Institutional Effectiveness
2024-2025

Program: Biology MS
College and Department: College of Arts & Sciences, Biology
Contact: Steve Hayslette
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):
Attached Files: See Appendix 1

Student Learning 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.

Link to 'Tech Tomorrow' Strategic Plan:
2.B Research, Scholar, Intellect, and Creativity

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 criteria we have set for this outcome.
The number of students passing these exams has remained relatively constant over these years, generally ranging from 7 to 9, although somewhat fewer students defended their thesis in this most recent year (Table 1).

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

Academic Year	*n*
2020-2021	7
2021-2022	9
2022-2023	7
2023-2024	9
2024-2025	5

Use of Results to Improve Outcomes:

We are delighted that our graduate students have had such success in passing their thesis defense exams. We will continue to recruit well-qualified graduate students and provide high-quality mentorship for those students.

Student Learning 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 state, regional, national, or international meetings, with at least 50% of students having at least one presentation each year.

Assessment Methods:
Prior to 2024-2025, we used information regarding M.S. student presentations gleaned from faculty annual reports, in which faculty were asked to list posters and oral presentations in which they were coauthors with their graduate students.

Beginning in 2024-25, we're conducting annual surveys of our M.S. students during the spring semester. In those surveys, we ask students to list oral and/or poster presentations for the year, along with the type of presentation (oral or poster) and scope of meeting (regional, state, national, international). This data should give us a direct, more accurate count of the presentations made by our students. We'll corroborate these estimates using data from faculty annual reports, as in previous years.

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.

Link to 'Tech Tomorrow' Strategic Plan:
2.B Research, Scholar, Intellect, and Creativity,4.C Network of Scholars

Results and Analysis:
We've met our goal of having at least 50% of master's students present research at scientific meetings (in the form of oral or poster presentations) for the last two years (Table 2), as 64% and 52% of our M.S. students made at least one scientific presentation in 2023-24 and 2024-25, respectively. Prior to that year, the closest we came to our target was in 2021-2022, when 48% made presentations. However, we've suspected that the estimates for previous years were undercounts, as not all faculty listed graduate student presentations on their annual reports. The shift to using M.S. student annual reports as our primary data source likely has led to more complete documentation of graduate student presentations, and the shift to generation of faculty annual reports (our secondary data source) in Watermark this year may have helped, as well. Additionally, a greater emphasis on research, in general, among our

younger faculty mentors may have led to relatively high numbers of graduate student presentations, as well.

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
2020-2021	4	28	14.3
2021-2022	12	25	48.0
2022-2023	7	23	30.4
2023-2024	16	25	64.0
2024-2025	15	29	51.7

Use of Results to Improve Outcomes:

We're pleased that our latest annual count of graduate student presentations indicates that students are exceeding our goal for the program. We hope that continued emphasis on increasing research productivity among our younger faculty will lead to future increases in presentations, as well. In Spring 2025, we organized our second annual Student Research Symposium in conjunction with the School of Environmental Studies. This event gives our graduate students practice and experience presenting to a scientific audience and hopefully makes them more likely to present at other scientific meetings. Given the fact that we've achieved our goal relative to scientific presentations by our graduate students two years in a row, and never previously, the Colloquium seems to be having the desired effect, and we plan to continue it in the future. It should be noted that participation in our Colloquium did *not* qualify as presenting at a scientific meeting.

Program Outcome 1: 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.

Link to 'Tech Tomorrow' Strategic Plan:
2.B Research, Scholar, Intellect, and Creativity,4.B Programs, Certificates, and Training

Results and Analysis:
Enrollment in the Biology master's program dipped from a high of 28 to a low of 23 halfway through this cycle (2022-23) but has since rebounded to 28 students in the most recent year. Our goal is to increase enrollment over the next 5 years by 25%, to approximately 30 master's students, and we're close to meeting that goal already. Further increases in graduate enrollment seem possible given the three recently hired faculty members in our department, the three possible new hires, 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 represents counts taken at the start of each of the past 5 Fall semesters.

Year	*n*
2020	28
2021	25
2022	23
2023	25
2024	28

Use of Results to Improve Outcomes:

Over the last four years, our department has hired three new faculty members, and we currently are attempting to hire three more to fill recent vacancies. A number of our recently hired faculty members have active research programs and external grant funding, making growth in our Biology M.S. program likely. Additional recruiting efforts at scientific meetings (hopefully) will help to increase our graduate student numbers, as well.

