

# BIOL 317: Entomology

## Spring 2011

**Instructor:** Dr. Christopher J. Paradise

**Phone:** 894-2890

**Office Hours:** Mon 10:30 – 11:20; Wed 9:30-10:30; Thur 1:40 – 2:55; Fri 10:30 – 11:20; or by appt.

**Office:** Watson 272

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**Class meets** on Monday, Wednesday, and Friday, 11:30-12:20, Chambers 1003

**Laboratory meets** on Monday 1:30-4:20 (A) or Wednesday 1:30-4:20 (B) either in Watson 243 or, if going in the field, at another announced location.

**Prerequisite:** Biology 111 and 112; or permission

### **DESCRIPTION:**

Entomology is an examination of the biology of insects and related arthropods, and the course will be structured around biological concepts, applications, and investigation of hypotheses as they relate to insects. Insects have a remarkable impact on humans, ranging from devastating diseases, affecting the outcomes of battles, pollinating our major crops, and inspiring art. We find insects just about everywhere except in the oceans, and they can be perceived as disgusting, bothersome, dangerous, or beautiful. All, however, are complex and interesting to study. A significant part of the course will be devoted to medical and forensic entomology integrated with concepts such as introduction of non-native species, global climate change and emerging diseases, arboviruses, epidemiology, and insect life cycles. Major emphasis in the laboratory involves an independent research project and the making of a collection of local insects.

By the end of this course you should be able to pick up a common insect (a feat in itself for some people) and tell your friends to what order it belongs, how it moves, how it eats and digests its food, where it usually lives, whether it is harmful or beneficial to people or animals, how it's controlled if it is a pest, and how it may impact our lives. My hope is that you gain a lifelong appreciation for this important group of animals.

### **COURSE OBJECTIVES:**

- Learn about the classification, morphology, physiology, ecology, and behavior of insects
- Be able to explain the value and importance of insects to human life and endeavors and how humans manage insect populations
- Learn how to identify major orders and families of insects
- Learn to conduct literature research on entomological topics and research using standard experimental design and analysis techniques.
- Acquire skills for collecting, mounting, and preserving insects for scientific study

### **REQUIRED TEXTS (B&N refers to Barnes and Noble website: [www.bn.com](http://www.bn.com))**

Gullan P, Cranston P (2010) The Insects: An Outline of Entomology, 4<sup>th</sup> edition. Wiley-Blackwell, John Wiley & Sons, Ltd. ISBN-13: 9781444330366

**One** of the following insect field guides (purchase on your own through local bookstore, Amazon.com, or Barnes&Noble.com – listed in order of my preference):

Evans AV (2007) National Wildlife Federation Field Guide to Insects and Spiders of North America. Sterling Publishing. ISBN-13: 9781402741531. B&N list price: \$19.95, online price: \$15.96

Milne LJ, Milne M (1980) National Audubon Society Field Guide to North American Insects and Spiders. ISBN-13: 9780394507637. B&N list price: \$19.95, online price: \$15.96

Borror DJ, White RE (1998) A Field Guide to Insects: America North of Mexico. Houghton-Mifflin. ISBN-13: 9780395911709. B&N online price: \$19.00

Eaton E, Kaufman K (2007) Field Guide to Insects of North America. Houghton Mifflin Harcourt. ISBN-13:

9780618153107. B&N list price: \$18.95, online price: \$15.16

### **ADDITIONAL RESOURCES THAT WILL BE AVAILABLE**

Castner JL (2000) Photographic Atlas of Entomology and Guide to Insect Identification. Feline Press, Gainesville, FL. ISBN: 0-9625150-4-3

Mullen G and Durden L (2002) Medical and Veterinary Entomology. Academic Press, Boston, MA (selected readings will be drawn from this source)

Resh VH and Carde RT (eds, 2003) Encyclopedia of Insects. Academic Press, Boston, MA

Triplehorn CA and Johnson NF (2005) Borror and DeLong's Introduction to the Study of Insects (7<sup>th</sup> edn). Thomson Brooks/Cole, Belmont, CA

Various identification guides and dichotomous keys to specific taxonomic groups

### **REVIEWS, WRITTEN ASSIGNMENTS, PARTICIPATION**

**Reviews and Quizzes:** There will be three reviews and several quizzes during the semester. The reviews will cover material presented in lecture, laboratory, and the readings, including insect order-level identifications. The quizzes are designed to keep you up to date on terminology and concepts. You will learn a lot of new vocabulary and some new concepts in this course – it is unavoidable in the study of a new taxonomic group. The quizzes will help you test your progress and understanding of the course material before you are subjected to a review.

