

Topic: Reproduction in Protozoa.

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Reproduction in Protozoa:

Protozoans reproduce in a variety of ways and the process of reproduction is variable amongst different groups. But in all essence and purpose protozoan reproduction is nothing more than the division of the cell. It reproduces both asexually and sexually.

I. Asexual Reproduction:

When the continuity of species is maintained without the participation of the gametes and the asexual reproduction takes place by the division of the body of individual into two or more parts, these parts give rise to the new individuals (Fig. 1.).

The asexual reproduction is of the following types:

- A. Binary fission,
- B. Multiple fission or Sporulation,
 - 1. Schizogony or Agamogony
 - 2. Gamogony
 - 3. Sporogony
- C. Plasmotomy
- D. Budding and
- E. Repeated fission.

A. Binary fission:

It is the usual method in which the body of the individual divides into two equal halves and the furrow extends along the long and the extended axis of the body.

Depending upon the plane of division, the binary fissions are of the following categories:

(i) Longitudinal binary fission:

The plane of constriction is along the long axis of the animal, e.g., *Euglena*, *Vorticella*, *Trypanosoma* etc.

(ii) Transverse binary fission:

The plane of division of the body constricts transversely, e.g., *Paramecium*.

(iii) Oblique binary fission:

The plane of division is somewhat oblique, e.g., *Ceratium*.

The different organelles present in the body may divide or they may be retained by one of the daughter cells; while in the other cell regenerates the lost organelles. In extreme cases organelles disappear altogether and are regenerated by both the offspring.

(iv) Encysted condition:

In *Colpoda*, *Tellina* and in testaceans, binary fission takes place in encysted condition. One of the daughter individuals remains within the old test while the other moves away to form a new one.

B. Multiple fission or Sporulation:

In multiple fission the body divides and a number of daughter individuals are formed. The nucleus divides a number of times and a multinucleate state results. The nuclei come to the periphery and gather some amount of cytoplasm round them. The cell-membrane breaks and daughter individuals corresponding to the number of nuclei are produced.

The number of individuals produced by multiple fission varies and sometimes as many as 1000 individuals are formed. Multiple fission occurs in Foraminifera, Radiolarians and Sporozoans.

Multiple fission is also known by the following names:

1. Schizogony or Agamogony:

When the products of the fission directly develop into individuals as in *Plasmodium* in the red blood cells or hepatic cells of man.

2. Gamogony:

When the products are sex cells as the microgametocytes of *Plasmodium*.

3. Sporogony:

When it occurs following sexual fusion as in *Monocystis* and *Plasmodium*.

C. Plasmotomy:

It is the division of the cell-body without nuclear division and occurs in many multinucleate ciliates like *Opalina*.

D. Budding:

It is a process in which one or more individuals are produced on the body of the parent and are budded off. The individuals generally do not resemble the mother and undergo further development before or after being free. Budding occurs only in *Suctorina*. The site of bud formation may be inside or outer side of the body.

1. Exogenous bud:

When the buds are constricted off to the exterior as in *Noctiluca* and some *Myxosporidia*.

2. Endogenous bud:

When the buds are formed in the brood chamber or internal spaces of the mother body and come out later as in *Testaceans*, *Arcella*, *Suctorians* and many *Myxosporidia*.

E. Repeated fission:

In which equal division of the nucleus occurs twice or thrice forming four or eight nuclei which do not separate till the process for which the nucleus divides is complete as in the micronucleus of *Paramecium* and *Volvox*.

