

# Chapter 8: How Do Organisms Reproduce?

## *The Fundamentals Of Reproduction*

Individuals are reproduced by reproducing organisms (parents). Individuals so formed are genetically identical to one another and to their parents. This resemblance is due to DNA (Deoxyribonucleic Acid).

It is the template for all organisms' fundamental body structures. The nucleus of a cell contains DNA in the form of a condensed structure called a chromosome. At the most fundamental level, reproduction entails creating duplicates of the blueprints for its bodily design.

1. Cells replicate their DNA via biological processes.
2. The DNA contained in the cell's nucleus serves as the source of information. It contributes to the production of various proteins and cellular machinery inside the cell, which results in the various body patterns.

## *Variation*

- DNA replication is followed by the formation of a new cellular machinery. Following that, the cell splits efficiently into two new cells. It always results in some sort of variation in the freshly created cell.
- This results in the distinctions between an organism's morphological and physiological characteristics.
- Due to the fact that no biological process is completely dependable, the DNA copies made are similar but not identical.
- DNA replication should be very precise throughout the reproduction process. If this is not the case, individual differences will develop. This might be advantageous or detrimental to the person.
- This inherent tendency for diversity during reproduction serves as the foundation for evolution.

### *Importance Of Variation*

- Organisms use their capacity to reproduce to occupy well-defined positions or niches in the environment.
- Organisms with similar body designs have the same niche or location in the environment.
- When a niche appropriate for organisms in a given population is substantially altered, the population is likely to perish totally.
- However, if differences occur in a few individuals within these communities, certain individuals may survive, for example, in a community of bacteria that live in temperate water.
- If the temperature rises as a result of global warming, the majority of microorganisms will die. However, the heat-resistant varieties would live and thrive. Thus, it demonstrates that population variety is critical for a species' survival.

### *Types Of Reproduction*

#### *Asexual Reproduction*

This is a relatively frequent occurrence in unicellular creatures. It is claimed to be the simplest mode of reproduction, as shown by budding in Hydra, binary fission in Amoeba, spore generation in Rhizopus, fungi, and vegetative propagation in blooming plants such as roses, among others.

Asexual reproduction has the following characteristics:

1. It is a method of quick multiplication.
2. Cell division takes might be mitotic or amitotic in nature.
3. The new people formed as a result of cell divisions are always genetically identical to their parents or clones of them.
4. There is just one parent involved, i.e. there are no opposing sexes involved.
5. It is not a fusion of gametes.

## *Sexual Reproduction*

This is a prevalent technique in multicellular organisms. It is a process that occurs between male and female individuals that results in the production of new offspring by the fusing of gametes generated by both parents, for example, in humans, dogs, cats, fish, and frogs.

Sexual reproduction has the following characteristics:

1. It is not a fast method of reproduction.
2. Meiosis occurs throughout some phases of cell division, most notably during gamete production.
3. The new individuals formed as a result of cell division are variable.
4. The male gamete fuses with the female gamete (sex cells).

## *Modes Of Asexual Reproduction*

### *Fission*

Fission is the reproductive process whereby a unicellular organism divides into two or more distinct daughter cells. It is the most prevalent and straightforward way of asexual reproduction among unicellular organisms such as bacteria and protozoans.

Cell division of a single-celled organism into two or more portions results in the formation of new organisms in this case. It is classified into two forms, binary and multiple fission.

**Binary Fission :** The process through which a parent organism splits into two identical daughter organisms with a fixed orientation. Initially, the nucleus separates in half.

This is followed by cytoplasmic division. Finally, the parent cell divides into two daughter cells. Certain unicellular creatures have a more organised body. For example, *Leishmania* (the causative agent of kala-azar) has a whip-like structure at one end of the cell.

Binary fission happens in a certain direction relative to the cell structure of such organisms.

**Multiple Fission :** The process through which a parent organism splits into several identical daughter organisms simultaneously.

Multiple fission occurs in species such as Monocystis, Plasmodium (malaria parasite) and others.

### *Fragmentation*

It is an asexual reproductive method seen in multicellular organisms such as filamentous algae (Spirogyra). These creatures disintegrate into two or more little bits or pieces during development.

Each piece then evolves into a fully formed new creature. This form of cell division occurs in multicellular organisms with an uncomplicated body structure.

### *Regeneration*

1. All multicellular organisms are not merely a collection of randomly distributed cells. They display varying degrees of organisation. As a result, they need a sophisticated mechanism of replication.
2. These organisms are composed of a single cell type that is capable of expanding, reproducing, and producing other cell kinds given the correct conditions. Hydra and Planaria are two animals that can regenerate a whole person from a single portion of their body.
3. Thus, regeneration is a kind of asexual reproduction in which a new organism develops from a damaged or injured portion of an existing one. This is accomplished by the proliferation of specialised cells that generate a huge number of cells. From a chisel-shaped mass of cells, diverse cells undergo transformation to become distinct tissues and cell types.

