

ENTOMOLOGY

Undergraduate Minors

All minors require at least 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Minor - Insect Science

The department offers a minor in Insect Science that may be earned by completing ENT 3700 Insect Biology and 12 credits in courses selected from an approved list supplied by the department.

Minor - Global Health

The Global Health minor is a transdisciplinary program designed for students who seek a broad and flexible set of skills for understanding contemporary health challenges and broad-based thinking in finding solutions. Humans are at the core of Global Health, which is viewed and addressed through an understanding of disease, disease transmission, health and well-being. Global health incorporates all cultures and places and integrates knowledge of health's social, anthropological, historical, biological, and ecological dimensions. The program cultivates capacities to deal with complex problems across disciplines and social constructs: how to identify the critical issues, ask the right questions, and create solutions that are meaningful, lasting and effective.

Requirements of the Global Health minor

The Global Health minor will consist of selecting courses that have at their core a focus on health, disease transmission, and social aspects that pertain to health. The minor will require a minimum of 15 credit hours with all students required to take Global Health (V MPM/MICRO/GLOBE 3600) and Insects and Our Health (ENT/MICRO 3740). The remaining credits to fulfill the minor will come from courses listed in two tracks:

- 1. Biological sciences of health
- 2. Social sciences aspects of health

Students must select a minimum of three credits from each of the two tracks, and an additional three credits from either track. Students may petition to take courses not on the approved list, providing these courses can be shown to include substantial study related to global health.

Required for Global Health minor:

| | | |
|-----------|----------------------------|---|
| VMPM 3600 | Global Health (F) | 3 |
| ENT 3740 | Insects and Our Health (S) | 3 |

Biological Science track:

| | | |
|-----------|--|---|
| BIOL 3280 | Molecular and Cellular Biology of Human Diseases (F) | 3 |
|-----------|--|---|

| | | |
|-----------|--|---|
| ENT 3740L | Insects and Our Health Laboratory (Alt. S) | 1 |
|-----------|--|---|

| | | |
|------------|--|---|
| FSHN 4600 | Global Nutrition, Health and Sustainability | 3 |
| HS 3500 | Human Diseases (F, S, SS) | 3 |
| MICRO 3100 | Medical Microbiology (F) | 3 |
| MICRO 4080 | Virology | 3 |
| MICRO 3530 | Introductory Parasitology (S) | 3 |
| VDPAM 4280 | Principles of Epidemiology and Population Health (S) | 3 |

Social Science track:

| | | |
|------------|---|---|
| AGRON 3420 | World Food Issues: Past and Present | 3 |
| ECON 3850 | Economic Development | 3 |
| FSHN 4420 | Issues in Food and Society | 2 |
| GLOBE 3300 | Global Health Disparities | 3 |
| HS 3100 | Community and Public Health | 3 |
| SOC 3450 | Population and Society | 3 |
| SOC 3480 | Global Poverty, Resources and Sustainable Development | 3 |
| SOC 4110 | Social Change in Developing Countries (S) | 3 |

Graduate Study

The department offers work for the master of science and doctor of philosophy degrees with a major in entomology. Studies at the Ecosystem, Organismal, and Subcellular levels occur in the following areas: aquatic entomology, biological control, chemical ecology, ecology, host plant resistance, insecticide toxicology, medical/veterinary entomology, pathology, pest management, physiology, population genetics, or systematics.

Graduates have a broad understanding of entomology and related disciplines, and an in-depth command of their area of concentration. They are able to communicate effectively with scientific colleagues and the general public in both formal and informal settings. Graduates are able to address complex problems facing entomology or toxicology professionals, taking into account related ethical, social, legal, economic, and environmental issues. They are skilled in research methods, data analyses, and interpretation of results. They also are skilled in working effectively with their colleagues, and writing concise and persuasive grant proposals. They have an understanding of and can critically evaluate current entomological literature.

Prerequisite to the entomology major and to minor graduate work in the department is completion of at least two years of zoological courses, for part of which credit in other closely allied biological sciences may be substituted. Specific course requirements for advanced degrees depend partly upon previous training and experience in the major field of specialization.

