Insect Classification FALL Semesters

ENY 4161/ 6166

Time TBA, Steinmetz Hall, Rm TBA

Instructor: Dr. Andrea Lucky (alucky@ufl.edu) TA: (TA name)
Rm 2108, Entomology-Nematology Building
Office hours: by appointment
CANVAS Course Website: XXXXX

Course goals:

The goal of this course is to provide you with a sound theoretical and practical understanding of insect diversity and the practice of classifying organisms. Lectures discuss general principles of systematics, classification, nomenclature, use of identification tools, and biology and evolutionary history of hexapods. We explore why competing classifications exist in taxonomy, and how classifications reflect patterns of evolutionary change and diversification. Laboratory work provides examples for recognition of insect orders and families; in-class exercises reinforce lecture concepts. A required insect collection is the foundation for refining your ability to identify insects to order, family, and species. Accumulating the required numbers of taxa will be possible only by employing a variety of collecting techniques. Building this insect collection with correctly identified and curated specimens is an excellent way to learn, understand, and employ 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:

- Identify hexapods to order and the majority of common insects to family by sight
- Effectively navigate dichotomous keys to identify adult insects to order and family
- Use a variety of techniques in diverse habitats to collect insects and record field data
- Curate specimens properly: labeling, pinning, point mounting, and preserving in EtOH
- Contrast the mechanics of taxonomy (species description, naming, classification) with the process of evaluating whether classificatory schemes reflect evolutionary history.
- Explain how key innovations in the life history of insects led to their incredible diversity.
- Interpret phylogenetic trees depicting evolutionary relationships among insects

Course Prerequisite: ENY 3005, Principles of Entomology, or a similar course dealing with the classification of insects. *Students are expected to be familiar with all insect orders and some families before taking this class.*

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, Belmont, CA (~$80).

Primary General Education Designation: Biological Sciences (B)

Biological science courses provide instruction in the basic concepts, theories and terms of the scientific method in the context of the life sciences. Courses focus on major scientific developments and their impacts on society, science and the environment, and the relevant processes that govern biological systems. Students will formulate empirically-testable hypotheses derived from the study of living things, apply logical reasoning skills through scientific criticism and argument, and apply techniques of discovery and critical thinking to evaluate outcomes of experiments. (*Note: A minimum grade of C is required for general education*)

EXAMPLE COURSE SCHEDULE		
Week		**Topic**
1		Course introduction & Collecting Techniques
		Pinning and Curation
2		Tools for identification
		Insect morphology
3		Major lineages of insects
		Entognathous hexapods and minor insect orders
4		Ephemeroptera, Odonata + Neoptera
		Polyneoptera
5		Collecting Field Trip
		Paraneoptera
6		Open Lab
		Hemiptera cont'd, Mini Collection due
7		Midterm Written & Practical Exam
		Classification, taxonomy, systematics, phylogenetics
8		Hymenoptera
		Insect Evolution
9		Lepidoptera, Grad. Literature Review due
		Neuroptera + Coleoptera
10		Coleoptera, cont'd
		History of Insect Classification
11		Open lab
		Zoological nomenclature
12		Diptera
		Species concepts and descriptions
13		Open Lab
		FIELD TRIP - FL State Collection of Arthropods
14		Open lab
		NO CLASS - THANKSGIVING
15		Collection Due
		TBA
16		Final Written & Practical Exam

* This schedule is just an example and will change each semester as needed, please refer to the ONLINE schedule for final dates.

Course Grading Scale (%)

93-100	A
90-92.9	A-
87-89.9	B+
83-86.9	B
80-82.9	B-
77-79.9	C+
73-76.9	C
70-72.9	C-
67-69.9	D+
63-66.9	D
60-62.9	D-
60-below	E

Course 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%
Grad Paper	0%	17%

Further info about UF Grading Policies: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Succeeding in this Class:

Collect, collect, collect! Success in this course is largely linked to the effort you make to collect insects in diverse environments *early* in the semester. Keep in mind that the more orders and families you have, the more specimens you have for studying key morphological characters of these groups. Even if the weather is not perfect, you can find a lot of diversity once you start looking. Don't overlook urban environments and indoor habitats such as homes and greenhouses, especially if it is cold outside! Plan to collect many more insects than the required number of Orders, Families and Species. This is because many of your insects will belong to the same families, but you won't know this until you have curated and identified them.

Plan ahead. Plan to collect intensively for the first third of the course, curating specimens as you go and identifying insects in the groups that you are learning about in lecture. After about 5 weeks, switch your focus to the *identification* of specimens that you have already collected and curated. This will allow you to become familiar with the identification keys in the textbook using your own specimens. As you learn to recognize common families, your collecting can become more targeted as you search for groups not yet included in your collection.