### *Budding*

It is a kind of asexual reproduction in which a daughter organism develops from a tiny protrusion called a bud. It develops as an extension of the parent body's recurrent cell divisions. When completely developed, it detaches to become a new autonomous individual, such as Hydra.

## *Vegetative Propagation*

- It is a kind of asexual plant reproduction in which new plants are generated from a portion of the parent plant.
- Numerous structures participate in this form of reproduction under favourable circumstances. This is referred to as natural vegetative propagation, and it occurs when plant components such as the root, stem, and leaves grow into new plants.
- Cutting, layering, and grafting all use the vegetative proliferation feature. These are referred to as artificial vegetative propagation techniques.
- They are used by farmers for a variety of plants, including sugarcane, roses, grapes, and others.
- Certain organs of certain plants are employed for vegetative propagation, for example
  - Potato bud
  - Onion bulb
  - Ginger rhizome
  - Bryophyllum leaf buds
  - Dahlia adventitious roots

**Grafting :** A portion from one plant without roots (scion) may be linked to a portion of another plant having roots (stock). Numerous apple types, lemons, grapes, mangos, and pears are produced in this manner.

The following are the advantages of vegetative propagation:

- Contributes to genetic stability. Genetically identical to the parent plant, the generated plants retain all of the parent plant's traits.
- Plants propagated vegetatively may yield blooms and fruits sooner than seeds-grown plants.
- It also enables the proliferation of seeds-producing plants such as orange, rose, banana and jasmine.

## *Spore Formation*

**Numerous multicellular organisms** use **blob-on-a-stick-like structures** for **reproduction**. These lumps are called **sporangia**, and they are **reproductive structures** that hold **spores**.

As a result, **spore development** is a sort of **asexual reproduction**. Here, **live cells** or **spores germinate** and form a new **colony** of offspring organisms.

The **spores** are protected by **thick walls**. They may begin to develop when they come into touch with a **wet surface**, such as **soil**. If a **wet loaf** is left open for a few days, **thread-like projections** called **hyphae** sprout on it.

This is because the airborne **Rhizopus spores** adhere to the bread and **germinate**, forming a new **Rhizopus colony**.

## *Modes Of Sexual Reproduction*

Both sexes, i.e. **male** and **female**, are engaged in this sort of **reproduction**. One parent's (**male**) sex cell merges with the sex cell of the other parent (**female**).

This leads to the formation of a new cell known as a **zygote**. Thus, if the zygote is to expand and develop into an organism with highly specialised tissues and organs, it must have an adequate supply of **energy**.

Simple creatures contain **germ cells** that are almost identical in size to one another. Whereas in complex species, germ cell size varies significantly. In these creatures, the germ cell that stores more nourishment is referred to as the **female gamete**.

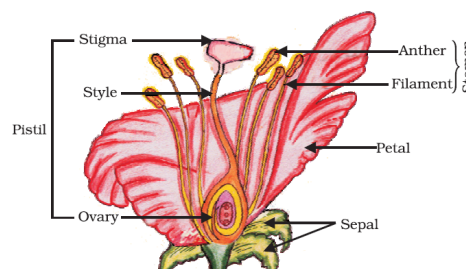
**Male gamete** is the name given to the opposite germ cell, which is **smaller** and more **motile**.

Thus, **sexual reproduction** entails two critical processes:

1. **Meiosis** is the process through which **gametes** are formed.
2. **Gamete fusion**.

## *Sexual Reproduction In Flowering Plants*

- Angiosperms are typically flowering plants. Their reproductive organs are contained inside the flower, and their seeds are contained within a fruit.
- The majority of aircraft contain both male and female reproductive parts in the same flower, which is why they are referred to as bisexual flowers, such as the lily, rose, Hibiscus, and mustard.
- While others, such as papaya and watermelon, contain either male or female reproductive components in their blossoms and are referred to as unisexual flowers.
- A flower is made up of four primary components: sepals, petals, stamens, and carpels. The reproductive organs of a flower are the stamens and carpels.
  - **Stamen** : The stamen is the flower's male reproductive organ. A single flower may include a variable number of stamens.
  - **Anther** : It is a bilobed structure that contains two pollen sacs at the stamen's tip. These generate yellowish pollen grains.
  - **Carpel (Pistil)** : This is the female reproductive component of the flower that is located in the centre. It is divided into three sections:
    - **Stigma** : It is the terminal portion of the carpel that is sticky. It aids in pollination by capturing pollen grains.
    - **Style** : It is the extended central portion of the carpel. It aids in the stigma's adhesion to the ovary.
    - **Ovary** : Ovary is the enlarged portion of the carpel's bottom. It is composed of ovules that contain an egg cell (female gamete).



