



Biology-Reproduction

In a general sense reproduction is one of the most important concepts in biology: it means making a copy, a likeness, and thereby providing for the continued existence of species. Although reproduction is often considered solely in terms of the production of offspring in animals and plants, the more general meaning has far greater significance to living organisms. To appreciate this fact, the origin of life and the evolution of organisms must be considered. One of the first characteristics of life that emerged in primeval times must have been the ability of some primitive chemical system to make copies of itself.

At its lowest level, therefore, reproduction is chemical replication. As evolution progressed, cells of successively higher levels of complexity must have arisen, and it was absolutely essential that they had the ability to make likenesses of themselves. In unicellular organisms, the ability of one cell to reproduce itself means the reproduction of a new individual; in multicellular organisms, however, it means growth and regeneration. Multicellular organisms also reproduce in the strict sense of the term—that is, they make copies of themselves in the form of offspring—but they do so in a variety of ways, many involving complex organs and elaborate hormonal mechanisms.

angiosperm: Reproduction

The vast array of angiosperm floral structures is for sexual reproduction. The angiosperm life cycle consists of a sporophyte phase and a gametophyte phase. The cells of a sporophyte body have a full complement of chromosomes (i.e., the cells are diploid, or...

Levels Of Reproduction

Molecular replication

The characteristics that an organism inherits are largely stored in cells as genetic information in very long molecules of deoxyribonucleic acid (DNA). In 1953 it was established that DNA molecules consist of two complementary strands, each of which can make copies of the other. The strands are like two sides of a ladder that has been twisted along its length in the shape of a double helix (spring). The rungs, which join the two sides of the ladder, are made up of two terminal bases. There are four bases in DNA: thymine, cytosine, adenine, and guanine. In the middle of each rung a base from one strand of DNA is linked by a hydrogen bond to a base of the other strand. But they can pair only in certain ways: adenine always pairs with thymine, and guanine with cytosine. This is why one strand of DNA is considered complementary to the other.

The double helices duplicate themselves by separating at one place between the two strands and becoming progressively unattached. As one strand separates from the other, each acquires new complementary bases until eventually each strand becomes a new double helix with a new complementary strand to replace the original one. Because adenine always falls in place opposite thymine and guanine opposite cytosine, the process is called a template replication—one strand serves as the mold for the other. It should be added that the steps

involving the duplication of DNA do not occur spontaneously; they require catalysts in the form of enzymes that promote the replication process.

Molecular reproduction

The sequence of bases in a DNA molecule serves as a code by which genetic information is stored. Using this code, the DNA synthesizes one strand of ribonucleic acid (RNA), a substance that is so similar structurally to DNA that it is also formed by template replication of DNA. RNA serves as a messenger for carrying the genetic code to those places in the cell where proteins are manufactured. The way in which the messenger RNA is translated into specific proteins is a remarkable and complex process. (For more detailed information concerning DNA, RNA, and the genetic code, see the articles nucleic acid and heredity: Chromosomes and genes). The ability to synthesize enzymes and other proteins enables the organism to make any substance that existed in a previous generation. Proteins are reproduced directly; however, such other substances as carbohydrates, fats, and other organic molecules found in cells are produced by a series of enzyme-controlled chemical reactions, each enzyme being derived originally from DNA through messenger RNA. It is because all of the organic constituents made by organisms are derived ultimately from DNA that molecules in organisms are reproduced exactly by each successive generation.

Cell reproduction

The chemical constituents of cytoplasm (that part of the cell outside the nucleus) are not resynthesized from DNA every time a cell divides. This is because each of the two daughter cells formed during cell division usually inherits about half of the cellular material from the mother cell (see cell: Cell division and growth), and is important because the presence of essential enzymes enables DNA to replicate even before it has made the enzymes necessary to do so.

Cells of higher organisms contain complex structures, and each time a cell divides the structures must be duplicated. The method of duplication varies for each structure, and in some cases the mechanism is still uncertain. One striking and important phenomenon is the formation of a new membrane. Cell membranes, although they are very thin and appear to have a simple form and structure, contain many enzymes and are sites of great metabolic activity. This applies not only to the membrane that surrounds the cell but to all the membranes within the cell. New membranes, which seem to form rapidly, are indistinguishable from old ones.