MUSEUMS of WESTERN COLORADO EDUCATION

Dinosaur Journey Exhibit Activity

Homology Hunt

High School
NGSS HS-LS 4-1
CO Science Standard LS 2-9

Background

As students explore the exhibit hall, they might notice similarities among the different animals on display. These are called **homologous traits**, which are structures that look similar but function differently in different organisms. Homologous traits occur when organisms inherit traits from a common ancestor, but evolve to use the traits differently. An example of this would be a human arm and a bat wing. Homologous traits are different from **analogous traits**, which occur when organisms independently develop traits with the similar functions, such as a bat wing and an insect wing.

Homologous traits can help paleontologists determine how different organisms are related. When organisms share similar traits, we know that they inherited those traits from a **common ancestor**, similar to how cousins share a same grandparent or how siblings share the same parent, but in this case a common ancestor represents a species rather than individuals.

To help understand these relationships, scientists can create a **phylogenetic tree**, a diagram depicting the evolutionary changes and possible relationships within a **lineage** (a group of organisms sharing a common ancestor). Students can think of a phylogenetic tree like a family tree. Each fork (called a **node**) in the tree represents a shared common ancestor. Species that are closely related share a more recent common ancestor than species that are farther apart. Phylogenetic trees can rely on a variety of data to determine relationships among species. These data can include: genetics, behaviors, or **morphology** (the structures of an organism). Because paleontologists rarely have genetic or behavioral data, most often they rely on morphological data. However, a phylogenetic tree only represents a hypothesis. By collecting more data, our understanding of relationships can change.

Concepts

- Paleontologists rely on homologous traits to determine the relationships among organisms.
- Relationships and evolutionary change within a lineage can be depicted with a phylogenetic tree
- Understanding common ancestry can have beneficial applications in agriculture and medicine

Learning Objectives

By the end of this lesson, students will be able to:

- Identify homologous traits
- Compare and contrast homologous traits among fossil and living organisms
- Create a simple phylogenetic tree
- Support their phylogenetic tree using evidence
- Explain the importance of understanding common ancestry

This lesson assumes students have some prior knowledge of evolution, extinction, species/speciation, analogous/homologous traits, and phylogenetic trees. If necessary, please review these concepts with your class before visiting Dinosaur Journey. Helpful videos to review these concepts include:

- Homologous Structures vs Analogous Structures | Key Differences: https://youtu.be/2N3OPRodRvk
- Phylogenetic trees | Evolution | Khan Academy: https://youtu.be/6_XMKmFQ_w8

During your visit

Engage: Take a guided or self-guided tour of Dinosaur Journey. If you choose to take a guided tour, please be sure to mention that you plan on doing this activitiy so that we can cover content for this lesson throughout the tour.

Explore: After the tour, divide the students into groups of two or three. Give each group a copy of the Homology Hunt worksheet. Using the worksheet, students will explore the museum in search of as many homologous traits that they can find in the time allowed. Students will also examine several specimens closely to determine their relationships on a phylogenetic tree.

Explain: After students have had time to complete the Homology Hunt worksheet, have them discuss their answers as a class. If necessary, guide the discussion towards correct answers and clear up any misconceptions that may arise. (Clarification for a potential misconception: bird wings and pterosaur wings are analagous as wings because of different ancestry, but they homologus as forearms)

After your visit

Elaborate: In the classroom, ask students to reflect on thier visit to Dinosaur Journey. Ask the class to write a short essay explaining why they think understanding common ancestry is important. (Answers coiuld include but are not limited to: medical research involving the use of animals for understanding human diseasees, testing or developing new drugs, gaining a better understanding of how human (or other animal) bodies work, development pesticides that only target specific pests, etc)

Evaluate: The teacher can use the Homology Hunt worsheet, the essay on common ancestry, or student participation during class discussions to evalute student performance. Contact the Education Department at Museums of Western Colorado if there are any questions regarding the identification of homologus traits on display at Dinosaur Journey.

