

Entomology

College of Agriculture, Food & Environment

The Department of Entomology offers graduate work leading to the Master of Science (Plan A -- Thesis and Plan B -- Non-thesis) and the Doctor of Philosophy degrees. Individual graduate programs are planned by students in consultation with their advisory committee and the Director of Graduate Studies. Entomology, like all agricultural and biological sciences disciplines, continues to evolve and integrate state of the art technology and new research perspectives with insect biology. Although departmental research is unified by a focus on insects and their arthropod relatives, many research groups creatively merge aspects of basic and applied biology. Graduate study and research opportunities are available in a diverse range of areas of entomology, including agricultural and urban entomology, biological control and integrated pest management, medical, veterinary, and public health entomology, pollinator biology and insect-plant relationships, forest entomology, and arachnology. Research covers many major fields of biology including behavior, biochemistry, ecology (including evolutionary, urban, landscape, and general ecology), genetics, neuroscience, molecular biology, physiology, toxicology, and systematics.

Admission Requirements

Minimum admission requirements include an overall undergraduate grade point average of 3.0 and an overall graduate grade point average of 3.25. Applicants whose native language is English must score at least 300 on the combined verbal and quantitative portions of the Graduate Record Examination (GRE) general test. Those whose native language is not English must have a Test of English as a Foreign Language (TOEFL) with a minimum score of 79 on the TOEFL iBT. A minimum overall band score of 6.5 on the International English Language Testing System (IELTS) may be used in lieu of a TOEFL score. They must also have a score of 150 on the quantitative portion of the GRE. The Program requires three letters of recommendation. Meeting the minimum requirements does not guarantee admission. These minimum requirements may be waived in exceptional cases if sufficient additional evidence is presented regarding the ability of the student to do graduate work. Admission to the Graduate Program in Entomology does not automatically guarantee financial assistance to the student.

Degree Requirements

During their first year of graduate studies, M.S. (Plan A) and Ph.D. students are required to prepare a formal written research proposal encompassing a thorough literature review, clear statement of objectives, and materials and methods of the project. A research proposal seminar will be presented to the Department upon completion of the written research proposal. An exit seminar, usually presented during the last semester of the student's tenure, is required for M.S. (plans A and B) and Ph.D. students. August graduates will present their seminar in the preceding spring. M.S. students using the Plan B option will be required to provide a detailed outline of their practicum to their Advisory Committee. The practicum must be a minimum of 3 credit hours (maximum of 6 credit hours) and may consist of library research, special problems, internships, etc., as agreed upon by the student and major professor, and approved by the Advisory Committee.

All M.S. and Ph.D. students must satisfy the following core course requirements:

1. An undergraduate course in general entomology. Students who have not had such a course before enrolling in the Entomology graduate program must take ENT 300.
2. STA 570 (Basic Statistical Analysis) or equivalent, or a different statistics course approved by the student's advisory committee
3. Each M.S. student must take two semesters of ENT 770, Entomological Seminar, (or approved

equivalent seminars) and Ph.D. candidates must take four semesters of approved seminars.

4. Ph.D. and M.S. candidates using the Plan A option must take a minimum of one course from two of the following core areas. M.S. candidates using the Plan B option must take a minimum of one course from all three core areas.

Core Area 1: Insect Behavior, Ecology, Evolution and Systematics.

ENT 564	Insect Taxonomy
ENT 568	Insect Behavior
ENT 607	Advanced Evolution
ENT 625	Insect-Plant Relationships
ENT 660	Immature Insects
ENT 665	Insect Ecology
ENT 667	Invasive Species Biology

Core Area 2: Insect Molecular Biology, Physiology and Genetics.

ENT 635	Insect Physiology
ENT 636	Insect Molecular Biology

Core Area 3: Pest Management and Applied Ecology.

