

Biology of Insects (Biology 345)

Fall 2021

(Lecture: TR 10 – 11:15 am, ISC 206; Lab: W 1:00 – 3:50 pm, ISC 206)

Course overview

Why study insects? The theoretical ecologist Robert May wrote, “To a good approximation, all species are insects.” This claim comes from the fact that of the 1.5 million described species, almost over 900,000 are insects. The number of described species is certainly an underestimate of the actual number, which has recently been estimated to be as many as 5.5 million. Insects are ubiquitous in the earth’s terrestrial ecosystems, occupying practically every possible ecological niche as herbivores, predators, parasites, scavengers, and decomposers. They provide valuable ecosystem services, as pollinators, biological control agents, food sources for other species, and decomposers of plant and animal detritus. While many of their activities benefit humans, an understanding of insect biology is also important to help control their negative impacts as vectors of disease and agricultural and forest pests. The small body size, abundance, short generation time, high reproductive rate, and ability to be experimentally manipulated have made insects valuable model organisms in the study of biology, significantly impacting research in fields such as physiology, genetics, biochemistry, development, ecology, and evolutionary biology. This course will introduce you to the biology of insects, from insect diversity, classification, and evolutionary history, to their morphology, physiology, behavior, ecology, and relevance to human activities. My hope is that it will inspire wonder and respect in you for these remarkable organisms!

Instructor: Dr. Jennifer L. Apple (*she/her/hers*) Office: ISC 258 Lab: ISC 340

Contact: e-mail: applej@geneseo.edu Phone: (585) 245-5442

Office hours: Online, T 1-2 pm (by appt), F 11-12 pm; in-person (ISC 206), W 9:30-10:30 am

Instruction modality: In-person, with some content delivered online

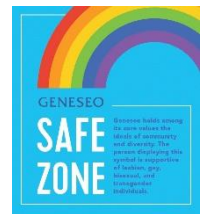
Course description from Bulletin: A survey course dealing with the classification, morphology, physiology, ecology, and economic importance of insects. (4 credits; 3 hrs lecture/3 hrs lab)

Prerequisites: Biol 117 and Biol 119

Course website: canvas.geneseo.edu

What you will need: Internet access and computer.

Required textbook: *Field Guide to Insects: America North of Mexico* by D.J. Borror and R.E. White. Peterson Field Guide Series. (Any edition, Houghton Mifflin Co.)



Learning outcomes

Successful students in this course will be able to

- integrate knowledge about the morphological, physiological, and ecological traits of insects to explain the success, abundance, diversity, and ecological importance of insects
- interpret the evidence for the proposed evolutionary relationships of insects and related groups and how this informs insect systematics
- identify insects to order and the most common families in major orders
- apply a variety of methods to collect insects and prepare insect specimens for a formal collection using standard museum techniques
- interpret and synthesize primary literature
- effectively communicate the context, interpretation, and significance of research findings

How this course will run

Overview of course activities

The lecture portion of the course will introduce you to many aspects of insect biology: classification and evolutionary history, anatomy, physiology, development, life history, behavior, and ecology. We will also address the impacts of insects and applied topics like medical entomology and conservation biology. In the course laboratory, you will practice methods of collecting, preserving, and curating insects. During several local field trips you will have opportunities to collect specimens and practice common methods of insect sampling. You will also be required to develop an insect collection meeting specific criteria, and this will likely involve time going out and collecting on your own, as well as working in the lab outside of regular lab times to prepare and identify your specimens. The lab will also include activities to learn about insect internal and external morphology, insect identification, and ecological patterns in insect distributions.

In order to maximize hands-on learning that is so important to the field of entomology, I will be using some of our “lecture” periods during the TR 10-11:15 am time slot for more “lab” oriented activities, like viewing reference specimens and practicing identifying insects to the order or family level. These hands-on activities will be emphasized during the early part of the semester to ensure you receive effective instruction and opportunities for practice with identification before you must turn in your insect collection (before Thanksgiving). To prepare for some of these activities, you may have to watch online video lectures.

