

ENTOMOLOGY

Dual-Titles

Dual-Title M.S. and Ph.D. in Entomology and Comparative and International Education

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international education may apply to the Entomology/CIED dual-title degree program. The goal of the dual-title degree Entomology and CIED graduate program is to enable graduate students from Entomology to acquire the knowledge and skill of their primary area of specialization in Entomology, while at the same time gaining the perspective and methods of comparative and international education. Graduate dual-title degree program in Entomology and CIED study in this program seeks to prepare students to assume leadership roles in science, science education, outreach, and project management anywhere in the world. Students are required to write research proposals and expected to write grants to support their research activities, reflecting the dual-title degree. As part of their professional development, presentations, publication of research articles, and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students are able to specialize in the research program areas of chemical ecology, disease ecology and biology, pollinator ecology and biology, ecology, genomic, and pest management. Additional specialization is available to students performing research with insects in the inter-college degree programs in genetics, ecology, and plant biology. At the same time they will acquire a broad perspective about how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can compare practices and outcomes between countries and regions.

Admission Requirements

For admission to the dual-title degree under this program, a student must first apply and be admitted to the Entomology graduate program. Once accepted into the Entomology program, the student can apply to the Admissions Committee on the Comparative and International Education program. The CIED admissions committee reviews applications and recommends students for admission to the dual-title degree program to the Fox Graduate School. Scores from the Graduate Records Examinations (GRE) are required for admission. In addition, students are to provide a written personal statement indicating the career goals they hope to accomplish by earning a dual-title Entomology/CIED degree. Refer to the Admission Requirements section of the CIED Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>). Doctoral students must be admitted into the dual-title degree program in CIED prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the Entomology program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in CIED, listed on the CIED Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

Within this framework, final course selection is determined by the student, their CIED adviser, and their Entomology program adviser.

Upon a student's acceptance by the CIED admissions committee, the student will be assigned a CIED academic adviser in consultation with the CIED program chair. As students develop specific scholarly interests, they may request that a different CIED faculty member serve as their adviser. The student and adviser will discuss a program of study that is appropriate for the student's professional objectives and that is in accord with the policies of Graduate Council, the Entomology program, and the CIED program.

Requirements for the Dual-Title M.S.

The master's in Entomology and CIED is a dual-title degree awarded only to students who are admitted to the Entomology master's program and admitted to the dual-title degree in CIED. Some courses may satisfy both the graduate primary program requirements and those of the CIED program. Final course selection is determined by the students in consultation with their CIED advisers and their major program advisers. Students and advisers should maintain the CIED Master's Degree Plan of Study, which must be submitted to the CIED program office two months before the student files the "Intent to Graduate" via LionPATH.

Dual-title M.S. students must write a master's thesis on a topic that reflects both the graduate program in Entomology and the dual-title offering in Comparative and International Education. The thesis committee for the dual-title M.S. degree will consist of two Graduate Faculty members from Entomology and one graduate faculty member from CIED.

Dual-title master's degree students in Entomology and CIED will also be required to pass a final oral examination covering the general field of Entomology and CIED, with emphasis on the student's area of specialization. The oral exam (thesis defense) is to be administered by the student's thesis committee. A favorable vote of a two-thirds majority is necessary for passing.

Requirements for the Dual-Title Ph.D.

The doctoral degree in Entomology and CIED is a dual-title degree awarded only to students who are admitted to the Entomology doctoral program and admitted to the dual-title degree in CIED. To qualify for the dual-title degree, students must satisfy the degree requirements for the degree they are enrolled in Entomology, listed in the Degree Requirements section. In addition, students must complete the degree requirements for the dual-title in CIED, listed on the CIED Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/comparative-international-education/>).

Particular courses may satisfy both the Entomology Department requirements and those in the Comparative and International Education program. Final course selection is determined by the student in consultation with their CIED advisers and their major program advisers. Students who already hold a master's degree from another institution may petition to have equivalent course credits accepted.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Entomology and must include at least one Graduate Faculty member from the CIED program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Entomology and CIED. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying

examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Entomology and CIED dual-title Ph.D. student must include at least one member of the CIED Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in CIED, the member of the committee representing CIED must be appointed as co-chair. The CIED representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Entomology and CIED. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Fox Graduate School.

