

# How Do Organisms Reproduce?

## Introduction Reproduction

Reproduction is the process by which all organisms multiply in number and increase their population.

## Asexual reproduction

Asexual reproduction is a method of reproduction that involves only one organism. A single organism reproduces two or multiple organism on its own. This is seen in all unicellular organism, some multicellular organism and few plants.

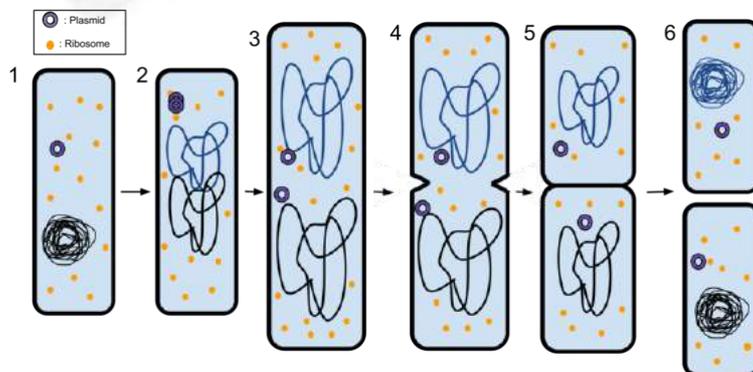
## Sexual reproduction

The mode of reproduction that involves two individual; one male and one female. They produce sex cells or gametes which fuse to form a new organism.

## Asexual Reproduction

### Fission

- Fission is an asexual reproduction that is common in most of the unicellular organism.
- When the fission results in two daughter cells, it is binary fission (e.g. paramecium).
- When fission results in many daughter cells, it is called multiple fission (e.g. Plasmodium).
- Planes of fission may be different for different organisms.

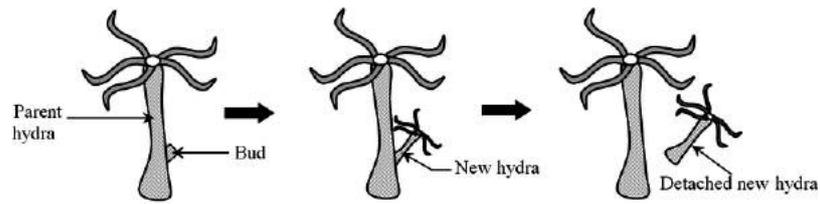


*Binary fission in a bacterium*

### Budding

Budding is a type of asexual reproduction in which a small cyst-like structure is formed on the parent's body which gives rise to a new individual.

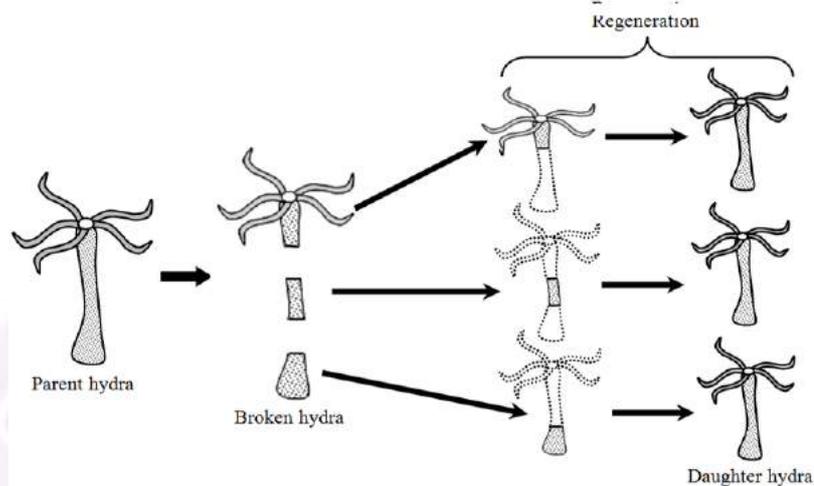
- Bud may remain attached to the parent (yeast) or may separate and become a new individual (hydra).