Any student receiving the M.S. in entomology shall have at least one course in insect physiology, one course in insect systematics, two

courses of ENT 5900 (selected from topics A through D, F through I, M and N, inclusive), and at least 1 credit of ENT 6000 Seminar.

Any student receiving the Ph.D. in entomology shall have at least one course in insect physiology, one course in insect systematics, four additional courses of ENT 5900 (selected from topics A through D and F through I, M through N inclusive), and at least 1 credit of ENT 6000 Seminar. At least one 5900 must be taken from each of these subgroups: Population (C, D, N); Organismal (A, B, F, M); and Suborganismal (G, I).

In addition, Ph.D. students majoring either in Entomology or Toxicology shall have two semesters of teaching experience, taken as ENT 5900K Special Topics: Teaching Experience both semesters or ENT 5900K Special Topics: Teaching Experience one semester and ENT 5900L Special Topics: Extension Internship the other semester.

A student can receive a Ph.D. minor in Entomology by taking 3 Entomology courses (5000 level and above) for a total of 9 credits to be determined by the student's POS committee and approved by the Entomology Director of Graduate Education.

An option for an emphasis in molecular Entomology is available. Any student receiving the M.S. in entomology with an emphasis in molecular entomology is required to take:

| | | |
|---|--|-----|
| ENT 5550 | Insect Physiology | 4 |
| ENT 5900G | Special Topics: Molecular Entomology | 1-3 |
| Plus one other course of 5900 selected from topics A-D, F, H, I, M, N | | |
| Plus one additional course in molecular entomology | | |
| ENT 6000 | Seminar | 1 |
| BBMB 4040 | Biochemistry I | 3 |
| BBMB 5420A | Introduction to Molecular Biology Techniques: DNA Techniques | 1 |

And one course from the following:

| | | |
|----------|-----------------------|--|
| ENT 5760 | Systematic Entomology | |
| ENT 5250 | Aquatic Insects | |
| ENT 5680 | Advanced Systematics | |

Any student receiving the Ph.D. in entomology with an emphasis in molecular entomology is required to take:

| | | |
|--|--|-----|
| ENT 5550 | Insect Physiology | 4 |
| ENT 5900G | Special Topics: Molecular Entomology | 1-3 |
| Plus three other courses of 5900 selected from topics A-D, F, H, I, M, N | | |
| 9 One additional course in molecular entomology | | |
| ENT 6000 | Seminar | 1 |
| BBMB 5420A | Introduction to Molecular Biology Techniques: DNA Techniques | 1 |
| Plus two other workshops selected from: | | |
| | | 6 |

| | | |
|---|--|---|
| BBMB 5420C | Introduction to Molecular Biology Techniques: Cell Techniques | 1 |
| BBMB 5420D | Introduction to Molecular Biology Techniques: Plant Transformation | 1 |
| BBMB 5420E | Introduction to Molecular Biology Techniques: Proteomics | 1 |
| An additional course with a molecular component | | |
| 3 Plus one from each of the following: | | |
| Systematics | | |
| ENT 5760 | Systematic Entomology | |
| ENT 5250 | Aquatic Insects | |
| ENT 5680 | Advanced Systematics | |
| Biochemistry | | |
| BBMB 4040 | Biochemistry I | |
| BBMB 4050 | Biochemistry II | |
| BBMB 5040 | Amino Acids and Proteins | |
| BBMB 5050 | Bioenergetics and Metabolism | |

Entomology faculty participate in the interdepartmental majors in ecology and evolutionary biology; genetics; microbiology; molecular, cellular and developmental biology; sustainable agriculture; and in the interdepartmental major and minor in toxicology (see Index).

The Federal Corn Insects and Crop Genetics Research Unit is available for advanced study in certain phases of entomological research.

More information about the department, such as current research, faculty resumes, physical facilities, and graduate students can be viewed on the department's website at www.ppe.msu.edu (<http://www.ent.msu.edu>).

