



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 I		

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

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
- 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

Use the attached **Lesson Slides** to follow along with the lesson. Begin with **slide 5**. Share the guidelines for the game "Telephone" with students.

- Pull the first student aside (if possible, into a hallway or other space where a conversation can be had at a normal level without being heard) and tell them the following phrase: "**The dodo bird was a flightless bird that laid one egg until humans arrived**" to the first student.
- Instruct the first student to whisper the same phrase to the student next to them. **They can only say the phrase once.**
- Have students continue whispering the message student-to-student until it reaches the last student.
- Have the last student in the chain announce to the whole class what they heard.
- Have students discuss changes in the phrase as a result of its being passed from person to person.

Teacher's Note: Playing Telephone

As students whisper the phrase from person-to-person, walk around and interrupt students as they are trying to pass the message. Intentionally target those who 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 interrupt the message intentionally, but brush this off and encourage the next person to keep passing the message until every student has "heard" the whispered phrase. Ask the last student to state the phrase aloud to the entire class. After the student has announced the phrase, ask the following questions to the group:

- *What does each person in the circle represent? **An organism***
- *What does the phrase represent? **DNA***
- *What does the teacher represent? **The environment***
- *What happened to the phrase by the time it reached the last person in the circle? **It changed***
- *What did we call that change in the last unit? **A mutation***
- *What do you think 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 for PBS's [Hunting the Nightmare Bacteria](#). Go to **slide 6**, and have students answer the questions as they follow along with the video. You may want to preview the handout before starting the video.

Teacher's Note: Stories in *Hunting the Nightmare Bacteria*

The video, *Hunting the Nightmare Bacteria*, is 54.46 minutes long and is comprised of three separate stories.

The Narrator for the PBS Frontline video explains the importance of the video, which looks at three disparate events:

"This is the story of three seemingly disconnected events beginning at the same time. What they each have in common is a type of infection that is becoming impossible to treat, a type of infection that has triggered deadly outbreaks even at one of our most prestigious hospitals. It is a crisis that is spreading alarmingly fast, threatening everyone, even the healthy" (Frontline Transcript).

Consider watching only the first half of the video on day one. Stop the video at the midpoint and review the relevant questions. The questions address all three events captured in the video.

Story 1: Addison (Addie) Rerecich's story introduces the video. Doctors could not explain how Addie's infection began. Addie's story pauses at minute mark 12.44. At minute-mark 48.22, Addie's episode is concluded.

Story 2: David Ricci's story begins at 12.45 minute-mark. David's illness begins with an injury requiring amputation of his leg. Infected with a drug-resistant gene NDM-1, David was not expected to survive the multiple surgeries he had while on a missionary trip to India. When he returned home from India, doctors discovered his infection was the first of its kind in the United States. At minute-mark 46.33, David's episode is concluded.

Story 3: The third story, which is not the story of one particular individual, begins at 22.06 minute mark. The third story, the story of another drug-resistant organism, explores the general spread of an organism known as KPC in a New York Hospital. This organism spreads mysteriously and is not contained in a single patient. Medical professionals and researchers explore the bacteria's growing resistance.

At the 33-minute mark, pause the video and point out 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 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."*

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 handout using 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.

Once each student has identified their S-I-T facts or ideas, have them pass their papers clockwise. Each student will add to their group members' list. When the paper gets back to its original writer, have groups draft a summary of the main lessons regarding evolution they gleaned from the video. Select one student to share their group's summary.

Teacher's Note: S-I-T

During the S-I-T exercise, walk around to ensure that each student has had enough time to add to each paper. Allot 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

Go to **slide 8**. Announce to the students that they will use a photo deconstruction strategy to learn about an organism based on close observation and analysis.

Give each student a sticky note and instruct them to write down what they infer about the characteristics of the organism on the following slide:

- What do you think this organism might have eaten? Why?
- Where do you think this organism might have lived? Why?
- What animal do you think this organism is related to? Why?

Show **slide 9**, which contains the fossil photograph. After students have analyzed the photograph, have them place their sticky notes on the projector screen, smartboard, or whiteboard around the picture. Share what each student has written.

After students have shared their inferences, share with them the scientific information about the organism on the slide: "[Fossilized ancient lizard shows how dinos evolved to live in the oceans.](#)" This link is also found in slide 9's footnote.

Teacher's Note: Discussion

Clear up some potential misconceptions and 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 explaining certain concepts.

Teacher's Note

You can use [Nearpod](#) for the same effect. Give students roughly 5-10 minutes to add their initial post, and then 10 minutes to respond to a peer. 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 *Vadasaurus herzogi* lizard to allow students to compare their observations to those of researchers:

- [Meet Vadasaurus, a foot-long, ancient swimming reptile](#)

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/>

- [Vadasaurus herzogi](#)

Hudson Institute of Mineralogy. (1993). Vadasaurus herzogi. <https://www.mindat.org/taxon-9398973.html>

- [Fossilized ancient lizard shows how dinos evolved to live in the oceans](#)

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>

15 minutes

Explain

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. You may 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.

60 minutes

Extend

Go to **slide 12**. Explain to your students what a timeline is and what it can show about an organism or a species. Assign them to develop a timeline of an organism (plant, animal, fungi, bacteria, protist) of their choice using a program such as [Adobe Spark](#) or any other program of their choosing. Your students will need to show the following:

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

Go over the instructions and **Extend Rubric** to make sure students know what is expected of them.

Optional: Variety

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

2 minutes

Evaluate

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.
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- K20 Center. (n.d.). Edpuzzle. Tech tools. <https://learn.k20center.ou.edu/tech-tool/622>
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<https://www.zmescience.com/science/ancient-lizard-dino-evolve-ocean-0432/%C2%A0>
- PBS Online: Nova Labs. (2020). Evolution 101. | WBGH 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/>