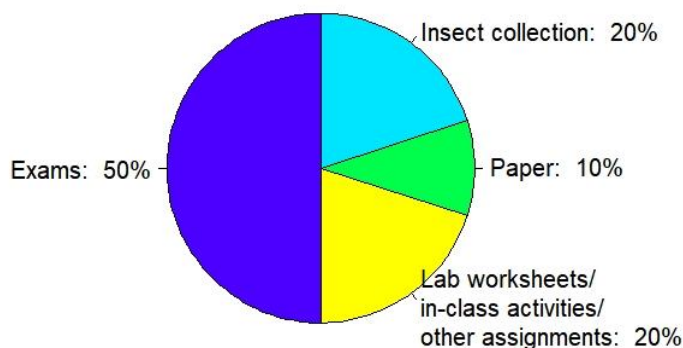
Attendance expectations and public health

In the context of the COVID-19 pandemic, it is vital that we all do what we can to protect the health and safety of each other. If you are experiencing symptoms associated with COVID on a day that class meets in-person, do not attend. Remember that it is better to stay home if you are not feeling well than to attend class and risk spreading illness to others. I will also follow this advice, so if I do not feel well, I may run a class through Zoom or post a recorded lecture instead of holding class in-person. Throughout the semester, please be proactive in communicating about absences and contact the Dean of Students if you expect to be out for an extended period of time. Rest assured that there will be no penalty for missing class and that I've designed our course so that there's a path for you to make up any learning that takes place in a class meeting you miss.

How is your grade determined?

Exams (50% of grade)

You will be assessed on your knowledge of material presented in lab and lecture through several exams/identification quizzes during either the lecture or the lab period; some exams will have practical components requiring identification of insect specimens or structures.



Insect collection (20% of grade)

The best way to learn about insects is to get a close look at them and experience the habitats where they live. Thus, a big part of this course involves collecting insects and learning how to preserve them in a way to facilitate their identification. I hope you started collecting insect specimens over the summer; field trips at the beginning of the fall semester will provide additional opportunities. Note that as the fall progresses insects will be more difficult to find, so it is imperative that you concentrate your collecting early in the semester. Your insect collection must include:

- adult representatives from 15 orders of insects
- adult representatives from 35 families of insects
- immature insects from 4 correctly identified orders: 2 hemimetabolous and 2 holometabolous

You should try to keep up with identifications so you know if you are missing orders or families, before it is too late. All insects must be properly labeled, mounted, and/or preserved according to provided guidelines. Extra credit of up to 24 points can be earned for including representatives of additional orders and/or families (correctly identified) than the minimum requirement. More details on the insect collection will be provided in another document. Note that insect collection is a MANDATORY component of this course – you cannot pass the course without turning in a collection.

Perspectives or review paper (10% of grade)

You will have an opportunity to explore more in depth a topic of your choice through writing a 4-6 page paper (1300-1600 words) that focuses on a recent important study on insect biology. The style of your paper will resemble that of the “Perspectives” articles found in *Science* magazine or the “Dispatches” in *Current Biology* – these are articles that highlight recent findings and help contextualize them for a broad audience. Alternatively, instead of focusing on a single study you can focus on a contemporary topic in insect biology and write a short review article (like the “Reviews” found in *Science* magazine, but shorter). Your focal study or topic must be approved by the instructor and cannot already be the subject of a published commentary or review. Note that this paper is also a MANDATORY component of this course – it contributes to the department writing requirement.

Laboratory worksheets, in-class activities, and other assignments (20% of grade)

Whenever we do hands-on work in lab (or lecture sessions) you will have a worksheet to complete and turn in. We may also have short Question of the Day activities or longer activities to complete in class periods. Several other larger assignments are included in this category, including intermediate assignments related to developing your paper, and a slide show project involving your collection and identification skills. More details will be provided on Canvas.

COVID-19 contingencies

We must be flexible in this course as public health considerations might force us to make changes to how this course runs over the course of the semester. If restrictions on face-to-face interactions interfere with course activities, some of the assignments described above may be altered or replaced, the means of content delivery may change, and the course schedule may require revision. If this is the case, be assured that my priorities are student success, course continuity, and accessibility of information.

Grading scale

A	93-100%	B	83-86.9%	C	73-76.9%
A-	90-92.9%	B-	80-82.9%	C-	70-72.9%
B+	87-89.9%	C+	77-79.9%	D	60-69.9%

I follow conventional rounding procedures, so a 92.94% would represent an A- (rounded down to 92.9%), while a 92.95% would be rounded up to 93.0% and an A.

