

Introduction to Natural Selection: Darwin & Lamarck

Written by Jennifer Folsom

Grade Level: Middle School

Overview

In this activity students will read two theories about how species change over time. Then, they will participate in an activity that requires them to apply their knowledge. Students will arrange sets of pictures in a way that demonstrates the two different theories.

Objectives

Upon completion of this activity, students will be able to:

- Describe the theories of Acquired Characteristics and Natural Selection.
- Arrange a set of cards to illustrate each theory.
- Explain why most scientists believe in Natural Selection.

Important Words

- Variation
- Benefit
- Adaptation
- Population
- Survival
- Inheritance
- Acquired Characteristics

Materials

Copies of **How do species change over time?**

Copies of **Activity Sheet 1: Compare the theories**

Copies of **Activity Sheet 2: Lamarck's theory** (white paper)

Copies of **Activity Sheet 3: Lamarck's Elephants** (white paper)

Copies of **Activity sheet 4: Darwin's theory** (colored paper)

Copies of **Activity Sheet 5: Darwin's Elephants** (colored paper)

Time Needed

60 minutes (less if reading is done ahead of time)

Teacher Preparation

Read the background information and **How species change over time**. Review Teacher Keys for the elephant card activities. Determine if you will have the students read the material individually, round robin, or if you will read it to them. You may want to assign the reading as homework or earlier in the week, and, then read it again in class.

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Background Information

Natural Selection is a scientific theory that has been supported by tremendous amounts of scientific evidence. In this lesson, students will be exposed to Natural Selection and an earlier alternate theory—Acquired Inheritance. Both of these theories are founded on the belief that animal species change over time and that offspring inherit traits from their parents. The two theories differ on how animals change and what traits offspring inherit from their parents.

The theory of **Acquired Inheritance** was introduced by Jean Baptiste Lamarck. It was based on his belief that individual organisms made changes in themselves and passed those changes on to their offspring. In his theory, individual organisms had the ability to change their physical characteristics. Giraffes that needed longer necks, or elephants that needed longer trunks would use them more and they would extend them through use. Lamarck not only believed that animals could make these changes, but also that they could pass them on to their offspring. For example, when mama giraffe stretched her neck a little to reach more food, it would stay stretched, and her new baby would have that long neck too.

Charles Darwin introduced **Natural Selection** to the scientific community. He said that organisms could neither willfully change themselves nor pass those changes on to their offspring. He said that individuals survived (or didn't) based on the specific traits they possessed. His well-known saying "survival of the fittest" meant that out of the entire population of one type of organisms, only the fittest will survive in an environment with limited resources. Those with the best adaptations for survival stayed alive and were most likely to reproduce. When they reproduce, they passed on their beneficial traits to their offspring. Eventually, the population had a higher percentage of individuals with those more "fit" traits. If the environment changed again in some way, the process happened again. As long as environments continue to change, so will makeup of populations of organisms. Natural Selection is the driver behind evolution.

This activity builds a foundation for understanding evolution, but does not explain the whole process of evolution. The goal is simply to describe a method by which plant and animal species can change over time. Evolution is taught in the upper grades. By giving your students an introduction to one of its mechanisms, you can provide them with a strong base for future learning. Standards in higher grades require mastery of these concepts.

There are many of web pages out with information on Darwin, Lamarck, their theories, evolution, and the controversy surrounding teaching evolution in public schools. Here are just a few:

- **www.nsta.org** is a comprehensive website for the National Science Teachers Association. Read their position statements on a variety of topics to learn what they think should be taught in science classes.
- **www.nap.edu/readingroom/books/evolution98** is an activity guide for teaching the foundations of evolution. It has some good teaching recommendations and explanations.
- **www.ncseweb.org** is a national organization that actively defends teaching evolution in the classroom. This organization acts as a clearinghouse for information on this topic.

