

# ENTOMOLOGY

## Undergraduate Minors

All minors require at least 15 credits, including at least 6 credits in courses numbered 300 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 370 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 360) and Insects and Our Health (ENT/MICRO 374). 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:

|           |                            |   |
|-----------|----------------------------|---|
| V MPM 360 | Global Health (F)          | 3 |
| ENT 374   | Insects and Our Health (S) | 3 |

Biological Science track:

|          |                                                      |   |
|----------|------------------------------------------------------|---|
| BIOL 328 | Molecular and Cellular Biology of Human Diseases (F) | 3 |
| ENT 374L | Insects and Our Health Laboratory (Alt. S)           | 1 |

|           |                                                      |   |
|-----------|------------------------------------------------------|---|
| FS HN 460 | Global Nutrition and Health                          | 3 |
| H S 350   | Human Diseases (F, S, SS)                            | 3 |
| MICRO 310 | Medical Microbiology (F)                             | 3 |
| MICRO 408 | Virology                                             | 3 |
| V PTH 353 | Introductory Parasitology (S)                        | 3 |
| VDPAM 428 | Principles of Epidemiology and Population Health (S) | 3 |

Social Science track:

|           |                                                       |   |
|-----------|-------------------------------------------------------|---|
| AGRON 342 | World Food Issues: Past and Present                   | 3 |
| ECON 385  | Economic Development                                  | 3 |
| FS HN 442 | Issues in Food and Society                            | 2 |
| GLOBE 330 | Global Health Disparities                             | 3 |
| H S 310   | Community and Public Health                           | 3 |
| SOC 345   | Population and Society (F)                            | 3 |
| SOC 348   | Global Poverty, Resources and Sustainable Development | 3 |
| SOC 411   | 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 590 Special Topics (selected from topics A through D, F through I, M and N, inclusive), and at least 1 credit of ENT 600 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 590 Special Topics (selected from topics A through D and F through I, M through N inclusive), and at least 1 credit of ENT 600 Seminar. At least one 590 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 590K Special Topics: Teaching Experience. both semesters or ENT 590K Special Topics: Teaching Experience. one semester and ENT 590L Special Topics: Extension Internship. the other semester.

A student can receive a Ph.D. minor in Entomology by taking 3 Entomology courses (500 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 555                                                              | Insect Physiology                                            | 4   |
| ENT 590G                                                             | Special Topics: Molecular Entomology.                        | 1-3 |
| Plus one other course of 590 selected from topics A-D, F, H, I, M, N |                                                              |     |
| Plus one additional course in molecular entomology                   |                                                              |     |
| ENT 600                                                              | Seminar                                                      | 1   |
| BBMB 404                                                             | Biochemistry I                                               | 3   |
| BBMB 542A                                                            | Introduction to Molecular Biology Techniques: DNA Techniques | 1   |
| And one course from the following:                                   |                                                              |     |
| ENT 576                                                              | Systematic Entomology                                        |     |
| ENT 525                                                              | Aquatic Insects                                              |     |
| ENT 568                                                              | Advanced Systematics                                         |     |

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

|                                                                         |                                                              |     |
|-------------------------------------------------------------------------|--------------------------------------------------------------|-----|
| ENT 555                                                                 | Insect Physiology                                            | 4   |
| ENT 590G                                                                | Special Topics: Molecular Entomology.                        | 1-3 |
| Plus three other courses of 590 selected from topics A-D, F, H, I, M, N |                                                              |     |
| One additional course in molecular entomology                           |                                                              |     |
| ENT 600                                                                 | Seminar                                                      | 1   |
| BBMB 542A                                                               | Introduction to Molecular Biology Techniques: DNA Techniques | 1   |

Plus two other workshops selected from: 6

|                                                 |                                                                    |   |
|-------------------------------------------------|--------------------------------------------------------------------|---|
| BBMB 542C                                       | Introduction to Molecular Biology Techniques: Cell Techniques      |   |
| BBMB 542D                                       | Introduction to Molecular Biology Techniques: Plant Transformation |   |
| BBMB 542E                                       | Introduction to Molecular Biology Techniques: Proteomics           |   |
| An additional course with a molecular component |                                                                    | 3 |
| Plus one from each of the following:            |                                                                    |   |
| Systematics                                     |                                                                    | 3 |
| ENT 576                                         | Systematic Entomology                                              |   |
| ENT 525                                         | Aquatic Insects                                                    |   |
| ENT 568                                         | Advanced Systematics                                               |   |
| Biochemistry                                    |                                                                    | 3 |
| BBMB 404                                        | Biochemistry I                                                     |   |
| BBMB 405                                        | Biochemistry II                                                    |   |
| BBMB 504                                        | Amino Acids and Proteins                                           |   |
| BBMB 505                                        | 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.ppem.iastate.edu](http://www.ppem.iastate.edu) (<http://www.ent.iastate.edu>).

