Skulls and Teeth: Clues to diet and behavior.

How do the skulls of **mammals** reflect **adaptations** to different diets and lifestyles?

Key Terms and Concepts:
Adaptation, morphology, evolution, biology.

Summary:
Students will explore similarities and differences between the size and shape of skulls and teeth of different mammals.

Next Generation Science Standards:
> NGSS.HS.LS2: Environmental changes lead to changes in diet and lifestyle, which affect physical morphology.
> NGSS.HS.LS4: Changes in morphology reflect evolutionary
pressures.

Learning Objectives:
- Students will learn about differences in tooth morphology that reflect diet.
- Students will work together or in groups to identify and analyze different features between mammal skulls.
- Students will compare **morphological features (differences in size and shape)** between the skulls of different mammals, and think critically about what those differences in shape might mean in terms of diet and lifestyle.

Materials:
The following packet includes materials for two lesson activities (total time ~45 minutes).

Examining changes in tooth morphology.

Note for Teachers:
The best way to teach about skull morphology is to work with real or model specimens. Students can be encouraged to look for backyard bones (with care for health and safety) to bring into the classroom. There are a number of companies that supply hands-on educational materials for teaching about paleontology and natural history. Special education kits specific to skull morphology (sets of skull replicas, etc.) are available through Skulls Unlimited (www.skullsunlimited.com) and Bone Clones (www.boneclones.com); discounts are often available for classroom teachers.

Comparative Skulls

Four types of teeth: incisors, canines, premolars, molars

Incisors
Canines
Premolars
Molars

Lower   **Upper**

Each tooth type is shaped to reflect a specific function.
<u>Match the functions with the appropriate tooth type (below).</u>

| Crushing and Grinding | | Incisors |
| Cutting and Breaking | | Molars |
| Tearing and Ripping | | Canines |

Instructions: Circle and label each of the 3 main tooth types: <u>using I for incisors, C for canines, M for molars</u>

HUMAN

DOG

BEAR

PIG

OPOSSUM
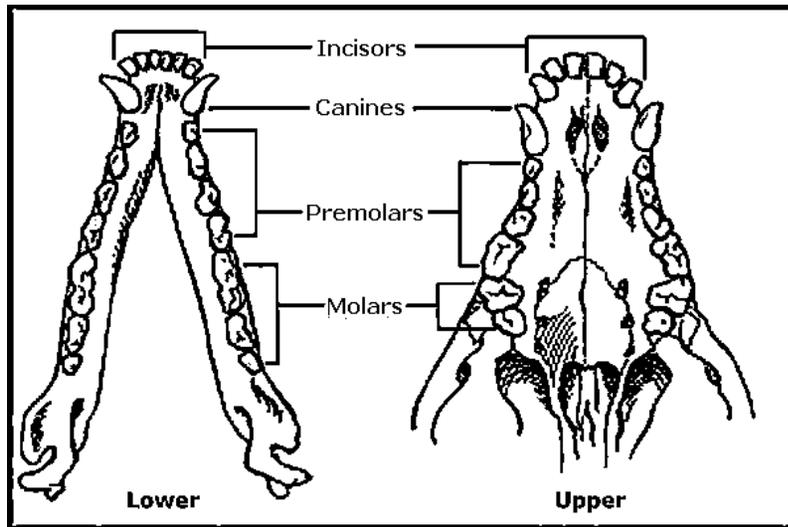
The range of omnivore jaw shapes.

Comparative Skulls

Omnivore, Herbivore or Carnivore? Compare the teeth of the following three mammals. Describe the most prominent diagnostic feature that supports your hypothesis. Which tooth type (incisors, canines, modified premolars, molars) are most specialized (reflecting diet)?
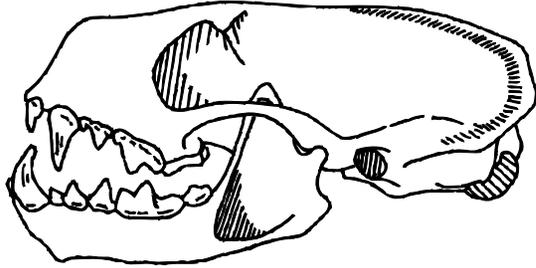
Omnivore, Herbivore or Carnivore? _____

Diagnostic Feature(s):   _____

Hypothesized diet: _____
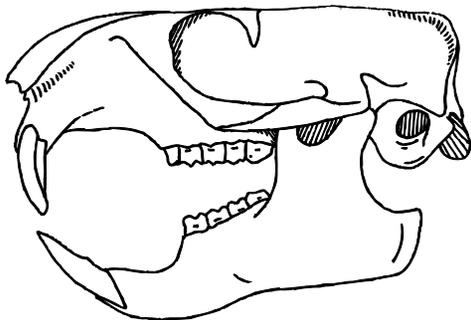
Animal Guess:

Omnivore, Herbivore or Carnivore? _____

Diagnostic Feature(s):   _____

Hypothesized diet: _____

Animal Guess:

Omnivore, Herbivore or Carnivore? _____

Diagnostic Feature(s):   _____

Hypothesized diet: _____

Animal Guess:

Comparative Skulls

Compare the teeth of the following three omnivores. Omnivore molars have large flat surfaces for grinding food. Canines can be equal in size to other teeth or slightly larger depending on diet.

Which skull belongs to whom? Identify the skull of the bear, dog and pig.

