



Program Assessment Report (PAR)

Biological Sciences (BIO) Masters Degree

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ACADEMIC YEAR COVERED BY THIS REPORT: 2021-2022

I. PROGRAM LEARNING OUTCOMES

Students completing a Master of Science in Biology will be able to Demonstrate how to formulate and critique arguments using accepted scientific theory and data. Apply norms of communication, including speaking and writing that are accepted in the field of biology. Read and synthesize primary literature within the field of biology. Demonstrate the ability to design, carry out, analyze and interpret results from experiments in biology. Demonstrate expertise within a particular field of biology Demonstrate how to identify and pursue a career in biology.

II. PROCEDURES USED FOR ASSESSMENT

A. Direct Assessment

Direct assessment was not used. Per the prior year's recommendations, we elected to use indirect assessment.

B. Scoring of Student Work

Qualtrics survey questions took a Likert scale: 0 = Not at all, 1 = Somewhat, and 2 = Very much.

C. Indirect Assessment

To estimate the extent to which students met each of the six Program Learning Outcomes (Table 1), the Biological Sciences Assessment Committee developed a

survey of students' confidence in applying each of the competencies to their working lives after graduation. These questions took a Likert scale: 0 = Not at all, 1 = Somewhat, and 2 = Very much. In order to better contextualize students' Likert responses, we also asked students open-ended questions about their perceived strengths and weaknesses of the Biological Sciences Master of Science program, courses they found most and least useful in their preparation, and their reflections on their research productivity during their program of study. The survey was delivered online through Qualtrics. The link was provided to students by the students' research advisors as well as via an e-mail message from the director of the Biological Sciences Assessment Committee. Four graduates completed the survey. Table 1. Summary of the six Program Learning Outcomes desired for Biological Sciences Master of Science students and survey questions to measure students' perceived mastery of each objective (0 = not at all; 1 = somewhat; 2 = very much). Outcome Statement Survey Question O1 Demonstrate how to formulate and critique arguments using accepted scientific theory and data. I excel at formulating and critiquing arguments using accepted scientific theory and data. O2 Apply norms of communication, including speaking and writing that are accepted in the field of biology. I excel at talking and writing about biology to academic audiences through multiple modalities such as peer-reviewed publications, technical reports, and conference presentations O3 Read and synthesize primary literature within the field of biology. I would excel at a job that required me to synthesize primary literature in the field of biology O4 Demonstrate the ability to design, carry out, analyze and interpret results from experiments in biology. I would excel at a job that required me to design, carry out, and interpret results from biological experiments O5 Demonstrate expertise within a particular field of biology I would consider myself an expert in a particular area of biology O6 Demonstrate how to identify and pursue a career in biology. I am confident that I will find a job that allows me to apply what I learned in the master's program in biology

III. ASSESSMENT RESULTS/INFORMATION:

The five objectives were represented by five respective survey questions. Mean and standard deviation (SD) were calculated for each Likert scale (1 = not at all, 2 = somewhat, 3 = very much). Qualitative open-ended responses were used to help contextualize the survey responses and give additional information the department can use to make strategic and data-driven decisions.

The data show that students leave the MS program highly confident in their ability to conduct scientific argumentation (Outcome 1) and synthesize primary literature (Outcome 3). All respondents indicated "Very much" on these outcomes. The social competencies of communication (Outcome 2) and how to pursue a career in the biological sciences (Outcome 6) were also rated highly with a mean score of 1.8. The most difficult-to-meet outcomes were Outcomes 4 (experimental design and interpretation) and 5 (expertise in a particular biology field) which indicates that our master's graduates have lower levels of confidence when it comes to pursuing an independent program of study. A rating of "Very much" on

these objectives may be necessary for students who aspire to pursue a job in independent research or a doctoral program; in this sense, we consider the average rating of 1.3 on these to be promising. Table 2. Summary of self-reported mastery of the six Program Learning Outcomes for the MS Program in Biological Sciences. Rows are ordered from highest to lowest level of mastery.