#### Courses primarily for undergraduates:

##### ENT 201: Introduction to Insects

(2.7-0) Cr. 1. F.S.SS.

Biological and ecological aspects of insects. Offered online only. 5 weeks.

##### ENT 211: Insects and Society

(2.7-0) Cr. 2. F.S.

Prereq: ENT 201

The importance of insects in human well-being. Insect-human interactions. Primarily for non-science and non-agriculture majors. Offered online only. 11 weeks.

**ENT 214: Insects in Forensic Science**

(3-0) Cr. 3. Alt. F., offered even-numbered years.

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.

**ENT 220: Introduction to Forensic Science**

(Cross-listed with C J). (3-0) Cr. 3. S.

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.

**ENT 283: Pesticide Application Certification**

(Cross-listed with AGRON, FOR, HORT). (2-0) Cr. 2. S.

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.

**ENT 358: Bee Biology, Management, and Beekeeping**

(Cross-listed with BIOL). (3-0) Cr. 3. F.

*Prereq: 1 course in 200-level BIOL or Permission of 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.

**ENT 370: Insect Biology**

(2-3) Cr. 3. F.

*Prereq: BIOL 101 or BIOL 211*

Structure, physiology, evolution, behavior, life histories, and recognition of insects. Collection required.

**ENT 372: Livestock Entomology**

(2-0) Cr. 2. Alt. S., offered odd-numbered years.

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.

**ENT 374: Insects and Our Health**

(Cross-listed with MICRO). (3-0) Cr. 3. S.

*Prereq: 3 credits in BIOL*

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.

**ENT 374L: Insects and Our Health Laboratory**

(Cross-listed with MICRO). (0-3) Cr. 1. Alt. S., offered even-numbered years.

*Prereq: Credit or concurrent enrollment in ENT 374 or MICRO 374*

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.

**ENT 375: Plant Protection Using Natural Enemies**

(Dual-listed with ENT 575). (3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: ENT 370 or ENT 376*

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.

**ENT 376: Fundamentals of Entomology and Pest Management**

(2-3) Cr. 3. S.

*Prereq: BIOL 101 or BIOL 211*

Introduction to entomology and insect-pest management, including life processes, ecology, economics, tactics of population suppression, and ecological backlash.

**ENT 425: Aquatic Insects**

(Dual-listed with ENT 525). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: BIOL 312*

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

**ENT 435: Entomology Field Trip**

(Cross-listed with A ECL). Cr. 2. Repeatable, maximum of 2 times. Alt. S., offered irregularly. Alt. SS., offered irregularly.

*Prereq: BIO 312; Permission of Instructor*

Field trip to study insects of major terrestrial and aquatic ecosystems. Location and duration vary. ENT 370 or ENT 425 recommended.

**ENT 450: Pesticides in the Environment**

(Dual-listed with ENT 550). (Cross-listed with TOX). (3-0) Cr. 3. S.

*Prereq: 6 credits of BIOL or Permission of Instructor*

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere.

**ENT 452: Integrated Management of Diseases and Insect Pests of Turfgrasses**

(Dual-listed with ENT 552). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: HORT 351*

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

**ENT 471: Insect Ecology**

(Dual-listed with ENT 571). (2-3) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: BIOL 211 or Permission of Instructor*

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 of 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.

**ENT 490: Independent Study**

Cr. 1-3. Repeatable, maximum of 9 credits.

*Prereq: Permission of Instructor*

A maximum of 9 credits of all (university-wide) 490 credits may be applied toward graduation.

**ENT 490E: Independent Study: Research or work experience.**

Cr. 1-3. Repeatable, maximum of 9 credits.

*Prereq: Permission of Instructor*

A maximum of 9 of all (university-wide) 490 credits may be used toward graduation.

**ENT 490U: Independent Study: Laboratory teaching experience**

Cr. 1-3. Repeatable, maximum of 9 credits.

*Prereq: Permission of Instructor*

For students registering to be undergraduate laboratory assistants. A maximum of 9 of all (university-wide) 490 credits may be used toward graduation.

