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Neumann University
EDU Senior Seminar II
Spring 2021

Evolution & Natural Selection Unit Plan

Grade Level: 10th Grade College Prep
Content Area: Biology
Duration of Unit: 4 weeks

Part I. Community of Learners

This unit on evolution and natural selection has been created for students in a 10th grade college prep biology course. During my student teaching experience, the unit I created was presented to two CP biology classes. My unit was taught both in-person and virtually to accommodate students during the Covid pandemic. The unit built on topics that were discussed in their previous unit; genetics. In building this unit, I used prior knowledge in my content area, information from my cooperating teacher, the biology book given to the students, and the other teachers in the science department at West Deptford High School. Mr. Robinson, my cooperating teacher, was able to give me good insight as to where the students were in the biology course for the year, and how school policy has changed because of the pandemic. Because students had been attending school virtually up until and most of my student teaching, the school wanted all of the teachers to be very accommodating when it came to due dates, extensions, asynchronous learning days, and workload.

The overall goal of my unit was to give students a background of evolution, the evidence we have for it, how it relates to other fields of science besides biology, and how we can use it in determining relationships among species. In my unit, I gave students the opportunity to express their learning through drawings, projects, worksheets, group assignments (virtually, of course), oral reflections, and an exam. I decided to break my unit up into 4 concepts; Natural Selection, Patterns of Evolution, Evidence of Evolution, and Phylogeny. For each unit, students will complete the guided notes that correspond with the presentation/lecture, a study guide containing vocabulary words and key concepts, and activities/projects that relate to the specific concepts being discussed. By the end of this unit, students should be able to identify the history of how we know about evolution, the evidence we see for evolution occurring/how it has occurred, understand that all living things descend from a common ancestor, create a phylogenetic tree/cladogram, describe each pattern of evolution, and provide a sufficient amount of examples for all of the key vocabulary terms we discuss in class.

Part II. Planning Questions to be Answered:
Themes Explored
- Distinction between macroevolution and microevolution and how it is viewed from an evolutionary standpoint.
- Four major principles of Natural Selection determined by Charles Darwin; Overproduction of Offspring, Variation within a population, Adaptation within a species, Descent from a common ancestor with modification.
- Evolution is the unifying theme of biology because it ties together evidence seen in various scientific disciplines like Paleontology, Morphology, Biogeography, Embryology, and Biochemistry.
- Phylogeny is a form of taxonomy classification used to determine the relatedness among different species through diagrams known as phylogenetic trees or cladograms.

Essential Questions:
- How are species affected by the changing environmental conditions?
- How does natural selection lead to adaptations of populations?
- What evidence shows that different species are related?
- What is the relationship between natural selection and evolution?
- Why do some species live in groups and others are solitary?

NJ State Standards Addressed in Unit:

HS-LS4-2:	Variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.
HS-LS4-3:	[*Disciplinary Core Idea*] - The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.
HS-LS4-5:	[*Disciplinary Core Idea*] -Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.
HS-LS4-5:	[*Disciplinary Core Idea*] - Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species.
HS-LS4-4:	[*Performance Expectation*] - Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-3:	[*Disciplinary Core Idea*] - Natural selection leads to adaptation, that is, to

a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.

Knowledge, Skills, and Understanding:
Learning Goals: By the end of the unit, students will be able to:

- Investigate patterns to find the relationship between the environment and natural selection.
- Demonstrate understanding of the factors causing natural selection and the process of evolution of species over time.
- Demonstrate understanding of how multiple lines of evidence contribute to the strength of scientific theories of natural selection and evolution.
- Demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution.
- Demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution.
- Use models, apply statistics, analyze data, and produce scientific communications about evolution. Understanding of the crosscutting concepts of patterns, scale, structure and function, and cause and effect supports the development of a deeper understanding of this topic.

