Definition of Unit
Department of Biology Mission and Definition
Reporting Year:

Providing Department:
Biology BS

Department/Unit Contact:
Christopher Brown

Mission/Vision/Goal Statement:

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.S. in Biology). Each degree program has a separate report. Program Goals and Student Learning Outcomes for the undergraduate programs are similar since Wildlife and Fisheries Science is applied Biology; however, assessment results differ for most goals and outcomes based on the assessment techniques used. The graduate program has a unique set of goals and learning outcomes.

This section contains the BS program in Biology.

Academic Curriculum Map
Academic Curriculum Map
Curriculum Mapping :

Table 16. Curriculum support for learning outcomes of the undergraduate programs in the Department of Biology.

		Learning Outcomes			
Course No.	Title	Critical Thinking	Extra-curricular Activities	Scientific Method	Demonstrated Knowledge
BIOL 1000	Intro. to Biol. Mthd.	X	X	X	
BIOL 1010	General Biology I	X		X	X
BIOL 1020	General Biology II	X		X	X
BIOL 1105	Founds. of Biology	X		X	X
BIOL 1114	General Zoology	X			X
BIOL 1310	Conc. of Biol. & Env. Sci.	X	X	X	X
BIOL 2010	Human Anat. & Phys. I	X		X	X
BIOL 2020	Human Anat. & Phys. II	X		X	X
BIOL 2110	General Botany	X	X		X
BIOL 2350	Intro. Anat. & Phys.	X			X
BIOL/WFS 2991-4	Topics				X
BIOL 3040	Comparative Vert. Anat.	X			X
BIOL 3120	General Ecology (no lab)	X		X	X
BIOL/WFS 3130	General Ecology	X		X	X
BIOL 3140	Cellular Biology	X	X	X	X
BIOL 3200	General Microbiology	X		X	X
BIOL 3230	Health Science Microbiol.	X		X	X
BIOL 3240	Field Botany	X		X	X
BIOL 3330	Entomology				X
WFS/CJ 3500	Wildlife Law Enforcement		X		X
BIOL 3530	Animal Physiology	X			X
BIOL 3700	Medical Humanism	X			X
BIOL 3810	General Genetics	X		X	X
BIOL 3920	Biol. Comm. Skills	X	X	X	X
BIOL 4000	General Parasitology	X			X
BIOL 4040	Immunology	X			X
BIOL 4060	Hormones/Chem. Comm.	X			X
BIOL 4100	Evolutionary Biology	X	X	X	X
BIOL 4130	Enviro. Microbiology	X		X	X
BIOL 4150	Molecular Genetics	X			X
BIOL 4160	Genetic Engineering Lab				X
BIOL/WFS 4220	Biostatistics	X		X	X
BIOL/WFS 4230	Animal Behavior	X			X
BIOL 4320	Plant Physiology	X	X	X	X
BIOL 4330	Plant Ecology	X		X	X
WFS 4500	National Wildlife Policy	X			X
BIOL 4610	Invertebrate Zoology	X		X	X
BIOL/WFS 4630	Ornithology	X			X
WFS 4640	Waterfowl Ecology & Mgt.	X			X

New Academic Curriculum Map Item

Curriculum Mapping :

Table 16. Curriculum support for learning outcomes of the undergraduate programs in the Department of Biology.

		Learning Outcomes			
Course No.	Title	Critical Thinking	Extra-curricular Activities	Scientific Method	Demonstrated Knowledge
BIOL 1000	Intro. to Biol. Methods	X	X	X	
BIOL 1010	Introduction to Biology	X		X	X
BIOL 1020	Diversity of Life	X		X	X
BIOL 1080	Concepts of Biology	X	X	X	X
BIOL 1113	General Biology I	X		X	X
BIOL 1123	General Biology II	X			X
BIOL 2010	Human Anat. & Phys. I	X		X	X
BIOL 2020	Human Anat. & Phys. II	X		X	X
BIOL 2310	General Botany	X	X		X
BIOL 2350	Intro. Anat. & Phys.	X			X
BIOL/WFS 2991-4	Topics				X
BIOL 3040	Comparative Vert. Anat.	X			X
BIOL 3120	General Ecology (no lab)	X		X	X
BIOL/WFS 3130	General Ecology	X		X	X
BIOL 3140	Cellular Biology	X	X	X	X
BIOL 3200	General Microbiology	X		X	X
BIOL 3230	Health Science Microbiol.	X		X	X
BIOL 3240	Field Botany	X		X	X
BIOL 3330	Entomology				X
WFS/CJ 3500	Wildlife Law Enforcement		X		X
BIOL 3530	Animal Physiology	X			X
BIOL 3700	Humanism in Medicine	X			X
BIOL 3810	General Genetics	X		X	X
BIOL 3920	Biol. Comm. Skills	X	X	X	X
BIOL 4000	General Parasitology	X			X
BIOL 4040	Immunology	X			X
BIOL 4060	Hormones/Chem. Comm.	X			X
BIOL 4100	Evolutionary Biology	X	X	X	X
BIOL 4130	Enviro. Microbiology	X		X	X
BIOL 4140	Pathogenic Bacteriology	X			X
BIOL 4150	Molecular Genetics	X			X
BIOL 4160	Genetic Engineering Lab				X
BIOL/WFS 4220	Biostatistics	X		X	X
BIOL/WFS 4230	Animal Behavior	X			X
BIOL 4320	Plant Physiology	X	X	X	X
BIOL 4330	Plant Ecology	X		X	X
WFS 4500	National Wildlife Policy	X			X
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		X	X
WFS 4710	Fisheries Management	X		X	X
WFS 4711	Fisheries Mgmt. (no lab)	X			X
WFS 4730	Conservation Biology	X	X	X	X
WFS 4740	Wildlife Principles	X			X
BIOL 4750	Medical Microbiology	X			X
WFS 4760	Fish Culture	X	X		X
WFS 4770	Nongame Species Mgmt.	X	X		X
BIOL 4780	Phycology	X		X	X
WFS 4790	Wildlife Techniques	X	X	X	X
BIOL/WFS 4810	Ichthyology	X	X		X
BIOL/WFS 4820	Mammalogy	X	X		X
BIOL/WFS 4830	Herpetology	X	X		X
BIOL/WFS 4840	Limnology	X		X	X
BIOL 4850	Applied Microbiology	X		X	X
BIOL/WFS 4900	Internship				X
BIOL/WFS 4991-4	**Advanced Topics**	X	X		X

