

## Institutional Effectiveness

2018-2019

**Program:** Biology BS

**College and Department:** College of Arts & Sciences/Department of Biology

**Contact:** Christopher 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.

The Department of Biology has three degree programs (B.S. in Biology, B.S. in Wildlife and Fisheries Science, and M

### **Student Learning Outcomes:**

SLO 1: Undergraduate Biology majors will demonstrate improved critical thinking skills.

Our goal is for students to meet or exceed the national average score on the California Critical Thinking Skills Test (CCTST).

SLO 2: Biology majors will participate in extracurricular activities related to their discipline.

Our goal is to have at least 25% of all Biology majors participate in extracurricular activities related to their discipline.

SLO 3: All students completing a degree in Biology at Tennessee Tech University will use scientific reasoning as codified by the structured process commonly known as the scientific method.

Our goal is to have all graduating seniors obtain a perfect score (100% correct answers) on the departmental Scientific Method Questionnaire.

SLO 4: Biology majors will be able to demonstrate a command of general biology concepts and the general principles in various specific areas of biology.

Our goal is to have our students perform above average in the TAMU Major Field Examination.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

### **Assessment Methods:**

*PG 1: Increase the percentage of students completing a co-op,*



The NSSE report changed how data are categorized from 2011 to 2014. As a result, the results provided for 2014 combines Biology with Biochemistry or biophysics, Biomedical science, Botany, Cell and molecular biology, Chemistry; Earth science (including geology), Marine science, Mathematics, Microbiology bacteriology, Natural science, Other biological sciences, Physical sciences (general), Physics, and Zoology. Therefore, the comparisons are not necessarily representative of Biology alone

*SLO 2:*



builds on techniques or information learned during the previous week. All of our majors must complete a group research project as part of the BOL 3920 course and present their findings and interpretations in a written and oral format. There have also been attempts at doing a flipped classroom in several courses over the past several semesters. Thus, what we are doing is a

*PG 3: Increase undergraduate retention*

The Department of Biology has monitored enrollment trends for several years and used these trends to develop strategies to meet this goal (Table 5). Although enrollment was not viewed as a concern by the department in 2018 in order to maintain a perspective on retention, enrollment data are included. In Fall 2014 and 2015, enrollment reached a high of 345 and declined to 285 in the fall of 2017 before rising slightly in 2018 (an increase of ~3%). Health Sciences Biology is the most popular concentration in the department, representing approximately 23% of all Biology majors, although enrollment in the Cellular/Molecular concentration is increasing and edging nearer to the enrollment in Health Sciences biology. As we have for several years, our departmental retention rate falls below the University average.

Table 5. Number of students enrolled as Biology majors and freshman fall retention rates (percent) for undergraduates within the Department of Biology and Tennessee Tech University.

Fall	Enrollment– Biology	Retention– Biology	Retention– TTU
2014	345	87.8	90.6
2015	345	82.1	91.9
2016	316	86.3	92.4
2017	285	84.7	90.3
2018	294	86.4	91.3

*PG 4: Increase diversity*

On-going evaluation of departmental efforts towards meeting diversity objectives indicated that a slow increase in minority students occurred in the B.S. Biology degree program the last five years.



these learning outcomes important by ranking the classes a “4” or “5” (Student Learning Outcome 1). To provide a more meaningful understanding of how students perceive if the goals are being met, the number of courses that students rated at least 50% of the time with a “4” or “5” was calculated. Based on these results (Table 7) it appears that during this last academic year, the percent of sections that were rated by students where substantial or exceptional progress was made increased slightly all three categories compared to the previous year, although values are still below those seen from 2014 to 2017.

Table 7. Percent of Unit courses that undergraduate Department of Biology students rate more than 50% of the time with a “4” or “5” in the “Progress Towards Goals” categories for teamwork, communication, and critical thinking over the last five years.

YEAR	TEAMWORK	COMMUNICATION	CRITICAL-THINKING
2014-2015	100%	82.4%	

*SLO 3: Use scientific reasoning*

Scientific Method Exam Student understanding of the scientific method, as assessed using the

## Modifications for Improvement:

*PG 1: Increase the percentage of students completing a co-op, internship, or study abroad*

Biology majors increased from 2.1% participation to 3.0% internships during the 2018-2019 academic year. Although this was a slight increase in participation, it does not represent a significant numerical change, as we still have typically only one or two biology majors take part in internships.

The department continues to administer the student questionnaire to graduating Biology majors to assess Program Goal 1 and evaluates the percentage data for participation in internship and co-op assignments on an annual basis. Due to low participation by Biology majors, departmental faculty post opportunities for Biology majors on the internship board, announce opportunities in classes, and forward e-mail announcements pertaining to internships and co-ops to students.

