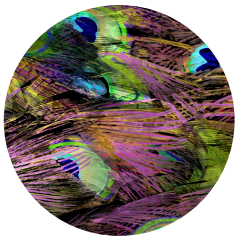

Ch-Ch-Ch-Ch-Changes

The Foundations of Evolution

Brittany Bowens
Published by *K20 Center*

Grade Level	9th – 10th Grade	**Time Frame**	212 minutes
Subject	Science	**Duration**	4-5 periods
Course	Biology		

Essential Question

How does environmental change impact evolutionary shift(s) in an organism's genetic makeup?

Summary

In this lesson, students will examine the facts associated with evolution, make inferences about an organism based on fossilized remains, explore how evolution is influenced by the environment, and construct a timeline of an organism's evolution as a result of environmental factors or human impact over time. This lesson offers multimodality, which means it offers face-to-face, online, and hybrid versions. The attachments also include a downloadable Common Cartridge file, which can be imported into a learning management system (LMS) such as Canvas or eKadence. The cartridge also includes interactive student activities and teacher's notes.

Snapshot

Engage

Students watch a video and respond to guiding questions about how mutations of an organism lead to evolution.

Explore

Students make inferences about an organism's lifestyle based on its fossil remains and discuss their inferences with their peers.

Explain

Students analyze how evolutionary selection occurs.

Extend

Students construct an evolutionary timeline and examine environmental factors that cause evolutionary shifts.

Evaluate

Students reflect on previous knowledge and misconceptions about evolution and compare them to what they learned in the lesson.

Standards

ACT College and Career Readiness Standards - Science (6-12)

EMI301: Identify implications in a model
EMI401: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text
EMI601: Determine which complex hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text

Oklahoma Academic Standards (Biology)

B.LS4.5 : Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
B.LS4.5.1: Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species.
B.LS4.5.2: Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' adaptation over time is lost.

Attachments

- Addie's Story S-I-T Activity—Ch-Ch-Ch-Ch-Changes - Spanish.docx
- Addie's Story S-I-T Activity—Ch-Ch-Ch-Ch-Changes - Spanish.pdf
- Addie's Story S-I-T Activity—Ch-Ch-Ch-Ch-Changes.docx
- Addie's Story S-I-T Activity—Ch-Ch-Ch-Ch-Changes.pdf
- Addie's Story Video Questions (Answer Key)—Ch-Ch-Ch-Ch-Changes.docx
- Addie's Story Video Questions (Answer Key)—Ch-Ch-Ch-Ch-Changes.pdf
- Addie's Story Video Questions—Ch-Ch-Ch-Ch-Changes - Spanish.docx
- Addie's Story Video Questions—Ch-Ch-Ch-Ch-Changes - Spanish.pdf
- Addie's Story Video Questions—Ch-Ch-Ch-Ch-Changes.docx
- Addie's Story Video Questions—Ch-Ch-Ch-Ch-Changes.pdf
- Common Cartridge—Ch-Ch-Ch-Changes.zip
- Extend Rubric—Ch-Ch-Ch-Ch-Changes - Spanish.docx
- Extend Rubric—Ch-Ch-Ch-Ch-Changes - Spanish.pdf
- Extend Rubric—Ch-Ch-Ch-Ch-Changes.docx
- Extend Rubric—Ch-Ch-Ch-Ch-Changes.pdf
- Lesson Slides—Ch-Ch-Ch-Ch-Changes.pptx

Materials

- Common Cartridge (attached)
- Learning Management System (LMS) account
- Addie's Story Video Questions handout (attached; one per student)
- Addie's Story Video Questions Answer Key document (attached; for teacher use)
- Addie's Story S-I-T Activity handout (attached; one per student)
- Extend Rubric (attached; one per student)

Preparation

Preparation instructions are outlined below for the face-to-face, online, and hybrid versions for this lesson.

Face-to-Face Lesson

Prior to the Explain phase of the lesson, create a Word Cloud on Mentimeter. Copy the invite code and QR code for the Word Cloud and insert the codes into the highlighted sections on **slide 13** of the **Lesson Slides**.

Online Lesson

Prepare your LMS for the lesson using the attached **Common Cartridge**.

Prior to the Explain phase of the lesson, create an EdPuzzle and embed the *Evolution 101* video. Include any additional questions throughout the video that you want students to answer. Assign the EdPuzzle to students and ensure that they are accessing the student version, not the editable version with questions.