**Papers and Class Presentations:** You will research two topics during the semester, one on a particular area of research in entomology that is “in the news” and one on a particular taxonomic group (order or family). You will write a 3-4 page paper on each topic and give a short presentation in class.

**Class Participation and Attendance:** Be prepared for each class, whether the format for that day is lecture, group activities, or class discussion. If you are going to be absent or late and think you have a **valid** excuse, **see or e-mail me** regarding the missed time.

### **HONOR CODE AND PLAGIARISM**

To remind you, the Honor Code states: "On my honor I have neither given nor received unauthorized information regarding this work, I have followed and will continue to observe all regulations regarding it, and I am unaware of any violation of the Honor Code by others."

The Honor Code is one of Davidson's most cherished institutions. Let's keep it that way! All of your work in this course is covered under the Honor Code and must be pledged (the word “pledged” and your signature, electronic signature, or type-written initials). Points will be deducted from any work that is not pledged.

The Davidson College Biology Department's statement on plagiarism is found at: <http://www.bio.davidson.edu/dept/plagiarism.html> and is the guide for this course. All reviews are closed book, closed notes, take-home exams. This form of testing is only possible because of the honor code. Please do not violate my trust in you or the honor code. In addition, you are required under the code to report to me or the Dean of Students any violations you observe or hear about second hand.

### **EVALUATION**

Final grades will be based on 1000 points to be distributed as follows;

Reviews (3 @ 100 each)	300
Entomological Papers (2 @ 100 each)	200
Presentations on Paper Topics (2 @ 50 each)	100
Participation and Attendance	50
Laboratory: Research Project	150
Laboratory: Insect Collection	150
<u>Laboratory: Progress Reports</u>	<u>50</u>
Total	1,000