*PG 2: Increase the incorporation of active-learning strategies in courses offered*

Faculty members will continue using their current approach to teaching including active learning strategies in courses, given that 95% Biology faculty members included active learning strategies in their courses during the 2018-2019 academic year. The department plans to assess the percentage of courses using active learning strategies again during the 2019 academic year.

Although the department has not conducted active-learning workshops, we are interested in this approach. Our data indicate that other than during 2006-2007 when this goal was added and we had 12 of 14 faculty members participating, we have maintained a relatively steady number of faculty members participating in active-learning workshops. All newly hired faculty members have been paired with mentors and have participated in active-learning workshops. More than 75% of faculty members incorporated active-learning strategies into their courses. This indicated that we have achieved our goal every year during the last five years that this goal has been monitored. One area for improvement could be increased participation by tenured faculty, as currently the majority of those attending active learning instruction are tenured. (9-38. (o)-9.6 (u(e)-3 (n)6 (r ))Tv)ou arsre



## Appendix 1: Biology BS Curriculum Map

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Course No.	Title	Learning Outcomes		
		Critical Thinking	Extra-curricular Activities	Scientific Method

BIOL 4610	Invertebrate Zoology	X	X	X
BIOL/WFS 4630	Ornithology	X		X
WFS 4640	Waterfowl Ecology & Mgt.	X		X
BIOL/WFS 4650	Marine Biology	X	X	X
WFS 4660	Wild Bird Ecology			X
WFS 4670	Wild Mammal Ecology			X
WFS 4700	Habitat Management	X		

Appendix 2: Senior Questionnaire

**GRADUATING SENIOR  
QUESTIONNAIRE**

**Department of Biology**

1. **Activities** - Please check any of the extracurricular activities in which you participated during your program at Tennessee Tech, and briefly indicate if you felt that ~~activities~~ <sup>activities</sup> contributed to your academic development.

- Beta Beta Beta active member
- Chem-Med Club active member
- Student Fisheries Association active member
- Wildlife Society active member
- Internship (BIOL/WFS 4900)
- Special topics (BIOL/WFS 4990)
- Attended one or more professional meetings
- Attended special seminars or talks
- Attended departmental sponsored activities not class related

Do you believe that your participation in these activities contributed to your academic development? If so, how? (Please leave this section blank if you did not participate in any of the above activities).

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### Appendix 3: Scientific Method Questionnaire

#### Scientific Method Questionnaire

Please select the response that best completes the sentence or answers the question.

\_\_\_\_\_ 1. \_\_\_\_\_, in which the experimental variable has been omitted, are used in research as standards of comparison against which experimental data are compared.

- A. Theories    B. Controls    C. Hypotheses    D. Observations    E. Replicates

\_\_\_\_\_ 2. A \_\_\_\_\_ is a tentative answer to a research question, which will be evaluated using an experiment.

- A. Theory    B. Control    C. Hypothesis    D. Experiment    E. Law

\_\_\_\_\_ 3. \_\_\_\_\_ is the use of multiple observations in a study.

- A. Hypothesis    B. Control    C. Theory    D. Experiment    E. Replication

\_\_\_\_\_ 4. True (A) or False (B): Science is knowledge obtained by observation.

\_\_\_\_\_ 5. True (A) or False (B): A theory is a very tentative idea with little or no scientific evidence to support it.

\_\_\_\_\_ 6. True (A) or False (B): Publishing results in a peer-reviewed journal is an important part of the scientific process.

Does oatmeal really reduce bad cholesterol? You decide to try to answer this question. You predict that people who eat oatmeal 5 times a week for a month will have lower cholesterol than those who don't. You select 10 people, 5 of whom you put on this oatmeal diet, and 5 of whom you don't. At the end of the month, you measure cholesterol in all 10 people.

\_\_\_\_\_ 7. The statement "Oatmeal reduces bad cholesterol levels" is the \_\_\_\_\_ of this research.

\_\_\_\_\_ 8. Using more than 1 person in each group illustrates the concept of \_\_\_\_\_.

\_\_\_\_\_ 9. Using a group of people who do not eat oatmeal illustrates the concept of \_\_\_\_\_.

- A. Observation    B. Control    C. Hypothesis    D. Experiment    E. Replication

Please arrange the following steps of the scientific method in the correct order.

\_\_\_\_\_ design an experiment

\_\_\_\_\_ make observations

\_\_\_\_\_ publish results

\_\_\_\_\_ formulate research hypothesis

\_\_\_\_\_ draw conclusions

\_\_\_\_\_ collect data