

## Overview:

The skeletal system in vertebrates is designed to protect vital organs, enabling animals to survive the lumps and bumps of life.

## Objectives:

The student will:

- construct a structure intended to protect and egg, representing a vital organ;
- name three vital organs protected by the skeletal system; and
- describe the importance of the skeletal system as protection for vertebrates.

## Targeted Alaska Grade Level Expectations:

### Science

[5] SC2.2 The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by explaining how external features and internal systems (i.e., respiratory, excretory, skeletal, circulatory, and digestive) of plants and animals may help them grow, survive, and reproduce.

## Vocabulary:

**brain** – the part of the nervous system in vertebrates that is enclosed within the skull, is connected with the spinal cord

**exoskeleton** – a hard, protective outer body covering of an animal, such as an insect, crustacean, or mollusk

**heart** – the hollow, muscular organ that pumps blood through the body of a vertebrate animal by contracting and relaxing

**lung** – either of two spongy organs in the chest of air-breathing vertebrate animals that serve as the organs of gas exchange

**skeleton** – the internal structure of vertebrate animals, composed of bone or cartilage, that supports the body, serves as a framework for the attachment of muscles, and protects the vital organs and associated structures

**vertebrate** – any of a large group of animals having a backbone, including fish, amphibians, reptiles, birds, and mammals

*Vocabulary Source:*

The American heritage student science dictionary. (2005). Boston, Mass: Houghton Mifflin.

## Whole Picture:

Traditional Athabascan stories talk of caribou in a deeply spiritual way. In the past, people lived in harmony with all animals, but the caribou was one of the most highly regarded. In fact many believed that each caribou has a human heart within its chest and every human has a bit of caribou heart. Because of this connection, people will always have a spiritual knowledge of what the caribou is thinking and feeling. The caribou, in turn, will share in the thoughts and feelings of the people.

## Materials:

- Spaghetti noodles (one package)
- Glue (two bottles)
- Butcher paper
- Masking tape
- Straws (6 per pair of students)

- Toothpicks (two small boxes)
- Rubber bands (thin - large bag)
- Tennis balls (one per pair of students)
- Eggs (one per pair of students)
- Yard stick
- STUDENT LAB: "Protect the Egg"
- STUDENT INFORMATION SHEET: "Skeletons Protect"

## Activity Preparation:

1. Cook and cool half the spaghetti noodles. Store in a plastic bag. The other half will remain uncooked.
2. Devise a way to partition the classroom so teams doing the activity cannot see each other.
3. Cover two tables or desks with butcher paper. Secure with masking tape. Prepare an area for testing protective structures. (See STUDENT LAB: "Protect the Egg.")

## Activity Procedure:

1. Divide students into two groups. Explain they are going to do a teambuilding exercise. (Don't show them the materials yet.) The two groups will be in competition to see who can build the tallest structure using just spaghetti noodles and glue. Teams will have five minutes. They must work quietly so they don't give away strategy to the other team. Secure the partition (see Activity Preparation 2).
2. Once teams are in place at the two stations, give one team the uncooked noodles, the other the cooked. Both get glue. Begin timing.
3. Once time is up, remove the partition and compare progress. Ask students to explain why one team had an easier time than the other despite the fact they had the same "basic" materials. (The uncooked spaghetti provided support and structure.) Leave structures in place for now.
4. Ask students the following questions:
  - a. What is the support system in our bodies? (bones, skeletal system)
  - b. What would human bodies be like if there was no support? (limp, unable to stand or move, like the cooked spaghetti)
  - c. What about in other animals, like dogs? What is the support system? (again, bones, skeletal system)
  - d. What about fish? (again, bones, skeletal system)
  - e. How about bugs? Think about an ant. What supports the body of an ant? (introduce term exoskeleton) Explain students will learn about vertebrates. (define vertebrate)
5. Ask volunteers from the group working with cooked spaghetti to take some of the noodles to the structure made of uncooked spaghetti. Ask, "is there a way to add the cooked spaghetti to the structure? Why will it now stay? What do you think the cooked spaghetti might represent in the body of an animal?" (The cooked spaghetti could be muscle, organs, etc.)
6. Remind students the skeletal system not only helps hold bodies upright, but it protects things in the body as well. Ask students to think about different organs the skeletal system protects in vertebrates. Share the story of humans and caribou found in the Whole Picture section. Both human and caribou hearts are protected.
7. Divide students into pairs. Hand out STUDENT LAB: "Protect the Egg." Explain students will construct a protective structure for the egg. It must be able to withstand having a tennis ball dropped on it from two feet above. Read through the lab with students prior to beginning. Explain they must complete each step, in order, prior to testing their design. At STEP FIVE, designs will be tested one at a time with teacher guidance.
8. Allow students time to complete the lab through STEP FOUR. Guide students through STEP FIVE, then through the remaining questions on the lab.
9. Hand out STUDENT INFORMATION SHEET: "Skeletons Protect" and discuss. Ask the following critical thinking questions:
  - a. How many of you have ever bumped your head? What protected your brain?
  - b. What would happen to your brain when you bumped your head if the skull were made of thinner bone or simply covered in skin?

