

Insect Classification FALL

ENY 4161/ 6166

Tues 8:30-11:30am, Thurs 9:30-11:30am

Steinmetz Hall, Rm 3118

Instructor: Dr. Andrea Lucky (alucky@ufl.edu)
Rm 2108, Entomology-Nematology Building
Office hours: by appointment

Course Website: <http://lss.at.ufl.edu/>

Course goals:

The goal of this course is to provide you with a sound theoretical and practical understanding of both insect diversity and the practice of classifying organisms. Lectures discuss the general principles of systematics, history of insect classification, construction and use of identification tools, nomenclature, and biology and evolutionary history of the hexapod orders. We also explore why competing classifications exist in taxonomy, and what existing classifications imply about broad patterns of evolutionary change and diversification within insects. Laboratory work focuses on the means of recognition of the major groups of insects (order and family); in-class exercises illustrate concepts discussed in lecture. A collection is required that will further refine your ability to identify insects to the level of order, family and in many cases species. Accumulating the required numbers of taxa will be possible only by employing a variety of collecting techniques. Building an insect collection, with correctly identified and curated specimens is an excellent way to learn, understand and employ the methods used by professionals to classify not only insects, but living organisms in general.

Learning Objectives:

After completing this course you should be able to:

- Sight identify all hexapods to order and the majority of common insects to family
- Describe key innovations in life history, growth, development and behavior for each insect order.
- Draw a phylogenetic tree depicting the evolutionary relationships among hexapod orders
- Collect insects and field data in different habitats using a variety of techniques.
- Curate specimens properly for deposition into a museum collection, including labeling, pinning, point mounting, slide mounting and preservation in ethanol.
- Describe the taxonomic process: how species are described, named and classified.
- Explain the importance of insects to global biodiversity and conservation.

Course Prerequisite: ENY 3005, Principles of Entomology, or a similar course dealing with the classification of insects.

REQUIRED Text: Triplehorn, C.A. and N.F. Johnson. 2005. Borror and DeLong's Introduction to the Study of Insects, 7th edition. Thomson Brooks/Cole, Blemont, CA.

COURSE SCHEDULE - tentative			
Week	Date	Session	Topic
1	Aug 23	T	Course introduction & Collecting Techniques – collecting in NATL
	25	TH	Pinning and Curation
2	30	T	Tools for identification
	Sept 1	TH	Insect morphology
3	6	T	Major lineages of insects
	8	TH	Entognathous hexapods and minor insect orders Grad Topics due
4	13	T	Ephemeroptera, Odonata + Neoptera
	15	TH	Polyneoptera
5	20	T	Collecting Field Trip
	22	TH	Paraneoptera
6	27	T	Open Lab
	29	TH	Hemiptera con't Mini Collection due
7	Oct 4	T	Midterm
	6	TH	Classification, taxonomy, systematics, phylogenetics
8	11	T	Hymenoptera
	13	TH	Insect Evolution
9	18	T	Lepidoptera Grad. Literature Review due
	20	TH	Neuroptera + Coleoptera
10	25	T	Coleoptera, cont'd
	27	TH	History of Insect Classification
11	Nov 1	T	Open lab
	3	TH	Zoological nomenclature
12	18	T	Diptera
	10	TH	Species concepts and descriptions
13	15	T	Open Lab
	17	TH	FIELD TRIP - FL State Collection of Arthropods
14	22	T	Open lab
	24	TH	NO CLASS - THANKSGIVING
15	29	T	Collection Due
	Dec 1	TH	TBA
16	6	Final Exam	Final Written & Practical Exam

* This schedule is tentative and may change throughout the semester as needed, please refer to the ONLINE schedule for final dates.

Course Grading Scale (%)

94-100	A
90-93	A-
86-89	B+
83-85	B
80-82	B-
76-79	C+
73-75	C
70-72	C-
66-69	D+
63-65	D
60-62	D-
59-below	E

Grading Criteria:

	Undergraduate	Graduate
Midterm Exam	18%	15%
Final Exam	18%	15%
Lab exercises and quizzes	20%	17%
Collection (and associated documents)	34%	30%
Class participation	10%	6%
Featured Creature Article or Literature Review	0%	17%

Further information about UF Grading Policies can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Attendance:

Class attendance is required. Please do not arrive late or leave class early; it is disruptive to the class. Students are responsible for *all* material distributed in/discussed in class. In the case of missed classes, students should obtain lecture notes and handouts from classmates. Make-ups (for quizzes, exercises and exams) are *not given* except under pre-arranged or university approved circumstances, consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>. If you have a conflict or problem, letting me know ahead of time may be all it takes to reach an arrangement.

