Suggested science learning activities for SPS students during the COVID-19 school closure. Seattle Public Schools is committed to making its online information accessible and usable to all people, regardless of ability or technology. Meeting web accessibility guidelines and standards is an ongoing process that we are consistently working to improve.

While Seattle Public Schools endeavors to only post documents optimized for accessibility, due to the nature and complexity of some documents, an accessible version of the document may not be available. In these limited circumstances, the District will provide equally effective alternate access.

Due to the COVID-19 closure, teachers were asked to provide packets of home activities. This is not intended to take the place of regular classroom instruction but will help supplement student learning and provide opportunities for student learning while they are absent from school. Assignments are not required or graded. Because of the unprecedented nature of this health crisis and the District’s swift closure, some home activities may not be accessible.

If you have difficulty accessing the material or have any questions, please contact your student’s teacher.
Grade 8 Science
Evolutionary History Unit Lesson 11
Instructional Materials for Amplify Chap. 3, Lesson 3.2

AmplifyScience

Student Name: _____________________________________________
School: _________________________________________________
Grade Level: ____________________________________________
Science Teacher: _________________________________________
Hello Families,

We hope you and your family are well and safe during this time. During this unprecedented out-of-school time, the SPS middle school science team will be offering instructional opportunities for students that align with the district’s adopted middle school science instructional materials.

This investigation packet is part of a series of district-aligned lessons for middle school science developed by AmplifyScience and adopted by SPS in 2019. While Amplify Science lessons are designed to be done in the classroom with peers, there are some activities that students can complete at home. In this packet you will find activities to accompany lessons in the unit. **Accompanying lesson videos are posted on the SPS Science webpage under their corresponding grade level.** These lesson videos, developed in collaboration between SPS teachers, Denver Public Schools teachers, and Amplify Science, feature teachers going through the information in the lessons. **The work in this packet is intended to be completed alongside the viewing of the video of the corresponding videos.** To find the correct lesson videos go to SPS Science webpage, scroll to your grade level, find the unit you are looking for, and select the video that matches the lesson you are completing that day.

For students who have access to the internet and the following devices and browsers may wish to log-in to their AmplifyScience account from home are welcome to do so. Chrome and Safari are the recommended browsers to use for full functionality of the Amplify digital tools and features.

Sincerely,

The Seattle Public Schools Science Department

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*Grade 8, Evolutionary History Unit, SPS Science, 4-2020*
Lesson 11

Unit Question
Why do species, both living and extinct, share similarities and also have differences?

Chapter 3 Question
How can we tell if the Mystery Fossil is more closely related to wolves or to whales?

Vocabulary
✓ body structure
✓ common ancestor population
✓ descendant species
✓ evolution
✓ evolutionary time
✓ paleontologist
✓ related
✓ shared structure
✓ species

Activity 1: Warm-up
Which species is Species C more closely related to?
Scientists have found a new fossil and they want to know which species it is more closely related to. What is the best place to put Species C on the evolutionary tree below?
1. Where should Species C be placed on the tree?

☐ space 1  ☐ space 2

2. What is one body structure you used to make your decision?

☐ skull  ☐ backbone  ☐ tail  ☐ front limb  ☐ back limb

3. Explain how this body structure helped you make your decision.

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How Paleontologists Determine Relatedness Video

1. Let’s Review the Lesson Investigation Question:  *When you compare different species, how can you tell which species are more closely related than others?*

   - How do you think paleontologists make this determination?  Think about the models you saw created using the K’NEX and the Modeling Tool in Lesson 10 (3.1).
   - Paleontologists look for shared body structures; species are more closely related when they share special diagnostic structures not shared with other species.]

2. Let’s connect the Investigation Question to placing the Mystery Fossil. Knowing how to answer this question will help you decide where to place this Mystery Fossil in the museum!
✓ The museum is organized so that species that are more closely related are placed near one another.
✓ We want to place the Mystery Fossil in a section of the museum where it will be near other types of organisms that it is closely related to—either whales or wolves.
✓ Knowing how paleontologists determine which species are more closely related (when comparing three or more species) will help you place the Mystery Fossil in the museum.

3. Let’s watch the How Paleontologists Determine Relatedness video (it is also viewable in the Amplify Science platform in Chapter 3, Lesson 3.2, tab #2).

✓ This video shows how paleontologists make determinations about how closely related to each other they think different species are.
✓ In this video, you will learn more about the process paleontologists use to determine how closely related different species are when they are comparing three or more different species.

4. What did you notice about what paleontologists look for when they look at a species?

✓ They look for a body structure that is unique and shared by one species and its ancestor!
Activity 2: Investigating the Relatedness of Extinct Whales

**Goal:** Study cetacean species structures in order to place them on the evolutionary tree by determining which species are more closely related in the Sim, and then reflect on diagnosing relatedness. Place all cetacean species onto the evolutionary tree.

