How EGG-ceptional Are We? (Biology)

Evolution: Embryonic Development

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Grade Level	9th – 12th Grade	**Time Frame**	150 minutes
Subject	Science	**Duration**	2–3 class periods
Course	Biology		

Essential Question

How do we decide what to believe about evolutionary claims?

Summary

Students will investigate the similarity of reproduction, embryonic development, and DNA sequences to illustrate the indirect evidence for evolution. "How EGG-ceptional Are We?" is written for a general biology course.

Snapshot

Engage

Students listen to the storybook *An Egg Is Quiet* then discuss observations from the book.

Explore

Students sort embryo images into similar groups.

Explain

Students use a second card sort and claims to draw conclusions.

Extend

Students analyze data and charts to draw conclusions about similarities between organisms.

Evaluate

Students answer open response questions to collect their thoughts and ideas.

Standards

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

IOD403: Translate information into a table, graph, or diagram
IOD404: Perform a simple interpolation or simple extrapolation using data in a table or graph
EMI201: Find basic information in a model (conceptual)
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
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

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-LS4-1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Oklahoma Academic Standards (Biology)

B.LS3.1.3: Each chromosome consists of a single, very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA.
B.LS3.2 : Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
B.LS4.1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Attachments

- Embryo Claim Cards—How EGG-ceptional Are We.pptx
- Explain Card Sort—How EGG-ceptional Are We.docx
- Explain-Card-Sort-How-EGG-ceptional-Are-We - Spanish.docx
- Explain-Card-Sort-How-EGG-ceptional-Are-We - Spanish.pdf
- Explain-Card-Sort-How-EGG-ceptional-Are-We.pdf
- I Used to Think But Now I Know Worksheet—How EGG-ceptional Are We.docx
- I Used to Think But Now I Know Worksheet—How EGG-ceptional Are We.pdf
- I-Used-to-Think-But-Now-I-Know-Worksheet-How-EGG-ceptional-Are-We - Spanish.docx
- I-Used-to-Think-But-Now-I-Know-Worksheet-How-EGG-ceptional-Are-We - Spanish.pdf
- I-Used-to-Think-But-Now-I-Know-Worksheet-How-EGG-ceptional-Are-We.pdf
- Lesson Slides—How-EGG-ceptional Are We Biology.pptx
- Nucleotide Sequence Extend—How EGG-ceptional Are We.docx
- Nucleotide-Sequence-Handout-How-EGG-ceptional-Are-We - Spanish.docx
- Nucleotide-Sequence-Handout-How-EGG-ceptional-Are-We - Spanish.pdf
- Nucleotide-Sequence-Handout-How-EGG-ceptional-Are-We.pdf
- Student Version Embryo Card Sort—How EGG-ceptional Are We.docx
- Student-Version-Embryo-Card-Sort-How-EGG-ceptional-Are-We - Spanish.docx
- Student-Version-Embryo-Card-Sort-How-EGG-ceptional-Are-We - Spanish.pdf
- Student-Version-Embryo-Card-Sort-How-EGG-ceptional-Are-We.pdf

- Teacher Version Embryo Card Sort—How EGG-ceptional Are We.docx

Materials

- *An Egg Is Quiet* by Dianna Aston
- Lesson Slides (attached)
- Student Version Embryo Card Sort (attached; one per group of two or three, cut out)
- Teacher Version Embryo Card Sort (attached)
- Explain Card Sort (attached; one per group of two or three, cut out)
- Claim Cards (attached; 1 per group of four)
- Nucleotide Sequence handout (attached; one per student)
- I Used to Think, but Now I Know worksheet (attached; one half sheet per student)
- Colored pens or markers
- Sticky notes

20 minutes

Engage

Use **slide 3** from the attached **Lesson Slides** to introduce the essential questions and **slide 4** to introduce the learning objectives to students.

Go to **slide 5.** If you have a copy of *An Egg is Quiet* by Dianna Aston, read it to students. If you do not have access to the book, show students the following "An Egg Is Quiet" read-aloud video on YouTube. Instruct students to use the I Notice, I Wonder strategy to write down observations, important details, and questions they think about as they hear the story.

Embedded video

https://youtube.com/watch?v=KgVaNbrCayU

Teacher's Note: Read a Picture Book? To High Schoolers?

