

I. Lesson Overview

Title: the A Bee C's of Anatomy:
Dissecting and Comparing Honeybees and Bumblebees

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Description of Lesson (Abstract):

Understanding the physical characteristics of an organism can be invaluable when learning about its role in the environment. Comparing the anatomy of two closely related species can give insight into concepts beyond the organisms' ecological roles as well: topics such as divergent evolution, competition, classification, and fitness can all be broached based on the comparison of physical attributes.

In this activity, students are given the opportunity to explore the physical adaptations of two different groups of bees (honeybees and bumblebees). First through an external examination, and later a full dissection, students will see how small physical changes make large differences in how an organism fits into its environment.

Grade Level: 9-12, Honors Biology, can be adapted for College Prep

Duration/Time (Hours, Days): Designed for a 120min class. The PowerPoint and initial question and answer session can be compressed to save time.

Standards: National Science Education Content Standards
California Science Content Standards

Learning Objectives:

After completing this activity, students will be able to...

- a) Explain how bees utilize various physical characteristics, and why those traits were favored in their evolution.
- b) Describe the differences between honeybees and bumblebees, and why those differences exist.
- c) Demonstrate an understanding of divergent evolution, and apply it to other case studies.
- d) Demonstrate good dissecting scope skills, and small scale dissection abilities.

Materials:

- 1) Dissecting microscopes with light sources
- 2) Compound microscopes with light sources
- 3) Glass slides
- 4) Probes (two per group)
- 5) Fine point scissors
- 6) Forceps (two pair per group)
- 7) Recently dead or previously frozen honeybees and bumblebees (any species)

II. Student Protocol (include visuals)

Background: Please see complimentary PowerPoint presentation with notes

Pre-Assessment: Question-and-Answer dialogue during the PowerPoint

Post-Assessment: Whole-class discussion of observations, dealing primarily with their answers to the questions at the end of the worksheet.

III. Instructor Information (include visuals)

A. Please see attached Powerpoint presentation with notes and background.

B. Preparation: Dead bees can be obtained from local apiaries and greenhouses which use bumblebees for pollination. Often times a phone call is all that's needed, although it can be nice to take the owners a labeled jar they can keep in their freezer. Give them

plenty of time to collect the bees – 4 weeks is often a reasonable time period, since you will only need one bee per group of 3 students. Keep bees frozen until the morning of the activity, and remove from the freezer no more than 90 minutes before the first class. Keep the jar cool during the day (surrounding it with ice is often sufficient).

C. *Safety Concerns:* Normal concerns surrounding dissections apply in this activity, although the risk of cuts is somewhat decreased since students are not using scalpels. We have not had a student manage to sting themselves with a dead bee yet, although I suppose there is a remote possibility they could figure out a way to do it.

D. *Class Setup:* The PowerPoint presentation should be given either at the start of the class period or the day before. This normally works best if leading questions are used to prompt student discussion (examples are provided in the Notes of the PowerPoint slides). Students should form groups of 3-4, and each group should be provided with both a dissecting and a compound microscope (if possible). Each group receives one honeybee and one bumblebee, with the understanding that if they destroy their bees they do not get a replacement.

E. Assessment

- 1. Informal/Formative:** during the course of the dissection, students will need to have their progress signed off on and show their specimen to the instructor for credit before they can proceed. This helps to ensure that students do not pull the bee apart and then fake their observations on the worksheet. This also allows the instructor to gauge class progress, and give mini Q &A based lectures as the groups move on to each new anatomical topic. students should answer any questions that come up based on their own observations. During this discussion, the instructor acts more as a mediator than a lecturer, prompting the conversation along.
- 2. Formal/Summative:** The questions at the end of the worksheet serve as the formal assessment. Based on instructor preference, students can attempt to answer these questions prior to the whole-class discussion and revise them afterwards, or simply have students wait until the discussion is complete.

IV. Appendices

- 1) *Sample PowerPoint*
- 2) *Sample Worksheet*
- 3) *Answer Key*

For more information, please contact Meg Eckles (meg.eckles@gmail.com).
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