- In order for plants to reproduce, the male germ cell must merge with the female germ cell.

- Pollination is the process by which pollen grains are transferred from the anther of the stamen to the stigma of a flower.
- Pollen grains may be spread by a variety of means, including wind, water, insects, and animals. Pollination is often accomplished in two ways:
  - **Self-Pollination** : Here, in this process, Pollen is transmitted from the seamen of a flower to the stigma of the same flower.
  - **Cross-Pollination** : In this process, Pollen from one flower's stamen is transported to another flower's stigma.

### *Fertilisation*

- In plants, **pollination** is followed by **fertilisation**. It is the process through which **male germ cells** are fused with **female gametes**.
- It results in the formation of a **zygote**. **Pollen** enters the **female germ cells** in the **ovary** as soon as it rests on an appropriate **stigma**.
- This develops as a result of the **pollen tube**. The **pollen tube** develops from the **pollen grain** and goes through the **style** to the **ovary**.
- Following **fertilisation**, the **zygote** splits several times and develops into an **embryo** within the **ovule**.
- After developing a thick covering, this **ovule** matures into a **seed**. The **ovary** develops swiftly and matures into **fruit**.
- The **seed** contains the future **embryo**, which, given the right circumstances, grows into a **seedling**. This is referred to as **germination**.

### *Sexual Reproduction In Human Beings*

After puberty, humans reproduce sexually. It is a stage of adolescence during which the reproductive organs, namely the **testis** in males and the **ovary** in females, begin to grow and become functional, i.e., reach **sexual maturity**.

Certain changes occur in both girls and boys throughout this reproductive period. **Sexual maturation** is indicated by these changes.

#### **Typical Developmental Changes in Boys and Girls:**



- Hair growth is excessive in the armpits and vaginal region between the thighs.
- Hair on the legs, arms, and face becomes thinner.
- Excessive sebum production and the formation of pimples.

## 2. Distinct Changes in Boys:

- Excessive facial hair development.
- Cracking or raspy voice.
- Penis sometimes becomes larger and erect.

## 3. Distinct Changes in Girls:

- Breast size starts to rise in females.
- Discoloration of the nipple skin.
- Menstruation begins.

Every one of these changes occurs gradually over months and years. Additionally, each modification takes time to execute. All of these changes occur differently in various individuals, i.e., each individual has a unique pattern of hair growth or a unique breast and penis size and form.

All of the alterations outlined before are associated with the **reproductive process**. Males and females who are sexually mature may create **gametes**. Males create **sperm**, whereas females produce **eggs** or **ovules**. When sperm and egg combine, the developing creature is referred to as **progeny**.

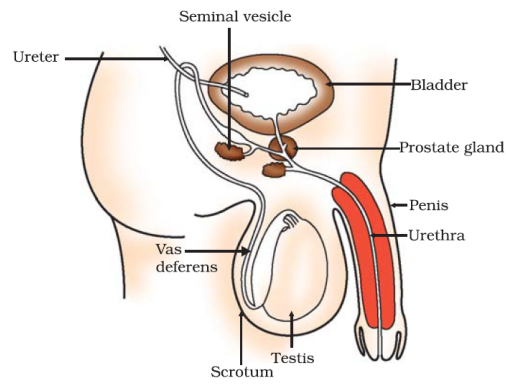
Despite the fact that their chromosomal counts are identical, an egg cell is genetically distinct from sperm.

### *Human Reproductive System*

The actual exchange of germ cells among two persons requires the use of particular sexual organs. This includes the male penis and the female vagina. The reproductive system refers to the collection of organs necessary for sexual reproduction.

## *Male Reproductive System*

The reproductive system in male is composed of many components. They generate the germ cells and transport them to the site of fertilisation.