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- www.wikipedia.org/wiki/Charles_Darwin or www.wikipedia.org/wiki/Jean_Baptiste_Lamarck These web pages give basic background information on these two scientists.

Activity 1: Introduction 5 minutes

Explain that a long time ago scientists noticed that the earth's organisms had changed over time. They started wondering how this could have happened. Two main theories developed—the theory of **Acquired Characteristics** and **Natural Selection**. Explain to your students that today you are going to study what those two theories said about how organisms changed.

Activity 2: 20 minutes

Complete the reading selection, **How do species change over time**, which is in the form of a question and answer sheet. Analyze the reading selection and have students complete **Activity Sheet 1: Compare the theories**. Encourage your students to think carefully about the information they just read. They will need to collect information from the reading to complete their sheet.

Review the students' responses and answer any questions they may have.

Activity 3: Order the Elephants 20 minutes

This activity requires students to apply their knowledge of the two theories. Using the pictures and the information provided in their labels, they will need to place each set of cards in order. Have the students work in pairs so they can discuss their ideas.

Hand out **Activity Sheets 2 and 3**. Have the students cut apart the pictures of Lamarck's elephants on **Activity Sheet 3**. They need to use what they learned about his theory to glue them down in the proper order on **Activity Sheet 2**.

Once the students are finished, hand out **Activity Sheets 4 and 5**. Have the students cut apart the pictures of Darwin's elephants on **Activity Sheet 5**. They need to use what they learned about his theory to glue them down in the proper order on **Activity Sheet 4**.

If your students are struggling with this you may want to do this activity as a class.

Conclusion 15 minutes

Review the two theories. Be sure to cover their main differences and how both theories agree on the fact that species did change.

Reading Selection: How do species change over time?

1. Who first studied how species change over time?

Jean-Baptiste Lamarck (1744-1829) and Charles Darwin (1809-1882) both had ideas about how life on earth got to be the way it is now. Some of their ideas were similar and some were very different.

2. What did Darwin and Lamarck think?

In the 1800s, when Darwin and Lamarck were alive, most people did not think that species changed at all. Many people believed that the way an organism was right then was an example of how that species had always been, and the way that species would always be.

Darwin and Lamarck disagreed with that idea. Both of them thought that living things on this planet had changed gradually over time, were still changing, and would keep changing. They also both thought that living things change so that they have a better chance of surviving in their environment, but they disagreed on how that change happened. Lamarck called his theory, the theory of **Acquired Characteristics**. Darwin called his idea **Natural Selection**.

Lamarck said that the animals were **selecting themselves** to survive. Species never went extinct; they just kept changing. Darwin said that nature exerted the pressure on a population to change, and then **nature selected** those with the best traits to survive. He believed that populations of organisms could become extinct if they were not well enough adapted to their environment.

3. What is Lamarck's theory of Acquired Characteristics?

Lamarck put forth the theory of **Acquired Characteristics**. He said that if an individual *wanted* to change something about the way its body worked, it could. When that individual reproduced, the changes that it had made during its lifetime would be passed on to its offspring.

For example, Lamarck believed that elephants all used to have short trunks. When there was no food or water that they could reach with their short trunks, they had to do something in order to survive. He believed that they stretched out their trunks a little bit, and were able to reach more water and food. When they had babies, he said that they were born with their trunks already stretched out a little longer. When this next generation needed to reach food and water that was even farther away, they stretched their trunks even farther. When they had their own babies, they were born with these even longer trunks. Eventually, all elephants were born with long trunks.

4. What is Darwin's theory of Natural Selection?

Darwin said that the fact that an individual changes something about its body or its behavior during its lifetime doesn't mean that change can or will be passed on to their offspring. Darwin said that organisms only pass down the traits that they themselves were born with. He said that individual organisms, even of the same species, are all just a little bit different from each other. For example, each person is just a little different from every other person. We have different eye colors, hairlines, and earlobes, but we are all still people. He called this **variation** within a **population or species**.

