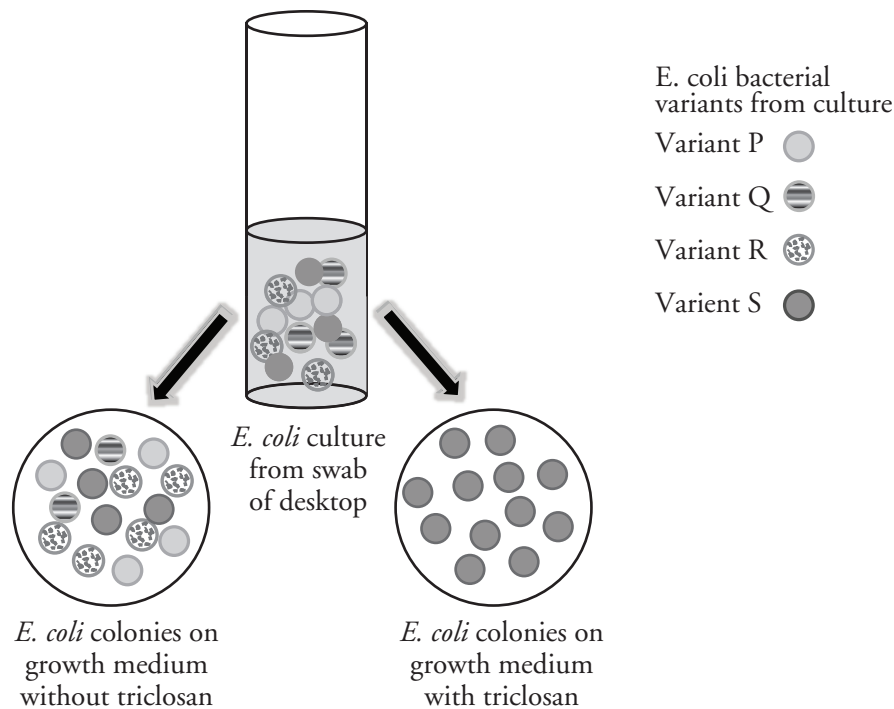# Evolution and Selection

What mechanisms lead to changes in the diversity of species on Earth?

## Why?

People make choices by selecting options they like best. The natural world also "selects" (although not as a conscious decision) when environmental conditions allow organisms with a particular genetic trait to live healthier lives than other organisms. In this activity, we will explore how selection affects populations over time.

## Model 1 – Desktop Swab Results



E. coli bacterial variants from culture

Variant P

Variant Q

Variant R

Varient S

*E. coli* culture from swab of desktop

*E. coli* colonies on growth medium without triclosan

*E. coli* colonies on growth medium with triclosan

1. What is the source of the bacteria in the culture tube in Model 1?

2. How many genetic variants of *E.coli* were present in the culture from the initial swab?

3. What variants of *E.coli* are found on the dish grown without triclosan?

4. Refer to the dish in Model 1 with the medium that included triclosan.

   *a.* What variants of *E.coli* are found on the dish grown with triclosan?

   *b.* What likely happened to the other variants of *E.coli* on the dish with the medium containing triclosan?

5. Based on its effect on *E.coli,* why is triclosan used as a cleaning agent?

6. Suppose the desktop swabbed earlier was cleaned with a solution containing triclosan. Would living *E.coli* remain? Support your answer.

7. Suppose the desktop was swabbed again after cleaning it with triclosan over a 9-month school year. When the sample was cultured only variant S was seen.

    *a.* What characteristic does the variant S bacteria have that allows it to remain on the desktop even after several months of treatment with triclosan?

    *b.* Is it likely that the bacteria in the new swab were on the desk 9-months ago, or are they off-spring of the original bacteria?

    *c.* Propose an explanation for the presence of only variant S on the desktop after so much time.

