

Revision Notes

Class 10 – Science

Chapter 8 – How do Organisms Reproduce?

1. Do organisms create exact copies of themselves?

- The organisms are similar in their looks due to having similar body designs, which in turn indicates that the source for these designs must be similar. And hence **reproduction** is that process where these designs are created.
- The nucleus of a cell contains the **chromosomes**, which carry the information for the inheritance of features from parents to the next generation. It is present in the form of **DNA molecules**.
- The DNA present in the nucleus of a cell is the source of information for making proteins. If this information changes, then a different set of proteins will be synthesised which will eventually lead to altered body designs in the organisms.
- Hence it can be noted that a basic event in reproduction involves the creation of a DNA copy.
- This copying of DNA is accompanied by the creation of an additional cellular apparatus, after which the DNA copies separate with each of them having its own cellular apparatus. Thus, a cell divides to give rise to two cells.
- Since this process of copying DNA is a biochemical process, it may not be reliable and it will lead to some **variations** each time.
- If the created new DNA copy is not viable, then the cell will not survive. And the surviving cells will be similar but may not be identical to the original and will subtly differ from each other.

1.1. The importance of variation

- The consistent DNA copying that happens during reproduction is essential to maintain the features of body design of an organism so that it can occupy its well-defined space or niche in the ecosystem.
- Hence reproduction is very much linked with the stability of a population of a species.
- The variations become important here as an organism may be suited for a specific niche and a drastic change in that due to unforeseen environmental conditions makes their survival difficult.

- Hence in such situations when a few among the species have some variations, they stand a chance of survival in the new niche. And thus, these species adapt themselves to the new conditions and the species are maintained over a period of time.
- It can be understood with an example. If a species of bacteria is living in the temperate waters and suddenly the temperatures rise due to global warming, then most of the bacteria in that water would not survive. But maybe a few variants among them who are able to resist the heat may survive and grow. In case the variations were not present, that entire species of bacteria would have become extinct.
- Thus, the **importance of variation** lies in the **survival of a species** over time.

2. Modes of reproduction

Reproduction can be defined as a process that involves the production of an offspring by a particular individual or individuals with the aim of propagating their species. Generally, reproduction happens during the reproductive phase of an organism. The mode of reproduction may vary in organisms. They can be broadly categorised as:

a) Asexual mode of reproduction:

- The mode of reproduction by means of which a single individual creates a new generation of species is termed as asexual reproduction.
- Generally unicellular organisms exhibit asexual mode of reproduction, though some of them exhibit sexual mode too.

b) Sexual mode of reproduction:

- The mode of reproduction by means of which two individuals take part in the creation of a new generation of species is termed as sexual reproduction.

Types of asexual mode of reproduction:

2.1. Fission:

- In unicellular organisms the new individuals are created by the process of cell division or fission.
- The nucleus of the cell divides into new individual cells under favourable conditions.
- Fission can be of two types depending on the number of new individuals created.

- a) **Binary fission:** This division leads to the formation of two new individuals. These can be further divided based on their plane of division as:
- i. **Irregular binary fission:** In this type of fission the plane of division of a cell is irregular, it can be in any plane. Example - Amoeba.
 - ii. **Transverse binary fission:** In this type of fission the cells divide along a transverse plane. Example - Paramecium.
 - iii. **Longitudinal binary fission:** In this type of fission the plane of cell division is longitudinal. Example - Euglena.
- b) **Multiple fission:** This is the division of a single cell into many new daughter cells. Example - Plasmodium.

2.2. Fragmentation:

- This is a process where an organism simply **breaks up into smaller pieces** when they are mature.
- Each of the fragments or broken pieces grow into a new individual. There should be a cell that is capable of growing into a new individual in such organisms.
- Example - Spirogyra.

2.3. Regeneration:

- This is a process where some fully differentiated organisms can be cut or broken into pieces and **each of their body parts** have the ability to **grow into a new individual**.
- Different cells in this mass of cut cells undergo a lot of changes in an organised manner to become different cells and tissues.
- Example - Planaria, Hydra.

