PEEBEDU **Environmental Effects on Phenotype** Unit 5: Heredity
Lab

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

Open **peebedu.com** and navigate to **Environmental Effects on Phenotype Lab**. Read the introduction popup, which explains how environmental conditions influence gene expression and can lead to **phenotypic plasticity**. Then click **Begin Experiments** to enter the lab.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Environmental Effects on Phenotype Lab as a scientific model.

M — Mode

What type of model is the Environmental Effects on Phenotype Lab? Describe how this computational simulation represents the relationship between environmental conditions and phenotypic expression. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about how genotype and environment interact to produce phenotype.

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A — Accuracy

(a) Identify two things this simulation represents **accurately** about how environmental factors influence phenotype. For each, name the specific simulation feature and explain what biological concept it demonstrates.

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(b) Identify two things this simulation **oversimplifies or leaves out** about the relationship between environment and gene expression. Consider what molecular-level processes are not visible in the simulation that would be important for a complete understanding of phenotypic plasticity.

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P — Purpose

What is the learning goal of this simulation? Explain how the Environmental Effects on Phenotype Lab is designed to help you understand that the same genotype can produce different phenotypes under different environmental conditions. In your answer, connect at least one specific simulation feature to a biological concept related to how organisms respond to their environment.

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P — Permanency

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

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Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for environmental effects on phenotype?

- 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 observable phenotypic changes to underlying gene expression?

Part 2 — NGSS Questions

1.

Simulation Task: In Experiment 1, tap each planter to plant a genetically identical hydrangea seed, then click **Grow All Plants**. *Observe how flower color changes across the pH gradient from 4.0 (Very Acidic) to 8.5 (Very Alkaline).*

All ten hydrangea seeds carry the same genes, yet the flowers that grow range from blue to purple to pink. Explain how an environmental factor such as soil pH can cause organisms with the same genetic information to develop different observable traits.

HS-LS3-3

2.

Simulation Task: Look at the Results section after growing the hydrangea plants. Compare the flower colors at pH 4.0, pH 6.5, and pH 8.5.

Using the pattern of flower colors you recorded, describe the relationship between soil pH and hydrangea flower color. Based on this pattern, predict what color a hydrangea flower would most likely be if it were grown in soil with a pH of 5.5.

HS-LS3-3

3.

A gardener moves a blue-flowering hydrangea from acidic soil (pH 4.0) into alkaline soil (pH 8.5). Predict whether the new flowers that grow will remain blue or change color, and explain your reasoning based on what you observed in the simulation about how the environment influences which traits appear.

HS-LS3-3

4.

In this reptile species, eggs with the same genetic makeup develop as male or female depending on the temperature during incubation. Explain how temperature acts as an environmental signal that determines which traits develop, even when the genes themselves do not change.

HS-LS3-3

5.

Describe the pattern you observe between incubation temperature and the sex of the offspring. Explain why variation in environmental conditions can lead to a range of different traits within a group of organisms that share the same genes.

HS-LS3-3

6.

Simulation Task: Review both experiments. In Experiment 1, the same genes produce different flower colors depending on soil pH. In Experiment 2, the same genes produce different sexes depending on temperature.

In the box below, draw a diagram that shows how one set of genes can lead to different observable traits when the organism develops in two different environments. Use either the hydrangea or the reptile example. Label the genes, the two environments, and the resulting traits in your diagram.

Draw your diagram here.

HS-LS3-3

7.

Simulation Task: In Experiment 2, run trials at 26°C and 34°C and think about what would happen to a reptile population if average nest temperatures increased over many years due to a warming climate.

If rising global temperatures caused most reptile nests to stay at the high end of the temperature range, predict how the sex ratio of the population would change over many generations. Explain how this shift in trait variation could affect the population's ability to survive and reproduce in the changed environment.

HS-LS4-5