UNIT VI
REPRODUCTION

Chapter 1
Reproduction in Organisms

Chapter 2
Sexual Reproduction in flowering Plants

Chapter 3
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Chapter 4
Reproductive Health

Biology in essence is the story of life on earth. While individual organisms die without fail, species continue to live through millions of years unless threatened by natural or anthropogenic extinction. Reproduction becomes a vital process without which species cannot survive for long. Each individual leaves its progeny by asexual or sexual means. Sexual mode of reproduction enables creation of new variants, so that survival advantage is enhanced. This unit examines the general principles underlying reproductive processes in living organisms and then explains the details of this process in flowering plants and humans as easy to relate representative examples. A related perspective on human reproductive health and how reproductive ill health can be avoided is also presented to complete our understanding of biology of reproduction.

PANCHANAN MAHESHWARI
(1904-1966)

Born in November 1904 in Jaipur (Rajasthan) Panchanan Maheshwari rose to become one of the most distinguished botanists not only of India but of the entire world. He moved to Allahabad for higher education where he obtained his D.Sc. During his college days, he was inspired by Dr W. Dudgeon, an American missionary teacher, to develop interest in Botany and especially morphology. His teacher once expressed that if his student progresses ahead of him, it will give him a great satisfaction. These words encouraged Panchanan to enquire what he could do for his teacher in return.

He worked on embryological aspects and popularised the use of embryological characters in taxonomy. He established the Department of Botany, University of Delhi as an important centre of research in embryology and tissue culture. He also emphasised the need for initiation of work on artificial culture of immature embryos. These days, tissue culture has become a landmark in science. His work on test tube fertilisation and intra-ovarian pollination won worldwide acclaim.

He was honoured with fellowship of Royal Society of London (FRS), Indian National Science Academy and several other institutions of excellence. He encouraged general education and made a significant contribution to school education by his leadership in bringing out the very first textbooks of Biology for Higher Secondary Schools published by NCERT in 1964.

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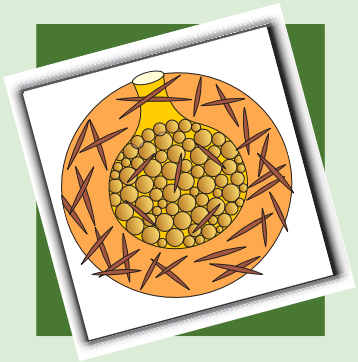


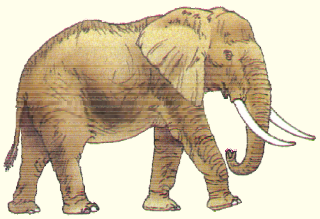
CHAPTER 1

REPRODUCTION IN ORGANISMS

1.1 *Asexual Reproduction*

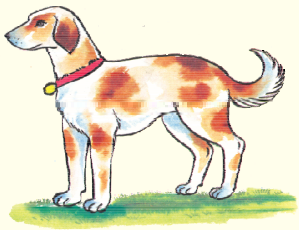
1.2 *Sexual Reproduction*

Each and every organism can live only for a certain period of time. The period from birth to the natural death of an organism represents its **life span.** Life spans of a few organisms are given in Figure 1.1. *Several other organisms are drawn for which you should find out their life spans and write in the spaces provided.* Examine the life spans of organisms represented in the Figure 1.1. Isn't it both interesting and intriguing to note that it may be as short as a few days or as long as a few thousand years? Between these two extremes are the life spans of most other living organisms. You may note that life spans of organisms are not necessarily correlated with their sizes; the sizes of crows and parrots are not very different yet their life spans show a wide difference. Similarly, a mango tree has a much shorter life span as compared to a *peepal* tree. Whatever be the life span, death of every individual organism is a certainty, i.e., no individual is immortal, except single-celled organisms. *Why do we say there is no natural death in single-celled organisms?* Given this reality, have you ever wondered how vast number of plant and animal species have existed on earth for several thousands of years? There must be some processes in living organisms that ensure this continuity. Yes, we are talking about reproduction, something that we take for granted.

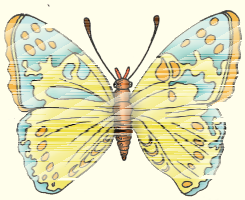


Elephant(_____)

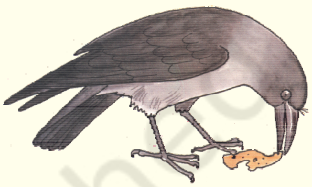
Rose (_____)



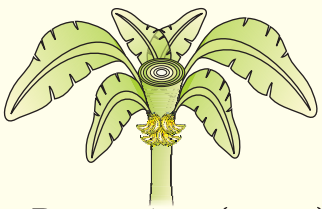
Dog (_____)



