

MODULE

4

REPRODUCTION: THE CONTINUITY OF LIFE

Overview

The beginning of a new life is truly a remarkable event. The sight of a chick making its way out of the cracked shell or a germinating seed slowly pushing through the soil can leave one fascinated. The ability of an organism to produce new individuals is one of the characteristics that distinguishes living things from nonliving things. This ability is called reproduction.

In the previous modules, you have already begun to explore the diversity of organisms. These organisms bring about the continuation of their own kind through reproduction. And although these organisms have different methods of reproduction, every method leads to the beginning of a new life.

This module will discuss the different modes of reproduction in representative plants, animals, and microorganisms. Investigations are included in this module to help you understand the different ways that organisms reproduce and differentiate the offspring resulting from each mode of reproduction.

What are the different modes of reproduction?
How can we use this knowledge in growing plants?

MODES OF REPRODUCTION

In order to continue their own kind, organisms must reproduce. Organisms may reproduce either asexually or sexually.

I. Asexual Reproduction

There are several ways by which organisms reproduce asexually. In the following activity, let us examine how potatoes reproduce.

Activity 1

Can you grow new plants from “eyes”?

A potato tuber is a specialized stem which functions as a food storage organ. Let us investigate how tubers can be used in growing new plants.

Objectives

After you have performed this activity, you should be able to:

- describe how potatoes reproduce.
- explain what vegetative reproduction is.
- describe the advantages of growing plants using vegetative reproduction.

Materials Needed

- 1 potato
- 5 big cans filled with garden soil
(you may use big cans of powdered milk)
- Trowel
- Knife

Procedure

- Examine the potato. Can you see depressions? These are the “eyes” or buds.

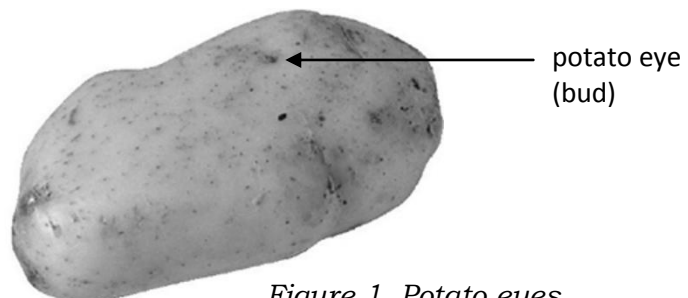


Figure 1. Potato eyes.

2. Cut the potato into pieces with each piece having an “eye”. Observe how the cut pieces look.
 3. Set aside the cut pieces for 2-3 days. Draw and describe how the cut pieces look after 3 days.
 4. After 3 days, plant each piece in a can, about 10-cm deep. Set the tuber so that the “eye” points upward.
- Q1. Can you give a reason why it is better to plant the cut pieces with the “eye” pointing upward?
5. Set aside the cans in a shady area. Water the soil everyday to keep it moist.
- Q2. How many “eyes” from each potato were you able to get?
- Q3. How many new shoots grew from each potato “eye” you planted?
- Q4. What is the advantage of using this type of propagation?
6. Report the progress of your work to your teacher. Discuss your work in class.

After this activity, you may transplant the potato plants in your school garden. You may harvest the potatoes within 10 weeks. Check how many potatoes you can harvest from one plant.

The activity that you have performed shows how potatoes are propagated vegetatively. From a single potato, several new potato plants can be produced. Potato “eyes” are axillary buds where shoots can emerge. **Vegetative reproduction** is a kind of **asexual reproduction** where a new individual, known as the offspring, is produced from a single parent.

Aside from potatoes, many economically important plants can be propagated vegetatively. The kalanchoe, a medicinal plant, can reproduce through its leaves (Figure 2). Plantlets can grow around the leaf margin.



Figure 2. Plantlets grow around the leaf margins of the Kalanchoe.

Do you know other examples of plants that can be propagated through vegetative reproduction?

In the lower grades, you have learned that during reproduction, certain traits are passed on from parent to offspring. These traits are in the form of codes contained in genes. Genes are found in chromosomes which are in turn located in the nucleus of cells.

In asexual reproduction, the parent and the resulting offspring have the same genes and this is the reason why they have the same traits. In other words, we can say that they are genetically identical.

Why do we use vegetative propagation to grow plants? Vegetative propagation results in plants that reach maturity faster than plants grown from seeds. Another good thing about vegetative propagation is that the same good agricultural traits such as taste, yield, and resistance to pests will be passed on from generation to generation. But one disadvantage is that the population might be wiped out if environmental conditions become unfavourable.

