

Investigate Carnivorans: Similarities and Differences

OVERVIEW

Students will examine structural similarities and differences between carnivorans, a distinct group of mammals.

BACKGROUND FOR EDUCATOR

Individuals inherit traits, or features, from their parents. Those members of a species with traits that help them survive in a particular environment pass on these characteristics. Generation after generation, individuals with the advantageous trait, or adaptation, will survive longer and produce more offspring, until most or even all members of the species possess it. Called natural selection, this is the main mechanism of evolution.

Scientists use taxonomy as a method for classifying groups of organisms based on common characteristics and evolutionary relationships. The animals in the class Mammalia all descended from a common ancestor that have three middle ear bones. The class is divided into over 20 orders, one of which is Carnivora*, a diverse group of placental mammals with certain traits such as bladelike teeth called carnassials. Carnivora is further divided into two main groups: the catlike Feliformia and the doglike Caniformia. Today, there are over 270 living species of carnivorans that are found in every kind of habitat.

*Refer to the Essential Questions to clarify the difference between carnivoran and carnivore.

BEFORE YOUR VISIT

Activity: Carnivorans & Their Shared Traits

Have students explore the Dioramas website (amnh.org/dioramas) and to compare and contrast the following seven mammals from the Hall of North American Mammals:

- Bison
- Brown Bear
- Moose
- Mountain Goat
- Mountain Lion
- Pronghorn
- Wolf

Ask students to identify mammals that have all these characteristics:

- claws
- necks that are shorter than those of other mammals
- eyes that are closer together than those of other mammals
- large canines
- no hooves
- no horns
- can eat meat

Review the correct list of mammals with students. (*Answers: Brown Bear, Wolf, and Mountain Lion*)

Tell students that they just identified a distinct group of mammals called carnivorans, and that they will study them further at the Museum.

New York State Science Curriculum

LE 3.1e Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life-forms, as well as for the molecular and structural similarities observed among the diverse species of living organisms.

Plan how your students will explore the Hall of North American Mammals using the student worksheets. You might choose to have students explore the exhibition individually or in pairs.

Distribute copies of the student worksheets to students before coming to the Museum. You may want to review the worksheets and the map of the exhibition with them to make sure they understand what they are to do.

DURING YOUR VISIT

Hall of North American Mammals

1st floor (45 minutes)

Have students use the worksheets to compare and contrast 12 carnivorans in this hall. Working individually or in pairs, they will examine physical features and investigate the similarities and differences within this group of mammals. You may wish to provide copies of the hall map so they can easily locate the dioramas.

Wallace Wing of Mammals & Their Extinct Relatives

4th floor (20-30 minutes)

Divide your class into two groups. Have one group investigate the exhibition area titled "Carnivores: Cats, Dogs, Bears, Seals, and Their Relatives." There they can examine fossils of extinct carnivorans such as the saber tooth tiger, dire wolf, and cave bear and observe their bladelike teeth called carnassials (marked in red). Direct the other group to the Mammals Theater to the right. Have them watch the film "The Evolution of Mammals and their Extinct Relatives" to learn about mammal diversity, the characteristics scientists use to classify them, and cladograms. When students are done, have the groups swap locations.

BACK IN THE CLASSROOM

Activity: Classify Carnivorans

Tell students that when determining the evolutionary relationships between mammals, scientists examine not only the external physical features, they also look at bones and teeth. Tell them that they will now examine four types of teeth to collect more data about the four groups of carnivorans they studied at the Museum.

Have students work individually or in small groups. Distribute pictures of teeth and worksheets.

ONLINE RESOURCES

Extreme Mammals Exhibition

amnh.org/extrememammals

Trace the ancestry and evolution of this remarkable group of animals.

Wallace Wing of Mammals & Their Extinct Relatives

amnh.org/exhibitions/permanent/fossilhalls/virtualtours/

Take a virtual tour of the Halls of Primitive Mammal and Advanced Mammal. (Scroll down to the middle of the page.)

Investigate Carnivorans: Similarities & Differences

1. Identify the Groups

The 12 animals below belong to a distinct group of mammals called Carnivora (carnivorans). Within the order of Carnivora, they are further divided into four groups. How would you group the animals? Complete the table below.

