

Bats

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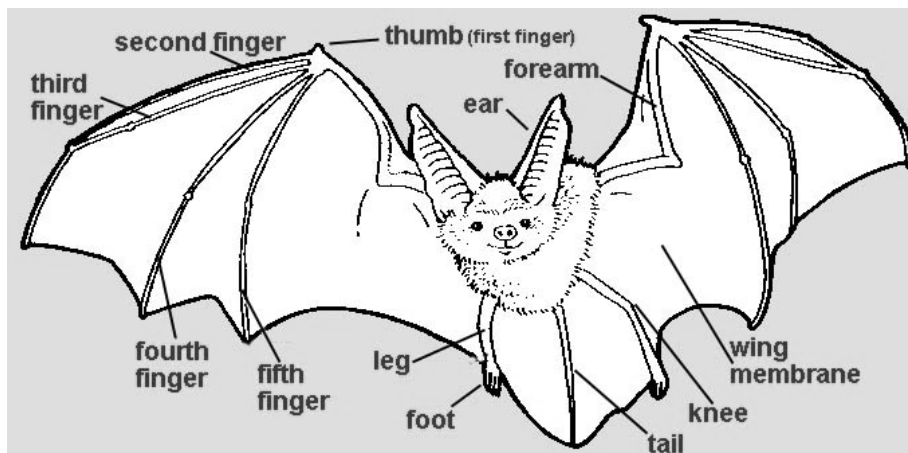
Background:

This lesson plan is designed to introduce students to a mysterious mammal, and to use this mammal as a model for understanding form and function and biodiversity. Inquiry-based teaching methods will be employed in this lesson plan, encouraging student participation and insight.

This lesson is taught after a lesson on Animal Diversity in which students learned about general features and similarities and differences in form and function among arthropods, fish, amphibians, reptiles, birds, and mammals.

Teachers should be familiar with the basics of bat form and function (e.g. bone structure, eating tactics, diet, physical features). Some important vocabulary words include echolocation, nocturnal, herbivore, and carnivore. For background information and diagrams, please refer to references at the end of the lesson.

Students are given Bat Questionnaire so that teacher can address misconceptions about bats and engage students by addressing questions that interest them.



<http://members.aol.com/bats4kids2/look.htm>

Objectives:

Students will be able to:

- hypothesize and model how the bones in a bat wing are organized
- test hypotheses by comparing models to museum specimens of bats
- develop questions about bat body parts based on bat photos
- hypothesize the purpose of different bat body parts based on their questions
- test hypotheses by watching video and having discussion
- hypothesize how bats locate their food
- model bat echolocation to test hypotheses regarding how bats find food

State Standards:

- Formulate a relative question through observations that can be tested by and investigation (S1C1P01)
- Formulate predictions in the realm of science based on observed cause and effect relationships (S1C1P02)
- Communicate verbally or in writing the results of an inquiry (S1C4P01)
- Identify the functions or parts of the skeletal system (S4C1P01)

National Standards:

Content Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Content Standard C: Life Science

- Structure and function in living systems
- Regulation and behavior
- Populations and ecosystems
- Diversity and adaptations of organisms

Content Standard E: Science and Technology

- Abilities of technological design

Content Standard F: Science in Personal and Social Perspectives

- Personal health
- Populations, resources, and environments

Content Standard G: History and Nature of Science

- Nature of science

Materials:

Fettuccini pasta	Glue
Scissors	Bat specimens (or attached digital photos)
Construction paper	Pens
Various bat photos	The Life of Mammals-Insect Hunters vol. 1 (see refs)
Water	Trays for holding water
Prey/tree object (pens)	Echolocation Handout

Time: 4 hours total

Grade Level: 5-8

Procedure:

Pre-lesson: Students are given Bat Questionnaire to reveal misconceptions and target student interest.

Part 1- Making a bat wing

1. Ask each student to develop hypotheses about the structure of a bat wing. What are its components? What does it look like? Have them draw or describe the bat wing.
2. Pass out pasta, glue and paper and ask the students to create a bat wing using the pasta as bones. Some students may need to be reminded that bats are mammals and have similar bone structure to humans (suggest that they can break the pasta to make smaller bones, if necessary).
3. After wing construction is complete, ask students to observe museum bat specimens (see link for attached photos of these specimens). Students use specimens to test their hypothesis of bat wing construction. Students present their wing to the class and describe the similarities and differences between their wing structure and the actual bat wing structure. During the presentation, students are also asked to explain whether they think their wing would be able to fly and why.

Part 2- Form and function using photos

1. Students are given a variety of bat photos (different species, features, environments) to compare. The photos should circulate the classroom so that all students have a chance to see each photo. Students are asked to come up with at least four questions about the different bats and bat body parts that they saw in the photos.
2. In groups of two, students hypothesize the answers to their proposed questions (purpose of bat body parts). Individually, the students write out their questions and hypotheses regarding the purpose of different bat body parts.
3. Students test hypotheses from previous activity by compare/contrast with other bat photos and video (30 minutes)
4. Students are asked to clearly describe the results of their findings on paper. Students individually hand in question/hypothesis/test/result (scientific method) for bat body parts.
5. Students are asked to hypothesize how bats find food (specifically how echolocation works). Teacher guides students regarding echolocation and relates many of the bat body parts to finding food.

Part 3- Echolocation

1. Students are asked to complete the Echolocation Handout in order to better understand bat predation.
2. Students test echolocation hypothesis by modeling bat echolocation (sound waves) with water waves. Students are given trays with 1-2 cm of water in them. Students make ripples in water and a comparison is made between

water waves and sound waves. Students are asked to compare waves that are larger/smaller, faster/slower, and close by/farther away. Then, students are instructed to place an object (representing a tree or insect) in the water and observe how the waves respond to the object. This activity is a model for how bat echolocation allows bats to detect objects including roost sites, trees, and prey. The water waves are used as a model for sound waves so that the students can see the waves and how they change. This activity is used as a model for understanding echolocation.

Evaluation:

1. Students are evaluated on their wing presentation including addressing the similarities and differences between model bat wing and actual bat wing, and justifying why their wing would be able to fly or not.
2. Students are graded on their group work regarding the bat body parts (question/hypothesis/test/result). Group participation, thoroughness, and clarity of ideas will be evaluated.
3. Students are evaluated on final test covering Animal Diversity and Bats (see attached sample inquiry-based questions).

References:

Books

Fenton, M.Brock. 2001. Bats-revised edition. Checkmark Books, New York.
Altringham, John D. 1996. Bats- Biology and Behaviour. Oxford University Press, New York.

DVD

The Life of Mammals by David Attenborough (Volume 3- The insect Hunters). 2002. BBC Books, London.

Websites

<http://www.batcon.org>

<http://geochange.er.usgs.gov/sw/impacts/biology/bats>

http://www.desertusa.com/jan97/du_bats.html

http://www.enature.com/guides/select_mammals.asp?curGroup=Mammals

<http://www.ccooe.k12.ca.us/bats/welcome.html>

<http://www.ucmp.berkeley.edu/mammal/eutheria/chromm.html>

Extension:

Ask students to research the bats that live in their state (e.g. Arizona), and to write a report about these bats. Focus may be directed at biodiversity in the area, threats to native bat species/populations, or misconceptions about neighborhood bats (e.g. disease carriers, bat attacks on humans).