Chapter 24

Sexual and Asexual Reproduction

Most people are about as happy as they make up their minds to be.
Abraham Lincoln

24-1 Introduction

1. In general, most species reproduce during which season of the year? Why is this season so appropriate for birth?

Reproduction
If you lived on the farm, every spring you would be delightfully aware of the miracle of reproduction. There you would see the baby lambs, colts and calves being born. You would see the birds building their nests and shortly observe the mother feeding her young. New flowers would appear on the hillsides. The apple and cherry trees would blossom, producing thousands of tiny flowers ready to reproduce to multiply and continue the species. Spring is a time of new birth. It's a time of new beginnings in the wild as well. Deer, bear, foxes and wolves have their young in the spring. Fish spawn, insect eggs hatch. Frogs lay their eggs and it seems that just about every creature is reproducing. In temperate climates spring is an advantageous time for most animals and plants to begin life. There is an abundance of food, water and warmth through the summer and early fall. With the rapid growth seen in most organisms, they can often be independent by the time winter arrives. Some animals, including humans, can reproduce throughout the year. For such animals, survival is not dependent upon the season of reproduction.

2. Why is spring the ideal time for birth of plants and animals in temperate climates?

There are two major forms of reproduction: **sexual** and **asexual** reproduction. They are very different in process but similar in their outcomes: they result in new individuals. In this chapter, you will learn the differences between the two.

Development
The result of sexual reproduction is a **fertilized egg**. In the human and other animals, life begins with this newly formed cell. It has one nucleus, a set of chromosomes and a little cytoplasm. In most cases it is smaller than the head of a pin. It contains all the

information it needs to form the adult it is destined to become. As the human fertilized egg begins to divide and develop, all organ systems will generally form completely and without mistake from this tiny cell. Every structure will be in its proper place and will function as it should. The brain will have every needed area and each area will be wired to every organ of the body by a two-way neuron system. The eyes will be able to produce a clear color image superior to those produced by any camera. The person's appearance will resemble that of both parents yet will be unique and unlike any other individual who has ever lived. And this all comes about by the repeating division of one small cell. Almost no mistakes are made as the genetic material in the chromosomes duplicates itself. Whether the development process occurs inside of a hen's egg, in a pond or in the human uterus, it is basically the same. How do the cells know what to eventually become? How do they collect together to become an organ and have a common purpose to perform for the body? How do all the systems know how to hook up and relate to each other in an integrated way to function as an intelligent, experiencing and feeling human being? Scientists do not yet have all of the answers to these questions.

24-2 Sexual Reproduction

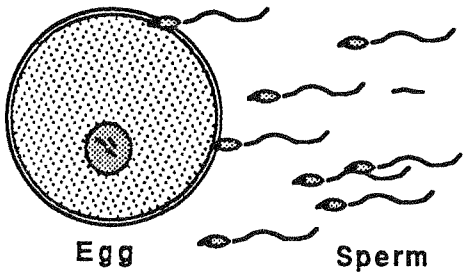
1. Do all animals that reproduce by sexual reproduction have sexual intercourse in a manner similar to humans? Give an example of any animal species that reproduce sexually without sexual intercourse as performed by humans? Explain.

Objective

You will be expected to define sexual reproduction, ovum, zygote and fertilization.

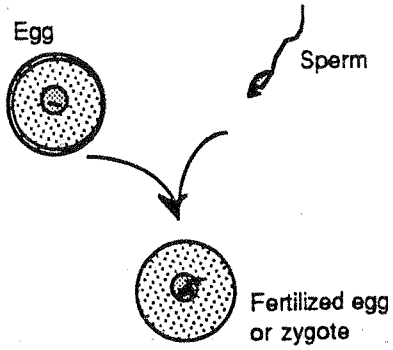
Definition of Sexual Reproduction

Sexual reproduction can take place in a variety of ways, in some cases the male does not need to be present at all. In every case of sexual reproduction **a sperm from the male unites with an egg from the female.** This may be the only common element. The sperm may be deposited inside of the female and close to the egg, as in mammals. In fish and frogs, the sperm unite with eggs outside of the female's body. In flowering plants the sperm unites with the egg inside of the pistil of the flower. Eggs shed from seaweed unite with



sperm in the water nearby. With earthworms, any individual can produce **both** eggs and sperm. During mating, two worms deposit sperm in the other's receptacle for it. Later both will lay fertilized eggs. Even though there are a wide variety of methods to bring sperm and eggs together, **all species that reproduce by sexual reproduction have one thing in common. They all produce egg and sperm and the two unite to produce the fertilized egg which will develop into the new individual.** The new individual will have genetic characteristics of both parents.