Dual-Title M.S. and Ph.D. in Entomology and International Agriculture and Development

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in international agriculture and development may apply to the Entomology/INTAD Dual-Title Degree Program. The goal of the dual-title degree Entomology and INTAD graduate program is to enable graduate students from Entomology to acquire the knowledge and skills of their primary area of specialization in Entomology, while at the same time gaining the perspective and methods needed for work in the international agriculture. Graduate study in this program seeks to prepare students to assume leadership roles in science, science education, outreach, and project management anywhere in the world. Students are required to write research proposals and expected to write grants to support their research activities, reflecting the dual-title degree. As part of their professional development presentations, publication of research articles and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students are able to specialize in the research program areas of chemical ecology, disease ecology and biology, pollinator ecology and biology, ecology, genomics, and pest management. Additional specialization is available to students performing research with insects in the inter-college degree programs in genetics, ecology, and plant biology. At the same time they will acquire a broad perspective about how to apply their research findings in the context of the broader international community. Thus, the dual-title will allow students to master their field of specialization from an international perspective so that they can compare practices and outcomes between countries and regions.

Admission Requirements

For admission to the dual-title doctoral degree under this program, a student must first apply and be admitted to the Entomology graduate program. Once accepted into the Entomology program, the student can then submit an application to the INTAD Academic Program Committee for the dual-title degree program. The application consists of a written

personal statement indicating the career goals that a student hopes to accomplish by earning a dual-title ENT/INTAD degree. For admission a student should have a strong background in biological sciences. Courses in chemistry through organic, physics, mathematics through calculus, statistics, and computer application are recommended. Refer to the Admission Requirements section of the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>). Doctoral students must be admitted into the dual-title degree program in INTAD prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the Entomology program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in INTAD, listed on the INTAD Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/international-agriculture-development/>).

Requirements for the Dual-Title M.S.

The dual-title master's in Entomology and INTAD is awarded only to students who are admitted to the Entomology master's program and admitted to the dual-title degree in INTAD. Some courses may satisfy both the graduate primary program requirements and those of the INTAD program. Final course selection is determined by the students in consultation with their INTAD advisors and their Entomology program advisors. Permission from a student's academic adviser, in consultation with the program chair, is required to substitute a 400-level course for a 500-level course; however, the requirement for 18 credits at the 500 and 600 level combined must still be met, in total, across both the major and the dual-title courses of study. Students and advisors should maintain the INTAD Master's Degree Plan of Study, which must be submitted to the INTAD program office two months before the student files the "Intent to Graduate" via LionPATH.

Students in the program must write a master's thesis on a topic that reflects both the graduate program in entomology and the dual-title offering in INTAD. Thesis research credits (SUBJ 600) must be taken in the major program. All members of the student's committee for the dual-title master's degree will be members of the Graduate Faculty. The committee must include at least one Graduate Faculty member from INTAD. A Degree Committee form should be filed upon selection of the committee members and should be approved by the INTAD Academic Program Committee Co-chair.

Candidates for the dual-title master's degree in Entomology and INTAD will also be required to pass a final oral examination covering the general field of entomology and INTAD, with emphasis on the student's area of specialization. The oral exam is to be administered by the student's thesis committee. A favorable vote of a two-thirds majority is necessary for passing.

Requirements for the Dual-Title Ph.D.

The doctoral degree in Entomology and INTAD is a dual-title degree awarded only to students who are admitted to the Entomology doctoral program and admitted to the dual-title degree in INTAD.

Permission from a student's academic adviser, in consultation with the program chair, is required to substitute a 400-level course for a 500-level course; however, the requirement for 18 INTAD credits at the 500 or 800 level must still be met, in total, across both the major and the dual-title courses of study. Particular courses may satisfy both the Entomology Department requirements and those in the INTAD program. Final course selection is determined by the student in consultation with their INTAD advisers and their Entomology program advisers. Students who already

hold a master's degree from another institution may petition to have equivalent course credits accepted.

Graduates of the dual-title INTAD master's degree program who wish to pursue an INTAD doctoral degree must re-apply to the INTAD program for admission. INTAD master's degree credits may be carried over to the doctoral program. Six additional INTAD credits will be required. INTAD master's degree graduates who pursue an INTAD Ph.D. are required to take the INTAD 820 International Agricultural Development Seminar a second time.