- c. If your ribs and sternum weren't protecting your heart, would it be safe to go sledding? Why?
  - d. Think about your favorite animal. What kinds of things does it like to do? Does it run and jump? Would it survive without the protection of the skeletal system?
  - e. Why do hunters need to understand how an animal's skeletal system is structured? How do they know what kind of weapon to use?
10. In student science journals, or on blank lined paper, ask students to finish the following prompt in a short paragraph: "The skeletal system protects by..."

### Extension Idea(s):

A fun and engaging way to explore the characteristics of a "body" is to have students dissect a pickle. Using an Internet search engine, enter the terms "dissect a pickle." You will find many lessons ideas.

### Answers:

#### **STUDENT LAB: "Protect the Egg"**

STEPS ONE through SIX: answers will vary.

*Further Questions:*

1. answers will vary
2. brain, heart, lungs
3. skull, rib cage

**NAME:** \_\_\_\_\_  
**PROTECT THE EGG**

**Directions:** Directions: Using only the materials supplied, build a protective structure for your egg. It must be able to withstand having a tennis ball dropped on it from two feet above

- Choose from these materials:
- straws, limit: 6
  - toothpicks, limit: 12
  - rubber bands, limit: 25
  - scrap paper, limit: 1 8½x11 piece (cut or torn)
  - Every pair gets one egg

**STEP ONE:**

Decide what materials to use. Collect materials, including one egg.

