

# ENTOMOLOGY

<b>Graduate Program Head</b>	Gary W. Felton
<b>Program Code</b>	ENT
<b>Campus(es)</b>	University Park (Ph.D., M.S.)
<b>Degrees Conferred</b>	Doctor of Philosophy (Ph.D.) Master of Science (M.S.) Dual-Title Ph.D. and M.S. in Entomology and Comparative and International Education Dual-Title Ph.D. and M.S. in Entomology and International Agriculture and Development Dual-Title Ph.D. and M.S. in Entomology and Operations Research
<b>The Graduate Faculty</b>	View ( <a href="https://secure.gradsch.psu.edu/gpms/?searchType=fac&amp;prog=ENT">https://secure.gradsch.psu.edu/gpms/?searchType=fac&amp;prog=ENT</a> )

Students in Entomology represent a range of experiences and interests, with varied backgrounds from biology, chemistry, zoology, entomology, meteorology, ecology, and botany programs to name a few. You will find an exceptional faculty that offer an unequaled range of research expertise and breadth within our focus areas. The strength of our research resides in four main program themes:

- Chemical Ecology
- Ecological Applications
- Disease Biology and Ecology
- Pollinator Biology and Ecology

Many opportunities are available for study abroad experiences from which students return with a new perspective that enhances their studies and research. Additional specialization is available to students conducting research with insects in intercollegiate degree programs in ecology, genetics and plant biology.

## 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/>).

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.

The language of instruction at Penn State is English. English proficiency test scores (TOEFL/IELTS) may be required for international applicants. See GCAC-305 Admission Requirements for International Students (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-300/gcac-305-admission-requirements-international-students/>) for more information.

## 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/>)

The Master of Science degree in Entomology is an intermediate degree leading toward the development of special knowledge in entomology. It provides training for prospective doctoral candidates. A minimum of 30 credits (400 and 500 level) is required, with at least 20 credits earned in residence. At least 18 credits in the 500 and 600 series must be included in the program. A minimum of 12 credits in coursework (400 and 500) must be completed in the major program.

Code	Title	Credits
<b>Required Courses</b>		
ENT 432	Insect Biodiversity and Evolution	4
ENT 518	Insect Natural History	2
ENT 522	Critical Thinking and Professional Development in Entomology	6
ENT 530	Seminar in Insect Science	2
3 credits of 400- to 500-level ENT courses		3
3 credits of statistics (i.e., STAT 501, STAT 502, STAT 541, AG 400, or equivalent)		3
ENT 590	Colloquium	1
<b>Electives</b>		
Additional courses may be selected by the student in consultation with his/her graduate committee.		3
<b>Culminating Experience</b>		
ENT 600	Thesis Research	6
<b>Total Credits</b>		<b>30</b>

Each master's student is expected to serve as a teaching assistant for 3 credits (ENT 602); however, these 3 credits cannot be counted towards the minimum credits required for the degree.

Each student must present the results of thesis research at a departmental seminar, and the student may register for 1 credit of ENT 590 that semester. A thesis equivalent to 6 credits (ENT 600) is required. A final oral examination covering the general field of entomology, with emphasis in the student's area of specialization, is required by the department. This is to be administered by the student's committee. A favorable vote of a two-thirds majority is necessary for passing.

Committees for master's degree candidates should be formed during the first semester, and are suggested jointly by the student and adviser, with approval by the Department Head. Masters committees have a minimum of three members. One of these should be from another degree program, particularly if the student plans to minor in that area. Adjunct faculty members cannot constitute a majority of the committee. The student and committee shall meet early in the process to plan the student's program and approve a thesis project. Refer to the Graduate School's Thesis and Dissertation Guide (<http://gradschool.psu.edu/current-students/etd/thesisdissertationguidepdf/>).

## 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 degree of Doctor of Philosophy signifies high scholastic achievement and demonstrated capability in independent research. Although there is no formal credit requirement at the Ph.D. level, five academic years of full time graduate work beyond the bachelor's degree are normally required. Some of the work may be completed off campus or on a part-time basis, but between admission to the Ph.D. program and completion of the Ph.D. program, the student must spend two academic sessions in residence within a twelve-month period. The program requires all students to take:

Code	Title	Credits
<b>Required Courses</b>		
ENT 432	Insect Biodiversity and Evolution	4
ENT 518	Insect Natural History	2
ENT 522	Critical Thinking and Professional Development in Entomology	6
ENT 530	Seminar in Insect Science	4
3 credits of 400- or 500-level ENT courses		3

Other course requirements are dependent on the student's program of study. Each Ph.D. student is expected to serve as a teaching assistant for 6 credits (ENT 602). The results of the dissertation research must be presented at a departmental seminar. In addition, students must take and pass a comprehensive and final oral examination. Students commencing a doctoral program may have a provisional committee appointed as soon as the adviser is selected. A favorable vote by two-thirds of the qualifying examination committee members is necessary to pass the qualifying examination.

