How to read a skull like an open book

Each skull has a story to tell. It can tell us what the animal ate, which senses it used to hunt or find food, and whether it was the predator or prey. Through scientific investigation, we can unravel the mysteries in a skull and learn more about the animal when it was alive. To read the story of the skull, you need to be able to identify and analyze the clues left behind. To understand the clues, you need to know the language of skulls. We are going to learn the language of skulls so we can solve their mysteries.

Imagine you are walking through the park and you find a skull. How can you tell what animal it was? First you need to know what animals live in the park. This helps to narrow down the options.

Can you name different animals that live in the DePauw Nature Park?

What does each animal eat? Is it an herbivore, omnivore, or carnivore?

Is the animal a predator or prey?

White-tailed deer

The deer is an herbivore.

Male deer (bucks) have antlers. They shed the antlers each year after the mating season. They grow the antlers again the next year. Why do male deer have antlers?

Deer and other herbivores have a large gap between their lower incisors and cheek teeth. Why?

The cheek teeth of a deer are **selenodont** with crescent-shaped cusps.

Deer have an antorbital pit located just in front of each eye socket. This is a slight depression in the skull where the **antorbital gland** or **preorbital gland** is located. The antorbital gland produces secretions containing pheromones, like a scent gland. The gland becomes enlarged during rut.

Raccoon

A raccoon is classified as a carnivore; it is in the order Carnivora. But it is actually an omnivore. It eats both plants and animals.

A raccoon's cheek teeth are **multicuspid** and **secodont**. *Secare*- means "to cut." Secodont dentition refers to the cutting edges on the tooth cusps.

Beaver

A beaver is a large rodent, classified in the order Rodentia. A beaver has a large set of arc-shaped chisel-edged incisors. The beaver keeps its incisors sharp by using them. Its cheek teeth have wide flat surfaces with complex folds and ridges.

Coyote

The coyote is classified as a carnivore; it is in the order Carnivora. But it is actually an omnivore. It eats both plants and animals. It prefers to eat meat but will eat fruits, vegetables, and even garbage. It is an opportunistic eater; it will eat whatever it finds.

Black bear

The black bear is classified as a carnivore; it is in the order Carnivora. But it is actually an omnivore. It eats both plants and animals.

There are no black bears in Indiana.

The language of skulls

Size of eye sockets

Are the eye sockets large or small relative to the skull size? Large eye sockets are indicative of sharper eyesight and nocturnal behavior.

Placement of eye sockets

How are the eye sockets placed in the skull? Do the eye sockets face forward or face to the side? This helps us figure out if the animal is a predator or prey.

- Predators have eye sockets that face forward. An animal with forward-facing eyes has "binocular vision." This provides excellent depth perception for hunting and killing prey.

- Prey have eye sockets that fact to the side. The side placement gives the animal a wider field of view to see predators coming from all directions.

Do humans have forward-facing or side-facing eye sockets? What about dogs? What about horses and cattle?