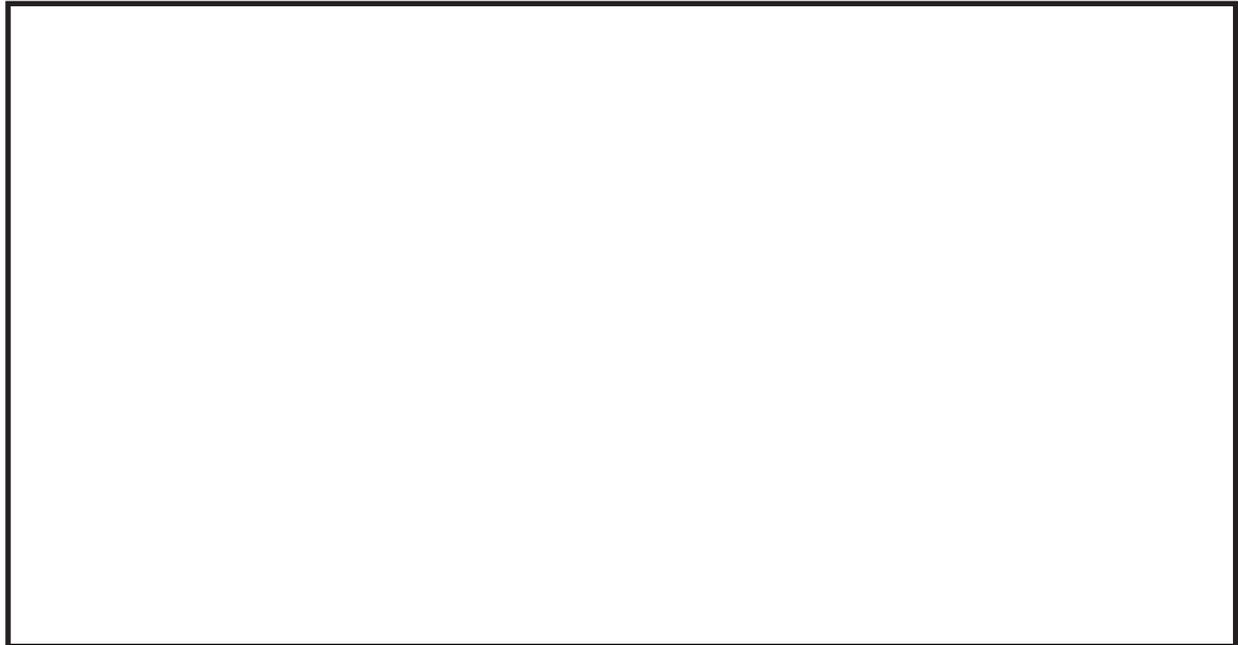
We are using:

\_\_\_\_\_

\_\_\_\_\_

**STEP TWO:**

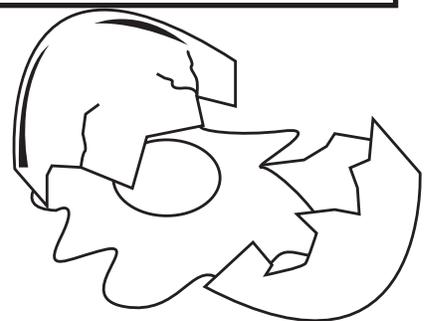
Plan your design. Draw your plan into the space below



**STEP THREE:**

Write a prediction. Use an "if, then" statement:

"If I build a protective structure by \_\_\_\_\_  
\_\_\_\_\_ then my  
egg will not break when a tennis ball is dropped from two feet above it."



1. Question regarding data (short answer). \_\_\_\_\_

NAME: \_\_\_\_\_  
**PROTECT THE EGG**

STUDENT WORKSHEET  
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**STEP FOUR:**

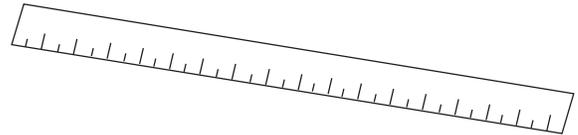
Construct a protective structure for your egg. Be careful not to break your egg while you work!

Draw your final design in the space below.



**STEP FIVE:**

Test your protective structure. Using a yardstick to measure, drop a tennis ball from two feet above your structure.



**STEP SIX**

Circle the word(s) that represent your results.

"My protective structure **did / did not** protect my egg when a tennis ball was dropped from two feet above"

**Further Discussion:**

1. What could you have done differently to better protect your egg? \_\_\_\_\_  
\_\_\_\_\_
2. What organs in the body of a vertebrate are as fragile as an egg and need to be protected? \_\_\_\_\_  
\_\_\_\_\_
3. What bones in the body of a vertebrate do the job of protecting fragile, vital organs? \_\_\_\_\_  
\_\_\_\_\_

## The skeletal system has three important jobs:

- It gives bodies shape and support. Without a skeleton, bodies would be a floppy mess.
- It protects vital organs. The brain is encompassed in the skull, the heart and lungs surrounded by the ribcage.
- It provides leverage for movement. Muscles are attached to bones and, working together, this allows a variety of movement

