Phoenixville Area School District Understanding by Design (UbD) Science Template

Grade Level: 8 **Unit Name: Biological Evolution: Unity and Diversity** **Author: D. Sylvan**

Stage 1 Desired Results

Overarching NGSS & PA Standards:

3.1.6-8.H
Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

3.1.6-8.O
Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life

Transfer

Students will be able to independently use their learning to…

1. Ask questions and/or define problems
2. Develop and/or use models
3. Plan and/or carry out investigations
4. Analyze and interpret data using computational thinking
5. Obtain, evaluate, and communicate information (supported by evidence)
6. Construct explanations and design solutions

Meaning-Making

Students will understand that…

- Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
- Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
- Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
- Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.
- Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
- Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

ESSENTIAL QUESTIONS
Students will keep considering...

LS 4A: What evidence shows that different species are related?

LS 4B: How does genetic variation among organisms affect survival and reproduction?

LS 4C How does the environment influence populations of organisms over multiple generations?

LS 1D How do organisms detect, process, and use

on Earth under the assumption that natural laws operate today as in the past. **3.1.6-8.P** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. **3.1.6-8.Q** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships		information about the environment?
	Knowledge and Skills Acquisition	
	UNDERSTANDINGS *Students will know…* • The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. • It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. • Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. • Comparison of the embryological development of distinct species also reveals similarities that show relationships not evident in fully formed anatomy. • Natural selection leads to the predominance of certain traits in a population, and the suppression of others. • In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. • Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. • Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population change. • Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.	*Students will be skilled at…* • Organize fossils based on their position in sedimentary rock. • Identify patterns based on the available data and position of fossils within sedimentary rock. • Analyze data to determine evidence for the existence, diversity, and extinction of life. • Explain the anatomical differences and similarities between modern and fossil organisms. • Reason, based on evidence, that animals with anatomical similarities are more closely related than organisms that do not share that pattern. • Organize and identify patterns of embryo development between organisms. • Explain how inherited traits can increase the chance of survival. • Use evidence to explain how traits pass from adult to offspring. • Analyse and explain how environmental factors can
	KEY VOCABULARY 1. Adaptation 2. Alle 3. Biodiversity 4. Biotic Factors 5. Cladogram	

not evident in the fully formed anatomy. **3.1.6-8.R** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. **3.1.6-8.S** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. **3.1.6-8.T**	6. Competition 7. Convergent Evolution 8. Continental Drift 9. Decomposition 10. Divergent Evolution 11. Diversity 12. DNA 13. Dominant/Recessive 14. Embryology 15. Empirical evidence 16. Endangered 17. Erosional Features 18. Evidence 19. Evolution 20. Fossil Evidence 21. Gene 22. Inherited Trait 23. Mutation 24. Natural Selection 25. Phylogenetic Tree 26. Population 27. Sediment Deposition 28. Survival of the fittest 29. Theory 30. Trait 31. Weathering	make some traits more likely to be passed down. • Explain and cite examples of organisms with an advantage out-competing others of the same species. • Identify methods that humans have used to cause artificial selection (gene therapy, GMO, selective breeding. • Assess evidence for credibility, accuracy, and/or bias. • Determine the effects of artificial selection on native populations. • Use mathematical data to identify and analyze how traits change over time. • Describe how sensory data responds to stimuli. • Explain the relationship between sensory data and stimuli. • Use evidence to show how the memory/stimuli relationship governs behavior.

Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. **Which branch(es) of science apply:** **LS**		

Stage 2 – Evidence

Evaluative Criteria	***Assessment Evidence***	

Graded tests and quizzes.
 	
Pre-Assessment via online game (quizizz, kahoot! Etc).
 	
Mastery Path Progress
	PERFORMANCE TASK(S):
	
	Projects, Labs, and Investigations:
	• Lab: Fossilization – make fossil casts and bury layer by layer.
	  ○ Lab groups will make plaster casts from objects in the room.
	  ○ Each object is buried in sand, soil, clay.
	  ○ Later excavated to determine which species are the oldest.
	  ○ Follow-up with layers that have been shifted due to "tectonic stress".
	  ▪ Potential Field trip to look at strata in a quarry.
	  ▪ Virtual Simulation
	• Lab: Embryology – Analyze different embryos
	  ○ Examine photographs of different embryos
		Differentiation Considerations:
		
		Differentiation Considerations:
		
		Different modes of presentation
		• PowerPoint
		• poster
		• Student choice
		
		Use of notes and resources
		
		Chunked Assignment

Rubrics related to each.	- Identify common characteristics - Determine which characteristic came first on the evolutionary tree. - Project: Phylogenetic Tree – differentiated research project using scientific names. - Students choose a scientific name without any prior knowledge based on pre-assessment data. - Research is conducted indicating why the species, if extinct, was unable to adapt to its environment. - If still alive, students indicate what adaptations it has that allow it to survive. - Project: Life – Hippo & Whale relationship (divergence) - Diorama based presentation project. - Students are given a set of environmental conditions. - Students must recreate the conditions in a diorama and design/model an organism that could survive them. - Organism must have adaptations suited to their environment. - Lab: Dragon DNA – Breeding Game where students use Punnett Squares to breed dragons - Students are set a task to create a dragon with a set of characteristics. - Collecting and analyzing data from each successful brood, students breed in the desired characteristic and breed out the undesired. - Lab: BioEYES Albino fish breeding - Students sort Zebra Fish eggs by viability - Allow eggs to hatch observe and count albino fish vs “wild type” - Hypothesize and discuss potential causes for the discrepancy in number. - Lab: Reaction Time – Dropping, catching, sense identification. - Drop a meter stick and lab partner catches it as soon as they notice. - Use a single/clutch of multiple paper clips to identify how nerves perceive multiple inputs as a singular input. - Record data on lab sheet. Alternative Projects/Labs/Presentations: - Monsanto Seed lab kit w/Aquaponics - How humans have selected traits. - MS LS4-5 GMO “Glo” Fish/Aquaponics - How humans have selected traits.	Adapted Assessment Chunked Assignment Checklists

Graded tests and quizzes. Pre-Assessment via online game (quizizz, kahoot! Etc). Mastery Path Progress Rubrics related to each.	OTHER EVIDENCE: Teacher Summative: • Fossil Record – Fossilization, Evolutionary History, Embryological Development • Natural/Artificial Selection Common Summative: • Unit Test Participation in hands-on labs a. Checklists of collaborative behaviors in labs and activities Science Notebook/Portfolio a. Concept maps b. Vocabulary/Glossary entries c. Guided Research d. Lab Reports described above e. Daily Journal Entries Checklists of collaborative behaviors in class discussions Self-assessments for Performance Tasks Class Participation	Differentiation Considerations: Differentiation Considerations: Adapted/Modified Quizzes Homogeneously grouped labs to allow for teacher support Pictures to support vocabulary Flexible grouping Peer Mentors Guided Notes/Printed PowerPoint Slides Pictures and videos to support vocabulary Sentence Starters Product modification in place of writing: • Drawing • Verbal explanation