

**Institutional Effectiveness
2022-2023**

Program: Biology MS

College and Department: College of Arts & Sciences

Contact: Chris Brown

Mission:

The primary mission of the Department of Biology at Tennessee Tech is to promote biological education in, and advance biological knowledge for, the region, state, and nation, through teaching, research, and public service.

Attach Curriculum Map (Educational Programs Only): *See Appendix 1.

PROGRAM OUTCOME 1: COMMAND OF SUBJECT MATTER

Define Outcome:

Master's students within the Department of Biology will demonstrate command of both general biological subject matter and more specialized information relative to their area of research interest by successfully passing their oral comprehensive exams, with all students passing this exam in no more than two attempts.

Assessment Methods:

Oral comprehensive exam and thesis defense. After completing the written thesis, all master's students meet with their thesis committee and are asked questions about the thesis and, following this, about general biological topics related or unrelated to their thesis topic. In order to pass, a majority of the committee must agree that the student has successfully answered a majority of questions. This information is recorded on a departmental thesis defense form.

Criteria for Success (Thresholds for Assessment Methods):

100% of students will successfully complete their oral comprehensive exams on either the first or second attempt.

Results and Analysis:

Over the past five academic years, all of our master's students who have reached the stage to defend their thesis and attempt their oral comprehensive exams have passed these on their first or (in one case) their second attempt. This meets the criterion we have set for this outcome. The number of students passing these exams has remained relatively constant over these years, ranging from 6 to 9 (Table 1).

Table 1. Number (*n*) of Master's students in the Department of Biology who successfully passed their oral comprehensive exam and thesis defense during the past five academic years.

Academic Year	<i>n</i>
2018-2019	8
2019-2020	6
2020-2021	7
2021-2022	9
2022-2023	7

Use of Results to Improve Outcomes:

We have created a rubric to try to better assess student knowledge in the comprehensive exams (one beyond just a simple pass/fail metric), but have yet to use it on a consistent basis. The goal for the upcoming year is to make use of this rubric for our comprehensive exams, and see if it proves useful or still needs some refinement.

PROGRAM OUTCOME 2: PRESENTATION OF RESEARCH

Define Outcome:

Master's students in the Department of Biology will report on their research efforts (the final stage of the scientific method) via presentations, either oral reports or posters, at regional, state, national, or international meetings, with at least 50% of students having at least one presentation prior to graduation.

Assessment Methods:

On their annual reports, faculty are asked to list poster and oral presentations in which they are coauthors with their graduate students.

As part of a master's student exit questionnaire, students will be asked for information on presentations, including type (oral or poster); number; type of meeting (regional, state, national, international); and whether the presentation was related to their thesis or to another (side) project/

Criteria for Success (Thresholds for Assessment Methods):

50% of graduating master's students will indicate that they presented their research in poster or oral form.

Results and Analysis:

Our goal of having at least 50% of master's students present research at scientific meetings (in the form of oral or poster presentations) has not been reached for any of the past five years, although it was close in 2021-2022 (Table 2). However, each year in this table is likely an undercount, as not all faculty list graduate student presentations on their annual reports. We

hope to get better estimates starting in 2023 by using graduate student survey forms each semester. Despite not reaching our goals, in three of the five years presentations have been done by at least ~30% of our master's students, and one year where the value was especially low occurred during the COVID pandemic, when opportunities to present were essentially absent for much of that academic year.

Table 2. Number of Biology Department master's students presenting their research at scientific meetings (# Presenting), total number of Biology master's students (Total), and percentage of master's students presenting their research at scientific meetings (Percentage) for each of the past 5 academic years.

Academic Year	# Presenting	Total	Percentage
2018-2019	4	19	21.1
2019-2020	7	24	29.1
2020-2021	4	28	14.3
2021-2022	12	25	48.0
2022-2023	7	23	30.4

Use of Results to Improve Outcomes:

One goal is to develop a better way to assess this, ideally directly from the graduate students rather than indirectly through their advisors' annual activity reports. We do not have a clearly identified method as of yet; it could be a yearly questionnaire given to graduate students, or a fillable file where they can post each time they make a presentation.

PROGRAM OUTCOME 3: GRADUATE STUDENT DIVERSITY

Define Outcome:

The Master's program in the Department of Biology will seek diversity amongst students by having a minimum of 15% of graduate students be from minority-identifying groups and 50% of graduate students be female, as determined by department enrollment information.

Assessment Methods:

Percentage of students in minority-identifying groups and percentage of female students will be obtained from enrollment data provided by the Office of Institutional Assessment, Research, and Effectiveness (IARE).

Criteria for Success (Thresholds for Assessment Methods):

A minimum of 15% of students in the Biology master's program will come from minority groups, and a minimum of 50% of master's students will be female, as determined by data from IARE.

Results and Analysis:

The percentage of minority students in the Biology master's program has remained low over the past five years, and we have been unable to reach our goal of 15% minority student composition for any of these years. We have typically had just 1-2 minority-identifying students in a given year.

Over the past two years the percentage of female students in the Biology master's program has exceeded our goal of having 50% of the graduate program students be female. This came after three consecutive years where we had failed to reach that goal, although the percentage of female students never dropped below one-third.

Table 3. Percent of graduate students in the Master's program of the Department of Biology who identify as a minority or as female. Data are determined at the start of the Fall semester of each year listed.

Year	Minority Students (%)	Female Students (%)
2018	0.0	42.1
2019	4.2	33.3
2020	7.1	39.3
2021	4.0	56.0
2022	4.4	56.5

Use of Results to Improve Outcomes:**PROGRAM OUTCOME 4: INCREASED GRADUATE ENROLLMENT****Define Outcome:**

The Department of Biology will seek to grow enrollment in the Master's program by 25% over the next 5 years, through mechanisms such as increased external grant support, increased teaching assistantships, or new program initiatives.