Yes, that is the Engage, and yes, high schoolers can be engaged by a picture book. Humans rely on sight observations more than any of us would like to admit, and a picture book capitalizes on that. It'll be nostalgic for them, and can be a break from the seriousness of getting older.

Afterwards, allow students to look back through the book if they need to revisit it. In pairs, have students share what they've written and revisit the book (or copies of pages of the book) to either reinforce the observations they made or to revise them. Also use this time for students to discuss the questions they wrote and see if rereading the book answers the questions or if further investigation is needed.

Teacher's Note: Observations

Considering the context of the lesson, it would be ideal for students to get to the point of observing how multiple species, with a great amount of diversity, all reproduce through egg/embryonic development. Also, all eggs, even though they are all different in shape, size, and species, function in the same way: protection and nutrition.

30 minutes

Explore

Teacher's Note: Preparation

Cut out the card sorts in advance. Remember to keep Set A (letters) and Set B (numbers) separate from each other so students can begin the activity with no prior knowledge of the card sort layout!

Go to **slide 6** and introduce Set A of the Card Sort (letters at the bottom) from the attached **Student Version Embryo Cards**. Pass out sets to groups of 2–3 students. Prompt students to group together the embryos that are similar. There are no duplicates, so each is a unique animal, but possible categories could be mammals, reptiles, amphibians, etc. Some students may think these are similar animals, but in different developmental stages. Try to leave it open-ended as "group what you think is similar together." When students are done, have them do a modified Gallery Walk, where students write the card groupings their group chose on sticky notes as category headings. The groups should rotate and read the other groups' ideas. When a full rotation through has happened, give time for students to decide if they want to change their original groupings or not.

Teacher's Note: Expectations

This is a very difficult task, which is the point. Let them struggle. A teacher key is included, but that are to be used once the task is completed and it's time to debrief. These moments of disequilibrium are the gateway towards opening the mind to other thinking.

Taking the idea further, pass out Set B (numbers at the bottom) from the same document, so that both Set A and Set B are together, to each group. Give the prompt for students to sort the cards. Students will probably understand that the idea is to pair the embryo with the developed animal, but try not to give it away.

Teacher's Note: Answer Key

The answers to what embryo is what animal are included not only as a teacher key but also on **slides 7–15**, to show students after they've worked independently. Reveal the answers eventually, but try to let the struggle happen as long as students aren't growing too frustrated.