2.4. Budding:

- This is a process where a protuberance like outgrowth which is called as **bud grows** by repeated cell division **at a specific site** and then they detach from the parent body to develop **into a separate individual** organism.
- Example - Hydra.

2.5. Vegetative propagation

This is the mode of reproduction by which plants reproduce asexually. In this mode, **new plants are developed** from a plant's vegetative parts

like **stem, leaf, root**. There are different methods of vegetative propagation that are carried out in plants which are as follows:

- a) **Stem cutting:** This involves cutting the stem into small pieces having internodes and axillary buds. These are then planted in the soil to propagate into new plants. This method is used in sugarcane, hibiscus, drumstick etc.
- b) **Layering:** This is a method where the young stem of a plant is bent and buried in the soil to develop roots and thus a new plant. Once the new plant develops, the stem is detached from the parent plant. This is used in jasmine, bougainvillea.
- c) **Grafting:** This is a method wherein the stems of two different plants are cut and joined together to unite and start developing into a new plant. This is used in nutmeg, roses etc.
- d) **Leaf buds:** This is a method in which the buds in the notches of leaves develop into new plants. This can be seen in bryophyllum.

Advantages of the vegetative propagation:

- a) The plants that are grown by vegetative propagation **bear flowers and fruits earlier** as compared to the plants produced from seeds.
- b) **All plants** that are produced this way **are genetically similar** to the parent plant and have all its characteristics.

2.6. Spore formation:

- Many multicellular organisms have specific reproductive parts.
- They have tiny thread-like structures with a blob called sporangia.
- These contain cells or **spores** which eventually develop into new individuals. The spores are very light and covered by a thick wall to protect them and when they come in contact with a moist surface they start to grow.
- Example - Rhizopus.

3. Sexual Reproduction:

3.1. Why the sexual mode of Reproduction?

- The sexual mode of reproduction involves two organisms, a male and a female to create a new organism or offspring.
- The sexual reproduction **allows greater variations in a species** as the two individuals involved in producing the offspring would have different patterns of variations. This process includes the combination

of DNA of two different individuals and the resultant combination and variation would be unique.

- Hence this ensures a mixing of the gene pool of the species within a population and it also ensures the survival of the species as this process generates more variations due to the genetic recombination.
- The process of combining DNA of two different individuals during sexual reproduction will lead to an offspring with twice the amount of DNA than their previous generation.
- The solution to this lies in the fact that there are certain specialised cells in such organisms called **germ cells or gametes**. These have half the number of chromosomes and, therefore half the amount of DNA in comparison to the other non-reproductive cells. The combination of these germ cells from two different individuals during the process of sexual reproduction restores the original number of chromosomes and DNA content in the new offspring.
- The germ cells may be similar and not much different from each other in simple organisms. With the complexity of the organisms the germ cell also becomes specialised. One of the germ cells becomes large and stores food. This is known as the **female gamete**. The other germ cell which is small and motile is called the **male gamete**. These gametes lead to the differences in the bodies and reproductive systems of males and females.

3.2. Sexual Reproduction in flowering plants

- The process of sexual reproduction in plants involves the fusion of gametes to produce offspring. The reproductive parts in angiosperms [plants that flower and produce fruits and seeds] are located in the flower. The parts of a flower consist of sepals, petals, stamens and pistils.
- The reproductive parts of the flower are **stamen** which contains the male gamete and the **pistil** containing the female gametes.
 - a) Stamen:** This is the male reproductive part and is also known as the androecium. It consists of a **filament** and an **anther** that encloses the pollen grains. The **pollen** grains produce the male germ-cells or gametes.
 - b) Pistil:** This is the female reproductive part of the flower and is also known as gynoecium. This is made of three parts, namely, stigma, style and ovary. The enlarged portion at the bottom of a pistil is the **ovary** that contains an ovule with an **egg cell**. The middle long part of the pistil is the **style** and the terminal sticky part is the **stigma**.

