

Fossil Kit Laboratory Investigation 5: Fossil Teeth

Investigation Summary: Students examine and compare fossil and modern teeth. Students use properties of tooth shape and size to identify and interpret the use of teeth.

Enduring Understandings

- Comparing fossilized teeth to modern teeth enables paleontologists to predict what fossil animals might have eaten.

Essential Questions

- What properties of teeth make them so abundant in the fossil record?
- How do different tooth shapes reflect differences in diet?

Students will know...

- Teeth have a wide variety of shapes, sizes and uses (or functions).
- Paleontologists use both fossil and modern teeth to understand fossil animals.
- Some properties of teeth can be measured and compared.
- Teeth provide clues about the diet of fossil animals.

Students will be able to...

- Observe and describe the properties of fossil teeth.
- Examine how tooth properties differ within and between individual animals.
- Compare their observations to those of fossil and modern teeth.

Assessment Evidence

Completion of Investigation Worksheet
Science Notebook Entries (as applicable)

Evidence Outcomes

Students can:

- a. Use evidence to develop a scientific explanation for:
 1. What fossils tell us about a prehistoric environment
 2. What conclusions can be drawn from similarities between fossil evidence and living organisms
- b. Analyze and interpret data to generate evidence about the prehistoric environment
- c. Evaluate whether reasoning and conclusions about given fossils are supported by evidence

Vocabulary:

Carnivore	Diet	Enamel
Herbivore	Heterodont	Homodont
Omnivore	Predator	Prey

Before You Teach

Teeth

- Teeth are abundant fossils.
- Tooth enamel covers the entire outside surface of a tooth, with the exception of the tooth's root. Enamel is the hardest and most mineralized substance in an animal's body. This makes teeth the most likely part of a vertebrate (including ourselves) to stand the test of time and become fossils!
- Paleontologists study the teeth of modern animals to better understand the teeth of the animals found in the fossil record and determine how they are related to each other. Teeth are among the most distinctive and diagnostic features of mammal and fossil mammal species. That is, if you go down to the zoo and look in the mouth of a tiger, you could identify that tiger to its genus (and even species) just by looking at its teeth.
- Most dinosaurs, reptiles, and fish are homodont, meaning their teeth are all about the same size and shape. However, most mammals (including ourselves) are heterodont, meaning we have teeth of different shapes and functions in our mouth – for example, we have incisors, canines, molars, and premolars, and each kind of tooth has a different function.
- Mammals have two sets of teeth throughout their lives (baby or milk teeth, and adult or permanent teeth), while most reptiles and sharks continuously replace their teeth.
- Paleontologists study the shape of an animal's teeth to learn more about diet.

Three Main Eating Habits of Animals

- There are three main categories of eating habits for animals: carnivore, herbivore, and omnivore.
- Carnivores such as lions and tigers use their teeth for ripping and slicing meat. They use the pointed front teeth (canines) to rip the meat and the cheek teeth (carnassials) to slice it. Their digestive systems are extremely active and they can swallow and digest their food without chewing it. Many carnivores do not eat every day.
- An herbivore has a round or oval-shaped chewing surface on its teeth that is usually flat or covered with bumps and/or ridges called cusps and lophs. They use the surface of their cheek teeth (or molars) for grinding up plant material. Herbivores need a lot of energy to stay alive and many of them, such as today's cows and sheep, eat all day long.
- Omnivores such as bears, pigs, and humans eat both meat and plants. They have a combination of both pointed (canine) and flat (molar) teeth to accommodate a varied diet. Most omnivores eat every day.

Other Eating Habits

- Insectivores eat insects.
- Frugivores eat fruit.
- Scavengers eat dead or decaying matter
- Piscivores eat fish

Additional Teacher Resources

Vocabulary:

Canine teeth – Pointed conical teeth near the front of the mouth in mammals, just posterior to the incisors. In ourselves, our canines occupy the third tooth position from the front of your mouth (occurring behind the two incisors).

Carnassial teeth – In many carnivores such as canids (dogs) and felids (cats), some cheek teeth are large and blade-like.