## Read This!

Populations of most living organisms exhibit genetic diversity among individuals. Certain traits in a population give some organisms a greater chance of survival than individuals that lack these traits. Because these traits tend to increase the chance of survival, these individuals may produce more offspring that will also have the trait that favors survival. Over time, the number of individuals within the population possessing the favorable trait increases while the number of offspring with the favorable trait decreases.

STOP

## Model 2 – Color Variations in Moths in Great Britain

**Peppered Moth Frequency**
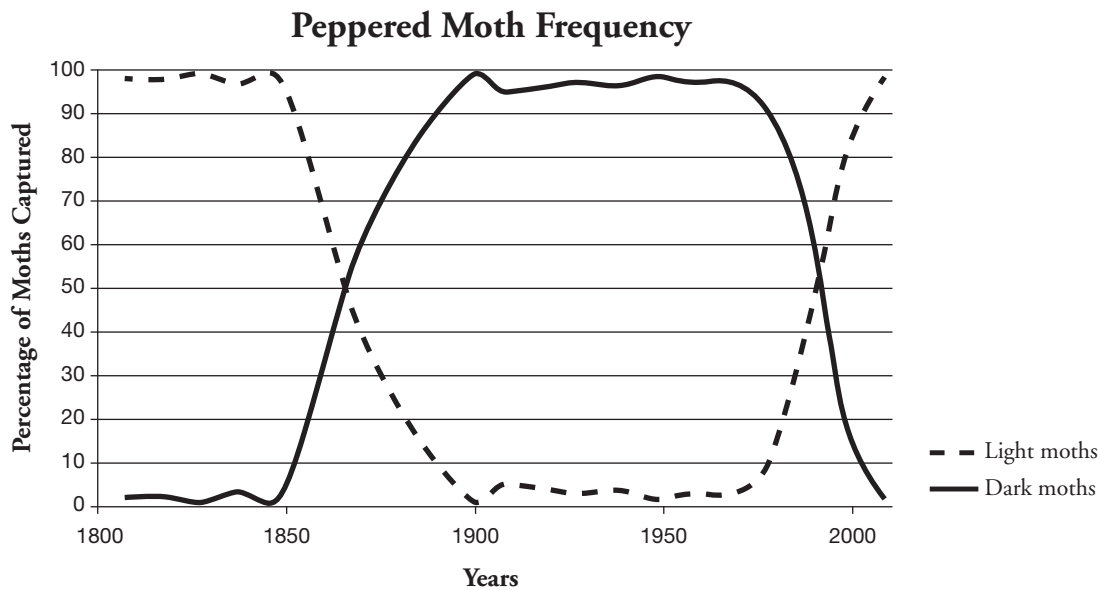


8. Refer to the graph of Peppered Moth Frequency in Model 2.

   *a.* Which moth color was more prevalent before 1850?

   *b.* Which color was more prevalent between 1900 and 1950?

9. Describe the change in the percentage of light-colored moths and dark-colored moths between 1850 and 1900.

10. Describe the change in the percentage of light-colored moths and dark-colored moths between 1950 and 2000.

11. During the Industrial Revolution through the mid-20th century, factories and power plants, which burned coal, produced large quantities of soot and smog. Near industrialized areas, black powder covered surfaces, including the moth habitat.

    *a.* Which color moth would have a better chance of surviving predation (better camoflage to hide from predators) on this dark surface?

    *b.* How does this help explain the change in the colors of the moth population shown in Model 2?

12. Clean Air Acts were passed by governments of industrialized nations beginning in the mid-1950s. Use this information to explain why the color of the moth population shifted again.