Goal/Objective/Outcome

Program Goal 1

Define Goal:

Program Goal 1: Increase the percentage of students in the Biology major who complete a cooperative program (“co-op”), experiential internship, and/or study abroad during their undergraduate years.

Intended Outcomes / Objectives:

Goal 1 - The goal is to have 10% of students in the Biology major complete one or more cooperative program ("co-op"), experiential internship, or study abroad opportunity during the time they are an undergraduate.

Program Goal 2

Define Goal:

Program Goal 2: Faculty in the Department of Biology will increase the incorporation of active-learning strategies in courses offered.

Intended Outcomes / Objectives:

Goal 2 - All departmental faculty members are expected to receive pedagogical training in active-learning techniques and strategies during their first 3 years of employment. We would like at least 75% of Department of Biology faculty to incorporate active-learning/critical-thinking strategies into their individual courses to improve the reasoning ability of our students.

Program Goal 3

Define Goal:

Program Goal 3: The Department of Biology will increase undergraduate retention.

Intended Outcomes / Objectives:

Goal 3 - Our goal is to increase the retention rate so that it equals or exceeds that of the university's average rate of retention.

Program Goal 4

Define Goal:

Program Goal 4: The Department of Biology will make significant progress toward increasing diversity.

Intended Outcomes / Objectives:

Goal 4 - The Department of Biology will make significant progress toward desegregation and affirmative action objectives.

Student Learning Outcome 1

Define Goal:

Student Learning Outcome 1: Undergraduate Biology majors will demonstrate improved critical thinking skills.

Intended Outcomes / Objectives:

Student Learning Outcome 1 - Our goal is for departmental faculty to select critical thinking as an important or essential component of a course on 50% of IDEA course evaluations.

Student Learning Outcome 2

Define Goal:

Student Learning Outcome 2: Biology majors will participate in extracurricular activities related to their discipline.

Intended Outcomes / Objectives:

Student Learning Outcome 2 - Our goal is to have at least 25% of all Biology majors participate in extracurricular activities related to their discipline.

Student Learning Outcome 3

Define Goal:

Student Learning Outcome 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.

Intended Outcomes / Objectives:

Student Learning Outcome 3 - Our goal is to have a success rate of 100% on the departmental Scientific Method Questionnaire for graduating seniors.

Student Learning Outcome 4

Define Goal:

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

Intended Outcomes / Objectives:

Student Learning Outcome 4 - Our goal is to have our students perform above average in the ACAT Major Field Examination.

Assessment Tools

Assessment - Goal 1

Goal/ Outcome/ Objective:

Cooperative programs (“co-ops”) or experiential internships will be completed by at least 10% of BIOL students during their undergraduate years.

Type of Tool:

Survey

Frequency of Assessment:

Each semester

Rationale:

Graduating seniors are asked to complete a short **Senior Questionnaire** (Appendix 1) concerning extracurricular activities at the time they take their major field exam, including an

assessment of how valuable they considered the experiences. One of the questions on the questionnaire is devoted specifically to internships and co-ops. The departmental chair tracks student internship participation rates through time. The goal is assessed by determining if 10% of Biology students complete cooperative programs ("co-ops") or experiential internships during their undergraduate years. The departmental Planning Committee, consisting of five departmental faculty members selected by the department chairperson, continually revises the senior questionnaire to provide more detailed information about activities that are most valuable to undergraduate students. Results from the Senior Questionnaire are compared with data from the **National Survey of Student Engagement (NSSE)**. The NSSE was given Spring semesters 2006, 2009, 2011, 2014. The NSSE assesses students' abilities to work as a team, communicate, and critically think. These values will be compared to data from the senior questionnaire and results from IDEA evaluation reports.

