OEB 155R: BIOLOGY OF INSECTS - SYLLABUS
FALL TERM 2023-2024

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Required text (available on website)
G&C: Gullan, P.J. and P.S. Cranston. 2014 (5th Edition).
The Insects: An Outline of Entomology. Blackwell Publ. Ltd, Oxford
Journal articles for discussion each week

MEDIA GALLERY with instructions about making collections:
(with thanks to Avalon Owens & Evan Hoki who prepared these in 2020):
https://www.youtube.com/playlist?list=PLgSH6brLglj0gr3wH8IzALPkrCSHxGUTQ

Optional texts (many resources available on website):
B,T&J: Triplehorn, C. A. and N. F. Johnson. 2005 (7th Edition).
Borror and Delong's Introduction to the Study of Insects, Thompson.
Grimaldi, D. & M.S. Engel. 2005. *Evolution of the Insects,* Cambridge Univ Press
Marshall, S.A. 2007. *Insects: Their Natural History and Diversity*.
Firefly Books, Ltd., Toronto

WEEK 1

Wed Sept 6th	**Lecture 1**: Mechanics and organization of course: insect diversity, external anatomy and orders of insects
Fri Sept 8th	**Lab/ Field:** Collecting insects; gear distributed Please watch instructional videos: https://www.youtube.com/playlist?list=PLgSH6brLglj0gr3wH8IzALPkrCSHxGUTQ
READINGS (G&C)	Chapters 1 & 2 (48 pp.)

WEEK 2

Wed Sept 13th	**Lecture 2:** Internal anatomy and physiology
READINGS (G&C)	Chapter 3 (35 pp.)
(PAPERS)	• Shi et al. (2015) Keeping cool: Saharan silver ants. *Science* 349: 298-301

	• Mandal et al. (2018) Hierarchically porous polymer coatings... daytime radiative cooling. *Science* 362: 315-319 • Anbutsu et al. (2017) Small genome symbiont underlies cuticle hardness in beetles. *PNAS* 114: E8382-E8391
Fri Sept 15th	**Lecture 2b**: Internal anatomy & physiology (cont.); [Lab: Preparation for Harvard Forest Trip]
(ORDER)	Hymenoptera
Sat/Sun Sept 17th /16th	**Harvard Forest Overnight Field Trip** Depart from Parking Lot behind MCZ Labs at 9:00 AM Sat; Return by 5:30 PM Sunday

WEEK 3

Wed Sept 20th	**Lab/ Field** [Estabrook Woods]
Fri Sept 22nd	**Lecture 3**: Sensory systems, behavior and reproduction
READINGS (G&C)	Chapter 4 & 5 (54 pp.**)**
(PAPERS)	• Arikawa K & K Aoki (1982) Response characteristics and occurrence of extraocular photoreceptors on lepidopteran genitalia. *J Comp Physiol* 148: 483-489 • Eacock A et al. (2019) Adaptive colour change and background choice behavior in peppered moth caterpillars is mediated by extraocular photoreception. *Comm Biology* 2 (286)
(ORDERS)	Lepidoptera and Trichoptera

WEEK 4

Wed Sept 26th	**Lecture 4**: Sensory systems, behavior and reproduction (cont)
READINGS (G&C)	Chapter 4 & 5 (54 pp.)
(PAPER)	• Schroeder, TBH et al. (2018) It's not a bug, it's a feature: functional materials in insects. *Adv. Mater.* 1705322; DOI: 10.1002/adma.201705322

Fri Sept 28th	**Lab/ Field:** [Arnold Arboretum](may visit North Attleboro site)
OPTIONAL READING	B,T&J - Chapters 2, 28 and 29
(ORDER)	Diptera

WEEK 5

Wed Oct 4th	**Lecture 5**: Insect development and life histories
READINGS (G&C)	Chapter 6 (34 pp.)
(PAPERS)	• Truman, JW (2019) The evolution of metamorphosis. *Current Biology* 29: R1252-R1268 • Reynolds, SE (2022) A transcription factor that enables metamorphosis. PNAS 119: e2204972119 • Truman, JW and LM Riddiford (2022) *Chinmo* is the larval member of the molecular trinity that directs *Drosophila* metamorphosis. PNAS 119: e2201071119
Fri Oct 6th	**Lab/ Field:** [Arnold Arboretum] [First Check-in for Collection: 3 orders, 7 families]
READINGS (G&C)	Taxobox 24, p. 490; Taxobox 25, p. 491; Taxobox 26, p. 492
OPTIONAL READING	B,T&J Chapters 31, 32 and 34
(ORDERS)	Mecoptera; Siphonaptera

WEEK 6

Wed Oct 11th	**Lecture 6**: Insect systematics and phylogeny
READINGS (G&C)	Chapters 7 and 8 (39 pp.)
(PAPERS)	• Alexander, DE (2018) A century and a half of research on the evolution of insect flight. Arthropod Structure & Devel 47: 322-327

• Wipfler, B et al. (2019) Evolutionary history of Polyneuroptera and its implications for our understanding of early winged insects. I 116: 3024-3029

