

## INSECT BIOLOGY Entomology 370

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Lecture - Tuesday and Thursday 11:00 - 11:50 AM

Laboratory - Science II 433

Section A - Wed 12-3; Section B - Wed 3-6; Section C - Thursday 12-3

**Prereq: Biol 109 or 201 or other equivalent Biology courses.**

### COURSE OBJECTIVES

- I. Performance of lecture and laboratory readings and exercises, the purposes of which are to learn:
  - a. the basic form and function of the insects;
  - b. the role of structural and functional attributes in the basic behavioral characteristics of insects;
  - c. the ecological aspects of insect biology;
  - d. how to recognize and identify the most common insect orders and families;
  - e. the major biological and ecological features of common insect orders and families.
- II. Completion of an insect collection, the purposes of which are to:
  - a. learn to locate and capture specific insects in their habitats;
  - b. learn the correct methods of preserving insects for study or reference;
  - c. use diagnostic characters to identify insects that you encounter;
  - d. help you learn how to use a specimen display to communicate technical information;
  - d. form a reference collection for your future use.
- III. (Optional) Participation in field trips, the purpose of which is to give you guided field experiences to help you better understand the biology of the insects that you observe, and with which you will work in the course.

### **Required Materials:**

1. **Textbook:** Daly, H. V., J. T. Doyen & A. H. Purcell III. 1998. Introduction to Insect Biology and Diversity.
2. **Laboratory Manual:** Entomology 370 – Insect Biology Laboratory Guide
3. **Dissecting Kit:** necessary some laboratory sessions; especially will need scissors, probe, and forceps.
4. **#3 Insect Pins: one packet,** necessary for pinning insect specimens. (can purchase in lab)
5. **Pigma MICRON 005, or equivalent, technical drawing pen**

All of these should be available at either the University Book Store or the Campus Book Store. Other materials necessary to complete the requirements of the course will be checked out to you in the laboratory for your use.

## SOME THOUGHTS ON THE ACTIVITIES OF THE COURSE

Entomology is a specialized field of zoology, which, in turn, is the area of biology that includes the study of animal life forms. Insects and related arthropods are the subject animals in entomology. Why dedicate an entire course, or courses, to the study of one type of animal? For that matter, why have an entire department dedicated to the study of insects, such as we have at Iowa State University and many other major universities? The reasons are many and varied. See if the following brief examples help answer these questions:

**a. Number of species.** There are more known insect species (slightly fewer than one million) than all other known species of life forms combined. The order Coleoptera, the beetles and weevils, comprises over one-third of all described living species of organisms. Insects may be small and incapable of modifying much of the environment to suit their needs, but they are masters at modifying themselves to fit the environment. Insects are everywhere: in the arctic regions and in the tropics; in our lawns, our gardens, our house plants, our fields, our forests, our lakes, streams, and rivers, and in our soil; on and in the bodies of our pets, our livestock, our wildlife, and ourselves. Any life form that has that much range, diversity, and numbers should, if we possess just a bit of curiosity about the living things with which we come in contact, perhaps pique our interest just the slightest. What do they do there? How do they do it? What attributes allow them this almost unlimited potential to adapt to their environment?

**b. Economic impact.** Insects collectively form an assembly of organisms that is probably the most significant group of animals with which other animals, including humans, must compete. Because we are human, we will allow ourselves to be selectively anthropocentric as we evaluate this problem. Let's consider a few of the more spectacular facts in this regard:

- (1) Insects consume nearly one-fourth of the world's food crops each year, every year. In some of the regions that can least afford food loss because of malnutrition and widespread hunger, they consume a much higher percentage.
- (2) In the United States, insects do more economic damage to our forests than do forest fires.
- (3) Termites alone cause more economic damage to wooden structures in the United States than do fires.
- (4) On the positive side: insects are necessary as pollinators of the majority of flowering plants; insects produce useful products such as honey; we use a large number of parasitic and predaceous insects to control some very important economic insect pests of food and fiber crops.

