

9th Grade Biology:
History of Life and the Theory of Evolution

April 14 – April 17

Time Allotment: 40 minutes per day

Student Name: _____

Period: _____

Teacher Name: *Ms. Carstens*

Packet Overview

Date	Objective(s)	Page #
Monday, April 6	NO CLASS	
Tuesday, April 7	1. Describe Charles Darwin’s contributions to scientific thinking about evolution. 2. Analyze the reasoning in Darwin’s theory of evolution by natural selection.	2
Wednesday, April 8	1. Identify inferences on the history of life that are supported by fossils and strata. 2. Explain how biogeography provides evidence that species evolve adaptations to their environments.	5
Thursday, April 9	1. Explain how the anatomy and development of organisms provide evidence of shared ancestry.	8
Friday, April 10	1. Describe how convergent evolution and divergent evolution affect species diversity. 2. Compare and contrast natural selection and artificial selection.	13

Additional Notes: Greetings! As a reminder, in addition to email, you may attend my Zoom office hours to seek support for your weekly work. These sessions are intended for the purpose of answering questions, clarifying instructions, and seeking more information on the content topics for the week. If you need to attend, please join the session that corresponds with your class schedule. The times are listed below:

- 1st Period – Mondays, Wednesdays from 10:00-10:50 am
- 3rd Period – Mondays, Wednesdays from 1:00-1:50 pm
- 4th Period – Tuesdays, Thursdays from 10:00-10:50 am
- 6th Period – Tuesdays, Thursdays from 1:00-1:50 pm

A minor assessment is found on pgs. 17-18 of this packet. **At the end of your lesson on Friday, you will complete this minor assessment** reviewing this week’s lessons. You may use your **notes** from the week. It should take approximately 15 minutes.

Academic Honesty

I certify that I completed this assignment independently in accordance with the GHNO Academy Honor Code.

Student signature:

I certify that my student completed this assignment independently in accordance with the GHNO Academy Honor Code.

Parent signature:

I. Tuesday, April 14

Unit – Chapters 14-15: History of Life and the Theory of Evolution
Lesson 5: Darwin’s Ideas

Weekly Overview:

“The past, the finite greatness of the past! For what is the present, after all, but a growth out of the past.”

~Walt Whitman

We will continue our exploration of **the evidence surrounding Earth’s fossil timeline** as well as **the findings and observations made by** Charles Darwin, and Alfred Russel Wallace, **regarding evolution and natural selection**. Their contributions and the contributions of numerous others helped to determine what we know of life’s origins and development into the species we see today and provide insight into what we may see tomorrow!

As we continue our study this week, recall these concepts from our previous units and last week’s unit overview:

- **DNA makes up all living things.**
- **DNA sequencing allows for the diversity of species.**
- **Adaptations, variances, and mutations can allow for beneficial changes to an organism’s DNA.**

Let’s continue to dig deep into Earth’s history and explore the weaving tapestry of evolution and natural selection!

Lesson 5 Socratic Guiding Questions: Keep this in mind as you study!

What is “Survival of the Fittest?”

Objectives: Be able to do this by the end of this lesson.

1. Describe Charles Darwin’s contributions to scientific thinking about evolution.
2. Analyze the reasoning in Darwin’s theory of evolution by natural selection.

Introduction to Chapters 14-15: Lesson 5

In Lesson 5, we will explore the evidence and reasoning of Charles Darwin, an English naturalist, biologist, and geologist, in regard to variations in species, a natural selection of surviving organisms.

Read pages 299-301 from your text. Then, complete the tasks on the following pages.

GUIDED OUTLINE: Darwin’s Ideas (pp. 299-301)

- ❖ Concept Check: Darwin’s Ideas – p. 299
 - ✓ In the mid-1800s, Charles Darwin and _____ both formed a new theory to explain how evolution may take place.
 - ✓ Both Darwin and Wallace had been on _____ around the world.
 - ✓ The name of the ship on which Darwin traveled was the H.M.S. _____.

✓ Darwin published *On the Origin of Species by Means of Natural Selection* in _____.

- He had _____ goals in his book. List them below.