The official Ph.D. committee is approved by the Department Head and is appointed by the Dean of the Graduate School through the office of Graduate Enrollment Services after the student has passed the qualifying exam. Ph.D. committees for students in the Entomology program include at least three members from the department, at least one member from a related field outside Entomology, and a total of no fewer than four members; five members are recommended. Typically, committee members are chosen in consultation with the adviser. If the student has a formal minor, a representative of the minor field must be on the committee.

The student and committee should meet early in the degree process to plan the student's Ph.D. program and approve a dissertation project. A student may change adviser or committee members without prejudice. The Ph.D. committee guides and monitors the student's progress, administers the comprehensive and final oral examinations, and evaluates the dissertation. Students are not formally admitted to doctoral candidacy until they have passed the comprehensive examination.

A student in the Doctor of Philosophy degree program is required to demonstrate high-level competence in the use of the English language, including reading, writing, and speaking, as part of the language and communication requirements for the Ph.D. Entomology assesses and works to improve competence of both domestic and international students. Assessments to evaluate competency prior to the qualifying exam include pieces of original writing required as part of ENT 522. Oral communication competency is evaluated during the qualifying examination. Students needing assistance are directed to appropriate remedial activities. International students should note that passage of

the minimal TOEFL or IELTS requirement does not demonstrate the level of competence expected of a Ph.D. from Penn State.

There is no foreign language requirement for the Ph.D. degree. However, depending on the nature of the dissertation research and with the advice and consent of the Ph.D. committee, competency in a foreign language may be required as a part of the doctoral studies of certain students.

## 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 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 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 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/](http://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 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 Graduate School.

## 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.

## 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.

Entomology (ENT) Course List (<https://bulletins.psu.edu/university-course-descriptions/graduate/ent/>)

## Learning Outcomes

### Master of science (M.S.)

1. Know: Graduates will demonstrate in depth knowledge of the core theories and methods as well as within one or more sub-specialties in the field of entomology. The core demonstration will include the application of insect ecology, physiology, systematics, and natural history, to problems in agriculture, chemical ecology, pollinator ecology, biotechnology, and integrated pest management.
2. Create: Graduates will be able to creatively synthesize theory and current literature to generate new ideas or hypotheses in the entomological sciences, devise critical tests of hypotheses, and/or develop unique solutions to entomological problems.
3. Apply: Graduates will be able to carry out independent and original research studies that address current problems in the field of entomology.
4. Critical thinking: Graduates will be able to critically analyze work by others in their field of specialty.
5. Communicate: Graduates will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations.
6. Professional practice: Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals within their field or with diverse scientific backgrounds. Graduates will demonstrate the PSU core values of Integrity, Respect, Responsibility, Discovery, Excellence, and Community.

### Doctor of Philosophy (Ph.D.)

1. Know: Graduates will demonstrate in depth knowledge of the core theories and methods as well as within one or more sub-specialties in the field of entomology. The core demonstration will include the application of insect ecology, physiology, systematics, and natural history, to problems in agriculture, chemical ecology, pollinator ecology, biotechnology, and integrated pest management.
2. Create: Graduates will be able to creatively synthesize theory and current literature to generate new ideas or hypotheses in the entomological sciences, devise critical tests of hypotheses, and/or develop unique solutions to entomological problems.
3. Apply: Graduates will be able to carry out independent and original research studies that address current problems in the field of entomology.
4. Critical thinking: Graduates will be able to critically analyze work by others in their field of specialty.
5. Communicate: Graduates will be able to convey ideas or arguments in clear, concise, well-organized papers and proposals as well as in formal, oral presentations.
6. Professional practice: Graduates will demonstrate the ability to collaborate in a collegial and ethical manner with other professionals

within their field or with diverse scientific backgrounds. Graduates will demonstrate the PSU core values of Integrity, Respect, Responsibility, Discovery, Excellence, and Community.

## Contact

<b>Campus</b>	University Park
<b>Graduate Program Head</b>	Gary Felton
<b>Director of Graduate Studies (DGS) or Professor-in-Charge (PIC)</b>	John Tooker
<b>Program Contact</b>	Susan Bass 501F ASI Building University Park PA 16802 sgb13@psu.edu (814) 865-3077
<b>Program Website</b>	View ( <a href="http://ento.psu.edu/graduateprograms/">http://ento.psu.edu/graduateprograms/</a> )