

ACTIVITY: SICKLE CELL ANEMIA AS AN ADAPTATION

HEU

1. What were the genotypes discussed in this activity?

AA (normal), AS and SS

2. What were the phenotypes?

Normal blood, normal w/ some sickled blood, Sickle cell anemia

3. Describe the hypothetical environment in the activity?

Africa - mosquitoes that carry malaria

4. An adaptation is a heritable characteristic that gives an organism an advantage in survival. What was the adaptation in this activity and why?

having sickle celled blood was an adaptation individuals w/ sickled blood cells didn't get malaria & therefore had an advantage to survive + reproduce

5. How could this adaptation change the population over time?

over time the allele for sickle celled blood could become more common

6. How did the environment affect this scenario?

the environment placed a pressure on the population, if malaria was present it wouldn't be advantageous to have the Sickle Cell trait

7. Currently there are not a lot of cases of malaria here in the United States. What could happen to the population in Massachusetts if a large amount of malaria infected mosquitoes were released into the area?

the sickle cell trait could become more frequent

8. Now imagine that malaria was eradicated. In this new scenario would the adaptation stay the same?

↳ no because, again, the sickle cell trait would no longer be advantageous

9. How does "survival" relate to how a population changes over time?

those that survive & reproduce pass on their traits to their offspring. Later generations will also have these inherited traits.

10. Look up the definition for natural selection in your book. Explain how this sickle cell / malaria example relates to natural selection.

Natural Selection states that individuals w/ advantageous traits will live to reproduce + thus pass on these genetic traits to their offspring.

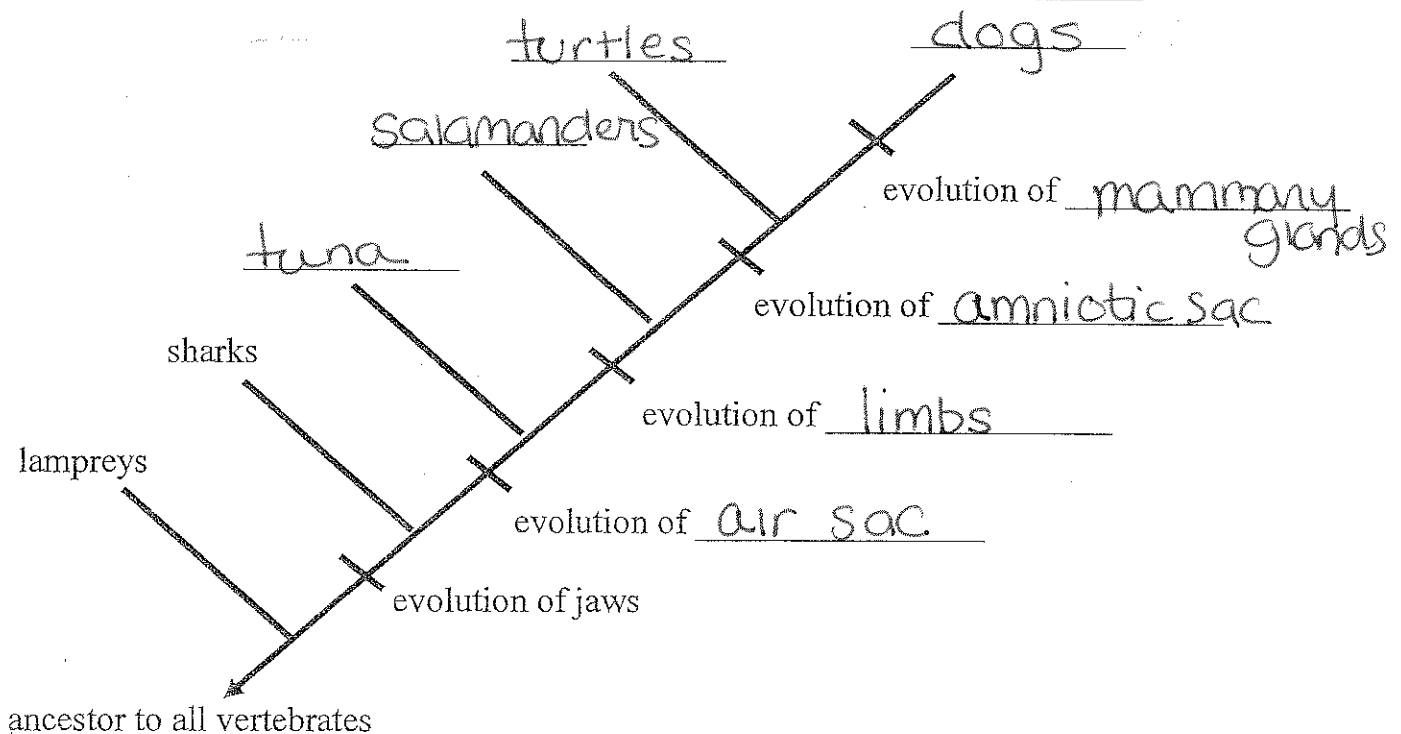
Building Darwin's tree of life – cladograms