1. _____

2. _____

✓ What does the phrase “descent with modification” describe?

✓ Darwin specifically noted observations made regarding _____ similar species of _____ in the Galapagos Islands. He noted that each of the species had unique beak adaptations that allowed it to eat particular kinds of food. But Darwin suspected that all 13 species _____ from and _____ from just a few ancestral _____.

❖ Concept Check: Natural Selection – pgs. 300-301

✓ Darwin proposed the theory of _____ as the mechanism for _____.

✓ List and write a description of the four main parts of Darwin’s theory of natural selection.

1. _____ -

2. _____ -

3. _____ -

4. _____ -

- ✓ Who was Thomas Malthus? Why was he significant to Darwin?

- ✓ An _____ is a trait that makes an individual _____ in its _____.

- ✓ Darwin sometimes used the phrase, “survival of the _____.” In evolutionary terms, what does **fitness** represent?

- ✓ How are long-term **adaptation** and *acclimatization* different?

Thoughts to Contemplate: Carefully read the following quotes from Charles Darwin’s On the Origin of Species by Means of Natural Selection and respond to the question.

Quote #1:

“But if variations useful to any organic being ever do occur, assuredly individuals thus characterised will have the best chance of being preserved in the struggle for life; and from the strong principle of inheritance, these will tend to produce offspring similarly characterized. This principle of preservation, or the Survival of the Fittest, I have called Natural Selection. It leads to the improvement of each creature in relation to its organic and inorganic conditions of life; and consequently, in most cases, to what must be regarded as an advance in organisation.”

Quote #2:

“But Natural Selection, as we shall hereafter see, is a power incessantly ready for action, and is immeasurably superior to man’s feeble efforts, as the works of Nature are to those of Art.”

1. According to Darwin, what is “Survival of the Fittest?”

II. Wednesday, April 15

Unit – Chapters 14-15: History of Life and the Theory of Evolution

Lesson 6: Evidence of Evolution – The Fossil Record and Biogeography

Lesson 6 Socratic Guiding Questions: Keep these questions in mind as you study!

How does studying the earth's layers help to uncover the past? What does it lack?

Objectives: Be able to do this by the end of this lesson.

1. Identify inferences on the history of life that are supported by fossils and strata.
2. Explain how biogeography provides evidence that species evolve adaptations to their environments.

Introduction to Lesson 6

Recall that **strata** is a term used to describe rock layers in the earth's crust. Today, we will be learning that within these rock layers, we find **fossils, or the remains or traces of an organism that dies long ago**. Based on these fossils and how they are positioned within the rock strata, scientists can make inferences of when the organisms lived, what other species might be relatives, and possibly how/when they died out (if extinct). In addition, we will explore **biogeography and its impact on theories of natural selection and evolution**.

Read pages 302-305 (STOP at “Anatomy and Embryology”) in your text. After reading, complete the tasks on the following pages.

GUIDED OUTLINE: Evidence of Evolution

❖ The Fossil Record and Biogeography: Concept Check – pgs. 302-305

- ✓ What is a **fossil**? _____

- ✓ In _____, Nicholas _____, a Danish scientist, proposed the principle of _____, which stated _____
_____.
- ✓ Using this principle and fossils found in rock strata, geologists constructed a timeline for the order in which different groups of rocks and fossils were formed. This timeline is commonly known as the _____.
- ✓ Define the following:
 - **Relative age** –
 - **Absolute age** –

How are these terms different? _____

- ✓ Why is the fossil record considered an “incomplete history of life?”

- ✓ According to “The Distribution of Fossils” on pg. 303, what are four inferences that can be made from the fossil record?

1. _____

2. _____

3. _____

4. _____

- ✓ In “Transitional Species” on pg. 304, one other inference is made based on the fossil record—that, over time, species have _____.

_____.

Scientists give the evolution of modern whales as an example of evidence of transitional species. Using *Figure 15-7* on pg. 304, list 2-3 pieces of evidence they suggest.

- ✓ **Biogeography** – the study of the _____ of organisms around the world.