Courses primarily for undergraduates:

ENT 2010: Introduction to Insects

Credits: 1. Contact Hours: Lecture 2.7.

Biological and ecological aspects of insects. Offered online only. 5 weeks. (Typically Offered: Fall, Spring)

ENT 2110: Insects and Society

Credits: 2. Contact Hours: Lecture 2.7.

Prereq: ENT 2010

The importance of insects in human well-being. Insect-human interactions. Primarily for non-science and non-agriculture majors. Offered online only. 11 weeks. (Typically Offered: Fall, Spring)

ENT 2140: Insects in Forensic Science

Credits: 3. Contact Hours: Lecture 3.

Introduction to the use of insects as evidence in court and how they can assist in solving crimes. Topics covered include basic insect biology, systematics, behavior, with emphasis on applications of forensic entomology. Offered even-numbered years. (Typically Offered: Fall)

ENT 2200: Introduction to Forensic Science

(Cross-listed with CJ 2200).

Credits: 3. Contact Hours: Lecture 3.

Study of fundamental forensic science techniques and procedures covering types of physical, chemical, and biological evidence and how this information is used in the legal system. Assessment of crime scenes and various forensic specialties will be introduced. (Typically Offered: Spring)

ENT 2400: Hemp: Potential and Constraints for a New Crop

(Cross-listed with AGRON 2400).

Credits: 2. Contact Hours: Lecture 2.

Repeatable.

History, biology, and agronomy of hemp as it is allowed to be grown in Iowa. (Typically Offered: Spring)

ENT 2830: Pesticide Application Certification

(Cross-listed with AGRON 2830/ FOR 2830/ HORT 2830).

Credits: 2. Contact Hours: Lecture 2.

Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized. (Typically Offered: Spring)

ENT 3580: Bee Biology, Management, and Beekeeping

(Cross-listed with BIOL 3580).

Credits: 3. Contact Hours: Lecture 3.

Prereq: Introductory (2000-level) biology coursework or permission of an instructor

Bee diversity and evolution, ecology, role as pollinators, behavior, anatomy, and development. Management of bees as agricultural pollinators and honey producers, focusing on honey bees. Working with live bee hives and demonstration of practical beekeeping skills will occur during several field trips to local hives. (Typically Offered: Fall)

ENT 3700: Insect Biology

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 1010 or BIOL 2110

Structure, physiology, evolution, behavior, life histories, and recognition of insects. Collection required. (Typically Offered: Fall)

ENT 3720: Livestock Entomology

Credits: 2. Contact Hours: Lecture 2.

Classroom and off-campus videotape sections. 12 weeks. Recognition, biology, behavior, economic importance, and management of insects and other arthropods affecting livestock and poultry production. Offered odd-numbered years. (Typically Offered: Spring)

ENT 3740: Insects and Our Health

(Cross-listed with MICRO 3740).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 3 credits in Biological Sciences

Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENT 3740L: Insects and Our Health Laboratory

(Cross-listed with MICRO 3740L).

Credits: 1. Contact Hours: Laboratory 3.

Prereq: Credit or concurrent enrollment in ENT 3740 or MICRO 3740

Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions. Offered even-numbered years. (Typically Offered: Spring)

ENT 3750: Plant Protection Using Natural Enemies

(Dual-listed with ENT 5750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENT 3700 or ENT 3760

Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies. Offered even-numbered years. (Typically Offered: Spring)

ENT 3760: Fundamentals of Entomology and Pest Management

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 1010 or BIOL 2110

Introduction to entomology and insect-pest management, including life processes, ecology, economics, tactics of population suppression, and ecological backlash. (Typically Offered: Spring)

ENT 4250: Aquatic Insects

(Dual-listed with ENT 5250/ AECL 5250). (Cross-listed with AECL 4250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

ENT 4350: Entomology Field Trip

(Cross-listed with AECL 4350).

Credits: 2. Repeatable, maximum of 2 credits.