_____   _____   _____
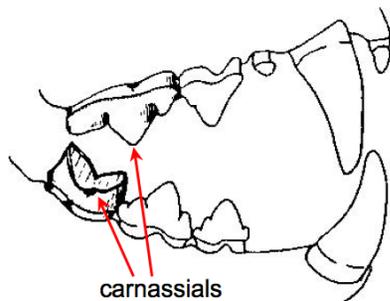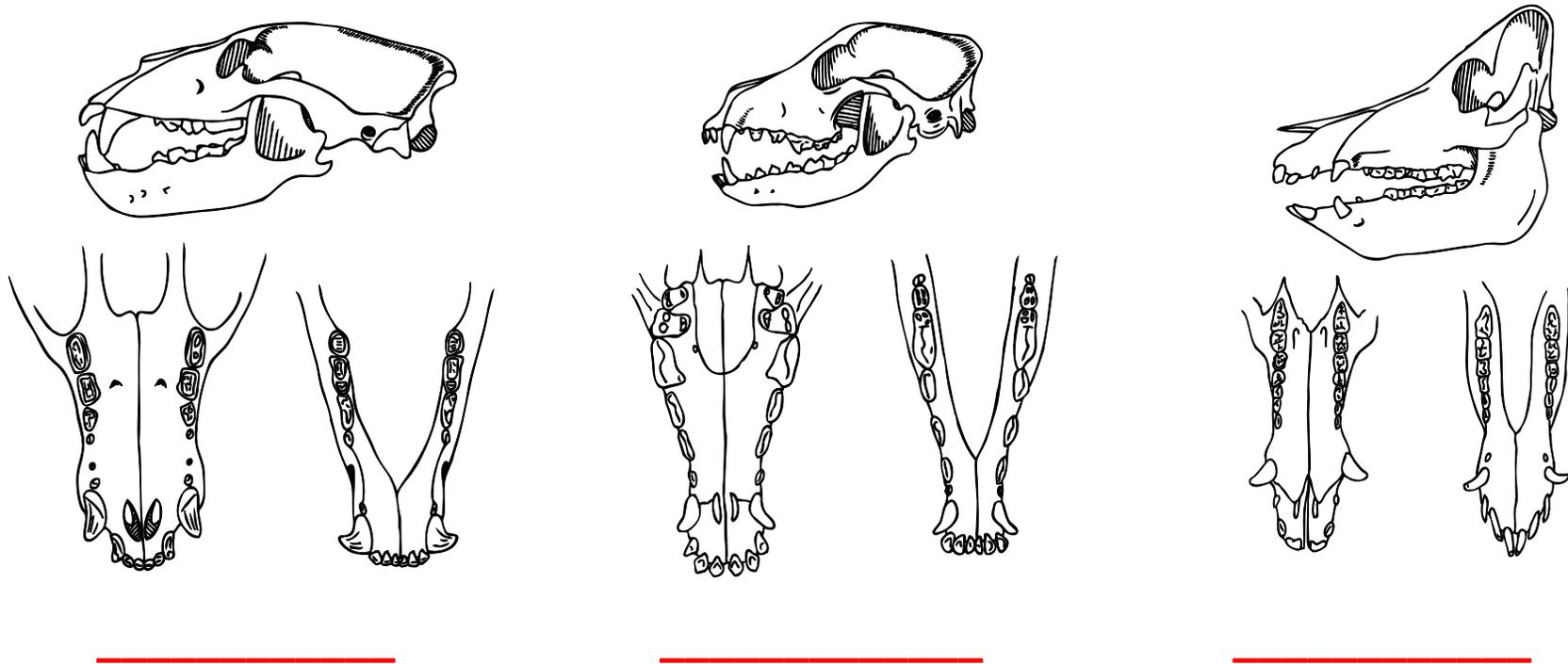
Carnivores (meat eaters) have specially adapted teeth for cutting and shearing meat, called ***carnassial teeth.*** Which of the three mammals uses carnassial teeth for cutting apart their prey? Carnassial teeth are especially prominent in one of the animals above. Circle the teeth.

carnassials

Carnassials are odified pre-molars. Elongated like scissor blades.

Comparative Skulls
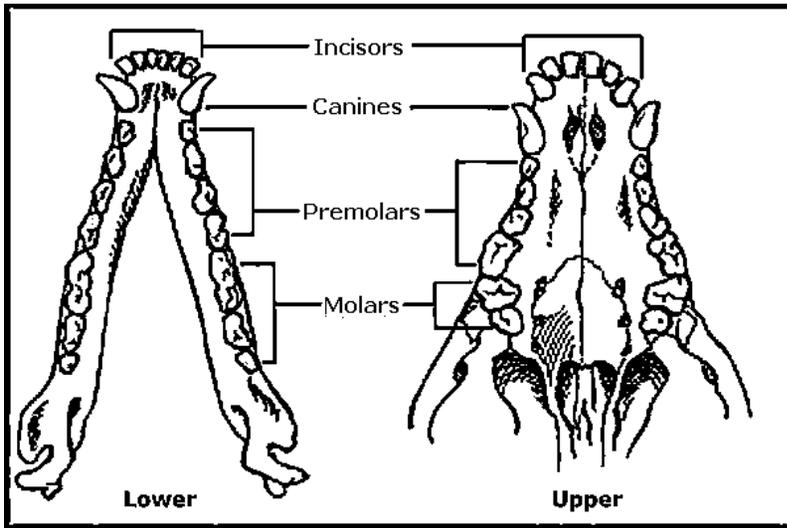
Four types of teeth: incisors, canines, premolars, molars

Each tooth type is shaped to reflect a specific function.
Match the functions with the appropriate tooth type (below).

Crushing and Grinding		Incisors
Cutting and Breaking		Molars
Tearing and Ripping		Canines

Instructions: Circle and label each of the 3 main tooth types: using I for incisors, C for canines, M for molars

HUMAN

DOG

BEAR

PIG

OPOSSUM

The range of omnivore jaw shapes.