Assessment Methods:

Graduate enrollment data is tracked by the Registrar's Office and the Office of Institutional Assessment, Research, and Effectiveness, and will be tracked on a yearly basis.

Criteria for Success (Thresholds for Assessment Methods):

Comparison of enrollment in the master's program between 2023 and 2028 will show a 25% overall increase in number of students.

Results and Analysis:

After several years of trending upwards (from 2018-2020), enrollment in the Biology master's program has trended downwards each of the past two years (Table 4). Our goal is to increase enrollment over the next 5 years by 25%, or to approximately 29 master's students. This would be similar to what was seen in Fall 2020, and seems possible given the three recently-hired faculty members in our department and the general trend toward increased grant support among our faculty.

Table 4. Number (*n*) of students enrolled in the Master's degree program in the Department of Biology. Data represent counts taken at the start of each of the past 5 Fall semesters.

Year	<i>n</i>
2018	19
2019	24
2020	28
2021	25
2022	23

Use of Results to Improve Outcomes:

Last year was our first year with a full faculty (no open lines) in roughly a decade. As long as we maintain this, grantsmanship should continue to increase, and that in turn should lead to an increase in graduate RAs.

Summative Evaluation:

Outcome 1: We have developed a new rubric for use during the oral comprehensive exams/thesis defense but have not used this on a consistent basis. The plan for this academic year is to do this and make any modifications that we feel are necessary based on the outcomes from this year.

Outcome 2: We have assessed master's students' presentations at meetings indirectly, through the annual reports of their supervising professors. We would like to assess this more directly and are working on a way to get this information consistently directly from the graduate students. Some type of questionnaire/reporting document will likely be developed, to be given to students at the end of each of the Fall and Spring semesters (and summer, if needed).

Assessment Plan Changes:

None

Appendix 1: Curriculum support for learning outcomes of the graduate program in the Department of Biology. Several courses are dual-listed under both BIOL (Biology) and WFS (Wildlife and Fisheries Sciences); these are listed here under BIOL only.

Course No.	Title	Learning Outcomes		
		Demonstrate Knowledge	Extra-curricular Activities	Scientific Method
BIOL 5000	Parasitology	X		
BIOL 5040	Immunology	X		
BIOL 5060	Hormones & Chem. Comm.	X		
BIOL 5070	Vertebrate Development	X		X
BIOL 5100	Evolutionary Biology	X		X
BIOL 5110	Microbial Evolution	X		X
BIOL 5120	Protozoology	X		
BIOL 5130	Environmental Microbiology	X		X
BIOL 5140	Pathogenic Bacteriology	X		X
BIOL 5150	Molecular Genetics	X		
BIOL 5160	Genetic Engineering Lab	X		
BIOL 5170	Pop. & Conservation Genetics	X		X
BIOL 5220	Biostatistics	X		X
BIOL 5230	Animal Behavior	X		X
BIOL 5300	Plant Speciation & Evolution	X		
BIOL 5310	Plant Anatomy	X		
BIOL 5320	Plant Physiology	X	X	X
BIOL 5330	Plant Ecology	X		X
BIOL 5340	Plant-Animal Interactions	X	X	
BIOL 5610	Invertebrate Zoology	X		X
BIOL 5630	Ornithology	X		X
BIOL 5650	Marine Biology	X		X
BIOL 5750	Medical Microbiology	X		
BIOL 5780	Phycology	X		X
BIOL 5810	Ichthyology	X	X	X
BIOL 5820	Mammalogy	X		X
BIOL 5830	Herpetology	X		X
BIOL 5840	Limnology	X		X
BIOL 5850	Applied Microbiology	X		X
BIOL 5860	Disease Prevention	X		
BIOL 6140	Fish & Wildlife Biometrics	X		X
BIOL 6150	Reservoir Fisheries Mgmt.	X		X
BIOL 6600	Microbial Ecology	X		X
BIOL 6630	Animal Ecology	X		X
BIOL 6660	Fish Ecology	X	X	X
BIOL 6670	Stream Ecology	X		X
BIOL 6680	Malacology	X		X

Appendix 1, continued

BIOL 6810	Ecological Ordination	X		X
BIOL 6930	Seminar	X	X	X
BIOL 6990	Research and Thesis	X		X
EVS 7800	Prof. Development for Doctoral Students		X	
EVS 7900	Scientific Writing & Grantsmanship	X		
EVSB 6010	Environmental Biology	X	X	X
EVSB 7110	Environmental Approaches to Fish Management	X		X
EVSB 7120	Endangered Species Biology	X		X
EVSB 7130	Wetlands Ecology	X		X
EVSB 7140	Wildlife & Fisheries Nutrition	X		X
EVSB 7150	Pop. & Community Ecology	X		X
EVSB 7230	Molecular Ecology and Evolution	X		X
WFS 5500	National Wildlife Policy	X	X	X
WFS 5640	Waterfowl Ecology & Mgmt.	X		X
WFS 5660	Wild Bird Ecology	X		
WFS 5670	Wild Mammal Ecology	X		
WFS 5700	Habitat Management			X
WFS 5710	Fisheries Management			X
WFS 5711	Fisheries Management			X
WFS 5730	Conservation Biology		X	X
WFS 5740	Wildlife Principles	X		X
WFS 5760	Fish Culture		X	
WFS 5770	Nongame Species Mgmt.	X	X	
WFS 5870	GIS for Wildlife & Fisheries	X		