Part 3: Vocabulary & Key Concepts
Concept 1
Vocabulary
- <u>Evolution</u>: The process of biological change in populations over time that makes descendants genetically different from their ancestors
- <u>Microevolution</u>: Small scale evolution affecting a single population
- <u>Macroevolution</u>: Large scale evolution affecting a species across populations
- <u>Natural selection</u>: Mechanism of evolution where organisms with the "best" traits are favored and thus live longer and reproduce more, causing changes in the population over time so that the fittest survive
- <u>Fitness</u>: A measure of how well an organism can survive in its environment

- Adaptation: A feature that allows an organism to better survive in its environment
- Gene pool: The combined alleles of all individuals in a population
- Genetic drift: Mechanism of evolution that occurs when random change in the allele frequency happens in the population
- Gene flow: Mechanism of evolution caused by the movement of genes into or out of a population
- Sexual selection: Mechanism of evolution that favors traits that potentially decrease survival, but increase likelihood of reproduction
- Genetic equilibrium: When there are no changes in the allele frequencies in a population over time, and thus evolution is not occurring

Key Concepts
1. Explain the principles of natural selection.
2. Explain how diversity within a species has resulted in an increase in fitness (survival of the fittest).
3. List the different factors that contribute to genetic variation and explain which is considered to be the "ultimate" source.
4. Explain what is meant by the phrase, "Individuals don't evolve, populations do."
5. Describe at least three mechanisms of microevolution.
6. Give an example of how genetic drift would have a bigger impact on a smaller population than a larger one.
7. List the 5 conditions that must be met for evolution to **not** occur.

Concept 2

Vocabulary
- Species: Group of organisms that can successfully interbreed and produce viable, fertile offspring
- Adaptive radiation: A type of divergent evolution occurring on a small scale over a shorter period of time

Key Concepts
1. Differentiate between speciation and extinction.
2. Explain why isolation would be necessary for speciation to occur
3. Differentiate between gradual and mass extinction.
4. Differentiate between gradualism and punctuated equilibrium.
5. Differentiate between divergent and convergent evolution. Include an example of each in your explanation.
6. Explain the significance of coevolution

Concept 3

Vocabulary
- Paleontology: Study of prehistoric life through the fossil record
- Morphology: Study of the form of living things
- Biogeography: Study of the geographic distribution of plants and animals
- Embryology: Study of embryo development
- Biochemistry: Study of chemical processes in living things
- Fossils: Preserved remains of organisms
- Endemic species: Species that exist only in one geographic region
- Pseudogenes: Non-functional genes

Key Concepts
1. Explain the role of transitional fossils in providing evidence for evolution.
2. Explain the differences between homologous, analogous, and vestigial structures. Be sure to indicate which pattern of evolution leads to these structures as well as an example of each
3. Describe how biogeography and embryology provide evidence of evolution.
4. List the two macromolecules that provide evidence for evolution in the field of biochemistry.
5. Describe an example from direct observation in the last century that has provided evidence for evolution.
6. Predict evolutionary relatedness between organisms based on provided evidence.

Concept 4
Vocabulary
- Taxonomy: Field of biology that classifies organisms
- Binomial nomenclature: 2-name naming system by Carolus Linnaeus that names organisms after their *Genus species*
- Phylogeny: Evolutionary history of a species
- Endosymbiosis: When one prokaryote ended up inside another and both organisms thrived
- Phylogenetic tree: A diagram used to predict evolutionary relationships among groups of organisms
- Maximum parsimony: Use the simplest explanation for creating the tree

Key Concepts
1. Distinguish the three domains all life is divided between and list the other levels of taxonomic classification.
2. Summarize the endosymbiotic theory.
3. Explain how taxonomy and phylogeny are similar yet unique fields of study.
4. Explain what phylogenetic trees show and what evidence is used to construct them.
5. List at least two things we can learn from a phylogenetic tree and two things we cannot learn from them.
6. *Make inferences about evolutionary relatedness based on the levels of classification in taxonomy.*
7. *Interpret phylogenetic trees in order to make statements about relationships between groups of organisms.*

Part IV. Lesson Plans

West Deptford High School

Subject	Biology
Grade	10th
Unit	Natural Selection & Evolution
Lesson	Intro to Natural Selection
Estimated Time Period	31 Minutes

Standards

HS-LS4-2:   Variation in the expression of that genetic information—that is, trait
variation—that leads to differences in performance among individuals.

HS-LS4-3:   [*Disciplinary Core Idea*] - The traits that positively affect survival are
more

likely to be reproduced, and thus are more common in the population.

HS-LS4-5:   [*Disciplinary Core Idea*] -Species become extinct because they can no
longer survive and reproduce in their altered environment. If members
cannot adjust to change that is too fast or drastic, the opportunity for the
species' evolution is lost.