As Darwin and Wallace traveled the world (separately), they made some observations of organisms in different parts of the world that appeared to be closely related but adapted specifically for their environment. Give an example of this. (See pgs. 299, 305)

III. Thursday, April 16

Unit – Chapters 14-15: History of Life and the Theory of Evolution
Lesson 7: Anatomy and Embryology

Lesson 7 Socratic Guiding Question: Keep this question in mind as you study!
What physiological evidence exists for the theory of evolution?

Objective: Be able to do this by the end of this lesson.

1. Explain how the anatomy and development of organisms provide evidence of shared ancestry.

Introduction to Lesson 7:

Recall the following concepts:

- **Anatomy is the study of the body structure of organisms.**
- **Embryology is the study of how organisms develop.**
- **A theory is an explanation for some phenomenon that is based on observation, experimentation, and reasoning, supported by large quantities of evidence, and does not conflict with any existing research data or observations.**
- **DNA serves as a template for RNA to transcribe and translate in protein synthesis.**

Today, we will explore how physical features of organisms as well as their growth and development can provide evidence and support in the theory of evolutionary processes. By looking at an organism's structure, we gain insight into how various body parts are used differently among species.

Read pages 305-307 (START at "Anatomy and Embryology") in your text. Then, complete the guided outline below.

GUIDED OUTLINE: Evidence of Evolution

- ❖ Concept Check – Anatomy and Embryology and beyond: pgs. 305-307
 - ✓ Using *Figure 15-8* on pg. 305, list at least 2 similarities and 1 difference among the structures of the human, penguin, alligator, and bat.

Similarity: _____

Similarity: _____

Difference: _____

✓ Complete the table.

	Description/Definition	Example
Homologous structures		
Analogous structures		
Vestigial structures		

✓ *Biological Molecules*

- Organisms that share _____ have a more recent _____ than organisms that share fewer traits. Based on DNA, RNA, and protein sequences, scientists have determined that the greater number of _____ between any given species, the more closely the _____ are related through a _____.

✓ *Developing Theory*

- Hypotheses and theories about evolution continue to be _____, _____, and _____. Although modern evolutionary theory can never be “_____,” it is widely _____ and _____ because it explains the broadest range of observations and makes useful predictions.
- One such example of usefulness – **phylogeny**
 - **Phylogeny** is _____

- *Phylogenetic tree* – a diagram that of a particular phylogeny that shows branches from common ancestors over time, based on evolutionary observations
Ex: Whales and their hypothesized ancestry to camels, *Figure 15-10*

Thoughts to Contemplate: Carefully read the following quotes from Charles Darwin’s On the Origin of Species by Means of Natural Selection and respond to the question.

Quote #1:

“But just in proportion as this process of extermination has acted on an enormous scale, so must the number of intermediate varieties, which have formerly existed, be truly enormous. Why then is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic chain; and this, perhaps, is the most obvious and serious objection which can be urged against the theory. The explanation lies, as I believe, in the extreme imperfection of the geological record.”

Quote #2:

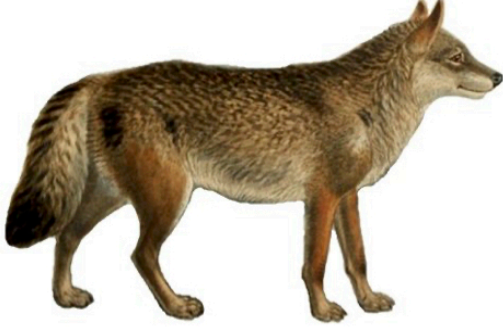
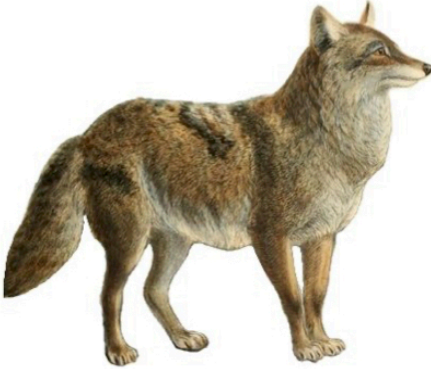

“The noble science of geology loses glory from the extreme imperfection of the record. The crust of the earth, with its embedded remains, must not be looked at as a well-filled museum, but as a poor collection made at hazard and at rare intervals. The accumulation of each great fossiliferous formation will be recognised as having depended on an unusual concurrence of favourable circumstances, and the blank intervals between the successive stages as having been of vast duration. But we shall be able to gauge with some security the duration of these intervals by a comparison of the preceding and succeeding organic forms.”

