HANDS-ON ACTIVITY
Exploring Dog Genetics and Evolution

BACKGROUND

Domestic dogs *(Canis familiaris)* are an amazing evolutionary story. Modern dogs are likely to be descendents of wolves or a wolf-like ancestor. Dogs can in fact breed with wolves. Scientists do not all agree on when the dog and wolf became separate species. Many scientists even argue that dogs and wolves are not separate species, but rather that dogs are a subspecies of wolves. It is clear, however, that dogs are now very different from wolves, in both behavior and physical traits.

Dogs have evolved to fit into a niche defined by humans. The first dog populations likely underwent some natural selection as they adapted to living near people. Humans also directly affect dog populations by controlling their breeding; a person may select a particular male dog to mate only with certain female dogs. This is artificial selection, and it is responsible for producing many of the dog breeds found in modern times.

Dogs can be found in many shapes, colors, and sizes—all of which are determined by their breed. A breed is a subgroup of dogs whose appearance (and, to some degree, behavior) has been shaped by artificial selection. Individuals in a breed are reproductively isolated from others—humans choose to mate them only with other members of the same breed. Dogs within a breed have similar versions of genes that affect their looks (such as genes that influence coat color). Most breeds were originally used for some sort of task—for example, rat terriers were once used to find and kill rats. Currently, the percentage of U.S. dogs that are "working dogs" is very low, and most are house pets.

In this activity you will research to learn about how dogs and wolves are different, how dogs evolved, the use of dogs for specific tasks, and the problems associated with inbreeding.

PREDICT

How are breeds of dogs different from each other and from wolves?

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PROCEDURE

Part 1—Differences and similarities between dogs and wolves

1. Use the Internet or other library resources to find at least four ways in which dogs and wolves differ physically. Be sure to find the answers to the following questions:

    • What physical qualities distinguish dogs from wolves?

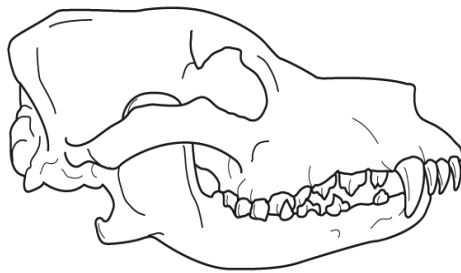   • Specifically, how is the bone and body structure of a dog different from a wolf?

2. Using information collected from your research, list several ways in which dogs are different from wolves:

a. _____

_____

b. _____
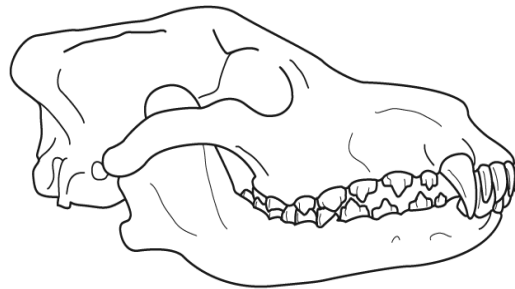
_____

c. _____

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d. _____

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3. Describe ways in which dogs and wolves are similar to one another.

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dog skull   wolf skull

4. Describe the differences and similarities you can observe between the dog skull and wolf skull shown here.

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Part 2—Compare and contrast modern dog breeds

1. Conduct research to identify a dog breed that was or is used for a particular task. Describe this breed in the first blank column in Data Table 1.

2. Investigate two more breeds, one that was used for a similar task and one that was used for an entirely different task. Describe each of them in Data Table 1.

DATA TABLE 1: DOG BREED COMPARISIONS

Breed Name			
Original "task"			
General appearance			
Size			
Coat (hair length and description)			
Color			
Tail description			
Head or skull shape			
Other information			

Part 3—Problems of inbreeding

Every animal can suffer from genetic disease, including dogs. The frequency of these diseases is increased by inbreeding—the breeding of close relatives. Inbreeding can be a serious problem for dogs. Some diseases occur more often in particular breeds.

1. Conduct research to identify diseases resulting from inbreeding.

2. List the diseases in Data Table 2.

DATA TABLE 2: BREED-SPECIFIC MEDICAL DISORDERS

BREED	DISEASE OR DISORDER

Part 4—The Dog Genome Project

You may have heard of the Human Genome Project. There is also a Dog Genome Project.

1. Search the Internet to find answers to the questions below about the Dog Genome Project.

a. What is the goal of the Dog Genome Project?

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b. What are three breeds that are still needed for research into the dog genome?

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_____
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ANALYZE

1. Do breeds that are used for similar tasks also have similar physical traits? That is, are their sizes, shapes, tails, leg lengths, ears, and so on similar? Explain.

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2. If two breeds that are used for the same task do not look alike, is there anything in the descriptions of their behavior that makes you think they might both be good at the job?

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3. Compare natural selection and artificial selection. In which of these processes do humans play a role?

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4. Dogs are not the only animals that are selectively bred by humans. Think of another animal species whose reproduction is controlled by people. What is this animal used for?

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5. The physical traits of a dog, or any animal, are determined by their genes and the environment. For example, a dog can have an inherited tendency to be tall (genes), but how tall the dog actually becomes partly depends on whether it has a good diet (environment). What is an example of another way that the environment may influence a dog's physical characteristics? Explain.

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6. A lot of research is currently being done on dog genetics. How could learning about dog genes benefit human health?

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