KEY

Another way to classify life's diversity is by focusing on traits themselves*. Cladograms show a tree diagram that show relationships between related organisms. One metaphor for cladistics is the Russian nesting dolls – each additional branch shows additional traits that only the top groups possess.

For example, in the part that I have completed below, we are comparing all of the other organisms with the lamprey. So all of these organisms come from a vertebrate ancestry. Sharks (and all other organisms above) gained jaws as an additional trait.

	4 limbs?	air sac?	amniotic egg?	jaws?	mammary glands?	
dogs	yes	yes	yes	yes	yes	5
lampreys	no	no	no	no	no	0
salamanders	yes	yes	no	yes	no	3
sharks	no	no	no	yes	no	1
tuna	no	yes	no	yes	no	2
turtles	yes	yes	yes	yes	no	4
total "no"	3	2	4	1	5	



Any group that includes all ancestors and organisms with a trait is a clade. So in our example, we could talk about the jawed animal clade, or the vertebrate clade, or the amniote clade.

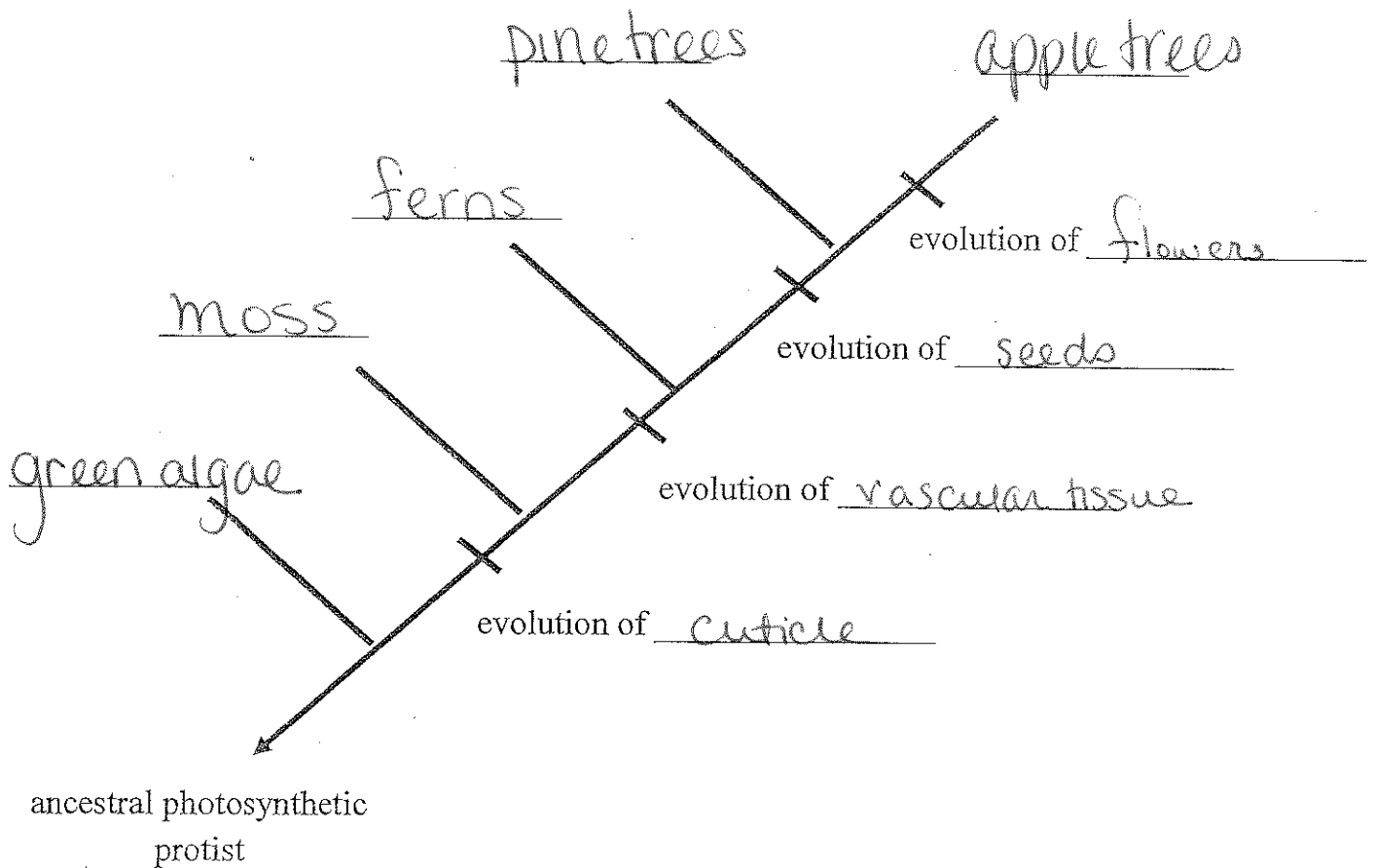
We could also use this diagram to discuss a group's phylogeny, or history of the species. For example, salamanders evolved from a common vertebrate ancestor that gained jaws, air sac, and legs over evolutionary time.