- Based on the presence of the stamen or pistil, flowers can be classified as:
 - a) **Unisexual:** These are the flowers that contain either stamens or pistils. These are also called incomplete flowers. Example - papaya, mulberry, watermelon etc.
 - b) **Bisexual:** These are flowers that contains stamens as well as pistils. Example - Hibiscus, mustard, rose etc.
- The process of sexual reproduction in plants starts with the fusion of the male and the female gametes, followed by the formation of a zygote that eventually develops into a new plant. The process is explained as follows:
 - a) **Pollination:**
 - The process of sexual reproduction in plants starts with the transfer of pollen grains from the anther of the stamen to the stigma of the pistil. This process is termed as pollination.
 - This is facilitated by pollinating agents like wind, birds, animals, water etc. which transfer the pollen grains.
 - There can be two types of pollination as follows:
 - i. **Self-pollination:** This involves the transfer of pollen grains from the anther to the stigma of the same flower. Example - wheat, peanut, etc.
 - ii. **Cross-pollination:** This type of pollination involves the transfer of the pollen grains from the anther of one flower to the stigma of another flower of the same species. Example - apples, pumpkin etc.
 - b) **Fertilization:**
 - Through the process of pollination, the pollen is deposited in the style of the pistil. For the next process in reproduction, it needs to reach the female germ-cells which are present in the ovary.
 - To facilitate this, a tube grows out of the pollen grain and reaches the ovule in the ovary of the pistil.
 - Here in the ovule the male germ-cell fuses with a female germ-cell to form a **zygote**. This process of fusion of the gametes is termed as fertilisation.
 - After the process of fertilization, the zygote thus formed, divides repeatedly to form an embryo inside the ovule. The ovule later develops into a **seed**.
 - And meanwhile the ovary grows and ripens into a fruit and the other parts of the flower, namely the petals, sepals, stamens, style and stigma may be shed off.

- The seed present inside the fruit encloses the future plant in its **embryo**.

c) Germination:

- The seed that contains the new plant or embryo develops into a seedling when the conditions are suitable. This process is termed as germination. Certain conditions like nutrients, water and proper temperature are necessary for the process of germination.
- The embryo gets its food from the reserve food material stored in the **cotyledons**. It also has a protective outer covering known as seed coat.

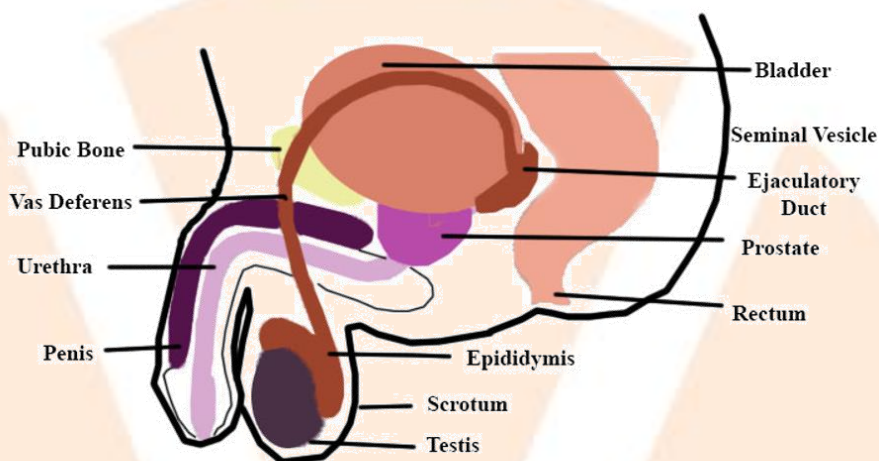
3.3. Reproduction in Human Beings.

- The mode of reproduction in human beings is sexual mode. The **reproductive phase** of an individual is that phase of life when the individual is ready to reproduce an offspring. Changes are noticed at every phase of growth right from birth.
- But there are some changes that begin in the teenage age that start to prepare us for the reproductive phase of life. This period of **adolescence** leads to sexual maturation. The body needs to create specialised germ-cells to take part in the sexual reproduction. The period of maturation of the reproductive tissues in the body is termed as **puberty**.
- Numerous changes are noticed in both boys and girls during this period. The boys start to have hair growth on their face and body, voice change, active functioning of sweat and sebaceous glands, enlargement of penis etc. The changes in the girls include growth of pubic hair, enlargement of breasts, oily skin leading to pimples, onset of menstruation etc. Both of them undergo changes in their body appearance and they become more conscious of these bodily changes.
- The process of fusion of germ-cells in sexual reproduction, the actual transfer of these germ-cells needs to be done. For the same special organs need to be present like penis in males and uterus in females for carrying the baby.