1. According to Darwin and your text, what shortcomings does the fossil record and the geologic time scale suffer when applied to evolutionary theory?

Complete the investigation on the following two pages.

Name: _____ Date: _____

Investigation: Is a dog more closely related to a coyote or to a wolf?

	<p>Gray Wolf</p> <p>Species Name: <i>Canis lupus</i></p> <p>Color: Light gray to black</p> <p>Size: 80-120 pounds, 2.5 feet tall</p> <p>Appearance: broad snout, round ears, long tail</p>
	<p>Coyote</p> <p>Species Name: <i>Canis latrans</i></p> <p>Color: Light gray to brown</p> <p>Size: 20-50 pounds, 1.5 feet tall</p> <p>Appearance: narrow snout, pointed ears, long tail</p>
	<p>Dog, Alaskan Malamute</p> <p>Species Name: <i>Canis lupus familiaris</i></p> <p>Color: Gray and white or brown and white</p> <p>Size: 70-80 pounds, 2 feet tall</p> <p>Appearance: broad snout, round ears, long tail</p>

1. Examine the images and descriptions above.

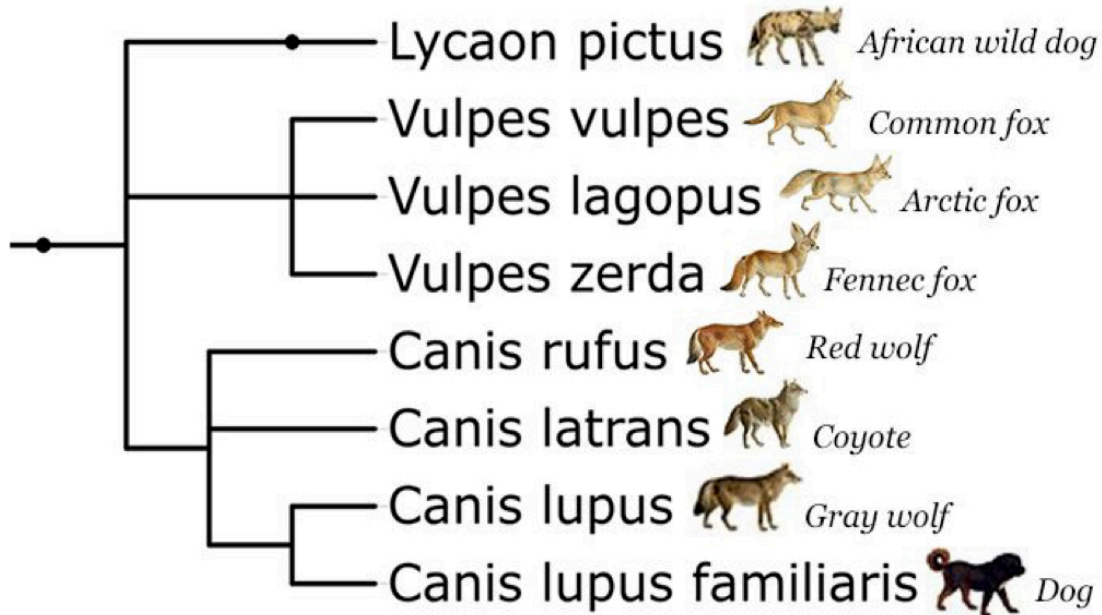
Underline any similarities between the dog and the wolf.

Place a star ★ next to any coyote traits that are similar to the dog.

2. Based on appearance alone, which do you think is the most closely related to a dog?

Part 2: Phylogenetic Trees

Once scientists learned how to sequence DNA, that became a great resource for determining relationships. A phylogenetic tree shown below is based on DNA evidence and similarities in appearance.