Darwin said the reason that populations changed over time was because of the pre-existing variation within the population. Certain variations made some organisms better suited to their environment than others. Since the ones that are better adapted had a survival advantage, they also lived longer, and were able to reproduce more. Every time they reproduced they passed their successful traits down to their offspring. We know today that it was the genetic makeup of entire populations that changed over time, but there was no change within each organism.

For example, Darwin would have said that a very long time ago most elephants had short trunks, but because of variation with elephants, a few of them had longer trunks. During times when food or water resources were inaccessible to elephants with short trunks, those animals with short trunks died off. They could not get enough food or water. The ones with longer trunks were able to get food and water, so they lived and went on to reproduce. Eventually, all of the elephants in the population had longer trunks. He called this process Natural Selection. It means that nature is doing the selecting, either for or against a certain trait or behavior.

5. Why do so many scientists believe Darwin was right?

Darwin's theory of Natural Selection has been supported by a lot of evidence. Lamarck's theory has been disproved. This was done in two ways— observations and new information about genetics.

Proof from Observation

Scientists have examined fossil evidence as well as living animals and found that their research doesn't support Lamarck's theory. Some things they have observed are:

- Physical injuries are not passed on to children.
- If a person is very good at chess, it doesn't mean that their children will be very good at chess. Their children will have to learn how to play, just like their parent did. Some will be good players through practice, while others will never master the game or acquire the skills to play.
- Fossils show evidence of entire populations becoming extinct. In Lamarck's theory, organisms would never become extinct. They would just change themselves into something else.

Proof from Genetics

The other evidence that proves Lamarck's theory wrong is the evidence provided by the study of genetics. Darwin knew that characteristics are passed on from parents to their children, but he never understood exactly how that happened. Today we know how through the study of genetics.

Your whole body is made up of trillions of cells. Each cell is so small that you can't see it without a microscope. Cells are composed of even smaller structures. Chromosomes are some of those very tiny structures inside of your cells. Chromosomes are made up of even smaller parts called genes.

Your genes make you who you are. They are the code that runs your body, much like the codes that run computers. Genes determine whether your hair grows straight or curly, or whether your ears stick out or lie flat. If you have children, you will pass one half of your genes on to them. The other one half of their genes will come from their other parent. Then, your children have their own set of genes, a mix of genes from both parents.

If you think about the elephants again, Lamarck said that the elephants stretched out their trunks and passed on those stretched out trunks to their babies. Now, we know this is not possible. The stretched out trunk is not part of their genes, and their genes are what they pass on to their babies.

Activity Sheet 1: Compare the theories!

Name _____ Date _____

Topic		Who thought this? Lamarck, Darwin, or both of them?
1.	Organisms have changed over time.	
2.	Organisms changed because they wanted to survive.	
3.	There was variation in a population.	
4.	Certain traits helped organisms survive and reproduce better than other organisms without those traits.	
5.	Organisms can never become extinct.	
6.	The environment had something to do with why organisms changed.	
7.	Parents are able to pass on at least some of their traits to their offspring.	
8.	Parents are only able to pass on traits that they were born with.	
9.	Organisms could decide to change something about their body and pass on that change to their offspring.	
10.	Organisms are still changing.	

Activity Sheet 1: Compare the theories!