Fertilization



The process of egg and sperm uniting is called **fertilization.** The sperm, carrying with it the genetic material from the father, penetrates the cell membrane of the egg. Inside the egg, the sperm nucleus unites with the egg nucleus to form one common nucleus containing genetic information from both the male and female. The fertilized egg is called a **zygote.** Some texts refer to the egg and sperm collectively as gametes. Male and female gametes unite to form a zygote. The process of fertilization is also sometimes called "conception". The egg is also called an **ovum** (ova is plural). Only one sperm cell is able to penetrate the ovum. When the first sperm penetrates the egg, it causes a chemical change in the egg's cell membrane which prevents entry by any other sperm cell. This assures that genetic information from only one sperm unites with the egg nucleus. This is essential if the zygote is to develop properly.

2. Define the following: sexual reproduction, fertilization, ovum, gamete and zygote.

3. Which of the following contains genetic material from <u>both</u> the male and female parents? Ovum, gamete, sperm, zygote - Explain.

4. There are usually many sperm cells trying to reach the ovum. Why is it that only one fertilizes it?

After fertilization, the zygote begins to divide and will divide many times as it begins its development into the species it is destined to become. Once cell division begins, it is no longer a zygote. It is now called an **embryo.** The study of embryos is called embryology. Details of plant and animal reproduction and embryology are presented in the remaining chapters of this unit.

Not all new organisms are the result of sexual reproduction. Many are the result of asexual reproduction. The section that follows will contrast the differences between sexual and asexual reproduction.

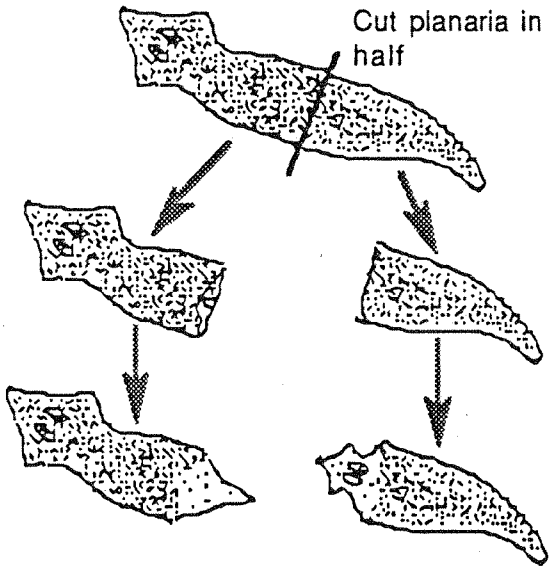
24-3 Asexual Reproduction

1. When a few leaves on a stem are cut from a garden plant and placed in a glass of water and left for a few weeks, what changes usually take place?

Objective

You will be expected to describe how asexual reproduction occurs and how it is different from sexual reproduction.

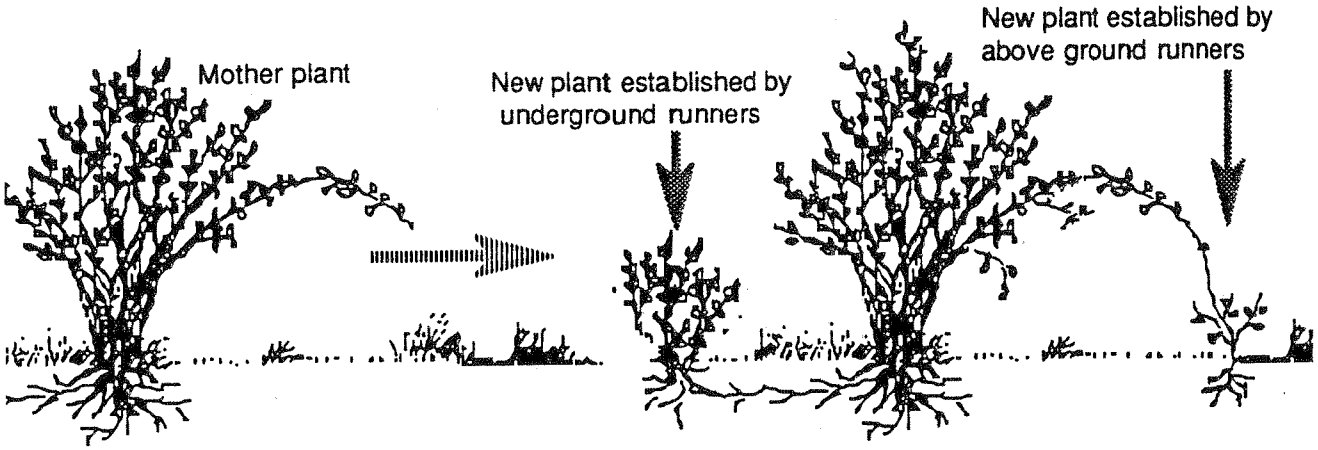
If you or anyone in your family have ever done what was described in question 1, then you have seen asexual reproduction in operation. You assisted in producing a new plant from a mother plant and this method of reproduction is called **asexual reproduction.**