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

Assessment - Goal 2

Goal/ Outcome/ Objective:

The Department of Biology will increase the incorporation of active-learning strategies in courses offered.

Type of Tool:

Annual Unit Report,Peer Assessment

Frequency of Assessment:

Each semester.

Rationale:

Faculty Annual Report. Conducted annually each Spring semester. Each faculty member submits a Faculty Annual Effort report to the chairperson that discusses their efforts for the previous calendar year. The departmental chair tracks the number of faculty participating in active-learning training and mentoring, and the incorporation of active learning/critical thinking strategies by gleaning such information from these reports.

The department chair discusses each individual faculty member's progress as summarized in **Faculty Annual Reports**. Active-learning is assessed by determining the number of Department of Biology faculty that enhance their knowledge of active-learning teaching approaches by participating in on- or off-campus training and development workshops devoted to such approaches. In addition, 100% of new Department of Biology faculty are paired with a faculty mentor who has experience with active-learning techniques in the classroom during their first year of employment. On-going progress on active learning/critical thinking implementation is summarized and included in the Departmental Annual Report submitted by the chair to the Dean of the College of Arts and Sciences.

IDEA Evaluation Reports. IDEA Evaluations are administered in each class during Fall and Spring semesters. All faculty are asked to have IDEA Evaluation Forms completed for their respective classes at the end of each semester. Faculty are encouraged to integrate active learning/critical thinking techniques into course objectives.

California Critical Thinking Test (CCTST). The California Critical Thinking Tests are administered during Fall and Spring semesters to graduating seniors. The CCTST evaluates students' abilities to critically think based on skills that they have learned in their courses.

- **IDEA Evaluation Reports** are used institution-wide and provide a mechanism for faculty to evaluate if they have achieved specific objectives in their respective courses. When completing IDEA Evaluation Forms, departmental faculty are encouraged to increase their selection of critical thinking and active learning objectives. The departmental chair and Planning Committee track these percentages from IDEA reports and provide feedback to the entire department at the start of each Fall Semester. In addition, the departmental chair and Planning Committee track percentages of students who responded with a "4" or "5" for items selected by faculty as important or essential in the "Progress Towards Goals" categories for teamwork, communication, and critical thinking. Results are compared with data from the **NSSE and the CCTST**. These results are also discussed at the Fall Semester faculty meeting.

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

Assessment - Goal 3

Goal/ Outcome/ Objective:

The Department of Biology will increase undergraduate retention.

Type of Tool:
Annual Unit Report,Retention Rate

Frequency of Assessment:
Annual.

Rationale:

TECH TRENDS Institutional Research Reports are reviewed by the chair to acquire information on institution-wide enrollment, demographics, and retention. Enrollments are compared from year to year. Retention is assessed by comparing number of freshmen enrolled during fall and the following spring. Departmental retention is compared to the university-wide average.

Assessment - Goal 4

Goal/ Outcome/ Objective:
The Department of Biology will make significant progress toward increasing diversity.

Type of Tool:
Annual Unit Report,Tracking Spreadsheet

Frequency of Assessment:
Annual.

Rationale:

To assess progress toward increasing diversity, the departmental chair uses demographic information to compare minority and women enrollments from year to year. These data are summarized in the Departmental Annual Report submitted to the Dean of the College of Arts and Sciences.

Assessment - Student Learning Outcome 1

Goal/ Outcome/ Objective:
Undergraduate Biology majors will demonstrate improved critical thinking skills.

Type of Tool:
Peer Assessment,Survey

Frequency of Assessment:
Each semester.

Rationale:

National Survey of Student Engagement (NSSE). Given Spring semesters 2006, 2009, 2011, and 2014. The NSSE assesses students' abilities to work as a team, communicate, and critically think. These values will be compared to data from the senior questionnaire and results from IDEA evaluation reports.

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

IDEA Evaluation Reports. Administered in each class during Fall and Spring semesters. All faculty are asked to have IDEA Evaluation Forms completed for their respective classes at the end of each semester. Faculty are encouraged to integrate active learning/critical thinking techniques into course objectives. When completing IDEA Evaluation Forms, departmental faculty are encouraged to increase their selection of critical thinking and active learning objectives.

California Critical Thinking Test (CCTST). Administered during Fall and Spring semesters to graduating seniors. The CCTST evaluates students' abilities to critically think based on skills that they have learned in their courses.

Assessment - Student Learning Outcome 2

Goal/ Outcome/ Objective:
Biology majors will participate in extracurricular activities related to their discipline.

Type of Tool:
Exit Exam,Survey

Frequency of Assessment:

Each semester.

Rationale:

Senior Questionnaire. Administered each Fall and Spring semester. Graduating seniors are asked to complete a short questionnaire (Appendix 1) concerning extracurricular activities, including cooperative programs and internships, at the time they take their major field exam. We include an assessment of how valuable they considered the experiences.

