Ecology & Evolutionary Biology, PhD

Degree Requirements

The graduate program in Ecology & Evolutionary Biology (EEB) explores the ecological and evolutionary processes that create and maintain biodiversity. The program combines field studies with biogeographic, computational, molecular, statistical, and theoretical approaches to gain an understanding of the ecology, evolution, and conservation of populations, communities, and ecosystems. Students' research opportunities are enriched by the University's partnerships with local institutions. Tyson Research Center, the environmental field station of Washington University in St. Louis, provides opportunities for field studies in local aquatic and terrestrial ecosystems. The Missouri Botanical Garden conducts systematic studies of plant diversity worldwide. The Saint Louis Zoo facilitates studies of the conservation biology of animals. Our faculty and students also conduct studies on a global scale at field sites in Africa, Asia, and South America.

Research in the program cuts across scales of biological organization, from genes to ecosystems. Study systems include a variety of model organisms (*Anolis*, *Dictyostelium*,*Drosophila, Plantago*, *Trifolium*), agricultural and domesticated species, human populations, and various natural plant and animal populations and communities spanning temperate and tropical ecosystems.

To earn a PhD at Washington University, a student must complete all courses required by their department; maintain satisfactory academic progress; pass certain examinations; complete all requirements for doctoral candidacy; fulfill residence and Mentored Experience Requirements; write, defend, and submit a dissertation; and apply for program completion (graduation) via Workday Student.

For the details of doctoral degree general requirements in Arts & Sciences, including an explanation of Satisfactory Academic Progress, students should review the Doctoral Degree Academic Information page of the Arts & Sciences *Bulletin.*

Program Requirements

- **Total Units Required:** 36
  - In addition to completing all required coursework outlined below, students enroll in the necessary number of units of BIOL 5906 Research to reach 9 units of coursework in each of their first four semesters to meet the 36-unit program requirement.
- **Degree Length:** Five years
  - Students are expected to maintain satisfactory academic progress in accordance with academic milestones. Students entering their fifth year in the program will receive a warning letter in regard to reaching their stated degree length.
  - **Note**: Students must be enrolled in 9 graduate credits each semester to retain full-time status. As students complete their coursework, if enrolled in fewer than 9 graduate credits, they must enroll in a specific Arts & Sciences graduate course that will show 0 units but does count as full-time status. Students should connect with their department to ensure proper enrollment prior to Add/Drop.
  - Continued support is guaranteed for the duration of the student's graduate studies, provided that the student maintains satisfactory progress toward completion of the degree.
- **Grade Requirement:** A minimum grade of B– in all required core courses with a minimum overall GPA of 3.0

Required Courses

Students must take at least one course from each program course group:

Group 1 Courses

- BIOL 5194 Community Ecology
- BIOL 5195 Disease Ecology

Group 2 Courses

- BIOL 5582 Macroevolution
- BIOL 5181 Population Genetics
- BIOL 5583 Molecular Evolution
- BIOL 5772 Behavioral Ecology

Group 3 Courses

- Group 1 courses: BIOL 5194 Community Ecology, BIOL 5195 Disease Ecology
- Group 2 courses: BIOL 5181 Population Genetics, BIOL 5582 Macroevolution, BIOL 5583 Molecular Evolution, BIOL 5772 Behavioral Ecology
- BIOL 5220 Practical Bioinformatics
- BBS 5488 Genomics
- BBS 5491 Advanced Genetics
- Other relevant courses subject to approval by the EEB Director of Graduate Studies

Note: Courses taken to fulfill the Group 1 and Group 2 requirements cannot be used to fulfill the Group 3 requirement.

Additional Requirements

- BIOL 5980 Topics in Evolution, Ecology and Population Biology
- Four semesters of BIOL 5800 Seminar in Population Biology
- BIOL 5906 Research as needed to reach 9 units/semester in each of the first four semesters

Qualifying Examinations

Progress toward the PhD is contingent upon the student passing examinations that are variously called *preliminary, qualifying, general, comprehensive,* or *major field exams.* The qualifying process varies according to the program. In some programs, it consists of a series of incremental, sequential, and cumulative exams over a considerable time. In others, the exams are held during a relatively short period of time. Exams may be replaced by one or more papers. The program, which determines the structure and schedule of the required examinations, is responsible for notifying the Office of Graduate Studies, Arts & Sciences, of the student's outcome, whether successful or unsuccessful.