**c. Ecological impact.** On a localized scale, changes in stream insect populations affect the ability of the stream to support fish populations. As one example of a larger scale impact, some of the outbreak species of insects, such as the spruce budworm and the several species of bark beetles, are capable of killing hundreds of thousands of continuous acres of forests in North America. This has many effects other than the obvious economic loss in tree production: it reduces the ability of the land to support wildlife species; the area no longer acts as an effective buffer for rainfall, with the possibilities of rapid runoff and erosion and stream pollution thus being increased; the probabilities of wildfire in the standing, dead timber drastically increases as the trees dry out.

**d. Medical and veterinary impact.** Many insects and related arthropods affect human and animal health, either directly or as vectors of pathogens that cause diseases. You are, of course, familiar with Lyme disease, the causal agent of which is vectored by a species of tick. Chiggers, fleas, lice, and other organisms are encountered by humans, wildlife, and livestock. Malaria is still one of the major world health problems because of the widespread death and debilitation that it causes; mosquitoes vector the pathogen that causes the disease.

There are, of course, many other reasons for recognizing the importance of insects. Aesthetically, they can be beautiful. Behaviorally, they exhibit a fascinating array of solitary and social modes. Because insects go through many generations in a short time, and are small and thus may be kept in large numbers, they have long been used as model animals for genetic, behavioral, and population studies. Many leading scientists in these areas have used insect populations as the models upon which to base some of the more widely accepted theories in biological studies.

In this course, the focus of study will be the insects themselves. The course comprises two 1-hour lecture sessions and one 3-hour laboratory each week.

## 1. Lecture Sessions

If you examine the lecture schedule, you will note that the course consists of a series of subject elements. The course is designed so that an understanding of each subject element depends upon an understanding of those elements preceding that subject. It is intended that lecture be relatively informal; questions and discussion during lecture are encouraged and necessary to ensure that you have a thorough understanding of the material. It is much more important that we understand the information than it is to follow the schedule rigidly. **Attendance in lecture is expected.**

A textbook is necessary for supplementary reading and examples for each lecture subject. You may be asked to discuss these examples in class or on an examination. Please see your lecture schedule for the assigned readings. Additional material may be handed out in lecture prior to or during the scheduled coverage of the subject. It will be assumed that you have read and understand all textual material and handouts.

As you learn to understand individual facts and theories about insects, it will be necessary to begin synthesizing these into a more holistic understanding of insects as organisms. Because it will take some time and thought, without the pressure of an examination environment to work through these syntheses, and because you will need the experience of communicating your understanding, **you will be required to write two microthemes about some aspect of insect biology.** The date of assignment and the due date for each is marked on your lecture schedule sheet.

There are **three major lecture examinations** during the term, and a **final examination** that encompasses primarily the lecture material. Each examination is comprehensive, although the major emphasis will be on material covered since the previous examination. The format of the examinations and the questions will be explained prior to the examinations.

## 2. Laboratory

The major objectives of the laboratory are to: a) learn the functional anatomy, both external and internal, of the insect; b) use this information to recognize the diagnostic characteristics that will allow you to distinguish among the insect orders and the most commonly encountered families of those orders, and; c) learn the ecological role that each of these most commonly encountered families plays in the environment.

As you are exposed to information in the laboratory, we will refer to that information and develop it as a reference base for lecture. Many of the laboratories are quite information intensive and require a great amount of time to assemble and disassemble; **attendance in laboratory**

**therefore is required. Attendance will be considered as both your presence and your participation in and completion of laboratory exercises.** If you must be absent because of an illness or other important reason, you must contact the laboratory instructor **before** the absence and schedule a time to make up the missed material. **You will be allowed to make up only one such laboratory absence during the term, unless verifiable long-term illness is involved. For any laboratory absences beyond the one that you may make up, you will forfeit 10% of your overall final term score.** There will be a graded quiz during the designated laboratories, and a final laboratory examination at the end of the term. The details of each of these will be explained in the laboratory.