Assessment - Student Learning Outcome 3

Goal/ Outcome/ Objective:

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

Type of Tool:

Survey

Frequency of Assessment:

Each semester.

Rationale:

Scientific Method Exams. Exams developed by the Biology Department (Appendix 2) are administered to students in selected classes that determine the degree to which students have learned the scientific method and to determine if they agree that our classes are adequately teaching the scientific method. Biology majors enrolled in two courses (a freshman course and an upper-division course) are required to complete a **Scientific Method Exam** at the end of the semester during which they take the courses. Results are evaluated by the departmental chair and the course instructors to determine the degree to which students have learned the scientific method and to determine if they agree that our classes are adequately teaching the scientific method. Comparisons are made for scores achieved by students in the freshman course and those achieved in the upper-division course.

Assessment - Student Learning Outcome 4

Goal/ Outcome/ Objective:

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

Type of Tool:
Exit Exam

Frequency of Assessment:
Each semester.

Rationale:

ACAT Major Field Examination. Administered each Fall and Spring semester. The ACAT exam breaks subject matter into a number of biological categories. We can select which categories should be used in evaluating our majors. These categories include bacteriology, cellular biology, ecology, genetics, botany, zoology, and evolution. This option is especially appealing because of the different focus of our program (i.e., organismal) from that of many other biology programs (i.e., molecular) in the state and nation.

All graduating senior Biology majors are asked to take the **ACAT Major Field Examination** during the semester in which they intend to graduate. Scores are compared to the national mid-point range for the areas of bacteriology, cellular biology, ecology, genetics, botany, zoology, and evolution. The departmental chair tabulates scores and reports the results to the departmental Planning Committee at the start of each Fall semester.

Results

Results - Goal 1

Goal/Objective/Outcome Number:

Goal 1 - Cooperative programs (“co-ops”) or experiential internships will be completed by at least 10% of BIOL students during their undergraduate years.

Results:

Senior Questionnaire Internships and cooperative programs usually are not as popular among Biology majors as Wildlife and Fisheries Science majors (Program Goal 1). Until recently, the internship program in the Department of Biology has been directed towards field programs, and almost all of the students who took advantage of this opportunity have been Wildlife and Fisheries Science majors. During the last five years, a few Biology majors chose to pursue internships, especially in the health-related disciplines. This trend continued during the last academic year, as only 3.0% of students participated in internships or co-op assignments; overall, we are not

meeting our target goal of 10% (Table 1). Note that we only had data from Spring 2019 this year, as the questionnaires from Fall 2018 have been misplaced.

Table 1. Percent of Biology graduates completing internship (BIOL 4900) or co-op assignment (n = number of students surveyed).

Academic Year	Sample Size (n)	Percent (%)
2014-2015	23	0.0
2015-2016	46	8.7
2016-2017	45	0.0
2017-2018	47	2.1
2018-2019	33	3.0

Attachments:

Results - Goal 2

Goal/Objective/Outcome Number:

Goal 2 - The Department of Biology will increase the incorporation of active-learning strategies in courses offered.

Results:

Faculty Annual Report During 2006, the Department of Biology determined through discussions at faculty meetings that it was essential that faculty develop and adopt **active learning techniques** into their courses. During 2014-2015, one faculty member attended "mEngage Leadership Academy" to mobilize emerging technology into the classroom. His experience promoted other faculty members to investigate how they might accomplish the same in their courses. During 2015-2016, faculty members participated in workshops such as a McGraw-Hill Higher Education Summit, AIMT Training for the Top 30 Classes, and the Flipped Classroom. During 2016-2017 five faculty members participated in workshops through the Center for Teaching and Learning. During 2017-2018 faculty members participated in several programs provided by the CITL (formerly the CTLE) and the Academic Learning Community program. Finally, in 2018-2019 we had four faculty participate in Academic Learning Communities, two obtain EDGE QEP grants, and two participate in outside active learning programs (one through McGraw-Hill and one through the American Society of Microbiologists).

Table 3. Number of tenured or tenure-track faculty in the Department of Biology that reported that they had participated in active-learning workshops during the last five years.

Academic Year	Sample Size (n)	Participants

2014-2015	17	1
2015-2016	21	3
2016-2017	17	5
2017-2018	17	5
2018-2019	16	6

Since 2014, **at least 80% of departmental faculty incorporated active-learning/critical-thinking strategies into their individual courses** (Table 4). The most commonly listed approaches were analysis and interpretation of independently gathered data in lab exercises and reviews of peer-reviewed articles. Several courses required students to work in teams to gather data that could not be collected as individuals, and they were required to provide a team report at the end of these exercises. Many lab exercises attempted to simulate real-world problems, and students were required to develop solutions to these problems. Many upper division labs are designed to be "on-going", and each week's exercise builds on techniques or information learned during the previous week. All of our majors must complete an group research project as part of the BIOL 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, we feel that we are doing an admirable job of incorporating critical thinking and active learning in our courses, but we will continue to develop additional approaches in these areas.

Table 4. Percent of Department of Biology faculty incorporating active-earning/critical- thinking strategies in their courses during the last five years.

