

Selective Breeding



Charles Darwin, a British naturalist who lived in the 19th century, is best known for his book *On the Origin of Species*. In it, Darwin established the idea of evolution that is widely accepted today. This idea proposes that all species alive have resulted from an adaptation to their surroundings. Natural selection, the process by which traits are handed down over time, is probably the most famous principle from the book.

The process of artificial selection, however, is perhaps not as well known. And yet it remains one of the most important concepts in our understanding of plant and animal behavior.

Today artificial selection is more often called “selective breeding.” Selective breeding involves breeding animals or plants for a specific, typically desirable trait. By doing so, the desired genes from the plant or animal will be passed on to its offspring.

Dog breeding is one of the most popular examples of artificial selection. You need only to tune into a dog show on TV to see the power of selective breeding at work. Crossbreeds, for example, are dogs born from parents of two different breeds. Mixed breeds were born from parents of more than two breeds, and pure breeds born from a single, recognizable breed. All three varieties are featured in most dog shows.

Dogs are a particularly interesting example of selective breeding. After all, we call dogs “man’s best friend” for a reason. Dogs originally evolved from wolves. But it was a trait known as “tamability,” or a dog’s ability to be tamed, that resulted in humans keeping dogs as pets.

Tamability, which can also be defined as a dog’s willingness to fetch a stick or lay down on command, was not always the most desirable trait for humans. In the past, a dog was valuable if it could hunt well, or herd cattle, or protect people from intruders. Now that many people

live relatively quiet, domestic lives, how well a dog can herd sheep is not of huge importance. What matters most is whether a dog makes a good companion.

And yet it's only over the last 50 years that scientists have come to understand tamability as a result of selective breeding, and even then through experiments with foxes, not dogs. In 1959, a Russian geneticist named Dmitry K. Belyaev conceived of an experiment with silver foxes. He collected dozens of them from various pet farms throughout Russia. What the researchers found is that wild foxes, like wild dogs, are capable of being bred for tamability. Over the years, they also determined that selectively breeding silver foxes for tamability changes not only the way they behave, but also how they look.

By breeding for tamability, Russian researchers have observed that traits such as white patches, colored spotting, and even floppy ears appear on tame foxes. Wild foxes, on the other hand, tend not to exhibit these traits. The floppy-eared, white-patched foxes tend to be better at socializing and responding to sound than their wild counterparts. This ongoing study is known as the Fox Farm Experiments.

Of course, selective breeding has long been performed on more than just dogs and foxes. In the early 1900s, the English bred pigeons to produce a certain type of long feather that looked good in women's hats. Today farmers breed chickens to have extra-large breasts and to lay a lot of eggs. A wild fowl—a chicken that lives in the woods—lays between 20 and 30 eggs per year. In contrast, a chicken born out of selective breeding can lay as many as 300.

In the same way that hens are selectively bred for eggs, cows are often selectively bred for meat or milk. Breeding a cow for both meat and milk, though, is not realistic. Cows bred for meat tend to produce only enough milk for a single calf. Over the course of the 1700s, the size of bulls sold for slaughter increased dramatically—from around 300 pounds (about 140 kilos) to nearly 800 pounds (about 360 kilos)—as a result of selective breeding. The dairy cow, on the other hand, which does not display a lot of girth or muscle, can produce enough milk for 10 calves. The way to identify such a cow is by the udders, which can hold over 20 liters of milk.

Often, animals' genetic mutations can help the process of selective breeding. The Belgian Blue, for instance, is an unusually muscular cow; it contains something called the double muscling gene. A muscular cow is valuable for the amount of meat found on its frame. A few hundred years ago, farmers capitalized on this particular cow's muscle mass by trying to breed more of them. Over time, and with effort, a new breed of muscular cow was born.

Charles Darwin may have been the first to describe the process of selective breeding. But the practice may be more than 2,000 years old. The Romans are said to have practiced selective

breeding among their livestock, showing favor to cows that produced a lot of milk. But it wasn't until the 18th century that farmers began practicing it on a large, industrial scale.

Any discussion of selective breeding would be incomplete without pigs. Pigs are extremely valuable to the food supply of the planet in general, and the U.S. in particular. Americans eat an average of around 18 lbs (about 8 kilos) of bacon every year. That's about 5,608,654,506 pounds for the entire U.S. As such, producing the highest number of pigs for the lowest cost has long been a top concern for American pig farmers.

The pigs you see in a pen at a country farm descended from wild pigs. According to wildlife biologists, a wild sow—an adult female swine—typically gives birth to around five piglets at a time. This has been true for thousands of years. With the introduction of selective breeding, however, sows raised on industrial farms often give birth to 15 or 20 piglets at a time.

Having so many piglets puts an enormous strain on the mother pig. Likewise, the act of rearing so many piglets can exhaust a sow and make her incapable of becoming pregnant again. But for farmers trying to increase their profits, a tired sow that cannot get pregnant is not worth very much. Their solution has been to remove the piglets from their mother at an early age. This gives the mother more time to recover from giving birth to 20 piglets.