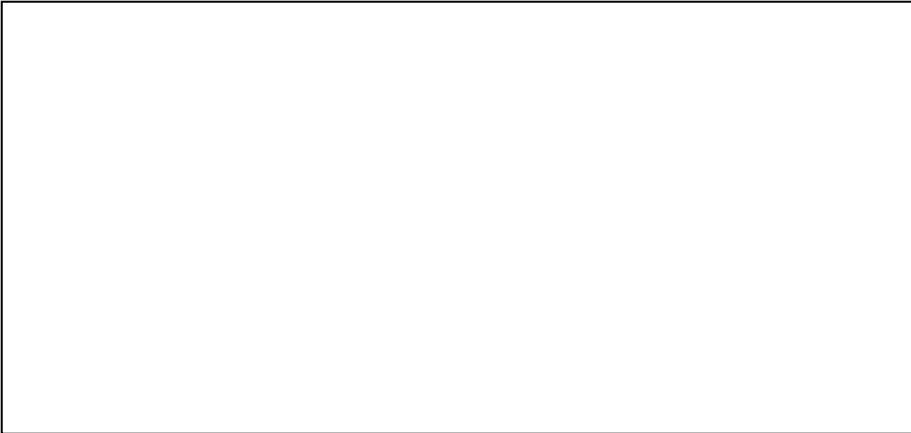
Teacher Key

Topic		Who thought this-- Lamarck, Darwin, or both of them?
1.	Organisms have changed over time.	Both
2.	Organisms changed because they wanted to survive.	Lamarck
3.	There was variation in a population.	Darwin
4.	Certain traits helped organisms survive and reproduce better than other organisms without those traits.	Darwin
5.	Organisms can never become extinct.	Lamarck
6.	The environment had something to do with why organisms changed.	Both
7.	Parents are able to pass on at least some of their traits to their offspring.	Both
8.	Parents are only able to pass on traits that they were born with.	Darwin
9.	Organisms could decide to change something about their body and pass on that change to their offspring.	Lamarck
10.	Organisms are still changing.	Both