Academic Year	Sample Size (n)	Percent (%)
2014-2015	18	83
2015-2016	21*	95
2016-2017	21*	95
2017-2018	20	95
2018-2019	19	95

*A total of 21 faculty members (tenure-track, tenured, and non-tenure-track) belong to the Department of Biology, but one did not receive IDEA evaluations during at least one semester during this academic year.

IDEA Evaluation Reports Departmental faculty members are incorporating active-learning/critical thinking strategies in their courses; however, **objectives incorporating teamwork, communication, and critical thinking** are incorporated at varying levels. We have not met our goal (25%) for teamwork in the last five years (Table 5). This was the first year we met our goal (25%) for communication in the last four years. In the last five years, our critical-thinking goal (50%) was met only in 2016-2017. The five year averages for Biology in these categories were 15.0% for teamwork, 22.3% for communication, and 43.1% for critical thinking. Consistency among years indicates that our departmental goals for critical thinking and teamwork are realistic and consistent with what faculty believe are important in their courses.

Table 5. Percent of IDEA evaluation forms where Department of Biology faculty selected critical-thinking and active-learning objectives as essential or important during the last five years.

YEAR	TEAMWORK	COMMUNICATION	CRITICAL-THINKING
2013-2014	11.5%	29.5%	44.3%
2014-2015	10.7%	16.7%	32.1%
2015-2016	16.7%	21.4%	40.5%
2016-2017	22.2%	18.9%	66.7%
2017-2018	14.0%	25.0%	32.0%

California Critical Thinking Test (CCTST) CCTST results for TTU Biology majors averaged 18.5 for 2018-2019. The TTU average for this time period was 16.8, and the national average was 15.42. Based on these results, our Biology majors learn critical thinking skills better than other students at both our University and at other universities administering the CCTST.

Attachments:

Results - Goal 3

Goal/Objective/Outcome Number:

Goal 3 - The Department of Biology will increase undergraduate retention.

Results:

TECH TRENDS Institutional Research Reports The Department of Biology has monitored **enrollment trends** for several years and used these trends to develop strategies to meet this goal (Table 7). Although enrollment was not viewed as a concern by the department in 2017, 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 still 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 7. Number of students enrolled as Biology majors and freshman fall-to-spring retention rates (percent) for undergraduates within the Department of Biology and Tennessee Tech University. Retention rates for 2018 were not available as of 12 August 2019.

Year	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	?	?

Attachments:

Results - Goal 4

Goal/Objective/Outcome Number:

Goal 4 - The Department of Biology will make significant progress toward increasing diversity.

Results:

TECH TRENDS Institutional Research Reports 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 over the last five years (Table 8). Most of these students are enrolled in the Health Sciences concentration, and the establishment of this program in 2001 probably is the major factor influencing this increase. Over the last five years, over 50% of all undergraduate Biology majors have been females. Currently, 195 of 292 Biology majors are female. Attractiveness of certain programs to females (e.g., health-related biology and microbiology), as compared to others (e.g., applied field biology), probably provides the best explanation for this difference in gender balance among programs.

Table 8. Percent of Biology majors as minorities and females during the last five years.

Year	Minorities (%)	Females (%)
2014	15.3	58.3
2015	13.3	60.9
2016	14.9	59.2

2017	14.4	62.8
2018	?	66.3

Attachments:

Results - Student Learning Outcome 1

Goal/Objective/Outcome Number:

Student Learning Outcome 1 - Undergraduate Biology majors will demonstrate improved critical thinking skills.

Results:

National Survey of Student Engagement NSSE 2017 data indicate that for **communication and critical thinking**, our majors improved from their freshman year through their senior year (Mean values for written communication improved from 2.56 (± 0.2) to 2.89 (± 0.15). Mean values for oral communication improved from 2.69 (± 0.2) to 2.93 (± 0.13). Mean values for critical thinking improved from 3.13 (± 0.22) to 3.26 (± 0.13)). NSSE 2017 data for teamwork indicated slightly more autonomy between freshman and senior years for Biology majors: 2.44 (± 0.26) to 2.85 (± 0.15), , but not statistically different. Therefore, we seem to be meeting this learning outcome and our active-learning program goal is being achieved.

IDEA Evaluation Reports Departmental faculty members are incorporating active-learning/critical thinking strategies in their courses; however, objectives incorporating teamwork, communication, and critical thinking are incorporated at varying levels.

We have not met our goal (25%) for teamwork in the last five years (Table 5). This was the first year we met our goal (25%) for communication in the last four years. In the last five years, our critical-thinking goal (50%) was met only in 2016-2017. The five year averages for Biology in these categories were 15.0% for teamwork, 22.3% for communication, and 43.1% for critical thinking. Consistency among years indicates that our departmental goals for critical thinking and teamwork are realistic and consistent with what faculty believe are important in their courses.

Table 5. Percent of IDEA evaluation forms where Department of Biology faculty selected critical-thinking and active-learning objectives as essential or important during the last five years.