What organisms are members of the amniote clade?

For additional practice, complete the cladogram below showing a basic cladogram for plants (and plant ancestors).

	cuticle?	flowers?	seeds?	vascular tissue?	
apple trees	yes	yes	yes	yes	4
ferns	yes	no	no	yes	2
green algae	no	no	no	no	0
moss	yes	no	no	no	1
pine trees	yes	no	yes	yes	3

4 1 2 3



Questions:

1) Identify one clade that ferns are classified within.
(vascular tissue clade)

2) Describe the phylogeny of modern pine trees.

pine trees evolved from a common ancestor that gained a cuticle, vascular tissue & mod. seeds over time.

Chapter
17Organizing Life's Diversity, *continued*

Reinforcement and Study Guide

Section 17.2 The Six Kingdoms

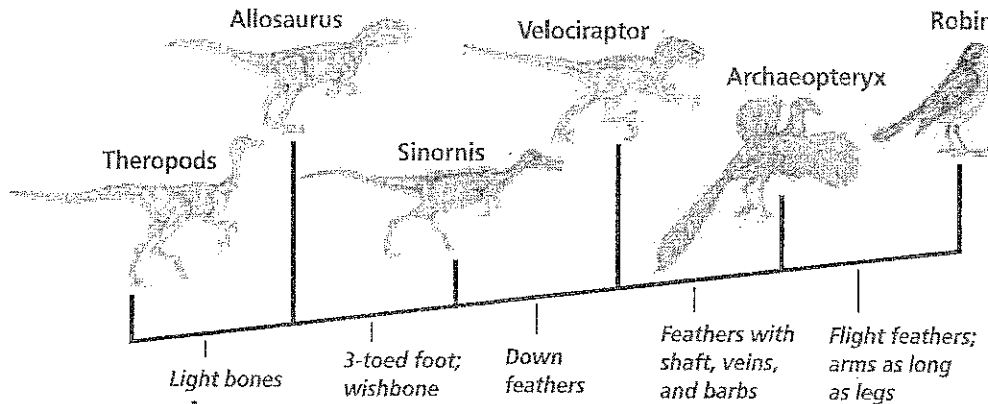
In your textbook, read about how evolutionary relationships are determined.

Explain how scientists use each item below to determine the evolutionary relationships among organisms.

