

Bone Structures Activity Package

Complement your museum visit and encourage the use of deductive reasoning to determine the feeding habits of some of the Beaty Biodiversity Museum’s skull specimens using this activity package. Included are printable templates, diagrams, a vocabulary list, as well as an additional collaborative, research-based project.

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Curriculum Links

Grade 6 Science:

- Multicellular organisms rely on internal systems to survive, reproduce, and interact with their environment

Grade 7 Science:

- Evolution by natural selection provides an explanation for the diversity and survival of living things
- Survival needs and interactions between organisms and the environment
- Earth and its climate have changed over geological time

Suggested Materials

- Graphic organizer/templates
- Poster boards
- Writing tools (pencil, pen, eraser)

Vocabulary

Adaptation: the process by which a plant or animal species adjusts itself to fit into its surroundings or environment. Even simpler organisms must adapt through various ways. Species adapt through their physiology, structure, genetics, development, dispersal, defense mechanism, locomotion, and reproduction

Canine: a pointed tooth found between the incisors and premolars of a mammal. Those of carnivores are often greatly enlarged

Carnivores: most carnivores are obligate carnivores that eat only meat (e.g. cats) whereas facultative carnivores (e.g. dogs) eat plant along with meat

Facultative carnivores: animals that do not exclusively eat meat, and may include plant materials into their diet

Herbivores: are animals that only eat plant material or vegetation (e.g. deer, koalas)

Incisors: a narrow-edged tooth that is adapted for cutting and is located at the front of the mouth. In human beings, each jaw contains four incisors

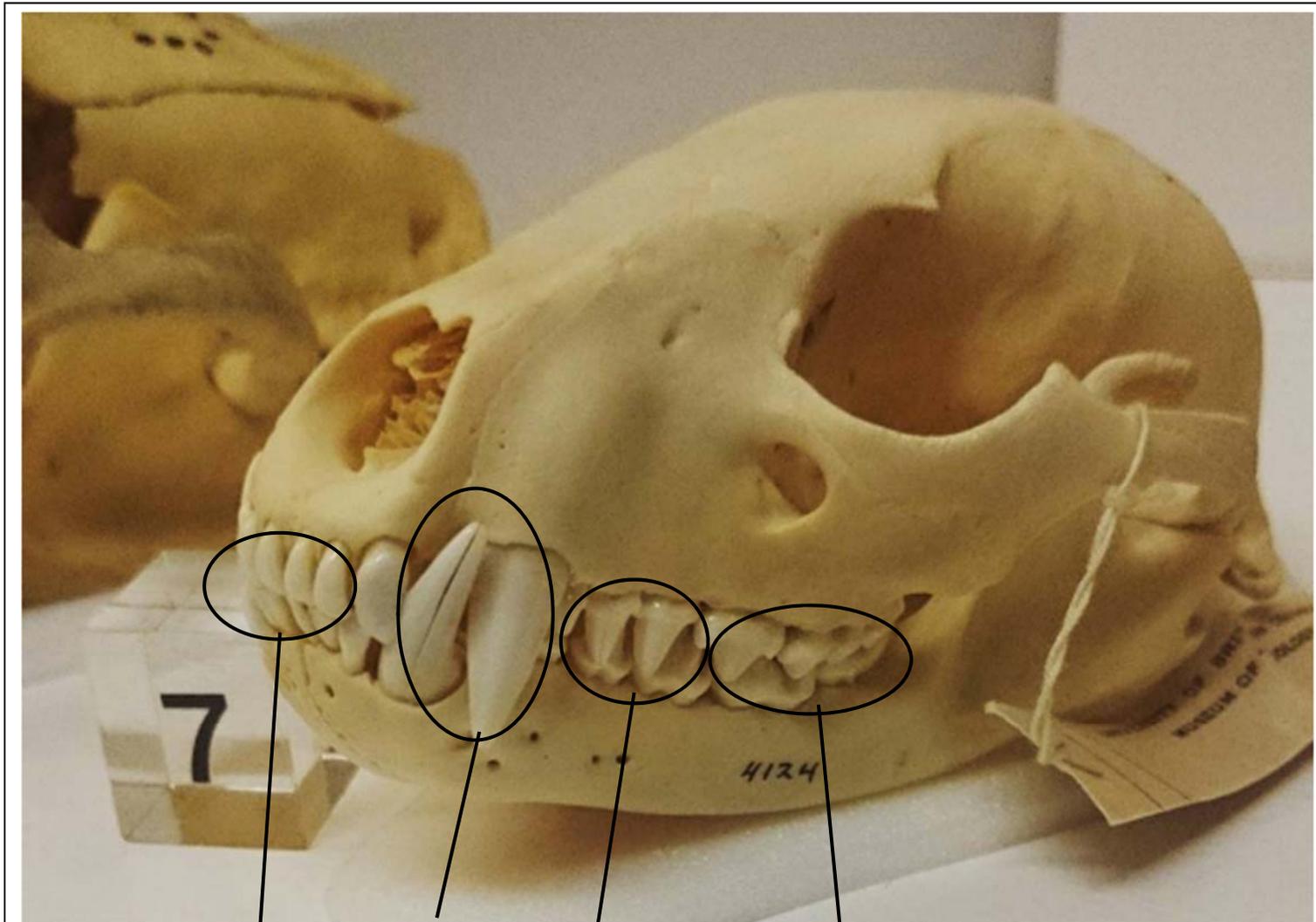
Molar: the grinding tooth located at the back of a mammal's mouth