Source of skull diagrams: Skulls and Bones: A guide to the skeletal structures and behavior of North American Mammals. Glenn Searfoss, 1995.
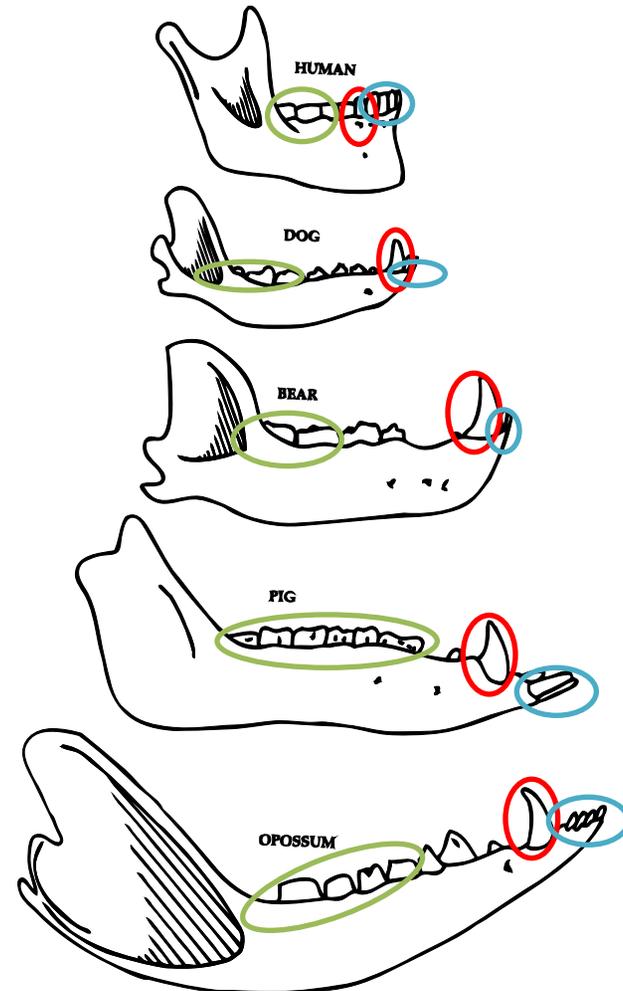
Comparative Skulls

Omnivore, Herbivore or Carnivore? Compare the teeth of the following three mammals. Describe the most prominent diagnostic feature that supports your hypothesis. Which tooth type (incisors, canines, modified premolars, molars) are most specialized (reflecting diet)?

Omnivore, Herbivore or Carnivore? _____CARNIVORE_____

Diagnostic Feature(s): SHARP TEETH, LARGE CANINES, JAW FOR RIPPING AND TEARING

Hypothesized diet: SMALL RODENTS, BIRDS, BERRIES, CARRION, LIZARDS, SNAKES, ETC.

Animal Guess: SKUNK
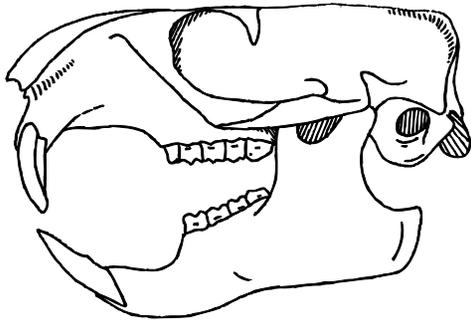
Omnivore, Herbivore or Carnivore? _____OMNIVORE_____

Diagnostic Feature(s):   _LARGE INCISORS, NO CANINES, FLAT MOLARS FOR GRINDING

Hypothesized diet: ___WILD GRASSES, BERRIES, INSECTS, SMALL MAMMALS, NUTS_

Animal Guess: WOODCHUCK (GROUNDHOG)
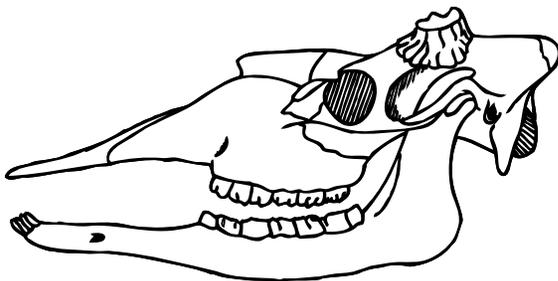
Omnivore, Herbivore or Carnivore? ____HERBIVORE (BROWSER)_____

Diagnostic Feature(s):   __NO CANINE TEETH, FLAT MOLARS FOR GRINDING_____

Hypothesized diet: WILLOW AND BIRCH SHOOTS, AQUATIC PLANTS, GRASSES, LEAVES

Animal Guess: MOOSE

Comparative Skulls

Compare the teeth of the following three omnivores. Omnivore molars have large flat surfaces for grinding food. Canines can be equal in size to other teeth or slightly larger depending on diet. Note the modified premolar carnassial teeth in the dog and bear.

Which skull belongs to whom? Identify the skull of the bear, dog and pig. Circle the prominent carnassial teeth.
Which of the three mammals uses carnassial teeth for shearing and cutting meat?

