

Reproduction of Organisms

Asexual Reproduction

..... Before You Read


| What do you think? Read the three statements below and decide whether you agree or disagree with them. Place an A in the Before column if you agree with the statement or a D if you disagree. After you've read this lesson, reread the statements to see if you have changed your mind. | | |
|--|--|-------|
| Before | Statement | After |
| | 4. Cloning produces identical individuals from one cell. | |
| | 5. All organisms have two parents. | |
| | 6. Asexual reproduction occurs only in microorganisms. | |

..... Read to Learn

What is asexual reproduction?

In **asexual reproduction**, one parent organism produces offspring without meiosis and fertilization. Offspring produced by asexual reproduction inherit all of their DNA from one parent. Therefore, they are genetically the same as each other and their parent.

You have seen the results of asexual reproduction if you have ever seen mold on bread or fruit. Mold is a type of fungus (FUN gus) that can reproduce either sexually or asexually. Asexual reproduction is different from sexual reproduction.

Recall that sexual reproduction involves two parent organisms and the processes of meiosis and fertilization. Offspring inherit half of their DNA from each parent, resulting in genetic variation among the offspring. 

Types Of Asexual Reproduction

There are many different types of organisms that reproduce asexually. Not only fungi, but also bacteria, protists, plants, and animals can reproduce asexually.

Key Concepts

- What is asexual reproduction, and why is it beneficial?
- How do the types of asexual reproduction differ?

Study Coach

Discuss Read the first two paragraphs about asexual reproduction. Then take turns with a partner saying something about what you learned. Repeat this process with the other paragraphs in this lesson.

Key Concept Check

1. Describe What is asexual reproduction?

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Make the following six-celled chart, then use it to compare types of asexual reproduction.

| | | |
|---------------------|-------------------------|---------|
| Fission | Mitotic cell division | Budding |
| Animal regeneration | Vegetative reproduction | Cloning |

Visual Check

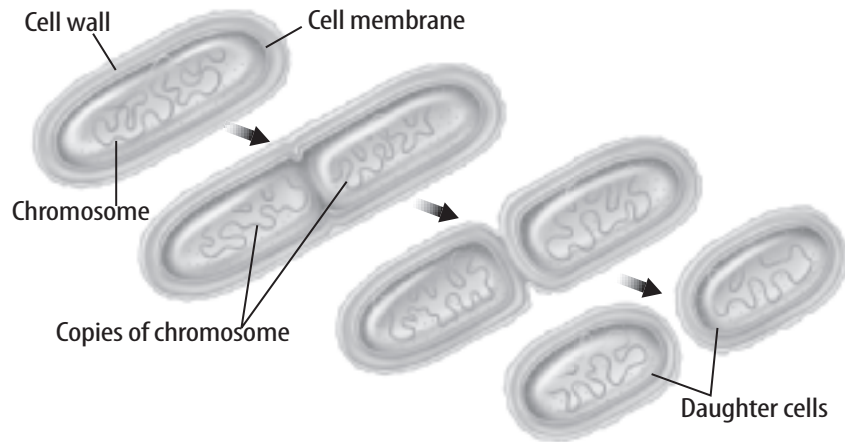
2. Recognize What happens to the original cell's chromosome during fission?

Reading Check

3. Evaluate What advantage might asexual reproduction by fission have compared to sexual reproduction?

Fission

Recall that a prokaryotic cell, such as a bacterial cell, has a simpler cell structure than a eukaryotic cell. A prokaryote's DNA is not contained in a nucleus. For this reason, mitosis does not occur. Cell division in a prokaryote is a simpler process than in a eukaryote. *Cell division in prokaryotes that forms two genetically identical cells is known as **fission**.*



Fission begins when a prokaryote's DNA is copied, as shown in the figure above. Each copy attaches to the cell membrane. Then the cell begins to grow longer. The two copies of DNA are pulled apart. At the same time, the cell membrane starts to pinch inward along the middle of the cell. Finally the cell splits and forms two new identical offspring. The original cell no longer exists. Fission makes it possible for prokaryotes to divide rapidly. ✓

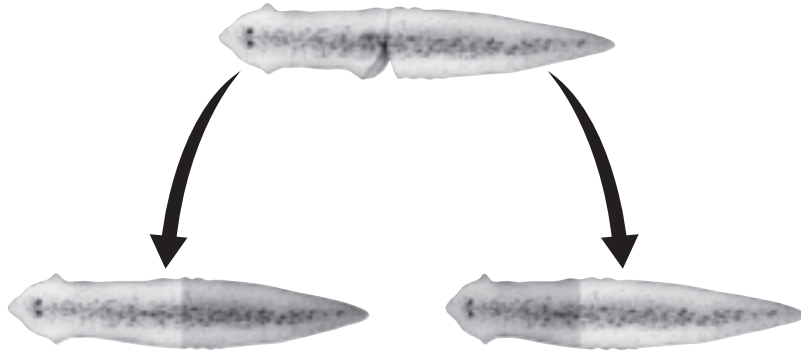
Mitotic Cell Division

Many unicellular eukaryotes, such as amoebas, reproduce by mitotic cell division. In this type of asexual reproduction, an organism forms two offspring through mitosis and cell division. The nucleus of the cell divides by mitosis. Next, the cytoplasm and its contents divide through cytokinesis. Two new amoebas form.

