Reading material

How do organisms reproduce?

Definition

Reproduction is defined as the biological process of producing young ones by organisms.

Basic events in reproduction

Genetic material is transferred from generation to generation through reproduction .sometimes changes in the composition of DNA occur due to crossing over of genetic material in meiosis in sexually reproducing organisms.

Variation

During reproduction DNA copying occurs, some errors arise during this process. Such errors cause variation,
Reproduction is chiefly of two types:

A.ASEXUAL

B.SEXUAL

Asexual reproduction

Asexual reproduction is a type of reproduction where young ones are produced from a single parent. These young ones are identical to parents called clones.

1) Binary fission: Binary fission is the most basic of the asexual reproduction by which the organisms split into two equal sized daughter cells by mitosis. Here the nucleus undergoes division after which cytoplasm gets divided and the daughter cells are genetically identical to the parent cell. It is found in amoeba (simple binary fission), paramecium (transverse binary fission) and Euglena (longitudinal binary fission).
2) Multiple fission: Multiple fission is the type of fission in which the nucleus followed by cytoplasm undergo multiple division, to form daughter cells. The type of cell division here is amitosis. It is observed in plasmodium and Entamoeba histolytic.
3) Budding: Budding is a process where in small buds arise from the parent cell, by the process of mitosis. It is found in the lower class of organisms like yeast, hydra, and sponges.
4) Fragmentation: Fragmentation is a type of asexual reproduction, where the individual organism gets split into multiple fragments each further developing into new individuals. It is observed in flatworms and microstomia.
5) Vegetative propagation: It is a type of asexual reproduction observed in plants, in which new plant can arise from a part of the parent plant or out of a specialized region. Here the plants reproduce from stem or tubers (potato, mint), leaves (bryophyllum), root (sweet potato, tapioca) or reproductive parts (onion, agave). Vegetative propagation is a natural process but can also be induced artificially.

Artificial vegetative propagation

It is widely used by the horticulturists to obtain variety in the yield as compared to the native plant and further clone it since the genetic material remains unchanged. This

method is widely used in plants where sexual reproduction or seeds are not available and the process is easier and cheaper compared to traditional propagation of plants. The different types include Cutting, such as in stem (rose), leaves (bryophyllum), roots (apple, lemon, tamarind) and placed in a suitable medium to grow into a new plant.
Grafting: Here the desired parts of two different plants are fused to form a new plant. Root is called stock and the part of plant grafted to; is called Scion. The scion and stock should be compatible with each other. The types of grafting can be done in plants such as in mango (wedge grafting), citrus plant (crown grafting), apple (tongue grafting), and almonds (budding).
Layering is the method of inducing root development at stem regions. Some of the types of layering include – simple layering (rhododendron), tip layering (raspberries, blackberries), stool layering (apple), compound layering (grapes), air layering (oleander).
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Spore formation