**Bear**   **Dog**   **Pig**

A

B

C

D
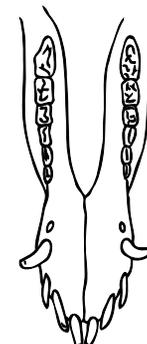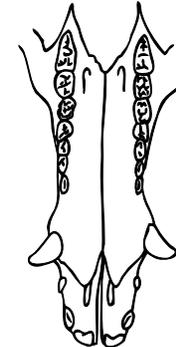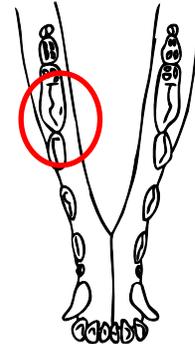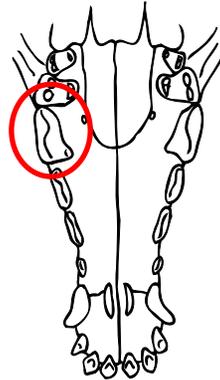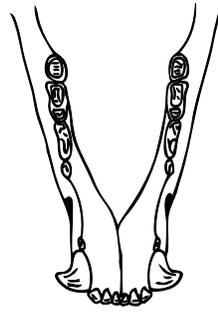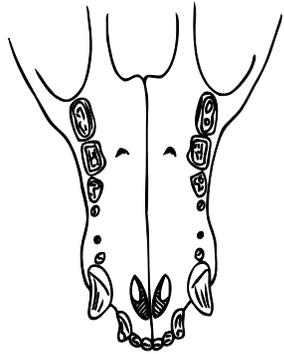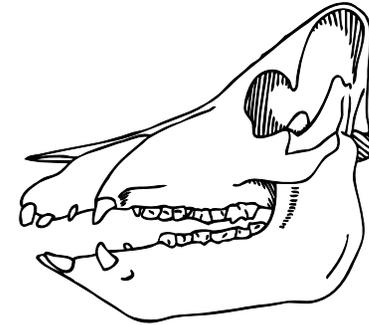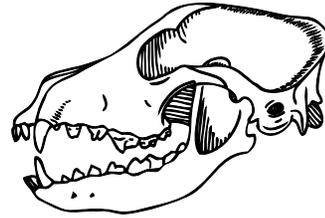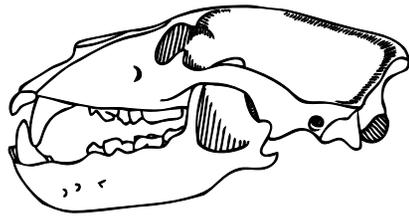