3. Branch points are called “**nodes**” and they indicate a more recent common ancestor from which each branch species has descended from.

- Place a box to indicate the node or common ancestor of all the fox species.
- Place a triangle to indicate the node or common ancestor of all the canis species.

4. Which two members of the canis group have the most recent common ancestor? _____

5. A species name has two words, a system called BINOMIAL NOMENCLATURE. The first word of a species name refers to its GENUS. For example, wolves, coyotes and dogs all belong to the genus “CANIS.”

What is the genus for the foxes? _____

6. In some cases, a third name is given to the animal to indicate a SUBSPECIES.

What animal on the chart is a subspecies? _____

What is this animal's full scientific name? _____

7. **Final Synthesis:** Is a dog more closely related to a coyote or to a wolf? _____
 Provide **EVIDENCE** from the phylogenetic tree to support your position.

8. **Extension:** Is a red wolf or a domestic dog more closely related to a common fox? Use the phylogenetic tree to explain your answer.

IV. Friday, April 17

Unit – Chapters 14-15: History of Life and the Theory of Evolution
Lesson 8: Evolution in Action

Lesson 8 Socratic Guiding Question: Keep this question in mind as you study!
What factors affect an organism’s ongoing evolution?

Objectives: Be able to do this by the end of this lesson.

1. Describe how convergent evolution and divergent evolution affect species diversity.
2. Compare and contrast natural selection and artificial selection.

Introduction to Lesson 8

In this lesson, we will **explore a proposed present-day case of evolution in action** found in the Caribbean islands. We will also **analyze two evolutionary processes that allow for variations** in species. Finally, we will discover how **the processes of natural selection and artificial selection differ** as well as **how some species coevolve**.

Read pages 308-310 in your text. After reading, complete the guided outline below.

GUIDED OUTLINE: Evolution in Action

❖ Concept Check – Case Study: Caribbean Anole Lizards pgs. 308-309

- ✓ When scientists compare groups of species, they tend to find _____,
that are best explained as _____.
- ✓ An example is the comparison of anole lizard species found on the Caribbean islands of _____, _____, _____, and _____.

Summarize what they observed and studied on these islands:

- ✓ Compare and contrast convergent evolution and divergent evolution using the chart below.

Convergent Evolution	Similarities? (At least 1)	Divergent Evolution
Definition:		Definition:
Example:		Example:

- ✓ Define adaptive radiation. _____

❖ Concept Check – Artificial Selection and Coevolution: p. 310

- ✓ Compare and contrast artificial selection and natural selection using the chart below.

Artificial Selection	Similarities? (At least 1)	Natural Selection
Definition:		Difference:
Difference:		Example:
Example:		

- ✓ **Coevolution** occurs when _____ or more _____ have evolved _____ to each other's _____.

Provide two examples of this process from your text.

1. _____

2. _____

Thoughts to Contemplate: Carefully read the following quotes from Charles Darwin's On the Origin of Species by Means of Natural Selection and respond to the question on the following page.

Quote #1:

“Two canine animals, in a time of dearth, may be truly said to struggle with each other which shall get food and live. But a plant on the edge of a desert is said to struggle for life against the drought, though more properly it should be said to be dependent on the moisture. A plant which annually produces a thousand seeds, of which only one on an average comes to maturity, may be more truly said to struggle with the plants of the sand and other kinds which already clothe the ground. The mistletoe is dependent on the apple and a few other trees, for, if too many of these parasites grow on the same tree, it languishes and dies. But several seedling mistletoes, growing close together on the same branch, may more truly be said to struggle with each other. As the mistletoe is disseminated by birds, its existence depends on them; and it may metaphorically be said to struggle with other fruit-bearing plants, in tempting the birds to devour and thus disseminate its seeds. In these several senses, which pass into each other, I use for convenience' sake the general term of Struggle for Existence.”

Quote #2:

“Therefore, during the modification of the descendants of any one species, and during the incessant struggle of all species to increase in numbers, the more diversified the descendants become, the better will be their chance of success in the battle for life. Thus the small differences distinguishing varieties of the same species, steadily tend to increase, till they equal the greater differences between species of the same genus, or even of distinct genera.”