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Name: Date:

Homology Hunt

Part 1:

Homologies are structures that look similar but function differently in different organisms. Homologus traits occur when organisms inherit traits from a common ancestor, but evolve to use the traits differently (for example, a human arm and a pterosaur wing). With your partner, identify as many homologus structures as you can in the exhibit hall. Draw and label the structures you find using the story boards and specimen labels for help. How do these structures function differently in each of your examples?

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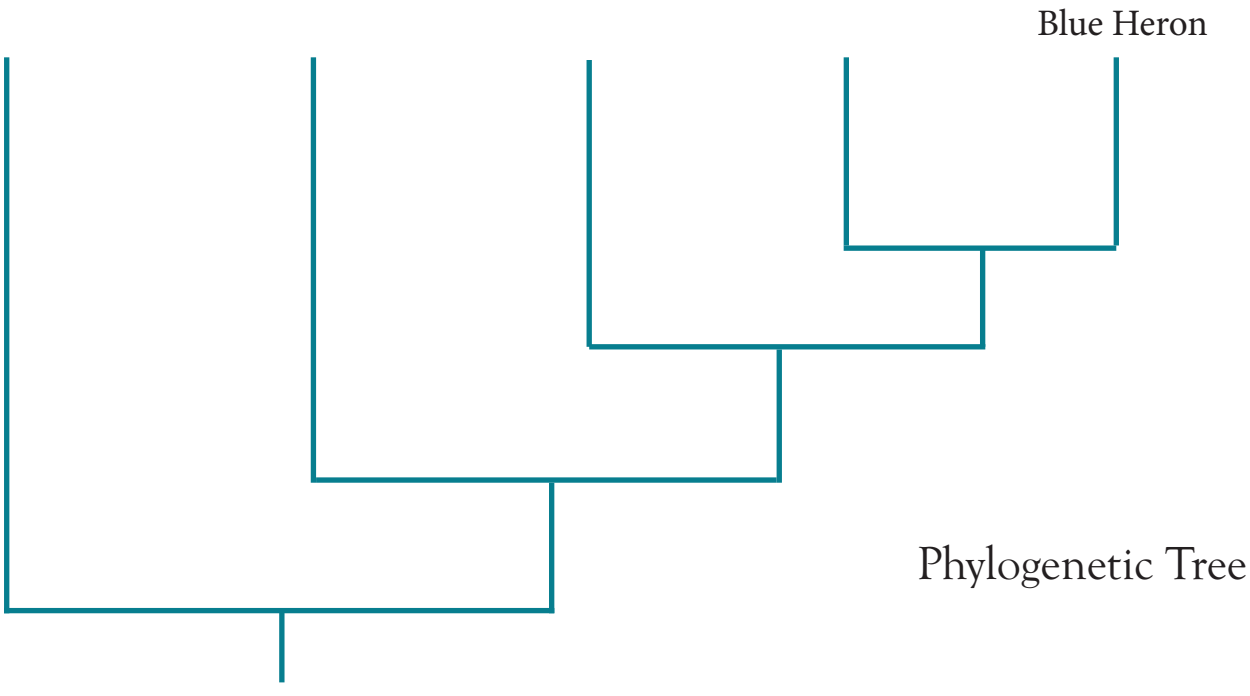
Part 2:

Compare and contrast the following specimens on display: Blue Heron, *Allosaurus*, *Archaeopteryx*, *Camptosaurus*, and *Velociraptor*. What do you think explains the similarities and differences? What do you think this tells us about the relationships among these animals? Fill out the phylogenetic tree below based on your observations. The Blue Heron is already been placed for you. (Remember organisms with the most shared traits are more closely related and should be closer on the phylogenetic tree than organisms with fewer shared traits. Some helpful traits to look at would be number of toes, presence of feathers, toe claws, types of teeth, etc)



Phylogenetic Tree