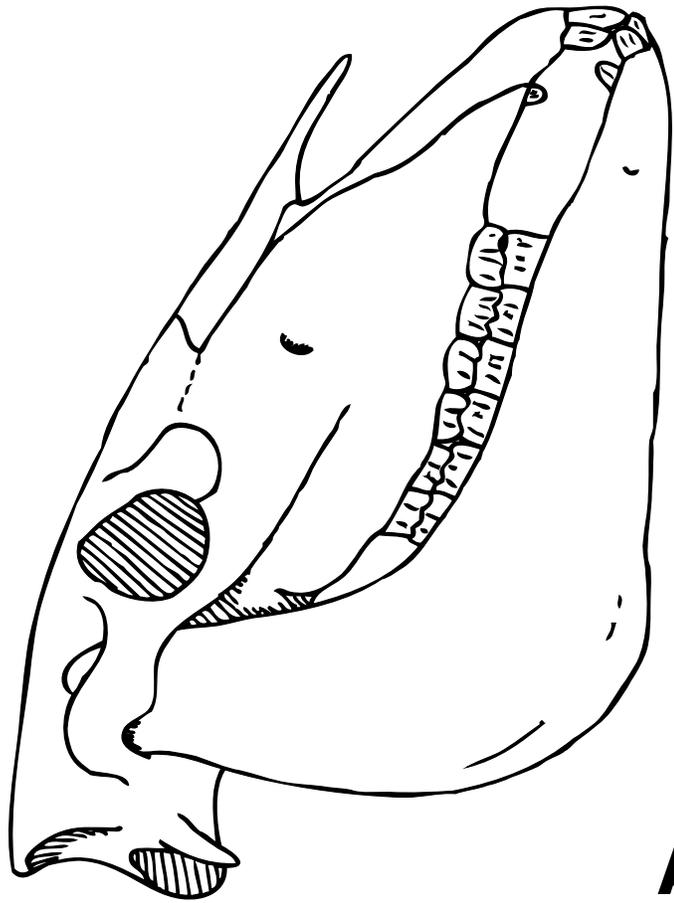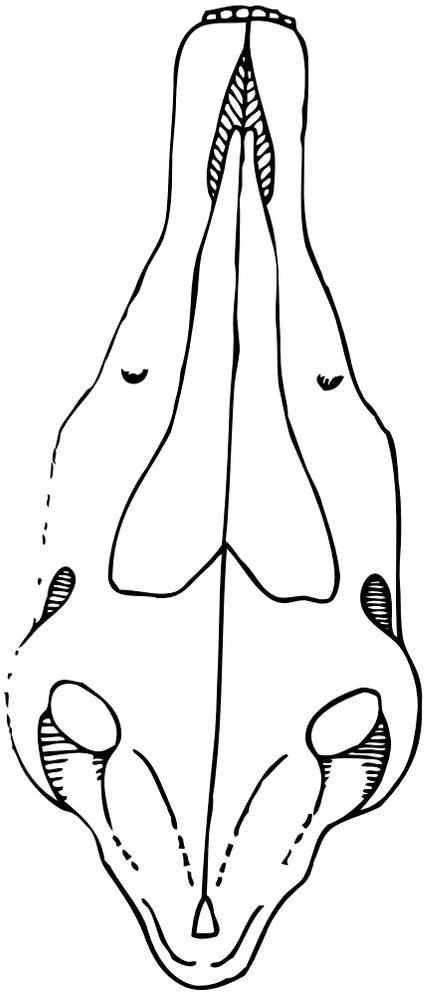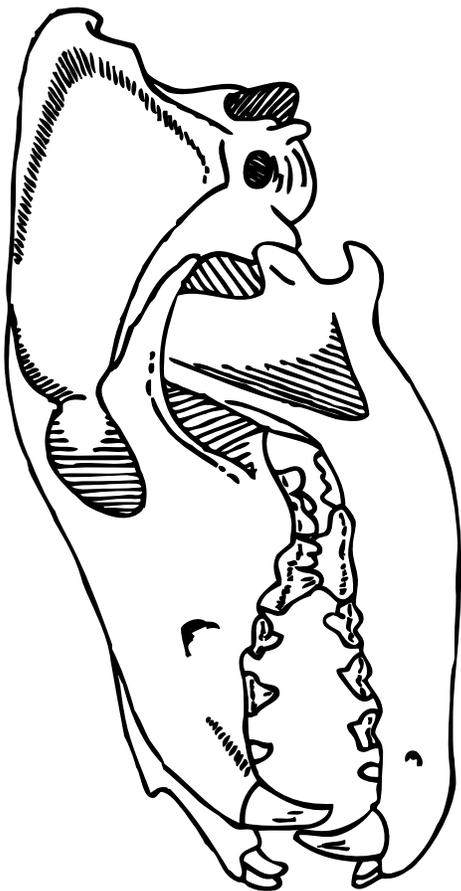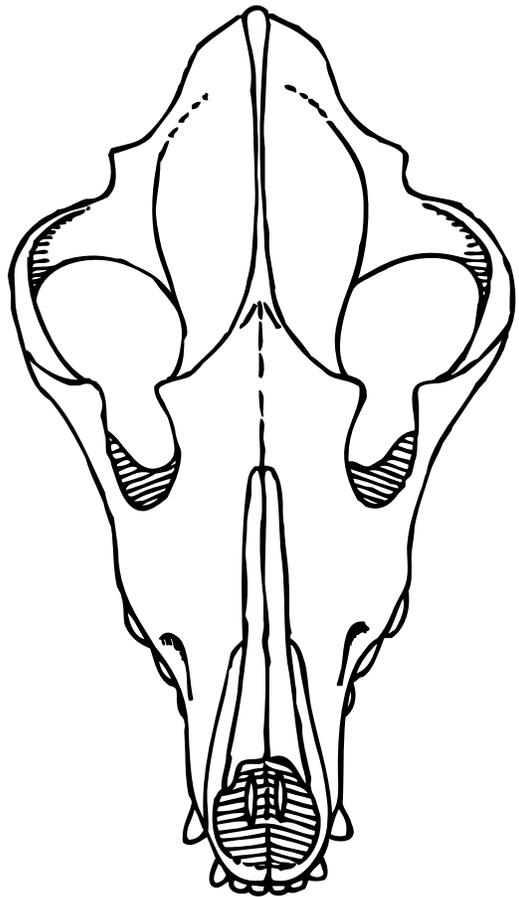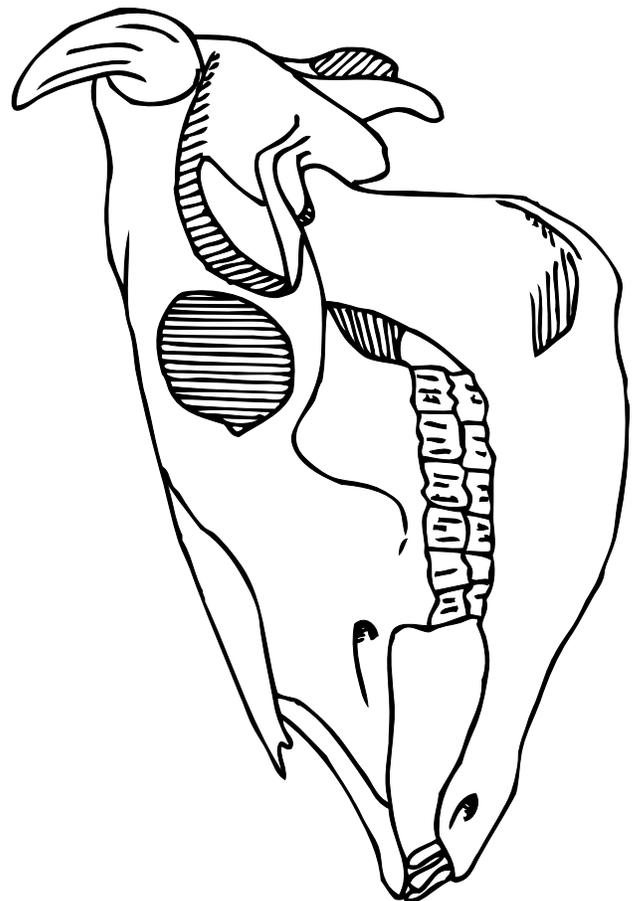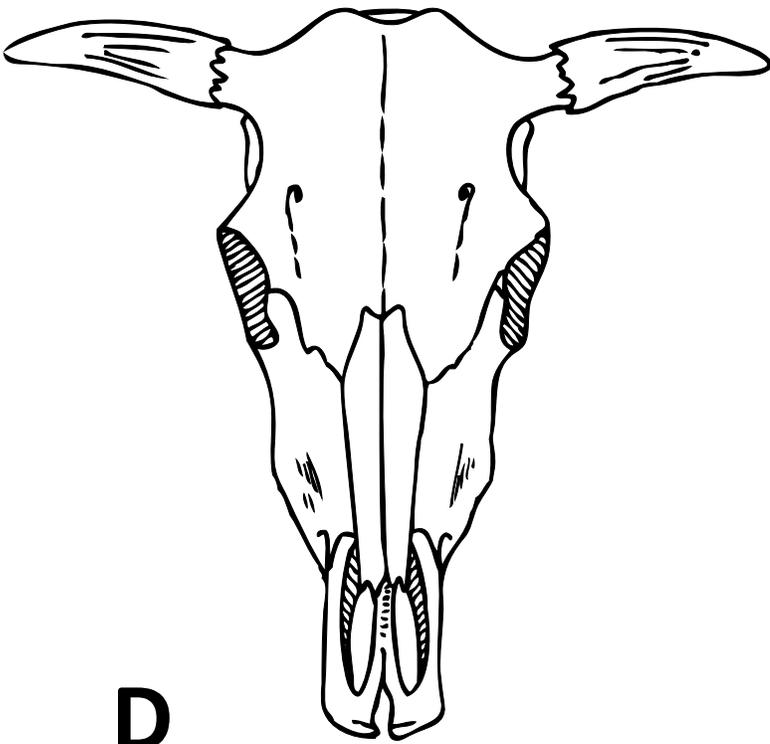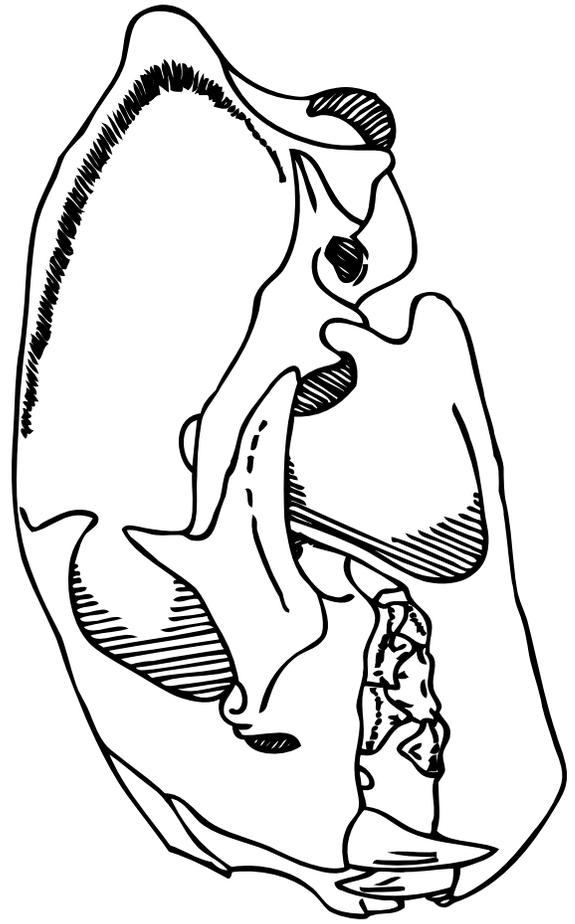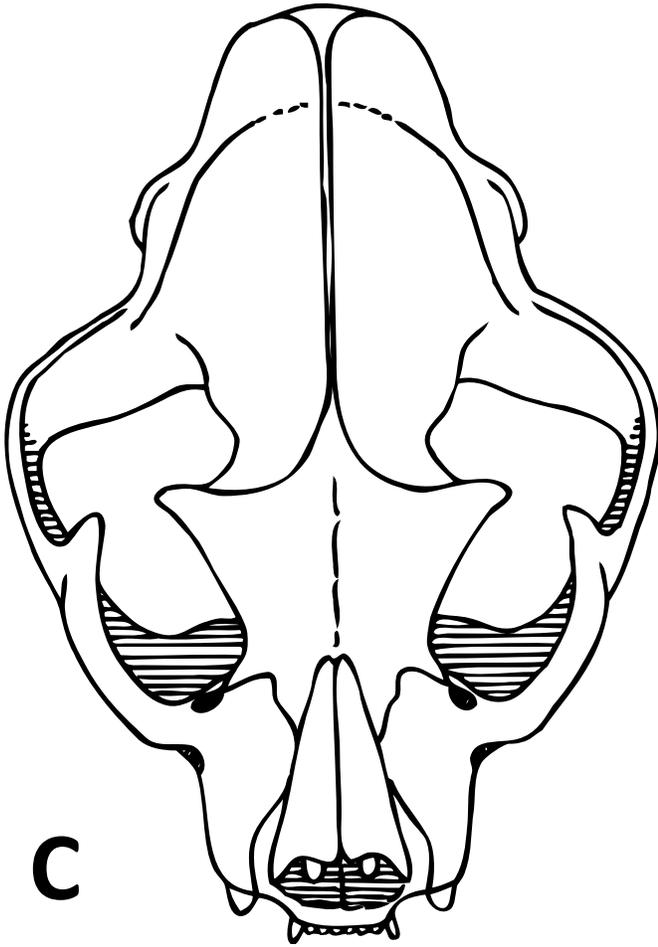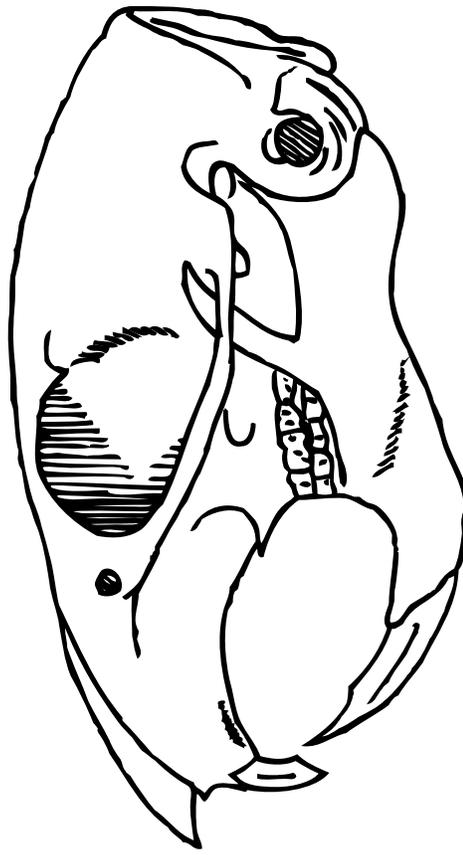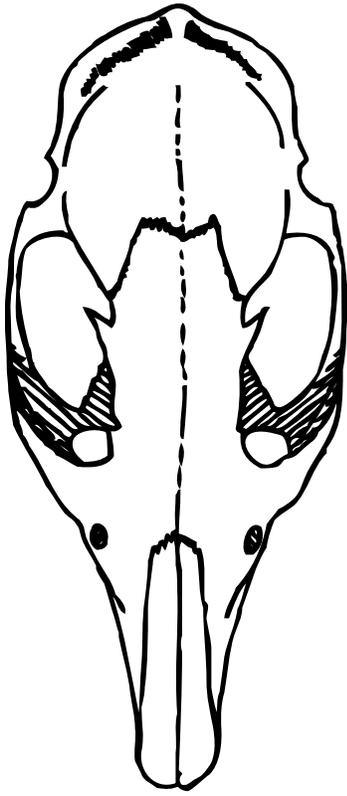