1. structural similarities: homologous structures (common due to common ancestry)
2. breeding behavior: Interbreeding populations help to define a species
3. geographical distribution: location of organisms helps to show how animals might have evolved by thinking how did the organisms get there?
4. chromosome comparisons: similarities in genetics shows how close ancestry is
5. biochemistry: shows similarities in physiology

In your textbook, read about phylogenetic classification: models.

Use the cladogram to answer the questions.



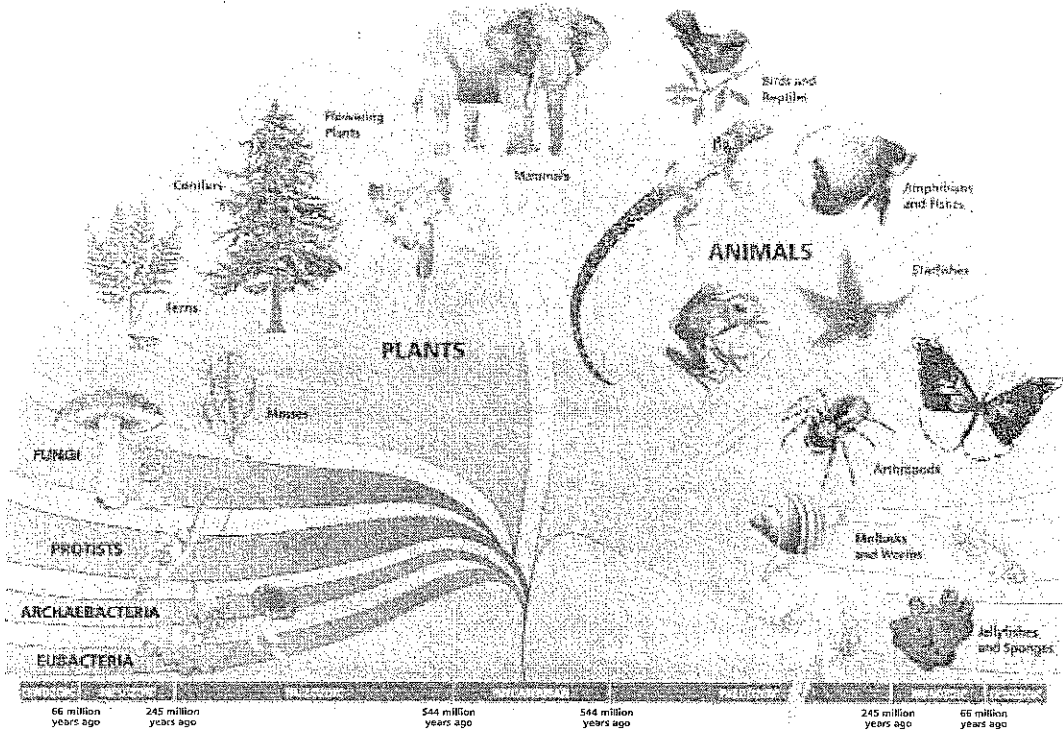
6. What five probable ancestors of the modern bird (robin) are shown on the cladogram? Archaeopteryx, Theropods, Allosaurus, Sinornis, Velociraptor
7. Which dinosaur is probably the most recent common ancestor of *Velociraptor* and *Archaeopteryx*? Sinornis
8. Which traits shown on the cladogram are shared by *Archaeopteryx* and modern birds?

Chapter **17** Organizing Life's Diversity, *continued*

Reinforcement and Study Guide

Section 17.2 The Six Kingdoms, *continued*

Use the fanlike phylogenetic diagram to answer the questions.



9. How does the fanlike diagram differ from a cladogram?

doesn't show derived characteristics

10. Which group of plants evolved most recently?

flowering

11. To which group are starfishes more closely related, arthropods or jellyfishes?

arthropods

12. Which group of animals includes the fewest species?

13. About how long ago did plants evolve?

In your textbook, read about the six kingdoms of organisms.

Circle the letter of the choice that best completes the statement or answers the question.

14. Organisms that do not have a nucleus bounded by a membrane are

- a. multicellular. b. eukaryotes. c. protists. d. prokaryotes.