Summative Evaluation:

Student Learning Outcome 1: We once again met our goal relative to this outcome. We will continue to recruit well-qualified graduate students and provide high-quality mentorship for those students.

Student Learning Outcome 2: We met our goal relative to this outcome for the second year in a row. We began using annual surveys of our M.S. students this past year to better quantify numbers of students making oral and/or poster presentations during the year. We corroborate these estimates using data from faculty annual reports, as in previous years.

Program Outcome 1: We're making progress toward our goal here but haven't reached it yet. New, research-active faculty in the department and new external grant funding will help us grow our Biology M.S. program. Additional recruiting efforts at scientific meetings (hopefully) will help to increase our graduate student numbers, as well.

Assessment Plan Changes:

Student Learning Outcome 1: None.

Student Learning Outcome 2: We'll continue using our annual survey of our M.S. students to quantify student presentations, corroborated using data from faculty annual reports.

Program Outcome 1: None.

List of Appendices:

Appendix 1: Biology MS Curriculum Map

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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	Subject Matter Command	Presentation of Research
BIOL 5000	Parasitology	X	
BIOL 5040	Immunology	X	
BIOL 5060	Hormones & Chem. Comm.	X	
BIOL 5070	Vertebrate Development	X	
BIOL 5100	Evolutionary Biology	X	
BIOL 5110	Microbial Evolution	X	
BIOL 5120	Protozoology	X	
BIOL 5130	Environmental Microbiology	X	
BIOL 5140	Pathogenic Bacteriology	X	
BIOL 5150	Molecular Genetics	X	
BIOL 5160	Genetic Engineering Lab	X	
BIOL 5170	Pop. & Conservation Genetics	X	
BIOL 5220	Biostatistics	X	
BIOL 5230	Animal Behavior	X	
BIOL 5240	Systematic Botany	X	
BIOL 5250	Economic Botany	X	
BIOL 5300	Plant Speciation & Evolution	X	
BIOL 5310	Plant Anatomy	X	
BIOL 5320	Plant Physiology	X	X
BIOL 5330	Plant Ecology	X	
BIOL 5340	Plant-Animal Interactions	X	X
BIOL 5610	Invertebrate Zoology	X	
BIOL 5630	Ornithology	X	
BIOL 5650	Marine Biology	X	
BIOL 5750	Medical Microbiology	X	
BIOL 5780	Phycology	X	
BIOL 5810	Ichthyology	X	X
BIOL 5820	Mammalogy	X	
BIOL 5830	Herpetology	X	
BIOL 5840	Limnology	X	
BIOL 5850	Applied Microbiology	X	
BIOL 5860	Disease Prevention	X	
BIOL 5870	Microbiomes	X	
BIOL 5880	Bioethics	X	
BIOL 5890	Histology	X	
BIOL 6100	Advanced Microscopy		
BIOL 6140	Fish & Wildlife Biometrics	X	
BIOL 6150	Reservoir Fisheries Mgmt.	X	

Appendix 1: Biology MS Curriculum Map, cont.

BIOL 6600	Microbial Ecology	X	
BIOL 6630	Animal Ecology	X	
BIOL 6640	Stream Ecology	X	X
BIOL 6660	Fish Ecology	X	
BIOL 6680	Malacology	X	
BIOL 6810	Ecological Ordination	X	
BIOL 6930	Seminar	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
EVSB 7110	Environmental Approaches to Fish Management	X	
EVSB 7120	Endangered Species Biology	X	
EVSB 7130	Wetlands Ecology	X	
EVSB 7140	Wildlife & Fisheries Nutrition	X	X
EVSB 7150	Pop. & Community Ecology	X	
EVSB 7230	Molecular Ecology and Evolution	X	
EVSB 7990	Research and Dissertation	X	X
WFS 5500	National Wildlife Policy	X	X
WFS 5640	Waterfowl Ecology & Mgmt.	X	
WFS 5660	Wild Bird Ecology	X	
WFS 5670	Wild Mammal Ecology	X	
WFS 5700	Habitat Management		
WFS 5710	Fisheries Management		
WFS 5711	Fisheries Management		
WFS 5730	Conservation Biology		X
WFS 5740	Wildlife Principles	X	
WFS 5760	Fish Culture		X
WFS 5770	Nongame Species Mgmt.	X	X
WFS 5870	GIS for Wildlife & Fisheries	X	