
| *Ajay Srivastava, Program Coordinator; Kerrie McDaniel, Doug McElroy, Assessment Coordinators* | | |
| ***Is this an online program***?  Yes  No | Please make sure the Program Learning Outcomes listed match those in CourseLeaf . Indicate verification here  Yes, they match! (If they don’t match, explain on this page under **Assessment Cycle)** | |

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| ***Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages. Add more Outcomes as needed.*** | | | |
| **Program Student Learning Outcome 1:**  Graduates will demonstrate a level of biological content knowledge appropriate to their degree level. | | | |
| **Instrument 1** | Biology Assessment Exam | | |
| **Based on your results, check whether the program met the goal Student Learning Outcome 1.** | | **Met** | **Not Met** |
| **Program Student Learning Outcome 2:**  Graduates will demonstrate an understanding of research ethics and the responsible conduct of research. | | | |
| **Instrument 1** | CITI Responsible Conduct of Research Course modules | | |
| **Based on your results, check whether the program met the goal Student Learning Outcome 2.** | | **Met** | **Not Met** |
| **Program Student Learning Outcome 3:**  Graduates will demonstrate the ability to apply scientific methodology and field/laboratory/analytical skills to a biological question. | | | |
| **Instrument 1** | Representative biology process artifact selected by the student from their required Biology Process Course or Biology Independent Research Experience | | |
| **Based on your results, check whether the program met the goal Student Learning Outcome 3.** | | **Met** | **Not Met** |
| **Assessment Cycle Plan:** | | | |
| During 2022-23 and consistent with its five-year assessment plan, the Department of Biology Program Review/Assessment Committee (the ‘Committee’) and faculty (1) implemented follow-up activities identified in its 2021-22 ASL Report, and (2) collected artifacts for the next round of bi-annual assessment of all SLOs. These assessment data will be analyzed and form the basis of the 2023-24 ASL Report. | | | |

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| **Program Student Learning Outcome 1** | | | | | |
| **Program Student Learning Outcome** | **Graduates will demonstrate a level of biological content knowledge appropriate to their degree level.** | | | | |
| **Measurement Instrument 1** | **Biology Assessment Exam**  The Biology Assessment Exam is an instrument, newly developed in 2020-21, designed to assess content knowledge within the program discipline. The exam is constructed around 12 vignettes, 2 each representing the six major areas of emphasis in our core curriculum (Cells, Metabolism, Genetics, Ecology, Evolution, Diversity). These major areas are literally the elements introduced in our required introductory course sequence (BIOL 120/121 and BIOL 122-123), and reinforced in our restricted elective core choices at the 200-level (BIOL 222/223, 224/225, or 226/227) and 300-level (BIOL 319/322 or 327/337 and BIOL 315 or 316). Free elective courses at the 300- and 400-levels provide students the opportunity to further master these topics in more specific contexts aligned with their individual professional interests.  Within each area of emphasis, there are 2 vignettes that are associated with 9 multiple-choice questions. Three (3) questions each test student content knowledge at the introductory, developing, and mastery level. In each area, several questions require interpretation of tables and/or figures, and assess students’ ability to apply the scientific process. This exam design allows for redundant assessment of knowledge by area of emphasis as well as mastery level; in addition, it provides the ability to carry out a meta-analysis of higher-order knowledge and skills such as correct interpretation of data and application of the scientific process.  The exam is given either electronically or in-person as part of BIOL 489, our required program capstone course that is taken by students during their final semester at WKU prior to graduation.  In 2022-23, the assessment exam was expanded to include a 9-question module addressing topics related to molecular biotechnology, immunology, and microbiology. | | | | |
| **Criteria for Student Success** | Students will score at least 50% or higher, with the score on Cells, Metabolism, and Genetics items at least 60%. | | | | |
| **Program Success Target for this Measurement** | | At least 75% of students will attain the criterion level of success. | **Percent of Program Achieving Target** | N/A – this was not an assessment year | |
| **Methods** | N/A. This was not an assessment year. During 202-23, the program implemented follow-up activities identified during the last assessment cycle and in the 2021-22 ASL Report. | | | | |
| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | | | | **Met** | **Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** | | | | | |
| Results: In the 2021-22 ASL Report, the program developed and implement an additional 9-question module within the assessment exam to focus on topics related to molecular biotechnology, immunology and microbiology, and clinical applications; this module addressed deficiencies in coverage identified during analysis of 2020-21 assessment data.  Conclusions: This activity was completed. These new questions were included in the Fall 2022 and Spring 2023 adminsitrations of the assessment, and will be analyzed as part of the 2023-24 ASL Report.  Plans for the Next Assessment Cycle: Analyze and report on assessment data collected during 2022-23, and develop follow-up activities based on the findings. | | | | | |