- black bear
- brown bear
- coyote
- fox
- grizzly bear
- jaguar
- lynx
- marten
- mink
- mountain lion
- weasel
- wolf

Group 1: Bears	Group 2: Dogs	Group 3: Cats	Group 4: Mustelids

2. Explore Similarities within Each Group

What physical features did you use to determine the groupings? Look more closely at the animals within each group. What physical features do all the animals share? (For example, do they all have similar snout length or posture?) Describe at least four features that are shared by the animals in each group.

	Physical Features Shared by All Animals in Each Group
Bears	
Dogs	
Cats	
Mustelids	

ANSWER KEY

Investigate Carnivorans: Similarities & Differences

1. Identify the Groups

The 12 animals below belong to a distinct group of mammals called Carnivora (carnivorans). Within the order of Carnivora, they are further divided into four groups. How would you group the animals? Complete the table below.

- black bear
- brown bear
- coyote
- fox
- grizzly bear
- jaguar
- lynx
- marten
- mink
- mountain lion
- weasel
- wolf

Group 1: Bears	Group 2: Dogs	Group 3: Cats	Group 4: Mustelids
<i>(Answer: black bear)</i>	<i>(Answer: coyote)</i>	<i>(Answer: jaguar)</i>	<i>(Answer: marten)</i>
<i>(brown bear)</i>	<i>(fox)</i>	<i>(mountain lion)</i>	<i>(mink)</i>
<i>(grizzly bear)</i>	<i>(wolf)</i>	<i>(lynx)</i>	<i>(weasel)</i>

2. Explore Similarities within Each Group

What physical features did you use to determine the groupings? Look more closely at the animals within each group. What physical features do all the animals share? (For example, do they all have similar snout length or posture?) Describe at least four features that are shared by the animals in each group.

	Physical Features Shared by All Animals in Each Group
Bears	<i>(Answers may include: short tails, bulky bodies, flat heads, round ears, stand on their whole foot with the foot flat on the ground)</i>
Dogs	<i>(Answers may include: pointed snout, fluffy tails, long legs)</i>
Cats	<i>(Answers may include: short snouts, large paws, whiskers, claws can retract)</i>
Mustelids	<i>(Answers may include: smaller bodies, longer torsos, short legs, small ears)</i>

ANSWER KEY

3. Explore Differences Between the Four Groups

Select features from the previous chart and list the general features in the first column below (for example, instead of "short snout" write "snout length"). Then describe the group's feature.

Features	Bears	Dogs	Cats	Mustelids
<i>(Sample answer: tails)</i>	<i>(short)</i>	<i>(long)</i>	<i>(long)</i>	<i>(short)</i>
<i>(Sample answer: tails)</i>	<i>(rounded)</i>	<i>(pointed)</i>	<i>(pointed)</i>	<i>(rounded)</i>

STUDENT WORKSHEET: Back in the Classroom

Classify Carnivorans

In the Hall of North American Mammals you observed similarities and differences in physical features between four groups of carnivorans: bears, dogs, cats, and mustelids. Now take a closer look at the teeth of these carnivorans to further investigate how the four groups are related.