YEAR	TEAMWORK	COMMUNICATION	CRITICAL-THINKING

2013-2014	11.5%	29.5%	44.3%
2014-2015	10.7%	16.7%	32.1%
2015-2016	16.7%	21.4%	40.5%
2016-2017	22.2%	18.9%	66.7%
2017-2018	14.0%	25.0%	32.0%

IDEA Reports now provide the percentages of students who respond with a "4" or "5" for items selected by faculty as important or essential. This allows a means of evaluating if students are learning the **goals of teamwork, communication, or critical thinking** in classes in which faculty consider these learning outcomes important by ranking the class as 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 6) it appears that during this last academic year, the percent of sections that were rated by students where substantial or exceptional progress was made declined across all three categories.

Table 6. 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
2013-2014	59.5%	57.7%	67.8%
2014-2015	100%	82.4%	96.6%
2015-2016	100%	66.7%	88.2%
2016-2017	75.0%	82.4%	95.0%
2017-2018	48.0%	40.2%	63.1%

Attachments:

Results - Student Learning Outcome 2

Goal/Objective/Outcome Number:

Student Learning Outcome 2 - Biology majors will participate in extracurricular activities related to their discipline.

Results:

Senior Questionnaire Internships and cooperative programs usually are not as popular among Biology majors as Wildlife and Fisheries Science majors (Program Goal 1). Until recently, the internship program in the Department of Biology has been directed towards field programs, and almost all of the students who took advantage of this opportunity have been Wildlife and Fisheries Science majors. During the last five years, a few Biology majors chose to pursue internships, especially in the health-related disciplines. During the last academic year, however, only 3.0% of students participated in internships or co-op assignments; overall, we are not meeting our target goal of 10% (Table 1).

Table 1. Percent of Biology graduates completing internship (BIOL 4900) or co-op assignment (n = number of students surveyed). For 2018-2019, only data from Spring 2019 were available; Fall 2018 questionnaires have been misplaced.

Academic Year	Sample Size (n)	Percent (%)
2014-2015	23	0.0
2015-2016	46	8.7
2016-2017	45	0.0
2017-2018	47	2.1
2018-2019	33	3.0

During the past 5 years, an average of 87.8% of graduating Biology majors indicated that they **participated in extracurricular activities** while at TTU, and well over half (range 54.5 - 85%) indicated that these experiences contributed positively to their education (Table 2). The senior questionnaire that was initiated in 2002-2003 has provided a more realistic estimate that is consistent with our impressions that students engage in a wide variety of major-oriented extracurricular activities.

Table 2. Percent of graduating Biology majors participating in extracurricular activities related to their discipline by academic year.

	2014-2015 (N=23)	2015-2016 (N=46)	2016-2017 (N=68)	2017-2018 (N=47)	2018-2019 (N = 33)
Ext-Cur. Activities	78.3%	80.4%	92.6%	93.6%	93.9%
Clubs	34.8%	32.6%	35.3%	38.3%	48.5%
Internships	0.0%	8.7%	0.0%	2.1%	3.0%

Sp. Topics	26.1%	19.6%	29.4%	25.5%	30.3%
Sci. Mtg.	30.4%	39.1%	26.5%	38.3%	39.4%
Seminars	65.2%	80.4%	76.5%	89.4%	60.6%
Other	26.1%	26.1%	20.6%	42.6%	36.4%
Positive Contribution	69.6%	76.1%	73.5%	85.1%	54.5%

National Survey of Student Engagement

NSSE data for 2017 seniors indicated that seniors in the Biological Sciences participated in **extracurricular activities** for an average of 6.06 hours each week. Our data indicate a high participation rate (93.9% in 2018-2019; see Table 2).

Attachments:

Results - Student Learning Outcome 3

Goal/Objective/Outcome Number:

Student Learning Outcome 3 - All students completing a degree in Biology at Tennessee Technological University will use scientific reasoning as codified by the structured process commonly known as the scientific method.

Results:

Scientific Method Exams Student understanding of the scientific method, as assessed using the Department of Biology Scientific Method Exam, was evident (Table 9). Results are consistent with long-term trends in the BIOL 1000 class that indicate that most of our freshmen students recognize the components of the scientific method and understand how to apply it. In general, upper division students in BIOL 3920 score higher than first-semester students. In the past, we concluded that reinforcement does occur throughout the program and that most senior students have retained some level of understanding of the process.

Table 9. Student performance (percent) on the scientific method exam administered to students in BIOL 1000 (freshman course) and BIOL 3920 (upper division).

	Average Score (%)		100% Correct (%)		> 90% Correct (%)		< 70% Correct (%)	
Year	1000	3920	1000	3920	1000	3920	1000	3920
2014-2015*	74.9	71.5	13.8	0.0	18.4	0.0	33.8	44.4
2015-2016	74.4	90.0	10.5	52.3	16.3	65.9	37.2	13.6
2016-2017	74.1	89.2	14.1	52.3	18.8	63.6	43.8	13.6
2017-2018	78.2	86.7	17.1	36.8	23.2	52.9	26.8	16.2
2018-2019	74.4	86.9	19.4	40.7	37.5	57.1	25.0	11.0

*Data from Spring 2014 only.