Obligate carnivores: animals that eat only meat

Omnivores: animals that eat a variety of food sources (both plants and meat) but tend to prefer one type over the other (e.g. pigs)

Omnivore Bone Structure

Anterior



Posterior

Incisors

Canines

Pre-molars

Molars

Racoon, *Procyon lotor*

Knowledge Check: Feeding Adaptations

The goal of this activity is to familiarize your group with the terms *carnivore*, *herbivore*, and *omnivore*. Students are encouraged to make an educated guess using their pre-existing knowledge about the general bone structures of animals included in each of these categories.

1. Students are introduced to the terms *herbivore*, *carnivore*, and *omnivore* and are given the basic definition.
2. Using Template A provided below, students are asked to complete the table using their prior knowledge, experiences, and/or *predictions* about what animals belong under the *herbivore*, *carnivore*, and *omnivore* categories.
 - a. The template includes a section where the students are to sketch what the *predicted morphology* of herbivore, carnivore, and omnivore bone structures.
 - b. You may want to encourage students to think about why a certain type of bone structure might be more beneficial to an animal who has a certain diet. *How might bone structure impact an animal's diet?*
3. At the museum, students can look for omnivore, herbivore, and carnivore specimens or images to check whether their predictions were correct and use this information to complete the table.

Template A

Name: _____

Knowledge Check: Feeding Adaptations

	Types of Animals	Sketch of general bone structure
<i>Carnivore: animals that eat only meat</i>		
<i>Herbivore: animals that eat only plants and vegetation</i>		
<i>Omnivore: animals that eat both plant and meat</i>		

Bone Structure Observations

The goal of this activity is to encourage the use of observation and deductive reasoning to determine the feeding habits of some of the Beaty Biodiversity Museum's skull specimens.

1. During your museum visit, ask students to look for skulls on display. Using *Template B*, students should fill in parts A, B, C, and D of the table. You may want to have some copies of the *Bone Structure Diagram* provided in this activity package, as it may be helpful to students for this activity.
 - a. You may want to form groups of two to three students to collaborate on this worksheet
 - b. Students should look for diverse skull morphology to see as many omnivore, carnivore, and herbivore skulls as possible
 - c. You can additionally ask students to sketch or take pictures of the specimens to help them complete the worksheet at a later time
2. Ask students to keep the following questions in mind as they complete this table:
 - a. How do the teeth function?
 - b. What do the different animals eat?
 - c. What are some similarities/differences between the different types of teeth of various skull structures?
 - d. What do you notice about the animals' teeth and bone structure?
3. Back in the classroom, ask students to research the specimens they saw at the museum and complete part E of the template.
 - a. Note: For a review on credible sources, you may want to have your students read:
 - Purdue Owl (2017). Using Research and Evidence. Retrieved from <https://owl.english.purdue.edu/owl/resource/588/02/>
 - University of California Santa Cruz (2017). Evaluate the quality and credibility of your sources. Retrieved from <http://library.ucsc.edu/help/research/evaluate-the-quality-and-credibility-of-your-sources>

Template B

Name: _____



Bone Structure Observations

A. What animal does the skull belong to?	B. Observations <i>What can you tell about the teeth and bone structure?</i>	C. Carnivore, Omnivore, or Herbivore?	D. What you think this animal eats?	E. What does this animal actually eat?