Additionally, create a Word Cloud on Mentimeter and share the invite code in your classroom's LMS.

Prior to the Evaluate phase of the lesson, create a discussion board in Padlet and share the link and QR code with students.

Hybrid Lesson

Prior to the Explain phase of the lesson, create a Word Cloud on Mentimeter. Copy the invite code and QR code for the Word Cloud and insert the codes into the highlighted sections on **slide 13** of the **Lesson Slides**.

Prior to the Evaluate phase of the lesson, create a discussion board in Padlet and share the link and QR code with students.

75 minutes

Engage

Teacher's Note: Preparation

Prepare for the first activity of the lesson by uploading the **Addie's Story Video Questions** to your learning management system (LMS) in a quiz format. You may also consider using EdPuzzle for the quiz.

Begin the lesson by having students watch the PBS video, *Hunting the Nightmare Bacteria*. Have them respond to the **Addie's Story Video Questions** in a quiz format within your LMS as they watch. Provide students with at least two days to complete this activity.

Optional Modifications

This activity is designed for students to complete individually, but you are welcome to show the video to the class and have students respond to the questions as a whole class.

Teacher's Note: Completing as a Class

If you are watching the video with the whole class, pause the video at the 34:25 minute mark, which should show a Petri dish. Draw students' attention to question 17 of the quiz questions. Have them read the passage found on their handouts, also reproduced below, and examine the Petri dish on screen.

"Notice, at the 34-minute mark of this film, the Petri dish shows a resistance test. Each white disc is a piece of paper infused with a different antibiotic. The clear area around the center disc demonstrates that the disc's antibiotic is effective against the bacteria being tested. The left disc's antibiotic is partially effective. The lack of a clear area around the other discs indicates that the bacteria are resistant to those antibiotic samples. The bacteria around those discs have grown enough to touch the discs."

Sample Student Responses

Sample student responses for the Addie's Story Video Questions handout can be found in the attached **Addie's Story Video Questions (Answer Key)** document.

After students complete the quiz questions, introduce the S-I-T (Surprising, Interesting, Troubling) instructional strategy. Ask students to create a discussion post in your LMS that includes one surprising fact or idea, one interesting fact or idea, and one troubling fact or idea from the video.

Have students then read their peers' discussion posts and choose one post to respond to. Have students respond to one of the three points in their chosen post, providing additional input through words or an image. Remind students to follow proper posting netiquette when responding to their peers.

Teacher's Note: Recommended Discussion Settings

To help students develop their own opinions and to allow for student discourse, consider updating the discussion options to allow for threaded replies. Consider hiding previous discussion posts prior to having students post.

For more information about facilitating an effective online discussion, read the K20 Center's best practices for online discussions.

30 minutes

Explore

This assignment can be completed in Nearpod or in a discussion board in your LMS.

Introduce the Photo Deconstruction instructional strategy. Have students view a photo, selected by either yourself or the students, of a fossilized organism and have them make inferences about the animal's lifestyle based on the fossil (e.g., what the animal may have eaten, where it may have lived, which other animal(s) it could be related to and why). Have them record these inferences in a discussion post.

Have students then read three other classmates' posts and reply to those posts to elaborate on their peers' opinions and observations. Consider prompting further discussion by showing a side-by-side comparison of the fossil of a modern-day organism and the fossil of that organism's ancestor. Have students note the differences and infer what may have caused any changes.

Teacher's Note: Completing as a Class

If completing this activity as a class, clear up any misconceptions or emphasize any comments that align to the lesson standards. Recognize comments that are being stated multiple times—these comments could indicate that students are already familiar with a concept and you can spend less time explaining it.

If students are completing this activity on their own, you can still engage with the discussion in the same way. Provide a date and time for the initial post and the follow-up peer response post. Have students add their names or initials next to their posts and peer responses.

15 minutes

Explain

Have students watch your created EdPuzzle video, Evolution 101, and have them respond to the questions throughout the video.

Have students then navigate to the Mentimeter word cloud using the invite code you previously created. Ask students to choose one or words that communicate the overall concept or theme of evolution based on what they learned from the *Evolution 101* video.

Teacher's Note: Completing as a Class

If you are having students complete the word cloud as a class, share the word cloud with the whole group as words are added. Comment on common themes and elaborate on major points as they are made.