ENT 530	Integrated Pest Management
ENT 561	Insects Affecting Human and Animal Health
ENT 574	Advanced Applied Entomology
ENT 680	Biological Control

In all cases, an equivalent graduate level course from another institution is acceptable upon approval of the Advisory Committee. Such approval will not decrease the minimum number of credits required, but simply will permit the student to take other courses.

Course Descriptions

ENT 502 FOREST ENTOMOLOGY. (3)

Lectures primarily address principles and concepts. Laboratories use a hands-on approach to demonstrate insect collecting and identification techniques, ecological concepts and management approaches, and use of reference materials. Prereq: A minimum of 3 credits of basic biology (BIO 103 or BIO 148 or equivalent) or consent of instructor. (Same as FOR 502.) [Offered in fall only.]

ENT 505 EVOLUTION IN AGRICULTURE, MEDICINE AND CONSERVATION BIOLOGY. (3)

An introduction to modern evolutionary theory with emphasis on its application to current problems in agriculture, the biomedical sciences, and conservation biology. Prereq: Genetics (ABT 360, BIO 304 or equivalent introductory genetics course). (Same as ABT 505.)

ENT 509 BRAINS AND BUDS: NEUROSCIENCE OF POLLINATION. (3)

Pollinators have tremendous agricultural and societal value, and to a neuroscientist, they showcase principles of cognition in the real world. Pollinator species present exquisite examples of co-evolution, physiological and dietary specialization, navigation in complex landscapes, collective decision-making processes, and the behavioral consequences of environmental toxins and disease. In this course, we will use pollinator species (honey bees and other insects, as well as vertebrate pollinators) to explore how critical features of pollination intersect at the level of brain function, covering

important neuroscience topics including sensory ecology and evolution, neural energetics, mechanisms of addiction and reward, molecular neuroscience, cognition, and learning and memory. Prereq: Students must have at least Junior standing in a life sciences discipline, or permission from instructor. (Same as BIO 509.)

ENT 530 INTEGRATED PEST MANAGEMENT. (3)

Principles of insect damage, populations and distributions. Various types of natural and applied control, including problems of insecticide toxicity, resistance and residues. Prereq: ENT 300 or ENT 310 or ENT 320.

ENT 550 SPIDER ECOLOGY AND BEHAVIOR. (3)

Spiders are fascinating in their own right, and also are major predators in terrestrial food webs. This course examines the ecology and behavior of spiders as model predators in systems ranging from undisturbed forests and meadows to agroecosystems and the urban landscape. While focusing on spiders, the course also intertwines two general sub-themes: (1) the advantages of employing diverse approaches (e.g. field and laboratory experiments, non-manipulative observations, and meta-analyses) in ecological and behavioral research; and (2) the strengths, and limitations, of using model organisms to develop and test theory. Prereq: One year of undergraduate biology.

ENT 561 INSECTS AFFECTING HUMAN AND ANIMAL HEALTH. (3)

Discussion of arthropod parasites and disease vectors. Topics include an overview of disease transmission and public health, epidemiology, vector biology, important arthropod groups and their control. Prereq: 3 credits of basic biology (BIO 103 or BIO 148 or equivalent) or permission of instructor. (Same as BIO/CPH 561.) [Offered in fall – odd years.]

ENT 563 PARASITOLOGY. (4)

Protozoan, helminth and arthropod parasites of man and domestic animals, emphasis on etiology, epidemiology, methods of diagnosis, control measures, and life histories. Techniques for host examination and preparation of material for study. Prereq: BIO 148, BIO 152, BIO 155 or BIO 198, or consent of instructor. (Same as BIO 563.)

ENT 564 INSECT TAXONOMY. (4)

A study of insect taxonomy including the collection, preparation, and identification of adult insect specimens. Prereq: Consent of instructor. (Same as BIO 564.) [Offered in fall – even years.]

ENT 568 INSECT BEHAVIOR. (3)

The principles of animal behavior will be stressed using insects as examples. Physiology, mechanisms, behavioral ecology and evolution of insect behavior will be covered. Prereq: One year of biology. (Same as BIO 568.) [Offered in spring – odd years.]