Insect specimens from the teaching collection will be available during designated labs. Take advantage of lab time! Class specimens, scopes and materials are not available outside of class. Students may not access the Teaching Collection without the permission of the instructor.

Field Trips:

During the course of the semester we will go to a variety of habitats to maximize your exposure to insect diversity. By doing so, it also maximizes the risk of coming across something that could harm you. Ticks, chiggers, widow spiders, mosquitoes, biting flies, reptiles, plants and other environmental hazards will be encountered during these trips, so dress accordingly, with closed-toe shoes, long pants, long sleeves and a hat. These do not completely eliminate risks associated with outdoor activity, but reduce them considerably. Bring insect repellent, sunscreen, snacks and water. A change of clothes is a good idea if you don't mind getting into your work!

- The class has one required collecting trip to a location around Gainesville. We will meet in our classroom at the normal class time (see schedule) and will take Entomology Department vans to a suitable collection site for the duration of the class period (perhaps longer if everyone can stay.)
- The class has a required collecting trip to the FL State Collection of Arthropods.
- Throughout the semester we will provide a variety of optional collecting opportunities that include specific collecting techniques (e.g. blacklighting) as well as specific habitats.

Exams:

Exams cover readings in the textbook, insect identification (sight ID and Key Out) and topics covered in lecture. They test your understanding of concepts, and your ability to identify orders and families by sight and using ID keys. The final exam focuses on material from the second half of the semester, but students are responsible for identification of all orders and all families from the entire course. Students who miss or arrive late to an exam without a valid excuse will not be permitted to take the exam and will receive a grade of zero.

Laboratory Exercises and Quizzes:

Laboratory exercises and quizzes are designed to reinforce material presented in lecture or lab from the most recent class periods. Exercises focus on applying concepts recently presented, either individually or in a group setting. Quizzes reinforce sight ID of families. *Exercises and quizzes may only be made up in cases of valid excuse.* One lowest quiz score will be dropped. Students arriving late will not be permitted to take the quiz and will receive a grade of zero.

Species Report (required for graduate students):

Each graduate student will complete a report on the life history and classification of a Florida insect species in the style of Featured Creatures (<http://entnemdept.ufl.edu/creatures>). For your topic to be approved, the species must not currently be featured on the Featured Creatures website. **Alternatively**, graduate students may elect to complete a literature review of the published literature on a taxon of your choice. This could be a smaller insect order or a major subgroup of a megadiverse order. The review should begin where your textbook leaves off, i.e., approximately 2005, and summarize findings on family-level (or higher) systematics, classification, keys, and fossils. The review should include a synopsis of the current classification and a bibliography of important works.

Topics must be submitted for approval AND approved by the date listed on the syllabus. Research for this project must include primary published literature - do not depend solely on Internet resources. The paper topic must be submitted for approval before Exam 1. References should be formatted in the style of the journal Systematic Entomology.

Mini collection:

Your mini collection is a 'preview' of your larger collection – and an opportunity to get feedback on your technique and IDs early on in the project. This assignment has an early deadline to encourage you to collect and curate your insects *early* in the course. You will turn in specimens representing **at least 10 orders, with 5 identifications to family and 2 to species**. They must all be correctly prepared, labeled and identified. In addition to pinned insects, you must also include at least one point-mounted or double-mounted specimen, one specimen with the wings spread and one specimen in a vial containing alcohol (EtOH). Also required with the Mini Collection are **1) Collection Contents List, 2) field notes, 3) References and 4) key characters for species-level IDs** (see requirements for main collection for details of how to format them.) As with your full collection requirement, please arrange the specimens phylogenetically, with Orders (not families) in the order listed in Triplehorn & Johnson 2005. Each Order-level grouping should be identified by a header label pinned to the bottom of the box.

Collection Requirements:

Collections should include **adult insects only**, at least 5 point-mounted insects and up to 15 EtOH vials. You can earn extra credit for the quality and organization of the collection and associated documents, as well as 2pts extra credit for each additional (correctly identified) insect order beyond the requirement. Incorrect order determinations incur a penalty of 2 pts. No credit is given for specimens in such bad shape that I cannot identify them! Due dates are firm - late submissions incur a penalty of one letter grade per day.

