

## How DO Organisms Reproduce?

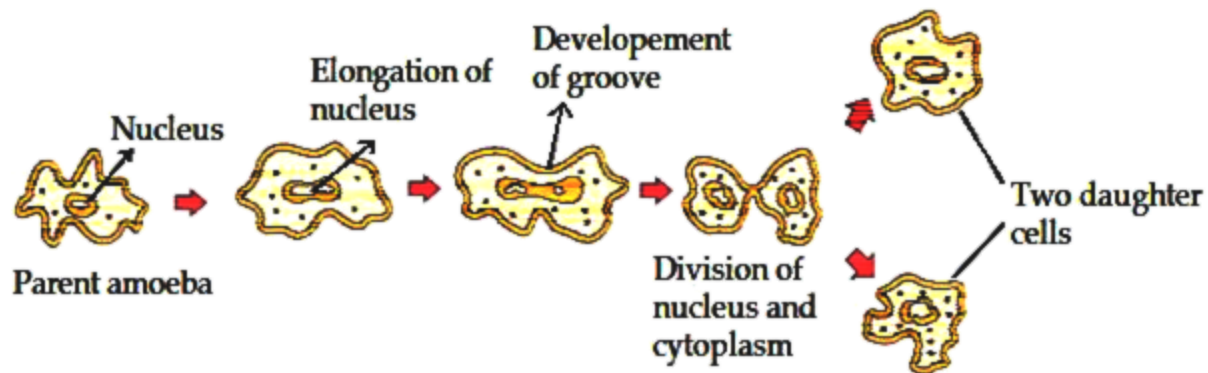
### Asexual Reproduction

- It involves only one parent.
- There is no formation and fusion of gametes.
- The young ones formed are almost identical to each other as well as to the parent cell.
- Asexual reproduction generally occurs during favourable environmental conditions and when there is an abundance of food.
- It is a faster method of reproduction.

Types of Asexual Reproduction is Unicellular Organism

#### (i) Binary Fission:

Seen in bacteria, protozoa like Amoeba, Paramecium. (In these first pseudopodia withdrawn (karyokinesis) the nucleus of the parent cell divides and then the cytoplasm divides (cytokinesis) resulting in the formation of two daughter cells). It occurs during highly favorable conditions. The cell division can occur in any plane as in case of Amoeba. However, organisms like Leishmania. (cause Kala-azar), which have a whip like flagella at one end, binary fission occurs in a definite orientation in relation to the flagellum.