*Budding in Hydra*

## Regeneration and fragmentation

- Regeneration is the process of growing back the lost organ or body part by the organism (e.g. Lizard).
- Fragmentation is the process by which an organism gets fragmented into smaller pieces and each piece grows into a whole new organism
- E.g. Planaria, Hydra

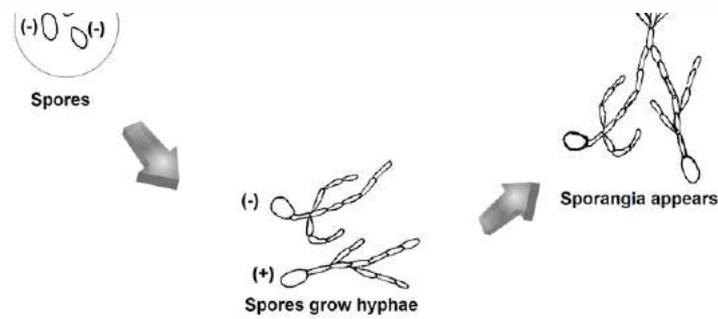


*Fragmentation and Regeneration in Hydra*

## Spore formation

Organisms such as fungi make spores that can grow into complete new individuals when dispersed from their fruiting body.





Reproduction cycle in Fungi

## Vegetative propagation

- This is a type of asexual reproduction seen in plants.
- Vegetative part of the plant, like leaves, stem, roots, gives rise to a new plant.
- Vegetative propagation can be artificial or natural.
- Natural vegetative propagation happens through leaves (e.g. bryophyllum), stem (e.g. turmeric, ginger), runners/stolon (e.g. grass runners, strawberry), bulbs (e.g. onion, lily) etc.
- Artificial methods include cutting, grafting, layering and plant tissue culture.

## Sexual Reproduction

### Types of Cell division

Two types of cell division seen in eukaryotic organisms:

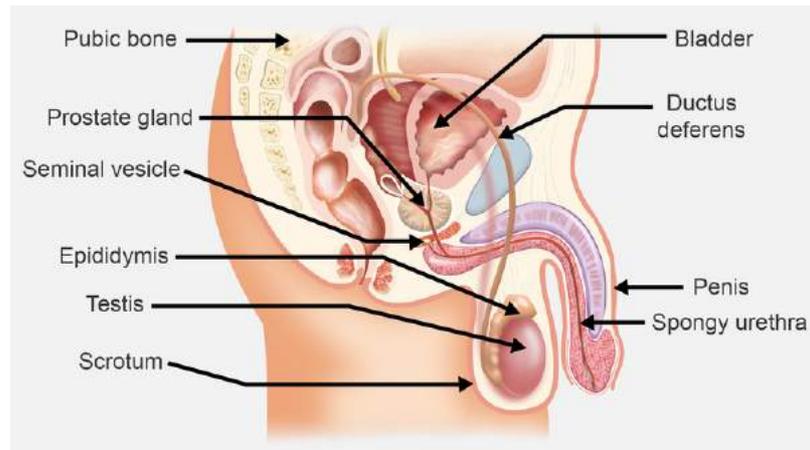
<i>Mitosis</i>
<i>Takes place in somatic cells</i>
<i>Maintains the chromosome number</i>
<i>Produces two, diploid daughter cells</i>
<i>Required for asexual reproduction, development and growth, cell replacement and regeneration</i>

## The Reproductive System

### Male reproductive system

- The main reproductive organ in males is a pair of testes.

They produce the male sex cells called sperms and also produce male sex hormone testosterone.



*Human Male Reproductive System*

### **Male main reproductive organs**

- The main reproductive organ in males is a pair of testes.
- They are present in scrotal sacs outside the body and contain seminiferous tubules as the structural and functional unit.
- Male sex cells, sperms, are produced by seminiferous tubules and matured in the epididymis.
- Leydig cells or interstitial cells present in between the seminiferous tubules secrete hormone testosterone.