	<u>Undergraduates:</u>	<u>Graduates:</u>
Orders (2 pts. each)	18	22
Families (1 pt. each)	100	120
Species identifications (1 pt. each)	14	21
Total	150	185
Additional Points: Up to 3 points awarded for quality in each of the following: (1 = satisfactory, 2 = good, 3 = excellent)		
<ul style="list-style-type: none"> - Collection Contents List - Citations - Key Characters for species - Field notes & collection data - Order header labels 	<ul style="list-style-type: none"> - Organization (phylogenetic order) - Data Labels - General appearance of specimens - Overall appearance of collection - Diversity within families 	

Collection Curation Guidelines:

1) **A Collection Contents List** must be submitted with the insect collection (see example below). This should list names and numbers of the following: Orders, Families, Species, as well as number of specimens overall and a reference for each determination. Specimens should be listed in phylogenetic order, i.e. the order in which they appear in the textbook (Orders only, for example from Protura to Diptera). This allows students to see a progression of morphological specialization across Insecta and helps when grading collections. **If no "Collection Contents List" is turned in with the collection, the collection will not be graded and the assignment grade will be zero.** *Note: The spelling of names on Collection Contents List is important – use care and be accurate!*

Order	# fam.	Family	# ind.	Species ID	Reference
Blattodea	2	Blaberidae	1		Triplehorn, C.A. and N.F. Johnson. 2005. <u>Borror and DeLong's Introduction to the Study of Insects</u> , 7 th edition. Thomson Brooks/Cole, Blemont, CA.
		Blattidae	2		Triplehorn, C.A. and N.F. Johnson. 2005. <u>Borror and DeLong's Introduction to the Study of Insects</u> , 7 th edition. Thomson Brooks/Cole, Blemont, CA.
				<i>Eurycotis floridana</i>	Featured Creatures – see attached
Hymenoptera	5	Formicidae	1		Triplehorn, C.A. and N.F. Johnson. 2005. <u>Borror and DeLong's Introduction to the Study of Insects</u> , 7 th edition. Thomson Brooks/Cole, Blemont, CA.
				<i>Camponotus floridanus</i>	Featured Creatures – see attached
		Apidae	3		Triplehorn, C.A. and N.F. Johnson. 2005. <u>Borror and DeLong's Introduction to the Study of Insects</u> , 7 th edition. Thomson Brooks/Cole, Blemont, CA.
		Sphecidae	2		Triplehorn, C.A. and N.F. Johnson. 2005. <u>Borror and DeLong's Introduction to the Study of Insects</u> , 7 th edition. Thomson Brooks/Cole, Blemont, CA.
		Ichneumonidae	1		Triplehorn, C.A. and N.F. Johnson. 2005. <u>Borror and DeLong's Introduction to the Study of Insects</u> , 7 th edition. Thomson Brooks/Cole, Blemont, CA.
		Vespidae	5		<i>Hymenoptera of the World</i> (1993). Goulet & Huber. Agriculture Canada.
TOTAL: 18	105		133	17	

2) **A Citation List** is required with every collection and should include full citations for all of references used to ID specimens to family or species. This list can be included in your Collection Contents list or in a separate document. Most references should be from published books and scientific journals. If you use an online reference, choose only authoritative sources (i.e. not www.insectidentification.org/) and include ALL of the following in your citation: website URL, article name, author, date accessed. Sites like BugGuide should NOT be your main source - they are not always reliable.

3) **Key Characters** must be presented for each species-level determination. Key characters identify the most important features that distinguish this species from other similar species, and especially those most closely related to it. These can be presented as a summary list of characters for each species, with references cited (*example below). Alternatively, you may submit copies of keys or authoritative articles with relevant characters highlighted. **ID points will be awarded only to those species for which valid key characters are presented.** Vague key characters do not merit points.

Examples of key characters:

Monomorium emarginatum (an ant that is not especially distinctive = needs more detail)

- Sm. black ant; petiole and post-petiole; lacks propodeal spines; 12-seg antennae = genus *Monomorium*
- One of 4 sp. in this genus in New England (specimen collected in Maine)
- Uniform black; sloping posterior surface of propodeum longer than dorsal surface; found in loamy soil (distinguishes this species from *M. viride*). Two other species are exotics only found indoors.
- Ref: Ellison, AM, Gotelli, NJ, Farnsworth, EJ and Alpert, GA. 2012. *A Field Guide to the Ants of New England*. Yale University Press. New Haven CT, USA.

Actias Luna

(a very distinctive species!)