A demonstration of asexual reproduction from the animal kingdom can be shown with the flatworm Planaria. A planarian can be carefully cut in half with a razor blade. In a few weeks each half will regrow its missing part. We start with one and end up with two. No eggs or sperm were involved. This is **asexual reproduction.** The prefix "a" in front of a word means *without.* Asexual reproduction is reproduction *without* a sexual dimension. **In asexual reproduction one part or fragment of a plant or animal grows into a new individual.** When a stem cutting is placed in water, it usually grows roots and can become a new independent plant. Since the new individual only has genetic material from one parent, it will be genetically identical to the mother.

In Plants

A piece of root, stem or leaf can be cut from appropriate plants and placed either in soil or water. They will grow the missing parts and become new individuals, all genetically identical to the parent. They will have both the same kind of leaves and the same color of flowers. In nature, parts of plants blown or broken from a mature plant can give rise to new offspring. Blackberry, strawberry, ivy and many other plants can reproduce asexually. They can send out root runners under the ground that will pop up through the soil and sprout new stems and leaves. A long stem can bend to the ground due to its weight. When the tip of the long stem touches moist soil, it sprouts roots and new stems and leaves to form a new plant. In each case, only one parent was involved and the new plants can live separate existences.

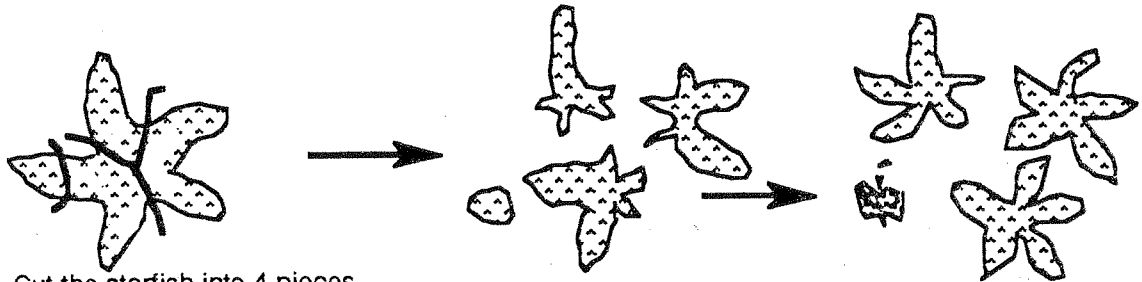


Grafting and separating of flower bulbs are other methods of asexual reproduction and are used by gardeners to obtain offspring sooner than by using seeds. Plants with flowers produce seeds. The seeds are the result of sexual reproduction. Flowering plants can, therefore, reproduce by either sexual or asexual reproduction. When one plants the seed from a geranium flower, the offspring are the result of sexual reproduction. If the cut stem of a geranium plant is placed in water and grows new roots, this offspring is the result of asexual reproduction.

2. Define asexual reproduction and describe how it is different from sexual reproduction.

Animal Asexual Reproduction

Simple invertebrates, like the starfish and Planaria, can be cut into fragments that can regrow missing parts. When a starfish is cut, each arm that retains a part of the center of the star will regenerate the rest of the starfish.

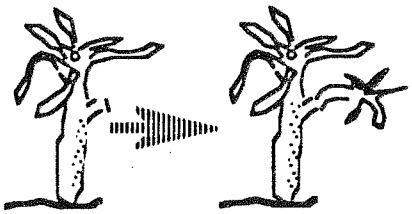


Cut the starfish into 4 pieces

Three of the pieces regenerate the lost arms

Budding

The hydra can reproduce by growing a new body stalk from the original one. The new growth is called a bud and the process is called budding. Eventually the new offspring will separate and become independent. Yeast cells also form small buds that separate to become new individuals.



Budding hydra

3. Describe how at least one plant and one animal reproduce by asexual reproduction.