HS-LS4-5:   [*Disciplinary Core Idea*] - Changes in the physical environment, whether
naturally occurring or human induced, have thus contributed to the
expansion of some species, the emergence of new distinct species as
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sometimes the extinction–of some species.

HS-LS4-4:   [*Performance Expectation*] - Construct an explanation based on evidence
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population dominated by organisms that are anatomically, behaviorally,
and physiologically well suited to survive and reproduce in a specific
environment. That is, the differential survival and reproduction of
organisms in a population that have an advantageous heritable trait
leads to an increase in the proportion of individuals in future

generations that have the trait and to a decrease in the proportion of individuals that do not.

Goals

Students will be able to...

High school students investigate patterns to find the relationship between the environment and natural selection. Students demonstrate understanding of the factors causing natural selection and the process of evolution of species over time. They demonstrate understanding of how multiple lines of evidence contribute to the strength of scientific theories of natural selection and evolution. Students can demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution. Students can demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution. Students can use models, apply statistics, analyze data, and produce scientific communications about evolution. Understanding of the crosscutting concepts of patterns, scale, structure and function, and cause and effect supports the development of a deeper understanding of this topic.

Essential Questions

How are species affected by the changing environmental conditions?
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What evidence shows that different species are related?
What is the relationship between natural selection and evolution?
Why do some species live in groups and others are solitary?

Understandings

Many factors affect variations of traits within species.
Scientific evidence supports natural selection as a mechanism for evolution.
Species change over time.

Critical Knowledge and Skills

Students will know...
Darwin and Wallace were the key scientists associated with evolution, however, the theory
of evolution is just a theory! A scientific explanation supported by research.

Learning Plan
- ★ Do Now: Have you ever heard of evolution? DO you have any idea what it is??
- ➢ Students will fill out the Pre-Survey
    - ○ Every Student either watch the youtube clip about Darwin or Wallace & take notes
        - ■ Share findings (through Remind)

Name: _____

EVOLUTION PRE-SURVEY
Place a SMILEY by the statements you believe to be TRUE.
Place a STOP by the statement you believe to be FALSE.

_____ 1. Evolution is just a theory.

_____ 2. Evolution is primarily concerned with the origin of humans.

_____ 3. According to evolution, people came from monkeys a long time ago.

_____ 4. Evolution is something that happened only in the past; it is not happening now.

_____ 5. Evolution is something that happens to individual organisms.

_____ 6. Evolution was developed as an idea to destroy or undermine religion.

_____ 7. In order to accept evolution as a real process, you cannot believe in a higher power.

_____ 8. Evolution takes thousands of years to occur.

_____ 9. There is not a lot of scientific evidence for evolution.

_____ 10. Evolution involves individuals changing in order to adapt to their environment.

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Understandings

Many factors affect variations of traits within species.
Scientific evidence supports natural selection as a mechanism for evolution.
Species change over time.

Critical Knowledge and Skills

Students will know…
The difference between micro and macro evolution with examples.

Learning Plan

➢ Concept 1 Notes: Evolution & two types
  ○ What is micro/macro evolution? Examples?
➢ Evolutionary Theory Timeline Activity

Activity: Evolutionary Theory Timeline

Task: You will be assigned a scientist from the past who has led to our current understanding of evolutionary theory. Your job is to research your scientist in order to create an 8.5 x 11 sheet of paper that summarizes your findings in an appealing, easy to read format. You will be expected to write a 1 paragraph reflection on your research (what are your thoughts? How is your research relevant to the current evolutionary theory?).

NOTE you do not need to draw this! You may use resources like AutoDraw, Google Drawing, Photopea, and AlpacaFire to create these digitally!

Requirements: (*the following must be displayed in your final work*)

❏ Name of the contributor
❏ At least 1 relevant picture
❏ Clear description of contribution to evolutionary theory
❏ COLORFUL, neat and visually appealing in 8.5 x 11 format
❏ Reflection (on back of paper or separate page)

Contributors: (*put a star next to the one you get assigned!*)

● Aristotle ● Anaximander of Miletus ● Carolus Linneaus ● George Cuvier ● James Hutton	● Thomas Malthus ● Charles Lyell ● Jean-Baptist Lamark ● Charles Darwin ● Alfred Russell Wallace

Rubric:

	Excellent *(10 points)*	Satisfactory *(9-7 points)*	Needs Improvement *(6-3 points)*	Unacceptable *(2-0 points)*
Content	All content listed under requirements is included.	Most content listed under requirements is included.	Some content listed under requirements is included.	Very little content listed under the requirements is included.
Appearance	Appearance is neat, descriptions are typed or neatly written, content is organized on an 8.5x11 piece of paper	Appearance is mostly neat, descriptions are typed or neatly written, and is organized on an 8.5x11 piece of paper.	Writing is hard to read and/or the project is not neatly done. Work may or may not be on an 8.5x11 piece of paper.	Appears hastily made. The content is not neat or organized. Work may or may not be on an 8.5x11 piece of paper.
Reflection	Reflection clearly shows if the student understands if their topic supports or contradicts current evolutionary theory.	Reflection mostly shows that the student understands if their topic supports or contradicts evolutionary theory.	Reflection somewhat shows that the student understands if their topic supports or contradicts current evolutionary theory,	Reflection shows that the student does not understand if their topic supports or contradicts current evolutionary theory.
Overall	Overall work is colorful, visually appealing, organized	Overall work is mostly colorful, visually appealing, organized,	Overall work is somewhat colorful, visually appealing, organized, and accurate.	Overall work is not colorful, visually appealing, organized

	and accurate. Work stands out from the rest and shows evidence of extra effort.	accurate, and shows evidence of good effort.	More effort needed.	and accurate. Lack of effort is evident.

West Deptford High School

Subject	Biology
Grade	10th
Unit	Natural Selection & Evolution
Lesson	Concept 2
Estimated Time Period	31 Minutes

Standards

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HS-LS4-3: [*Disciplinary Core Idea*] - The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.

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Essential Questions

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Why do some species live in groups and others are solitary?

Understandings

Many factors affect variations of traits within species.
Scientific evidence supports natural selection as a mechanism for evolution.
Species change over time.

Critical Knowledge and Skills

Students will know…
The different patterns that show evidence for evolution including speciation, extinction, gradualism, punctuated equilibrium, divergent evolution, convergent evolution, and coevolution.

Learning Plan
➢ Begin Concept 2 Notes
  ○ Students will take notes via 'fill in the blank Concept 2 notes' posted on google classroom while watching the lecture through zoom or in person.
★ Students will complete Patterns of Evolution worksheet via Kami
★ If there is time left in the period, concept 2 study guide is posted on google classroom for students to work on.
  ○ Next week: Review concepts 1 & 2 Monday, Test Tuesday, Introduce "Design Your Own Animal" Project Wednesday & Thursday

Practice: Patterns of Evolution

Read the following scenarios and determine each pattern of evolution being described. Each of the patterns of evolution will be used once.

1. Butterflies, bats, and birds all have wings that allow them to fly. Butterfly wings, however, do not have bones like bat and bird wings do.

2. 4000 years ago, a population of cichlid fish were isolated in Lake Nagubago in central Uganda. Since then 5 new species have formed, distinguished by their differing coloration and mating rituals. These five groups of fish are considered unique species because they do not naturally interbreed.

3. A population of mollusks are living in a stable ecosystem in the ocean. A rapid drop in sea level causes the formation of a lake, which isolates a group of mollusks from the rest. This quick environmental change causes rapid evolutionary change. Due to the new small population, genetic drift occurs, and mollusks with larger shells rapidly become the most common trait.

4. The Dodo was a flightless bird, first spotted by Dutch sailors in 1598. Dodos had no known predators until sailors started hunting them and new invasive species were introduced. The last sighting of a Dodo was in 1662.

5. Dogs and wolves share a common ancestor – the Grey Wolf. They share similar body shape, skull size, limb formation, genetic makeup and much more. Varying temperament in wolves eventually became so drastic resulting in extremely aggressive wolves and docile wolves that were eventually domesticated, leading to the formation of dogs.

6. Male bumblebees go to flowers, such as orchids, to pick up chemicals that allow them to create attractive scents to put off for female bumblebees. Flowers have waxy pollen to stick to the bumblebee's heads and abdomens in order to spread their pollen to other flowers. These two traits – sticky pollen and chemicals for attractive scents – have evolved together, forming a mutualistic relationship between flowers and bumblebees.

7. Fossil evidence suggests that whales evolved from land mammals. This was a slow process over thousands of years that resulted from continual reduction of the ancestral mammal's forelimbs over time, until they were reduced to fins.