Carnivore – Animals that eat mainly meat. Examples of carnivores are lions, tigers, crocodiles, and sharks.

Cusps – The bumps on the chewing surface of a tooth. (Ridges have a different name – they're called lophs on upper teeth and lophids on bottom teeth, but this isn't needed for this activity.)

Diet – What an animal eats and drinks each day.

Enamel – The hard, outer layer of a tooth. This is the layer that gets cleaned by the dentist, and which gets cavities if we don't brush our teeth.

Herbivore – Animals that eat plants. Examples of herbivores include cattle, deer, horses, rabbits, and duckbill dinosaurs.

Heterodont – Description of the teeth of animals that possess different tooth shapes. For example, mammals have heterodont teeth. There are four different kinds of teeth that are used in different ways – incisors (front teeth), canines (sharp, conical teeth posterior to the incisors), premolars and molars (collectively called the cheek teeth).

Homodont – Description of the teeth of animals whose teeth are all about the same size and shape. Many reptiles are homodont, meaning all of their teeth look the same and all are used in much the same way.

Molars – The cheek teeth in a mammal that are used for grinding and chewing.

Omnivore – Animals that eat both plants and animals. Examples of omnivores include most bears, pigs, many birds, and humans.

Predator – An animal that kills its prey and then feeds on it.

Prey – An animal hunted or caught for food.

Vertebrate Paleontology – The study of fossil vertebrates. Vertebrates are all of the animals with backbones, including fishes, amphibians, reptiles, birds, and mammals.

Online Resources

<http://www.ucmp.berkeley.edu/education/teachers.php> is a website that features valuable and easy to understand paleontology resources for teachers.

<http://www.newyorkscienceteacher.com/sci/esl/es/spanish-es.pdf> is a website that lists Spanish translations of Earth Science Terms.

<http://puzzlemaker.discoveryeducation.com/> is a website where you can easily create your own crossword puzzles or word searches using the listed vocabulary words.

Laboratory Investigation 5: Using Teeth to Predict Diet

Materials:

5 teeth:

Cast of Fossil Horse, Cast of Fossil *Spinosaurus*, Cast of Fossil Bear, Fossil Shark, Modern Human (students use their own teeth)

1 set of fossil labels

10 rulers

Investigation Worksheets

Conducting the Investigation:

1. Introduce vertebrate paleontology.

Explain to students that they are going to be vertebrate paleontologists and that vertebrate paleontology is the study of ancient (or fossil) vertebrates, which includes all animals with backbones, such as fish, reptiles, birds, mammals, and dinosaurs. Explain that since most animals with backbones have hard skeletons, it is the skeletons of vertebrates that are often preserved in the fossil record.

2. Introduce the idea of fossil teeth studies.

Explain that animals' teeth are made up of a hard outer layer called enamel, which stands the test of time much better than soft body parts, allowing teeth to be preserved in the fossil record.

In fact, teeth are THE most common vertebrate fossil in the rock record. There are some fossils of whole skeletons of animals, but they are very, very rare compared to teeth.

Explain to students that their challenge is to examine and identify animals' teeth, and make predictions about what type of food(s) the animals were likely to have eaten.

3. Introduce the teeth - Fossil Horse, Fossil *Spinosaurus*, Fossil Bear, Fossil Shark, Modern Human (students use their own teeth).

Show students the teeth. Fossilized teeth are often discolored, compared to the white teeth from modern animals. The discoloration occurs during fossilization as the minerals from groundwater and the sediment discolor the tooth.

4. Explain to students that studying fossil teeth is very important for paleontologists because teeth are diagnostic, meaning that by studying an ancient animal's teeth, paleontologists can often identify its family, genus, and even species.

5. Introduce the Investigation Worksheets.

6. Begin the investigation.

Students should make initial observations about teeth and record their observations on the worksheets.

7. Discuss and compare observations with other students.

8. Classify fossil teeth into herbivore, carnivore, and omnivore.

Students should discuss what kind of modern animal the fossil teeth look the most similar to. Students should predict the type of food that the fossil animals are most likely to have eaten.

