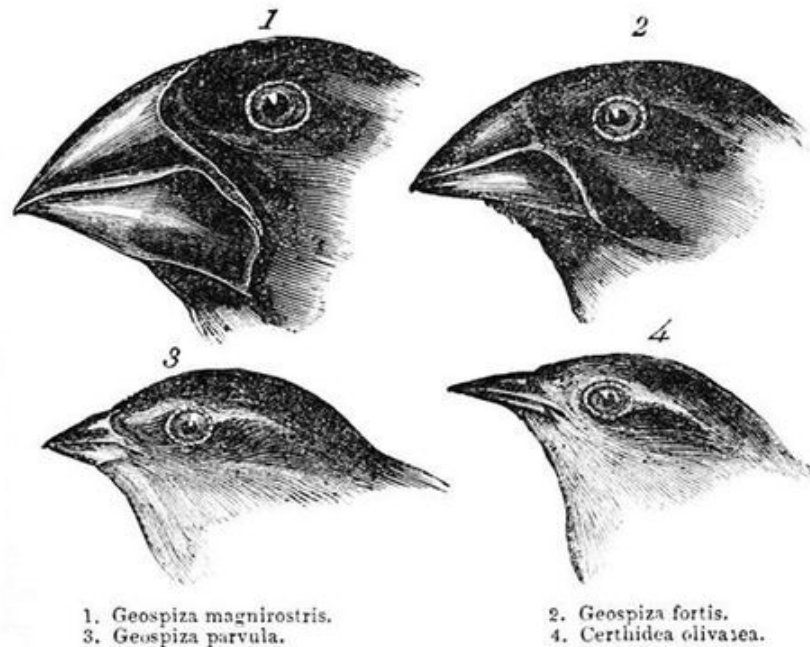


# Two Sets to Build Difference

by ReadWorks



You are most basically a blend of your biological parents. Your genetic material is a combination of their genetic material. A human typically has 46 chromosomes that contain his or her DNA, commonly referred to as genes. 23 chromosomes are provided by the maternal egg and 23 chromosomes are provided by the paternal sperm. Whether fertilization—the combining of an egg and a sperm cell—happens naturally or in a laboratory setting, the egg and sperm must be added together. Only once the egg is fertilized, with a complete set of genetic material, will it begin to divide and grow into an unborn fetus.

This combination of two incomplete sets of genetic materials accounts for trait variation and change (or *evolution*) across a sexually reproducing population. Charles Darwin, an English naturalist who lived and studied during the 19th century, was among the first scientists to observe and identify this phenomenon. For Darwin, his observations were ultimately clarified on a globe-spanning voyage aboard the HMS (Her Majesty's Ship) *Beagle*. It was captain Robert Fitzroy who brought Darwin on board for what was, in fact, the second voyage of the *Beagle* (from December 27, 1831 to October 2, 1836). The *Beagle's* mission was to survey the coastlines of South America, in order to render more accurate charts and maps. Darwin took advantage of these trips to explore the South American inland, and catalogue the various flora and fauna (plant and animal life) and various geological conditions. The *Beagle's* visit to the Galapagos Islands proved to be the most important for Darwin's studies.

It was on the various Galapagos Islands that Darwin first noted what are now classically referred to as Darwin's finches. He originally referred to these birds in scattered notes as either mockingbirds or wrens. It was only after his return to England and consultation with other scientists that Darwin came to understand these birds as different species of finches. This clarifying point led Darwin to reconsider his findings and ultimately arrive at his most compelling conclusions regarding variation and evolution.

Darwin gave special attention to the different beaks among these different species of finches. He considered how a certain beak might be better suited for consuming a specific type of food. For example, a larger beak might be better suited for cracking seeds and nuts with harder shells that may fall to the ground. Smaller and more nimble beaks might be better suited for catching insects quickly in mid-air. He also noted that larger finches tended to be found foraging for food on the ground, while smaller finches stayed perched in trees. When Darwin turned his mind to questions of why each bird had been bestowed with these particular features and habits, he ultimately began to formulate his theory of natural selection.