Attachments:

Results - Student Learning Outcome 4

Goal/Objective/Outcome Number:

Student Learning Outcome 4 - Biology majors will be able to demonstrate a command of general biology and the general principles in various specific areas of biology.

Results:

ACAT Major Field Examination We first began use of the ACAT exam in Fall 2006 to demonstrate student command of general biology and the general principles in various specific areas of biology, and we now have sufficient data to compare results among cohorts. Our majors have generally performed above average in some areas (e.g., genetics) and consistently low in others (e.g., evolution) (Table 10). The most recent academic year saw a marked decline in several areas, although this may be due to a low sample size and the lack of Spring 2019 data.

Table 10. Results of the ACAT Biology Exam during the last five years. For the 2019-2019 academic year, only Fall 2018 scores were available as of 12 August 2019.

Year & Sample Size	Bacteriology		Cellular Biology		Ecology		Genetics		Botany		Zoology		Evolution	
	Score	%tile	Score	%tile	Score	%tile	Score	%tile	Score	%tile	Score	%tile	Score	%til
2014-2015 (n = 44)	486	44	486	44	458	34	526	60	456	33	469	38	467	37
2015-2016	488	45	490	46	487	45	508	53	471	39	461	35	487	44

(n = 70)														
2016-2017 (n = 49)	483	43	488	45	488	45	488	45	471	39	468	37	478	33
2017-2018 (n = 47)	489	46	506	52	509	54	516	56	498	49	481	41	484	43
2018-2019 (n = 16)	470	38	455	33	453	32	442	28	480	42	499	50	462	35
AVG (n = 226)	483.2	43.2	485	44	479	42	496	48.4	475.2	40.4	475.6	40.2	475.6	38.4

Attachments:

Modifications and Continuing Improvement to Goals/Objectives/Outcomes

Modifications and Continuing Improvement to Program Goal 1

Goal/Objective/Outcome Number:

Program Goal 1: Cooperative programs (“co-ops”) or experiential internships will be completed by at least 10% of BIOL students during their undergraduate years.

Program Changes and Actions due to Results:

Biology majors increased from 2.1% participation to 3.0% in 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.

Link to Assessment:

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.

Link to 'Tech Tomorrow' Strategic Plan:
General Education Curriculum,Programs, Certificates, and Training

Modifications and Continuing Improvement to Program Goal 2

Goal/Objective/Outcome Number:
Program Goal 2: The Department of Biology will increase the incorporation of active-learning strategies in courses offered.

Program Changes and Actions due to Results:

Faculty members will continue using their current approach to teaching to including active learning strategies in courses, given that 95% of 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 2019-2020 academic year.

Link to Assessment:

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 tenure-track faculty and lecturers.

Link to 'Tech Tomorrow' Strategic Plan:
Programs, Certificates, and Training

Modifications and Continuing Improvement to Program Goal 3

Goal/Objective/Outcome Number:

Program Goal 3: The Department of Biology will increase undergraduate retention.

Program Changes and Actions due to Results:

Although 2018 data were not available, over a five year period the Department of Biology has a fall-to-spring retention rate on average lower than the university rate. Despite this, the department underwent a program review during the 2015-2016 academic year and retention was found to be "the envy of any department..." We will continue using our current methods to improve retention given our results.

Link to Assessment:

Even though we have been lauded for our retention rate by peers, we will need to assess our current methods to improve retention given our results.

Link to 'Tech Tomorrow' Strategic Plan:

Experiential Learning

Modifications and Continuing Improvement to Program Goal 4

Goal/Objective/Outcome Number:

Program Goal 4: The Department of Biology will make significant progress toward increasing diversity.

Program Changes and Actions due to Results:

An ad-hoc committee of faculty members in the Department of Biology was assigned the task of investigating options to increase diversity in terms of underrepresented minorities. Options were presented during the 2016-2017 academic year from which one will be pursued. The department planned to send one faculty member to high schools that have a high minority presence, given available funding, but was unable to do so due to lack of available faculty. The department is pursuing this in light of program review comments that indicated we may be at the limit given the demographics the institution draws in general.

Unlike minority enrollment, our recruitment and retention of female students has been successful, and mirrors the general trend in the biological sciences of increased enrollment of women, particularly in the health-related and lab-based concentrations.

Link to Assessment:

This is an issue that will require a new approach in the upcoming academic year. Our diversity subcommittee has been inactive for several years due to some turnover in the department, but we plan on reviving it this year and coming up with new strategies. This may make better use of the university diversity offices than have been done in the past.

Link to 'Tech Tomorrow' Strategic Plan:

Diversity

Modifications and Continuing Improvement to Student Learning Outcome 1

Goal/Objective/Outcome Number:

Student Learning Outcome 1: Undergraduate Biology majors will demonstrate improved critical thinking skills.