Prereq: BIOL 3120; Permission of Instructor

Field trip to study insects of major terrestrial and aquatic ecosystems.

Location and duration vary. ENT 3700 or ENT 4250 recommended.

Offered irregularly. (Typically Offered: Spring, Summer)

ENT 4500: Pesticides in the Environment

(Dual-listed with ENT 5500/ TOX 5500). (Cross-listed with TOX 4500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 6 credits of BIOL or Permission of Instructor

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

ENT 4520: Integrated Management of Diseases and Insect Pests of Turfgrasses

(Dual-listed with PLP 5520/ ENT 5520/ HORT 5520). (Cross-listed with PLP 4520/ HORT 4520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

ENT 4710: Insect Ecology

(Dual-listed with ENT 5710).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 9 credits of BIOL

The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture. Offered even-numbered years. (Typically Offered: Fall)

ENT 4900E: Independent Study: Research or Work Experience

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: 15 credits in biological sciences, Junior or Senior classification; Permission of Instructor

Graduation Restriction: A maximum of 9 credits of all (university-wide) 4900 courses may be applied toward graduation. (Typically Offered: Fall, Spring, Summer)

ENT 4900U: Independent Study: Laboratory teaching experience

Credits: 1-3. Repeatable, maximum of 9 credits.

Prereq: Instructor Permission for Course

For students registering to be undergraduate laboratory assistants.

Graduation Restriction: A maximum of 9 credits of all (university-wide) 4900 courses may be applied toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:**ENT 5110: Integrated Management of Tropical Crops**

(Cross-listed with HORT 5110/ PLP 5110).

Credits: 3. Contact Hours: Lecture 3.

Prereq: (ENT 3700 or ENT 3760 or HORT 2210 or PLP 4080 or PLP 4160) or Graduate Classification

Applications of Integrated Crop management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by a 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects. Offered odd-numbered years. Meets International Perspectives Requirement. (Typically Offered: Spring)

ENT 5250: Aquatic Insects

(Dual-listed with ENT 4250/ AECL 4250). (Cross-listed with AECL 5250).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: BIOL 3120 or graduate standing

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes. Offered odd-numbered years. (Typically Offered: Spring)

ENT 5300: Ecologically Based Pest Management Strategies

(Cross-listed with AGRON 5300/ SUSAG 5300/ PLP 5300).

Credits: 3. Contact Hours: Lecture 3.

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes. Offered even-numbered years. (Typically Offered: Fall)

ENT 5500: Pesticides in the Environment

(Dual-listed with ENT 4500/ TOX 4500). (Cross-listed with TOX 5500).

Credits: 3. Contact Hours: Lecture 3.

Prereq: 9 credits in BIOL or Graduate Classification

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere. (Typically Offered: Spring)

ENT 5520: Integrated Management of Diseases and Insect Pests of**Turfgrasses**

(Dual-listed with PLP 4520/ ENT 4520/ HORT 4520). (Cross-listed with PLP 5520/ HORT 5520).

Credits: 3. Contact Hours: Lecture 3.

Prereq: HORT 3510 or Graduate Classification

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments. Offered even-numbered years. (Typically Offered: Spring)

ENT 5550: Insect Physiology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: ENT 3700 or Graduate Classification

Life processes of the insects, including reviews of current problems in insect physiology. Offered even-numbered years. (Typically Offered: Spring)

ENT 5680: Advanced Systematics

(Cross-listed with EEOB 5680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Principles and practice of systematic biology; taxonomy, nomenclature and classification of plants and animals; sources and interpretation of systematic data; speciation; fundamentals of phylogenetic systematics. (Typically Offered: Spring)

ENT 5700: Plant-Insect Interaction

Credits: 2. Contact Hours: Lecture 2.