Name: _____

Laboratory Investigation 5: Fossil Teeth

1. Examine the fossil teeth, looking at tooth details such as the number and shape of the bumps (or cusps) on the teeth, and tooth size. Where would the root of the tooth be located?
2. Decide what surface the animal uses to eat its food.
3. Sort the teeth into two piles based on whether the teeth are pointy or flat.
4. Draw and label each tooth, including as many features as you can.
5. After you have sorted and drawn the fossil teeth, try to determine the diet and record that information in the table.
6. Determine your eating habits. Draw your teeth and add them to the table.

Tooth Shape	Eating Habit	Diet
Sharp and pointed. Sometimes long or curved.	Carnivore	Meat
Flat or bumpy chewing surface. Sometimes a round or egg-shaped chewing surface.	Herbivore	Plants
Combination of sharp, pointed teeth AND teeth with bumps on the chewing surface.	Omnivore	Both meat and plants.

Tooth	Drawing of Tooth	Eating Habit	Diet
#1 (<i>Spinosaurus</i>)			
#2 (Bear)			
#3 (Horse)			
#4 (Shark)			
#5 (Human)			

Laboratory Investigation 5: Vocabulary for Fossil Teeth

Carnivore – Animals that eat mainly meat. Examples of carnivores include lions, tigers, crocodiles, and sharks.

Diet – What an animal eats and drinks each day.

Enamel – Hard outer layer of a tooth. This is the layer that gets cleaned by your dentist, and gets cavities if you don't brush your teeth.

Herbivore – Animals that eat plants. Some herbivores are cattle, deer, horses, and rabbits (and duckbill dinosaurs).

Heterodont – Description of the teeth of animals that possess different tooth shapes. For example, mammals have heterodont teeth. There are four different kinds of teeth that are used in different ways – incisors (front teeth), canines (sharp, conical teeth posterior to the incisors), premolars and molars (collectively called the cheek teeth).

Homodont – Description of the teeth of animals whose teeth all look the same. For example, have you ever looked inside a fish mouth, or an alligator? They have teeth that all look like one another.

Omnivore – Animals that eat both plants and animals. Examples of omnivores include most bears, pigs, many birds, and us.

Predator – An animal that kills its prey and then feeds on it. Examples of predators that live in Colorado are bobcats and coyotes, as well as owls.

Prey – An animal that is hunted or caught for food. Examples of prey animals that live in Colorado include deer, rabbits, and mice.

Laboratory Investigation 5: Fossil Teeth – Answer Key

1. Examine the fossil teeth, looking at tooth details such as the number and shape of the bumps (or cusps) on the teeth, and tooth size. Where would the root of the tooth be located? *The root does not have enamel (shiny and harder than the root). Sometimes there will be more than one root.*

2. Decide what surface the animal uses to eat its food. *Opposite the root. Sometimes the enamel will show wear on the surface that is used for chewing.*

3. Sort the teeth into two piles based on whether the teeth are pointy or flat. *Pointed: Spinosaurus, shark Flat: Horse Flat with bumps: Bear, human*

4. Draw and label each tooth, including as many features as you can.

5. After you have sorted and drawn the fossil teeth, try to determine the diet and record that information in the chart.
 - a. Carnivore – Fossil *Spinosaurus*, Fossil Shark
 - b. Herbivore – Fossil Horse
 - c. Omnivore – Fossil Bear, Modern Human

(Table on next page)

Determine your eating habits. Draw your teeth and add them to the chart.

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Tooth	Drawing of Tooth	Eating Habit	Diet
#1 (<i>Spinosaurus</i>)		<i>Carnivore</i>	<i>Meat</i>
#2 (Bear)		<i>Omnivore</i>	<i>Both meat and plants.</i>
#3 (Horse)		<i>Herbivore</i>	<i>Plants</i>
#4 (Shark)		<i>Carnivore</i>	<i>Meat</i>
#5 (Human)		<i>Omnivore</i>	<i>Both meat and plants</i>