### **Male accessory reproductive organs**

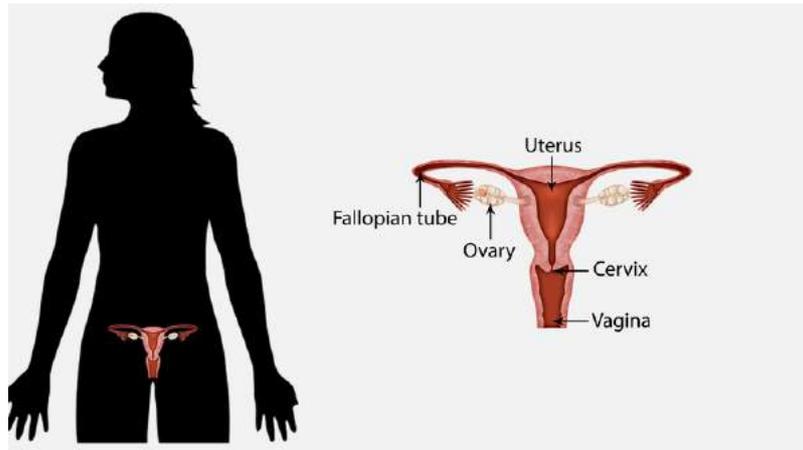
- Several accessory reproductive organs that aid in the reproductive process.
- The prostate gland and the seminal vesicles are glands of reproductive system which make semen and nourish the sperms.
- Penis, having urethra passing through it, is called copulatory organ.

### **Male Ducts**

- In males, the vas deferens and the urethra are the main ducts.
- A single vas deferens carries sperms from respective testis up to urethra.
- Urethra acts as a common passage for semen and urine.

### **Female reproductive system**

The human female reproductive system consists of a pair of ovaries, a pair of fallopian tubes/oviducts and the accessory organs such as the uterus and the vagina.



*Human Female Reproductive System*

## Female main reproductive organ

- The main reproductive organ in a female is a pair of ovaries.
- They produce the female sex cells called eggs or ova and also produce female sex hormones called estrogen and progesterone.

## Female accessory reproductive organ

- Uterus and vagina are the accessory reproductive organs in human females.
- The uterus is the site of fetal development and vagina receives sperms from the male.

## Menstrual Cycle

### Menstruation

Menstruation is the cyclic event of the release of the ovum from the ovary and its removal from the body when fertilization does not happen.

- During menstruation, the blood-rich endometrium of the uterus also breaks down while the ovum is being removed from the body.
- Two pituitary hormones, LH and FSH and two ovarian hormones, estrogen and progesterone, all have their roles in menstruation.
- In humans, the cycle repeats every 28 days.

# Fertilization

## Human reproduction

Humans reproduce sexually. The male produces sperms and the female produces eggs. When the sperm fuses with the egg, it forms a zygote that gives rise to a new progeny.

## Contraceptive Methods

### Reproductive health

Reproductive health deals with the prevention of STDs and unwanted pregnancy. Understanding the reproductive system is also a part of the reproductive health awareness.

### Contraceptives

- Contraceptives are the devices that prevent unwanted pregnancy and help avoid STDs.
- Contraceptives can be of various types such as mechanical barriers, hormonal/chemical methods, surgical methods etc.

### Coitus Interruptus

- It is a very unreliable contraceptive method where the coitus is stopped before the male ejaculates inside the female reproductive tracts.

### Rhythm Method

- Another unreliable method of contraception where the coitus is avoided when the female is fertile and the chances of fertilization are very high.

### Condoms

- One of the most effective contraception.
- A mechanical barrier that stops the semen from entering the female tract preventing pregnancy.
- It also avoids the possibility of contracting STDs

### Diaphragms

- Diaphragms are barriers that can be added inside the female reproductive tracts.
- They stop the entry of semen inside the female track and thus prevents pregnancy.

### Contraceptive Pills

Contraceptive pills are chemical methods of contraception.

They change the level of hormones in the body that prevents the release of the ovum from the ovaries.

## Emergency Pill

- Emergency pills are those pills which can be taken after coitus to avoid pregnancy.
- They quickly change the level of hormones in the body and prevents a successful implantation even if the egg gets fertilized.