How to be successful in this course

Health and well-being in a stressful time: take care of yourself

The changes brought on by COVID-19 have impacted us all in a number of ways and will continue to do so at various times and to varying degrees during the upcoming semester. Your health and well-being are foundational

to your ability to learn, and if you find that you are feeling unwell (physically or mentally) and it is impacting your ability to complete your coursework, please reach out. Concerns about academic performance, health situations, family health and wellness (including the loss of a loved one), interpersonal relationships and commitments, and other factors can contribute to stress. Students are strongly encouraged to communicate their needs to faculty and staff and seek support if they are experiencing unmanageable stress or are having difficulties with daily functioning. The [Dean of Students](#) (585-245-5706, www.geneseo.edu/dean_students) can assist and provide direction to appropriate campus resources. The college also has collected resources in a [Coping with College webpage](#).

Collect early and often!

Don't wait until the days get noticeably shorter and the nights are cool to collect your insects – you will discover they are harder to find and not as diverse! To ensure that you get enough orders and families represented in your collection, it is best to take advantage of the warmer conditions at the beginning of the fall semester. Also don't delay in preparing and reviewing your specimens to make sure that you have the diversity you need.

Take advantage of course resources and study aids

I continually update a Google doc with study questions that you can use to help guide your review of course material (available in a Google drive folder; make your own copy of to create a version you can edit). PDFs of the lecture slides are also posted in a Google drive folder.

Come see me if you need help!

Office hours. Some of my office hours will be **online** this semester and conducted via Zoom video conference. I will have regular “walk-in” office hours which are first-come, first-served. You may have to wait in the Zoom “waiting room” until I finish with other students. I will also have scheduled 15-min office hour sessions that you can sign up for via my Google Calendar. See Canvas for details. If any of the posted times do not suit you, you can email me to set up another appointment for a video conference. When doing so, please suggest some possible times that you are available to meet in your email to make our correspondence more efficient. I will also hold some in-person office hours at a set time in our lab room, ISC 206. Generally, I will not meet with students for office hours in my office.

Email communication. I can often answer your questions by email as well. Please do not expect an immediate response – I will try to get back to you within 24 hours.

Back up your work

Do yourself a favor to avoid last-minute computer calamities and stress by saving your work frequently and backing up your files using some kind of cloud storage system like Google Drive, OneDrive, Dropbox, or some other service. CIT provides some [tips on data backup](#). Also, don't wait until the day before a deadline to get started!

Diversity and inclusion

The Department of Biology has pledged to develop more inclusive pedagogical practices and work to promote diversity in our curriculum while confronting racism, particularly ways in which science has been used to sustain it ([Biology Department's Statement in Support of Racial Justice](#), also available on [Department of Biology website](#)). This course is no exception, and to help achieve these goals I will be highlighting the work of scientists of diverse identities and backgrounds in the field of entomology. I hope to create an inclusive and supporting learning environment in which anyone can succeed, regardless of your identity (race, gender, ethnicity, sexual

orientation, age, socioeconomic status, religion, and ability). I want to provide for students' growth as scientists and learners and promote a sense of belonging.

Land acknowledgment

The SUNY Geneseo campus is located in the historic homelands of the Seneca Nation of Indians and Tonawanda Seneca Nation. As stated in the [Community Commitment to Diversity, Equity, and Inclusion](#), "we at SUNY Geneseo have an obligation to recognize all who, through history or identity, have been marginalized or oppressed, made invisible or silenced." I encourage you to keep in mind the original occupants of the field sites we explore in this course.

Lab and field work and safety

Face masks

According to [current campus policy](#), face masks are required in all instructional spaces (including classrooms, lecture halls, and laboratories) and all common areas including residence halls and academic buildings. If you forget your mask, please be sure to pick up a disposable one before entering the classroom. Masks must be worn for the duration of lecture and lab sessions and must cover both your mouth and your nose. Masks must also be worn the entire time that we are in a van for a field trip. If you do not have a mask or are unwilling to wear one, you will be asked to leave the classroom. I cannot safely hold class if all students are not wearing face masks. If my teaching could be more accessible if I wear a clear face mask, please let me know as soon as possible. Students who have concerns about wearing a face mask due to a documented disability need to contact the Office of Accessibility Services (access@geneseo.edu) to request reasonable accommodations.

