MAJOR IN BIOLOGY - SECONDARY EDUCATION CONCENTRATION

The Biology Secondary Education concentration requires 126-137 units. Students in this concentration must complete 99-110 required units in content and Towson UTeach courses and 27 units in Core Curriculum courses not satisfied by the major, earning a grade equivalent of 2.00 or higher in each course.

Formal Admission to Towson UTeach

Students should apply to Towson UTeach when they have met the following criteria:

- completion of a written application available online (http://www.towson.edu/uteach);
- completion of at least 45 college units;
- a minimum GPA of 3.00 in the last two years;
- a passing score on the Maryland State Department of Education Basic Skills Assessment Requirement (http://marylandpublicschools.org/about/Pages/DEE/Certification/testing_info/praxis1.aspx);
- completion of a Criminal History Disclosure Form. This form is to be notarized and submitted to the Towson UTeach Office.

Full-Time Internship in Towson UTeach

Students in a mathematics or science secondary education concentration complete their full-time internship in their final semester. The following requirements must be met for the final internship semester:

- a minimum GPA of 2.75 in content courses required for the major;
- a minimum GPA of 3.00 in required education courses;
- a minimum cumulative GPA of 3.00.

GPA calculations based on transcripts from all institutions of higher learning attended, including Towson University.

For more information see the Standards for Teacher Education (http://catalog.towson.edu/undergraduate/education/admission-teacher-education) page.

Students who decide not to complete all secondary education requirements must select and complete a different concentration/track in the major in order to graduate.

All Biology majors must complete minimum 19 units toward the major at Towson University, with at least 10 of these units at the upper (300-400) level. Courses taken to fulfill Ancillary Course requirements do not count toward units in residence.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 200 &amp; 200L</td>
<td>INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LECTURE] and INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LAB]</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 202</td>
<td>INTRODUCTION TO ECOLOGY AND EVOLUTION</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 204</td>
<td>EDUCATIONAL AND CAREER PLANNING FOR THE BIOLOGIST</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 309</td>
<td>GENETICS</td>
<td>4</td>
</tr>
</tbody>
</table>

Breadth Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 205</td>
<td>GENERAL BOTANY</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 207</td>
<td>GENERAL ZOOLOGY</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one of the following:

- BIOL 408 | CELL BIOLOGY | 4 |
- BIOL 409 | MOLECULAR BIOLOGY | 4 |

Elective Courses

Biology electives selected from the other concentrations and approved by adviser.

Ancillary Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 131 &amp; 131L</td>
<td>GENERAL CHEMISTRY I LECTURE and GENERAL CHEMISTRY I LABORATORY</td>
<td>13-18</td>
</tr>
<tr>
<td>CHEM 132 &amp; 132L</td>
<td>GENERAL CHEMISTRY II LECTURE and GENERAL CHEMISTRY II LABORATORY</td>
<td>13-18</td>
</tr>
<tr>
<td>CHEM 330 or CHEM 331 &amp; CHEM 332</td>
<td>ESSENTIALS OF ORGANIC CHEMISTRY or ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY II</td>
<td>13-18</td>
</tr>
<tr>
<td>PHYS 211 or PHYS 241</td>
<td>GENERAL PHYSICS I; NON CALCULUS-BASED or GENERAL PHYSICS I CALCULUS-BASED</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Mathematics

Select one of the following:

- MATH 211 | CALCULUS FOR APPLICATIONS |
- MATH 231 | BASIC STATISTICS |
- MATH 237 | ELEMENTARY BIOSTATISTICS |
- MATH 273 | CALCULUS I |

Physical Science Electives

Select one of the following:

- ASTR 161 | THE SKY AND THE SOLAR SYSTEM |
- GEOL 121 | PHYSICAL GEOLOGY |
- GEOL 123 | HISTORICAL GEOLOGY |
- GEOG 377 | METEOROLOGY |

Science Education

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCIE 380</td>
<td>TEACHING SCIENCE IN THE SECONDARY SCHOOLS</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Units 59-70
Major in Biology - Secondary Education Concentration

Towson UTeach Courses (40 units)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMS 110 &amp; SEMS 120</td>
<td>INTRODUCTION TO STEM TEACHING I: INQUIRY APPROACHES TO TEACHING and INTRODUCTION TO STEM TEACHING II: INQUIRY-BASED LESSON DESIGN</td>
<td>2</td>
</tr>
<tr>
<td>or SEMS 130</td>
<td>INTRODUCTION TO STEM TEACHING I &amp; II COMBINED</td>
<td></td>
</tr>
</tbody>
</table>

*Permission of Towson UTeach Department required to take SEMS 130.

Core Towson UTeach Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMS 230</td>
<td>KNOWING AND LEARNING</td>
<td>3</td>
</tr>
<tr>
<td>SEMS 240</td>
<td>CLASSROOMS INTERACTIONS</td>
<td>3</td>
</tr>
<tr>
<td>SEMS 250</td>
<td>PERSPECTIVES IN SCIENCE AND MATHEMATICS</td>
<td>3</td>
</tr>
<tr>
<td>SEMS 360</td>
<td>RESEARCH METHODS</td>
<td>3</td>
</tr>
<tr>
<td>SEMS 370</td>
<td>PROJECT-BASED INSTRUCTION</td>
<td>3</td>
</tr>
<tr>
<td>SEMS 498</td>
<td>INTERNSHIP IN MATHEMATICS AND SCIENCE SECONDARY EDUCATION</td>
<td>3</td>
</tr>
<tr>
<td>SCED 460</td>
<td>USING READING AND WRITING IN THE SECONDARY SCHOOLS</td>
<td>4</td>
</tr>
<tr>
<td>SCED 461</td>
<td>TEACHING READING IN THE SECONDARY CONTENT AREAS</td>
<td>3</td>
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</table>