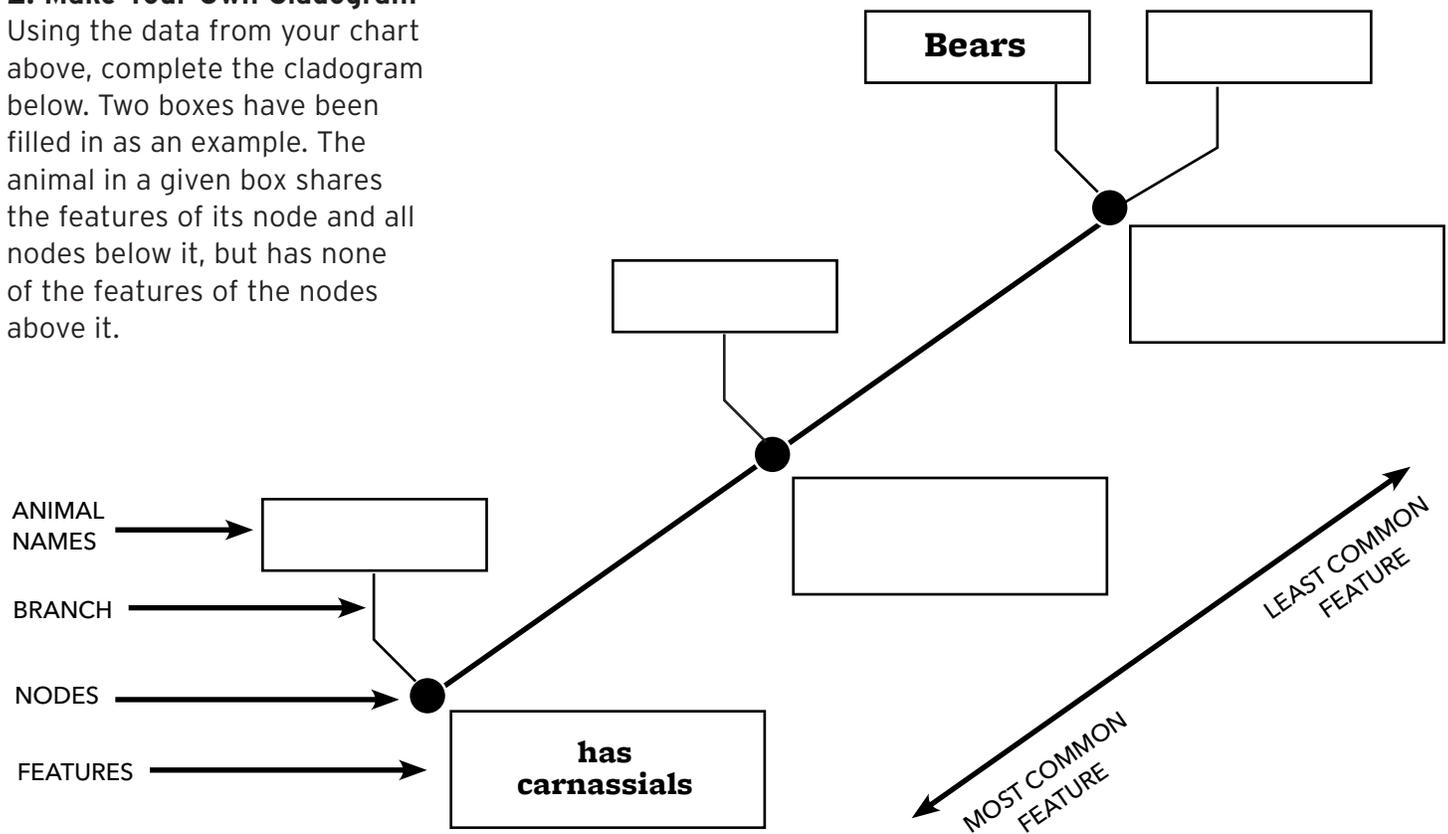
1. Examine the four sets of teeth.

Place an X in the chart below to indicate the features it possess.

Features	Bears	Dogs	Cats	Mustelids
4th premolar is broad (not narrow)				
Has only 2 cusps on p4				
Has carnassials				

2. Make Your Own Cladogram

Using the data from your chart above, complete the cladogram below. Two boxes have been filled in as an example. The animal in a given box shares the features of its node and all nodes below it, but has none of the features of the nodes above it.



3. Expand Your Cladogram

Analyze the data that you collected at the Museum. Use other physical traits to build out your cladogram.

STUDENT WORKSHEET: Back in the Classroom

ANSWER KEY

Classify Carnivorans

In the Hall of North American Mammals you observed similarities and differences in physical features between four groups of carnivorans: bears, dogs, cats, and mustelids. Now take a closer look at the teeth of these carnivorans to further investigate how the four groups are related.