PhD Qualification in EEB: Oral Examination Requirement

An oral qualifying examination is required of all students, and it is to be taken some time between February and April of the second year of graduate study. The examination committee will consist of three EEB faculty members, with the stipulation that the thesis advisor cannot serve on the committee. Two of those examiners will come from a standing committee (that rotates every year) in order to ensure consistency among exams and includes faculty spanning expertise in ecology and evolutionary biology. The student, in consultation with the advisor, will choose a third examiner from the EEB program, but not on the standing committee. The qualifying exam is not combined with the thesis proposal defense, which comes at a later date.

The purpose of the EEB qualifying exam is to test a student's knowledge in the two core areas of the program: ecology and evolutionary biology. To focus the discussion/examination, the student will choose three papers that share a central theme, and which will serve as the core of the examination. One possible set of papers would include a theoretical paper, a review paper, and a paper illustrating empirical research on the topic. However, through the course of the examination, the discussions/questions will broaden to relate the topics of the papers to general principles of ecology and evolutionary biology. Students should prepare by reviewing their knowledge in these fields, using courses in these areas as a guide. To avoid situations in which students do not choose an appropriate topic or papers, students must fill out a qualifying exam form. The form includes a short description of the topic, the papers, and how they fit together. The program coordinator will send your topic to the exam chair for approval.

Successful completion of the Group 1, Group 2, and Group 3 courses (listed above) is required as a demonstration of mastery of the basics of the field rather than a written exam.

Students are required to complete/pass their qualifying exam by April 30 of Year 2. Following the successful completion of the qualifying exam, students will identify and finalize their committee and complete their thesis proposal by December 15 of Year 3.

Doctoral Candidacy

Candidacy marks the transition from coursework and initial study to independent research and dissertation writing. At this stage, the student is considered prepared to contribute to their field through independent scholarship.

The status of candidacy for WashU Arts & Sciences doctoral students indicates a student has, at minimum, completed and passed their qualifying exam/paper and pre-candidacy requirements. Pre-candidacy requirements are determined by each PhD program. Those requirements may include, for example, completion of required coursework; completion of required foreign language exams; completion of the Mentored Experience Requirement; successful submission of the Title, Scope and Procedure form; and completion of the oral presentation to propose the dissertation to their Research Advisory Committee.

Doctoral candidacy in the EEB program is defined as the time when a student successfully completes their required coursework and Qualifying Examination. Students will advance to candidacy no later than the end of the Spring semester of Year 2. Students will complete their required courses by the end of the Spring semester of Year 2 and complete their Qualifying Examination no later than April 30 of Year 2.

Mentored Experience Requirement

Doctoral students, MFA in Writing students, and MFA in Dance students at Washington University must complete a department-defined Mentored Experience Requirement. The Mentored Experience Requirement is a degree requirement that is notated on the student's transcript when complete. Each department has an established Mentored Experience Implementation Plan in which the number of units that a student must earn through Mentored Teaching Experience(s) and/or Mentored Professional Experience(s) is defined. Each Mentored Experience Implementation Plan outlines how doctoral students within the discipline will be mentored to achieve competencies in teaching at basic and advanced levels. Some departments may elect to include Mentored Professional Experiences as an avenue for completing some units of the Mentored Experience Requirement. Doctoral students will enroll in ASGS 8005 MTE - Assistant in Instruction Experience, ASGS 8010 MTE - Assistant in Instruction Experience, or ASGS 8015 MTE - Assistant in Instruction Experience; ASGS 8020 MTE - Mentored Independent Teaching Experience; or ASGS 8120 MTE - Mentored Professional Experience to signify their progression toward completing the overall Mentored Experience Requirement for the degree.