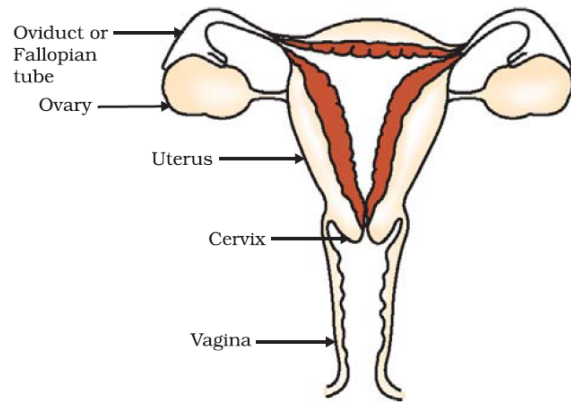


Several male reproductive system parts are illustrated below:

<b>PART</b>	<b>DETAIL</b>
Testis	Male sex organs that are paired and oval in shape. Are made up of seminiferous tubules, which are where sperm are produced. Generate testosterone, a male sex hormone. Which causes changes in the look of guys throughout puberty.
Scrotum	A small pouch containing testis. Found outside of the abdominal cavity. Because sperms are formed here, the temperature must be lower than the typical body temperature.
VAS Defences	A tube-like structure that links the testis to the urethra to facilitate the flow of sperm.
Urethra	Both sperms and urine move via the same passageway. It never carries both at the same time. Secretes seminal fluid and nutrients.
Prostate Gland and Seminal Vesicles	Semen is formed when fluid and nutrients interact with sperm. Fructose, proteins, and other substances in milky, viscous fluid feed and stimulate sperm.
Penis	During copulation, the external male genital organ transfers sperm into the female vagina.
Sperms	Tiny and motile bodies that migrate through the female reproductive canal using their long tail.

### *Female Reproductive System*

Ovaries produce eggs or female germ cells. Additionally, they are responsible for the generation of some hormones.



Several female reproductive system parts are illustrated below:

<b>METHOD</b>	<b>DETAIL</b>
Ovaries	Produce thousands of ova or egg cells; secrete female sex hormones such as oestrogen and progesterone; and are positioned in the abdominal cavity near the kidney.
Oviduct	It has a funnel-shaped entrance near the ovary and transfers the ova or egg from the ovary to the uterus. It is the location of fertilisation. These enter the uterus from both sides.
Uterus	A hollow, pear-shaped, bag-like structure in which the foetus grows and develops.
Cervix	The lower and thinner section of the uterus opens into the vagina.
Vagina	It receives sperm from the male partner and functions as a birth canal.

### *Fertilisation And Post-Fertilisation Changes*

**Fertilisation** is the process by which the nucleus of the sperm (male gamete) and the ovum (female gamete) fuse.

In humans, this process is as follows:

- During copulation or mating, the male gamete enters the female genital canal (vagina). This occurs in the **Fallopian tube** or **oviduct**.
- Sperms are very active and migratory. They enter the uterus through the cervix and exit via the oviduct.
- Fertilisation happens only in the presence of an egg in the oviduct.
- A sperm enters the ovum when it reaches the egg. A **zygote** is formed by **syngamy**, or the fusion of male and female nuclei.
- To produce an embryo, the zygote undergoes many **mitotic divisions**.

- The embryo descends into the uterus's soft and chick-like lining.  
**Implantation** is the process through which the embryo is embedded in the chick uterine lining.

The **placenta** develops into a disc between the uterine wall and the embryo during pregnancy. The placenta develops finger-like extensions called **villi** in the direction of the embryo. This results in a huge surface area for glucose and oxygen exchange between the mother and the embryo. Additionally, the growing embryo creates waste chemicals. These may be eliminated by passing them via the placenta into the mother's circulation.

In humans, the kid develops inside the mother's body for around nine months. If the egg is not fertilised, delivery occurs as a result of strong rhythmic muscle contractions in the uterus.

### **Menstruation :**

From the time a girl reaches **puberty**, her ovaries produce an **ovum** or **egg** once every 28 days. Each month, the uterus prepares itself to accept a fertilised egg. As a result, its lining becomes dense and spongy.

Without fertilisation, the egg has a lifespan of roughly a day. Following that, the uterine lining is no longer necessary, and **menstruation** begins.

Menstruation is a period of **uterine bleeding** during which an unfertilized egg and the dense uterine lining are released. It is passed via the vagina in the form of **blood** and **mucus**. Menstruation lasts around two to eight days.

### *Significance Of Sexual Reproduction*

1. **Sexual reproduction** is a process that requires the fusion of DNA from two distinct people. It has no effect on DNA's regulation of cellular machinery.
2. It results in the restoration of the chromosome number and DNA content in the next generation.
3. It results in novel gene combinations in gametes. Genetic diversity arises as a result of this reshuffling.
4. It fosters the development of a diverse range of characters/traits in the next generation.

## *Reproductive Health*

**Reproductive health** is the condition of physical, mental, and social fitness necessary to live a healthy reproductive life. Male and female reproductive health are mutually beneficial.