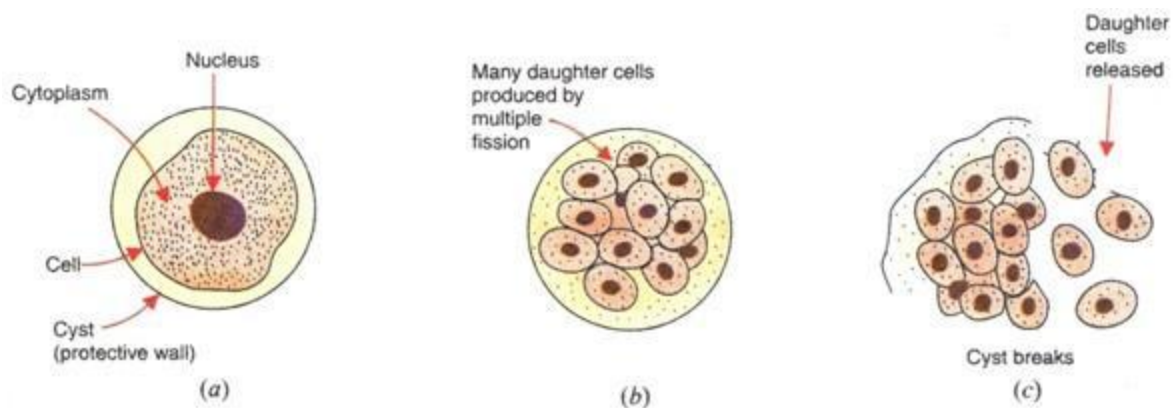


**Binary fission in Amoeba**

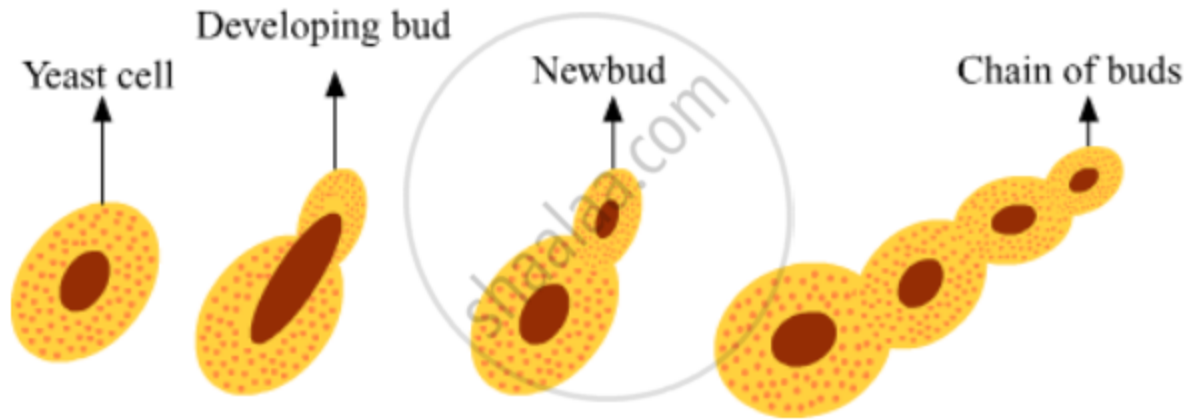
Cytokinesis: Division of cytoplasm.

Karyokinesis: Division of Nucleus.

**(ii) Multiple Fission:** Seen in Plasmodium, (a malarial parasite). In this during unfavorable conditions, the parent cell develops a thick resistant wall around itself forming a cyst. Within the wall, the cytoplasm divides many times to form many plasmodia. When conditions become favorable, the cyst wall breaks and the Plasmodium are released.

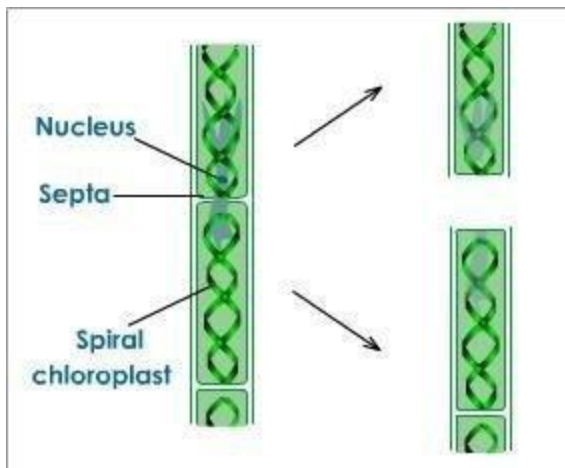


**(iii) Budding:** Seen in Yeast (a fungus). The parent yeast cell develops a protrusion or an outgrowth at its upper end. The nucleus of the parent cell divides and one of them moves into the outgrowth which grows bigger and finally separates from the parent cell to lead an independent existence. Very often if the conditions are highly favourable, a chain of buds is formed.