Outcome Statement	Mean	SD
O1 Demonstrate how to formulate and critique arguments using accepted scientific theory and data.	2.0	0.0
O3 Read and synthesize primary literature within the field of biology.	2.0	0.0
O2 Apply norms of communication, including speaking and writing that are accepted in the field of biology.	1.8	0.5
O6 Demonstrate how to identify and pursue a career in biology.	1.8	0.5
O4 Demonstrate the ability to design, carry out, analyze and interpret results from experiments in biology.	1.3	0.5
O5 Demonstrate expertise within a particular field of biology	1.3	0.5

aScale is: 2=Very much, 1=Somewhat, 0=Not at all

The students generally spoke highly of their research experience in their master's program, and several of the students indicated that they produced publishable work from their participation in master's program. Regarding the research experience one student wrote: The research is very well supported, please continue funding and supporting research, I think Wright State does a great job in that. Regarding the research productivity this facilitates, one student stated: I will be working on a publication soon. Another stated: I changed my course of research after my first semester. I have learned statistical methods and softwares that were very new to me. I am very proud that I have wrote a manuscript that will hopefully be published! Students also reported feeling supported socially during their program. One student wrote: The support I have found here has truly been essential and a blessing. I started my master's not only to gain experience with research but because I was a little bit lost and was unsure of my future. The most obvious influence in helping me gain experience, build my confidence, and cement my path was my PI. My PI was not the only one, however. I truly felt that the faculty members I came across had my interest at heart and worked with me as much as possible to give me guidance. I got into the professional program I wanted partially because of what I learned as master's student. Thanks to all of the Bio faculty and staff! These students collectively indicated a desire for more specialized coursework and more course opportunities to support their research. In the words of one student: ...I think the Bio department would greatly benefit from having a course that completely revolves on R studio and applying it. Creating plots and doing statistical analyses in R studio is becoming the norm across all fields of biology. R is very convenient when you know how to use it but learning how to use it requires time and having someone who could not only explain how to use the basics of R but also how to apply it to data would be extremely beneficial. I've had some professors do basic introductions to R, but that technically wasn't part of the course it was just an extra thing they did. I think teaching students the current methods of statistical analyses, specifically within the bio field, and giving them a proper resource is important. I want to emphasize that I think it should be a bio applied course and should not be general statistical methods. Although there is a movement to relegate our quantitative courses to the Statistics department, this comment exemplifies the importance of the discipline-specificity of quantitative methods which only a biological sciences faculty member can address. Another student stated: I feel it would be nice to have more subject focused classes. Some of the classes we have to take are not very helpful and there are no alternative classes offered. In the words

of another student: Stop cutting budgeting to faculty and staff would be nice so classes don't get removed from catalog.

[Analysis]

IV. ACTIONS TO IMPROVE STUDENT LEARNING

Program learning outcome data will be shared with program faculty and staff at the department meetings. It will be shared with other stakeholders including faculty and staff in other departments and department sponsors upon request by these parties. Although ratings are well above the “1” level aligning with “Somewhat”, the data show that specific disciplinary expertise and confidence in conducting independent research need the most attention. More specialized upper-level coursework or research opportunities may be instrumental in helping students build more expertise in a particular area in biology and confidence in formulating testable questions and carrying out biological experiences. Keeping some of the research methods and quantitative coursework within the department may also help students improve these outcomes since these courses simultaneously help students build specific disciplinary expertise and improve the quality and presentation of their research to relevant audiences. Although these data represent students’ perceptions of their mastery as opposed to a performance-based measure, these responses reflect how graduates are likely to communicate with others about the quality of the Biological Sciences MS program and their satisfaction with the program. To this end, we will use these data to guide discussions of potential reforms taking into account other financial and resource constraints. Regarding the assessments for the upcoming year, the Assessment Committee will discuss strategies for improving the response rates which we hope will increase the representativeness of the sample. Although we cannot necessarily require completion of the survey for graduation, there may be other ways to incentivize participation, and revisions of the survey will focus on optimizing brevity and simplicity while also retaining our ability to extract informative data.

V. SUPPORTING DOCUMENTS

Additional documentation, when provided, is stored in the internal Academic Program Assessment of Student Learning SharePoint site.