

EEB 4250, General Entomology: Fall, 2015
Hour Examination Questions

Four questions for the hour examination will be drawn from the following series. In preparing for the exam, use your notes, the material in the textbook, the laboratory manual, and any supplementary readings that you might have done. Make sure that you cover all parts of each question, and that you construct answers of approximately the same length for each question (on the exam, each answer has to be worth the same number of points). You may use outlines and diagrams, but there is no substitute for a well-reasoned, informative essay.

1. What features characterize Insecta? Which of these are *unique specializations* of insects, not just features shared with other, related arthropod groups?
 - Discuss the arguments for and against including entognathous hexapods (Collembola, Protura, and Diplura) with the true insects.
 - What is it about insects that has made them so successful (i.e. so many species)?
2. Discuss the several lines of speculation (and evidence) concerning the origin of insect wings. Why is this such a difficult problem to resolve? What are some steps to be taken in future work that might help resolve some of the issues?
3. Describe in some detail, with the aid of a diagram or diagrams, the organization of the insect integument, and note the sequential changes that occur prior to, during, and after molting.
 - What is the chemical composition of insect cuticle, and what goes on during sclerotization (hardening and/or tanning) of procuticle to form exocuticle?
4. Describe four different ways in which a flapping insect wing can produce lift, rather than simply beating and churning the air uselessly. Here, including a few simple drawings with your explanations might be useful.
5. Functional grouping of segments or embryonic somites is called tagmosis. Describe and discuss this phenomenon with regard to the three major regions of the insect's body, outlining for each region the (hypothesized) process of tagma formation and the functional significance of the changes you describe.
6. Discuss the significance of the three key evolutionary innovations achieved within the adaptive radiation of Class Insecta. Then,
 - Briefly summarize the uniquely defining features of the six superordinal groups or “complexes” Hemipteroidea, Orthopteroidea, Neuropteroidea, Antliophora, Amphiesmenoptera, and Hymenoptera.
 - List four representative orders within each of the complexes above (or fewer, if the complex contains fewer than 4 orders).
 - Arrange the complexes in a phylogenetic tree.

7. Describe three fundamentally different ways that colors are produced in insects. What sorts of functions do colors commonly serve? Can insects acquire pigments from their food? Always include examples whenever possible.
8. Describe cursorial (walking), fossorial (digging), natatorial (swimming), raptorial (predatory), saltatorial (jumping), stridulatory (sound-producing), and grasping (ectoparasitic) leg modifications in insects. Give at least two ordinal example of each. Also, describe two different examples of multiple convergent evolution of leg modifications (be specific).
9. Describe at least four fundamentally different ways in which insects have evolved suctorial mouthparts, naming the mouthpart pieces that have participated in forming the sucking structure in each type. The use of diagrammatic sketches is encouraged.
10. **(Bonus question)** Defend, attack, or refute the following statement: Within the insects, Endopterygota (Holometabola) is more advanced than “Exopterygota” (“Hemimetabola”).