- **Ways of contraception.**
- **Understanding of the ways in which couples may restrict their family number.**
- **Anti-infection and sexually transmitted illness protection.**

Our society should have a restricted family size and no partial opinions on the sex of the unborn. To do this, we must preserve the gender ratio and population size.

### *Sex Ratio*

**Sex ratio** stands for the ratio of females to men in a population. To sustain a healthy society, the female-to-male sex ratio should be maintained.

Due to irresponsible female foeticide, the sex ratio is quickly falling in certain segments of our society. As a result, **prenatal sex determination** (determining the gender of a kid before birth) should be **forbidden or restricted** by legislation.

### *Population Size*

The human population's growth is a reason for worry, since a rising population makes it more difficult to enhance one's level of life.

A population's size is determined by the rates of birth and death. If the birth rate outnumbers the mortality rate, the population size grows, and vice versa.

### *Birth Control*

**Sexual acts** are always associated with the possibility of pregnancy.

Pregnancy places significant demands on a woman's body and psyche. If she

is not prepared, it will have a detrimental effect on her health. As a result, several methods for avoiding pregnancy have been invented.

**Contraception** or **birth control** is the term used to refer to the act of preventing conception. Contraceptive techniques are used to prevent pregnancy. These might be physical, hormonal, pharmacological, or surgical barriers.

Hormonal approaches may also be classified as **chemical methods**. Hormones are biochemicals that may be regarded as chemicals and utilized in conjunction with chemical contraception.

Additionally, surgery may be used to terminate undesired pregnancies. These are sometimes employed by individuals who do not want to have children, for example, unlawful sex-selective abortion of female foetuses. The following table summarizes these techniques of contraception:

<b>Technique</b>	<b>Description</b>
Physical methods	Barrier methods like condoms and diaphragms.
Hormonal methods (chemical)	Birth control pills, patches, or injections.
Pharmacological methods	Spermicides and emergency contraceptives.
Surgical methods	Tubal ligation or vasectomy.



## **Barrier**

- *Example:* Condom
- *Detail:*
  1. Prevents the spread of Sexually Transmitted Diseases (STDs) and has no adverse effects by wearing a rubber sheath over the penis.
  2. A rubber cup is inserted into the vagina above the cervix.
  3. A doctor inserted copper-T into the uterus.
  4. Used to prevent pregnancy; may produce negative effects owing to uterine irritation.

## **Barrier**

- *Example:* Diaphragm
- *Detail:*
  1. Prevents the spread of Sexually Transmitted Diseases (STDs) and has no adverse effects by wearing a rubber sheath over the penis.
  2. A rubber cup is inserted into the vagina above the cervix.
  3. A doctor inserted copper-T into the uterus.
  4. Used to prevent pregnancy; may produce negative effects owing to uterine irritation.

## **Chemical**

- *Example:* Spermicide
- *Detail:*
  1. Used in the vaginal area.
  2. Kills sperms; must be used with condoms or a diaphragm.

## **Hormonal**

- *Example:* Oral contraceptive pills
- *Detail:*
  1. Contain hormones that block ovum release, preventing fertilization.

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2. Can produce negative effects by disrupting the body's hormonal balance.

## *Sexually Transmitted Diseases (STD)*

**Sexually transmitted Diseases (STDs)** are caused by a variety of microorganisms that are transmitted via intimate contact between an uninfected individual and an infected one.

Sexually transmitted illnesses that are most often transmitted include **gonorrhea** and **syphilis**, both of which are caused by bacteria. Additionally, viral illnesses such as **warts** and **HIV-AIDS** are prevalent.

### **Viral Infection**

- *Example:* **AIDS**
- *Causative Organism:* **HIV**
- *Comment:* It is incurable and terrible since it lowers the body's immune system. It may be transmitted by sexual contact with an infected individual, sharing needles, transfusions of unscreened blood, or from the mother to the child during pregnancy through the placenta.

### **Bacterial Infection**

- *Example:* **Syphilis**
- *Causative Organism:* **Treponema pallidum**
- *Comment:* Syphilis is spread from person to person by direct contact with syphilis sores, which are most common on the external genitals, vagina, anus, or in the rectum, although they may also appear on the lips and mouth. Syphilis may be transferred by vaginal, anal, or oral sexual contact. Pregnant women with the illness can pass it on to their unborn children. Antibiotics can be used to treat the condition.

### **Bacterial Infection**

- *Example:* **Gonorrhea**
- *Causative Organism:* **Neisseria gonorrhoeae**
- *Comment:* Transmission occurs via unprotected sexual contact with an infected individual. An infected mother may also transfer the virus to

the growing fetus. In males, it infects the urethra, whereas in women, it infects the cervix. Antibiotics treatment is efficient.