Lab preparation

If we are doing a field-based activity, you should be dressed for the weather with appropriate outerwear and shoes that can get muddy or wet – it is your responsibility to check the weather conditions and use your judgment about what to wear. Make sure you bring all of your assigned collecting gear for field trips. Sometimes plans for a lab session may change at the last minute because of the weather; you should make sure to check your email on the day of a lab to find out any changes. Please be courteous to the instructor and your classmates by arriving on time, particularly on field trip days. Pay attention to announcements on Canvas that may ask you to bring your laptop, field guide, or particular equipment for the day's activities. Note that this lab will involve at least one dissection of an insect to learn about internal morphology and all students are expected to participate in this activity.

Lab and field safety

Your safety and comfort are important to me. Please be prepared for our field trips by dressing appropriately for the weather and terrain, bringing water, and carrying any medication you might need (allergy medication, inhaler for asthma, epipen, etc.). Inform me of any allergies (particularly to bee stings!) or other medical conditions that could require emergency treatment. Also be prepared by applying sunscreen when appropriate or wearing clothing to protect yourself from the sun. We could encounter mosquitoes, ticks, other biting/stinging insects, and poison ivy on our outings, so be aware of these risks, and feel free to ask me any questions about them. While we are traveling to a field site in a vehicle you should be wearing a face mask. Also, be mindful of your safety if you go field-collecting on your own outside of our regular lab sessions. It is a good idea to bring a friend with you, or at least to tell someone where you are going and when you expect to be back.

You should wear closed-toed shoes and either long pants (not shorts) and/or a lab coat on days that we will be working with preserved specimens. No food or drink containers are permitted in the lab, either during or outside regular lab times. You should not be eating or drinking in the lab and should always have your mask on in the lab, even if alone, because it is a shared space.

Lab equipment

You will be issued some equipment at the beginning of the semester that you may use in developing and preparing your insect collection. Make sure you keep track of and take care of the items you are assigned. You are expected to return this equipment to the Department of Biology, ideally by Thanksgiving Break.

Other course policies

Late work

Graded assignments will be penalized by a loss of 5% of the total assignment's points possible per day. But if you think you must turn in something late because of extenuating circumstances, feel free to discuss the situation with me and we can negotiate terms. Your insect collection **must** be submitted before Thanksgiving break, however, even if incomplete.

Plagiarism and academic dishonesty

Plagiarism and other forms of academic dishonesty (cheating, turning in another student's work as your own) will not be tolerated. Evidence of academic dishonesty is grounds for a score of zero on any assignment and further action including notifying the department chair, Dean of Academic Planning and Advising, Dean of Students, and Student Conduct Board, which can result a report filed with the Dean of Students.

Plagiarism. According to the Academic Dishonesty Policy in the Student Handbook (<https://www.geneseo.edu/handbook/academic-dishonesty-policy>), plagiarism includes the following:

1. direct quotation without identifying punctuation and citation of source;
2. paraphrase of expression or thought without proper attribution;
3. unacknowledged dependence upon a source in plan, organization, or argument.

In SUNY Geneseo's policy, "Plagiarism is the representation of someone else's words or ideas as one's own or the arrangement of someone else's material(s) as one's own." Take care to properly cite sources of ideas, figures, data, etc. (including internet sources) in your writing and presentations. Even if you properly cite your source, when you borrow wording and sentence structure from the original source and pass it off as your own (i.e., by not using quotation marks), you are guilty of plagiarism. Learn how to paraphrase in your own words information from the original source.

Turnitin.com. To help insure against plagiarism (intentional and unintentional), both the draft and the final version of your perspective/review paper will be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. Note that all submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the terms of use agreement posted on the Turnitin.com site.

Copyright statement

Many of the materials that are provided to students in this course have been created by me. Students would be best to assume that all course materials are protected by legal copyright. Copyright will be indicated by a "© DATE AUTHOR" on the document. Copyright protection means that reproduction of this material is prohibited without the author's consent. Thus, students are prohibited from sharing or posting copyrighted material to any websites outside our course Canvas site. Students are also prohibited from reproducing material to be shared with other more limited groups (e.g., sorority/fraternity test bank).

