

Applications Of Biotechnology

- 1 Selective breeding has been used for thousands of years to
 - (1) develop bacteria that produce human insulin
 - (2) clone desirable plant varieties
 - (3) develop viruses that protect against diseases
 - (4) produce new varieties of domestic animals

- 2 The Old English Bulldog is extinct. To produce a new English Bulldog, dogs having the desired physical features, but not the aggressive nature of the old bulldogs, were mated. The result was a bulldog that was similar in appearance to the extinct bulldog, but without its fierce nature. Which technique was most likely used to develop this new variety of dog?
 - (1) cloning
 - (2) inducing mutations
 - (3) genetic engineering
 - (4) selective breeding

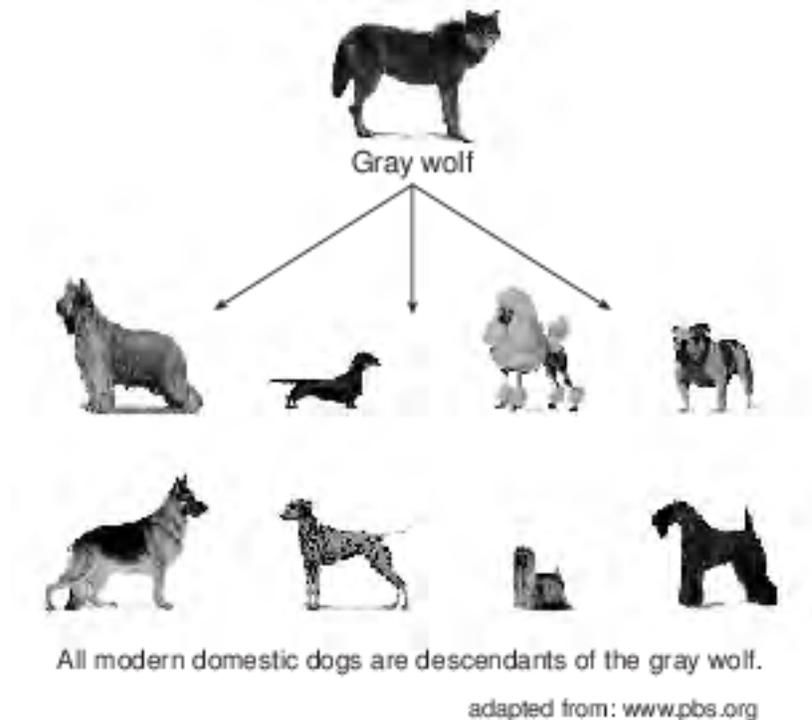
- 3 A news release about production of farm-raised salmon contains the following information: ■ The program is mating targeted fish to concentrate key traits in Atlantic salmon stocks. ■ The three-year process includes spawning, tagging, and choice of parent fish. ■ The fish are weighed, measured, and monitored to identify those with the best growth rates. ■ The project examines the performance of fish to determine which fish to use to produce the next generation.

These statements indicate that the producers are attempting to improve salmon through the use of

 - (1) genetic engineering
 - (2) homeostatic feedback
 - (3) selective breeding
 - (4) natural selection

- 4 In the past, humans developed varieties of dogs, such as the German shepherd and the bearded collie, using
 - (1) selective breeding for particular traits
 - (2) recombination of genes during mitosis
 - (3) mutations present only in body cells
 - (4) natural selection of favorable traits

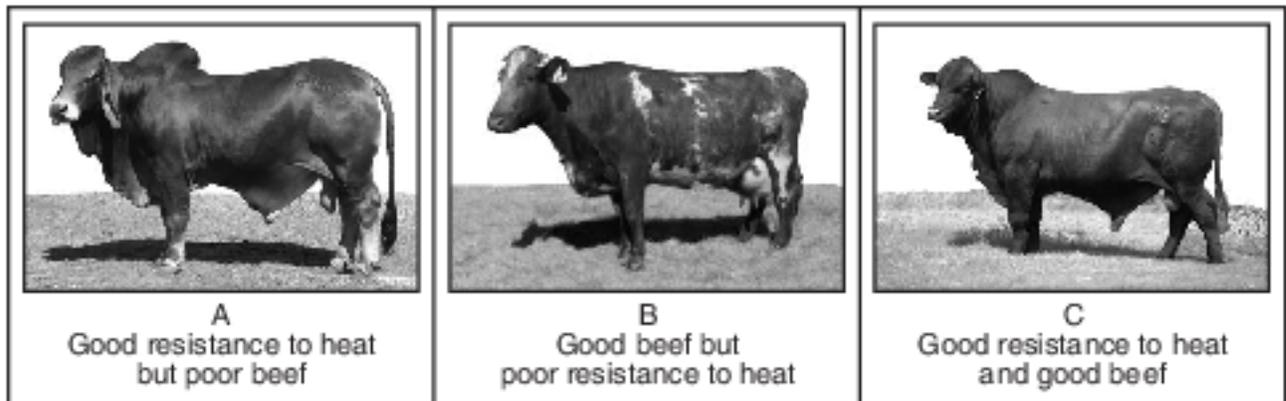
5 Modern dogs are direct descendants of the gray wolf. They first appeared about 130,000 years ago. Today, there are about 150 different breeds of domestic dog, a few of which are shown below.