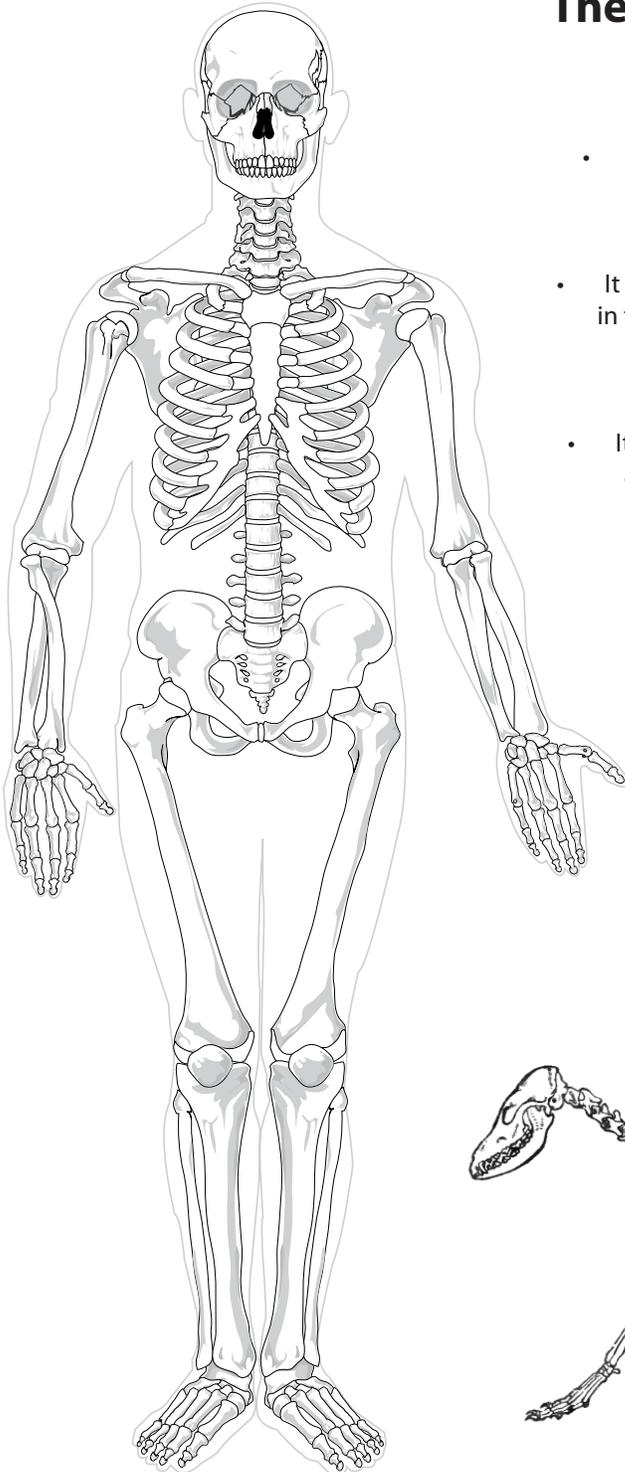


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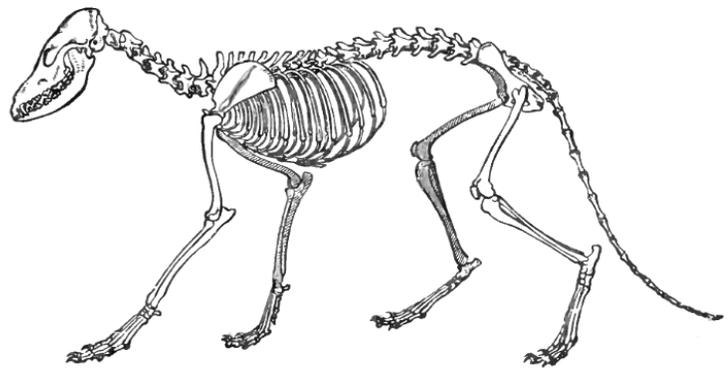


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