Size of nasal passages

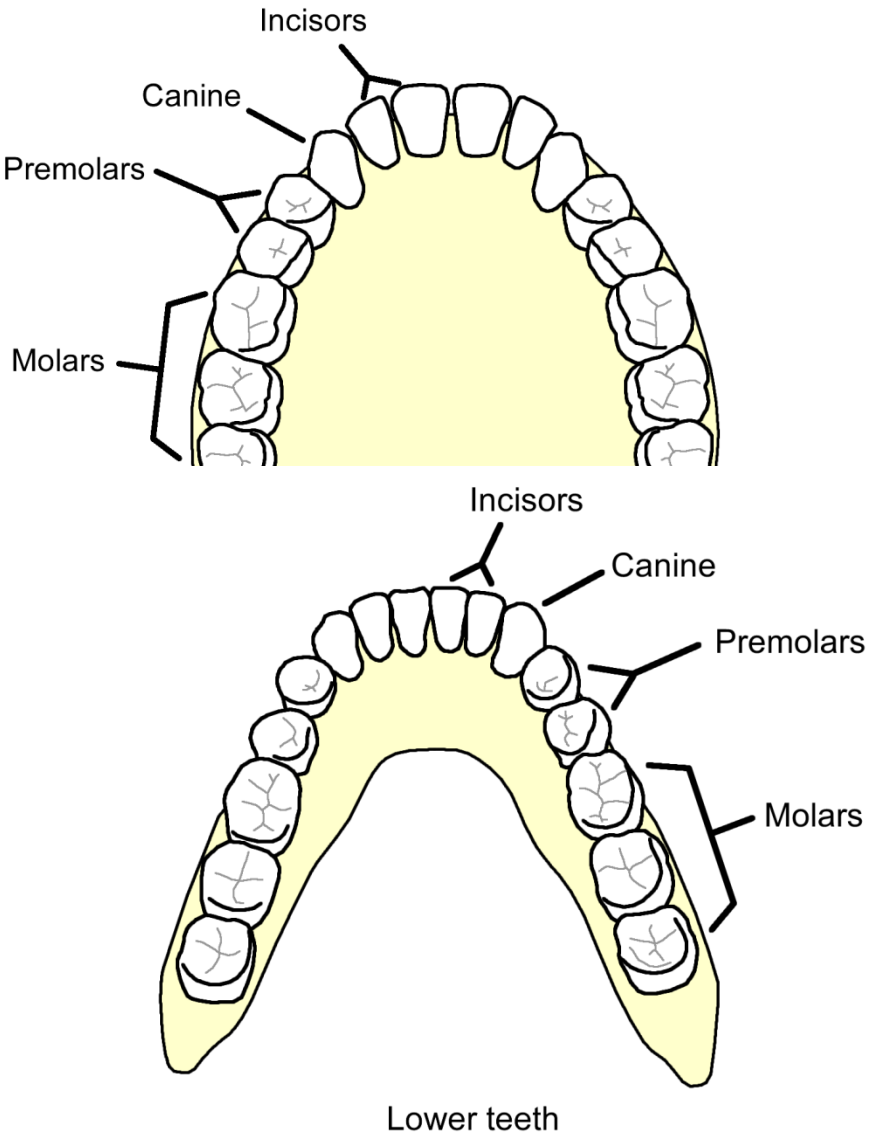
How large are the nasal passages? Large nasal passages are indicative of a keen sense of smell. Inside the nasal passages, look for bony, web-like structures call **nasal turbinates**. These provide the framework for membranes that sense odor.

Dogs have longer nasal passages and more complex nasal turbinates. This gives them a keen sense of smell. Cats have shorter nasal passages and less complex nasal turbinates. Cats rely on other senses for hunting.

Teeth

Humans have 20 “baby teeth” and 32 adult teeth. Our baby teeth emerge early and are smaller because our jaws aren’t big enough for adult teeth. We shed our baby teeth and replace them with permanent teeth when our jaws grow big enough to accommodate them. Most of our permanent teeth gradually emerge when we are between six and thirteen years old. Our last permanent teeth, referred to as our **wisdom teeth**, usually emerge when we are 17 to 25 years old.

We have four kinds of adult teeth: incisors, canines, premolars, and molars.



Lower teeth

Incisors

Close your eyes and imagine I just handed you a big red apple. Now imagine biting into it. What teeth did you use? Your front teeth, which are your **incisors**. We have four incisors in our upper jaw and four incisors in our lower jaw. Our incisors are located in the front of our mouth and are used for grabbing or cutting.

Rodents have very large incisors. A rodent's incisors are shaped like chisels and grow continuously throughout their lifetime. Why do you think a rodent has large incisors?

A **deer** doesn't have any upper incisors but does have lower incisors. A deer's front teeth and the shape of its mouth are like a scotch-tape dispenser! The deer uses its long tongue to grab onto a leaf and pull it into its mouth, then it uses its lower incisors to cut the leaf, just like rolling out and cutting a piece of scotch tape.

A **rabbit** has four upper incisors and two lower incisors. In a rabbit's upper jaw, two of the incisors are large and shaped like chisels, and the other two incisors are much smaller, shaped like pegs, and located directly behind the larger incisors. Like the rodents, incisors of rabbits continue to grow throughout their lifetime. Why do you think rabbits and rodents grow their incisors throughout their lifetime?

Carnivores have smaller incisors compared to rodents.

Canines

Close your eyes and imagine that I hand you a piece of beef jerky. Now imagine biting into it. Which teeth did you use? Your canines.

Our canines are located behind our incisors. We have four canines, two in our upper jaw and two in our lower jaw.

Canines are also referred to as **fangs** and are long, pointed teeth.

Carnivores have the largest and most prominent canine teeth. Vampire bats and tigers, for example, have large and prominent canines. Carnivores use their canine teeth to puncture or hold their prey.

Rodents, **rabbits**, and **deer** don't have any canines. Instead, herbivores have a large space or gap between their incisors and back teeth. This large space between their teeth gives the animal plenty of room to manipulate and grind up vegetation in their mouth.

Premolars and molars

Close your eyes and imagine that I gave you an ice cube to chew on. Which teeth did you use to grind up the ice? Your premolars and molars, also referred to as your "cheek teeth." Adults have 8 premolars and 12 molars. The premolars are located behind the incisors and canines. The molars are located behind the premolars. Children have 8 premolars and no molars.

You can usually tell the difference between a carnivore and an herbivore skull based on the shape of the cheek teeth.

- **Carnivores**, such as dogs and cats, have cheek teeth that are sharp and pointed for cutting and tearing flesh. The pointed tips are like a pair of scissors or knives, helping the animal tear meat tissue apart.

- **Herbivores**, such as deer and rodents, have wider and flatter cheek teeth. The surfaces of an herbivore's cheek teeth are highly corrugated with distinct grooves and edges. The complex tooth surfaces help the animal grind and chew up plant material. An herbivore moves its lower jaw from side to side to chew its food.

- **Omnivores**, such as raccoons, have cheek teeth with a combination of pointed tips and complex surfaces. Cheek teeth are a combination of sharp scissor-like teeth for slicing meat and teeth with flatter and wider surfaces for grinding and crushing plant material. An omnivore doesn't have side to side lower jaw movement.

Dental formulas

Each species of mammal has a unique dental formula. The animal's jaw is divided into four parts: upper left, upper right, lower left, lower right. Then we count the number of teeth by type (incisors, canines, cheek teeth) in each of the four parts. We write the dental formula separately for the upper jaw and lower jaw. Each number in the dental formula indicates the number of teeth by type of tooth in each of the four parts of the animal's jaw.

Humans have 32 teeth. We have 8 incisors, 4 canines, and 20 cheek teeth. In each of the four parts of our jaw we have 2 incisors, 1 canine, and 5 cheek teeth. Our dental formula is:

Upper jaw 2 1 5
Lower jaw 2 1 5

A **deer** has 32 teeth: 6 lower incisors, 2 lower canines, and 24 cheek teeth.

Upper jaw 0 0 6
Lower jaw 3 1 6

A **raccoon** has 40 teeth: 12 incisors, 4 canines, and 24 cheek teeth.

Upper jaw 3 1 6
Lower jaw 3 1 6

A **beaver** has 20 teeth: 4 incisors, 0 canines, and 16 cheek teeth.

Upper jaw 1 0 4
Lower jaw 1 0 4

A **coyote** has 42 teeth: 12 incisors, 4 canines, and 26 cheek teeth

Upper jaw 3 1 6
Lower jaw 3 1 7

A **woodchuck** has 22 teeth: 4 incisors, 0 canines, and 18 cheek teeth

Upper jaw 1 0 5
Lower jaw 1 0 4

A **muskrat** has 16 teeth: 4 incisors, 0 canines, and 12 cheek teeth

Upper jaw 1 0 3
Lower jaw 1 0 3

A **rabbit** has 26 to 28 teeth: 6 incisors, 0 canines, and 20 or 22 cheek teeth

Upper jaw 2 0 5-6
Lower jaw 1 0 5

A **black bear** has 40 to 42 teeth: 10 or 12 incisors, 4 canines, and 26 cheek teeth. Its premolars may be small or absent.

Upper jaw 2-3 1 6
Lower jaw 3 1 7

Mystery skull worksheet

Skull	Tooth shape?			Number of teeth?			Eye placement? (forward, side)	Herbivore, omnivore, or carnivore?	Kind of animal
	Incisors	Canines	Cheek teeth	Incisors	Canines	Cheek teeth			
1									
2									
3									
4									
5									
6									
7									
8									