The great variety of modern dogs can best be explained by

- (1) selective breeding of dogs over many years
- (2) the cloning of domestic dogs
- (3) genetic alterations in gray wolves alive today
- (4) natural selection favoring wolves over dogs

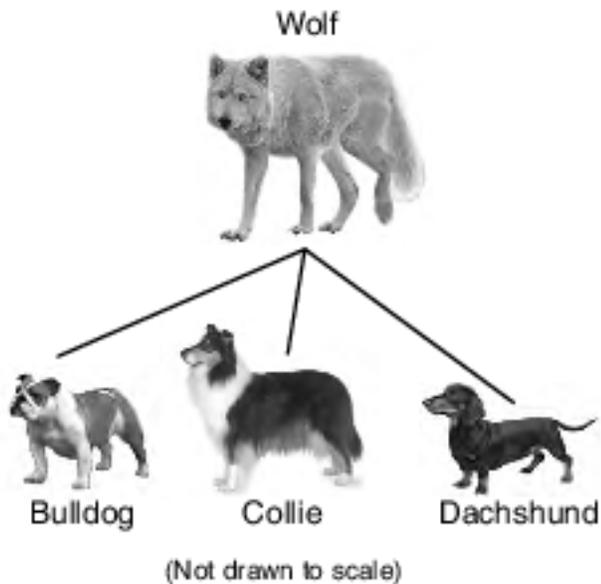
6 The photographs below show different varieties of cattle and characteristics of each variety.



Which statement best explains the development of variety C?

- (1) Nuclei from body cells taken from variety A were inserted into egg cells lacking nuclei taken from variety B.
- (2) Selective breeding was used to combine desirable traits from both varieties A and B.
- (3) The need to adapt to changes in the environment led to the selection of advantageous characteristics in the offspring of variety B.
- (4) Mutations that occurred in the body cells of variety A were passed on to the offspring generation after generation.

- 7 The diagram below indicates a few of the many varieties of domestic dogs thought to have originated from wolves that were domesticated thousands of years ago.



Adapted from: <http://evolution.berkeley.edu/evolibrary/article>

The many varieties of domesticated dogs were most likely produced as a result of

- (1) mutating the body cells of the dogs
- (2) selective breeding over many generations
- (3) genetic engineering with specific enzymes
- (4) cloning dogs with desirable traits

- 8 A farmer grows beans that he sells to local markets. Over a period of 40 years, the farmer has identified the plants that produced the most beans and only used those beans to produce new plants. This procedure is part of the process of
- (1) selective breeding
 - (2) genetic engineering
 - (3) replication
 - (4) cloning

- 9 Domestic horses have a greater diversity of coat colors than that of wild horses. The process that led to a greater diversity of coat colors in domestic horses is
- (1) selective breeding
 - (2) random mutation
 - (3) gene alteration
 - (4) natural selection

- 10 Over the past few thousand years, humans have helped to bring about changes in many plant and animal species in order to make them more useful. Examples include strong workhorses, hunting dogs, large-eared corn, and beautiful flower varieties. These changes were primarily brought about by humans, using the process of
- (1) mitosis
 - (2) selective breeding
 - (3) cloning
 - (4) natural selection

- 11 The corn we eat today is larger and has more kernels than the corn people first grew thousands of years ago. Which process is most likely responsible for the changes that have occurred?
- (1) mitosis
 - (2) succession
 - (3) direct harvesting
 - (4) selective breeding

Base your answers to questions 12 on the information below and on your knowledge of biology.