But it also causes some problems for these same piglets. Having been pulled away from their mother too soon, some of them do not mature properly. They often suffer later in life. The upside, for farmers and supermarkets that sell their products, at least, is that the sow can become pregnant more quickly. Consequently, they can produce more bacon, ham, and other pork products more cheaply, keeping farmers in business.

Naturally, there are dangers to selective breeding. Temple Grandin, an animal welfare advocate, notes that breeding animals for size and strength interferes with natural animal processes. Breeding roosters for muscle, say, can make them top-heavy and unsteady on their feet, interfering with their courtship dances. This can, in turn, alienate them from hens.

Speaking of hens, what about those that lay 300 eggs per year? Clearly this is not natural behavior. Laying one egg a day makes a hen's bones brittle, since the eggs soak up the bird's calcium supply. And what about so-called Broiler chickens—the ones that are bred for their large breasts? Often, they are born so muscle-bound their skinny legs can't support them. And in the drive to only produce farm animals that can create a marketable product, many animals are simply tossed aside. Since male chicks will never lay eggs, they are not raised by most industrial chicken farmers. According to animal rights activists, Britain kills around 30 million male chicks per year, simply because they will never produce eggs.

Cows required to produce enough milk for 10 calves tend to burn out quickly. Regular cows—meaning those not subject to selective breeding—can live up to 30 years. But prolific dairy cows tend to make it just four or five years before they are considered worthless and sent to slaughter.

As you can see, selective breeding comes with both benefits and drawbacks. Think of all the joy that dogs have offered humans in the form of companionship over the last 100 years. Selective breeding is to thank for man's best friends. And yet, the pain and suffering that livestock endure makes us think twice. In the future, it is important to keep in mind that, in some cases, the negative consequences of selective breeding outweigh the positive.

Name: _____ Date: _____

1. What is another term for "artificial selection"?

- A natural selection
- B evolution
- C selective breeding
- D desirable traits

2. The passage explains that the cause of bulls with more muscular frames is selective breeding. What is the effect?

- A Farmers have to buy more grain to feed the larger cows.
- B The cows develop larger udders and produce more milk.
- C The bulls cannot be selectively bred for other traits.
- D Farmers can obtain more meat from the slaughtered bulls.

3. Physical traits can indicate that a fox has been bred for tamability. What evidence from the passage best supports this conclusion?

- A The foxes with white patches are better at socializing than their wild counterparts.
- B Dmitry K. Belyaev collected dozens of silver foxes from pet farms across Russia.
- C Wild foxes are not as good at socializing as foxes bred for tamability.
- D Foxes that have been bred for tamability respond to sound better than wild foxes.

4. Read the following sentences: "Temple Grandin, an animal welfare advocate, notes that breeding animals for size and strength interferes with natural animal processes. Breeding roosters for muscle, say, can make them top-heavy and unsteady on their feet, interfering with their courtship dances. This can, in turn, alienate them from hens."

How do animal welfare advocates likely feel about selective breeding?

- A positive
- B negative
- C indifferent
- D confused

5. What is this passage mostly about?

- A breeding for "tamability" in silver foxes
- B the history of selective breeding from the Romans to today
- C the pros and cons of selective breeding
- D the problems associated with selective breeding in industrial farms

6. Read the following sentences: "Having so many piglets puts an enormous strain on the mother pig. Likewise, the act of rearing so many piglets can exhaust a sow, and make her **incapable** of becoming pregnant again. But for farmers trying to increase their profits, a tired sow that cannot get pregnant is not worth very much."

What does "**incapable**" mean?

- A** not able to do something
- B** exhausted from too much effort
- C** not willing to do something
- D** not worth much money

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

A wild sow typically gives birth to five piglets at a time; _____, a sow that has been selectively bred will give birth to 15 or 20 piglets at a time.

- A** for example
- B** as a result
- C** most importantly
- D** in contrast

8. Give an example of a positive effect of selective breeding.

9. Give an example of a negative effect of selective breeding.

10. Should the practice of selective breeding be continued? Support your argument using information from the passage.

Teacher Guide & Answers**Passage Reading Level:** Lexile 1090**1.** What is another term for “artificial selection”?

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8. Give an example of a positive effect of selective breeding.

Suggested answer: A positive effect of selective breeding is:

- the tame dogs we have as pets and companions
- increased supply of milk and meat from cows
- increased supply of eggs and meat from chickens
- increased supply of meat from pigs

9. Give an example of a negative effect of selective breeding.

Suggested answer: A negative effect of selective breeding is:

- shortened life spans of dairy cows
- roosters bred for muscle are top-heavy and cannot properly perform courtship dances
- chickens bred for large breasts cannot support the extra weight on their skinny legs
- chickens bred to lay more eggs have brittle bones since the eggs soak up the hens' calcium supply
- animals that are not profitable (such as male chicks) are killed

10. Should the practice of selective breeding be continued? Support your argument using information from the passage.

Suggested answer: Answers may vary and should be supported by the passage. Students may argue that yes, selective breeding should be continued because of the positive benefits it has for mankind, including tame dogs as pets and an increased food supply. Students may also argue that no, selective breeding should not be continued because of the negative effects it has on animals in industrial farms, as it interferes with natural animal processes. Students may also argue that selective breeding should be continued, but in a limited way that does not cause harm to the animals being bred.