Mentored Teaching Experience Requirement

Students are required to complete one Mentored Teaching Experience (MTE) in the fall or spring semester of Year 2, for a total of 10 Mentored Experience Requirement (MER) units. Students must enroll in ASGS 8010 MTE - Assistant in Instruction Experience during the semester in which they complete the MTE. 10 MER units are equivalent to an average of 10 hours per week of engagement.

The Doctoral Dissertation

A Research Advisory Committee (RAC) must be created no later than the end of the student's second year; departments may set shorter timelines (e.g., by the end of the student's third semester) for this requirement. As evidence of the mastery of a specific field of knowledge and of the capacity for original scholarly work, each candidate must complete a dissertation that is approved by their RAC.

A Title, Scope, and Procedure form for the dissertation must be signed by the committee members and by the program chair. It must be submitted to the Office of Graduate Studies, Arts & Sciences, at least one year before the degree is expected to be conferred or before beginning the eighth semester of full-time enrollment, whichever is earlier.

A Doctoral Dissertation Guide and a Dissertation Template that give instructions regarding the format of the dissertation are available on the website of the Office of Graduate Studies, Arts & Sciences. Both should be read carefully at every stage of dissertation preparation.

The Office of Graduate Studies, Arts & Sciences, requires each student to make the full text of the dissertation available to the committee members for their review at least one week before the defense. Most degree programs require two or more weeks for the review period; students should check with their faculty.

The Dissertation Defense

Approval of the written dissertation by the Research Advisory Committee (RAC) is strongly recommended before the student can orally defend the dissertation. The Doctoral Dissertation Committee that examines the student during the defense consists of at least five members. Normally, the members of the RAC also serve on the Doctoral Dissertation Committee. The dissertation committee is then additionally augmented to ensure that the following criteria are met:

1. Three of the five members (or a similar proportion of a larger committee) must be full-time Washington University in St. Louis faculty members or, for programs involving Washington University in St. Louis-affiliated partners, full-time members of a Washington University in St. Louis-affiliated partner institution. All members must be authorized to supervise PhD students and have appropriate expertise in the proposed field of study. One of these three members must be the PhD student's primary thesis advisor, and one may be a member of the emeritus faculty.
2. All other committee members must be active in research/scholarship and have appropriate expertise in the proposed field of study whether at Washington University in St. Louis, at another university, in government, or in industry.
3. At least one of the five members must bring expertise outside of the student's field of study to the committee, as judged by the relevant department/program and approved by the Office of Graduate Studies, Arts & Sciences.

The approval processes outlined in the RAC section of the Doctoral Council bylaws also apply to the Doctoral Dissertation Committee, including approval of each dissertation committee by the Office of Graduate Studies, Arts & Sciences.

The student is responsible for making the full text of the dissertation accessible to their committee members for their review in advance of the defense according to program rules. Washington University in St. Louis community members and guests of the student who are interested in the subject of the dissertation are normally welcome to attend all or part of the defense but may ask questions only at the discretion of the committee chair. Although there is some variation among degree programs, the defense ordinarily focuses on the dissertation itself and its relation to the student's field of expertise.

Attendance by a minimum of four members of the Doctoral Dissertation Committee, including the committee chair and an outside member, is required for the defense to take place. This provision is designed to permit the student's defense to proceed in case of a situation that unexpectedly prevents one of the five members from attending. Students should not plan in advance to only have four members in attendance. If four members cannot attend, the defense must be rescheduled. The absence of all outside members or of the committee chair also requires rescheduling the defense.

Students, with the support of their Doctoral Dissertation Committee chair, may opt to hold their dissertation defense in person or by utilizing a virtual or hybrid format.

Submission of the Dissertation

After the defense, the student must submit an electronic copy of the dissertation online to the Office of Graduate Studies, Arts & Sciences, by the established deadline for their graduation term. Dissertations must be submitted no later than three months after the oral defense of the dissertation. Petitions for an extension to the three-month limit may be submitted to the director of graduate studies for consideration and approval.