50 minutes

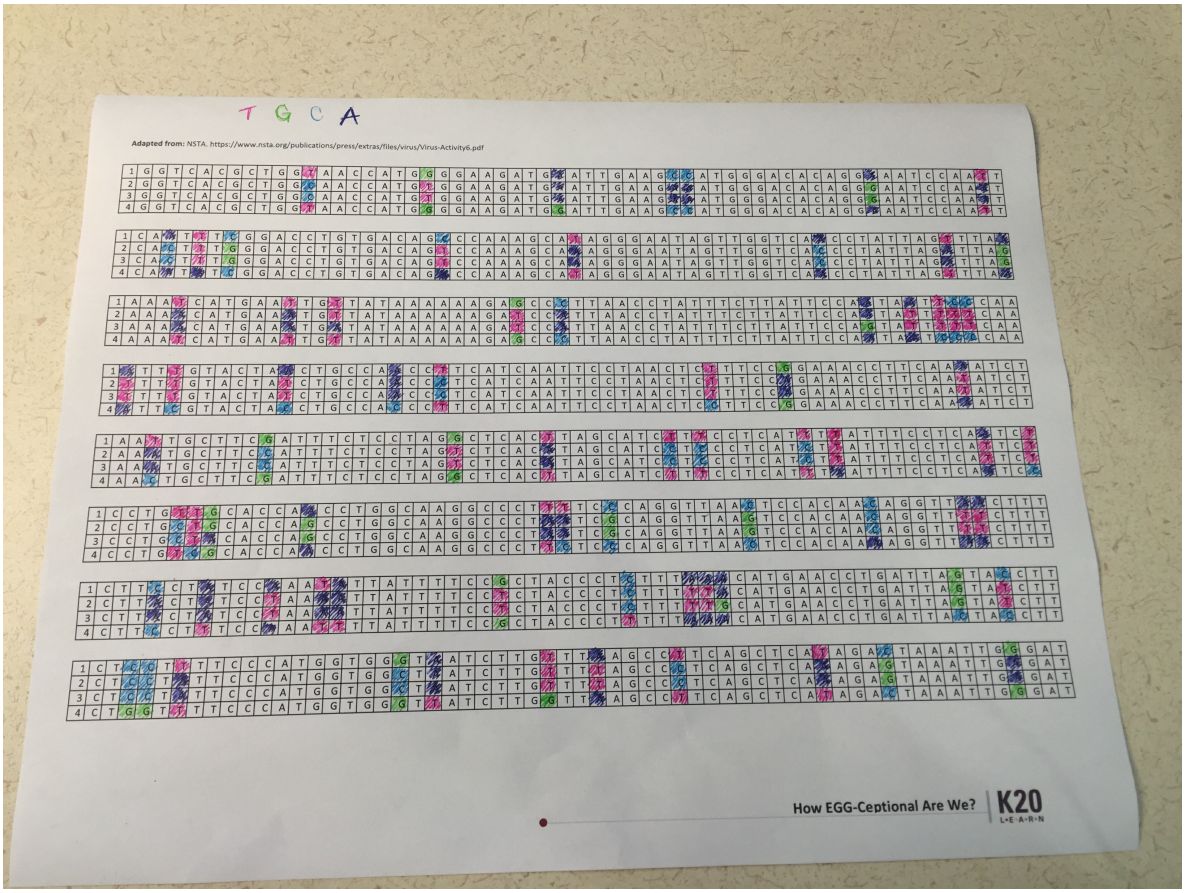
Explain

Let students keep the card sorts for reference during the Explain and Extend sections. Go to **slide 16** and pass out the attached **Explain Card Sort**, which features a few stages of a chicken embryo and a mouse embryo. Display or verbally share the prompt: "There are two sets. Separate the two sets, then put each set in order." Allow students to work on this in pairs, then have each pair find another. Next, pass out slides 2–5 of the **Embryo Claim Cards** slide deck to each group of four. Have students use the Claim Cards strategy. Give each student a claim. Instruct them to take turns with their group members reading their claim and either supporting or refuting it based on the evidence from their card sorts in the Explore section. Have them next share responses with the whole group. There are answers and explanations for each claim on **slides 17–20**.

30 minutes

Extend

Go to **slide 21** and distribute the attached **Nucleotide Sequence Extend** document. Offer colored pens or markers and prompt students to look through and sequence the data with a partner. There are questions on the back that can provide inspiration for students, but allow students to explore the nucleotide sequences on their own.



Sample of DNA sequencing. Only the differences between the organisms are colored in. This is not the only possible response.

Allow students to hang on to this data and answers for the Evaluate section, but have them turn it in along with their Evaluate task.

20 minutes

Evaluate

Go to **slide 22** and pass out a half sheet from the attached I Used to Think...But Now I Know document to each student. Give about 5 minutes for students to reflect upon what was presented to them and record what they used to think about embryos and fetal development compared to what they now know. Have students share their responses with a partner, then turn their responses in as an Exit Ticket.

What Are Acceptable Responses?

Most of the time, students will talk about how they didn't realize how babies develop, or make that connection with pregnancy. Students may connect with the information presented, or they may resist it because of other information or what they've been told in other places. Don't force particular statements; otherwise, it may be impossible to tell what a student is or is not retaining. Evaluate doesn't always mean "right" or "wrong"—in this case, it means, "What conclusions did the students individually come to?"

Resources

- K20 Center. (n.d.).
  Bell ringers and exit tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Card sort. Strategies. https://learn.k20center.ou.edu/strategy/147
- K20 Center. (n.d.). Claim cards. Strategies. https://learn.k20center.ou.edu/strategy/160
- K20 Center. (n.d.). Gallery walk. Strategies. https://learn.k20center.ou.edu/strategy/118
- K20 Center. (n.d.). I notice, I wonder. Strategies. https://learn.k20center.ou.edu/strategy/180
- K20 Center. (n.d.). I used to think...But now I know. Strategies.
  https://learn.k20center.ou.edu/strategy/137
- Sunshine lemonade. (2016). *An egg is quiet* [Video]. YouTube. https://www.youtube.com/watch?v=KgVaNbrCayU