### 3. Insect Collection

You will be required to collect insects of the various orders and more commonly encountered families from different habitats. Collecting material will be checked out to you individually in the first laboratory period. During the first laboratory, we will discuss collecting techniques and we will visit a local area to acquaint you with collecting methods. You will be shown how to preserve specimens so that you can best examine the diagnostic characters that will allow you to identify the insect to family. Labeling techniques will be illustrated so that the insects collected can have value as reference specimens. There will be a number of guided collecting trips to local areas to collect specimens. Most of your collecting will need to be done on your own, however. **It is necessary to remember that the quality of collecting falls off drastically after the first heavy frost; therefore, you really should do most of your collecting before the end of September.** Specific details on the collection will be made in the laboratory. Beginning with laboratory #7, you will be required to show identification and labeling of your collected material from those groups reviewed in the previous laboratory. For example, during laboratory #8, you will need to have your laboratory instructor review your identified and labelled Orthopteroid orders and families. Where mistakes have occurred, suggestions for improvement or correction will be made.

### EVALUATION SCHEDULE

Exam I	Reading and Lecture Material (with references to laboratory) through lecture #6	100 points
Exam II	Reading and Lecture Material (with references to laboratory) through lecture #14	100 points
Exam III	Reading and Lecture Material (with references to laboratory) through lecture #22	100 points
Written Exer.	Two written exercises; 25 points each	50 points
Laboratory	Six quizzes @ 15 points each = 90 points; 60-point laboratory final	150 points
Collection	60 pts hemimetabolous, 90 pts holometabolous	150 points
Final Exam	Comprehensive, with emphasis on material covered since Exam III	150 points
<b>TOTAL</b>		<b>800 points</b>

Your grade will be assigned based upon your total points at the end of the term:

A	744-800	93-100 %	C+	616-639	77-79
A-	720-743	90-92	C	584-615	73-76
B+	696-719	87-89	C-	560-583	70-72
B	656-695	83-87	D+	536-559	67-69
B-	640-655	80-82	D	504-535	63-66
			D-	480-503	60-62

If you are at or near the breaking point between two grades, two other factors are included in the final grade assignment decision: 1) your individual contribution to lecture and laboratory through discussion, questions, and

work with your classmates, and; 2) the trend of your performance throughout the term. Your final grade is assigned cooperatively by consensus between the lecture instructor and the laboratory instructor.

### Entomology 370 Lecture Schedule

			Pages in DDP	Lab quizzes
1	Tues	Course Introduction		
2	Thrs.	Insect Overview	3-20	
3	Tues	Insect Body Plan	21-26	
4	Thrs.	Insect Body Plan	(cont.)	
5	Tues	Integument	51-56	1 <sup>st</sup>
6	Thrs.	Molting	56-60	
7	Tues	<b>– EXAM I – through #6</b>		
8	Thrs.	Development	61-74	
9	Tues	Reproduction	74-87	2 <sup>nd</sup>
10	Thrs.	Nutrition	88-99	
11	Tues	Ventilation - <b>1<sup>st</sup> writing assign. handed out</b>	100-113	
12	Thrs.	Circulation; Excretion	(cont.)	
13	Tues	Muscles; Locomotion - <b>1<sup>st</sup> writing assign. due</b>	113-119	3 <sup>rd</sup>
14	Thrs.	Thermoregulation	119-123	
15	Tues	<b>– EXAM II –</b>		
		through #14; emphasis on #8 through #14		
16	Thrs.	Nervous System	124-130	
17	Tues	Sensory Organs	130-138	4 <sup>th</sup>
18	Thrs.	Sensory Organs		
19	Tues	Sensory Organs		
20	Thrs.	Behavior	138-152	
	Fri	<b>Hemimetabolous Collection Due 5 PM</b>		
21	Tues	Social Behavior	153-157	5 <sup>th</sup>
22	Thrs.	Biology of Social Insects	158-170	
23	Tues	<b>– EXAM III –</b>		
		through #22; emphasis on #16 through #22		
24	Thrs.	Plant Feeding - <b>2<sup>nd</sup> writing assign. handed out</b>	219-226	
25	Tues	Plant Feeding		6 <sup>th</sup>
26	Thrs.	Predatory Insects - <b>2<sup>nd</sup> writing assign. due</b>	227-240	
27	Tues	Parasites of Vertebrates	241-248	
28	Thrs.	Insects as Food	248-255	
	Fri	<b>Holometabolous Collection due 5 PM</b>		
29	Tues	Insects as Pathogen Vectors	265-275	Final
30	Thrs.	Insects as Pathogen Vectors		

Finals week - Final examination, during designated time and day.