West Deptford High School

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Unit	Natural Selection & Evolution
Lesson	Evidence of Evolution
Estimated Time Period	45 Minutes

Standards

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Understandings

Critical Knowledge and Skills

Students will know…
How to read and build a phylogenetic tree based on given information about a group of organisms.

Learning Plan

➢ Students will select 5 traits from a given list of adaptations. After they've selected their traits, they will complete a chart that compares their "created animal" to real life animals. Finally, students will be asked to draw their created animal using paper or an online platform. They will need to include all 5 traits as well as the environment the animal lives in.

Design Your Own Animal! (PART1)

Natural Selection states that organisms that are best suited to their environment have the greatest chance of surviving and reproducing and thus passing down their favorable traits to future generations. In order to win this battle for survival, successful animals must possess certain beneficial traits that enable them to overcome the constant challenges they face in their environment. These traits, called **Adaptations**, have been developed over long periods of time (hundreds of thousands to millions of years) through evolution.

In this activity, you will choose some general information about an animal that will be helpful in determining some possible adaptations they may possess that would increase their chances of survival. You will use this information to create a fictitious animal that must posses all the general characteristics you have chosen. You should think about what your imaginary animal would look like and how it would live and behave in the wild. To assist you in this task, the chart on the next page will help you start thinking about possible adaptations your "Created Animal" may have.

An **Adaptation** is defined as: "a trait an organism has (physical or behavioral) that results in it being better suited to survive in its environment and thus allowing it to reproduce".

Directions:
1. Go to section **A** and carefully choose the traits that your "Created Animal" will have. Select carefully, your decisions are final.

2. Go to Section **B and Follow the Given Directions** on how to complete the chart that compares **traits of real animals** (existing or extinct) with **traits of your "Created Animal"**. You must fill in at least eight real animals on the chart.

Section A: You Will Each Select Traits (5 Total) From The Following Categories:

Size: (choose 1)

1. Smaller than a cat

2. Between a cat and a large dog

3. Between a large dog and a horse

4. Larger than a horse

Acquisition of Food: (choose 1)

1. Scavenger / Omnivore

2. Predator / Carnivore

3. Grazer / Herbivore

Survival Strategies: (choose 2)
1 from each group = 2 total

Group #1:

1. Speed / Quickness

2. Flight

3. Strength / Power

4. Keen Senses
(sight, smell, hearing, etc.)

Group #2:

5. Camouflage / Mimicry

6. Protective Structures
(shell, plate, spines)

Habitat: (choose 1)
Use google if you don't know what these are!

1. Tropical Rain Forest

2. Savannah

3. Taiga / Mountains

4. Temperate Grasslands

5. Desert

6. Deciduous Forest

7. Tundra

8. Polar Region

9. Ocean (surface or deep)

10. River / Stream

7. Poison
   (inject, spit, on skin, etc.)

   11. Lake / Pond

8. Sharp Claws, Teeth, or Beak

Section B: Comparison of Your "Created Animal" to Real-Life Animals Alive or Extinct:

Please list the names of animals in the real world (extinct or living) in the first column. You will delete what's written in red and type in the traits that you circled in section A.

- ❏ You must choose 5 real animals that fit into ANY 3 of your 5 categories
- ❏ Think of 2 real animals that fit into ANY 4 of your 5 categories
- ❏ **TRY** to think of at least 1 real animal that fits into all 5 of your categories (worth 2 extra credits points if you get this!).

Name of REAL Animal: (list below)	TYPE THE SIZE OF YOUR ANIMAL HERE	TYPE THE ACQUISITION OF FOOD FOR YOUR ANIMAL HERE	TYPE THE HABITAT FOR YOUR ANIMAL HERE	TYPE THE SURVIVAL STRATEGIES PART A FOR YOUR ANIMAL HERE	TYPE THE SURVIVAL STRATEGIES PART B FOR YOUR ANIMAL HERE
1.					
2.					
3.					
4.					
5.					

