
**ENTOMOLOGY 627 –
INSECT BEHAVIOR AND NATURAL HISTORY
(FALL 2020, 3 CREDITS)**

COURSE OVERVIEW: Insects represent the most diverse eukaryotic clade and every single species has unique and distinct behaviors that are essential for its survival and reproduction. Behavior can be defined as the sum of responses to external and internal stimuli, or more simply, what animals do in response to various stimuli. In essence, the study of insect behavior centers on understanding how an insect adjusts to and interacts with its total environment, including members of its own species and other species. This course is designed to broadly introduce the study of insect behavior to graduate students with a particular emphasis on hands-on activities in documenting the natural history of insects via field observations as well as conducting behavioral experiments using live insects. Students will be exposed to various types of insect behaviors and learn how scientists have investigated these behaviors by discussing current and classic literature. Students will also learn theoretical and practical approaches involved in behavioral research, so that they will be ready to design and carry out their own research.



INSTRUCTOR: Dr. Hojun Song (hsong@tamu.edu)
OFFICE: 118 Biological Control Facility (979-845-2481)
OFFICE HOURS: by appointment

LECTURE: Mondays and Wednesdays 12:40-1:30PM, Heep Center Room 205
LAB: Wednesdays 1:50-4:40PM, Heep Center Room 210

PREREQUISITES: One semester of introductory entomology or equivalent, or approval of instructor.

REQUIRED TEXT: None

SUGGESTED READING:

- Canfield, M. R. (Ed.) (2011). *Field Notes on Science & Nature* (1st ed.). Cambridge, MA: Harvard University Press.
- Matthews, R. W., & Matthews, J. R. (2010). *Insect Behavior* (2nd ed.). New York: Springer.

ARTICLE READING: Available electronically through course-specific Google Drive

LEARNING OUTCOMES: Upon completing ENTO 627 successfully, students will be able to:

1. Correctly identify and describe major types of insect behavior and integrate the basic principles of evolution with an understanding of insect behavior.
2. Observe and properly describe the behavior and natural history of insects in the field.
3. Be able to place any observed insect behavior into the four questions in behavioral research (causation, survival value, development, and evolution) that are applied in analyses of insect behavior.
4. Critically read and interpret scientific articles in the field of insect behavior.
5. Develop a testable hypothesis, design a proper experiment, analyze the resulting data, and communicate the findings in the context of insect behavior.

COURSE GRADING SCHEME:

3 field notes (10 points each):	30	points
3 lab notes for lab exercises (10 points each):	30	points
5 lab notes for group project (10 points each):	50	points
11 reading summaries (10 points each):	110	points
Group presentation:	100	points
Exam 1:	100	points
Exam 2:	100	points
Total possible points:	520	points

GRADING: A (90-100%); B (80-89%); C (70-79%); D (60-69%); F (below 60%)

(Rounding policy: If your final grade percentage is within 0.5% of the next grade up [for example, 89.7%], you will receive the grade for a rounded-up percentage [for example, 90%])

LECTURES AND READING: This course is topically organized into seven sections to allow in-depth investigation of the field of insect behavior. The first section focuses on establishing a conceptual framework for behavioral research, which will be critical for understanding the next sections. The following sections will focus on the diversity, mechanism, and evolution of insect movement (section 2), feeding and foraging behavior (section 3), defensive behavior (section 4), communication behavior (section 5), reproductive behavior (section 6), and social behavior (section 7). Because this is a graduate-level course, you are expected to read and understand primary literature as assigned readings and be ready to discuss in class, and the reading material will be available through eCampus. You will be required to submit a summary of each reading (11 total) to Google Drive by specific deadlines listed in the schedule. **The reading summary should contain bullet points outlining each section of the paper, and one question you have from reading the paper, and the expected length is less than 1 page.**

LECTURE AND LABORATORY SCHEDULE AND TOPICS (SUBJECT TO CHANGE):