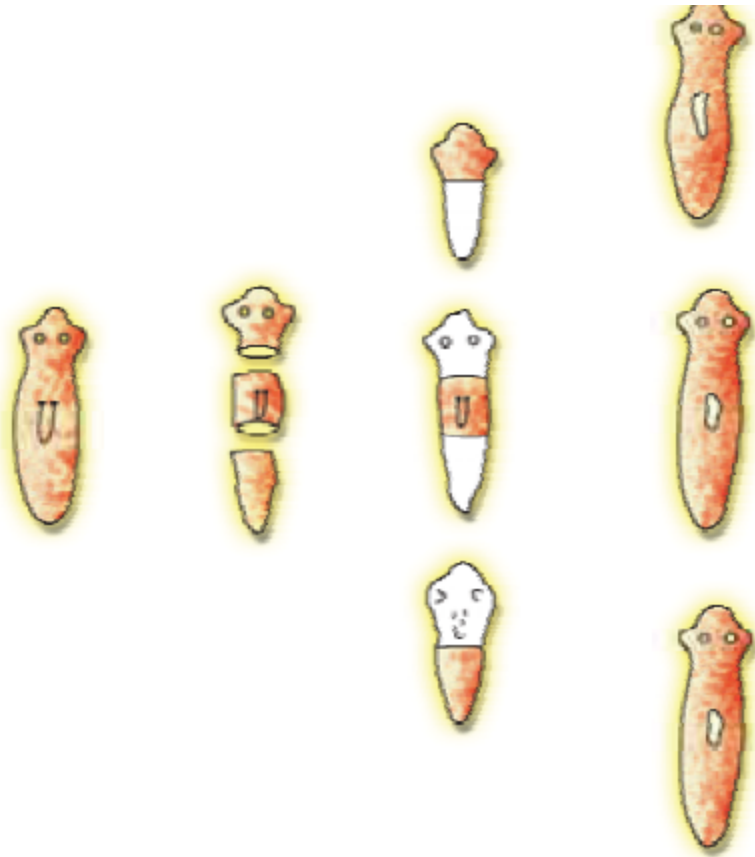


Types of Asexual Reproduction in Multicellular Organisms :

**(i) Fragmentation:** Seen in multicellular organisms which have a relatively simple body organization like Spirogyra. Spirogyra has a filamentous body. (If it breaks into smaller pieces or fragments). Each fragment has the capacity to form a new individual. However, all multicellular organisms cannot show cell-by-cell division as cells from tissues which form organs. These organs are placed at definite positions in the body. Hence, they need to use more complex methods of reproduction.

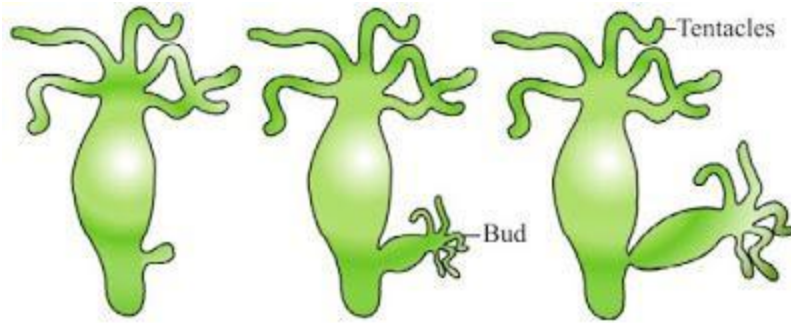


**(ii) Regeneration:** It is the ability of organisms to develop their lost parts. Some organisms show high regenerative capacity it is also a means of reproduction for example; Planaria. (Regeneration is carried out by specialized cells which redivide to form a mass of cells from which different cells undergo changes to become different cell types and tissues. These changes occur in an organized sequence known as development).



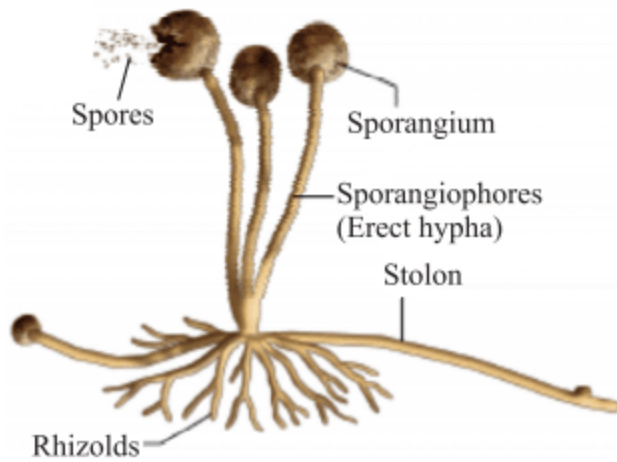
*Regeneration in Planaria*

**(iii) Budding:** Seen in Hydra. Parent Hydra develops a bud at its lower end. This grows in size and finally breaks off to live independently.



