

REPRODUCTION

In biology, the process by which a living organism produces other organisms more or less similar to itself. The ways in which species reproduce differ, but the two main methods are by **asexual reproduction** and **sexual reproduction**. Asexual reproduction involves only one parent without the formation of gametes: the parent's cells divide by mitosis to produce new cells with the same number and kind of chromosomes as its own. Thus offspring produced asexually are clones of the parent and there is no variation. Sexual reproduction involves two parents, one male and one female. The parents' sex cells divide by **meiosis** producing **gametes**, which contain only half the number of chromosomes of the parent cell. In this way, when two sets of chromosomes combine during fertilization, a new combination of genes is produced. Hence the new organism will differ from both parents, and variation is introduced. The ability to reproduce is considered one of the fundamental attributes of living things.

Asexual Reproduction

This occurs mainly in lower animals, microorganisms, and plants. In lower animals and microorganisms, the chief methods of reproduction are by **binary fission**, **fragmentation**, and **budding**. Binary fission occurs in unicellular organisms, such as protozoans and bacteria: the nucleus of the parent cell divides to form two new daughter cells. Where more than two new cells are formed, this is termed 'multiple fission'. Fragmentation occurs in some invertebrates, such as jellyfish: parts of the organisms break away and subsequently differentiate to form new organisms. Regeneration may sometimes occur before separation, producing chains of offspring budding from the parent organism.

The main methods of asexual reproduction in plants are by **vegetative reproduction** and the formation of sexual **spores**. In vegetative reproduction, or propagation, new plants are produced from the outgrowth of the old ones, such as by runners, bulbs, cuttings, and grafting. Spore formation occurs in plants such as mosses and ferns; it also occurs in fungi, bacteria, and some protozoans. The spore may develop into an organism resembling the parent, or into another stage in the life cycle (see alternation of generations.) Some organisms, such as aphids, reproduce by parthenogenesis; this is a degenerate form of sexual reproduction in which the unfertilized female's eggs develop directly into new organisms without contribution from the male.

Sexual reproduction in plants

Seed-bearing plants (**spermatophytes**) are divided into two classes: **angiosperms**, or flowering plants, and **gymnosperms**.

In flowering plants, the function of a flower is reproduction. Despite the enormous variety of

flowers, they all contain parts that produce gametes for sexual reproduction. On the outside of the flower are **sepals**, which provide protection while it is in bud. Inside the sepals lie the **petals**, usually brightly colored in order to attract insects to the **nectar**. This is a gland at the base of the petals which produces a sugary liquid, nectar, on which the insects feed. Inside the petals are the **stamens**; these are long filaments, each with an anther at the top containing pollen grains; this is where the male gametes are found. The female part of the flower, the **carpel**, lies at the centre; it consists mainly of an ovary within which are many ovules containing the female gametes. Before fertilization can take place, pollination must occur – that is, the pollen containing the male gametes must be transferred from the anther to the stigma in order to reach the ovules inside the carpel. This may happen by the wind blowing the pollen onto the stigma, or by the accidental transfer of pollen when insects are feeding on the flower's nectar. Once fertilization has taken place, the zygote divides and forms an embryo inside the ovule, which increases in size as the embryo develops and becomes a seed. Upon germination, the embryonic shoot and root emerge from the seed to develop into a new plant.

The principal gymnosperms are **cycads** and **conifers**, the cone-bearing plants. The plants carry both male cones and female cones and, like flowering plants, pollen is transferred both by the wind and by insects. **Gymnosperm** means 'naked seed', and in these plants the ovules, and the seeds into which they develop, are not enclosed in ovaries but are borne unprotected on the scales of their cones.

Sexual reproduction in fish

Reproduction in fish is mainly by external fertilization, or **spawning**. The females, which carry enormous numbers of eggs in their ovaries, lay their eggs in the water, and the male releases sperm onto them. The eggs contain yolk which supplies the embryo with food, and albumen – a protein– which protects it. The embryo obtains its oxygen from the water by diffusion, and the young fish, or larvae, hatch after a few days. In cartilaginous fish, such as sharks, the eggs are fertilized internally and hatch inside the body.

Sexual reproduction in amphibians

Like fish, fertilization in amphibians (such as frogs, toads, salamanders) is usually external. Their larvae are **aquatic**, having gills for respiration. Upon metamorphosis to adult terrestrial form, the tail is absorbed into the body and the gills are replaced by lungs.