3.3.1. Male reproductive system

- The male reproductive system consists of organs that produce and transport the male germ-cell or gamete, male hormone testosterone and the organs which facilitate the discharge of male germ-cells into the female reproductive system for fertilization.

- The male gamete is the **sperm** which is a tiny body containing the genetic material and they have a long tail for motility to help them reach the female germ-cell for fertilization.
- The system consists of some external organs like penis, scrotum, testes and internal organs like urethra, prostate and seminal vesicles.

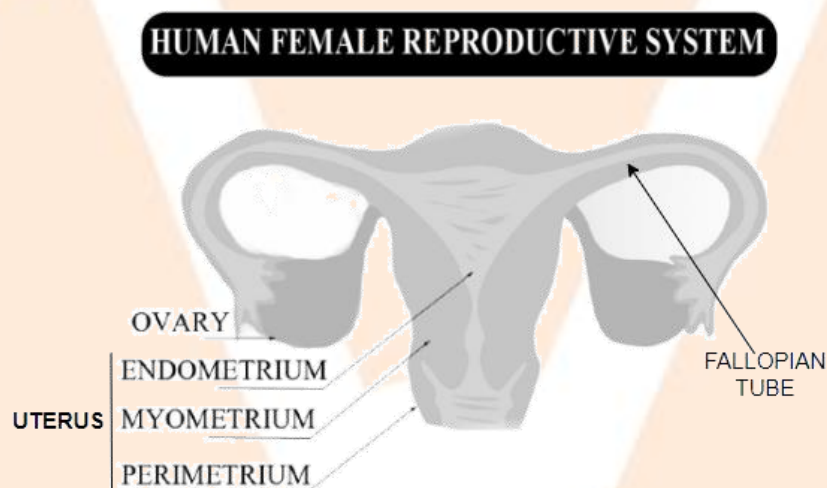


MALE REPRODUCTIVE SYSTEM

- Testes:** Testes is the part that is responsible for the production of the male germ-cell or sperms and the male hormone **testosterone**. Testes are present in a structure known as **scrotum**, located outside the abdominal cavity. This is thus located because the formation of sperm requires a temperature that is lower than the normal body temperature. The hormone testosterone plays a role in regulating the formation of sperms and also the development of the secondary sexual characteristics that are seen in boys during puberty.
- Vas deferens:** The sperms that are produced in the testes are stored in the **epididymis**. Vas deferens is a tube that transports these sperm to the urethra.
- Urethra:** This is a common passage for the sperm as well as urine. The same passage connects the urinary bladder and the vas deferens.
- Prostate gland and seminal vesicles:** These glands are located along the vas deferens. They secrete a fluid, called **semen** that nourishes the sperm. This semen helps in the easier movement of sperms.

3.3.2. Female Reproductive System.

- The female reproductive system includes the organs that produce the female germ-cells, provides site for fertilization of the gametes and development of the embryo into a new individual.
- The female gametes are the **eggs** that are produced in the ovaries.
- They also produce some hormones like **estrogen and progesterone** that are responsible for the onset of secondary sexual characteristics in girls at puberty.
- This system includes a pair of ovaries, a pair of oviducts, uterus and vagina that opens externally through the urethra.



- Ovaries:** The ovaries are a pair of glands that are located on either side of the uterus. The ovaries protect the female gametes or eggs and make them suitable for fertilization. At birth the ovary of a girl contains thousands of eggs that are immature. After puberty, when the eggs mature, the ovaries release one egg every month. The ovaries also produce the hormones oestrogen and progesterone that are essential in bringing the secondary sexual changes in a girl at puberty.
- Fallopian tube:** This is also known as **oviduct**. This is a thin tube that connects the ovaries to the uterus. The eggs that are released by the ovary are transported through this tube.
- Uterus:** This is a bag-like muscular elastic structure into which the two oviducts open. The uterus is the site where the fertilized egg is implanted and it grows into a foetus. It is made of 3 tissues, outer perimetrium, middle layer of myometrium and the inner endometrium. This is also responsible for supporting the developing foetus during the entire gestation period.

