

EEB 4250, General Entomology: Fall 2015
Study Questions for the Final Exam

1. Describe the processes of food handling and digestion in the typical insect (cockroach), from mouth to anus. Briefly summarize in your discussion the major functions of each area of the alimentary tract, together with a brief description of its ontogeny (embryonic development).
 - What happens to water that is ingested with the food?
 - Describe the most important associations involved in digestion and nutrition in insects that are specialized for feeding upon materials that are difficult to break down or lack essential nutrients.
2. An ant can lift many times its own weight: it seems effortlessly to carry the carcasses of much larger arthropods back to the nest. Science fiction has seized on this fact, to depict giant ants tossing automobiles around. From your knowledge of insect exoskeletons and muscles, put these issues into proper perspective.
 - Now that you've done that, describe what is physiologically exceptional about insect muscle, and how it achieves those remarkable properties.
3. Compare the nature of the wing-beat mechanism in Paleoptera with that in more specialized insects capable of ultra-high wing-beat frequencies (diagrams will be helpful). Make sure that in your answer you include a detailed comparison of typical systems from insects with indirect versus direct flight muscles.
4. Discuss the physiology of vision in insects. In your answer, it might be useful to “follow” a photon from entry into the eye to integration by the brain. Make sure you also touch upon the following subjects:
 - trapping and guiding of light within the eye
 - the chemical basis of photoreception
 - capabilities for color discrimination
 - polarized light detection
 - what insects actually see: potential for forming focused images, significance of these images, etc.
5. Explain why insects (and many other invertebrates) possess (1) a double system of muscle innervation and (2) giant axon fibers. In your essay, describe -- with diagrams if needed -- a typical insect muscle, including its innervation and its organization into units, fibers and myofibrils.
6. How is sex determined in insects?
 - What is the basis (genetic, cellular, physiological, etc.) of secondary sexual characteristics in insects, and how can this lead to gynandromorphy (also, define the latter term, a few of its different types, and how those originate)?
 - Discuss the occurrence and types of asexual reproduction in insects.

7. Describe the structure and function of the stomatogastric nervous system -- where located, its major components, its mode of action, etc. (labeled diagrams are a must-do).
8. Describe some of the methods used by aquatic insects for acquiring oxygen for respiratory function.
 - Also, compare aquatic respiratory adaptations with endoparasitic ones, describing some unique types of the latter.
 - Why haven't the insects successfully invaded the marine environment?
9. Describe several important mating systems characteristic of insects, including examples of those systems. In your answer, define sexual selection and discuss its importance in our understanding of secondary sexual characteristics, external and/or internal morphology of the genitalia, and courtship and mating behavior in insects.
 - Also include in your answer a list of the basic sensory modalities (channels) used during courtship, along with their respective advantages and disadvantages.
10. It is now known that "cold blooded" insects actually thermoregulate. By what methods can they do so? (describe all major methods). Why is thermoregulation so important?
11. Describe four different ways in which a flapping insect wing can produce lift, rather than simply beating and churning the air uselessly.
 - What important changes to wing structure have evolved in (1) orthopteroid insects (Polyneoptera), (2) Coleoptera, (3) Hemiptera: Heteroptera, (4) Diptera (5) Thysanoptera, (5) Hymenoptera, and (6) Psocodea: Phthiraptera?