Collecting:

Again, *Collect, Collect, Collect*! This is the most important piece of advice for your success with your insect collection. Collect MANY MORE insects than you expect to include in your final collection. Generally, you can expect to collect different types of insects with different sampling methods in different habitats, however, you will not necessarily know what kinds of insects you have collected until they are curated and identified.

Collecting Equipment:

You have the option of borrowing equipment from the Entomology department stockroom (Entomology Rm 2326) including pins, boxes, vials, net, spreading board, etc. If you want to borrow other items you can ask us or contact Jennifer Carr (352-273-3979 or jennster@ufl.edu). Just remember: borrowed collecting equipment must be returned by the end of the semester! Failure to return equipment can result in a hold on your record.

Attendance:
Class attendance is required. If you will arrive late or leave class early please notify your instructor in advance. If you have a conflict or problem, letting us know ahead of time may be all it takes to reach an arrangement. Make-ups (for quizzes, exercises, discussions and exams) are *not given* except under pre-arranged or university approved circumstances, consistent with university policies: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. Students are responsible for material distributed in/discussed in class. In the case of missed classes, students should obtain lecture notes from classmates. **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, if possible, we may go to a variety of habitats to maximize your exposure to insect diversity and collecting techniques. 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/boots, long pants, long sleeves, and a hat. Remember to bring water! These do not completely eliminate risks associated with outdoor activity, but reduce them considerably.

Laboratory Exercises and Quizzes:
Laboratory exercises and quizzes are designed to reinforce material presented in lecture or lab. Exercises focus on applying concepts recently presented, either individually or in a group setting; Quizzes reinforce sight ID of families. Stuff happens, so one lowest quiz score will be dropped for each student. Use this freebie wisely! *Without a valid excuse, a missed in-class activity or quiz receives a grade of zero and cannot be retaken.*

Exams:
Exams cover material related to insect identification (sight ID and Key Out) and topics covered in lecture. They test your ability to identify orders and families by sight and using ID keys and give you a chance to demonstrate your mastery of concepts. The final exam focuses on material from the second half of the semester, but students are responsible for identification of all orders 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.

Graduate paper
Each graduate student will complete a report focused on insects in one of the following formats: 1) literature review of the published literature on a taxon of your choice, or 2) proposal for a formally recognized insect common name, crafted according to the guidelines of the Entomological Society of America's Common Names of Insects Committee. https://www.entsoc.org/pubs/use-and-submission-common-names. Details about these assignments can be found on the course Canvas site.

Mini- and Full Collection:
The mini collection is just that – a miniature version of your final collection. This assignment provides a benchmark to ensure you don't leave all your collecting and curation until the end of the course and gives you feedback early in the course. You will turn in specimens representing

at least **10 orders, 5 families and 2 species, all correctly identified, curated and labeled**. In addition to pinned insects, your collection must include at least one point-mounted or double mounted specimen and one specimen with the wings spread. **A Collection Contents List, your field notes so far and references with key characters for your species-level IDs are also required** as part of the Mini Collection (see requirements for main collection for details of how to format them). As with your full collection requirement, please arrange the specimens with orders arranged phylogenetically (i.e., in the order found in the textbook) and identify each Order-level grouping with header labels pinned to the bottom of your box.

Late submission and re-grade policy:
Assignment deadlines are firm unless an extension has been granted by the instructor, and any major assignment submitted late will receive a penalty of one letter grade per day. If you believe an error has been made in calculating your grade for any assignment, you may submit a re-grade request in writing. Please provide a written description detailing the problem **within one week of receiving your grade.** Submit the original item with the request and note that *the entire assignment with be re-evaluated*.

Suggested references:
Our textbook is the only *required* book for this course, however, it is only appropriate for Order and Family-level IDs. 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.

Examples of Helpful 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.

Collection Requirements:

Collections should include **adult insects only** and, beyond pinned specimens, should have at least 5 point-mounted and 5 spread-winged insects. You can earn extra credit for the quality and organization of the collection and associated documents, as well as for extra orders. Incorrect order IDs cost you 2 pts. No credit is given for specimens in such bad shape that I cannot identify them! Five points will be deducted for any LIVE specimens included in the collection. Note that the submission deadline is firm - *late submissions incur a penalty of one letter grade per day*.

	Undergraduates:	**Graduates:**
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 2 points awarded for quality in each of the following:
(1 = very good, 2 = wow! above and beyond)

- Collection Contents List
- Citations
- Key Characters for species
- Field notes & collection data
- Order header labels
- 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. Borror and DeLong's Introduction to the Study of Insects, 7th edition. Thomson Brooks/Cole, Blemont, CA.
		Blattidae	2		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.
				Eurycotis floridana	Featured Creatures – see attached
Hymenoptera	5	Formicidae	1		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.
				Camponotus floridanus	Featured Creatures – see attached
		Apidae	3		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.
		Sphecidae	2		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.
		Ichneumonidae	1		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.
		Vespidae	5		*Hymenoptera of the World* (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 (with marker or highlighter). 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 previously submitted for the requirement of another course **may not be included** in the collection for this class.