Student success resources

Accessibility and accommodations. SUNY Geneseo is dedicated to providing an equitable and inclusive educational experience for all students. The Office of Accessibility will coordinate reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities to ensure equal access to academic programs, activities, and services at Geneseo. Students with letters of accommodation should submit a letter to each faculty member and discuss their needs at the beginning of each semester. Please contact the Office of Accessibility Services for questions related to access and accommodations: access@geneseo.edu, 585-245-5112, www.geneseo.edu/accessibility-office.

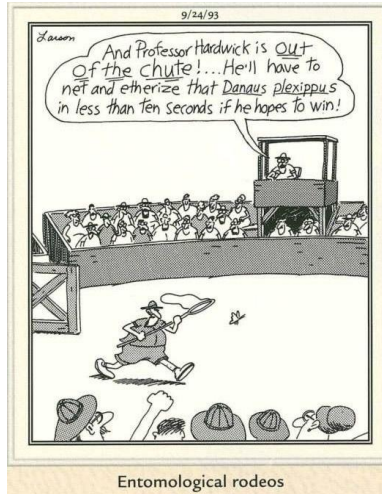
Reporting bias-related incidents. Here at SUNY Geneseo, we want to provide a space where everyone feels welcome to learn and grow in their identities as well as in their role as students, faculty, and staff. If in the unfortunate instance you experience an incident of bias, we encourage you to reach out to the we encourage you to reach out to the Chief Diversity Officer (routenberg@geneseo.edu), Director of Multicultural Programs and Services (seloievans@geneseo.edu), and/or our University Police Department. In trying to create an environment that facilitates growth through diverse thoughts and ideas, reporting incidents of bias - including threats, vandalism, and microaggressive behaviors - can help bring a better understanding of our campus climate as well as provide opportunities for learning and restoring harm.

Student well-being and mental health. Prioritizing well-being can support the achievement of academic goals and alleviate stress. Eating nutritious foods, getting enough sleep, exercising, avoiding drugs and alcohol, maintaining healthy relationships, and building in time to relax all help promote a healthy lifestyle and general well-being.

As a student, you may experience a range of challenges that can impact your mental health and thus impact your learning; common examples include increased anxiety, shifts in mood, strained relationships, difficulties related to substance use, trouble concentrating, and lack of motivation, among many others. These experiences may reduce your ability to participate fully in daily activities and affect your academic performance.

SUNY Geneseo offers free, confidential counseling for students at the Lauderdale Center for Student Health and Counseling, and seeking support for your mental health can be key to your success at college. You can learn more about the various mental health services available on campus at health.geneseo.edu. To request a counseling appointment, please complete the online form through myhealth.geneseo.edu. Getting help is a smart and courageous thing to do -- for yourself and for those who care about you.

Other resources. Additional resources are available to support your academic success and well-being, including [academic support services](#), [library research help](#), [computer and technology support](#), food security support, and emergency funding. See the “Student Success Resources” link on the Canvas course page for more information about these services.



Dates of exams

(Note: subject to change if public health demands changes in course structure)

Exam	Topic	Date
Exam I	Modules 1 & 2, insect order ID (lab specimens)	Wed, Oct 6
ID exam	Coleoptera/Hemiptera family ID (lab specimens)	Tuesday, Oct 19
Exam II	Modules 3, Orthoptera/Hymenoptera/Diptera family ID (lab specimens)	Wed, Nov 10
Final exam	Modules 4 & 5, some cumulative components	Thurs, Dec 16, 8-11:20 am

Dates of major assignments (excludes lab worksheets, in-class activities, online quizzes)

(Note: may require modification if public health situation requires changes in course structure)

Assignment	Deadline	Details
Perspective/review paper: Focal paper/topic choice with 1-2 primary sources	Thurs, Oct 7	Submit online; earlier for earlier feedback; might need to submit revised topic
Perspective/review paper: outline/annotated bibliography (8 sources, 6 primary)	Fri, Oct 29	Submit online; earlier for earlier feedback
Perspective/review paper: draft	Mon, Nov 15	Submit online; earlier for earlier feedback
Insect collection	Tues, Nov 23	Drop off in ISC 206, with collecting supplies
Identification slide show	Wed, Dec 1	Submit online
Perspective/review paper: final version	Mon, Dec 6	Submit online

The course schedule on the next page is subject to change. Refer to Canvas for an updated schedule of lecture topics, activities, and assignments week by week. Exam dates will remain fixed unless changes are necessitated by changes in the public health situation.