Darwin understood each human to be a product of his or her parents. He recognized that a child, while resembling each parent, has a varied collection of the traits both parents managed to pass on. In that capacity for variation, Darwin saw potential for adaptation. If finch offspring were endowed with more advantageous traits, a larger beak perhaps, better at cracking seeds that have fallen to ground, then that particular bird would live a more successful life. With a greater inherent ability to consume food, that particular finch would stand a greater chance of living long enough to find a mate and produce offspring of its own. Thus, the advantageous variation would be passed on. As a population accumulates advantageous variations across generations, this piecemeal process builds into what is called speciation. The evolutionary process, called survival of the fittest, results in the formation of a new species.

Evolutionary scientists have over the years come to appreciate just how serendipitous an event Darwin's visit to the Galapagos Islands was. We might go as far as to consider the Galapagos Islands a natural laboratory, perfectly suited to observe the various results of evolutionary processes. We must first reconsider the phenomena of variations across a population being passed on through subsequent generations. If the population is very large or in close proximity to, and can interbreed with other populations of the same species, advantageous traits must trickle down over many generations before a critical number of individuals can be cast as a distinct species. However, if the population is small and isolated (only able to breed amongst itself), then an advantageous variation might only be passed down through relatively few subsequent generations before a new species distinguishes itself.

The Galapagos Islands provided the perfect environment for accelerated evolution and speciation in Darwin's finches. The populations were small and perhaps most importantly, isolated from mainland South America. This allowed sexual reproduction and individual cases of mutation to introduce advantageous traits and disadvantageous traits that would not be diffused across a very large population. Darwin noted specifically that, while of distinctly different species, the finches of the Galapagos bore some resemblance to the finches of mainland South America. Perhaps a strong wind blew ancestral finches flying along South America's coastline off course. The disoriented ancestors ultimately found a home on the more recently formed volcanic islands of the Galapagos. The newly settled population bred. The individuals among subsequent generations that were fitter or better adapted to certain conditions of the population's new home, continued the breeding process, and thus, new species evolved. Those individuals that inherited disadvantageous traits, given environmental stressors, stood a greater chance of dying off before they could reproduce and pass the traits on to their offspring.



# species

spe · cies

## Definition

noun

1. a group of living things that are the same in many important ways. Members of a species can produce young together.

*Cats and dogs belong to different species.*

## Advanced Definition

noun

1. in biology, the most fundamental classification of living things, comprising individuals that can breed with one another but not with those of other species; subdivision of a genus.
2. a variety, type, or kind of something; sort.
3. the human race (prec. by the).

## Spanish cognate

*especies*: The Spanish word *especies* means species.

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## These are some examples of how the word or forms of the word are used:

1. Plant life, animal **species**, bacteria and other chemical compounds have all evolved in specific ways that enable their survival in diverse, and sometimes even hostile environments.
2. Mesopotamia is considered the birthplace of agriculture-it is here where the first **species** of wheat, barley, flax, chick pea and lentil were first cultivated by man for human consumption.
3. The possible variations inherent in recombining the parents' DNA are very, very broad and infinitely larger than the pool of entries in the state lotto jackpot! That's why we get so much variation even within the population of a particular sexually reproducing **species**.
4. Central Park is located in the middle of Manhattan and takes up quite a chunk of land. It includes a couple of ponds, hundreds of trees, large grassy areas, rocky parts, and trails for urban "hiking." Many **species** of animals call Central Park home, too.
5. Scientists unveiled pieces of skull and bone that are approximately 2 million years old. Their discovery confirmed what earlier fossil findings had introduced as a possible piece of the human origin story: that humankind is merely one of a number of human-like **species**, each with its own lifespan.
6. The Everglades, a famous region in Southern Florida, are a wetland ecosystem home to tropical and marshland plant and animal **species**.

7. Irrigation is incredibly important to the survival of the **species** of man. One-third of all food in the world that is produced comes from irrigated lands.
8. Zoe remembered hanging posters of endangered animals in her room as a child and hoped one day she would somehow be able to save them. Therefore, when she came to work at the zoo, she wanted to work in the exhibits of endangered **species**.
9. The Amazon rainforest in South America is an amazing place. Filled with beautiful tropical flowers, towering trees, colorful parrots, and poisonous fish, it has some of the greatest levels of biodiversity of any region in the world. This means there are more different kinds of animal and plant **species** in this forest than in most other places.
10. When the famous naturalist Charles Darwin, who helped develop the theory of evolution, visited the Galapagos Island in the 1830s, he made an interesting discovery about native birds. He noticed that 13 different **species** of finches were all very similar, but that they differed in the size and shape of their beak. Some of the birds had long, thin beaks, while others had short, thick beaks; others still had shapes somewhere in between.