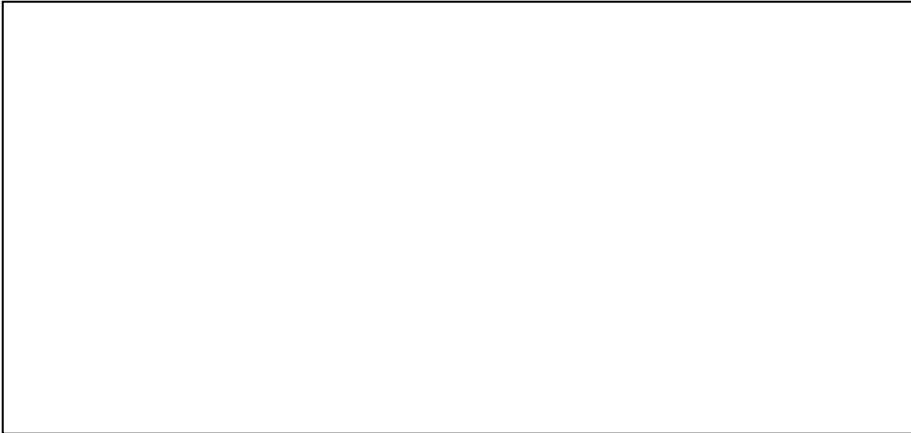
Activity Sheet 2: Lamarck's Theory

Name _____ Date _____

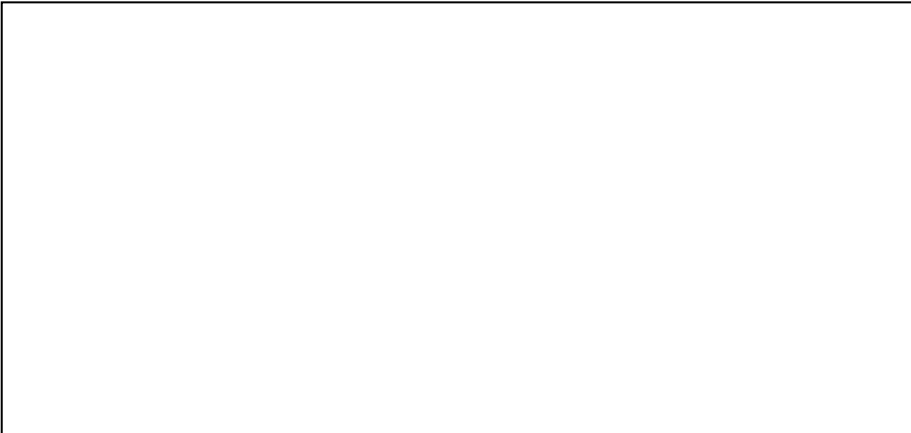
Step 1



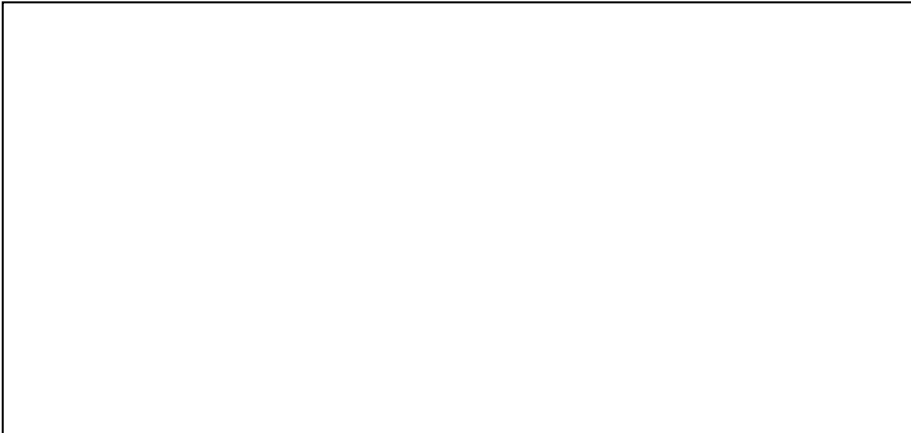
Step 2



Step 3

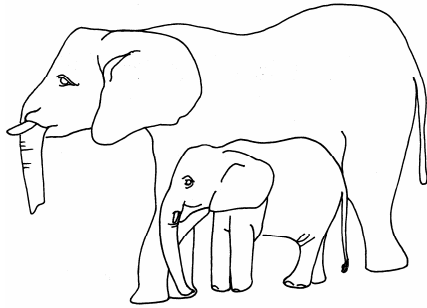


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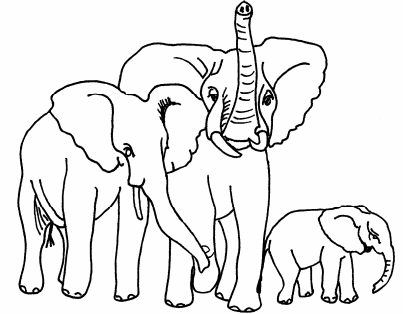


Activity Sheet 3: Lamarck's Theory

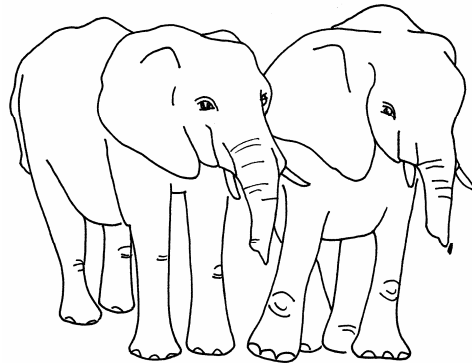
Baby elephants are born with stretched trunks .



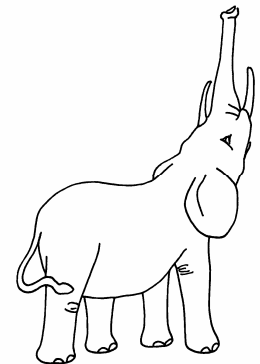
Elephants continue to stretch their trunks and have babies with even longer trunks



All elephants have short trunks



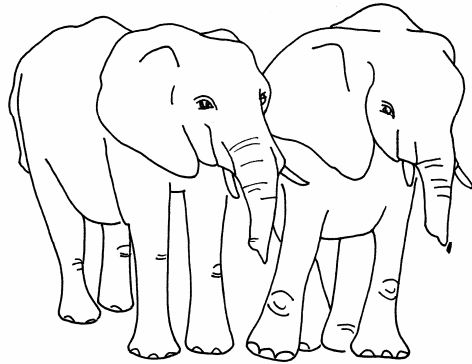
All elephants stretch their trunks a little.