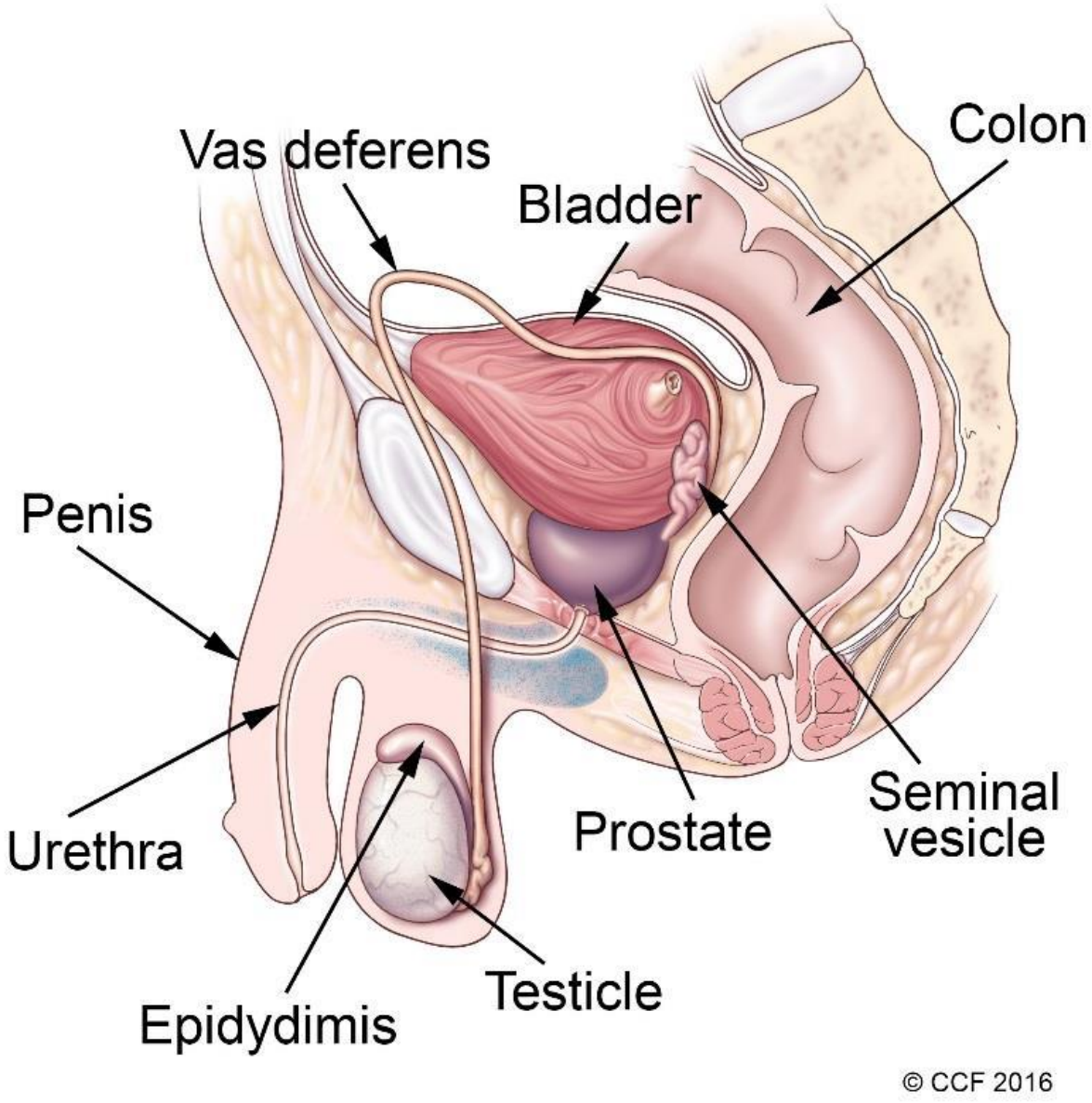
It is a method in asexual reproduction which occurs in fungi and bacteria. Rhizopus generates thousands of spores in sporangium. Each

Spore grows into new organism

SEXUAL REPRODUCTION

Sexual reproduction is a mode of reproduction which involves fusion of organisms of different sexes, such as the male and female, giving rise to offspring of the same kind. . The male gamete is sperm and female gamete is the egg. The haploid no. of chromosomes of male and female gamete fuse in a process of fertilization, giving rise to diploid no. of chromosomes in the fused fertile cell called zygote, which is a precursor to the embryo (offspring).

Male reproductive system in human



he male reproductive system consists of :