2) Most specimens in the insect collection **should be collected by the owner of** the collection; some specimen trading with classmates *this* semester is permitted.

3) All specimen identifications must be made by the **owner** of the collection.

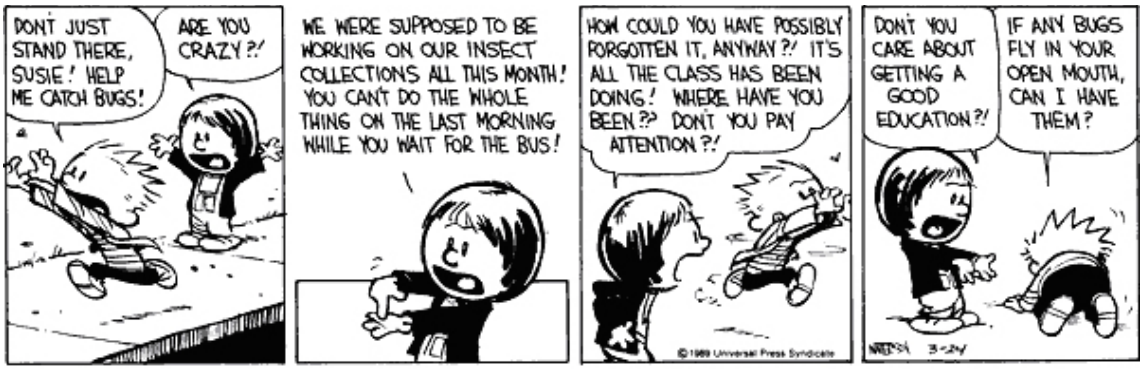
4) No insects may be collected from protected areas without permission. These include City Parks, State Parks, National Parks, Preserves, Reserves, Private Forests, etc. *If you are unsure, it is your responsibility to find out if collecting is permitted!*

5) Rules concerning academic honesty apply to specimens, specimen labels, and field notes submitted for the collection. If you are not sure whether something is allowed, just ask!!

Academic misconduct *is taken seriously in this class and by UF, and may result in dismissal from the University. Violation of these rules will incur a grade penalty and a misconduct report filed with the Dean of Students. Avoid plagiarism by understanding what it is. When in doubt, ask!*

Submitting Your Collection

Before packing your collection, **take a photo** for your records, then deliver it to our classroom or the UF Entomology department front office. Specimen boxes must be well sealed and pest-free; 10 point deduction if your collection arrives with *live* insects, such as ants, dermestid beetles, or silverfish inside! Make sure that EVERY item you submit has your name on it. Each box, each paper, etc. Please note on your collection contents list whether you would like to **KEEP** or to **DONATE** your collection. If you don't specify, your specimens will be considered a donation.


DON'T JUST STAND THERE, SUSIE! HELP ME CATCH BUGS!
ARE YOU CRAZY?!
WE WERE SUPPOSED TO BE WORKING ON OUR INSECT COLLECTIONS ALL THIS MONTH! YOU CAN'T DO THE WHOLE THING ON THE LAST MORNING WHILE YOU WAIT FOR THE BUS!
HOW COULD YOU HAVE POSSIBLY FORGOTTEN IT, ANYWAY?! IT'S ALL THE CLASS HAS BEEN DOING! WHERE HAVE YOU BEEN?? DON'T YOU PAY ATTENTION?!
© 1989 Universal Press Syndicate
DON'T YOU CARE ABOUT GETTING A GOOD EDUCATION?!
IF ANY BUGS FLY IN YOUR OPEN MOUTH, CAN I HAVE THEM?


HOW DID YOU MOUNT YOUR INSECTS, SUSIE?
IN THIS BOX WITH PINS.
HMM... I DON'T HAVE A BOX OR PINS. I GUESS I'LL JUST STICK MY BUGS ON NOTEBOOK PAPER.
OOPS. TAPE DOESN'T WORK TOO WELL. GROSS. I HOPE I CAN GET HIM BACK TOGETHER.
CAN I BORROW YOUR PASTE?
THE WAY YOU'RE GOING, MAYBE YOU'D PREFER A STAPLER.

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. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

- 0001 Reid Hall, 352-392-8565, https://disability.ufl.edu/ .

Attendance 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/UGRD/academic-regulations/attendance-policies/

Campus Helping Resources
Students experiencing crises or personal problems that interfere with their general wellbeing 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

Counseling Services, Groups & Workshops, Outreach & Consultation, Self-Help Library, Wellness Coaching

• U Matter We Care, www.umatter.ufl.edu/

• Career Connections Center, First Floor JWRU, 392-1601, https://career.ufl.edu/

• Student Success Initiative, http://studentsuccess.ufl.edu

Student Complaints: https://sccr.dso.ufl.edu/policies/student-honor-code-studentconduct-code/

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.