**Unit Two - Insect Evolution**

**Study Guide**

**Lesson Objectives**

**By the end of the unit you should be able to:**

1. Describe the four successive stages of insect evolution
2. Define ametabolous, hemimetabolous and holometabolous, and the similar terms regarding wing development
3. C:\Users\baldwinr\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\MO6DDP02\MC900020453[1].wmfDescribe the two theories of insect wing evolution and why it is difficult to explain how insects evolved their wings.

*Note:* For this unit of information, listen to the lecture, then read Chapters 16 and 2. (p 18-50, p311-341) You may want to read through the questions on this study guide before beginning work on the lecture and readings. There are many new terms in the readings. We will cover the insect orders in unit 3, but there will be references to them during your readings.

Thought Questions:

1. Which types of insects are the most diverse? How many total species might there be? (p 327)
2. What are some of the advantages wings and flight provide?

**Evolutionary Stages**

**Apterygota**

1. What does "apterygote" mean?
2. Describe this stage and which insects represent this group.

**Paleopterous**

1. What does "paleopterous" mean?
2. Which two Insect Orders currently make up Paleoptera?
3. Describe this stage and which insects represent this group.
4. Explain the difference between the direct flight musculature found in dragonflies and the indirect musculature found in mayflies and other winged insects.

**Wing Flexon (Infraclass Neoptera)**

1. What does "neopterous" mean?
2. Describe this stage and which insects represent this group.
3. How was this stage an advantage over the previous stages?
4. Why do some researchers prefer to use the terms exopterygota and endopterygota to hemimetabola and holometabola?

**Metamorphosis terms**

Differentiate between ametabolous, hemimetabolous, and holometabolous.

|  |  |  |
| --- | --- | --- |
| **Type of metamorphosis** | **Definition** | **Insects that do this** |
| **ametabolous** |  |  |
| **hemimetabolous** |  |  |
| **holometabolous** |  |  |

**Other topics to consider:**

1. Describe complete metamorphosis and which insects represent this group.
   1. Why are insects in this group so successful?
2. The evolution of what other organisms contributed most to the evolution of insects?
3. What body structure is the most common fossil of insects? (p335)
   1. Which age is referred to as the “Age of Cockroaches” (p338)?

*Note:* Search “Meganeura” on YouTube to see animations of this giant of the ancient world. Also, check out the chapter on the DVD Life in the Undergrowth on the Invasion of Land to see a recreation of some of the fossils of dragonflies. This DVD is well worth purchasing if you like nature documentaries.

1. Insects are best preserved in amber. How can the abundance of only amber fossils and the lack of other fossil types bias the fossil record?
   1. Were the first insects aquatic or terrestrial? What evidence is there to support this conclusion? Note that primitive insects appeared during the Devonian “Age of Fishes”, but didn’t expand and radiate (flight) until the Carboniferous.
   2. For what evolutionary reason did wings evolve?
2. What life changes occurred to produce the holometabolic mode of metamorphosis from the hemimetabolic mode? How do the life stages of each strategy correspond to one another?

NOTE: The next grouping of questions can be answered from Chapter 2 in the textbook. You have some questions about homology that correspond to the lecture material, but much of what you read during this chapter isn’t discussed during this lecture. This material will be covered in the laboratory part of the class, so you will still be responsible for the information. Understanding this material now, will help you when we discuss the characteristics of the insect orders in Unit 3, so it is important that you don’t skip the material just because there are no questions on this study guide about them. The lab is a co-requisite for this class, so the readings you complete here about the anatomical positions, the body regions, and the modifications of the antennae, mouthparts, legs, etc. will mainly be covered in the lab. Also, if you need a quick diagram to remind you of an anatomical feature, you can check the inside cover of the textbook. That will come in handy when reviewing for your lab practical.

Please review the information in Chapter 2 to become familiar with the terms. (p18-46)

1. What is homology? (p 18) Would beetles with chewing mouthparts and mosquitoes with piercing-sucking mouthparts be homologous?
2. What is an example of convergent evolution between insects and birds?
3. What term is used to define a single cell of the epidermis that is modified into something that resembles a hair? How can this be used for defense? (p20)
4. How are muscles attached to the exoskeleton? ( p 20)
5. What are Hox genes? (p47-50)
   1. What do Hox genes tell us about the fate of gills among the arthropod subphyla (p 50)?
   2. Do centipedes have gills? What about spiders?

*When completing your lab material and insect collection, it will be important to understand the anatomical positions. If you are not familiar with them, please review them in your readings.*

**Wing Evolution/ Adaptation ASSIGNMENT**

Write a brief essay for your journal (**no more than one-page, no less than 300 words**) supporting one hypothesis over the others. Title your journal entry, "Wing Evolution Project." This will be submitted on E-Learning, so click the link to see further instructions and the due date for the assignment.

NOTES: