

BITE-SIZED BIOCHEM: STRUCTURES OF LIVING ORGANISMS | GRADE 4



Overview

In this onsite field trip, students observe plant and animal specimens from the museum's collection and consider the physical structures that help organisms survive and thrive. Students also experience a hands-on activity modeling sensory information collection and processing and draw on the experience to discuss the ways animals collect, interpret, and respond to information about their environments. Allergen warning: this program uses Jelly Belly BeanBoozled and original flavor jelly beans.

Standards

NGSS 4-LS1 (1-2): From Molecules to Organisms: Structures and Processes

- **4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** Students will encounter many examples of internal and external plant and animal structures that function to support survival, growth, behavior, and reproduction. Items will include animal skulls and teeth from the museum's collection as well as the seeds of a common Maryland species (the maple tree).
- **4-LS1-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.** Students will engage in a sensory activity using Jelly Belly jellybeans which models the ways animals use their senses to receive and process information about their environments. Following the activity, a museum educator will lead the students in a follow-up discussion to help students relate their experience to the ways animals use their senses to help them survive, grow, behave, and reproduce.

CCSS.ELA-LITERACY: Speaking and Listening

- **CCSS.ELA-LITERACY.SL.4.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.** Students will engage with a museum educator, peers, teachers, and chaperones during discussions and activities about the structures and processes of plant and animal organisms.
- **CCSS.ELA-LITERACY.SL.4.2: Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.** Students will encounter presentation of information in a variety of media formats, including visual and quantitative presentations throughout the museum, oral presentations from the museum educator, and video presentations by external organizations and creators. Through various activities, students will determine the main ideas of presented information.
- **CCSS.ELA-LITERACY.SL.4.3: Identify the reasons and evidence a speaker provides to support particular points.** Students will engage with a museum speaker to ask and answer questions related to presented information.

Exhibitions & Materials

- Featured exhibition: *Origins of the Teeth*
- Non-exhibit artifacts:
 - Maple seeds
- Graphics and photographs: Laptop for video presentation
- Student supplies: Animal Tooth Observation worksheets, clipboards, pencils, Jelly Belly BeanBoozled jelly beans, Jelly Belly original jelly beans



The Dr. Samuel D. Harris

**NATIONAL
MUSEUM of
DENTISTRY**

Program Introduction

INTRODUCE: Museum, Museum Educator, and Program

- We are the National Museum of Dentistry. We are located in Baltimore at the University of Maryland, Baltimore because the University of Maryland School of Dentistry is the oldest dental school in the world. Our mission is to celebrate the history and future of oral health.
- Fourth graders can visit our museum to learn about **LIVING ORGANISMS** and the biological structures they have that support their survival.

PROGRAM FORMAT: In this program, students rotate through two stations. Groups under 25 students may proceed together through Stations 1-2 in order. Groups between 25-50 students may divide in half, with one group starting at Station 1 (proceeding 1-2) and another starting at Station 2 (proceeding 2-1). For groups with more than 50 students, museum staff will determine how best to proceed.

Station 1: Origins of the Teeth

(Exhibit made possible through the generous support of the American Academy of the History of Dentistry)

Define & Discuss (Supplies: maple seeds)

Plants and animals have internal (inside) and external (outside) biological structures that function to support their survival, growth, behavior, and reproduction.

WHAT IS AN EXAMPLE OF AN INTERNAL BIOLOGICAL STRUCTURE IN ANIMALS?

(Allow students to answer and explain, but the below replies may be discussed as well)

- **STOMACH:** Animal stomachs digest food and help the body process essential nutrients.
- **BONES:** Animal bones hold the body upright and protect the animal's internal organs.

WHAT IS AN EXAMPLE OF AN EXTERNAL BIOLOGICAL STRUCTURE IN ANIMALS?

- **SKIN:** Animals skins protect animals' internal structures from injury and germs and help regulate body temperature.
- **FEATHERS:** Feathers help birds to fly and keep warm.

WHAT IS AN EXAMPLE OF AN INTERNAL BIOLOGICAL STRUCTURE IN PLANTS?

- **VASCULAR SYSTEM:** Just like animals and humans, plants have systems of veins that circulate water and nutrients throughout the plant.
- **CHLOROPHYLL:** Chlorophyll is a green pigment that plants use to make food out of sunlight during **PHOTOSYNTHESIS**.

WHAT IS AN EXAMPLE OF AN EXTERNAL BIOLOGICAL STRUCTURE IN PLANTS?

- **THORNS & SPINES:** Rose thorns and cactus spines ward off herbivore predators like rabbits and deer so that plants can survive, grow, and reproduce by making seeds.
- **STEMS:** A plant's stem transports water and minerals to its leaves, which the plant can then use to undergo photosynthesis—a process through which plants convert sunlight into food.

HANDS-ON EXAMPLE: Maple trees, which are common in Maryland, produce seeds with special wing-like structures that help them float in the wind. This helps maple seeds spread far and wide, increasing the likelihood that the species will survive in Maryland for a long time! (Show maple seeds)

WHAT IS OUR FAVORITE BIOLOGICAL STRUCTURE? Here at the National Museum of Dentistry, our favorite biological structure is, of course, teeth! Teeth, along with saliva, help animals cut, crush, and chemically break down food items in preparation for digestion. Some animals use their teeth for additional survival functions as well.

Activities

ANIMAL SKULL GUESSING GAMES (No supplies needed)

These are the skulls of several real animals. Some of them are **CARNIVORES** (meat-eaters), some are **HERBIVORES** (plant-eaters), and some are **OMNIVORES** (animals who eat both meat and plants). Each animal has teeth that support their particular diet.

- What kind of teeth do carnivores have? (Sharp, pointy)
 - What kind of teeth do herbivores have? (Flat, wide)
 - What kind of teeth do omnivores have? (Both kinds)
- **GAME 1:** Without needing to know what they are, line up behind:
 - A carnivore (ask a volunteer who chose the **ALLIGATOR** to explain their choice)
 - A herbivore (ask a volunteer who chose the **HORSE** to explain their choice)
 - An omnivore (ask a volunteer who chose the **BEAR** to explain their choice)
 - **GAME 2:** Can you guess what each of these animals are? Based on their teeth, can you guess whether they eat plants, meat, or both?
 - **AFRICAN WARTHOG:** Warthogs are omnivores. They have sharp, pointy teeth that are good for eating meat and wide, flat teeth that are good for chewing grasses, roots, and berries.
 - **AFRICAN LION:** Lions are carnivores. They have sharp, pointy teeth that are good for eating meat.
 - **SEA LION:** Sea Lions are carnivores. They have sharp, pointy teeth that are good for eating meat.
 - **TURTLE:** Turtles are the trickiest animal for this game! They do not have any teeth, but they are omnivores. Turtles can eat both meat and plants, as long as their food is soft. Turtles eat leafy greens as well as animals like jellyfish and worms.
 - **ALLIGATOR:** Alligators are carnivores. They have sharp, pointy teeth that are good for eating meat.
 - **RUSSIAN BOAR:** Wild boars are omnivores. They have sharp, pointy teeth that are good for eating meat *and* wide, flat teeth that are very good for chewing fruit and nuts.
 - **ALASKAN BROWN BEAR:** Bears are omnivores. They have sharp, pointy teeth that are good for eating meat and wide, flat teeth that are very good for chewing berries and grains.
 - **HORSE:** Horses are herbivores. They have wide front teeth that are good for biting through grass, hay, and crunchy fruits and veggies like apples or carrots and flat back teeth that are very good for chewing those fibrous foods.

DENTAL CONNECTION: Humans are omnivores. This means that our teeth are able to chew plants and meat. Based on all we have discussed and observed, can you tell which teeth in your mouth are good for eating plants? Which ones are good for eating meat?

ANIMAL TOOTH OBSERVATION (Supplies: laptop, Animal Tooth Observation worksheets)

- **INTRODUCE:** We are going to observe two of these skulls more closely to identify how their teeth function to support survival behaviors *beyond* eating food.
- **SETUP:** Students should be divided into two groups. Each student will need a clipboard, pencil, and Animal Tooth Observation worksheet. Assign one group to observe the African Warthog and the other to observe the African Lion.
- **INSTRUCT:** Each group should fill out their side of the Animal Tooth Observation worksheet. After a few minutes, a volunteer spokesperson should share the group's answers with the other student group. (Museum educator should spend time with each group to help guide them toward the answers.)
 - **LION VIDEO:** <https://www.youtube.com/watch?v=bsOoJDIrnu4>
 - **WARTHOG VIDEO:** <https://www.youtube.com/watch?v=VICxJVtWPZO>

DENTAL CONNECTION: Do you use your teeth for behaviors other than eating? (Smiling!) Does smiling have a biological purpose? (Yes--smiling is social communication!)

Station 2: Atrium

Define & Discuss

ANIMALS USE THEIR SENSES TO DETECT INFORMATION ABOUT THEIR ENVIRONMENTS. Animals use some of the same senses humans have to gather information about their environments. Some senses, including sight, taste, and touch, gather physical information about an object or organism. Other senses, including smell and taste, gather chemical information about an object or organism. Some animals, like sharks and eels, have an additional sense that allows them to detect electricity.

WHAT IS THE BIOLOGICAL PURPOSE OF SENSES? Animals, including humans, process sensory information in their brains. Then, their brains tell them how to respond so that they can stay safe, survive, grow, and reproduce. Animal brains can interpret sensory data to:

- **DETERMINE IF A PLANT IS SAFE TO EAT.** Does it look/smell/taste ripe or rotten? Does it have thorns or spines or feel prickly?
- **DETERMINE IF ANOTHER ORGANISM IS FRIENDLY OR DANGEROUS.** Is it showing teeth, spines, or claws? Is it making a scary noise?
- **DETERMINE WHEN TO SEEK SHELTER OR HIGHER GROUND.** Does the ground feel too soft or unstable? Is there the sound of thunder or the sight of floods or lightning?

Activity

TESTING OUR SENSES (Supplies: Jelly Belly BeanBoozled jelly beans, Jelly Belly original jelly beans)

- **SETUP:** Seat students at tables in the middle of the atrium. Each student should receive one BeanBoozled jelly bean.
- **INSTRUCT:** We are going to use our senses to help us learn about these jellybeans and decide whether or not we should eat them.
 - **STEP 1:** Look at your jellybean. If your jellybean looks like it is good to eat, move to the wall of Davidge Hall. If your jellybean looks like it is bad to eat, move to the water fountain area.
 - **STEP 2:** Crush your jellybean between two fingers (demonstrate). If your jellybean smells good to eat, move to the wall of Davidge Hall. If your jellybean smells like it is bad to eat, move to the water fountain area.
 - **STEP 3:** Taste your jellybean. If your jellybean tastes like it is good to eat, move to the wall of Davidge Hall. If your jellybean tastes like it is bad to eat, you may spit it out, then move to the water fountain area.
 - **STEP 4:** Review & reflect on the experience.

STUDENTS NEAR DAVIDGE	STUDENTS NEAR WATER FOUNTAIN
Ask a volunteer: what was the flavor of your jellybean? If you cannot identify it for certain, try your best to describe it to the group. Next, ask someone from the other side to describe theirs and continue until all students who would like to share have done so.	Ask a volunteer: what was the flavor of your jellybean? If you cannot identify it for certain, try your best to describe it to the group. Next, ask someone from the other side to describe theirs and continue until all students who would like to share have done so.
Does anyone notice a pattern?	
Did the flavor of your jellybean mimic something in the real world that humans can eat?	Did the flavor of your jellybean mimic something in the real world that would cause harm to humans if we ate it?
Your flavor was probably: tutti-fruitti, buttered popcorn, peach, juicy pear, coconut, lime, berry blue, chocolate pudding, caramel corn, or licorice	Your flavor was probably: stinky socks, rotten egg, barf, booger, baby wipes, lawn clippings, toothpaste, canned dog food, moldy cheese, or skunk spray



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Activity

TESTING OUR SENSES (CONT'D)

- **WERE THE "GOOD" JELLY BEANS DISTINGUISHABLE FROM THE "BAD" JELLY BEANS BASED ON SIGHT ALONE?** In most cases, no. A "booger" flavored jelly bean looks exactly like a "juicy pear" flavored jelly bean.
- **DID YOU HAVE TO CHANGE FROM ONE WALL TO THE OTHER AT ANY POINT? WHY OR WHY NOT?** Students may have thought a jelly bean looked good or bad, but changed walls after smelling or tasting their jelly bean.
- **WHAT SENSE DID YOU RELY ON MOST HEAVILY TO DETERMINE WHETHER YOUR JELLY BEAN WAS GOOD OR BAD TO EAT?** By raise of hands:
 - Sight
 - Smell
 - Taste
 - It does not matter which sense you relied on most heavily--all of our senses are important in assessing information about our environments.
- **HOW DOES THIS ACTIVITY MODEL THE WAYS ANIMALS SURVIVE, GROW, BEHAVE, AND REPRODUCE IN NATURE?** Animals use their senses in a very similar way to collect information about their environments and respond to the resources and stimuli around them. Based on sights, smells, tastes, and even sounds, animals decide:
 - which foods to eat
 - how to engage with other animals (e.g. is the other animal a potential mate? An ally? An enemy?)
 - where to sleep
 - where to raise their young
 - whether to seek shelter from a predator or dangerous weather
 - (and more!)
- **BECAUSE WE WANT YOUR BRAINS TO REMEMBER THAT THE NATIONAL MUSEUM OF DENTISTRY IS A GREAT PLACE TO BE:** we will send everyone home with GOOD-TASTING jelly beans! (Distribute mini packets of Jelly Belly original jelly beans.) **Please help our brains remember that you are kind, lovely, respectful fourth graders by making sure to throw away your trash in the trash bin.**

Program Conclusion

WHY DO FOURTH GRADERS STUDY THE STRUCTURES OF LIVING ORGANISMS? By studying the structures of living organisms that function to support their survival, growth, behavior, and reproduction, we can better understand, respect, and protect the Earth and the plants and animals who live on it--including ourselves!

QUESTIONS?

TOUR THE MUSEUM: Following any programming, students, teachers, and chaperones may tour the museum at their own pace and/or eat lunch in the atrium.



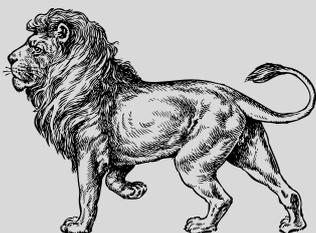
Animal Tooth Observation

Observe the teeth of two African mammals: the lion and the warthog. Both animals use their teeth to eat, but their teeth have other survival functions as well. Can you guess what they are?

GROUP 1 **African Lion**

In addition to eating, we think lions use their teeth for:

This helps them survive because:



GROUP 2 **African Warthog**

In addition to eating, we think warthogs use their teeth for:

This helps them survive because:



DISCUSSION KEY

Animal Tooth Observation

Observe the teeth of two African mammals: the lion and the warthog. Both animals use their teeth to eat, but their teeth have other survival functions as well. Can you guess what they are?

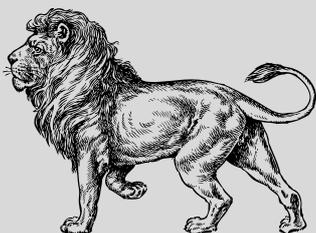
GROUP 1 African Lion

In addition to eating, we think lions use their teeth for:

COMMUNICATION. Lions bare their teeth at one another to establish social order, and at other animals to warn them to back off if they are getting too close. Sometimes, lions accompany this action with a growl, but sometimes they don't!

This helps them survive because:

Maintaining social order and dominance allows lions to function and thrive as a pride (family). Warding off threats and hunting competition helps lions protect themselves and their young.



GROUP 2 African Warthog

In addition to eating, we think warthogs use their teeth for:

HABITAT-BUILDING. Warthogs use their strong snouts and tusks to dig burrows to live in. Their tusks help cut through tough roots in the ground.

This helps them survive because:

Having a safe shelter is critical to survival. By living in burrows, warthogs shield themselves from extreme temperatures and hide from large predators, like lions.