Towson UTeach Courses - Science

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCIE 393</td>
<td>INTERNSHIP IN SECONDARY EDUCATION-SCIENCE</td>
<td>12</td>
</tr>
<tr>
<td>SCIE 430</td>
<td>SEMINAR IN STUDENT TEACHING - SCIENCE</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Units 40

Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Freshman

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 200 &amp; 200L (Core 7)</td>
<td>4 BIOL 202 (Core 8)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 131 &amp; 131L</td>
<td>4 CHEM 132 &amp; 132L</td>
<td>4</td>
</tr>
<tr>
<td>MATH 211, 231, 237, or 273 (Core 3) (if prerequisites met)</td>
<td>3 SEMS 120</td>
<td>1</td>
</tr>
<tr>
<td>SEMS 110&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1 Core 2 (or Core 1)</td>
<td>3</td>
</tr>
<tr>
<td>Core 1 (or Core 2)</td>
<td>3 Core 4</td>
<td>3</td>
</tr>
<tr>
<td>Core 10</td>
<td>3 Core 6</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 204&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1 BIOL 205</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 207</td>
<td>4 CHEM 332 (or elective)</td>
<td>5</td>
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</tbody>
</table>

Junior

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 408 or 409</td>
<td>4 BIOL 222 &amp; 222L (or elective)</td>
<td>4</td>
</tr>
<tr>
<td>SCED 460</td>
<td>4 SCED 461</td>
<td>3</td>
</tr>
<tr>
<td>SEMS 250 (Core 5)</td>
<td>3 SEMS 370</td>
<td>3</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td>4 Select one of the following:</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 221 &amp; 221L</td>
<td>ASTR 161</td>
<td></td>
</tr>
<tr>
<td>BIOL 325</td>
<td>GEOL 121</td>
<td></td>
</tr>
<tr>
<td>Core 14</td>
<td>3 GEOL 123</td>
<td></td>
</tr>
<tr>
<td>Core 4</td>
<td>3 GEOG 377</td>
<td></td>
</tr>
<tr>
<td>Core 11</td>
<td></td>
<td>3</td>
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</tbody>
</table>

Sophomore

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL Elective</td>
<td>3-4 SCIE 393</td>
<td>12</td>
</tr>
<tr>
<td>SCIE 380</td>
<td>3 SCIE 430</td>
<td>1</td>
</tr>
<tr>
<td>SEMS 360 (Core 9)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SEMS 498</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Core 12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Core 13</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

Senior

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Units Term 2</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL Elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCIE 393</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>SCIE 380</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SEMS 360 (Core 9)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Core 12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Core 13</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

1 Selection of this Concentration means that all of the requirements must be met; otherwise another Biology concentration must be completed.

NSTA Standard 1: Content Knowledge

Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure. Below are the elements of the standard.

Pre-service teachers will:

1a) Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association.

1b) Understand the central concepts of the supporting disciplines and the supporting role of science-specific technology.

1c) Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students.

Assessment: Praxis II scores

NSTA Standard 2: Content Pedagogy

Effective teachers of science understand how students learn and develop scientific knowledge. Pre-service teachers use scientific inquiry to develop this knowledge for all students. Below are the elements of the standard.
Pre-service teachers will:
2a) Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science.
2b) Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate.
2c) Design instruction and assessment strategies that confront and address naive concepts/preconceptions.
Assessment: This Standard is usually met using Assessment 3 - Unit Plan. GPA required in content coursework.

NSTA Standard 3: Learning Environments

Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources—including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the learning goals are met.
Below are the elements of the standard.
Pre-service teachers will:
3a) Use a variety of strategies that demonstrate the candidates knowledge and understanding of how to select the appropriate teaching and learning activities including laboratory or field settings and applicable instruments and/or technology- to allow access so that all students learn. These strategies are inclusive and motivating for all students.
3b) Develop lesson plans that include active inquiry lessons where students collect and interpret data using applicable science-specific technology in order to develop concepts, understand scientific processes, relationships and natural patterns from empirical experiences. These plans provide for equitable achievement of science literacy for all students.
3c) Plan fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated.
3d) Plan a learning environment and learning experiences for all students that demonstrate chemical safety, safety procedures, and the ethical treatment of living organisms within their licensure area.
Assessment: Curriculum Development Project (CDP) score

NSTA Standard 4: Safety

Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure.
Below are the elements of the standard.
Pre-service teachers will:
4a) Design activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction.
4b) Design and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students.
4c) Design and demonstrate activities in a P-12 classroom that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms.
Assessment: Internship Evaluations

NSTA Standard 5: Impact on Student Learning

Effective teachers of science provide evidence to show that P-12 students understanding of major science concepts, principles, theories, and laws have changed as a result of instruction by the candidate and that student knowledge is at a level of understanding beyond memorization. Candidates provide evidence for the diversity of students they teach.
Below are the elements of the standard.
Pre-service teachers will:
5a) Collect, organize, analyze, and reflect on diagnostic, formative and summative evidence of a change in mental functioning demonstrating that scientific knowledge is gained and/or corrected.
5b) Provide data to show that P-12 students are able to distinguish science from non-science, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science.
5c) Engage students in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner.
Assessment: Portfolio scores

Standard 6: Professional Knowledge and Skills

Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community.
Below are the elements of the standard.
Pre-service teachers will:
6a) Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community.
6b) Engage in professional development opportunities such as conferences, research opportunities, or projects within their community.
Assessment: Flinn Science Safety Course completion