ENT 574 ADVANCED APPLIED ENTOMOLOGY. (4)

The objective of this course is to present the student with advanced concepts of applied entomology in a system-specific context. Each week, the insect problems associated with a different commodity/production system will be presented so as to illustrate a different broadly-based theme. Prereq: An introductory entomology course and consent of instructor.

ENT 595 ENTOMOLOGICAL SPECIAL TOPICS (Subtitle required). (1-4)

Special topics or experimental courses in Entomology for undergraduate and graduate students. Special title is required and must be approved by the chairperson of the Department of Entomology. A particular title may be offered twice at most under ENT 595. Students may not repeat under the same subtitle. Prereq: Will be set by instructor. (Offered in fall and spring.)

ENT 606 CONCEPTUAL METHODS IN ECOLOGY AND EVOLUTION. (3)

This course provides students with hands-on experience in a diverse array of conceptual research techniques used by ecologists and evolutionary biologists. The focus will be on optimization methods used for predicting animal and plant behaviors and life histories, and on methods for assessing population trends and dynamics. Mathematical techniques used will include graphical analyses, matrix algebra, calculus, and computer simulations. The latter part of the course will consist of collaborative modeling projects, in which small groups of students will work with the instructor to address an important contemporary research problem and will report their results in a public talk and a project writeup. Prereq: One year of calculus and BIO 325 or FOR 340 or ENT 665, or consent of instructor. (Same as BIO/FOR 606.)

ENT 607 ADVANCED EVOLUTION. (2)

This course covers advanced topics in evolution, concentrating on questions central to the understanding of general evolutionary processes. Phenomena occurring both within populations (e.g., selection, inheritance, population subdivision) and between populations (e.g., gene flow, competition) will be addressed. Special attention will be given to modern research approaches and techniques including quantitative genetics, measurement of selection, phylogenetic analyses of comparative data and molecular systematics. Prereq: One year of calculus, genetics (BIO 304 or BIO 461) and BIO 508 or consent of instructor. (Same as BIO/FOR 607.) [Offered in fall only.]

ENT 608 BEHAVIORAL ECOLOGY AND LIFE HISTORIES. (2)

This course uses an evolutionary approach to examine behavior and life histories. Topics addressed include: the optimality approach, constraints on optimality, kin and group selection, predator and prey behaviors, social and mating behaviors, and life history evolution. Prereq: BIO 325 and one semester of calculus; or consent of instructor. (Same as BIO/FOR 608.)

ENT 609 POPULATION AND COMMUNITY ECOLOGY. (3)

This course discusses the processes that determine population distributions and dynamics and community structure for both plants and animals. Topics addressed include: population regulation and population stability, community diversity and stability, ecological succession, population interactions (competition, predation, mutualism), coevolution, and the effects of spatial and temporal heterogeneity on population and community patterns. Prereq: BIO 325 or FOR 340 or consent of instructor. (Same as BIO/FOR 609.) [Offered in fall only.]

ENT 625 INSECT-PLANT RELATIONSHIPS. (3)

This course examines the natural history, ecology, and evolution of insect/plant relationships. Topics include mechanisms and theory of plant defense, behavioral and physiological adaptations of herbivorous insects, pollination biology, multitrophic-level interactions, causes of insect outbreaks, and applications to managed ecosystems. Critical reading and discussion of current literature is emphasized. Prereq: Two years of college-level biology. (Same as BIO 625.) [Offered in spring – odd years.]

ENT 635 INSECT PHYSIOLOGY. (4)

Study of insect physiological processes including development, digestion, reproduction, respiration, excretion, hormones and immunity. Opportunity to learn techniques used in insect physiology and molecular biology. Prereq: Consent of instructor. (Same as BIO 635.) [Offered in spring – even years.]