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| **Program Student Learning Outcome 2** | | | | | |
| **Program Student Learning Outcome** | **Graduates will demonstrate an understanding of research ethics and the responsible conduct of research.** | | | | |
| **Measurement Instrument 1** | **CITI Responsible Conduct of Research Course Modules**  The Collaborative Institutional Training Initiative (CITI) is a web-based ethics training course for responsible conduct in research that has been adopted by the WKU IRB, IACUC, and IBS Committees as a prerequisite certification to be attained by any investigator seeking approval for a research project through one or more of these committees. All PIs, Co-PIs, and Faculty Sponsors are required to complete CITI RCR training and receive certification (based on a minimum score of 80%) across all course training modules. These module educate and evaluate researchers on up-to-date issues and standards of research ethics, research integrity, and researcher conduct.  The Physical Science RCR Course used to assess this SLO consists of 7 individual modules: (1) Research Misconduct; (2) Data Management; (3) Authorship; (4) Peer Review; (5) Mentoring; (6) Conflicts of Interest; and (7) Collaborative Research. Within each module, participants review a multimedia presentation and several seminal articles related to the topic. At the end, participants demonstrate competency through a five-question multiple choice test, with test items randomly drawn from a larger question pool.  Completion of CITI RCR training is required of all students enrolled in BIOL 489, our required program capstone course that is taken by students during their final semester at WKU prior to graduation. Students are required to submit (1) a Completion Certificate indicating that they have attained a minimum score of 80% across all course modules, and (2) individual module scores (percentage of questions answered correctly) from their first attempt. | | | | |
| **Criteria for Student Success** | Students will attain the required minimum score for certification, with at least 60% correct answers on each module from their first attempt. | | | | |
| **Program Success Target for this Measurement** | | At least 75% of students will attain the criterion level of success. | **Percent of Program Achieving Target** | N/A – this was not an assessment year | |
| **Methods** | N/A. This was not an assessment year. During 202-23, the program implemented follow-up activities identified during the last assessment cycle and in the 2021-22 ASL Report. | | | | |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | | | | **Met** | **Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** | | | | | |
| Results: In the 2021-22 ASL Report, the program developed a plan to integrate additional CITI modules into early portions of the curriculum as a means of scaffolding learning Specifically, we committed to (1) require all students in BIOL 121 and 123 to complete the (a) Investigators, Staff, and Students Basic Course, and (b) Physical Sciences Responsible Conduct of Research Course, (2) integrate and require all students in BIOL 223, 225, and 227 to complete the Basic Biosafety Course, (3) require require all students in BIOL 322 and 337 to complete the NIH rDNA Guidelines Course or similar, appropriate CITI course, and (4) integrate and require students who did not complete all CITI courses previously (e.g., transfer students) to do so in BIOL 489/500.  Conclusions: This plan was approved by the program faculty, and is in the process of being implemented. Our intent is to integrate these additional modules in a progressive manner through the curriculum, beginning with BIOL 121 and 123 in Fall 2023. Thus, the Fall 2023 entering cohort will experience all of these revisions as they progress.  Plans for the Next Assessment Cycle: Analyze and report on assessment data collected during 2022-23, and develop follow-up activities based on the findings. | | | | | |