## IUD

- IUD stands for Intrauterine Device.
- They can be used for a couple of years.
- It is a device that is inserted into the uterus, changing its shape and preventing successful implantation of the zygote.

## Sterilization

- Sterilization is a surgical method of going permanently sterile.
- This can be done in both males and females.
- In males, it is called vasectomy and in females, it is called tubal ligation.

## Reproduction in Plants

### Sexual reproduction in flowering plants

- Sexual reproduction in plants happens through the flowers.
- Essential whorls of the flowers such as androecium and the gynoecium help in the sexual reproduction of plants.

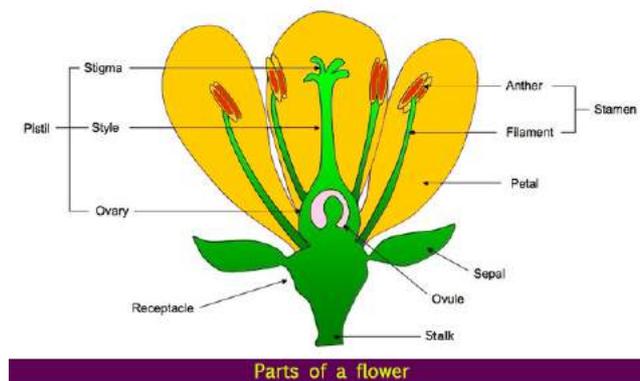
### Non-essential parts of flowers

- The typical structure of flower contains essential whorls and non-essential whorls.
- Sepals and Petals are called as non-essential whorls as they do not directly take part in reproduction.
- Sepals protect the inner delicate whorl during bud condition and also perform photosynthesis if they are green in colour.
- Petals, when they are coloured, attract insects for pollination.

### Essential whorls of flowers

Androecium and gynoecium are called as essential/reproductive whorls of a flower.

- Androecium produces pollen grains containing male gametes and gynoecium produces ovules which are female gametes.
- Bisexual flowers contain both the whorls while unisexual flowers contain either of them.
- Each individual member of androecium is called as **stamen** and consists of **anther and filament**.
- Anther produces haploid pollen grains.
- Each individual member of gynoecium is called as **pistil** and consists of **stigma, style and ovary**.



## Pollination

The process of transfer of pollen grains from anthers to the stigma of a flower is known as pollination.

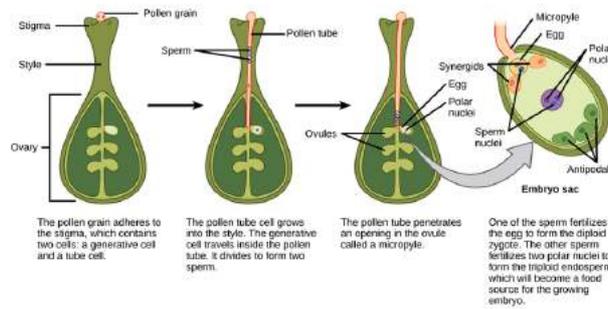
- It is required for fertilization.
- Pollination has two types, self-pollination (autogamy) and cross-pollination (allogamy).
- In self-pollination, transfer of pollen grains takes place from anthers to the stigma of the same flower or another flower of the same plant.
- In cross-pollination, pollens are transferred from anthers to the stigma of another flower.
- Many pollinating agents play their roles in cross-pollination. examples: water, wind, insects, birds, bats etc.

## Fertilization

Fusion of male and female gametes is known as fertilization.

In flowering plants after pollination, the pollens germinate on the stigma surface of pistil and generate two male nuclei.

- Ovule has egg cell and two polar nuclei.
- One male nucleus fuses with two polar nuclei and forms triploid endosperm.
- Another male nucleus fuses with the egg cell and forms the zygote that gives rise to the embryo and future plant.
- After fertilization, ovary becomes fruit and ovules turn into seeds. All other parts wither away.



*Germination of pollen grain and fertilization in plants*