If students are working on the word cloud independently, allow 24 hours for students to respond to the video questions and add to the word cloud. After students submit their work, post the word cloud results in your LMS by embedding the word cloud or sharing a screenshot.

90 minutes

Extend

Provide students with information about what a timeline is and what it can illustrate about an organism or species. Invite students to develop a timeline of an organism of their choice (plant, animal, fungi, bacteria, protist) using a program such as Adobe Spark or another program of their choosing.

Provide students with the attached **Extend Rubric** to help guide the timeline expectations. Share the following requirements for the timeline with students:

- Timelines should demonstrate:
  - How the organism evolved over at least three different time periods.
  - The environment conditions and factors that may have caused the evolutionary shift during each time period.

Optional Variations

If you want variety among kingdoms, you can assign each student a specific kingdom. Have students share their findings with the entire class.

Teacher's Note: Rubric

See the attached Extend Rubric to evaluate students' submissions.

If meeting with students, review the rubric and ensure that students understand what is expected of them.

Have students share their findings with the class.

2 minutes

Evaluate

Have students navigate to the Padlet you prepared prior to the lesson. Introduce students to the I Used to Think... But Now I Know instructional strategy. Have students post responses in the Padlet sharing what they used to think about evolution compared to what they know now. Ask students to respond to at least two of their classmates' posts.

Teacher's Note: Activity Goals

This activity enables students to examine any misconceptions they have about evolution and helps them understand the role the environment plays as an organism adapts in order to survive.

Resources

- Adobe. (n.d.). Free online custom timeline maker. https://www.adobe.com/express/create/timeline
- Bever, G. S., & Norell, M. A. (2017). *A new rhynchocephalian (Reptilia: Lepidosauria) from the Late Jurassic of Solnhofen (Germany) and the origin of the marine Pleurosauridae* [Image]. Wikimedia Commons. https://commons.wikimedia.org/wiki/Category:Vadasaurus#/media/File:Vadasaurus_herzogi_holotype_(fossil).jpg
- Hudson Institute of Mineralogy. (n.d.). *Vadasaurus herzogi*. Mindat. https://www.mindat.org/taxon-9398973.html
- Huizen, J. (2015, October 26). *Why the dodo deserves a new reputation.* Audubon. https://www.audubon.org/news/why-dodo-deserves-new-reputation
- John Hopkins University. (2017, December 7). *Meet Vadasaurus, a foot-long, ancient swimming reptile.* https://hub.jhu.edu/2017/12/07/vadasaurus-reptile-fossil/
- K20 Center. (2021, September 21). *K20 Center 2 minute timer* [Video]. YouTube. https://www.youtube.com/watch?v=HcEEAnwOt2c
- K20 Center (n.d). Collaborative word clouds. Strategies. https://learn.k20center.ou.edu/strategy/103
- K20 Center. (n.d.). Chain notes. Strategies. https://learn.k20center.ou.edu/strategy 52
- K20 Center. (n.d.). Edpuzzle. Tech tools. https://learn.k20center.ou.edu/tech-tool/622
- K20 Center. (n.d). I used to think...but now I know. Strategies. https://learn.k20center.ou.edu/strategy/137
- K20 Center. (n.d.). Mentimeter. Tech tools. https://learn.k20center.ou.edu/tech-tool/645
- K20 Center. (n.d). Nearpod. Tech tools. https://learn.k20center.ou.edu/tech-tool/4803
- K20 Center. (n.d.). Padlet. Tech tools. https://learn.k20center.ou.edu/tech-tool/1077
- K20 Center. (n.d.). Photo or picture deconstruction. Strategies.
- https://learn.k20center.ou.edu/strategy/140
- K20 Center. (n.d.). S-I-T. Strategies. https://learn.K20center.ou.edu/strategy/926
- Micu, A. (2017, November 8). *Fossilized ancient lizard shows how dinos evolved to live in the oceans*. ZME Science. https://www.zmescience.com/science/ancient-lizard-dino-evolve-ocean-0432/%C2%A0
- Nova Labs. (2020). *Evolution 101* [Video and interactive game]. PBS Online. https://www.pbs.org/wgbh/nova/labs//lab/evolution/research#/chooser
- Young, R. (Producer). (2017). Hunting the nightmare bacteria (Season 2013, Episode 14) [TV series episode]. In *Frontline*. Public Broadcasting Services (PBS).