Course Schedule

Week	Day	Date	Lecture topic	Class/lab activity
			Module 1	Phylogeny & systematics
1	T	8-31	Introduction to course, insects & their importance	
1	W	9-1	LAB: field trip - Arboretum and other campus sites	Pinning, pointing, field collection methods
1	R	9-2	Hexapods, Apterygotes, Paleoptera	
2	T	9-7	Polyneoptera & Paraneoptera orders	
2	W	9-8	LAB: field trip – Indian Fort	Collecting: forest, field, pond
2	R	9-9	Holometabola orders	
			Module 2	Habitats, habits, & life history
3	T	9-14	Aquatic insects – overview of taxa, biological indicators	
3	W	9-15	LAB: field trip – Papermill Park	Stream sampling
3	R	9-16	Ground-dwelling insects	
4	T	9-22	Mouthparts & digestive system	
4	W	9-22	LAB: order ID practice	
4	R	9-23	Reproductive & mating behavior	
5	T	9-28	Life history variation	
5	W	9-29	LAB: field trip – Research Reserve, Island Preserve	Collecting aquatic and terrestrial environments
5	R	9-30	Coleoptera & Hemiptera ID (watch video lecture before class)	Practice Coleoptera ID
			Module 3	Evolutionary innovations
6	T	10-5	Library research; paper guidelines	Practice Hemiptera ID
6	W	10-6	EXAM I	Modules 1 & 2; insect order ID
6	R	10-7	How insects fly	Practice ID: Coleoptera Perspective paper topic due
7	T	10-12	NO CLASS – FALL BREAK	
7	W	10-13	LAB: ID practice; collection work	Practice Coleoptera & Hemiptera ID
7	R	10-14	Evolution of flight; metamorphosis	
8	T	10-19	LAB EXAM	Coleoptera/Hemiptera ID

Week	Day	Date	Lecture topic	Class/lab activity
8	W	10-20	LAB: external anatomy, Orthoptera ID	Grasshopper external anatomy, Orthoptera family ID; collection work
8	R	10-21	Metamorphosis, hormones, evolution of holometaboly	
9	T	10-26	Hymenoptera family ID (watch video lecture before class)	Practice Hymenoptera family ID
9	W	10-27	LAB: internal morphology	Cockroach dissection; collection work
9	R	10-28	Social insects I	Fri, Oct 29: perspective paper outline & annotated bibliography due
10	T	11-2	Diptera family ID (watch video lecture before class)	Practice Diptera family ID
10	W	11-3	LAB: ID practice, collection work	LAB: Practice Orthoptera/Hymenoptera/ Diptera family ID
10	R	11-4	Social insects II	
			Module 4	Insect senses & communication
11	T	11-9	Nervous system, detecting sound	
11	W	11-10	Exam II	Module 3; Orthoptera/ Hymenoptera/ Diptera family ID
11	R	11-11	Temperature regulation	
12	T	11-16	Chemoreception, pheromones	Mon, 15 Nov – Perspective paper draft due
12	W	11-17	LAB: Collection work	Work on collections
			Module 5	Ecological roles of insects
12	R	11-18	Vision and navigation	
13	T	11-23	Medical entomology	Insect collection due
13	W	11-24	THANKSGIVING BREAK	NO LAB
13	R	11-25	THANKSGIVING BREAK	NO CLASS
14	T	11-30	Insect herbivory	
14	W	12-1	LAB: Digital collections	Identification slide show due
14	R	12-2	Pollination & other mutualisms	
15	T	12-7	Predation, parasitism, defense	Mon, Dec 6 – Perspective paper final version due
15	W	12-8	LAB: Insects & climate change	
15	R	12-9	Insect conservation	
	R	12-16	FINAL EXAM (8 – 11:20 am)	Modules 4 & 5; untimed cumulative component

