PEEBEDU

Founders Effect Simulator

Unit 7: Natural Selection and Evolution

Name: _____ **Period:** _____ **Date:** _____

> Open **peebedu.com** and navigate to **Founder's Effect Simulator**. Click **Start Exploring** to dismiss the introduction popup. Read the six information panels, which describe island evolution, adaptive coloration, migration challenges, mutation and variation, population dynamics, and carrying capacity.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Founder's Effect Simulator as a scientific model.

M — Mode

What type of model is the Founder's Effect Simulator? Describe how this computational simulation represents the founder effect and genetic drift. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about population genetics.

A — Accuracy

(a) Identify two things this simulation represents **accurately** about the founder effect and genetic drift. For each, name the specific simulation feature and explain what aspect of population genetics it demonstrates.

(b) Identify two things this simulation **oversimplifies or leaves out** about the founder effect. Consider what you cannot observe in the simulation that would be important for a complete understanding of how founding populations diverge genetically.

P — Purpose

What is the learning goal of this simulation? Explain how the Founder's Effect Simulator is designed to help you understand how random processes, including genetic drift and the founder effect, can change allele frequencies in small populations. In your answer, connect at least one specific simulation feature to a real-world biological scenario where the founder effect has shaped a population.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries might change or improve a simulation like the Founder's Effect Simulator. 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 the founder effect?
- 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 random processes to changes in allele frequencies over time?

Part 2 — Free Response Questions

Conceptual Analysis

Question 1 — Genetic Drift in Founding Populations

> *Simulation Task: Set the Population slider to 200 and Water Survival to 0.30. Keep Mutation at 0.01 and all island Selection values at 4. Click Start and let the simulation run for approximately 100 frames. Observe the Population Over Time graph and note which insect colors are present on each island.*

(A) (1 pt) **Describe** how the founder effect is a type of genetic drift in which a small group of individuals that is not genetically representative of the larger population establishes a new population in a new geographic area.

(B) (1 pt) **Explain** why the insect color frequencies on the peripheral islands differ from the color frequencies on the central island.

(C) (1 pt) **Predict** what would happen to the genetic diversity of the island populations if Water Survival were reduced to 0.10, further limiting the number of migrants that successfully reach each island.

(D) (1 pt) **Justify** your prediction by explaining how a reduction in founding population size increases the role of random chance in determining which alleles are represented in the new population.

EK 7.4.A.1(iv), 7.4.B.1

Analyze Model / Visual Representation

Question 2 — Reduced Genetic Variation and Population Divergence

> *Simulation Task: Reset the simulation. Set Population to 200, Water Survival to 0.50, and Mutation to 0.00. Set the Green island Distance to 80 and its Size to 30. Set Brown island Distance to 200 and its Size to 60. Leave Red island at defaults. Click Start and run for at least 150 frames. Compare the populations on the Green and Brown islands.*

(A) (1 pt) **Describe** how genetic drift in small founding populations can reduce genetic variation within a population while increasing the differences between populations of the same species.

(B) (1 pt) **Explain** why the Green island population (closer, smaller) and the Brown island population (farther, larger) show different patterns of genetic diversity.

(C) (1 pt) **Represent** the relationship between founding population size and genetic diversity.

Draw your diagrams here.

(D) (1 pt) **Explain** how the reduced genetic diversity resulting from the founder effect could affect the resilience of an island population if the environment changed, such as a shift in the dominant vegetation color.

EK 7.4.A.1(iv), 7.4.B.1, 8.6.A.1