The submission website requires students to choose among publishing and copyrighting services offered by ProQuest's ETD Administrator. Students are asked to submit the Survey of Earned Doctorates separately. The degree program is responsible for delivering the final approval form, signed by the committee members at the defense and then by the program chair or director, to the Office of Graduate Studies, Arts & Sciences. Students who defend their dissertations successfully have not yet completed their PhD requirements; they finish earning their degree only when their dissertation submission has been accepted by the Office of Graduate Studies, Arts & Sciences.

Master's Degree in Lieu of a PhD

The EEB program awards a Master of Arts (MA) degree as an exit mechanism for students who, for any number of reasons, are unable to continue in the PhD program. To receive a master's degree in lieu of a PhD, students must complete the following requirements:

- Complete a minimum of 36 semester units of graduate studies.
- Complete required coursework, including one Group 1 course, one Group 2 course, one Group 3 course, BIOL 5980 Topics in Evolution, Ecology and Population Biology (one semester), BIOL 5800 Seminar in Population Biology (four semesters), and BIOL 5906 Research (as needed).
- Pass the Qualifying Examination.

No thesis is required.

Mentored Experience Implementation Plan

As part of their degree requirements, PhD students must complete a program-defined Mentored Experience Requirement (MER) as per these guidelines. The Mentored Experience Implementation Plan (MEIP) is the written articulation of a program-defined degree requirement for PhD students to engage in mentored teaching activities and/or mentored professional activities, collectively referred to as *MERs.*

Mentored Experience Requirements (MERs)

Students are required to complete one Mentored Teaching Experience (MTE) in the fall or spring semester of Year 2, for a total of 10 Mentored Experience Requirement (MER) units. Students must enroll in ASGS 8010 MTE - Assistant in Instruction Experience during the semester in which they complete the MTE. 10 MER units are equivalent to an average of 10 hours per week of engagement.

Philosophy of Teaching

Effective communication of information and concepts is a critical skill for biomedical research scientists. Although much of the teaching that scientists engage in is through one-on-one interactions with individuals in the laboratory, all scientists must have fundamental instruction in and experience with pedagogy principles, be able to deliver effective lectures to a wide audience, and be prepared to teach courses to undergraduate and graduate students. These represent the goals of the required Mentored Teaching Experience (MTE).

Preparatory Engagement

Preparatory Engagement activities are those that represent an introduction to the foundational skills associated with teaching or communication. Pedagogical preparation engagement activities are normally completed before students are permitted to engage in assisting or teaching in a classroom.

Prior to beginning their MTE and typically during their second graduate year, students will be required to complete the Graduate Student Teaching Orientation and two additional teaching workshops offered by the Center for Teaching and Learning. Students will meet with assigned course director(s) prior to the start of the semester and complete a Mentoring Plan Form. Upon completing the MTE, the course director(s) will complete an MTE Evaluation Form.

Mentored Teaching Experiences (MTEs)

Assistant in Instruction (AI)

An Assistant in Instruction (AI) is a PhD student who is directly engaged in the organization, instruction, and/or support of a semester-long course *primarily taught by a faculty member.* An AI receives mentorship from a faculty member related to best practices in classroom engagement, instruction in the field, interpersonal engagement, and other relevant skills. Students and mentors complete a mentorship plan prior to the start of each AI experience. To complete each AI assignment and to ensure that it applies toward their degree requirements, students must register for the appropriate course number for each semester of engagement. Refer to the "Required Pathways for Completion" section below for course numbers and details.