**Budding in Hydra**

**(iv) Spore Formation:** Seen in Rhizopus (a fungus). Rhizopus body is made up of thread-like structures called hyphae. The erect hyphae bear sporangia inside which reproductive structures called spores are formed. Spores are asexually reproducing bodies having a thick protective wall. They are produced during unfavorable times and help to tide over the unfavorable environmental conditions. When the spores fall on a suitable medium, each one forms a new individual.



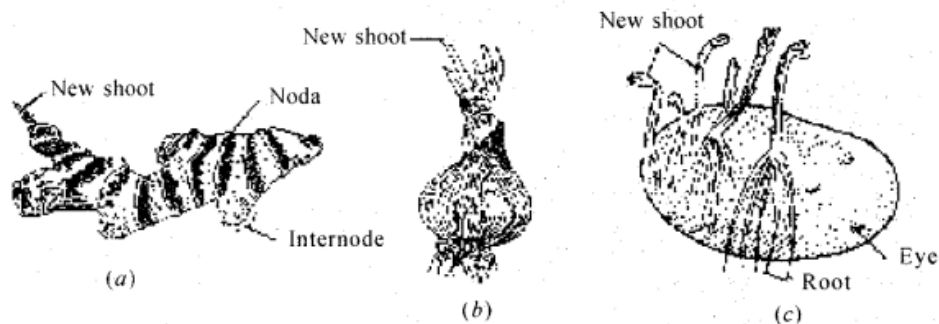
**Spore formation in Rhizopus**

**(v) Vegetative Propagation:** Method by which plants reproduce by their vegetative parts such as roots, stems, and leaves.

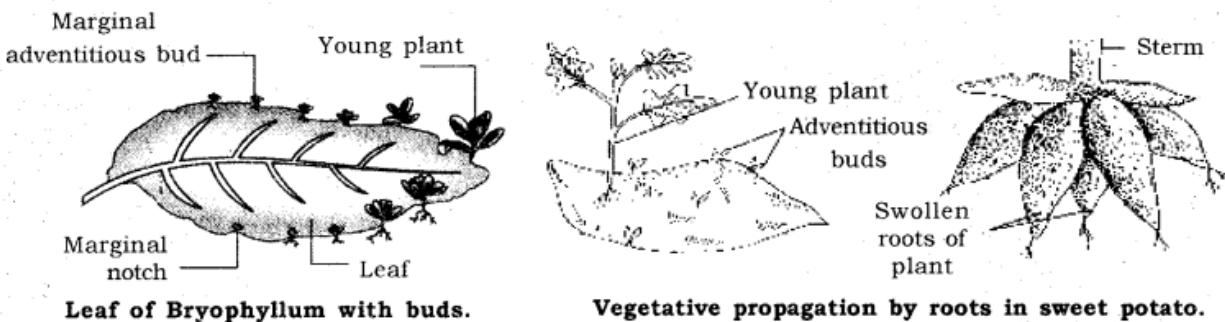
Types of Vegetative Propagation: It is two types

- Natural vegetative propagation.
- Artificial vegetative propagation (Tissue culture).

Mint reproduces naturally by roots. Sugarcane, jasmine by stems and Biophyllum by leaves. In biophyllum buds are produced in the notches along the leaf margins and when they fall on the soil, they develop into new plants.



Vegetative propagation by stem in— (a) ginger (rhizome) and (b) onion (bulb) and (c) potato (tuber).



### Importance of Vegetative Propagation

- Plants can bear flowers and fruits earlier.
- Plants which have lost the ability to produce viable seeds can also reproduce by vegetative propagation.
- All plants are genetically almost similar to the parent plant.
- Seedless varieties can be obtained.
- The property of vegetative propagation is used by horticulturists in developing methods like layering, grafting to grow many plants like sugarcane, roses, or grapes.

**Tissue Culture:** The technique of developing new plants from a cell or tissue in a nutrient medium under aseptic conditions. The cell or tissue is placed in a nutrient medium where it forms a mass of cells called callus. This callus is then transferred to another nutrient medium where it differentiates and forms a new plant.

**Sexual Reproduction:** Sexual reproduction in plants, Sexual reproduction in human beings. The mode of reproduction that takes place with the involvement of two individuals of two different sexes i.e. male and female.