**Courses primarily for graduate students, open to qualified undergraduates:**

**ENT 511: Integrated Management of Tropical Crops**

(Cross-listed with HORT, PL P). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: PL P 408 or PL P 416 or ENT 370 or ENT 376 or HORT 221*

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 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects.

Meets International Perspectives Requirement.

**ENT 525: Aquatic Insects**

(Dual-listed with ENT 425). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: BIOL 312*

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

**ENT 530: Ecologically Based Pest Management Strategies**

(Cross-listed with AGRON, PL P, SUSAG). (3-0) Cr. 3. Alt. F., offered even-numbered years.

Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

**ENT 550: Pesticides in the Environment**

(Dual-listed with ENT 450). (Cross-listed with TOX). (3-0) Cr. 3. S.

*Prereq: 6 credits of BIOL or Permission of Instructor*

Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere.

**ENT 552: Integrated Management of Diseases and Insect Pests of Turfgrasses**

(Dual-listed with ENT 452). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: HORT 351*

Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

**ENT 555: Insect Physiology**

(3-3) Cr. 4. Alt. S., offered even-numbered years.

*Prereq: ENT 370*

Life processes of the insects, including reviews of current problems in insect physiology.

**ENT 568: Advanced Systematics**

(Cross-listed with EE0B). (2-3) Cr. 3. Alt. S., offered irregularly.

*Prereq: Permission of instructor*

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.

**ENT 570: Plant-Insect Interaction**

(2-0) Cr. 2. Alt. F., offered odd-numbered years.

*Prereq: 9 credits in biological sciences*

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: tritrophic interactions, biological control of plants by insects, and pollination biology. Student-led discussions and draws on both the primary and secondary literature.

**ENT 571: Insect Ecology**

(Dual-listed with ENT 471). (2-3) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: BIOL 211 or Permission of Instructor*

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 of 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.

**ENT 574: Medical Entomology**

(3-3) Cr. 4. Alt. S., offered even-numbered years.

*Prereq: 9 credits in biological sciences*

Identification, biology, and significance of insects and other arthropods that attack people and animals, particularly those that are vectors of disease.

**ENT 575: Plant Protection Using Natural Enemies**

(Dual-listed with ENT 375). (3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: ENT 370 or ENT 376*

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.

**ENT 576: Systematic Entomology**

(3-6) Cr. 5. Alt. F., offered even-numbered years.

*Prereq: ENT 370*

Classification, distribution, and natural history of insects, including fundamentals of phylogenetic systematics, biogeography, taxonomic procedures, and insect collection and curation.

**ENT 581: Experience in Plant Science Extension and Outreach**

(Cross-listed with AGRON, HORT, PL P). Cr. 1. Alt. SS., offered odd-numbered years.

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 crop, horticulture, or Master Gardener programming.

**ENT 590: Special Topics**

Cr. 1-3. Repeatable.

*Prereq: 15 credits in biological sciences.*

**ENT 590A: Special Topics: Biological Control and Pathology.**

Cr. 1-3. Repeatable.

**ENT 590B: Special Topics: Chemical Ecology and Behavior.**

Cr. 1-3. Repeatable.

**ENT 590C: Special Topics: Ecology and Pest Management.**

Cr. 1-3. Repeatable.

**ENT 590D: Special Topics: Evolution and Systematics.**

Cr. 1-3. Repeatable.

**ENT 590E: Special Topics: Special Research Topics.**

Cr. 1-3. Repeatable.

**ENT 590F: Special Topics: Medical and Veterinary Entomology.**

Cr. 1-3. Repeatable.

**ENT 590G: Special Topics: Molecular Entomology.**

Cr. 1-3. Repeatable.

**ENT 590I: Special Topics: Toxicology**

Cr. 1-3. Repeatable.

**ENT 590K: Special Topics: Teaching Experience.**

Cr. 1-3. Repeatable.

**ENT 590L: Special Topics: Extension Internship.**

Cr. 1-3. Repeatable.

**ENT 590M: Special Topics: Immature Insects.**

Cr. 1-3. Repeatable.

**ENT 590N: Special Topics: Population Genetics.**

Cr. 1-3. Repeatable.

**Courses for graduate students:**

**ENT 600: Seminar**

Cr. 1. F.S.SS.

Presentation of research results.

**ENT 675: Insecticide Toxicology**

(Cross-listed with TOX). (2-3) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: ENT 555 or TOX 501*

Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides.

**ENT 699: Research**

Cr. arr. Repeatable.