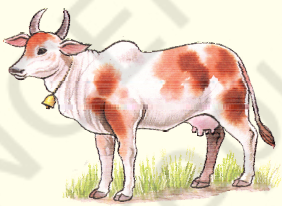
Butter fly (1-2 weeks)



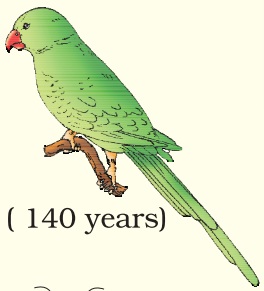
Crow (15 years)



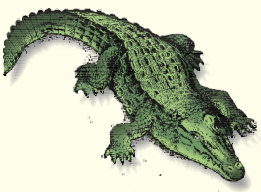
Banana tree (_____)



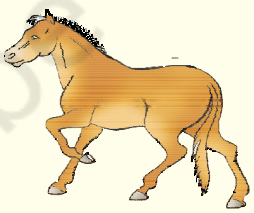
Cow (_____)



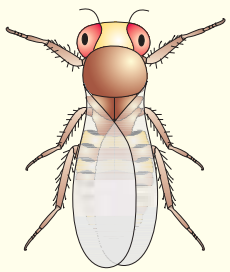
Parrot (140 years)



Crocodile (60 years)

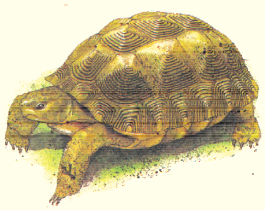


Horse (_____)

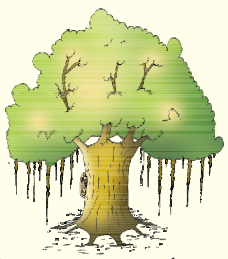


Fruit fly (_____)

Rice plant (_____)



Tortoise (100-150 years)



Banyan tree (_____)

Figure 1.1 Approximate life spans of some organisms

Reproduction is defined as a biological process in which an organism gives rise to young ones (offspring) similar to itself. The offspring grow, mature and in turn produce new offspring. Thus, there is a cycle of birth, growth and death. Reproduction enables the continuity of the species, generation after generation. You will study later in Chapter 5 (Principles of Inheritance and Variation) how genetic variation is created and inherited during reproduction.

There is a large diversity in the biological world and each organism has evolved its own mechanism to multiply and produce offspring. The organism's habitat, its internal physiology and several other factors are collectively responsible for how it reproduces. Based on whether there is participation of one organism or two in the process of reproduction, it is of two types. When offspring is produced by a single parent with or without the involvement of gamete formation, the reproduction is **asexual.** When two parents (opposite sex) participate in the reproductive process and also involve fusion of male and female gametes, it is called **sexual reproduction**.

1.1 Asexual Reproduction

In this method, a single individual (parent) is capable of producing offspring. As a result, the offspring that are produced are not only identical to one another but are also exact copies of their parent. *Are these offspring likely to be genetically identical or different?* The term **clone** is used to describe such morphologically and genetically similar individuals.

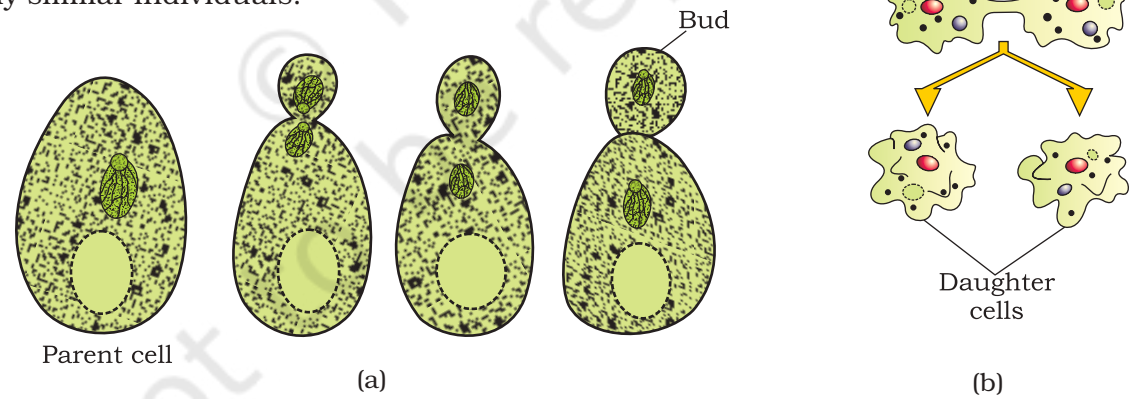


Figure 1.2 Cell division in unicellular organism: (a) Budding in yeast; (b) Binary fission in *Amoeba*

Let us see how widespread asexual reproduction is, among different groups of organisms. Asexual reproduction is common among single-celled organisms, and in plants and animals with relatively simple organisations. In Protists and Monerans, the organism or the parent cell divides by mitosis into two to give rise to new individuals (Figure1.2). Thus, in these organisms **cell division** is itself a mode of reproduction.