During sexual reproduction, male organism having male sex organs produces male gametes i.e. sperms which are small and motile and the female organism having female sex organs produces ova which are generally large and store food. Male and female gametes fuse to form a zygote that grows into a new organism.

### **Significance of Sexual Reproduction**

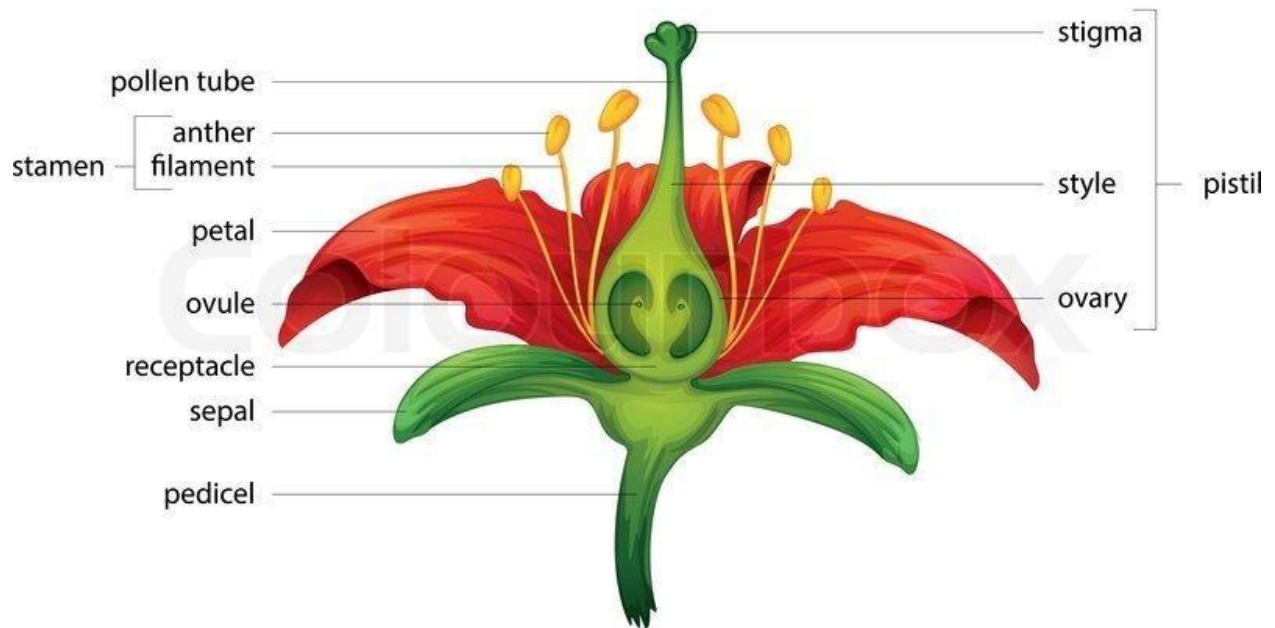
- Sexual reproduction involves DNA as well as cellular apparatus of two different organisms which promotes diversity of characters in the offspring.
- Since gametes are derived from two different organisms, it results in a new combination of genes which increases the chances of genetic variations.
- Sexual reproduction results in the origin of. new species.
- Sexual reproduction involves division in the sex organs that reduces the DNA matter to half so that the zygote formed after fusion has the same amount of DNA as the parents it maintains DNA in a species.

**Limitation of Sexual Reproduction:** Sexual reproduction involves the process of combining DNA from two different organisms which may bring some undesirable features also.