Design Your Own Animal! (PART 2)

<u>Directions:</u> You <u>MUST</u> Complete The Following Tasks <u>IN THE ORDER LISTED BELOW</u>:

1. Now that you've had some time to think about the possible traits of your new animal, it's time to create it. Please be <u>creative</u> in designing your "Created Animal"! On a blank sheet of paper <u>Draw a Picture</u> of your "Created Animal". Make your drawing large and be sure to show any physical adaptations your "Created Animal" has. Please color your drawing and please <u>include part of its **Habitat** (where it lives) as the background</u>. If you are not as talented as Picasso don't worry, just be neat and do the best you can.
   a. Things to include on your picture:
      i. Labeled characteristics:
         1. Do your best to label each trait (from Section A). Obviously labeling speed can be a challenge, just do your best.
         2. Make sure your picture includes color!
         3. Don't forget the habitat your creature lives in.
         4. You may:
            a. Hand draw your picture, take a picture of it, and insert it into this document
            b. Draw it directly on this document using "Insert - Drawing"
            c. Use the "Canvas" Application on the computer
               i. Click the little circle in the bottom left hand side of the computer
               ii. Type in the search "Canvas"
               iii. Free Hand your drawing
               iv. When you are done, you can exit the drawing and hit the 3 dots
               v. save as an image and insert the image onto this document
               vi. If you need any help, e-mail me and I can do my best to try and help
               vii. Whatever you decide to use, make sure your picture is FABULOUS!

West Deptford High School

Subject	Biology
Grade	10th
Unit	Natural Selection & Evolution
Lesson	Phylogeny
Estimated Time Period	45 Minutes

Standards

HS-LS4-2: Variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.

HS-LS4-3: [*Disciplinary Core Idea*] - The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.

HS-LS4-5: [*Disciplinary Core Idea*] -Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.

HS-LS4-5: [*Disciplinary Core Idea*] - Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species.

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

HS-LS4-3: [*Disciplinary Core Idea*] - Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.

Goals

Students will be able to…

      High school students investigate patterns to find the relationship between the environment and natural selection. Students demonstrate understanding of the factors causing natural selection and the process of evolution of species over time. They demonstrate understanding of how multiple lines of

evidence contribute to the strength of scientific theories of natural selection and evolution. Students can demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution. Students can demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution. Students can use models, apply statistics, analyze data, and produce scientific communications about evolution. Understanding of the crosscutting concepts of patterns, scale, structure and function, and cause and effect supports the development of a deeper understanding of this topic.

Essential Questions

How are species affected by the changing environmental conditions?
How does natural selection lead to adaptations of populations?
What evidence shows that different species are related?
What is the relationship between natural selection and evolution?
Why do some species live in groups and others are solitary?

Understandings

Critical Knowledge and Skills

Students will know…
How to read and build a phylogenetic tree based on given information about a group of organisms.

Learning Plan

➢ Review how to read a phylogenetic tree
➢ We will complete Phylogenetic Tree Practice WS 1 as a class, then students will individually complete Phylogenetic Tree Practice WS 2 independently
➢ Should there be time left at the end of class, I will introduce the lab we will be doing on Friday.

Practice: Phylogenetic Trees #1

Answer the questions about each tree below.

1. In the diagram to the right, which node represents the most recent common ancestor for organisms B and C?

   Add Text Here!

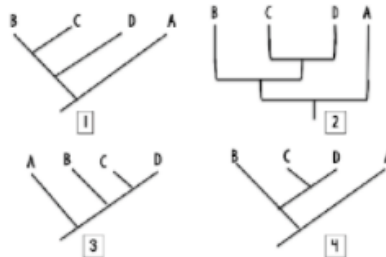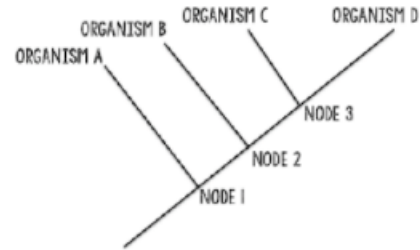2. Which node represents the most recent common ancestor for A and C?

   Add Text Here!

3. Which organism is B more closely related to, A or C? Explain.

   Add Text Here!

4. Which organism is B more closely related to, C or D? Explain. _____

   Add Text Here!

5. Which tree above shows a different evolutionary history from the others? Explain the difference.

   Add Text Here!

6. What characteristic do all of the organisms in the tree to the right have in common?

   Add Text Here!

7. What characteristic is common to only amphibians and land vertebrates?

   Add Text Here!

8. What characteristic(s) do sharks and lungfish have in common?

   Add Text Here!

9. Who is the ray-finned fish more closely related to – sharks or lungfish? Explain. _____

   Add Text Here!

10. Are lungfish more closely related to amphibians or land vertebrates? Explain. _____

    Add Text Here!