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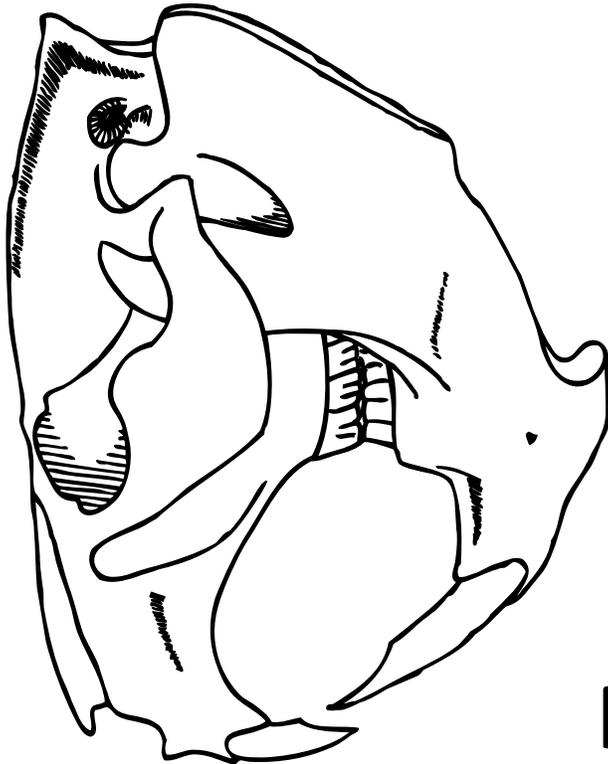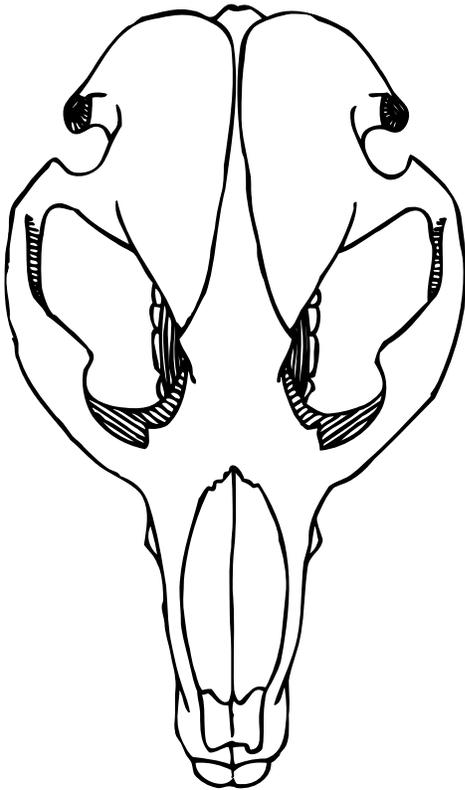
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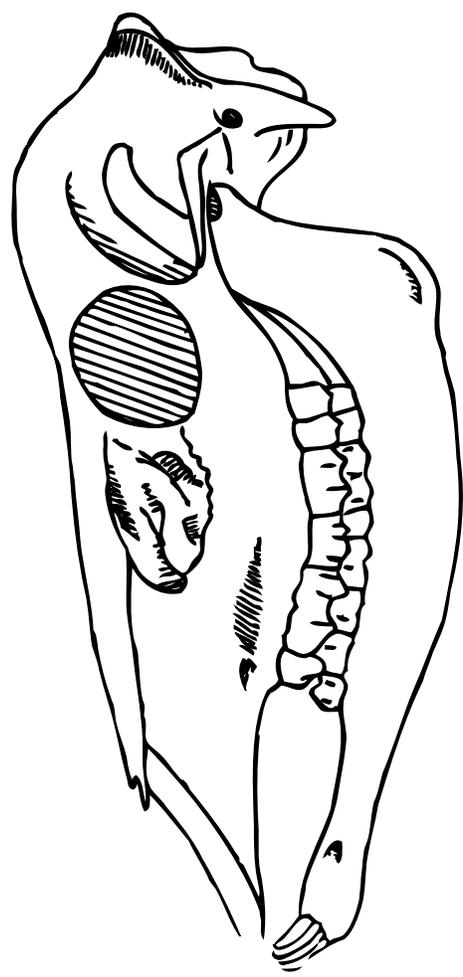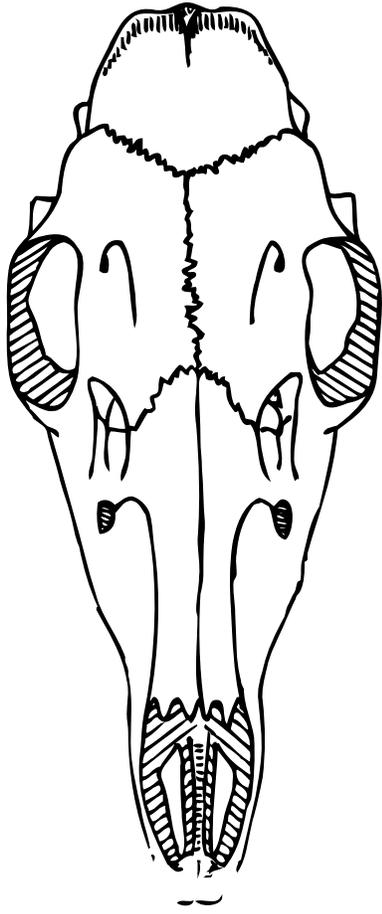
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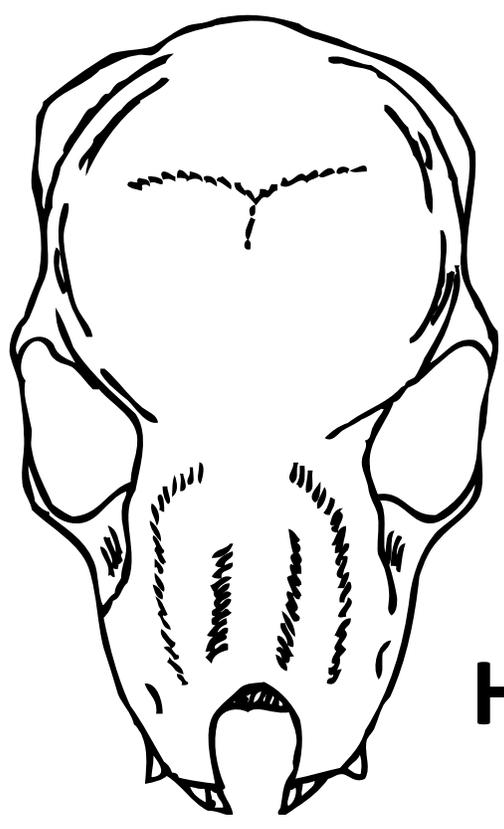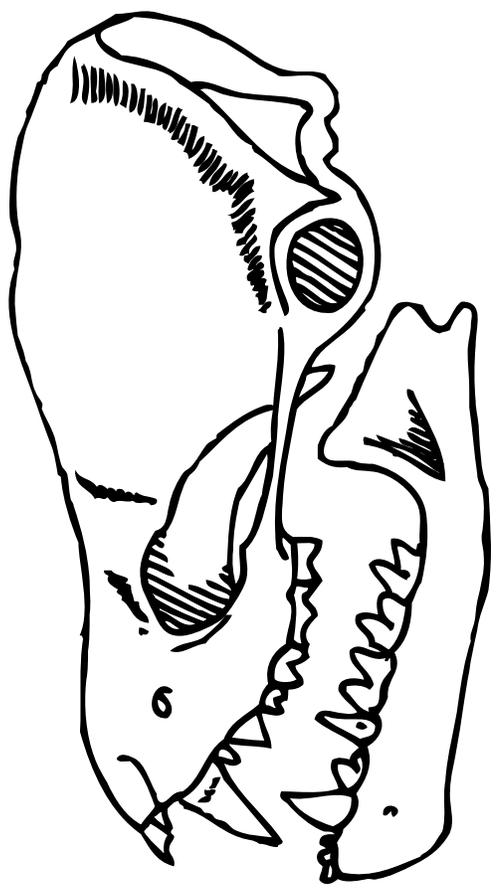