Let us now look at other types of asexual reproduction.

Activity 2

Can one become two?

While walking to school, have you noticed greenish growth on barks of trees or on slippery concrete walkways? What could this organism be? Let us observe closely what organism this might be.

Objectives

After you have performed this activity, you should be able to:

- a) describe how *Protococcus* reproduce.
- b) explain what fission is.
- c) infer the characteristics of the offspring of *Protococcus*.

Materials Needed

- Scalpel or blade
- Microscope slide
- Cover slip
- Microscope
- Tap water in clean bottle
- Dropper

Procedure

Preparation for Activity

1. Look for barks of trees, stones, rocks, moist flower pots that have greenish growth.
2. Get the greenish growth by scraping the sides.
3. Soak the scrapings in water overnight to separate the soil particles and debris from the microorganisms.

Day 1

1. Put a small amount of scraping on a slide.
2. Add a drop of water.
3. With 2 dissecting needles, carefully tease or separate the scraping and mix it with the water.
4. Gently place a cover slip on the slide. Examine the scraping under the low power objective.

Look for a cell similar to the figure below.

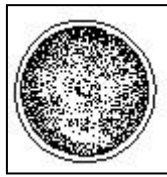


Figure 3. *Protococcus* is a round single-celled green alga.

5. Show your teacher the *Protococcus* cell that you have located.
 6. *Protococcus* reproduces by dividing. Dividing cells are separated by a wall-like structure. Look for *Protococcus* cells that are dividing.
 7. Shift to high power objective.
- Q5. Draw the dividing *Protococcus* cells that you have identified.
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This type of asexual reproduction is called **fission**. The cell divides to form two identical daughter cells. Each daughter cell continues to grow until it becomes as large as the parent cell.

- Q6. Research on other examples of unicellular organisms that reproduce through fission.

Budding

Budding is another type of asexual reproduction. Yeast, hydra, and sponges reproduce this way. Figure 4 shows how yeast, a microorganism used in baking, reproduces by budding. In budding, a new individual may form as an outgrowth of the parent. The outgrowth separates from the parent and becomes a new individual.

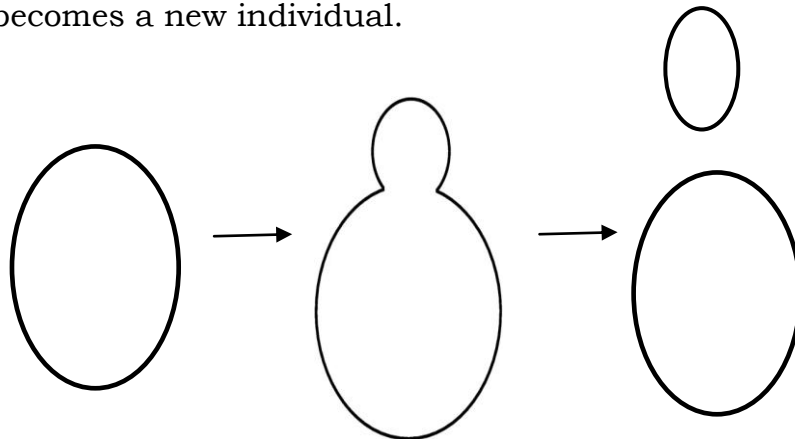


Figure 4. Budding in yeast.

Spore formation

Have you seen a piece of bread with mold growing on it? The black, round structure at the tip of a stalk is called a **spore case** which contains the spores. When the spore case opens, the tiny spores are released and may be carried by wind or water. Once the spore lands on a favourable environment, it develops into a new organism. Under the microscope, a bread mold with a spore case looks like the one in Figure 4.

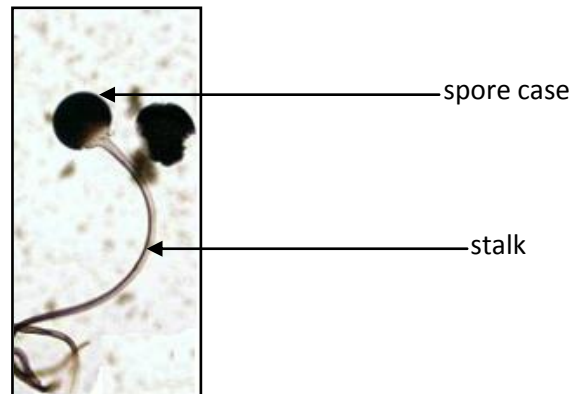


Figure 4. Bread mold spore case

Formation of spore is another type of asexual reproduction common among molds or fungi.