Teacher Key

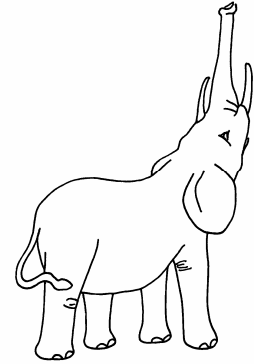
Step 1

All elephants have short trunks.



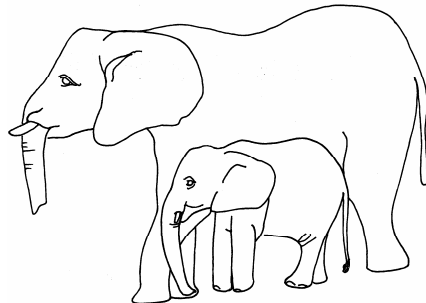
Step 2

All elephants stretch their trunks a little.



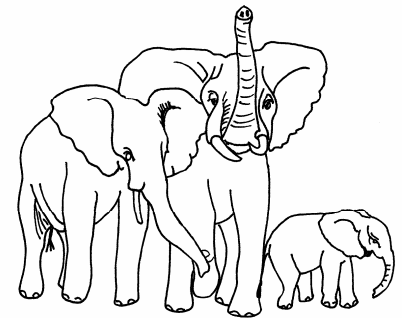
Step 3

Baby elephants are born with stretched trunks



Step 4

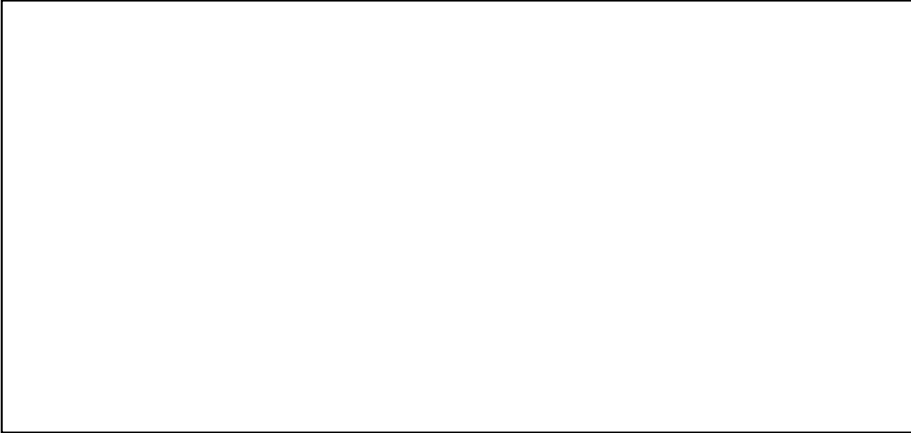
Elephants continue to stretch their trunks and have babies with even longer trunks



