

BIOLOGY

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| Graduate Program Head | Elizabeth McGraw |
| Program Code | BIOL |
| Campus(es) | University Park (Ph.D., M.S.) |
| Degrees Conferred | Doctor of Philosophy (Ph.D.) Master of Science (M.S.) |
| The Graduate Faculty | View (https://secure.gradsch.psu.edu/gpms/?searchType=fac&prog=BIOL) |

The Biology graduate program encompasses a broad spectrum of research areas, including bioinformatics, cell biology, developmental biology, ecology, evolution, genetics, neuroscience, phylogenetics, and physiology. The courses of study are planned individually by the student and a Graduate Faculty adviser, often with input from the student's doctoral committee. Typically, tenure-line and tenured faculty in Biology have 1 to 5 graduate students in their laboratories, leading to a low student/adviser ratio for both doctoral and master's students.

Admission Requirements

Applicants apply for admission to the program via the Graduate School application for admission (<https://gradschool.psu.edu/graduate-admissions/how-to-apply/>). Requirements listed here are in addition to Graduate Council policies listed under GCAC-300 Admissions Policies (<https://gradschool.psu.edu/graduate-education-policies/>).

Admission is restricted to students who have the baccalaureate degree in a biological science or related field and who present a cumulative undergraduate average of at least 3.00 on a scale of 4.00. Each applicant must provide a personal statement of interests and objectives, curriculum vitae/cv/resume, and letters from three persons verifying the applicant's academic preparedness and readiness for graduate study. GRE scores will not be accepted.

Degree Requirements

Master of science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with least 18 credits at the 500 and 600 level, combined. Students are required to write a thesis, and at least 6 credits in thesis research (BIOL 600 or BIOL 610) must be taken in conjunction with completing the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense. The master's program in Biology is usually completed within two years.

Four Biology courses are curricular requirements for all master's students, as is the successful completion of ethics training administered by the Collaborative Institutional Training Initiative (CITI). Additional course work is tailored to the student's research interests after advance consultation with their adviser, and specific courses may be required by the adviser depending on the student's background and research plans.

| Code | Title | Credits |
|-------------------------|--|----------|
| Required Courses | | |
| BIOL 590 | Colloquium | 2 |
| BIOL 592 | Critical Evaluation of Literature in Biology | 1 |
| BIOL 893 | Experiential Teaching in Biology | 2 |
| BIOL 400 | Teaching in Biology | 1 |
| Total Credits | | 6 |

The culminating experience for the Master of Science degree is a research-based thesis that generally results in a peer-reviewed publication. The student will present and defend the thesis to a committee of three tenured or tenure-line Graduate Faculty members, consisting of the adviser and two other members of the Graduate Faculty. At least two members of the committee, including the adviser, must be members of the Graduate Faculty in the Biology graduate program.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

The doctoral program in Biology is first and foremost a research-oriented program. The single most important component is the successful completion and defense of an original research project – the dissertation. Additionally, the Biology graduate program and Graduate Council policies require that students meet certain residency requirements, maintain satisfactory scholastic performance, demonstrate competency of the English language, and successfully pass qualifying, comprehensive, and final oral examinations, outlined in the link above. To earn the Ph.D. degree, doctoral candidates must write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

Four Biology courses are curricular requirements for all doctoral students, as is the successful completion of ethics training administered by the Collaborative Institutional Training Initiative (CITI). Although doctoral students are required to complete 4 credits of BIOL 602 Supervised Experience in College Teaching, these 4 credits cannot be counted towards the degree requirements.

| Code | Title | Credits |
|-------------------------|--|-----------|
| Required Courses | | |
| BIOL 590 | Colloquium | 4 |
| BIOL 592 | Critical Evaluation of Literature in Biology | 1 |
| BIOL 893 | Experiential Teaching in Biology | 2 |
| BIOL 602 | Supervised Experience in College Teaching | 4 |
| Total Credits | | 11 |

Additional course work is tailored to the student's research interests after advance consultation with their adviser and Ph.D. committee, and specific courses may be required by the adviser and/or Ph.D. committee depending on the student's background and research plans. All doctoral students must pass a written and oral qualifying examination that is usually administered during their third semester of study. After a student has completed all of their course work and made substantial progress on the design and execution of their dissertation research, a comprehensive examination is administered by their Ph.D. committee. The dissertation must represent a significant original contribution suitable for publication, and will usually require between two and four years of laboratory and/or field research. When complete the dissertation must be defended before

the student's Ph.D. committee (the final oral examination). The defense is normally immediately preceded by a public presentation of the thesis research by the student.