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| **Program Student Learning Outcome 3** | | | | | |
| **Program Student Learning Outcome** | **Graduates will demonstrate the ability to apply scientific methodology and field/laboratory/analytical skills to a biological question.** | | | | |
| **Measurement Instrument 1** | **Representative Biology Process Artifact**  All students in the program are required to successfully complete one of several approved process courses, which incorporate specific course SLOs related to application of the scientific process to address relevant questions in biology. In addition, many students undertake faculty-directed independent research. Both of these experiences yield artifacts – such as evidence and argument papers, research presentations or posters, Honors CE/T projects, or manuscripts – that allow for assessment of this SLO.  As part of BIOL 489, students are required to submit the artifact from their process course(s) or independent research experience that they consider to be both representative of their best work as well as best aligned with the elements of the assessment rubric for this SLO.  Artifacts are assessed by 2-person program faculty teams using the AAC&U LEAP Inquiry and Analysis rubric. Faculty teams independently assess each artifact they are assigned; when faculty ratings differ by more than 25% across all rubric elements, artifact ratings are reconciled either by a third reviewer or by discussion between team members. The Inquiry and Analysis rubric is attached to this report. | | | | |
| **Criteria for Student Success** | Students will receive an rating of 3.0 or higher across all rubric elements, with no rubric element below 3 (out of 4). | | | | |
| **Program Success Target for this Measurement** | | At least 75% of students will attain the criterion level of success. | **Percent of Program Achieving Target** | N/A – this is not an assessment year | |
| **Methods** | N/A. This was not an assessment year. During 202-23, the program implemented follow-up activities identified during the last assessment cycle and in the 2021-22 ASL Report. | | | | |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | | | | **Met** | **Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** | | | | | |
| Results: In the 2021-22 ASL Report, the program faculty committed to establish a framework and process within the department to review and standardize expectations for process course artifacts.  Conclusions: This activity was completed. The Program Review/Assessment and Curriculum Committees developed and received approval of a set of standards for process course artifacts to be followed in all process courses. These standards set forth criteria for the format and elements of process course assignments (and resulting artifacts), which map directly to the LEAP Inquiry & Analysis rubric used to assess the artifacts. These will be implemented beginning in Fall 2023.  Plans for the Next Assessment Cycle: Analyze and report on assessment data collected during 2022-23, and develop follow-up activities based on the findings. Note that the artifacts in this cycle will not explicitly reflect the newly-adopted standards, though some faculty have independently modified their process assignments based on their experiences with assessing the artifacts included in the 2021-22 ASL Report. | | | | | |

**\*\*\* Please include Curriculum Map (below/next page) as part of this document**

**A picture containing text

Description automatically generatedINQUIRY AND ANALYSIS VALUE RUBRIC**

*for more information, please contact value@aacu.org*

**Definition**

Inquiry is a systematic process of exploring issues/' objects/works through the collection and analysis of evidence that result in informed conclusions/ judgments. Analysis is the process of breaking complex topics or issues into parts to gain a better understanding of them.

*Evaluators are encouraged to assign a zero to any work sample or selection of work that does not meet benchmark (cell one) level of performance.*