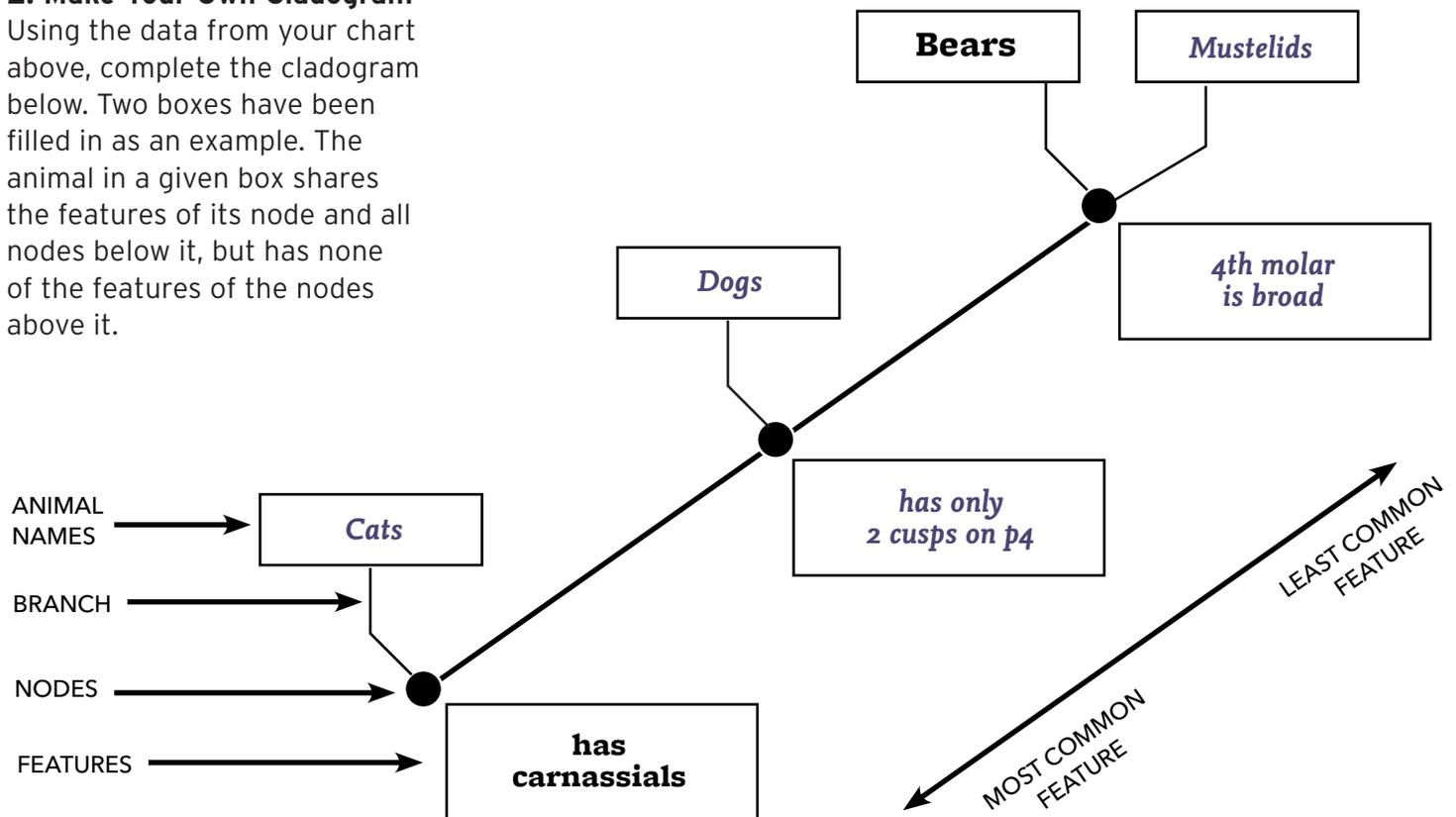
1. Examine the four sets of teeth.

Place an X in the chart below to indicate the features it possess.

Features	Bears	Dogs	Cats	Mustelids
4th premolar is broad (not narrow)	X			X
Has only 2 cusps on p4	X	X		X
Has carnassials	X	X	X	X

2. Make Your Own Cladogram

Using the data from your chart above, complete the cladogram below. Two boxes have been filled in as an example. The animal in a given box shares the features of its node and all nodes below it, but has none of the features of the nodes above it.