- Distinctive large, green moth with a long tail on each hind wing and distinctive purple/ yellow eyespots on both fore and hind wings. Nearctic.
- No other moth in the Saturniidae presents this coloration at this size (adult wingspan 75-105 mm).
- Refs: 1) Hall, DW. *Featured Creatures*. 2007. Publication #EENY-411. http://entnemdept.ufl.edu/creatures/misc/moths/luna_moth.htm. Accessed Sept. 1, 2016. 2) and Covell, CV. *A Field Guide to Moths of Eastern North America*. 1984. VA Museum of Natural History. VA, USA. 518 pp.

4) **Field Notes** must accompany each insect collection. These can be in the format of your choosing (e.g. in a notebook, word document or spreadsheet – see below), organized chronologically so any specimen can be referenced by collection date. Each collection event should include *at minimum* date, locality, habitat type, collection method and collector. Good field notes also include some or all of the following: Accession numbers, season, time of day, weather, detailed habitat characteristics, behavioral/ecological notes and tentative IDs.

Collections without field notes will not be graded.

Date	Country	State	City/Co.	Specific location	General Habitat	Specific Habitat	Coll. method	Collector	Notes
08-Aug-2017	USA	FL	Gainesville, Alachua Co.	Lake Alice woods, UF	Mixed pine/ oak forest	Lakeside grasses	Sweep net	A. Lucky	Mayflies, flies, hemipteran. Warm afternoon
10-Aug-2017	USA	FL	Gainesville, Alachua Co.	Lake Alice woods, UF	Mixed pine/ oak forest	Under pine bark	Hand coll.	A. Lucky	Beetles & termites. Carabidae? Collected soldiers & workers.
13-Aug-2017	USA	FL	Gainesville, Alachua Co.	NATL, UF	Recently burned pine forest	Standing dead stump	Leaf litter / berlese	A. Lucky	Cockroach, thrips, ants. Sample from base of stump.

5) **Labels.** In addition to a locality label, each specimen needs an identification label indicating the Order to which it belongs, as well as Family and Species, where appropriate. For specimens with species determinations, the borders of the ID label are to be colored **green**. The green borders help in finding the species determinations while grading your collection.

6) **Organization.** Orders should be arranged in the phylogenetic order presented in the textbook. All specimens in an Order should be grouped under a header label, which can be pinned to the bottom of the box. NOTE: A specimen identified to the wrong Order results in a 2 pt. deduction from the overall collection score, even if the Family ID on the specimen is correct.

Specimen Guidelines:

1) Insects that were submitted for the requirement of another course must not be included in the collection for this class. Previously-submitted specimens in a collection are considered academic dishonesty and will be reported to the Dean of Students Office and students will incur a letter-grade penalty.

2) Specimens used for the insect collection requirement must have either been collected by the student turning in the collection or by a classmate currently enrolled in ENY 4116 / 6166.

3) Specimen labels must indicate the **collector**. I.e. your traded specimens must include your classmates' name on the label, not your own.

4) Identifications of all specimens should be made by the **owner** of the collection. This applies to material acquired through trading with classmates – you need to confirm these IDs.

5) No insects may be collected from protected areas without legal permits. These include City Parks, State Parks, National Parks, Preserves, Reserves, Private Forests, etc. Violation of this rule will result in a collection grade of zero.

6) Rules concerning "Academic Misconduct" apply to all specimens and specimen labels submitted for the insect collection requirement of this course. Any violation of these rules will be reported to the DSO and could result in dismissal from the University.

Re-grade Policy:

If you believe an error has been made in calculating your grade for an assignment, you may submit a re-grade request. Provide a written description detailing the problem **within one week of receiving your grade** and submit the original item with the request. Note that *the entire assignment will be re-evaluated* so your grade may go up OR down, if more errors are found.

Suggested references:

Our textbook is the only *required* book for this course, however, there are many excellent resources available for learning about and identifying insects. You will need to seek out references to identify your insects to species-level, so look for papers, guides and websites with dichotomous keys and high quality identification information, not just photographs. Try to use up to date references as older ones may use outdated classification. The following references are the types of textbooks and identification guides that you might find helpful.

Textbooks:

Daly & Doyen's *Introduction to Insect Biology and Diversity*. Whitfield & Purcell, 2012. ~ \$119.

