

PEEBEDU Pocket Mice Natural Selection (NGSS)

Unit 7: Natural Selection and Evolution

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Pocket Mice Natural Selection**. Click the **Start Exploring** button to begin. Read the introduction popup, which describes how the MC1R gene controls coat color in pocket mice and how owl predation drives changes in allele frequencies across generations.

Part 1 – Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Pocket Mice Natural Selection simulation as a scientific model.

M – Mode

What type of model is the Pocket Mice Natural Selection simulation? Describe how this computational simulation represents the process of natural selection in pocket mouse populations. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about natural selection and evolution.

A – Accuracy

(a) Identify two things this simulation represents **accurately** about natural selection. For each, name the specific simulation feature and explain what aspect of natural selection it demonstrates.

(b) Identify two things this simulation **oversimplifies or leaves out** about natural selection in real populations. Consider what you cannot observe in the simulation that would be important for a complete understanding of how natural selection operates in the wild.

P – Purpose

What is the learning goal of this simulation? Explain how the Pocket Mice Natural Selection simulation is designed to help you understand how environmental change and predation drive shifts in allele frequencies over generations. In your answer, connect at least one specific simulation feature to a real-world biological scenario where natural selection has shaped a population.

P – Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries about the MC1R gene or natural selection might change or improve a simulation like this. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for natural selection?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the simulation help you connect changes in allele frequency to the concept of evolution by natural selection?

Part 2 – NGSS Questions

1.

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 5%. Keep the environment as Sandy Desert with 2 owls. Click Skip to advance through at least 5 generations. Observe which mice the owls capture each generation.

Describe how owl predation acts as a selective pressure on the pocket mouse population in the sandy desert. Explain why dark-furred mice are more likely to be captured than light-furred mice in this environment and how this affects the survival of individuals with different fur colors.

HS-LS4-2

2.

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 50%. Run the simulation on Sandy Desert with 2 owls. Click Skip to advance through 8 generations and watch the Allele Frequencies display on the right panel.

Explain how the frequency of the R allele changes over multiple generations in the sandy desert. Describe why mice that inherit fur color matching their environment are more likely to survive and reproduce, passing their traits to offspring.

HS-LS4-3

3.

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 50%. Run the simulation on Sandy Desert for 3 generations. Then click Trigger Volcanic Eruption to change the environment to dark lava rock and continue running the simulation for at least 5 more generations.

Describe how the volcanic eruption changes which fur color provides better camouflage. Explain why the same trait that was harmful before the eruption becomes beneficial afterward, and how this shift causes the population to change over time.

HS-LS4-4

4.

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 50% on Sandy Desert. Run 5 generations with 1 owl. Then reset and repeat with the same settings but change the owl count to 5. Compare how quickly the allele frequencies change in each trial.

Describe the difference in how fast the population changes when there are more predators hunting. Explain why stronger predation pressure causes the population to shift toward camouflaged fur color more rapidly.

HS-LS4-2

5.

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 50%. Run the simulation on Sandy Desert with 2 owls for 8 generations. Observe the Genotypes panel (RR, Rr, rr counts) and the Phenotypes panel (Dark vs. Light counts) each generation.

Explain why natural selection acts on the fur color (the visible trait) rather than directly on the gene combinations. Describe how mice with the Rr combination appear dark-furred and are captured at the same rate as RR mice, even though they carry a copy of the light-fur gene.

HS-LS4-3

6.

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 50%. Run the simulation on Sandy Desert for 3 generations, then click Trigger Volcanic Eruption and continue for 5 more generations. Record the R allele frequency at each generation from the Allele Frequencies display.

In the box below, draw a line graph showing how the R allele frequency changes over all 8 generations. Label the x-axis “Generation” and the y-axis “R Allele Frequency (%)” Mark the generation when the eruption occurred with a vertical dashed line. Describe the overall pattern you observe and explain what caused the direction of change to reverse.

Draw your graph here.

HS-LS4-4

7.

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 95%. Run the simulation on Sandy Desert with 2 owls for 10 generations. Notice what happens to the number of dark-furred mice over time and consider what would happen if all dark-furred mice were eventually removed from the population.

Using your observations from the simulation, explain how a sudden environmental change (such as a volcanic eruption) could threaten the survival of a population that has lost most of its variation in fur color. Describe why populations with greater variation in heritable traits are better able to survive when their environment changes unexpectedly.

HS-LS4-5