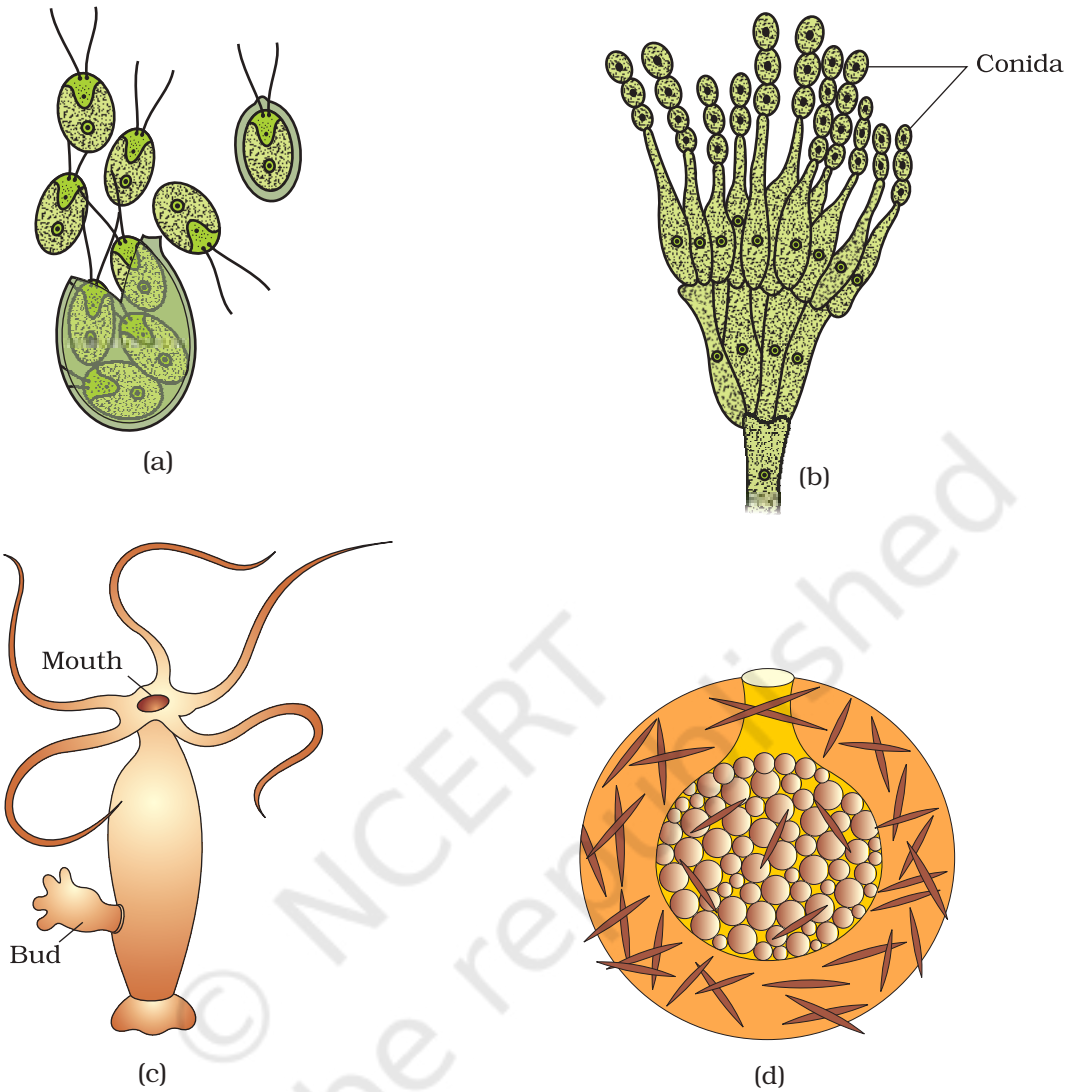


Figure 1.3 Asexual reproductive structures: (a) Zoospores of *Chlamydomonas*; (b) Conidia of *Penicillium;* (c) Buds in *Hydra*; (d) Gemmules in sponge

Many single-celled organisms reproduce by **binary fission,** where a cell divides into two halves and each rapidly grows into an adult (e.g., *Amoeba, Paramecium*). In yeast, the division is unequal and small **buds** are produced that remain attached initially to the parent cell which, eventually gets separated and mature into new yeast organisms (cells). Under unfavourable condition the Amoeba withdraws its pseudopodia and secretes a three-layered hard covering or cyst around itself. This phenomenon is termed as **encystation**. When favourable conditions return, the encysted Amoeba divides by multiple fission and produces many minute amoeba or pseudopodiospores; the cyst wall bursts out, and the spores are liberated in the surrounding medium to grow up into many amoebae. This phenomenon is known as **sporulation**.