**TENTATIVE SCHEDULE: G & C refers to Gullan and Cranston, 4<sup>th</sup> edition**

<b>Date</b>	<b>Lecture Topic</b>	<b>Reading/Assignment</b>
1/10	Introduction and logistics / Importance and awesomeness of insects	G & C: Ch. 1
1/12-14	External anatomy: focus on the GRASSHOPPER and an insect of your choosing	G & C: Ch. 2, Taxoboxes 10 and one other
1/17	<b>MLK, Jr. Day observance</b>	<b>NO class</b>
1/19-21	Arthropod and insect classification and systematic: focus on SPRINGTAILS & MAYFLIES	G & C: Chs. 1 and 7 (skim 7.3 and 7.4), Taxoboxes 1 and 4
1/24-26	Insect evolution and phylogenetics: focus on DRAGONFLIES & STONEFLIES (evolution of wings and flight)	G & C: Chs. 3 (3.1.4), 7 (skim 7.3 and 7.4), 8, Taxoboxes 5 and 6
1/28	Internal Systems I: Respiration, digestion, & excretion: focus on CATERPILLARS	G & C: Ch. 3 (3.5, 3.6 & 3.7), Taxobox 28
1/31	Internal Systems II: Nervous, endocrine, and circulatory systems: focus on V.B. WIGGLESWORTH & RHODNIUS	G & C: Ch. 3 (3.2, 3.3 & 3.4), Taxobox 20
2/2-4	Sensory systems and behavior: focus on COCKROACHES	G & C: Ch. 4, Taxobox 15
2/7	Medical/Veterinary Entomology: overview of important orders	G & C: Ch. 15 (15.1-15.5), Taxobox 24; Mullen & Durden: Ch. 1
2/9	Medical/Veterinary Entomology: arboviruses	Mullen & Durden: Chs. 2, 8
2/11-14	Medical/Veterinary Entomology: epidemiology of arthropod-borne diseases	Mullen & Durden: Ch. 3 <b>REVIEW 1 passed out 2/11</b>
2/16-18	Medical/Veterinary Entomology: focus on TICKS & FLEAS	G & C: Ch. 15, Taxobox 26 <b>REVIEW 1 due 2/16</b>
2/21	Medical/Veterinary Entomology: focus on MOSQUITO ecology and diseases	Mullen & Durden: Ch. 8, Spielman & D'Antonio: Chs. 1-3
2/23-25	Taxonomic group (order or family) presentations	<b>Be prepared to give a 8-10 minute presentation on your topic</b>
2/28-3/4	<b>SPRING BREAK</b>	<b>NO CLASS</b>
3/7	Reproductive Biology: attracting the opposite sex: focus on PRAYING MANTIDS	G & C: Chs. 3 (3.8), 5, Taxobox 14
3/9	Reproductive Biology: insect sex; focus on SCORPIONFLIES	G & C: Ch. 5, Taxobox 25
3/11	Development: metamorphosis and hormones; focus on TRUE BUGS	G & C: Ch. 6 (6.1-6.3), Taxobox 20 <b>PAPER #1 on taxonomic group due</b>
3/14	Evolution of insect life histories: focus on BUTTERFLIES	G & C: Ch. 6 (6.4-6.11), Taxobox 28
3/16	Forensic Entomology: diversity and taxonomy of necrophages; focus on BEETLES	G & C: Ch. 15 (15.6), Taxobox 22, Benecke (2001)
3/18	Forensic Entomology: focus on BLOW FLIES	Archer & Elgar (2003)
3/21	Forensic Entomology: corpse communities, focus on BEETLES	G & C: Ch. 9 (9.2-9.4), Taxobox 22; Shahid et al. (2003)
3/23	Forensic Entomology: corpse succession	Tabor et al. (2004)
3/25	Forensic Entomology: estimating PMI	Anderson (2000); Kulshrestha & Satpathy (2001) <b>REVIEW 2 passed out on 3/25</b>
3/28-30	Urban Entomology: focus on COCKROACHES & WASPS	Readings TBA; G & C: Taxoboxes 15 and 29 <b>REVIEW 2 due 3/30</b>
4/1-4	Conservation and biodiversity	G&C: Ch.8; Hughes et al. (2000); Kocher & Williams (2000)
4/6	Insect Societies II: evolution of eusociality; focus on ANTS	G & C: Ch. 12

<b>Date</b>	<b>Lecture Topic</b>	<b>Reading/Assignment</b>
4/8	Insects and Plants I: herbivory and coevolution	G & C: Ch. 11
4/11-13	Predation and insect defenses: focus on DRAGONFLIES & NEUROPTERANS	G & C: Chs. 13, 14, Taxoboxes 5 and 21
4/15	Parasites and parasitoids	G & C: Ch. 13
4/18-20	Research topic presentations	Be prepared to give a 8-10 minute presentation on your topic
4/22	Insects as food for humans	Readings TBA
4/25	<b>EASTER Break</b>	<b>NO CLASS</b>
4/27	Pests and integrated pest management	G & C: Ch. 16
4/29-5/2	Ecology and economics of pesticides	G & C: Ch. 16 PAPER #2 on research topic due 4/29
5/4	Catch-up day/open	REVIEW 3 passed out

Additional Readings (available as PDFs on Entomology website or electronic reserve at Library)

Anderson GS (2000) Minimum and maximum development rates of some forensically important Calliphoridae (Diptera) *Journal of Forensic Science* 45: 824-832

Archer MS & Elgar MA (2003) Effects of decomposition on carcass attendance in a guild of carrion-breeding flies. *Medical and Veterinary Entomology* 17: 263-271

Benecke M (2001) A brief history of forensic entomology. *Forensic Science International* 120: 2-14

Epstein PR (2001) Climate change and emerging infectious diseases. *Microbes & Infection* 3: 747-754

Hughes JB, Daily GC, Ehrlich PR (2000) Conservation of insect diversity: a habitat approach. *Conservation Biology* 14:1788-1797

Kocher SD, Williams EH (2000) The diversity and abundance of North American butterflies vary with habitat disturbance and geography. *Journal of Biogeography* 27: 785-794

Kulshrestha P, Satpathy DK (2001) Use of beetles in forensic entomology. *Forensic Science International* 120: 15-17

