



Ch-Ch-Ch-Ch-Changes

Biology



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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) on an organism's genetic makeup?

Summary

In this lesson, students will examine the facts associated with evolution, infer what fossilized remains can inform us about an organism, explore how evolution is influenced by an ever-changing environment, and construct a timeline of an organism change resulting from environmental factors or human impact over time. This is a multimodality lesson, which means it includes face-to-face, online, and hybrid versions of the lesson. 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 includes interactive student activities and teacher's notes.

Snapshot

Engage

Students answer guiding questions throughout the video about how mutations lead to the evolution of an organism.

Explore

Students determine an organism's lifestyle based on its fossil remains.

Explain

Students analyze how evolutionary selection occurs.

Extend

Students analyze the environmental causes of an organism's evolutionary shift.

Evaluate

Students share their understanding of evolution by creating an evolutionary timeline of an organism.

Standards

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

IOD403: Translate information into a table, graph, or diagram

SIN502: Predict the results of an additional trial or measurement in an experiment

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

EMI403: Determine which models imply certain information

EMI502: Determine whether presented information, or new information, supports or contradicts a simple hypothesis or conclusion, and why

EMI505: Determine which experimental results or models support or contradict a hypothesis, prediction, or conclusion

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-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

- Set-up that allows videos and slide decks to be presented for everyone to view
- Common Cartridge (attached)
- Lesson Slides (attached)
- Addie's Story Video Questions handout (attached; one per student)
- Addie's Story S-I-T Activity handout (attached; one per student)
- Extend Rubric (attached; one per student)
- Sticky notes (one per student)

75 minutes

Engage (Face to Face)

Go to **slide 5**. Inform students that they will be playing the game telephone. Pull the first student aside to whisper the following phrase, "**The dodo birds were a flightless bird that laid one egg until humans arrived.**" That student will be asked to whisper that same phrase only one time to the next individual. students will continue to pass the message along until it reaches the last individual. That individual will tell the whole class what the phrase originally was.

Teacher's Note

As students are passing the phrase from person to person, be sure to walk around and interrupt the students as they are trying to pass the message. Intentionally target those that are trying to pass the message with questions like, "Hey Kim what did you do this weekend?" or "John how did the football game go this past Friday?" Some students may catch on that you are trying to mess them up intentionally but keep it going until the end. After the last individual tells the phrase to the entire class the class answer the following questions out loud:

- *What did each person in the call represent: **The organism***
- *What did the phrase represent: **DNA***
- *What did the the instructor represent: **The environment***
- *What did we notice happen to the phrase we started with and the one at the end?: **It changed***
- *What did we call that change in the last unit?: **A mutation***
- *And what did you notice that caused that change?: **The environment***

Point out that the dodo bird was a real bird that existed on Mauritius Island. Its extinction illustrates an evolutionary process. Share with students that the dodo bird became extinct for two reasons: (1) overhunting by humans — resulting in a dramatic change in their environment; and (2) their reproduction process. They were able to produce only one offspring (one egg) at a time, limiting the number of birds on the island at any one time. They rapidly became extinct when Portuguese sailors hunted them for food and destroyed their habitats.

Introduce the concept that a shift in an organism's DNA and overall features is often a change that is enforced by their environment. This process is called **evolution**. The extinction of the dodo bird is an example of how the environment can significantly affect an organism or an entire species.

Take a minute to address general misconceptions of the word *evolution*. It is often misunderstood. This lesson does not focus on how life begins. What it does focus on, however, is change over time. When the lesson is complete, the students will understand that evolution is a very slow process, and the evidence that scientists have studied for many decades confirms that, while change in living species is slow, it definitely occurs and can be traced.

Pass out the attached **Addie's Story Video Questions** handout, PBS'S [Hunting the Nightmare Bacteria](#). Go to **slide 6** and have students answer the questions as they follow along.

Teacher's Note

It is recommended that you show half of the video, after telephone, and finish out the other half the following day.

At the 33 minute mark of the movie, you may pause and explain the following: *"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 shows that antibiotic is effective against the bacteria being tested. The one on the left is partially effective, while the others show the bacteria is resistant to those antibiotics because it has grown right up to the disc."*

This activity can also be done independently through Edpuzzle. For more information, see [the K20 Center's instructions on how to use Edpuzzle](#).

After viewing the video, pass out the attached **Addie's Story S-I-T Activity** handout. Go to **slide 7** and have students complete the [S-I-T \(Surprising, Interesting, Troubling\) strategy](#). This task includes aspects of the [Chain Notes Strategy](#) as well. Instruct students to individually identify one surprising fact or idea, one interesting fact or idea, and one troubling fact or idea from the video and write them down on a piece of paper.

Next, have students swap their papers in an assigned group of 3-4 clockwise. Have students choose one of the three points made by the original writer and give an additional fact, idea, or correction through words or drawings. They should continue to pass and add to each paper until the paper gets back to the original writer. Have the groups read through all the responses they received from their classmates. Then, give them 5 minutes to discuss a summary of the main lesson they gathered from Addie's video concerning evolution. Have one person from each group share their group's summary.

Teacher's Note

During the S-I-T exercise, walk around to ensure that each student has had enough time to add to each paper. Allow students about 10-15 minutes to jot down their initial S-I-T responses, 5 minutes for each peer response, 5 minutes to review their paper's responses, and 5 minutes to discuss their group summary.