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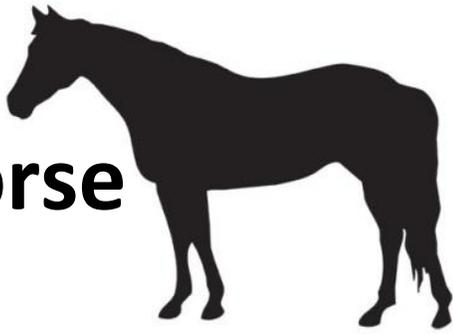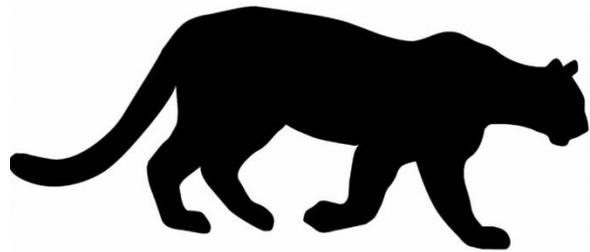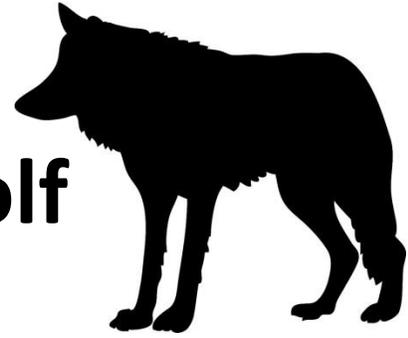
Horse	**Wolf**
Mountain Lion	**Cow**
Chipmunk	**Beaver**
Deer	**Cave Bat**
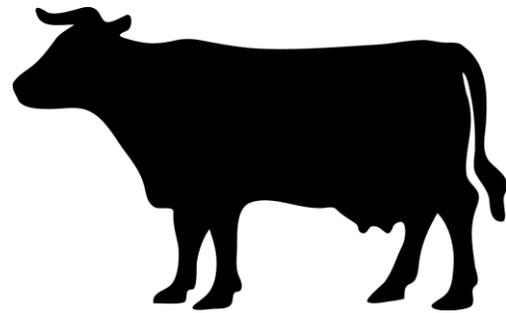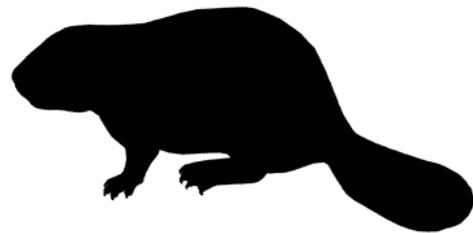
Guess the Skull: Comparing Mammals