Prereq: 9 credits in BIOL or Graduate Classification

Physiological, behavioral, ecological, and evolutionary factors that govern interactions between insects and plants, applications of this knowledge to agriculture, and important results from the study of natural systems. Additional topics covered during the semester include: tritropic interactions, biological control of plants by insects, and pollination biology. Student-led discussions and draws on both the primary and secondary literature. Offered odd-numbered years. (Typically Offered: Fall)

ENT 5710: Insect Ecology

(Dual-listed with ENT 4710).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: 9 credits in BIOL or Graduate Classification

The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture. Offered even-numbered years. (Typically Offered: Fall)

ENT 5740: Medical Entomology

Credits: 4. Contact Hours: Lecture 3, Laboratory 3.

Prereq: 9 credits in BIOL or Graduate Classification

Identification, biology, and significance of insects and other arthropods that attack people and animals, particularly those that are vectors of disease. Offered even-numbered years. (Typically Offered: Spring)

ENT 5750: Plant Protection Using Natural Enemies

(Dual-listed with ENT 3750).

Credits: 3. Contact Hours: Lecture 3.

Prereq: ENT 3700 or ENT 3760 or Graduate Classification

Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies. Offered even-numbered years. (Typically Offered: Spring)

ENT 5760: Systematic Entomology

Credits: 5. Contact Hours: Lecture 3, Laboratory 6.

Prereq: ENT 3700 or Graduate Classification

Classification, distribution, and natural history of insects, including fundamentals of phylogenetic systematics, biogeography, taxonomic procedures, and insect collection and curation. Offered even-numbered years. (Typically Offered: Fall)

ENT 5810: Experience in Plant Science Extension and Outreach

(Cross-listed with AGRON 5810/ PLP 5810/ HORT 5810).

Credits: 1.

A supervised learning experience in several extension delivery methods used in the plant sciences. Participation in Iowa State University-based extension programs that may include field crops horticulture, or Master Gardener programming. Offered odd-numbered years. (Typically Offered: Summer)

ENT 5900A: Special Topics: Biological Control and Pathology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Biological Control and Pathology. (Typically Offered: Fall, Spring, Summer)

ENT 5900B: Special Topics: Chemical Ecology and Behavior

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Chemical Ecology and Behavior. (Typically Offered: Fall, Spring, Summer)

ENT 5900C: Special Topics: Ecology and Pest Management

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Ecology and Pest Management. (Typically Offered: Fall, Spring, Summer)

ENT 5900D: Special Topics: Evolution and Systematics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Evolution and Systematics. (Typically Offered: Fall, Spring, Summer)

ENT 5900E: Special Topics: Special Research Topics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Special Research Topics. (Typically Offered: Fall, Spring, Summer)

ENT 5900F: Special Topics: Medical and Veterinary Entomology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Medical and Veterinary Entomology. (Typically Offered: Fall, Spring, Summer)

ENT 5900G: Special Topics: Molecular Entomology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Molecular Entomology. (Typically Offered: Fall, Spring, Summer)

ENT 5900I: Special Topics: Toxicology

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Toxicology. (Typically Offered: Fall, Spring, Summer)

ENT 5900K: Special Topics: Teaching Experience

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Teaching Experience. (Typically Offered: Fall, Spring, Summer)

ENT 5900L: Special Topics: Extension Internship

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Independent Study. (Typically Offered: Fall, Spring, Summer)

ENT 5900M: Special Topics: Immature Insects

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Immature Insects. (Typically Offered: Fall, Spring, Summer)

ENT 5900N: Special Topics: Population Genetics

Credits: 1-3. Repeatable.

Prereq: Instructor Permission for Course

Special Topics: Population Genetics. (Typically Offered: Fall, Spring, Summer)

Courses for graduate students:

ENT 6000: Seminar

Credits: 1. Contact Hours: Lecture 1.

Presentation of research results. (Typically Offered: Fall, Spring, Summer)

ENT 6750: Insecticide Toxicology

(Cross-listed with TOX 6750).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

Prereq: ENT 5550 or TOX 5010 or Graduate Classification

Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides. Offered even-numbered years. (Typically Offered: Fall)

ENT 6990: Research

Credits: 1-30. Repeatable.

Prereq: Instructor Permission for Course

Research. (Typically Offered: Fall, Spring, Summer)