## Model 3 – Natural vs. Artificial Selection



§ – Artificial selection
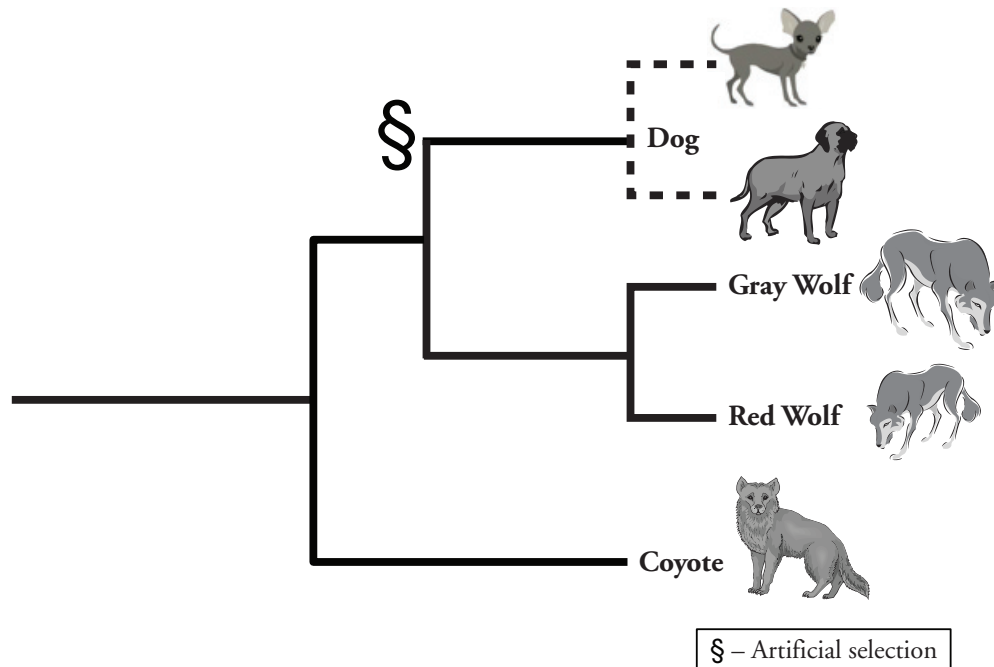
13. Model 3 traces the lineage of what organisms?

14. How does Model 3 indicate that all three types of organisms came from a common ancestor?

15. According to Model 3, wolves (gray and red) are more closely related to what other group—dogs or coyotes? Explain your answer.

16. Think about the characteristics of the organisms above.

    *a.* What are some differences that you note between wolves and dogs?

    *b.* What similarities can you identify?

17. Modern domesticated dogs arose from wolves through selective breeding by humans.

   *a.* What traits might humans have selected in the common ancestor of dogs and wolves that would account for the differences between dogs and wolves?

   *b.* According to Model 3, what is the name of this type of selection?

(STOP)

## Read This!

The events that lead to changes in groups of organisms are called **selection** by evolutionary biologists. Charles Darwin (1809–1882) is the person credited with carefully outlining how various changes in populations of organisms might occur through time. He called this process **natural selection**. Humans participate in selection through selective breeding of plants and animals. This is referred to as **artificial selection**.

18. Is the selection that led to the development of wolves and coyotes an example of natural selection or artificial selection? Explain your choice.

19. Refer to Model 1. Is the selection leading to changes in the *E. coli* variants natural or artificial selection? Explain your choice.

20. Two differences between red and gray wolves is their color and size. What environmental conditions might have resulted in selection for red wolves and gray wolves?

21. Refer to Model 2. Is the selection of moths that blend in to their environment an example of natural or artificial selection? Explain your choice.

## Extension Questions

22. For the past 10 to 25 years, farmers have planted crop seeds that have been genetically modified to withstand treatment with a common weed killer called Roundup®. This allows the farmers to spray their fields to get rid of weeds without harming their crops. Recently, more and more farmers have discovered that their fields have Roundup-resistant pigweed growing along with their crop. Use what you've learned in this activity to explain how this came about.

23. Many popular products from hand soap to clothing advertise that they have antibacterial qualities. Most microbiologists recommend against their routine use in our daily lives. How can you explain this using your knowledge from this activity?