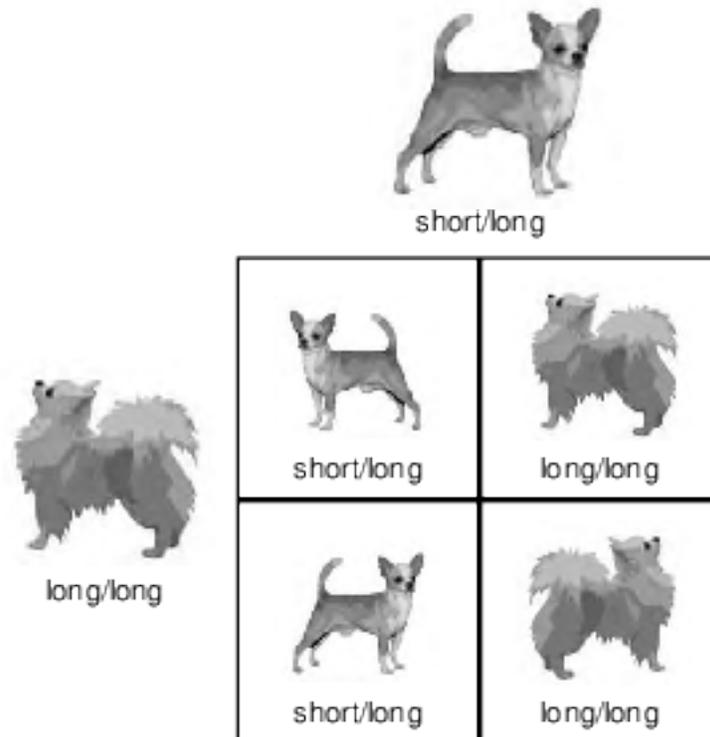
Transgenic Salmon

Transgenic Atlantic salmon have been produced using DNA from other species of related fish. These genetically modified fish have an altered DNA “switch” that causes them to overproduce growth hormone. The transgenic Atlantic salmon grow to normal size, but they reach market size in half the time of conventional Atlantic salmon. As with most of the salmon consumed by people, the transgenic Atlantic salmon would be grown using aquatic farming methods. Scientists have expressed concern that transgenic fish can have undesirable effects on the natural environment. Fish growers would be expected to take steps to ensure that the transgenic salmon do not escape into the wild.

- 12 State one advantage genetic modification has over selective breeding when producing new varieties of animals or plants. [1]

Base your answers to questions 13 on the information and diagram below and on your knowledge of biology.

If a Chihuahua with short hair has a hidden gene for long hair, it can produce both long-haired and short-haired puppies when bred to a Chihuahua with long hair.



- 13 A family decides that they want to produce Chihuahuas with long hair. Identify a procedure that could be used to make sure that the puppies all have long hair. [1]

Base your answer to question 14 on the information below and on your knowledge of biology.

For many years, scientists hypothesized the existence of a single tomato gene that increases the sweetness and production of tomatoes. After years of research, a team of scientists identified the gene and observed greater sweetness and tomato production in plants that contain this gene.

- 14 Identify a process that could be used to insert this gene into other plant species to increase fruit production. [1]

Base your answers to questions 15 on the information below and on your knowledge of biology.

Green Algae Could Help Clean up Radioactive Nuclear Waste

Recent studies have shown that the uses of green algae are boundless. First, scientists at R.I.T. used algae to synthesize biofuel, and recently scientists at Northwestern University and Argonne National have found that freshwater algae can remove strontium 90 from radioactive wastewater. These developments can significantly aid the future effort to clean up radioactive waste at the Fukushima Daichi Plant [a nuclear power plant in Japan]. Scientists discovered that the process begins when the green algae first absorb strontium, calcium and barium from water. The strontium and barium form crystals inside each algae cell. The crystals remain inside the cells, but the algae filters out and excretes calcium and other minerals that may be present. The strontium is then isolated, and thus able to be treated.

Researchers are still figuring the best way to harness the algae's capabilities. Since algae doesn't differentiate between radioactive and inactive strontium (they are chemically identical), it is not known how the algae would hold up in a highly radioactive environment. But the good news is that they have been able to manipulate the algae's process to be more strontium-selective, thus removing as much as possible....

Source: <http://inhabitat.com/green-algae-could-help-clean-up-radioactive-nuclear-waste/algae-ed01/>

- 15 State one way the scientists may “have been able to manipulate the algae’s process to be more strontium-selective.” [1]

Answer Keys

1 4

2 4

3 3

4 1

5 1

6 2

7 2

8 1

9 1

10 2

11 4

12 Allow 1 credit. Acceptable responses include, but are not limited to:

- — With genetic modification, specific traits can be changed.
- — Direct gene modification can be quicker while selective breeding can take many generations.
- — It can take many generations to modify animals or plants with selective breeding.

13 Allow 1 credit. Acceptable responses include, but are not limited to:

- — breeding two dogs with long hair to produce long-haired puppies
- — selective breeding
- — cloning/genetic engineering

14 Allow 1 credit. Acceptable responses include, but are not limited to:

- — genetic engineering
- — gene splicing
- — gene manipulation
- Note: Do not allow credit for biotechnology; it is a field of science, not a process.

15 Allow 1 credit. Acceptable responses include, but are not limited to:

- — They could use genetic engineering to produce algae that are able to collect more strontium.
- — gene manipulation
- — Modify their DNA to make them better at taking in the strontium.
- — Find organisms with the specific genes they need, cut them out, and then insert them into the algae.