Molecular Evolutionary Biology Option

The department awards graduate degrees in Biology covering the full spectrum of subjects represented by our diverse faculty in the base degree programs described above. If desired, a student may also elect to pursue the following option as part of his/her program of study.

1. The student must meet the criteria for the M.S. or Ph.D. in Biology.
2. The student's research adviser must be a member of the Graduate Faculty in the Biology graduate program and/or a full member of the Institute of Molecular Evolutionary Genetics. Other committee members may be chosen as needed providing that a majority of the committee is associated with the IMEG.
3. In addition to the normal Biology program requirements, the student must take (for both an M.S. or Ph.D. in Biology):

| Code | Title | Credits |
|---|--|-----------|
| Required Courses | | |
| BIOL 591 | Molecular Evolutionary Biology Seminar | 3 |
| 9 credits from among the following courses (selected in consultation with the student's committee): | | 9 |
| BIOL 405 | Molecular Evolution | |
| BIOL 422 | Advanced Genetics | |
| BIOL 427 | Evolution | |
| BIOL 428 | Population Genetics | |
| BIOL 514 | Topics in Systematics and Evolution | |
| Total Credits | | 12 |

4. The student must complete any other course work or training deemed appropriate by the student's committee.
- 1.

Minor

A graduate minor is available in any approved graduate major or dual-title program. The default requirements for a graduate minor are stated in Graduate Council policies listed under GCAC-600 Research Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>) and GCAC-700 Professional Degree Policies (<https://gradschool.psu.edu/graduate-education-policies/>), depending on the type of degree the student is pursuing:

- GCAC-611 Minor - Research Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-611-minor-research-doctorate/>)
- GCAC-641 Minor - Research Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-641-minor-research-masters/>)
- GCAC-709 Minor - Professional Doctorate (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-709-professional-doctoral-minor/>)
- GCAC-741 Minor - Professional Master's (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-700/gcac-741-masters-minor-professional/>)

Student Aid

Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (<https://gradschool.psu.edu/graduate-funding/>) section of The Graduate School's website. Students on graduate assistantships must adhere to the course load limits (<https://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants/>) set by The Graduate School.

In addition, several graduate fellowships and scholarships are available for students within the Department of Biology.

Programs of study are planned to require no more than two years for the M.S. degree and five for the Ph.D. degree. A student transferring to the department with the M.S. degree should plan on four additional years. Financial support from teaching or research assistantships or from fellowships is available to students in good standing, but not awarded beyond these limits except in unusual cases.

Courses

Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Biology (BIOL) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/biol/>)

Learning Outcomes

1. **Knowledge:** Demonstrate comprehensive knowledge of their major concentration area within biology including the fundamental questions in the field. The comprehensive knowledge may integrate multiple areas of biology. Demonstrate knowledge in other relevant areas of concentration (statistics) necessary for research in the biological sciences.
2. **Apply:** Demonstrate advanced research skills, including posing hypotheses, designing critical experiments, collecting data, evaluating data, and drawing conclusions in the study of biological problems.
3. **Communication:** Use professional standards of the field of Biology from evaluation of literature to communication of research findings in written and spoken presentations. These presentations might include talks or posters given at local or national meetings.
4. **Create:** Make an original and substantial contribution to the field of Biology and produce publishable scholarship that is presented within multiple chapters within their dissertation. Ideally, students will submit and publish research papers in peer reviewed journals during the course of their Ph.D. program.
5. **Teach:** Demonstrate effective skills in undergraduate teaching using effective pedagogical practice.

Contact

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| Program Website | View (http://bio.psu.edu/) |