Choose a group spokesperson by asking a general question such as, "Who is the youngest person in the group?" Then have that student choose a fellow student to speak for their group.

30 minutes

Explore (Online)

This assignment can be completed in a program called [Nearpod](#), or a discussion board in your LMS. Students should use a modified version of the [Photo Deconstruction Strategy](#). They should view a photo of a fossilized organism that is given or one of their choosing, and infer about this animal's lifestyle based on its fossil, ie. what it might have eaten, what area it may have lived, what animal do they think it's related to and why, etc. Students should then view three classmates and add a response that elaborates on their peer's opinions. You could also show a side by side fossil of an organism today compared to the fossil of its ancestor and have students notice the differences and infer what may have caused that change.

Teacher's Note

If completing as a class, clear up some potential misconceptions or emphasize any comments that are aligned to the standard. Recognize comments that are being stated multiple times, this could be an indicator that you may not need to spend much time later in the lesson on explaining it.

If students are completing this activity on their own, you can use Nearpod to get the same effect. Give a date & time for the initial post and peer response post. Be sure to have students add their names or initials next to their posts and peer responses. If you like, after the discussion, you can share the true origin of this fossil, the extinct *Raphus cucullatus*, dodo bird, to allow students to compare their observations to those of researchers:

- [Why the Dodo Deserves a New Reputation](#)
 - Huizen, Jennifer. (2015, October 26). Why the Dodo Deserves a New Reputation. Audubon. <https://www.audubon.org/news/why-dodo-deserves-new-reputation>

15 minutes

Explain (Face to Face)

Go to **slide 10** and introduce students to the Nova Labs video "[Evolution 101](#)." Open this video from a browser—the PBS link cannot be posted in the slide deck.

This video lasts 4:47 minutes. Stop at the 4:23 mark, where the substance of the video ends.

After watching the video, go to **slide 11**. Explain the concept of [Collaborative Word Clouds](#) to the students. Direct them to [Mentimeter](#), where the class can collaboratively create a word cloud.

Guide the students in choosing one or two words that communicate the overall concept or theme about evolution from the Evolution 101 video.

Key in and elaborate on the main points the groups make. Ask them to comment on what words are used most frequently. Elaborate on the major points made by each group.

Teacher's Note: Asynchronous Teaching

If you want students to work independently on their Word Clouds, assign them to work in [Edpuzzle](#).

Allow 24 hours for completion of the video questions and Word Cloud. After students have submitted their projects, post the word cloud results on Canvas, either via embedding or screenshot. View an example word cloud in Mentimeter here: [Mentimeter link](#).

90 minutes

Extend (Face to Face)

Go to **slide 12**. Invite students to develop a timeline of an organism (plant, animal, fungi, bacteria, protist) of their choice. A program such as [Adobe Spark](#) can be used for this activity. Students will need to show:

- How the organism has evolved over time in at least three different periods.
- What the environmental conditions and factors are that may have caused an evolutionary shift during each time period.

Optional: Variety

If you want more variety among kingdoms, you can assign each student a kingdom from which they can choose their organism.

Teacher's Note: Rubric

See the attached **Extend Rubric** to evaluate students' submissions.

If meeting with students, go over the instructions and rubric to make sure students know what is expected of them.

Have students share their findings with the class.

2 minutes

Evaluate (Online)

Teacher's Note

Create a discussion board in [Padlet](#) and share the link and QR code on **slide 13** with your students.

Go to **slide 13**. Instruct students to complete the [I Used to Think... But Now I Know](#) activity. Have students respond to the prompt in [Padlet](#), comparing what they used to think about evolution with what they now know. In addition, ask students to respond to at least two of their classmates' posts.

Teacher's Note: Activity Details and Goals

The [I Used to Think... But Now I Know](#) and [Padlet](#) activities enable students to examine any misconceptions they may have about evolution and, more importantly, help them understand the role environment plays as an organism adapts in order to survive.

Resources

- Hudson Institute of Mineralogy. (1993). [Vadasaurus herzogi](https://www.mindat.org/taxon-9398973.html).
<https://www.mindat.org/taxon-9398973.html>
- John Hopkins University Staff. (2017, December 07). Meet Vadasaurus, a foot-long, ancient swimming reptile.
<https://hub.jhu.edu/2017/12/07/vadasaurus-reptile-fossil/>
- K20 Center. (n.d.). S-I-T. Strategies. <https://learn.k20center.ou.edu/strategy/926>
- 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.). Padlet. Tech tools. <https://learn.k20center.ou.edu/tech-tool/1077>
- Micu, A. (2017, November 08). Fossilized ancient lizard shows how dinos evolved to live in the oceans.
<https://www.zmescience.com/science/ancient-lizard-dino-evolve-ocean-0432/%C2%A0>
- PBS Online: Nova Labs. (2020). Evolution 101. | WGBH Educational Foundation.
<https://www.pbs.org/wgbh/nova/labs/lab/evolution/research#/chooser>
- Young, R. (2013, October 23). Hunting the Nightmare Bacteria. | PBS.
<https://www.pbs.org/wgbh/frontline/film/hunting-the-nightmare-bacteria/>