Regeneration

Animals can also reproduce by regeneration. Did you know that when a hydra is cut into several pieces, a process known as fragmentation, each piece can grow into another hydra? In certain types of starfish, an arm that breaks off from the body can develop into a new individual.

II. Sexual Reproduction

Sexual reproduction is a mode of reproduction that involves two parents. Parents produce reproductive cells called gametes through a type of cell division called meiosis. Meiosis will be discussed in detail in Grade 8.

Gametes from the two parents unite in a process called fertilization. The fertilized cell is referred to as a zygote which develops into a new organism.

Organisms reproduce sexually in a number of ways. Let us take a look at the different ways how representative microorganisms, plants, and animals reproduce sexually.

Conjugation

Some microorganisms undergo sexual reproduction by a process called conjugation. An example of a microorganism that reproduces by conjugation is *Spirogyra*, a green alga. *Spirogyra* can be found in freshwater habitats such as ponds and rivers.

During conjugation, a bridge forms between two cells of two *Spirogyra* filaments lying side by side. The contents of one cell pass into the other cell through the bridge, emptying the other cell. The contents of both cells combine in the other cell and form the zygote. This zygote is able to secrete a substance that forms a wall around itself for protection against unfavorable environmental conditions (e.g. when the pond dries up). When conditions become suitable for growth and development, the zygote grows into a new individual.

Sexual Reproduction in Flowering Plants

The flower is the reproductive organ in flowering plants. Flowers have structures that produce the gametes necessary for reproduction. Let us take a look at the parts of a gumamela flower.

Activity 3

Structure of a Gumamela flower

Objectives

After you have performed this activity, you should be able to:

- a) distinguish the male and the female reproductive structures of a gumamela flower
- b) describe the function of each structure in reproduction.

Materials Needed

- 2 gumamela flowers (1 fresh and 1 withered)
- 1 gumamela bud
- Hand lens
- Scalpel or Razor blade

Procedure

1. Examine the entire flower and the part of its stem.

Q6. Describe how the flower is attached to the stem.

2. Examine the bud, an unopened flower. Identify the sepals.

Q7. What is the function of the sepals in the unopened flower?

3. Remove the sepals and petals. The most important reproductive parts remain. Touch the stigma in a relatively fresh opened flower, in a bud and in a withered one.

Q8. On which flower does the stigma feel sticky?

Q9. Why do you think the stigma is sticky?

4. Cut through the ovary and examine the parts with a hand lens.

Q10. How many compartments do you find?

Inside the compartments are ovules which contain the egg cell (female gamete).

5. Touch the tip of a stamen or tap it lightly over a piece of white paper. The powdery materials at the tips are made up of pollen grains. Sperm cells (male gamete) are produced inside these grains.

6. Take a whole flower. Measure the distance between a pollen grain on a stamen and the ovary where the ovule is.

Q11. How do you think pollen grains reach the pistil?

Pollination brings together the gametes of a flower and it occurs when a pollen grain of the right kind lands on the stigma of the pistil. Each pollen forms a tube that grows down through the pistil and reaches the ovule in the ovary. One of the nuclei in the pollen tube unites with the egg nucleus in the ovule to form a zygote. The other sperm nucleus combines with another bigger nucleus in the ovule which develops into the endosperm.

Sexual Reproduction in Humans and Animals

Humans (and all animals that reproduce sexually) have cells called gametes. Gametes are formed during meiosis and come in the form of sperm (produced by males) or eggs (produced by females). When conditions are right, sperm and egg unite in a process known as fertilization. The resulting fertilized egg, or zygote, contains genes from both parents.

Comparison of Asexual and Sexual Reproduction

In asexual reproduction, a single organism is the sole parent and the offspring is genetically identical to the parent.

In sexual reproduction, two parents produce offspring that have unique combinations of genes. Offspring of sexual reproduction differ genetically from their siblings and both parents.

Summary

1. Organisms must reproduce to continue their own kind.
2. There are two major modes of reproduction: asexual and sexual reproduction.
3. Asexual reproduction gives rise to offspring that are identical to the parent.
4. Individuals that reproduce through sexual reproduction need two parents, a male and a female, that produce egg cell and sperm cell.
5. Sexual reproduction gives rise to offspring that are a combination of the traits from its parents.