- d) **Cervix:** This is the site where the uterus opens into vagina. This facilitates a passage for the entry of the sperm into the uterus.

Fertilization and development:

- The process of fertilization of a male and female gamete or sperm and egg starts when the sperm enters the female reproductive system through the vaginal passage during a sexual intercourse. From the vaginal passage they move up through the uterus towards the fallopian tubes.
- The eggs are present in the fallopian tube, meet the sperm and get fertilized.
- The fertilized egg, which is known as the **zygote**, starts dividing repeatedly and travels down the fallopian tube to the uterus.
- The ball of cells or **embryo** gets implanted in the endometrial lining of the uterus and continues to grow into a foetus. The embryo gets its nourishment from the mother through a special tissue called the **placenta** which acts as a connection between the mother and the developing embryo. It helps to transport glucose and oxygen to the embryo and remove the wastes generated by the embryo.
- It takes about nine months for the complete development of the child inside the mother's body. The child is born due to the rhythmic contractions of the uterine muscles.

3.3.3. What happens when the egg is not fertilized?

- An egg is released by the ovary every month in anticipation of it getting fertilised. In case the egg does not get fertilized, it can survive for only a day. Similar to the ovary releasing an egg every month, every month, the uterus too prepares itself to the fertilized egg by creating a thick and spongy lining in order to provide nourishment to the embryo.
- When the fertilization does not occur, this lining too is not required and this lining and the egg is shed as blood and mucous through the vagina. This is called menstruation. This cycle occurs every month and lasts for about 2 - 8 days roughly.

3.3.4. Reproductive Health.

- The process of sexual maturation is a gradual one which happens while the general body growth is ongoing. Some amount of

sexual maturation does not prepare a young person to be sexually active or get married and bear children and bring them up.

- Reproductive health deals with all these aspects concerned with healthy and safe sexual practices. It becomes difficult for the young people to make the correct choice given the various types of pressure they face from peers, family, society.
- Lack of proper information and unhealthy sexual practices can lead them to contract some diseases from one partner to another and even to the offspring as a sexual act is an intimate physical contact between them. The diseases transmitted in this manner are termed as **sexually transmitted diseases** (STDs), like bacterial infections such as gonorrhoea and syphilis, viral infections such as warts and HIV. These can lead to health complications and be fatal too if left untreated.
- Reproductive health covers the area of safe sex to help young people. Pregnancy is a risk in a sexual act. As pregnancy is very demanding for the body and mind and has to be planned, unwanted pregnancies and abortions can be avoided by using some **contraceptive methods**.
- The contraceptive methods can be by using physical barriers that block the entry of sperm into oviducts and not letting fertilization take place. Examples are condoms or coverings on the penis.
- Contraceptive devices like Copper-T or **intrauterine contraceptive device** (IUCD) that are implanted in the uterus which does not allow the sperm to travel ahead.
- The other contraceptive method changes the hormonal balance of the body, preventing fertilization. These are mostly in the form of **drugs** which can be taken orally in a scheduled manner. Examples are pills like Mala D, I-pill etc.
- Another method is the surgical one like **vasectomy** in males in which the vas deferens is blocked to prevent the transfer of sperm. In females, **tubectomy** is done which blocks the fallopian tube and thus prevents the egg from reaching the uterus. The surgical methods are more reliable and safer as compared to the other methods.
- Though surgery is used to abort unwanted pregnancies, it has been widely misused by the people, especially for illegally aborting a female foetus.

- There is a law in place to prevent this **female foeticide** (killing of a foetus), which states that prenatal sex determination is prohibited.
- A proper ratio of males to females is essential to maintain a balance in the society and to have a healthy population too.