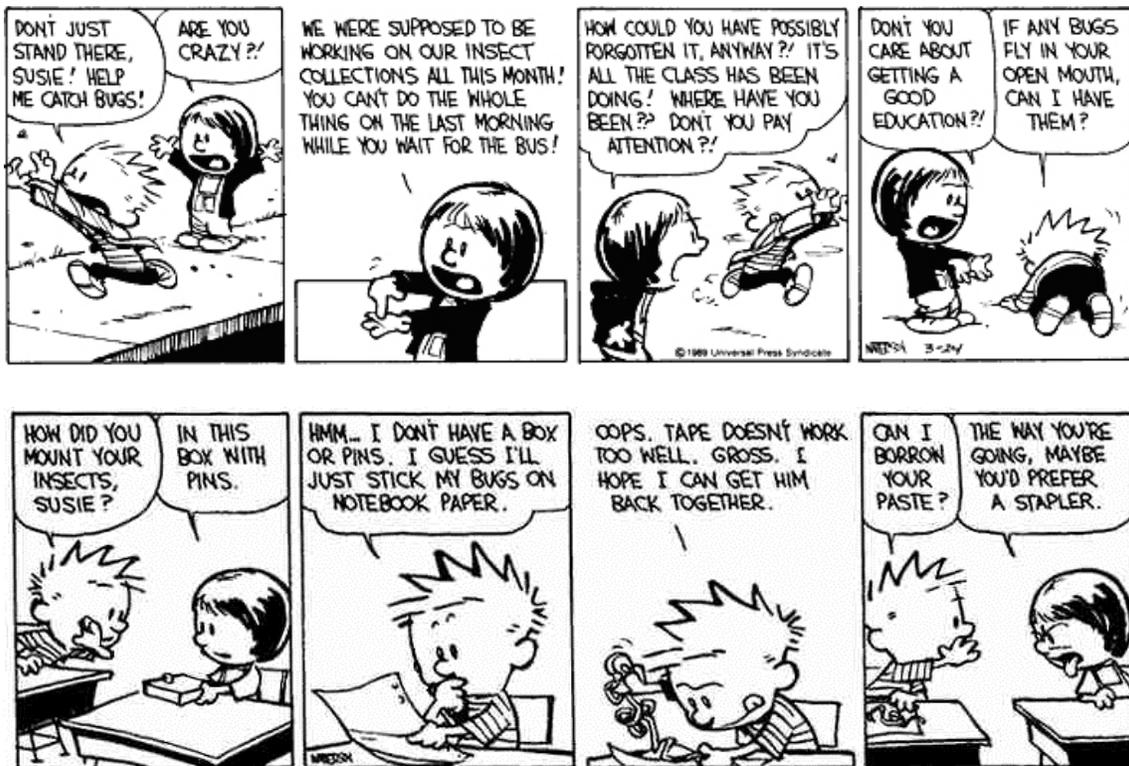
The Insects: An Outline of Entomology, 5th Ed. P. J. Gullan, P. S. Cranston. 2014. ~ \$100.

Field Guides:

Dragonflies and Damselflies of the East. Butterflies through Binoculars: A Field Guide to the Butterflies of Eastern North America. A Field Guide and Identification Manual for Florida and Eastern U.S. Tiger Beetles. Beetles of Eastern North America. The Bees in Your Backyard: A Guide to North America's Bees.

Websites: NOTE: Do Not Rely On Websites Alone! There are many excellent websites that can be helpful in identifying insects, but some are more reliable than others. Try these first:

<http://entnemdept.ufl.edu/creatures/> and www.bugguide.org.



General Information:

Services for Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

Absences and Make-Up Work. Requirements for class attendance, make-up exams, assignments and other work are consistent with university policies that can be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

If you are having problems in school please make an appointment to see me, or if appropriate, call one of the counseling services below. Do not wait until the end of the semester!

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/*
- *Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/*
- *U Matter We Care, www.umatter.ufl.edu/*

Academic Honesty

In 1995 the UF student body enacted an honor code and voluntarily committed itself to the highest standards of honesty and integrity. When students enroll at the university, they commit themselves to the standard drafted and enacted by students.

The Honor Pledge: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

On all work submitted for credit by students at the university, the following pledge is either required or implied: "**On my honor, I have neither given nor received unauthorized aid in doing this assignment.**" Students should report any condition that facilitates dishonesty to the instructor, department chair, college dean, Student Honor Council, or Student Conduct and Conflict Resolution in the Dean of Students Office. All work in this class is to be completed independently unless the assignment is defined as a group project, in writing by the instructor. This policy will be vigorously upheld at all times in this course.

Academic misconduct is taken very seriously at the University of Florida. Any violation of the Honor Pledge will be submitted to the Dean of Students office for review.

Software Use:

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.