Name _____ Period _____ Date _____

Quiz: Chapters 14-15

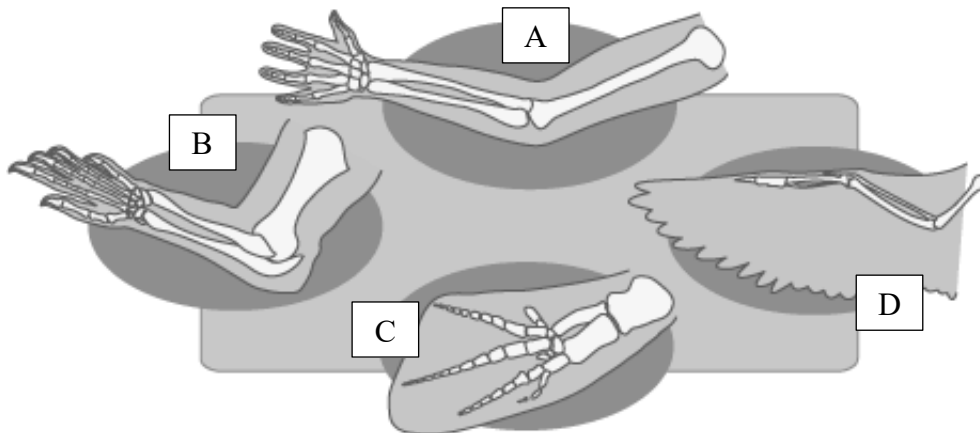
Directions: For each pair of terms, explain how they are related. These can be similarities, differences, and/or how they rely on one another.

1. *Relative age—Absolute age*

2. *Natural Selection—Artificial Selection*

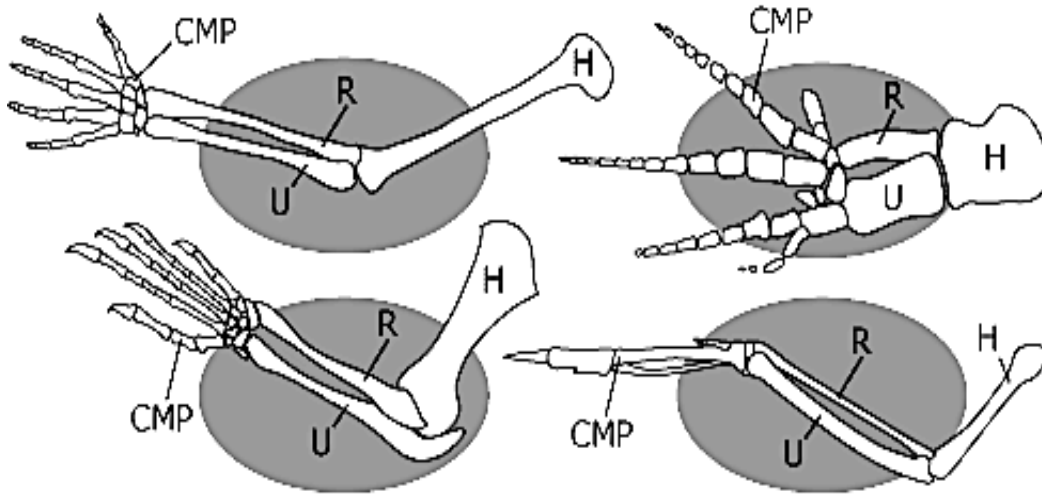
Directions: Study the homologous structures in the diagram below. Then follow the instructions and answer the questions on the next page based on what you see.

Homologous Tetrapod Limbs



- A. Human
- B. Lizard
- C. Whale
- D. Bird

Color the following homologous structures according to the key: *Humerus (H)* – red, *Radius (R)* – blue, *Ulna (U)* – green, *Carpals/Metacarpals/Phalanges (CMP)* – yellow.



1. Are all the bones arranged in the same way? Explain.
2. Compare the concepts of homologous structures, analogous structures, and vestigial structures.

Directions: Complete the following.

1. Identify and explain at least two observations and/or events led Charles Darwin to propose the theory of Natural Selection.