# variation

var · i · a · tion

## Advanced Definition

### noun

1. the act or process of changing, or the condition of being changeable.

*During the spring, there is a great deal of variation in the temperature.*

2. a slightly different form or version of something, such as an artistic work.

*This story is a variation of a well-known folk tale.*

3. the degree to which something varies; amount of change or difference.

## Spanish cognate

*variación*: The Spanish word *variación* means variation.

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## These are some examples of how the word or forms of the word are used:

1. Consider, for instance, the cellular phone. It wasn't until the early 1980s that this mobile **variation** on the standard telephone was even available for people to use, but now, in 2013, cell phones are everywhere, sending and receiving information in speedy ways invisible to the human eye.
2. "Seeing what goes on inside of all of us was a shock," Dr. Shu said. As a student, she had studied the theory of how the human body worked-right down to the molecular level-but she hadn't expected the reality to look so different from her textbooks. "What struck me was how much **variation** there is in tissue color and other internal features," she said. "Everyone looks different on the inside as well as the outside."

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Who was Charles Darwin?

- A. the captain of a ship whose mission was to survey the coastlines of South America
- B. a boy who grew up on the Galapagos Islands and later moved to England
- C. one of the first scientists who identified the phenomenon of evolution
- D. a scientist known for studying the planets and discovering Neptune

2. What is the sequence of events in this passage?

- A. Darwin observed finches; Darwin developed his theory of natural selection; Darwin sailed to the Galapagos Islands.
- B. Darwin observed finches; Darwin sailed to the Galapagos Islands; Darwin developed his theory of natural selection.
- C. Darwin developed his theory of natural selection; Darwin sailed to the Galapagos Islands; Darwin observed finches.
- D. Darwin sailed to the Galapagos Islands; Darwin observed finches; Darwin developed his theory of natural selection.

3. Advantageous traits are passed on from a finch to its offspring.

What evidence from the passage supports this statement?

- A. In his notes, Darwin first referred to the finches on the Galapagos Islands as mockingbirds or wrens.
- B. Having advantageous traits increases the chance that a finch will live long enough to produce offspring.
- C. The mission of the *Beagle* was to survey the coastlines of South America in order to make better maps
- D. A strong wind may have blown finches flying along South America's coastline toward the Galapagos Islands.



4. How likely to survive is a finch with disadvantageous traits compared to a finch with advantageous traits?
- A. A finch with disadvantageous traits is much more likely to survive than a finch with advantageous traits.
  - B. A finch with disadvantageous traits is somewhat more likely to survive than a finch with advantageous traits.
  - C. A finch with disadvantageous traits is as likely to survive as a finch with advantageous traits.
  - D. A finch with disadvantageous traits is less likely to survive than a finch with advantageous traits.

5. What is this passage mostly about?

- A. the evolutionary process and how Darwin discovered it
- B. the finches living on the mainland of South America
- C. the 46 chromosomes that contain a person's DNA
- D. the charts and maps that existed before the second voyage of the *Beagle*

6. Read these sentences: "If finch offspring were endowed with more **advantageous** traits, a larger beak perhaps, better at cracking seeds that have fallen to ground, then that particular bird would live a more successful life."

What does the word "**advantageous**" mean above?

- A. confusing
- B. slow
- C. helpful
- D. harmful



7. Choose the answer that best completes the sentence below.

Darwin observed finches in the Galapagos Islands, \_\_\_\_\_ developing a theory based on those observations.

- A. in contrast
- B. previously
- C. currently
- D. ultimately

8. What kind of food might a small, nimble beak help a finch catch?

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9. What does the evolutionary process result in?

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8. What kind of food might a small, nimble beak help a finch catch?

A small, nimble beak might help a finch catch insects.

9. What does the evolutionary process result in?

The evolutionary process results in the formation of a new species.

10. Summarize the process of evolution.

Answers may vary but should identify the key parts of the process. Evolution occurs when differing traits appear in an animal population. Animals with advantageous traits generally pass those traits on to their offspring, while animals with disadvantageous traits are less likely to survive and reproduce. As more and more advantageous traits accumulate over generations, a new species is formed.