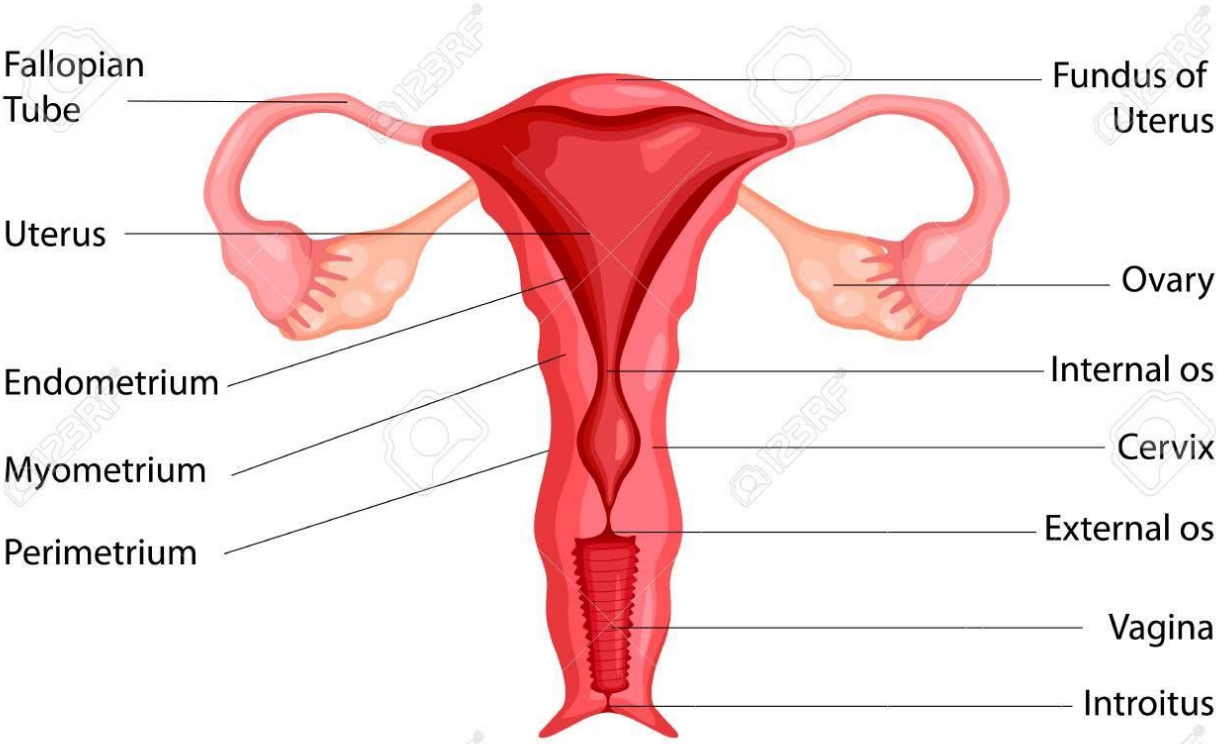
- **Testicles (testes):** A pair of oval-shaped organs masked in a pouch called scrotum. They are responsible for the production of sperms and the male hormone testosterone.
- **Scrotum:** It is a sac-like organ that hangs below the penis and behind it. It is the houses of the testicles, or testes, and maintains a temperature that is required for the production of sperm by it.
- **Vas deferens:** The sperms produced in testes are stored in a tube called epididymis. Here the sperms get matured and pass to urethra through the muscular tube called vas deferens.
- **Accessory glands**: This includes three glands, namely seminal vesicles, prostate gland, and Cowper's gland. The secretions from the three glands mix to form a fluid called semen. Semen nourishes the sperm, increases the volume and helps in lubrication.
- **Penis**: Penis is a cylindrical tube which serves as both reproductive organ as well as an excretory organ. It delivers sperms into the vagina during sexual intercourse.

Explore more: Male Reproductive System

Female Reproductive System

The female reproductive system is active before, during and after fertilization as well. It consists of the following parts:

- **A pair of ovaries:** Ovaries produce and store ovum in them. They also produce a female hormone called estrogen.
- **Fallopian tubes (Oviducts):** They are the site of fertilization. They connect ovaries with the uterus.
- **Uterus:** Uterus is the site of development for the embryo.
- **Vagina:** It is the part which connects cervix to the external female body parts. It is the route for the penis during coitus as well as a fetus during deliver



Fertilization is a process of fusion of male and female gametes, in which the offspring receives half of the genetic material from each of the parents.
The type of cell division that takes place in gamete formation is Meiosis or the reduction division. Meiosis is called reduction division since the genetic material gets halved, i.e., the diploid gametes undergo cell division twice as Meiosis I and Meiosis II giving rise to haploid no. of chromosomes in gametes.
In Meiosis I, there is a reduction division of the homologous chromosomes along with crossing over of the non-sister chromatids. The cell is divided into two sister cells. The genetic material is exchanged. In meiosis II, the 2 sister cells are divided into four sister cells and no other changes are found. The end of meiosis is marked with 4 haploid cells arising from a single diploid parent cell. Fertilization can be differentiated into three major stages:

Pre-fertilization stage:

In this phase, events such as gametogenesis and gamete transfer take place.