Fri Oct 13th — **Lab/ Field**: [Arnold Arboretum]

(ORDERS) — Coleoptera and Strepsiptera

WEEK 7

Wed Oct 18th — **MIDTERM**

(covers material through Lecture 6)

Fri Oct 20th — **MCZ Entomology Collection Tour**
Curatorial Associate **Dr. Crystal Maier**

OPTIONAL READINGS
(G&C) — Chapters 9 & 10 (44 pp.)
(B,T &J) — Chapters 26 &33

WEEK 8

Wed Oct 25th — **Lecture 8**: Insects and plants

READINGS (G&C) — Chapter 11 (34 pp.)
Taxoboxes 7, 9, 10, 17, and 18 (pages 471 - 480)

(PAPERS)

• Ehrlich, PR and PH Raven (1964) Butterflies and plants: a study in coevolution. *Evolution* 18: 586-608

• Edger, PP et al. and CW Wheat (2015) The butterfly plant arms-race race escalated by gene and genome duplications. *PNAS* 112: 8362-8366

• Hardy NB and SP Otto (2014) Specialization and generalization in diversification of phytophagous insects: tests of the musical chairs and oscillation hypotheses. *PRSB* 281: 20132960

Fri Oct 27th — **LAB PRACTICAL 1**
(covers material through Coleoptera & Strepsiptera)

[2nd Lab Check-In (5 NEW orders, 10 NEW families]

WEEK 9

Wed Nov 1st

Lecture 9: Insect Societies

READINGS (G&C)

Chapter 12 (25 pp.)

5 PM Deadline to propose topic for independent presentation

(PAPERS)

- O'Donnell S *et al.* and S Sulger (2015) Distributed cognition and social brains *PRSB* 282: 20150791
- Sayol F *et al.* (2020) Feeding specialization and longer generation time are associated with relatively larger brains in bees. *PRSB* 287: 20200762
- Cook CN *et al.* (2020) Individual learning phenotypes drive collective behavior *PNAS* 117: 17949-17956

Fri Nov 3rd

Lab: Work on orders [possible field trip to North Attleboro on Friday Nov 4]

OPTIONAL READINGS

(B,T &J)

Chapters 22, 23, 27 (optional)

(ORDERS)

Thysanoptera, Hemiptera, Neuroptera, Megaloptera

WEEK 10

Wed Nov 8th

Lecture 10: Insect predation / parasitism and defense

READINGS (G&C)

Chapters 13 & 14 (46 pp.)

(PAPERS)

- Skelhorn, J, Rowland HM, Speed, MP and GD Ruxton 2010 Masquerade: Camouflage without Crypsis. *Science* 327: 51-52
- Skelhorn, J., G.G. Holmes, T.J. Hossie, and T.N. Sherratt 2016 Multicomponent deceptive signals reduce the speed at which predators learn that prey are profitable. *Behavioral Ecology* 27: 141-147 and reviewed here: https://www.nytimes.com/2015/08/25/science/evolving-a-defense-mimics-save-themselves.html?smid=em-share

• Kang, C., Zahiri, R and TN Sherratt 2017 Body size affect the evolution of hidden color signals in moths. *PRSB* 284: 20171287

• Vidal-Garcia, M, O'Hanlon, JC, Svenson, GJ and KDL Umbers 2020. The evolution of startle displays: a case study in praying mantises. *PRSB* 287: 20201016

• Janzen, DH, W Hallwachs and JM Burns 2010 A tropical horde of counterfeit predator eyes. *PNAS* 107: 11659 - 11665

Fri Nov 10th **Lab:** Work on Orders

(ORDERS) Orthoptera, Dermaptera, Zoraptera, Psocoptera, Phthiraptera, Grylloblattodea, Mantophasmatodea, Phasmatodea, Embiidina, Ephemeroptera

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WEEK 11

Wed Nov 15th **Lecture 11**: Symbiosis, mutualism, parasitism and manipulation

READINGS (G&C) Chapters 15 & 16 (48 pp.)

Fri Nov 17th **Lab:** Work on Orders

(ORDERS) Odonata, Plecoptera, Isoptera*, Blattodea, Mantodea, Collembola, Diplura, Archeognatha, Zygentoma, (Thysanoptera)

WEEK 12

Wed Nov 22hd **[Thanksgiving recess]**

Fri Nov 24th **[Thanksgiving recess]**

WEEK 13

Wed Nov 29th **Lecture 12:** Economically important insects: pollinators, pests and vectors

Readings (G&C)	Chapters 16 & 17 (54 pp.)
PAPERS	• Garibaldi, LA et al 2013 Wild pollinators enhance fruit set of cro regardless of honey bee abundance. *Science* 339: 1608-1611 • Tabashnik BE and Y Carriere 2019 Global patterns of resistance to Bt crops highlighting pink bollworm in the United States, China and India. J. Economic Entomology 112: 2513-2523
Fri Dec 1st	**LAB PRACTICAL 2 [in lab]** (covers all orders after Coleoptera/ Strepsiptera)

WEEK 14

Wed Dec 6th	Final presentations

WEEK 15

Wed Dec 13th	Collections due / End of course