Qualifying Examination

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Entomology and must include at least one Graduate Faculty member from the INTAD program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Entomology and INTAD. Qualifying examination procedures will be based on the procedures of the major department and will have an international dimension. Although not encouraged, the dual-title degree student may require an additional semester or more to fulfill requirements for the dual-title degree program. Therefore, under exceptional circumstances, the qualifying exam may be delayed at the discretion of the student's adviser in consultation with the INTAD program coordinators.

Ph.D. Committee Composition

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Entomology and INTAD dual-title Ph.D. student must include at least one member of the INTAD Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in INTAD, the member of the committee representing INTAD must be appointed as co-chair.

Comprehensive Exam

At the end of the course work, students in the dual-title doctoral degree program in Entomology and INTAD will be required to pass an oral comprehensive examination based on their thesis proposal and area of specialization in entomology, while reflecting their dual-title curriculum. A separate comprehensive examination is not required by the INTAD program, but international agriculture must be one of the key areas of the exam and the INTAD representative on the student's Ph.D. committee must have input into the development of and participation in the evaluation of the comprehensive examination.

Dissertation and Dissertation Defense

Ph.D. students enrolled in the dual-title degree program are required to write and orally defend a dissertation on a topic that reflects their original research and education in both Entomology and International Agriculture and Development. The dissertation should contribute to the body of knowledge in international agriculture. A public oral presentation of the dissertation is required. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Fox Graduate School.

DUAL-TITLE PH.D. IN Entomology AND Microbiome Sciences

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://>

gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/).

Doctoral students with research and educational experiences in Entomology may apply to the Entomology-Microbiome Sciences Dual-Title Doctoral Degree Program. The goal of the dual-title Ph.D. degree in Entomology and Microbiome Sciences is to enable ENT graduate students to acquire the knowledge and skills of their major area of specialization in ENT, while at the same time gaining expertise and skills in Microbiome Sciences. Graduate study in this program seeks to provide students with the intellectual foundation for integrated and mechanistic understanding of interactions between plant hosts, microbes, and environmental systems. Interdisciplinary training that includes Microbiome Sciences will prepare students for positions in academia, government, non-profit organizations, and the private sector, including agricultural and environmental sciences, energy industries, and the integrated study of the sustainability of biological systems.

Admission Requirements

For admission to the dual-title doctoral degree in Microbiome Sciences, a student must first apply and be admitted to the Entomology PhD graduate program and the Fox Graduate School, preferably but not necessarily discussing the dual-title interest beforehand with a major adviser who has been appointed to the Microbiome Sciences program. After admission to their primary program, students must apply for admission to and meet the admissions requirements of the Microbiome Sciences dual-title program. Refer to the Admission Requirements section of the Microbiome Sciences Bulletin page (<https://bulletins.psu.edu/graduate/programs/majors/microbiome-sciences/>). Doctoral students should enroll in a dual-title graduate degree program early in their training, and no later than the end of the fourth semester (not counting summer semesters) of entry into the graduate major program.

Degree Requirements

Students are required to have two advisers from separate disciplines: one individual serving as a primary adviser in their major degree program and a secondary adviser in an area within a field covered by the dual-title program who is a member of the Microbiome Sciences Graduate Faculty. The major program adviser will normally also be a member of the Microbiome Sciences Graduate Faculty. The two faculty advisers can represent different academic programs, but this is not required, as faculty from a scientifically diverse department could represent very different areas of expertise. The qualifying examination for Entomology will satisfy the qualifying examination requirement for the dual-title degree program in Microbiome Sciences. In addition to the general Graduate Council requirements for Ph.D. committees (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>), the Ph.D. committee of an Entomology and Microbiome Sciences dual-title doctoral degree student must include at least one member of the Microbiome Sciences Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in Microbiome Sciences, the member of the committee representing Microbiome Sciences must be appointed as co-chair. The Microbiome Sciences representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

To fulfill the course requirements for the dual-title in Microbiome Sciences, students must complete a total of 15 credits including 2 credits of MBIOM 550 (<https://bulletins.psu.edu/search/?P=MBIOM%20550>) and at least 13 credits chosen in consultation with the adviser from an

approved list of courses, with at least 3 credits in each of the following areas: microbial sciences, ecology and evolution, and bioinformatics and research tools. All students must pass a qualifying examination in their major field of study. The qualifying examination for Entomology will satisfy the qualifying examination requirement for the dual-title degree program in Microbiome Sciences.