Week	Lecture	Module	Lecture Topic	Lab Activity	Assignments/Due
1	1 (8/24)	I. Primer on insect behavior research and conceptual framework	Introduction and course overview		
	2 (8/26)		Diversity and coordination of insect behavior	Field observation: Locomotion and orientation @ Lick Creek Park	
2	3 (8/31)		Conceptual framework: Tinbergen's four questions		Field note on locomotion and orientation behavior
	4 (9/2)		Challenges and pitfalls of behavioral research	Field observation: Foraging behavior and defensive behavior @ Lick Creek Park	Reading summary
3	5 (9/7)		How to design and execute behavioral experiments I		Field note on foraging behavior and defensive behavior
	6 (9/9)		How to design and execute behavioral experiments II	Field observation: Communication and mating behavior @ Lick Creek Park	Reading summary
4	7 (9/14)	II. Movements	Diversity of insect movement		Field note on communication and mating behavior
	8 (9/16)		Mechanism of insect movement	Group lab exercise: Grasshopper movement lab	Reading summary
5	9 (9/21)		Evolution of insect movement		Lab note on grasshopper movement experiment
	10 (9/23)	III. Feeding and foraging behavior	Diversity of feeding and foraging behavior	Group lab exercise: Feeding preference lab	Reading summary
6	11 (9/28)		Mechanism of feeding and foraging behavior		Lab note on feeding preference experiment
	12 (9/30)		Evolution of feeding and foraging behavior	Group lab exercise: Defensive behavior lab	Reading summary
7	13 (10/5)	IV. Defensive behavior	Diversity of defensive behavior		Lab note on defensive behavior experiment
	14 (10/7)		Mechanism of defensive behavior	Group project: Reconnaissance observation, and idea development	Reading summary
8	15 (10/12)		Evolution of defensive behavior		Lab note on group project meeting; Exam 1 due (10/12 5pm)
	16 (10/14)	V. Communication and mating behavior	Diversity of communication behavior	Group project: Hypothesis development, experimental design	Reading summary
9	17 (10/19)		Mechanism of communication behavior		Lab note on group project meeting
	18 (10/21)		Evolution of communication behavior	Group project: Experiment troubleshoot	Reading summary
10	19 (10/26)	VI. Reproductive behavior	Diversity of reproductive behavior		Lab note on group project meeting
	20 (10/28)		Mechanism of reproductive behavior	Group project: Experiment troubleshoot/data generation	Reading summary
11	21 (11/2)		Evolution of reproductive behavior		Lab note on group project meeting
	22 (11/4)	VII. Social behavior	Diversity of social behavior	Group project: Data generation	Reading summary
12	23 (11/9)		Mechanism of social behavior		Lab note on group project meeting
	24 (11/11)		Evolution of social behavior	Group project: Data analysis	Reading summary
13	(11/16)	No class	Entomological Society of America		
	(11/18)	No class	Entomological Society of America		
14	25 (11/23)	Group project	Group project: Presentation preparation		Exam 2 due (11/23 5pm)
	(11/25)	No class	Reading Day		
15	26 (11/30)	Group project	Group project: Presentation preparation		
	27 (12/2)	Group project	Group project: Oral Presentation (during lecture period)		

FIELD/LAB NOTEBOOK: During the first 3 weeks of the course, we will meet at Lick Creek Park for the lab period. During this time, students will discover, observe, and document specific insect behavior in the field using a field notebook. Each week, we will focus on different types of insect behavior. To study insect behavior, it is critical to properly and accurately record field observations and other relevant information, but this is often not emphasized and there is little guidance on how to do this. For this course, students will learn how to take good field notes through examples and exercises in addition to developing their own system of field note-taking through actual field observations. After each field trip on the following lecture period, students will turn in their field notebooks to be graded. The grading will be based on legibility, information organization, and contents.