Activity Instructions:

Teacher prep: Print and cut out each of the 10 different drawings of animal skulls[1], pasting each around the classroom.

Print the individual name cards, and distribute to students or group. Students (individually or in teams) are asked to match to the name of the organism to the correct skull. There are 10 name cards; depending on the size of the group enough can be printed out, one for each student with overlap if there are more than 10 students. Students can work together as a class.

Each student makes a 'decision' by standing next to the skull they believe matches their animal.

When the class comes to a consensus about how everyone is placed, the teacher or group leader can reveal the correct answers. Students who have guessed wrong are asked to move to the correct skull, thus shuffling the class to the correct matching.

Learning Objective:

In this exercise students will need to compare different **morphological features (differences in size and shape)** between the skulls of different mammals, and think critically about what those differences in shape might mean in terms of diet and lifestyle.

Each animal is uniquely adapted to a particular lifestyle, and physical features of the skull reflect those evolutionary differences. For example, the size and shape of the jaw and cheek bones allow for the attachment of different muscles which can mean a stronger gripping bite or more strength/force with the back chewing teeth.

The size and shape of bone reflects the size and shape of muscles evolved to perform differently: predators have sharp canine teeth and strong jaws; herbivores tend to have eyes on the side of their heads for better peripheral vision, etc.

For more information, see the accompanying activity on jaw muscles taken from the book: Skulls and Bones by Glenn Searfoss.

Answer Key

A- Horse

B- Wolf

C- Mountain Lion

D- Cow

E- Chipmunk

F- Beaver

G- Deer

H- Cave Bat

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[1] Source of skull diagrams: Skulls and Bones: A guide to the skeletal structures and behavior of North American Mammals. Glenn Searfoss, 1995