Tuesday, May 20, 2025

Heritage University

Annual Program Review Report

Select the academic year you are reporting on	2024-2025
Program Title	Biology, B.S.
Individual completing form (name and title)	Bob Kao, Associate Professor in Biology
Provide a link to the program's course catalog page.	http://catalog.heritage.edu/preview_program.php?catoid=19&poid=2260&hl=biology&returnto=search
What one program learning outcome did you focus on this past year?	1) Question Formulation: Pose testable questions and hypotheses to address gaps in knowledge. Study Design: Plan, evaluate, and implement scientific investigations. 2) Data Interpretation and Evaluation: Interpret, evaluate, and draw conclusions from data in order to make evidence-based arguments about the natural world.

What data did you review and analyze related to the program learning outcome? (e.g. key assignments, end of course evaluation qualitative data, end of program survey data)

I analyzed the following key assignments:

1.) pre and post final research proposals on experimental design presentations

2.) post class discussion written assignments on data interpretation

These two assignments were analyzed through an equity lens for the following courses and labs:

1.) Microbiology class and lab (Biol 322/322L) from Fall 2022 semester

2.) Molecular Cell Biology class and lab (Biol 330W/330L) from Spring 2024 semester

3.) Genetics class and lab (Biol 318W/318L) from Fall 2024 semester

Finally, qualitative data were collected with example anonymous student reflections on data interpretation and experimental design from Microbiology class and lab (Biol 322/322L, Fall 2022 semester); Molecular Cell Biology class and lab (Biol 330W/330L, Spring 2024 semester); and Genetics class and lab (Biol 318W/318L, Fall 2024 semester).

Please upload data you reviewed and analyzed. (Note: it is required that data be disaggregated, analyzed, and used with an equity lens.)

PDF HU biology life sciences assessment … .pdf

5_data interpretation examples micro … .pdf

4_experimental design examples micr… .pdf

3_Micro Fall 2022 Mcb Spring 2024 G… .pdf

2_HU biology life sciences assessme… .pptx

Provide a brief analysis of the program learning outcome data you reviewed.

(note: SaraBecca, please see shared onedrive folder given the large datasets restrictions on jotforms, thank you)

I analyzed the following program learning outcomes:

Learning Outcome 1: Question Formulation: Pose testable questions and hypotheses to address gaps in knowledge.
Study Design: Plan, evaluate, and implement scientific investigations.

Learning Outcome 2: Data Interpretation and Evaluation: Interpret, evaluate, and draw conclusions from data in order to make evidence-based arguments about the natural world.

The qualitative and quantitative analysis revealed the importance in tracking students across the three courses in microbiology, molecular cell biology, and genetics and to provide inclusive and equitable mentoring within the context of situational and public learning spaces. Integrating themes during class and lab discussions that are aligned with student and team centered experiential learning experiences (e.g., course based undergraduate research experiences or CUREs) provide new pathways for students to immerse into the process of data interpretation and experimental design. More in-depth reflections are presented in the attached pdf files to this jotform on experimental design and data interpretation sections for each of the following courses and labs:

1.) Microbiology class and lab (Biol 322/322L) from Fall 2022 semester

2.) Molecular Cell Biology class and lab (Biol 330W/330L) from Spring 2024 semester

3.) Genetics class and lab (Biol 318W/318L) from Fall 2024 semester

What changes, if any, will you make as a result of this analysis?

Future Directions for Biology Life Sciences Assessment Plan & Equitable Student-Centered Class and Lab Experiences:

1a.) Through a series of collaborative discussions with HU Science Department Chair Dr. Tyson Miller, and with Drs. Melvin Simoyi and Alex Alexiades, we will plan to develop updated rubrics on data interpretation and experimental design for program-level and course-level outcomes linked to the Bioskills Guide.

1b.) Apply pre and post data interpretation and experimental design learning outcomes and rubrics to develop equitable student-centered mentoring in course based undergraduate research experiences (CUREs).

2.) Tracking HU undergraduate progress in data interpretation and experimental design learning outcomes between General Biology II class and lab (Biol 111/111L) to Biol 318W/318L Genetics class and lab.

3a.) Developing equitable & interactive Kahoot questions on data interpretation data analysis from peer-reviewed research articles in microbiology, genetics/epigenetics, and molecular cell biology.

3b.) Begin to reformat the post class discussions questions in the Fall 2025 for genetics/epigenetics and Spring 2026 molecular cell biology class and lab to have pre and post assessment timepoints for data interpretation.

What program learning outcomes will you be reviewing and analyzing next year?

I will plan to analyze both data interpretation and experimental design learning outcomes aligned with Vision and Change (2011) and Bioskills program learning outcomes for the following courses and labs next year: General Biology II (Biol 111/111L); Genetics (Biol 318W/318L); and Molecular Cell Biology (Biol 330W/330L). Formative student feedback will be collected midterm and at the end of the fall and spring semesters for reflection and future course and lab adjustments for equitable and inclusive learning communities for all HU students.

Furthermore, during late May and April 2025, Dr Bob Kao met in-person with Drs. Tyson Miller, Melvin Simoyi, and Alex Alexiades to gather input in reviewing the work-in-progress data interpretation and experimental design assessment data and have four future plans:

1.) Developing a future program level rubric for biology concepts (based on established biology concept inventory and rubric from peer-reviewed life science education research from Vision and Change and Bioskills guide) across life sciences that includes ecology, anatomy, genetics, molecular biology, and physiology. A helpful resource includes A Biology Core Concept Instrument (BCCI) to Teach and Assess Student Conceptual Understanding | CBE—Life Sciences Education

2.) Refining four point scale rubric that includes capstone (e.g. Biology 490) that could be used across 100, 200, and 300 level courses at the program level in biology pathway. Another option is have four point scale rubrics only for specific courses and labs.

3.) We discussed ideas from shared article in chemistry education by Domin 1999 on different types of lab inquiry in chemistry education and to explore approaches to redesign biology lab inquiry as it relates to experimental design and data interpretation from data collected from students' lab projects.

4.) Tracking students' growth and career next steps and it is worth considering a survey to send to HU alumni in the life sciences pathways, and we would need to consider what types of questions to add in a future survey for HU alumni.