Students enrolled in the dual-title program are required to write and orally defend a dissertation on a topic that reflects their original research and education in Entomology and Microbiome Sciences. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Fox Graduate School.

Dual-Title M.S. and Ph.D. in Entomology and Operations Research

Requirements listed here are in addition to requirements listed in GCAC-208 Dual-Title Graduate Degree Programs (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-208-dual-titles/>).

Graduate students with research and educational interests in operations research may apply to the Entomology/OR Dual-Title Degree Program. The goal of the dual-title degree Entomology and OR graduate program is to enable graduate students from Entomology to acquire the knowledge and skill of their primary area of specialization in Entomology, while at the same time attain and be identified with the tools, techniques, and methodology of operations research. Operations research is the analysis—usually involving mathematical treatment—of a process, problem, or operation to determine its purpose and effectiveness and to gain maximum efficiency. Graduate Dual-Title degree program in Entomology and OR study in this program seeks to prepare students to assume leadership roles in science, science education, outreach, and project management anywhere in the world. Students are required to write research proposals and expected to write grants to support their research activities, reflecting the dual-title degree. As part of their professional development, presentations, publication of research articles, and active participation in professional societies is expected. Emphasis is placed upon the professional development of the student. Students are able to specialize in the research program areas of chemical ecology, disease ecology and biology, pollinator ecology and biology, ecology, genomics, and pest management. Additional specialization is available to students performing research with insects in the inter-college degree programs in genetics, ecology, and plant biology. At the same time they will acquire a broad perspective about how to apply their research findings in the context of operations research. Thus, the dual-title will allow students to master their field of specialization from an operations research perspective.

Admission Requirements

For admission to the dual-title degree under this program, a student must first apply and be admitted to the Entomology graduate program. Once accepted into the Entomology program, the student can apply to the Admissions Committee of the Operations Research program. The OR admissions committee reviews applications and recommends students for admission to the dual-title degree program to the Fox Graduate School. Scores from the Graduate Records Examinations (GRE) are required for admission. Refer to the Admission Requirements section of the OR Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Doctoral students must be admitted

into the dual-title degree program in OR prior to taking the qualifying examination in their primary graduate program.

Degree Requirements

To qualify for a dual-title degree, students must satisfy the requirements of the Entomology program in which they are primarily enrolled. In addition, students must complete the degree requirements for the dual-title in OR, listed on the OR Bulletin page (<http://bulletins.psu.edu/graduate/programs/majors/operations-research/>). Within this framework, final course selection is determined by the student, their OR adviser, and their Entomology program adviser.

The qualifying examination committee for the dual-title Ph.D. degree will be composed of Graduate Faculty from Entomology and must include at least one Graduate Faculty member from the OR program. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. There will be a single qualifying examination, containing elements of both Entomology and OR. Dual-title graduate degree students may require an additional semester to fulfill requirements for both areas of study and, therefore, the qualifying examination may be delayed one semester beyond the normal period allowable.

In addition to the general Graduate Council requirements for Ph.D. committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>), the Ph.D. committee of an Entomology and OR dual-title Ph.D. student must include at least one member of the OR Graduate Faculty. Faculty members who hold appointments in both programs' Graduate Faculty may serve in a combined role. If the chair of the Ph.D. committee is not also a member of the Graduate Faculty in OR, the member of the committee representing OR must be appointed as co-chair. The OR representative on the student's Ph.D. committee will develop questions for and participate in the evaluation of the comprehensive examination.

Students in the dual-title program are required to write and orally defend a dissertation on a topic that is approved in advance by their Ph.D. committee and reflects their original research and education in Entomology and OR. Upon completion of the doctoral dissertation, the candidate must pass a final oral examination (the dissertation defense) to earn the Ph.D. degree. The dissertation must be accepted by the Ph.D. committee, the head of the graduate program, and the Fox Graduate School.