Budding

In **budding**, a new organism grows by mitosis and cell division on the body of its parent. The bud, or offspring, is genetically identical to its parent. When the bud is large enough, it can break from the parent and live on its own. Organisms such as yeasts, which are fungi, reproduce through budding. Sometimes the bud stays attached to the parent and starts to form a colony. Corals are animals that form colonies through budding.

Original planarian is divided into two pieces.



The head end regenerates a new tail.

The tail end regenerates a new head.

Animal Regeneration

Another type of asexual reproduction, **regeneration**, occurs when an offspring grows from a piece of its parent. Animals that can reproduce asexually through regeneration include sponges, sea stars, and planarians.

Producing New Organisms The figure above shows how a planarian reproduces through regeneration. If the planarian is cut into two pieces, each piece of the original planarian becomes a new organism.

If the arms are separated from the parent sea star, each of these arms has the potential to grow into a new organism. To regenerate a new sea star, the arm must have a part of the central disk of the parent. If conditions are right, one five-armed sea star can produce five new organisms. As with all types of asexual reproduction, the offspring are genetically the same as the parent. ✓

Producing New Parts Some animals, such as newts, tadpoles, crabs, hydras, zebra fish, and salamanders, can regenerate a lost or damaged body part. Even humans are able to regenerate some damaged body parts, such as the skin and the liver. This type of regeneration is not considered asexual reproduction. It does not produce a new organism.

Vegetative Reproduction

Plants can also reproduce asexually in a process similar to regeneration. **Vegetative reproduction** is a form of asexual reproduction in which offspring grow from part of a parent plant. Strawberries, raspberries, potatoes, and geraniums are other plants that can reproduce this way

Visual Check

4. Describe What happens to a planarian when it is cut into two pieces?

ACADEMIC VOCABULARY

potential
(noun) possibility

Reading Check

5. Specify What is true of all cases of asexual reproduction?

Visual Check

6. Locate Circle the offspring of the strawberry plant in the figure.



The strawberry plant shown in the figure above sends out long stems called stolons. Wherever a stolon touches the ground, it can produce roots. Once a stolon grows roots, a new plant can grow, even if the stolon breaks off from the parent plant. Each new plant grown from a stolon is genetically identical to the parent plant. Roots, leaves, and stems are the structures that usually produce new plants.

Cloning

Cloning is a type of asexual reproduction performed in laboratories. It produces identical individuals from a cell or from a cluster of cells taken from a multicellular organism. Farmers and scientists often clone cells or organisms that have desirable traits.

Plant Cloning Some plants can be cloned from just a few cells using a method called a tissue culture. Tissue cultures make it possible for plant growers and scientists to make many copies of a plant with desirable traits. The new plants are genetically the same as the parent plant. Also, cloning produces plants more quickly than vegetative reproduction does.

A plant might be infected with a disease. To clone such a plant, a scientist can use cells from the meristem of the plant. Cells in meristems are disease-free. Therefore, if a plant becomes diseased, it can be cloned using meristem cells.

Animal Cloning In addition to cloning plants, scientists have been able to clone many animals. All of a clone's chromosomes come from one parent, the donor of the nucleus. This means that the clone is genetically the same as its parent. The first mammal cloned was a sheep named Dolly.

Steps in Cloning Dolly The first step in cloning Dolly was to remove cells from a sheep, as shown in the figure on the next page. DNA was then removed from an unfertilized egg of a second sheep. In a laboratory, the cells were fused, or combined, and the new cell had the DNA from the first sheep. The cell developed into an embryo. The embryo was then placed in a third sheep. The cloned sheep developed inside the third sheep and was later born.