3. Expand Your Cladogram

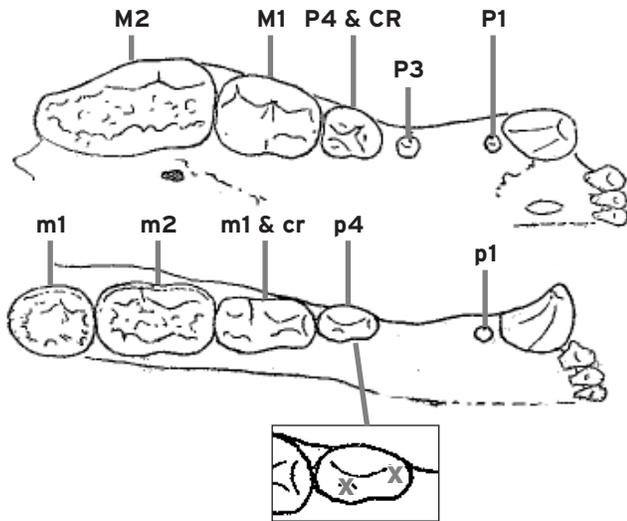
Analyze the data that you collected at the Museum. Use other physical traits to build out your cladogram.

Classify Carnivorans

KEY: M: upper molar P: upper premolar CR: upper carnassial
 m: lower molar p: lower premolar cr: lower carnassial
 x: cusp = a pointed tip on a tooth (only cusps on p4 are shown)

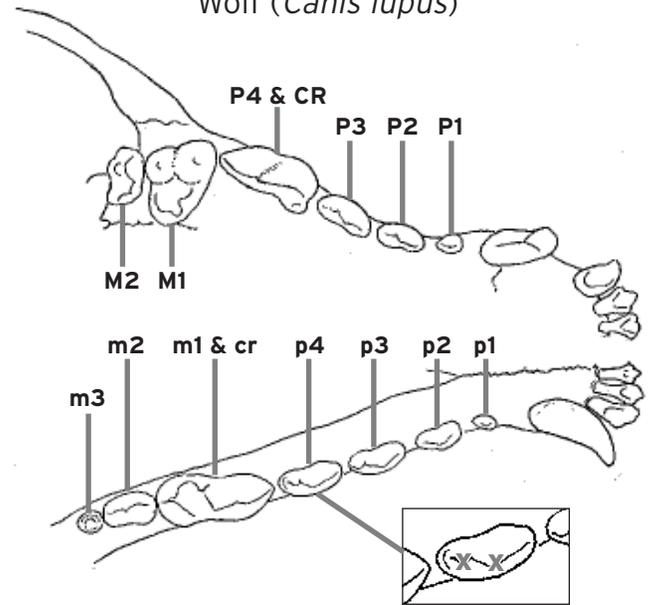
BEARS

Brown Bear (*Ursus arctos*)



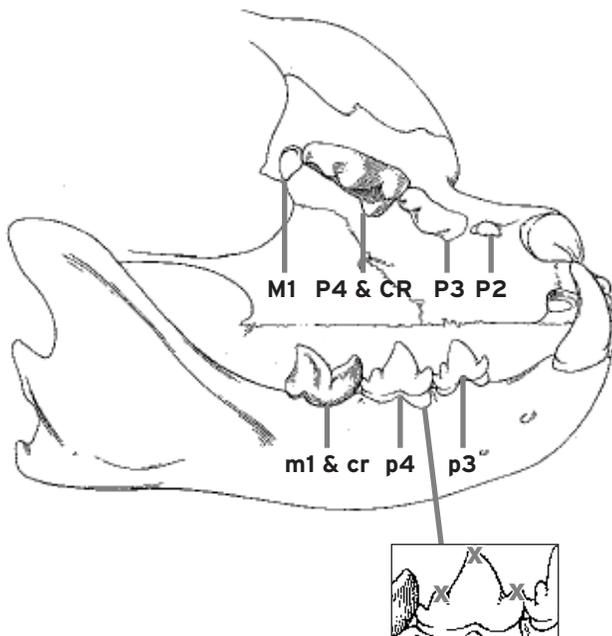
DOGS

Wolf (*Canis lupus*)



CATS

Lion (*Panthera leo*)



MUSTELIDS

Otter (*Lutrogale perspicillata*)