ENT 636 INSECT MOLECULAR BIOLOGY. (4)

Principles of insect molecular biology. Analysis of insect development, reproduction, behavior, immunity, transgenic insects and insecticide resistance at the molecular level. Hands-on experience with molecular

biology techniques. Prereq: ENT/BIO 635 or consent of instructor. (Same as BIO 636.) [Offered in spring – odd years.]

ENT 660 IMMATURE INSECTS. (3)

Bionomics, structure and classification of immature stages of insects; practice in their identification. Lecture, one hour; laboratory, six hours. Prereq: BIO 570 or ENT 564, or consent of instructor.

ENT 665 INSECT ECOLOGY. (3)

The biotic and physical factors influencing the distribution and abundance of insects and insect populations. Prereq: Consent of instructor. (Same as BIO 665.) [Offered in fall – even years.]

ENT 667 INVASIVE SPECIES BIOLOGY. (3)

This course will examine circumstances that allow introduced species to become invasive, how invasive species threaten our resources, and approaches to minimizing the incidence and impact of invasions. Prereq: Graduate standing or consent of instructor. (Same as BIO/ FOR 667.) [Offered in fall – odd years.]

ENT 670 SCIENTIFIC PUBLISHING: PROCESS AND ETHICS. (2)

An introduction to scientific publishing, including types of scientific journals, choosing where to publish, the structure of scientific papers, the peer review process, data management and archiving, post-publication promotion of research, metrics of scientific impact such as impact factors and altmetrics, and publication ethics.

ENT 680 BIOLOGICAL CONTROL. (3)

Principles related to the use of arthropods to suppress populations of arthropod pests and weeds. Includes historical perspective, ecological relationships, and contemporary issues related to the conservation and manipulation of arthropod predators, parasitoids, and herbivores. Prereq: ENT 300 or equivalent. [Offered in spring – even years.]

ENT 684 PHYLOGENETIC SYSTEMATICS. (3)

Theory and methods of phylogenetic analysis and cladistics will be explained. Applications of phylogenetic analysis, such as historical biogeography, biological classification, and testing of ecological hypotheses will be explored. (Same as BIO 684.)

ENT 695 SPECIAL TOPICS IN ENTOMOLOGY (Subtitle required). (1-4)

Special topical or experimental courses in entomology for graduate students. Special title required and must be approved by the chairperson of the Department of Entomology. A particular title may be offered twice at most under ENT 695. Students may not repeat under the same subtitle. Prereq: Will be set by instructor. [Offered in fall and spring.]

ENT 748 MASTER'S THESIS RESEARCH. (0)

Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed. [Offered in fall and spring.]

ENT 749 DISSERTATION RESEARCH. (0)

Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.

ENT 767 DISSERTATION RESIDENCY CREDIT. (2)

Residency credit for dissertation research after the qualifying examination. Students may register for this

course in the semester of the qualifying examination. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended. [Offered in fall and spring.]

ENT 768 RESIDENCE CREDIT FOR THE MASTER'S DEGREE. (1-6)

May be repeated to a maximum of 12 hours.

ENT 769 RESIDENCE CREDIT FOR THE DOCTOR'S DEGREE. (0-12)

May be repeated indefinitely.

ENT 770 ENTOMOLOGICAL SEMINAR. (0-1)

Discussion of current research problems in entomology. May be repeated to a maximum of six hours.

[Offered in fall and spring.]

ENT 780 SPECIAL PROBLEMS IN ENTOMOLOGY AND ACAROLOGY. (2-3)

Investigations of chosen insect problems, including original work. Discussion and assignment of current insect subjects. May be repeated to a maximum of six credits. Prereq: Consent of instructor. [Offered in fall and spring.]

ENT 790 RESEARCH IN ENTOMOLOGY AND ACAROLOGY. (1-6)

Independent research in entomology or acarology. May be repeated to a maximum of 12 hours. Prereq: Consent of instructor. [Offered in fall and spring.]