SCIENCE USE V. COMMON USE

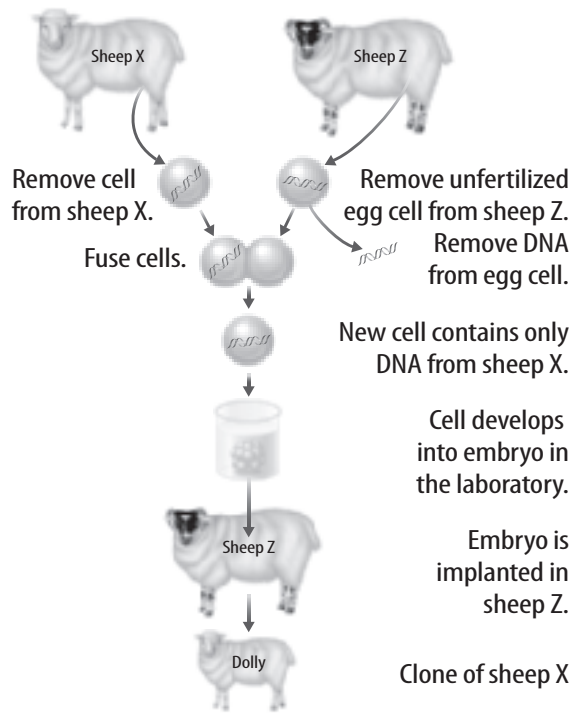
culture

Science Use the process of growing living tissue in a laboratory

Common Use the social customs of a group of people

Think it Over

7. Synthesize Do all cloned plants have the same genetic makeup? Why or why not?



Visual Check

8. Identify Circle the two sheep that are genetically identical.

Cloning Issues Scientists are working to save some endangered species from extinction by cloning. Some people are concerned about the cost and ethical issues of cloning. Ethical issues include the possibility of human cloning.

Advantages of Asexual Reproduction

One advantage of asexual reproduction is that an organism can reproduce without a mate. Recall that finding a mate takes time and energy. Another advantage is that some organisms can quickly produce a large number of offspring. For example, crabgrass reproduces by underground stolons. This enables one plant to spread and colonize an area in a short period of time.

Disadvantages of Asexual Reproduction

Asexual reproduction produces offspring that are genetically the same as the parent. This results in little genetic variation within a population. Genetic variation can give organisms a better chance of surviving if the environment changes. Imagine that all of the crabgrass plants in a lawn are genetically the same. If a weed killer can kill the parent plant, then it can kill all of the crabgrass plants in the lawn. This might be good for the lawn, but it is a disadvantage for the crabgrass. Another disadvantage involves genetic changes called mutations. A harmful mutation passed to asexually reproduced offspring could affect the offspring's ability to survive.

Key Concept Check

9. Compare and contrast the different types of asexual reproduction.

Key Concept Check

10. State the advantages of asexual reproduction.

After You Read

Mini Glossary

asexual reproduction: a form of reproduction in which one parent organism produces offspring without meiosis and fertilization

budding: a form of asexual reproduction that occurs when a new organism grows by mitosis and cell division on the body of its parent

cloning: a type of asexual reproduction performed in a laboratory that produces identical individuals from a cell or from a cluster of cells taken from a multicellular organism

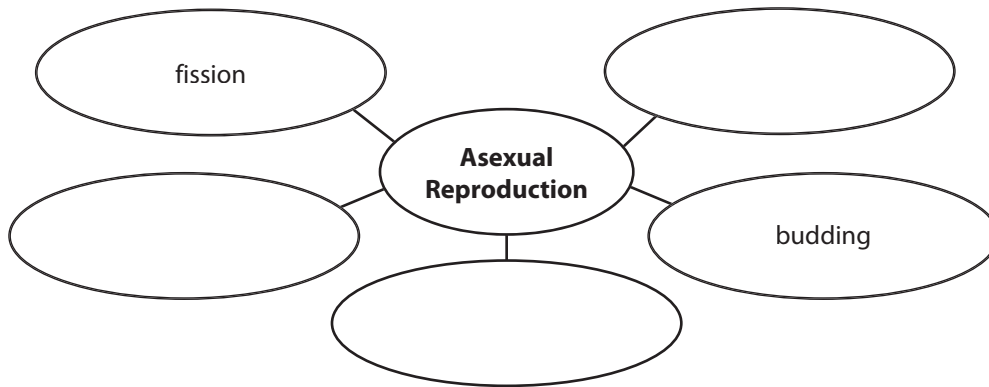
fission: cell division in prokaryotes that forms two genetically identical cells

regeneration: a form of asexual reproduction that occurs when an offspring grows from a piece of its parent

vegetative reproduction: a form of asexual reproduction in which offspring grow from a part of a parent plant

1. Review the terms and their definitions in the Mini Glossary. Write a sentence that compares regeneration and vegetative reproduction.

2. Fill in the spider map below with the different types of asexual reproduction. Use terms from the Mini Glossary.



3. How did discussing what you learned from each paragraph with another student help you learn about asexual reproduction?

What do you think **NOW?**

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?



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