Environmental Toxicology, Bachelor of Science

The Major Program

Toxic agents in the environment include pesticides, food additives, industrial waste, and metals as well as chemicals produced by animals, plants, fungi and bacteria. Students in the Environmental Toxicology major learn how toxicants produce adverse effects by understanding their environmental fates and biological activities. They learn about monitoring concentrations and the distribution and persistence of agents found in water, soil, air and foods. Toxicity testing procedures and exposure assessments are used to help evaluate the potential for harm to humans and other species. By understanding the cellular targets and biochemical mechanisms of perturbation by toxicants, toxicologists can better estimate adverse effects. Overall, students learn mechanisms by which toxic agents act, their origin and fate and how toxicologists evaluate the risk of adverse effects and balance them against the benefits.

The Program

Preparatory courses in biology, chemistry, mathematics, and physics are required to provide fundamental principles that underlie toxicology. Students in the major are expected to understand the environmental fates and biological activities of different classes of toxic substances, and the legislative issues that arise from chemical use. Opportunities are available to develop an in-depth understanding in areas of emphasis through a selection of electives.

Emphases

Elective course work in many disciplines can complement the required core courses. Providing a framework for selecting restricted electives, the major offers specializations in (1) Ecotoxicology & Environmental Chemistry, (2) Forensic Science & Regulatory Toxicology, and (3) Molecular & Biomedical Toxicology. The first category includes topics in chemical fate, transport and degradation, as well as ecology, wildlife, and aquatic toxicology. The second category includes forensic science, environmental policy and management, and public health. The third category includes pharmacology, biotechnology, medicine, veterinary medicine, and food toxicology. Students are encouraged to select course work from these Emphases and beyond to match their interests.

Internships & Career Alternatives

Occupations that use environmental toxicology include risk assessment, pharmaceutical development, food additive toxicity testing, managing regulatory compliance, residue or forensic analysis, pest control, monitoring and field sampling, industrial hygiene, and environmental health and safety. A substantial proportion of graduates elect to pursue advanced professional training in law, medical, pharmacy, or veterinary medical school, or in graduate programs in pharmacology, toxicology, agricultural and environmental chemistry, or public health. During undergraduate study, optional internships or research projects are recommended to provide training and work experience to help students pursue future goals.

Lead Faculty Advisor

Andrew Whitehead

Environmental Toxicology Major Advisor

Erica Cefalo

Advising Center for the major is located in 1086 Academic Surge. Contact the Environmental Toxicology major advisor at 530-754-9796.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>Biological Science</td>
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<tr>
<td>BIS 002A</td>
<td>Introduction to Biology: Essentials of Life on Earth</td>
<td>5</td>
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<tr>
<td>BIS 002B</td>
<td>Introduction to Biology: Principles of Ecology &amp; Evolution</td>
<td>5</td>
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<tr>
<td>BIS 002C</td>
<td>Introduction to Biology: Biodiversity &amp; the Tree of Life</td>
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| Chemistry                                          |                                               |       |
| Choose a series:                                   |                                               | 15    |
| CHE 002A & CHE 002B & CHE 002C                    | General Chemistry and General Chemistry       |       |
| CHE 002AH & CHE 002BH & CHE 002CH                 | Honors General Chemistry and Honors General Chemistry |       |
| Choose CHE 118 series or CHE 128 series & CHE 129A or CHE 103 series: |                                               | 10-12 |
| CHE 118A & CHE 118B & CHE 118C                    | Organic Chemistry for Health & Life Sciences and Organic Chemistry for Health & Life Sciences and Organic Chemistry for Health & Life Sciences |       |
| OR                                                   |                                               |       |
| CHE 129A                                           | Organic Chemistry Laboratory                  |       |
| OR                                                   |                                               |       |

| Mathematics                                         |                                               | 12    |
| Choose a series:                                    |                                               |       |
| MAT 017A & MAT 017B & MAT 017C                      | Calculus for Biology & Medicine               |       |
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<th>MAT 021A &amp; MAT 021B &amp; MAT 021C</th>
<th>Calculus and Calculus and Calculus</th>
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**Physics**

- PHY 007A General Physics 4
- PHY 007B General Physics 4
- PHY 007C General Physics 4

**Statistics**

Choose one: 4

- STA 100 Applied Statistics for Biological Sciences
- STA 103 Applied Statistics for Business & Economics
- STA 104 Applied Statistical Methods: Nonparametric Statistics
- STA 106 Applied Statistical Methods: Analysis of Variance
- STA 108 Applied Statistical Methods: Regression Analysis

**Upper Division Writing**

Choose one: 1

- UWP 101 Advanced Composition
- or UWP 101V Advanced Composition
- or UWP 101Y Advanced Composition
- UWP 104A Writing in the Professions: Business Writing
- or UWP 104AV Writing in the Professions: Business Writing
- or UWP 104AY Writing in the Professions: Business Writing
- UWP 104B Writing in the Professions: Law
- UWP 104C Writing in the Professions: Journalism
- UWP 104D Writing in the Professions: Elementary & Secondary Education
- UWP 104E Writing in the Professions: Science
- UWP 104F Writing in the Professions: Health
- or UWP 104FY Writing in the Professions: Health
- UWP 104I Writing in the Professions: Internships

Satisfaction of the General Education requirement to include courses selected with advisor's approval to complement the major; courses in agricultural economics, environmental studies, political science, psychology, and sociology are particularly recommended.

**Preparatory Subject Matter Subtotal** 72-74

**Depth Subject Matter**

**Biological Science**

- BIS 102 Structure & Function of Biomolecules 3
- BIS 101 Genes & Gene Expression 3-4
- or BIS 103 Bioenergetics & Metabolism

**Environmental Toxicology**

- ETX 101 Principles of Environmental Toxicology 4
- ETX 102A Environmental Fate of Toxicants 4
- ETX 102B Quantitative Analysis of Environmental Toxicants 5
- ETX 103A Biological Effects of Toxicants 4

**ETX 103B Biological Effects of Toxicants: Experimental Approaches** 5

Choose ETX 127 or two others: 6-10

- ETX/NUT 127 Environmental Stress & Development in Marine Organisms
- OR
- ETX/NUT 104 Environmental & Nutritional Factors in Cellular Regulation & Nutritional Toxicants
- ETX 120 Perspectives in Aquatic Toxicology
- ETX/FST 128 Food Toxicology
- ETX 130 Role & Applications of Toxicology in Modern Industry
- ETX 131 Environmental Toxicology of Air Pollutants
- ETX 135 Health Risk Assessment of Toxicants
- ETX 138 Legal Aspects of Environmental Toxicology
- ETX 146 Exposure & Dose Assessment

**Restricted Electives**

Choose three-four courses: 12-16

- Electives selected for area of Emphasis with faculty advisor's approval with 6 unit combined maximum of 190, 192, 198, and 199; see department website for details.

**Depth Subject Matter Subtotal** 46-55

**Total Units** 118-129

1 Preferably, the course should be taken prior to enrollment in ETX 102B & ETX 103B.