### Sexual reproduction in flowering plants

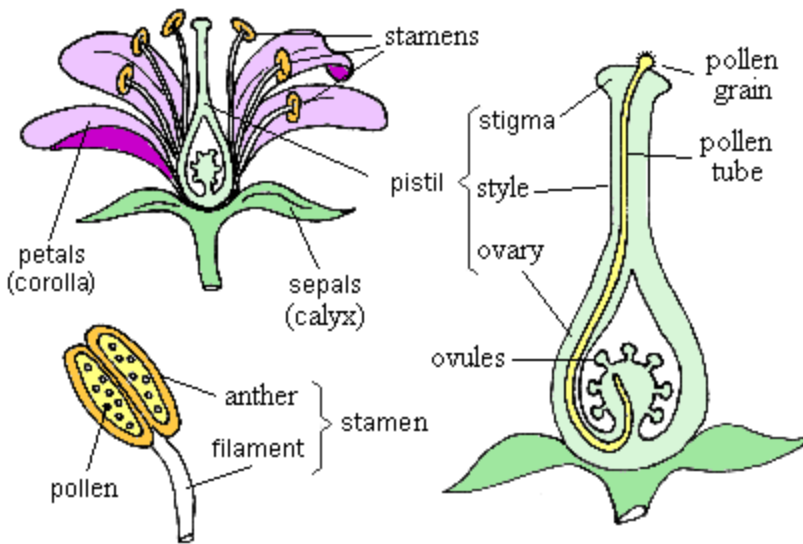
- The reproductive parts are present in the flower.
- The parts of the flower are sepals, petals, stamens and carpels.
- Sepals are green structures that protect the inner parts when the flower is in bud stage.
- Petals are colorful and attract the insects for pollination.
- Stamens are male reproductive parts and produce pollen grains that contain male gametes. Each stamen has two parts—
- Filament i.e. stalk and Anther i.e. swollen top part which has large number of pollen grains.

## Parts of a Flower



The carpel is the female reproductive part and produces ovules that contain female gametes. It has three parts—Stigma which is top sticky part and receives pollen grains during pollination. Style which is the middle long part and ovary which is the swollen part and contains ovules. Each ovule has an egg cell i.e. female gamete.





The flowers may be bisexual i.e. having both stamens and carpels for example; Mustard China Rose (Hibiscus).

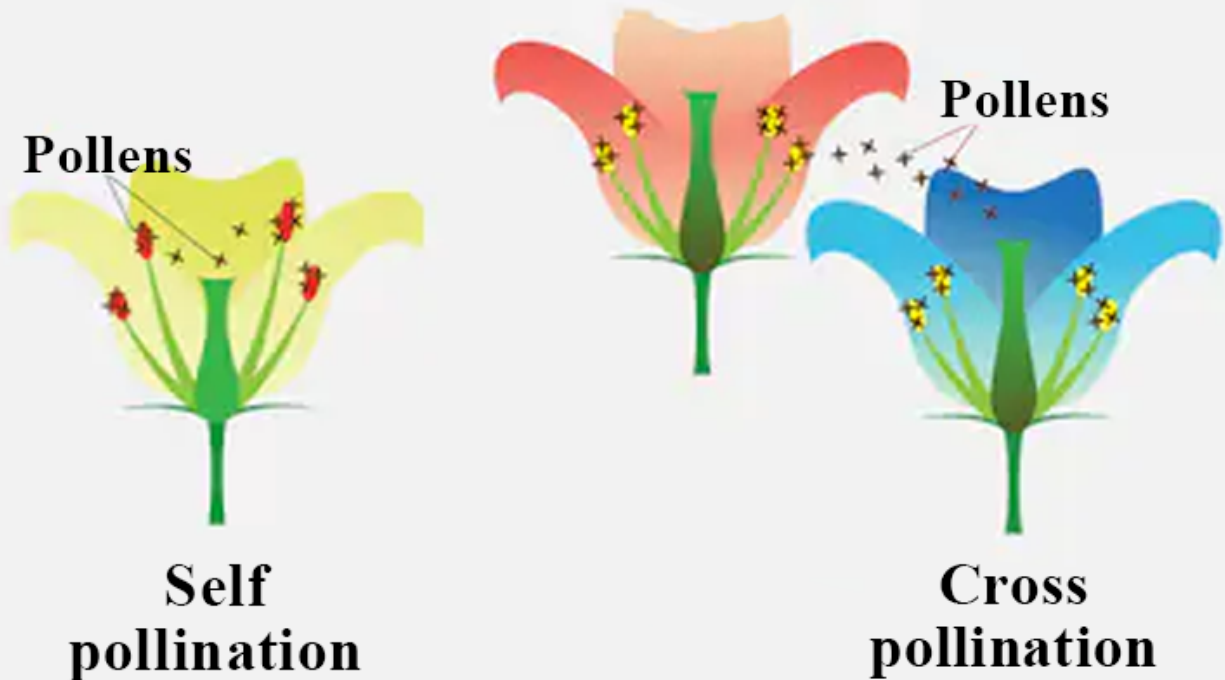
The flower may be unisexual i.e. having either stamens or carpels for example; Papaya, Watermelon.