Program Changes and Actions due to Results:

Faculty report a much higher inclusion of critical thinking skills as a part of their courses than are represented in the IDEA evaluations. There are many other factors in the IDEA evaluations to consider and some of those factors may be considered of greater importance. The greater the number of factors included for evaluation the poorer the score may be and this, in combination with the importance of critical thinking skills relative to the other factors, may preclude inclusion of critical thinking skills and direct assessment via the IDEA evaluation. Faculty will be encouraged to include metrics that reflect the critical thinking skills in their IDEA evaluations for better assessment.

Link to Assessment:

When compared with data from the National Survey of Student Engagement (NSSE) 2017 results, our students were found to be no different compared to the national average in critical thinking. We await the 2018 results to see if this result holds.

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

Modifications and Continuing Improvement to Student Learning Outcome 2

Goal/Objective/Outcome Number:
Student Learning Outcome 2: Biology majors will participate in extracurricular activities related to their discipline.

Program Changes and Actions due to Results:
Historically, the departmental faculty has encouraged participation when advising, in classes, and via flyers announcing opportunities. With such methods approximately 93% of students have engaged in extracurricular activities during their academic career in the Biology degree program. To increase that number, we will continue to make opportunities available by reaching out to students through electronic media (e.g., email) in addition to the currently used methods.

Link to Assessment:

Results from our survey indicate that a higher percent of our Biology graduates participated in extracurricular activities than data posted in the 2017 NSSE survey. Since the level of participation varies among various activities (e.g., seminars vs. internships), we may develop target participation rates for various activities in the future. We may also start to include study abroad, since that is becoming more common for our biology majors.

Link to 'Tech Tomorrow' Strategic Plan:
Experiential Learning,Programs, Certificates, and Training

Modifications and Continuing Improvement to Student Learning Outcome 3

Goal/Objective/Outcome Number:
Student Learning Outcome 3: All students completing a degree in Biology will use scientific reasoning as codified by the structured process commonly known as the scientific method.

Program Changes and Actions due to Results:

The department will assess the instrument used to quantify how well students understand the scientific method. If the faculty deem it necessary to modify the instrument used, appropriate modifications will be made.

Link to Assessment:

Recommendations for new survey tools or modifications to provide more meaningful results are discussed at departmental faculty meetings and voted upon before being implemented.

Link to 'Tech Tomorrow' Strategic Plan:

Programs, Certificates, and Training

Modifications and Continuing Improvement to Student Learning Outcome 4

Goal/Objective/Outcome Number:

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

Program Changes and Actions due to Results:

Courses that habitually have lower than average scores will be assessed to determine what can be done to improve retention of knowledge. We will also discuss ways to encourage students to perform well on the exam; since it has no grade associated with it, students often fail to take it seriously and may not study for it. This can lead to lower scores than might otherwise obtain.

Link to Assessment:

We will continue to monitor student progress through the ACAT Major Field Examination.

Link to 'Tech Tomorrow' Strategic Plan:

Programs, Certificates, and Training

Improvement to Assessment Plan

Improvements - Goal 1

Improvements to Assessment Plan:

Departmental faculty will continue to build relationships with local and national agencies, non-profit organizations, and biology-related businesses to create opportunities for student internships and co-ops. The departmental Planning Committee will discuss and develop other potential strategies for increasing participation.

Improvements - Goal 2

Improvements to Assessment Plan:

These data will continue to be included in departmental annual reports that are submitted to the Dean of the College of Arts and Sciences. We will continue to monitor this goal using IDEA evaluations, and the departmental Planning Committee will conduct additional faculty discussions to determine what courses should emphasize these approaches and whether we wish to modify the target percentages to more adequately reflect faculty opinion.

Improvements - Goal 3

Improvements to Assessment Plan:

We plan to continue monitoring retention closely in the future and attempt to determine reasons for low retention of our majors if a declining pattern develops. The department also plans to discuss ways to increase retention to match more closely that of the university as a whole, and to better understand the reasons for why students in this major leave the university.

Improvements - Goal 4

Improvements to Assessment Plan:

The Department continually seeks out minority and women students and actively recruits these students into our programs. Further discussions on this topic will be conducted by the departmental Planning Committee as to which new approaches to implement. We also plan to meet with the office of multicultural affairs to discuss potential strategies.

Improvements - Student Learning Outcome 1

Improvements to Assessment Plan:

We will continue to monitor these results and perhaps revise our goal for teamwork and communication.

Improvements - Student Learning Outcome 2

Improvements to Assessment Plan:

We will continue to provide a wide diversity of extracurricular opportunities to all students, and we will increase our level of encouragement to participate.

Improvements - Student Learning Outcome 3

Improvements to Assessment Plan:

We will continue to study these results to determine what additional tools can be used to ensure that all students retain an understanding of the scientific method, and potentially cover this idea in a systematic way in a wider variety of classes.

Improvements - Student Learning Outcome 4

Improvements to Assessment Plan:

We will evaluate area weaknesses, and improve our students' skills in these areas by devoting more time to these topics in our courses. Faculty discussions identifying pedagogical approaches that seem to produce better results in some subjects than others will be assessed. We will also emphasize the importance of these exams because some students perform poorly because they do not take them seriously.