Gametogenesis:

Gametogenesis is a process in which the formation of gametes; male and female gametes takes place. The gametes are haploid cells and develop from their parent cells after undergoing cell division. The gametogenesis involves oogenesis and spermatogenesis.

a) Oogenesis is a process of formation of the egg from the oocyte. Oogonium, a germ cell (diploid) undergoes mitosis to increase its number to a few million cells. The primary oocyte is diploid in nature, undergoes its first meiotic division at adolescence, gets arrested and later develop into the follicle, giving rise to the secondary oocyte and a polar body. The secondary oocyte further undergoes meiotic division and gets arrested and completes the division at the time of fertilization. The polar body formed during oogenesis is degenerated and used up by the body.
b) Spermatogenesis: In this process, the spermatogonium, a stem cell is deposited at the time of birth and forms sperms in the adolescence. The spermatogonium, the diploid cell undergoes mitosis to increase in number and further continue to undergo meiosis to form haploid sperms.

Gamete transfer:

The gametes must be brought in contact with each other to achieve fertilization. The gametes are transferred to the region of fertilization, as a result of which, the haploid gametes fuse to form a fertilized diploid egg. In most of the organisms, sperm is motile, and egg stays within the organism. All the sperms do not reach the egg, hence they are produced in millions of numbers, so the fertilization can be achieved.
In plants, pollination is involved in the transfer of pollen present on anther, containing the male gamete into the ovary of the plant containing the egg. It is easier in self – pollinating plants, as the anther and stigma are placed close to each other. In cross-pollinating plants, the pollen on anther of one plant is transferred to the stigma of the other plant of same species, which is usually achieved by bees or by the wind.

Fertilization stage:

It is the process of fusion of male and female gamete, resulting in the formation of fertilized egg or zygote, a pre-cursor to embryo usually inside the female organism. Sometimes, the female gamete undergoes transformation to form the offspring without fertilization, it is called as parthenocarpy, bearing a seedless variety of fruits or vegetables in plants. In animals, it is called parthenogenesis, observed in certain insects and lizards.

Post-fertilization stage:

This stage is marked by the formation of zygote.
Zygote formation: Zygote is the fertilized egg, which is diploid in nature in all sexually reproducing organisms. It is either formed on the medium such as water, in case of external fertilization and inside the female organism, in case of internal fertilization. The zygote is a precursor to an embryo.
Embryogenesis: It is the development of the embryo from zygote. The zygote undergoes several mitotic divisions to form specialized cells, which eventually transforms into organs and organisms. Cell division and cell differentiation are the key events in this stage. Cell division is to increase the number of cells in the embryo which can be further specialized based on the structural and functional organization of the organism. Cell differentiation is helpful for the complete development of the organism. In lower organisms, a thick wall is formed around the cell wall to prevent desiccation or damage to the cell in the period of rest, the post which they germinate by dissolving the wall.
In the case of plants, the zygote is formed inside the ovule of a flower. The ovule develops into seeds while zygote develops into embryo and ovary forms the fruit. The outside protective layer called pericarp develops on the surface of the fruit. Seed dispersal is one of the ways of plant propagation.

Reproduction In Organisms – Advantages and disadvantages of asexual reproduction

Advantages:

1) Genetic variation can be achieved within the species level.
2) Resistance to diseases is possible due to immunity in the organisms.
3) Adaptability to evolution is a prime feature.

Disadvantages:

1) Certain genetic features may be lost due to genetic variation
2) Slow process, hence less offspring can be produced compared to asexual reproduction.
3) The rate of success is not 100%, since one of the organisms involved in fertilization may be sterile or unproductive.

Reproduction has evolved over time and it has made way for several kinds of research and discoveries leading to prominent solutions and a better way of living.