15. Fungi obtain food by

- a. photosynthesis. b. chemosynthesis. d. absorbing nutrients from organic materials.

16. Animals are

- a. autotrophs. b. heterotrophs. c. prokaryotes. d. stationary.

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Evolution Worksheet answers

Part 1 – Short Answer

(Make sure to explain your answers fully).

Use the following information to answer questions 1-5

KEY

Year	# of Species 1	# of Species 2	# of Species 3
1960	180	150	205
1965	184	175	212
1970	179	185	225
1975	127	221	190
1980	104	256	208
1985	75	312	210
1990	20	335	222
1995	0	400	202

1. Describe what the data above indicates about each species.

Species #1 has a disadvantage. Something in their environment is putting pressure on this species. The species is unable to survive and by 1995 has died out. Species #2 must have an adaptation that is helping it to survive in its environment. Survival results in reproduction and passing on the genes to future generations. Species #3: this population is staying constant. Therefore, some individuals in the population have adaptations which help them to survive where other individuals probably are unable to survive and die.

2. Sketch a line graph diagramming the data. Provide a key (legend) for your graph.

3. What species was **best** able to adapt? Explain your reasoning.

Species #2 – population increased in number over time

4. Which species was **least** able to adapt? Explain your reasoning.

Species #1 – population decreased over time

5. What do you predict will happen in the next five years? Explain your reasoning.

The number of individuals in Species #2 will eventually level off, because they will eventually reach the carrying capacity (max number of individuals the ecosystem can support)

Part 2 – Multiple Choice/ Numerical Response

(Choose the best answer.)

1. Mutations cause variations among individuals. If these variations provide an advantage to individuals, then the resulting traits are known as adaptations. Which of the following statements about adaptations is **incorrect**?

A. They provide a selective advantage in any environment.

2. Which of the following statements about fossils is **not** true?

A. All vertebrates appear in fossil record at the same time.

3. The idea that populations produce more offspring than their environment can support was derived from the works of

A. Charles Darwin

4. Which of the following processes was proposed by Charles Darwin as the mechanism of evolution?

A. natural selection

5. Mutations may enable an organism to survive its environment better. The situation where a mutation that was once harmful turns out to be favorable in a new environment is referred to as

A. natural selection

6. The scientist that made a theory based on the above assumption, and the name of the theory, respectively, is

A. Lamarck, inheritance of acquired characteristics

6. Lamarck and Darwin came up with two very different theories of evolution. Lamarck's theory for how evolutionary change occurs is based on i , while Darwin's theory is based on ii . The statement

given above is completed by the information in row:

Row	i	ii
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A.	<i>the use and disuse of organs</i>	<i>the fossil record</i>
B.	<i>the fossil record</i>	<i>geology</i>
C.	<i>the use and disuse of organs</i>	<i>natural selection</i>
D.	<i>geology</i>	<i>natural selection</i>

8. The wings of birds and bats perform the same function and are an example of

A. homologous organs

9. What is required for natural selection to occur?

A. Variation within a species

10. Two species arise from a common ancestor. The process that has occurred is

A. divergent evolution

11. Which of the following is considered to be an evolutionary adaptation?

A. the ability of plants found near iron deposits to grow in soil enriched with iron

12. Evolution is defined as

A. a change in gene frequency of a population over time

13. Fish are among the oldest vertebrates. This is inferred from the

A. fossil record of vertebrates

Use the following information to answer the next question.

14. The most likely explanation for Observation 3 is that

A. the green individuals had a survival advantage

15. Charles Darwin was unable to explain the source of the variations he claimed were necessary for evolution. This was because

A. genes had not been discovered during his lifetime

16. What valuable information was not available to Darwin when he was formulating his Theory of Evolution?

A. Mendel's work on pea plants

17. Which field of research provides evidence that supports Darwin's Theory of Evolution?

A. All of the above

Part 3 – Matching

Match each of the following contributions to the Theory of Evolution with the scientist(s) that proposed it. Some contributions may be used more than once.

___c___ 1. Buffon

___d___ 2. Lamarck

___b, d, e___ 3. Charles Darwin

___e___ 4. Thomas Malthus

___a___ 5. Charles Lyell

___b___ 6. Alfred Russell Wallace