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|  | **Capstone**  **4** | **Milestones**  **3 2** | | **Benchmark**  **1** |
| **Topic selection** | Identifies a creative, focused, and manageable topic that addresses potentially significant yet previously less explored aspects of the topic. | Identifies a focused and manageable/doable topic that appropriately addresses relevant aspects of the topic. | Identifies a topic that while manageable/doable, is too narrowly focused and leaves out relevant aspects of the topic. | Identifies a topic that is far too general and wide-ranging as to be manageable and doable. |
| **Existing Knowledge, Research, and/or Views** | Synthesizes in-depth information from relevant sources representing various points of view/approaches. | Presents in-depth information from relevant sources representing various points of view/approaches. | Presents information from relevant sources representing limited points of view/approaches. | Presents information from irrelevant sources representing limited points of view/approaches. |
| **Design Process** | All elements of the methodology or theoretical framework are skillfully developed. Appropriate methodology or theoretical frameworks may be synthesized from across disciplines or from relevant subdisciplines. | Critical elements of the methodology or theoretical framework are appropriately developed; however, more subtle elements are ignored or unaccounted for. | Critical elements of the methodology or theoretical framework are missing, incorrectly developed, or unfocused. | Inquiry design demonstrates a misunderstanding of the methodology or theoretical framework. |
| **Analysis** | Organizes and synthesizes evidence to reveal insightful patterns, differences, or similarities related to focus. | Organizes evidence to important patterns, differences, or similarities related to focus. | Organizes evidence, but the organization is not effective in revealing important patterns, differences, or similarities. | Lists evidence, but it is not organized and/or is unrelated to focus. |
| **Conclusions** | States a conclusion that is a logical extrapolation from the inquiry findings. | States a conclusion focused solely on the inquiry findings. The conclusion arises specifically from and responds specifically to the inquiry findings. | States a general conclusion that, because it is so general, also applies beyond the scope of the inquiry findings. | States an illogical, or unsupportable conclusion from inquiry |
| **Limitations and Implications** | Insightfully discusses in detail relevant and supported limitations and implications. | Discusses relevant and supported limitations and implications. | Presents relevant and supported limitations and implications. | Presents limitations and implications, but they are possibly irrelevant and unsupported. |

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| **CURRICULUM MAP TEMPLATE** | | |  |  |  |
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| **Program name:** | 738 Molecular Biotechnology | | |  |  |
| **Department:** | Biology | | |  |  |
| **College:** | Ogden | | |  |  |
| **Contact person:** | Ajay Srivastava | | |  |  |
| **Email:** | [ajay.srivastave@wku.edu](mailto:ajay.srivastave@wku.edu) | | |  |  |
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| **KEY:** | |  |  |  |  |
| **I = Introduced** | |  |  |  |  |
| **R = Reinforced/Developed** | |  |  |  |  |
| **M = Mastered** | |  |  |  |  |
| **A = Assessed** | |  |  |  |  |
|  |  |  | **Learning Outcomes** |  |  |
|  |  |  | **LO1:** | **LO2:** | **LO3:** |
|  |  |  | Graduates will demonstrate a degree of biologcial content knowledge appropriate to their degree level. | Graduates will demonstrate the ability to apply scientific methodology and field/ laboratory/ analytical skills to a biological question. | Graduates will demonstrate an understanding of research ethics and responsible conduct of research. |
| **Course Subject** | **Number** | **Course Title** |  |  |  |
| BIOL | 120/121 | Biological Concepts: Cells Metabolism and Genetics Lecture/Lab | I | I | I |
| BIOL | 122/123 | Biological Concepts: Evolution, Diversity, and Ecology Lecture/Lab | I | I | I |
| BIOL | 212 | Genome Discovery Exploration | I | I | I |
| BIOL | 226/227 | Microbial Biology and Diversity Lecture/Lab | R |  | R |
| BIOL | 312 | Bioinformatics | R | R |  |
| BIOL | 319/322 | Introduction to Molecular and Cell Biology Lecture/Lab | R | R | M |
| BIOL | 327/337 | Genetics Lecture/Lab | R | R | M |
| BIOL | 350 | Introduction to Recombinant Genetics | R | R |  |
| BIOL | 382 | Introductory Biostatistics |  | R |  |
| BIOL | 388 | Contemporary Issues in Biotechnology | R | R |  |
| BIOL | 369 | Cooperative Education in Biology |  |  |  |
| BIOL | 399 | Research Problems in Biology |  |  |  |
| BIOL | 411/412 | Cell Biology Lecture/Lab | M | M |  |
| BIOL | 446/447 | Biochemistry Lecture/Lab | M | M |  |
| BIOL | 2xx | Approved Elective Courses in Biology | R |  | R |
| BIOL | 3xx | Approved Elective Courses in Biology | M |  |  |
| BIOL | 4xx | Approved Elective Courses in Biology | M |  |  |
| BIOL | 3xx/4xx | Approved Biology Process Courses |  | M |  |
| BIOL | 489 | Professional Aspects of Biology | A | A | A |