Students will serve as mentored AIs in courses approved by the Department of Biology and EEB Director of Graduate Studies. Units for a given course will be determined ahead of the assignment. A unit is equivalent to approximately one hour per week, so 10 units would involve ten hours of support (on average per week) for a course. The PhD student is formally listed as instructional support in the course listings and receives mentorship from the faculty member in best practices for classroom engagement, instruction in the field, interpersonal engagement, and other relevant skills. The mentored teaching training must incorporate at least one of the following activities: delivering lectures, leading lab activities or discussion groups, or conducting review sessions for groups of students. Grading exams or papers, holding office hours, administrative tasks, one-on-one tutoring, and so on may also be components of the assistantship and should be counted in the 10 units; however, these activities are not sufficient to meet the teaching training requirement. In general, AI assignments connect to undergraduate or lower-level graduate courses that the AI has taken previously. Students must enroll in ASGS 8010 MTE - Assistant in Instruction Experience during the semester(s) of their assigned MTEs.

The PhD student should receive regular feedback or evaluation from the mentor throughout the semester, a formal evaluation of teaching skills by the faculty at the end of the semester, and evaluation by the students at the end of the term as part of the course evaluation. If the course director determines that the PhD student's facility with essential teaching skills is unsatisfactory, the student will be counseled by the course director and the EEB Director of Graduate Studies and then will complete another MTE to attain mastery of these skills. Mentored teaching opportunities will be reviewed annually to ensure that the experiences meet the requirements established in this policy.

Required Pathways for Completion

Students work with their faculty mentor and their Director of Graduate Studies to plan how and when they will complete their MER. Students register during the normal registration period for courses in accordance with one of these approved pathways.

- Preparatory Engagement completed during the second year

Pathway #1

ASGS 8010	Take one time

Optional Activity: Professional Intensive Pathway (PIP)

The PIP is an optional pathway for those students whose career interests lie outside of academia or who want to benefit from mentored professional experiences (MPEs). An MPE is an unpaid professional experience for PhD students that allows students to develop skills and experiences relevant to their intended career outcomes. Students and mentors complete a mentorship plan prior to the start of each MPE. Students who are interested in participating in this elective experience must formally request to participate, which is subject to program approval. Due to this experience being an elective, unpaid experience, students who participate in the PIP will not receive compensation.

Students and mentors complete a mentorship plan prior to the start of each MPE. To complete each MPE assignment and ensure that it applies toward their degree requirements, students must submit the Mentorship Registration Request form for approval and register for the appropriate course number (ASGS 8120 MTE - Mentored Professional Experience) for each semester of engagement.

The MPE via the PIP is an optional activity. Students should engage in activities that enhance their professional development and record these activities at their thesis update meetings. For some students, an optional MPE is encouraged. The MPE can be fulfilled by a wide range of activities that advance the careers and professional development of PhD students. These could include, for example, opportunities in data science, biotech or pharmaceuticals (including at a startup or established company); science communication; science outreach; diversity, equity, and inclusion work; government or policy opportunities; consulting; or higher education administration. Academic-track students may use the MPE to learn a new technique at a core facility or other lab. The duties and responsibilities of the MPE should be intellectually substantive and offer opportunities for the student to develop new skills and experiences. MPEs are distinct from internships in that they are considered part of the PhD training and are recorded on students' transcripts as courses. The scope of the MPE will be determined in conversation among the student and the site mentor, and the final plan must be approved by the principal investigator and the EEB Director of Graduate Studies. An average of 10 hours per week of MPE for a total of 150 to 180 hours is expected for each student.

Prior to the start of an MPE, the student and the site mentor will submit a plan to the Office of Graduate Studies, Arts & Sciences, detailing the scope of the project(s) to be undertaken and including a schedule and list of anticipated outcomes, and the mentor will provide an explicit commitment to the mentorship. This plan should be directly related to the goals developed via the student's recent completion of an Individual Development Plan, and students should enroll in ASGS 8120 MTE - Mentored Professional Experience. During the semester, the mentor and the mentee should meet frequently (i.e., weekly or biweekly) to track the progress of the student's work. At the end of the MPE, the mentor should provide a written assessment (approximately 500 words) of the overall learning experience for the student and the quality of the work completed, and the student will submit a self-reflection statement detailing the skills and experiences gained and how their career goals may (or may not) have changed. The mentor will register the completion of ASGS 8120 MTE - Mentored Professional Experience as Pass/No Pass.

Optional Pathway

ASGS 8120	Take one time