**Do:**
- If you have access to the Amplify Science platform, go to Chap 3, Lesson 3.2 and use the Chrome browser to open the SIM.
- Open the Cetaceans mode of the SIM, press TREE to open Tree View, and navigate to the Cetaceans branch of the tree.
- Study the Blue Whale and Orca structures.
  - Review the Structures tab in the Study windows of Blue Whale and Orca. Note that both species have nostrils at the top of their skulls and lack full back limbs.
  - Review the Structures tab in the Study windows of Dorudon and Kutchicetus. Invite students to share what they notice about these species’ body structures that might help them decide which species to place in Location 1.
- Read the questions below and choose between the two possible species given in the question to place in that Location on the evolutionary tree, beginning with Location 1, then repeat this for each of the locations. For each location,
  - **Tip:** Use the Structures tab in the Study windows and the “i” icons to help you make your decisions.
1. Which of these two species belongs in Location 1? (Hint: Investigate hind limbs and skulls.)
   - Dorudon
   - Kutchicetus

2. Which of these two species belongs in Location 2? (Hint: Investigate limb sizes.)
   - Pakicetus
   - Kutchicetus

3. Which of these two species belongs in Location 3? (Hint: Investigate limb sizes.)
   - Indohyus
   - Ambulocetus

4. Which of these two species belongs in Location 4? (Hint: Investigate hind limb structures.)
   - Pakicetus
   - Indohyus

5. Which species is Dorudon more closely related to: the blue whale or Ambulocetus? Which diagnostic structure(s) could you use to show this?

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Activity 3: Student-to-Student Discussion: Word Relationships

At the end of the lesson, you will be asked to decide whether the Mystery Fossil is more closely related to whales or wolves. To prepare for this work, answer the following question:

When you compare different species, how can you tell which species are more closely related than others?

Word Relationships Directions:

- Use at least two different Word Relationships words from the Word Bank below in each sentence of your answer.
• You may use the same word more than once.
• You do not need to use all the vocabulary words.
• There are many different ways to answer the question, and you will need to create more than one sentence in order to express your ideas completely.

Word Bank

<table>
<thead>
<tr>
<th>common ancestor population</th>
<th>evolution</th>
<th>shared structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>descendant species</td>
<td>related</td>
<td>species</td>
</tr>
</tbody>
</table>

Activity 4: Homework: Shared Structures and Relatedness Among Carnivores

Today, you learned about how paleontologists look for shared structures to figure out how closely related different species are. In this homework activity, you will use the evolutionary tree in the Sim to look at some of the structures shared by species in the Carnivora order.

Goal: Use shared structures to place the dire wolf and saber-toothed cat on the evolutionary tree.

Do:

 If you have access to the Amplify Science platform, go to Chap 3, Lesson 3.2 and use the Chrome browser to open the SIM

 Open the Mammals mode of the SIM, press TREE to open Tree View, and navigate to the Laurasiatheria branch of the tree.

 Study the following species:
  o Dire wolf and saber-toothed cat in the Fossil Collection.
  o African lion and gray wolf on the evolutionary tree.

 Use similarities and differences in shared structures to decide which species are most closely related to the dire wolf and the saber-toothed cat, and place these fossil species on the tree accordingly.
From about 250,000 years ago until the end of the Ice Age 10,000 years ago, large numbers of **Dire wolves** (*Canis dirus*) lived in North and South America. Dire wolves probably lived and hunted in large packs, and they mostly ate large prey such as bison, sloths, and even elephant-sized mastodonts. Dire wolves were a little larger than modern wolves, about 1.5 m (5 feet) long and weighing up to 80 kg (175 lbs). They also had stronger jaws and larger carnassial (slicing) back teeth compared to modern wolves. Dire wolves went extinct at the end of the Ice Age, probably because the large herbivores they hunted also went extinct around that time.

Smilodon [SMIL-oh-don], or the **saber-toothed cat**, was a predator that roamed North and South America starting 40,000 years ago, until they went extinct 10,000 years ago. Smilodon was a little shorter than a lion, but it weighed twice as much, with short but powerful legs. It probably lived in social groups, like lions do today, but unlike the lion, Smilodon had a very short tail and very long canine teeth—up to 18 cm (7 inches) long! Smilodon hunted large herbivores such as bison by sneaking up on these animals and ambushing them, using its saber teeth to deliver a quick, fatal stab.
Compared to other living cat species, the lion is the most social. Lions live in groups called prides, which are composed of related females and a few males, and the females of the pride hunt together. There are several different species of lions, but the best-known is the African lion (Panthera leo), which can be recognized by the male's large mane. African lions evolved about one million years ago. These lions used to live throughout Africa and some of Asia. However, they now live only in some areas of Africa because humans have taken over much of their former habitat. African lions mostly hunt at night, and they eat a range of animals such as zebras and buffaloes.

There are several wolf species living today, and the gray wolf (Canis lupus) is the largest of them, weighing as much as 45 kg (99 lbs). Gray wolves are extremely social. They live and hunt in small family groups called packs and they communicate with each other using facial expressions, tail and body movements, and sounds including barks and howls. Gray wolves hunt prey of all sizes, including deer, elk, and rabbits. They have lived throughout Europe, Asia, and North America since about 2 million years ago. Modern dogs shared a common ancestor with the gray wolf about 40,000 years ago, when some of these wolves started living near human groups and evolved to become social with humans.
1. What are some structures that are shared between all four species?
__________________________________________________________________________________
__________________________________________________________________________________

2. What diagnostic shared structure(s) helped you decide where to place the dire wolf and the saber-toothed cat on the evolutionary tree?
__________________________________________________________________________________
__________________________________________________________________________________