After the first three weeks, the course will shift gears to focus on experiment-based behavioral research. For the next three weeks, we will be conducting simple insect behavior experiments, and then there will be one group project that will be conducted throughout the course (see below). The field notebook will then function as a lab notebook and students will learn how to properly take notes in the lab. After the completion of each experiment, students will turn in their lab notebooks, which will be graded based on guidelines that will be provided later in the course. Students must purchase and bring a composition notebook to each lab to be used as a field/lab notebook.

GROUP PROJECTS: There will be one group project during the lab period that students will participate. For this project, students will be assigned to groups of 2-3 to develop a specific hypothesis on a particular insect behavior of interest, design and execute experiments, analyze the data, and present the findings. The duration of the project will be 6 weeks. In the first week, students will observe insect behavior and identify a set of questions to develop into a cohesive, testable hypothesis. In the second week, students will develop experiments and in the third and fourth week, students will troubleshoot, with the actual experiment being carried out in the fourth and fifth weeks. After the experiment, the group will analyze the resulting data in the sixth week and will present their results as oral presentations (15 minute Microsoft PowerPoint) the last week of the class. As this is a group project, each member of the group needs to contribute equally and your efforts will be documented and signed off on by every member of the group before final submission. Every member of the group will participate in the final oral presentation. Everyone in the group will receive the same grade for the project. The lab notebooks will be graded on an individual basis. In addition to the instructor's grading, the oral presentations will be peer-reviewed following the guideline of the student presentation competition of the Entomological Society of America.

LIVE INSECTS: For the group projects, students will have access to various live insects that we have in colonies around the Department of Entomology. These include, but are not limited to, grasshoppers, cockroaches, crickets, mealworms, armyworms, aphids, ants, and various flies. These live insects are model organisms that are used in entomological research, but they are also living organisms with specific behavior patterns, which will be investigated through experiments.

LECTURE EXAMS: There will be 2 lecture exams for this course. The exam will consist of short and long essays based on the lecture material as well as in-class discussion of primary literature. These will be take-home, open-book exams that need to be completed in 1 week. The exam

questions will be electronically distributed to students and the students will turn their answers in within a single Microsoft Word document via email (hsong@tamu.edu) by specific exam deadlines (10/12 for exam 1 and 11/23 for exam 2).

CLASS ATTENDANCE: Regular attendance in lectures and labs is *required* in this course. The student is responsible for providing satisfactory evidence to the instructor to substantiate the reason for an absence. Rules for excused and unexcused absences are described in Student Rule 7, found at <http://student-rules.tamu.edu/rule07>. Failure to notify and/or document properly may result in an unexcused absence. Falsification of documentation is a violation of the Honor Code. If you are remotely taking the course, we will make an arrangement to accommodate you.

SAFETY IN TEACHING LABORATORIES: The Department of Entomology is committed to the safety of all students and employees participating in teaching laboratories. To ensure that a safe environment is maintained in our teaching laboratories, it is expected that all students will adhere to general safety guidelines and emergency procedures, as well as course-specific and activity-specific safety instructions provided by faculty and teaching assistants. Laboratory safety and emergency procedures will be reviewed during the first class period and you will be asked to sign your acknowledgement of these instructions before attending further classes in this course.

FIELD TRIPS: To observe and document insect behavior in the field, we will conduct several field trips to Lick Creek Park. When you are out collecting in the field, there are several creatures and plants that can harm you, including ticks, chiggers, spiders, mosquitoes, biting flies, snakes, and poison ivy, and, thus, I suggest you dress properly. Appropriate field dress includes close-toed shoes (hiking shoes or tennis shoes, but not sandals or flip-flops), long pants, and a hat. Insect repellent and sunscreen are also recommended for these trips along with snacks and water.

ACADEMIC INTEGRITY STATEMENT: As students of Texas A&M University, you are expected to abide by the Aggie Honor Code, which states “*An Aggie does not lie, cheat, or steal or tolerate those who do.*” Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. Honor Council Rules and Procedures can be found at <http://www.tamu.edu/aggiehonor/>.

AMERICANS WITH DISABILITIES ACT (ADA): The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit <http://disability.tamu.edu>.