Template B

Bone Structure Observations

A. What animal does the skull belong to?	B. Observations <i>What can you tell about the teeth and bone structure?</i>	C. Carnivore, Omnivore, or Herbivore?	D. What you think this animal eats?	E. What does this animal <i>actually</i> eat?

Teacher Guide

You may choose to guide your students through some of the rows of the museum to highlight some of the skull specimens you would like them to observe. The following table will help you to find the diverse carnivore, herbivore, and omnivore specimens in the museum.

Row	Carnivore	Omnivore	Herbivore
2	Emperor penguin		Greater kudu
		Collared peccary	Common eland
	Wild boar		Kenya highland Hartebeest
	Melanistic jaguar		Common warthog
			Bald eagle
			Impala
			Bleshok
			Grant's gazelle
			Elk
			Laristan mouflon
			Moose
			Muskox
			Asiatic elephant
4	Canidae (04.02)	Red fox (04.06)	
	Grey wolf (4.04)	Black bear (04.08)	
	Polar bear (04.07)	Grizzly bear (04.09)	
	Steller sea lion (04.11)	Skunk (04.20)	
	Walrus (04.12)	Western spotted skunk (04.21)	
	Ribbon seal (04.13)	Rock hyrax (04.22)	
	North American river otter (04.14)	North American raccoon (04.23)	
	Sea otter (04.15)		
	American marten (04.16)		
	American badger (04.18)		
5	Komodo dragon (05.06)		
		Northwestern crow (right next to 7.01)	
7		Ring-tailed lemur (07.09)	
		Guinea baboon (07.10)	
		Eastern grey squirrel (07.11)	

Feeding Habits Scavenger Hunt

Ask your group to find five examples of herbivores, carnivores, and omnivores throughout the museum. Provide the students with Template C and use the *Teacher Guide* provided to check their answers.



You can see row numbers by looking at the number in box 2 above. The number before the decimal point states the the number of the row in which the cabinet is situated, while the number following the decimal point is the cabinet number. In this example, this cabinet is located in row 37, and the cabinet number is 10.

Feeding Habits Scavenger Hunt

Find five carnivores, herbivores, and omnivores throughout the museum. State where you found this specimen, and briefly explain why a specific feeding habit is appropriate for each specimen.

Carnivores

Species Name	Location in the museum	Reason for classification

Omnivores

Species Name	Location in the museum	Reason for classification

Herbivores

Species Name	Location in the museum	Reason for classification

After the Visit

Complement your museum visit with this collaborative, research-based project.

1. Have students visit <http://humanorigins.si.edu/evidence/3d-collection/other-animals> to view, explore, and review 3D models of various animals. Students are encouraged to select the animals that they encountered during the museum visit and observe its bone structure from a variety of angles
2. Form groups of 2-3 students. Assign a trophic level to each group (carnivore, herbivore, or omnivore) and ask these groups to conduct research on one animal of their choosing that falls within the trophic level they were assigned
 - a. It is best if no two groups choose the same animal
3. Ask each group to create a poster board presentation to share the information they learn about this animal.
 - a. The presentation should include:
 - i. The chosen species
 1. Including both the Latin name, and the common name for this species
 - ii. A short explanation of how this species has evolved over time
 - iii. A description of how this species' bone structure and teeth have adapted to suit its needs
 - iv. An explanation of how this species uses its teeth
 - v. A description of this species' diet
4. This research activity will be a jigsaw activity. In this activity, different groups of learners become "experts" in a topic (herbivore, carnivore, or omnivore) and then share this with their classmates who are experts in a different aspect (herbivore, carnivore, or omnivore). After each group has become an expert in their topic, the students go into new groups so that one person from each expert group is in each new group. Each new group consists of 1-2 students from each of the "expert" groups. Once they regroup, each student then shares his or her "expert" knowledge with the other group members through their poster (Gibbons, 2015).

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Picture Citations

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