Miller GL (1997) Historical natural history: insects and the Civil War. *American Entomologist* 43: 227-245

Peterson RKD (1995) Insects, disease, and military history: the Napoleonic campaigns and historical perception. *American Entomologist* 41:147-160

Shahid SA, Schoenly K, Haskell NH, Hall RD, Zhang W (2003) Carcass enrichment does not alter decay rates or arthropod community structure: a test of the arthropod saturation hypothesis at the Anthropology Research Facility in Knoxville, Tennessee. *Journal of Medical Entomology* 40: 559-569

Tabor KL, Brewster CC, Fell RD (2004) Analysis of the successional patterns of insects on carrion in southwest Virginia. *Journal of Medical Entomology* 41: 785-795

## BIOL 317: Entomology Laboratory

Spring 2011

**MATERIALS:** Paradise (2009) Bio 321: Ecology Laboratory & Field Manual; insect collecting equipment; proper clothes for field (shoes, not sandals; hat; etc.)

**Evaluation:** The laboratory portion of your grade will be based on a total of 350 points to be distributed as follows; 1) a research project with a partner testing a hypothesis related to insects (150 points); 2) an insect collection (150 points); and periodic progress reports on the project and collection (50 points).

LAB SCHEDULE		
Dates	EXERCISE	NOTES
1/10 & 12	Collecting and curating insects; order-level identification; begin collection; discuss experimental design & project ideas	<ul style="list-style-type: none"><li>• Read Exercises 1 &amp; 2, G &amp; C: Ch. 17</li></ul>
1/17 & 19	NO LAB	<ul style="list-style-type: none"><li>• MLK, Jr Day</li></ul>
1/24 & 26	Brainstorm research projects with partner; overview of experimental design and analysis; work on collection	<ul style="list-style-type: none"><li>• Read Exercise 3</li><li>• Dress for field</li></ul>
1/31 & 2/2	Anatomy of insects	<ul style="list-style-type: none"><li>• Read Exercise 4; G &amp; C: Ch. 3</li><li>• <b>RESEARCH PROPOSAL DUE</b></li></ul>
2/7 & 9	Winter insect collecting; insects of streams	<ul style="list-style-type: none"><li>• Independent work</li><li>• Dress for field</li></ul>
2/14 & 16	Time to work on projects	<ul style="list-style-type: none"><li>• Independent work</li></ul>
2/21 & 23	Time to work on projects and collections	<ul style="list-style-type: none"><li>• Independent work</li></ul>
2/28 & 3/2	SPRING BREAK	<ul style="list-style-type: none"><li>• NO Laboratory this week</li></ul>
3/7 & 9	Time to work on projects and collections	<ul style="list-style-type: none"><li>• Independent work</li><li>• <b>Oral progress reports</b></li></ul>
3/14 & 16	Time to work on projects; finish up and begin data analysis	<ul style="list-style-type: none"><li>• Independent work</li><li>• Review data analysis techniques</li></ul>
3/21 & 23	General time for collecting and curating; prepare research reports; nocturnal insect collecting	<ul style="list-style-type: none"><li>• Dress for field</li><li>• Discuss report format</li><li>• Dress for field for evening campus walk; date TBA</li></ul>
3/28 & 30	Insect curating and identifying; work on research reports	<ul style="list-style-type: none"><li>• Consult with prof. on difficult specimens</li></ul>
4/4 & 6	Insect curating and identifying	<ul style="list-style-type: none"><li>• Go over report drafts in laboratory</li><li>• <b>Oral progress reports</b></li></ul>
4/11 & 13	Teaching entomology to elementary school children	<ul style="list-style-type: none"><li>• Dress for field, bring collecting equipment to class</li></ul>
4/18 & 20	Insect Collections – finish curation	<ul style="list-style-type: none"><li>• <b>Report: final copy DUE</b></li><li>• Review Exercise 1</li></ul>
4/25 & 27	Easter BREAK	<ul style="list-style-type: none"><li>• NO laboratory this week</li><li>• Work on your Insect Collections</li></ul>
5/2 & 4	Optional class days; no laboratory	<ul style="list-style-type: none"><li>• Complete collections</li><li>• <b>Collection DUE on 5/4</b></li></ul>