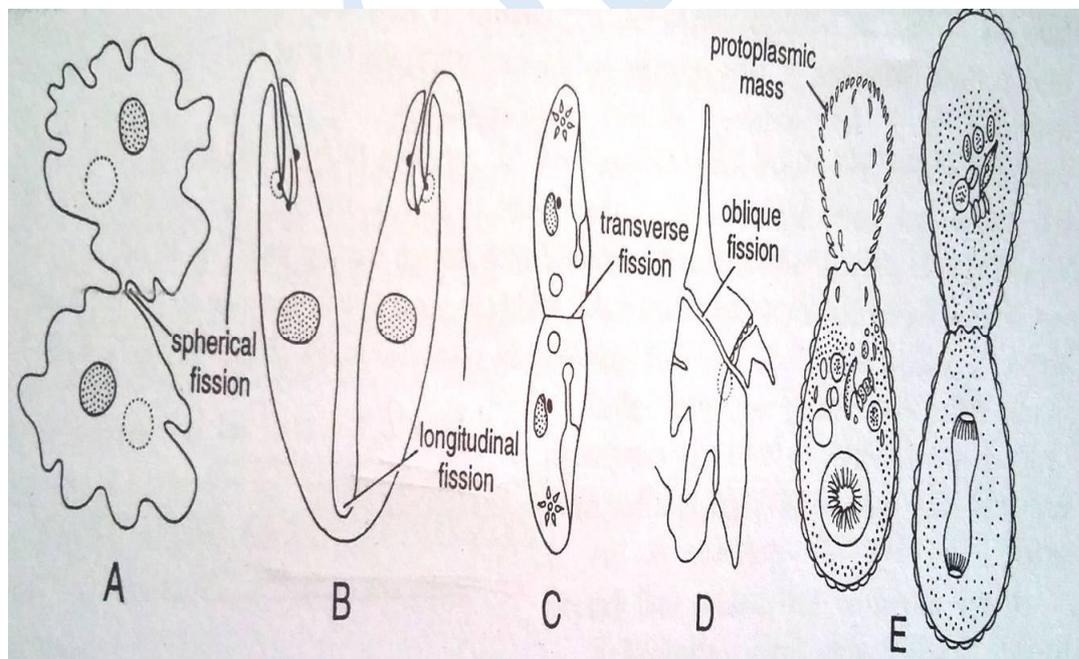


Fig. 1. Binary fission in Protozoa. A – *Amoeba* (irregular). B – *Euglena* (longitudinal). C – *Paramecium* (transverse). D – *Ceratium* (oblique). E – *Euglypha* (two stages in fission).

II. Sexual Reproduction:

Sexual reproduction is one when it takes place by the union of two entire individuals or it involves merely the nuclear exchange and their subsequent fusion.

In Protozoa the sexual reproduction occurs by the following processes:

A. Syngamy or Copulation:

Syngamy is the complete fusion of two sex cells or gametes, resulting in the formation of zygote. Depending upon the degree of differentiation displayed, by the fusing gametes, syngamy is of the following types:

(a) Hologamy:

The two ordinary mature protozoan individuals do not form gametes but themselves behave as gametes and fuse together to form zygote. It occurs in a few Sarcodina and Mastigophora.

(b) Isogamy:

When two fusing gametes are similar in size and shape and cannot be morphologically distinguished from each other though there exist physiological differences, they are called isogametes and their union, isogamy. The isogametes are generally produced by multiple fission. Isogamy is common in *Forminifera*, *Gregarines* and *Phytomonadina* like *Copromonas*.

(c) Anisogamy:

It is fusion of dissimilar gametes. The copulating sex units are dissimilar in size, form and behaviour. The large and non-motile unit is called female or macrogamete and the small mobile one is termed male or microgamete in such fusion. They widely occur in *Phytomonadina* and *Sporozoa*, e.g., *Plasmodium*.

(d) Oogamy:

In this case the gametes are quite dissimilar. The female gamete is non- motile egg and the male is a flagellate and motile sperm. It is found in *Volvox*.

(e) Paedogamy:

When the fusing pronuclei are present in two different cells derived from a single parent cell, the process is called paedogamy. The process has been observed in *Actinophrys* sold by Blar (1922) and in some *Myxosporidia*.

Significance of syngamy:

(i) Syngamy brings about a nuclear reorganization, and physiologically it has distinct effects.

(ii) It brings two previously separated lines of heredity in close association.

(iii) It increases diversity among the offspring.

B. Conjugation:

Conjugation may be defined as a temporary union of two individuals belonging to same species for the purpose of exchange of nuclear material. Conjugation is a complex process in which several nuclear divisions occur both in the preparatory and post-conjugation phases and one of these divisions is meiotic in nature. Conjugation occurs in *Euciliates* and *Suctorians*.

Significance of conjugation:

(i) Conjugation helps in rejuvenescence to gain vigour and vitality.

(ii) It brings about the genetic recombination, and the origin of genetic variations takes place.

(iii) Reorganesation of nuclear apparatus takes place between the individuals.

C. Parthenogenesis:

In case the syngamy is missed, gametes develop parthenogenetically. The examples are *Actinophrys*, *Polytoma* and *Chlamydomonas*.

D. Regeneration:

Protozoa possess a remarkable power to regenerate lost parts like cilia, flagella, cytostome and vacuoles, provided nuclear material is included. When an amoeba is cut into two parts and the parts are kept in proper environment—the part without nucleus degenerates while the nuclear part regenerates. Shell of *Foraminifera* regenerates if broken.