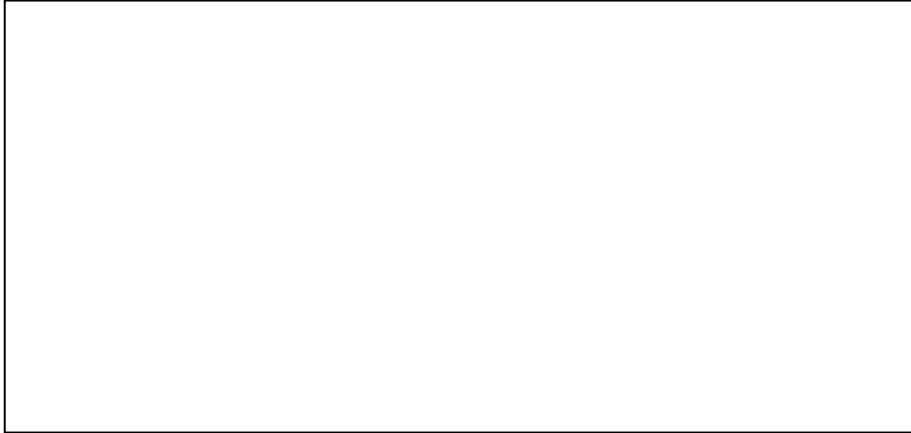
Activity Sheet 4: Darwin's Theory

Name _____ Date _____

Step 1



Step 2



Step 3

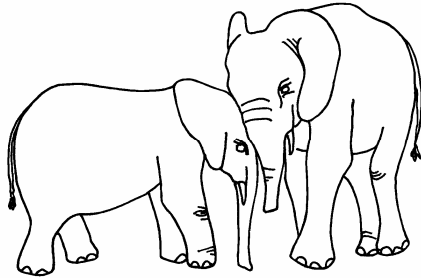


Step 4

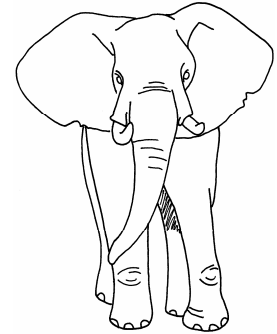


Activity Sheet 5: Darwin's Theory

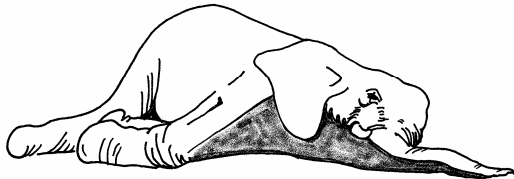
Most elephants have short trunks, but some elephants have long trunks



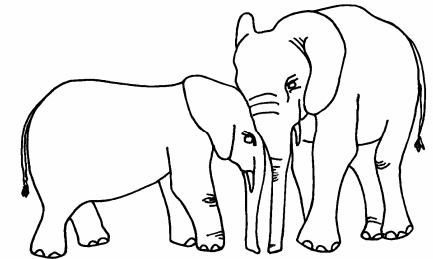
All the elephants that survive have long trunks.



Short-trunked elephants begin to die off because they can't reach food and water.



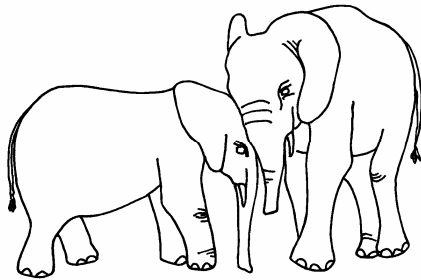
Living elephants with long trunks have babies with long trunks.



Activity Sheets 4 and 5: Darwin's Theory
Teacher Key

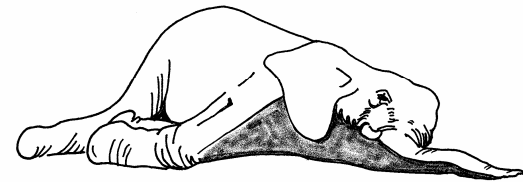
Step 1

Most elephants have short trunks, but some elephants have long trunks



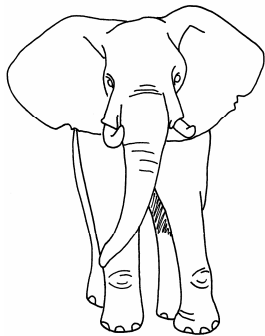
Step 2

Short-trunked elephants begin to die off because they can't reach food and water.



Step 3

All the elephants that survive have long trunks.



Step 4

Living elephants with long trunks have babies with long trunks.

