



Life in a Petri Dish

Evolution and Natural Selection



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| Grade Level | 9th – 12th Grade | Time Frame | 3-4 class period(s) |
| Course | Biology I, Biology II | Duration | 200 minutes |

Essential Question

How do environmental forces change a species?

Summary

In this lesson, students will learn about the concepts of evolution and natural selection through playing Perfect Strain, a digital game-based learning (DGBL) module. The DGBL module allows them to explore and apply the concepts they are learning within an interactive world using artificial selection to see the effects of selection pressures such as mutations and evolutionary adaptation.

Snapshot

Engage

Students watch the "What is Natural Selection?" video.

Explore

Students play the first two missions of Perfect Strain to explore the concepts of evolution and natural selection.

Explain

Students use the Concept Card Mapping strategy to learn more about the relations between the concepts they've learned so far.

Extend

Students play the third mission of Perfect Strain to continue exploring and applying the concepts they have learned about evolution.

Evaluate

Students use the Human Scatter Graph strategy to demonstrate learning.

Standards

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

HS-LS4-3: Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-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.

HS-ETS1-4: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Oklahoma Academic Standards (Biology)

B.LS3.2.2: Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which also cause mutations in genes, and variables in mutations are also inherited.

B.LS4.1: Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

B.LS4.2.1: Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.

Attachments

- [ConceptCards - Spanish.docx](#)
- [ConceptCards - Spanish.pdf](#)
- [ConceptCards.docx](#)
- [ConceptCards.pdf](#)
- [Human Scatter Graph Questions and Answers.docx](#)
- [Perfect Strain Teachers Guide DGBL 2015-08.pdf](#)

Materials

- Student devices with internet access
- K20 Game Portal accounts or iPad apps of Perfect Strain
- Whiteboard
- Writing utensils
- Paper
- Concept Cards (attachment)

Engage

Have student's watch the "[What is Natural Selection?](#)" video. This video is nine minutes long and introduces many of the concepts that students will be further exposed to as they begin playing the Perfect Strain DGBL module.

Explore

Once every pair has shared, you can introduce them to the DGBL module Perfect Strain. Click [here](#) to learn more about the game.

Teacher's Note: Accessing The Game

You will need to have game access set up ahead of time. If you are using the iPad app, you only need to install the app to be ready to go. If, however, you need students to play the game via computer, contact either Will Thompson (will.thompson@ou.edu) or Javier Elizondo (elizondoj@ou.edu) directly at the K20 Center to be granted access. Further contact information can be found at the end of the teacher's guide in the Attachments section.

Prepare students to play the game on their computers or tablets and have them play through the first two missions, which should take roughly 30 minutes. You do not need to give them further instruction here. The game will introduce them to its mechanics, concepts, and story. At this point, take time to walk around the room, helping students who are confused or stuck and observing their progress.

Teacher's Note: Alternative For Technology Limitations

If it is not possible to supply each student with access to the game, having students play the game in pairs or small groups will also work. However, Perfect Strain is a real-time game, so if it is played in groups, it will most likely require a single student to play the game while other students watch and give advice on which actions to take.

Teacher's Note

Perfect Strain consists of five missions. For the purposes of this lesson, students will only need to play through the first three missions. The fourth and fifth missions provide a greater challenge and can be used to occupy students who advance significantly faster.

Teacher's Note: Tracking Student Progress

If you are having the students play the game on computers, it is possible to track student progress through the Game Portal Teacher Dashboard where you access the game. Unfortunately, this functionality does not exist for the iPad version of the game.

Explain

Now that students have played some of the game. Use the [Concept Card Mapping](#) strategy to allow students to review what they've learned and go into deeper explanations of the concepts.

Divide your class into small groups and give each group a set of the concept cards. Then have them build a concept map using the cards. Once all the concept maps are complete, discuss them as a class, using them to build a whole-class concept map.

Teacher's Note: Concept Cards

The "Concept Card" handout (located in Attachments) contains the terms and definitions as presented in the Perfect Strain DGBL module and accompanying teacher's guide, along with spaces to add additional cards. You can either print the cards double-sided so the definitions are on the reverse side of the terms, or you can print them all as separate cards to provide additional challenges and learning opportunities for your students.

Use this discussion and the resulting concept map to identify any areas where students are confused or have questions about specific concepts. Then you can spend additional time better explaining those specific concepts.

Extend

Now, have your students play the third mission of the Perfect Strain DGBL module. This module is more difficult than the first two, and you can expect it to take at least 30 minutes for them to play through it.

Teacher's Note

Again, having students play the game in small groups will also work if it is not possible to provide each student with individual access. It is recommended that these groups have no more than four students apiece.

Evaluate

Use the [Human Scatter Graph](#) strategy as a final evaluation of student learning over the course of this lesson. You can use the list of questions and answers located under Attachments or generate your own list. Label two perpendicular walls in your classroom to be the x-axis and the y-axis. The y-axis should be labeled with sections called A, B, and C. These will be choices for the students later on in the activity, so leave enough room for multiple students to stand in the same area. Label the side of the x-axis that is closest to the y-axis "low confidence" and the side that's farthest away from the y-axis "high confidence."

Present your students with the first question and list of answers either by writing them on the board, by using a SMART board, or by using an overhead projector.

Have students choose an answer by moving to the portion of the room that corresponds with their answer and their confidence in that answer. Once all students have moved, choose a student from each answer group to explain their justification, then discuss which answer was correct and why. Discuss the students' thinking, making sure to clear up any misconceptions students have that may have led to wrong answers.

Repeat this process for as many questions as you feel is necessary to evaluate your class.

Resources

- K20 Center. (n.d.). Concept Card Mapping. Strategies.
<https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f505c351>
- K20 Center. (n.d.). Human Scatter Graph. Strategies.
<https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f507a17f>
- K20 Center. (2017). Perfect strain [Computer software]. Norman, OK: The Board of Regents of the University of Oklahoma
- Stated Clearly. (2013). What is natural selection? [Video file]. Retrieved from
<https://www.youtube.com/watch?v=0SCjhI86grU&t=160s>