**Pollination:** The process of transfer of pollen grains from an anther to the stigma of the flower is pollination. Two types of pollination are:

**(i) Self-pollination:** The transfer of pollen grains from the anther to the stigma of the same flower or another flower of the same plant.

**(ii) Cross-pollination:** The transfer of pollen grains from the anther to the stigma of another flower or another flower of a different plant of the same species. It generally takes place with the help of some agents like insects, birds, wind and water.

# Pollination in Plants



**Fertilization:** Fertilization is the process of fusion of male and female gamete to form a zygote during sexual reproduction. Pollination is followed by fertilization in plants. The events are

Pollen grains land on the stigma of the ovary.

Pollen tubes grow out of the pollen grains, travel through the style and reach the ovary, through micropyle.

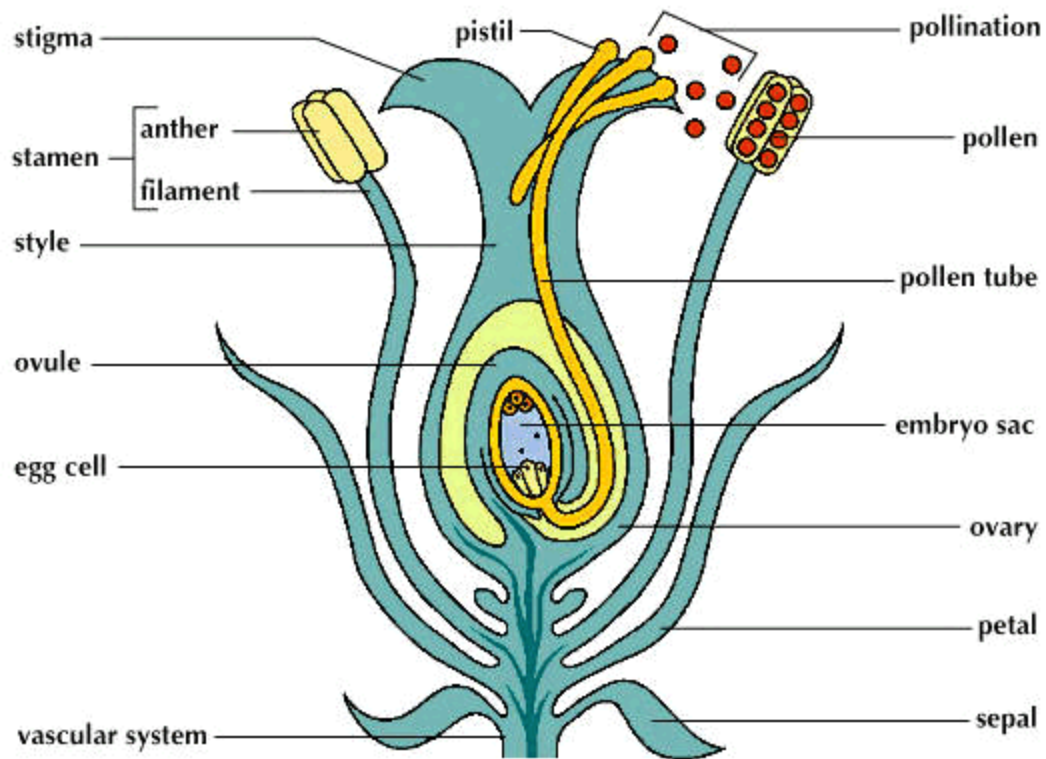
Pollen tube has two male germ cells. Each ovule has two polar nuclei and a female germ cell (egg).

Pollen tube releases two male germ cells inside the ovule, one of them fuses with female germ cell and forms a zygote which grows into the baby plant i.e. embryo, the fusion is known as syngamy. The other male germ cell fuses with two polar nuclei, the process is known as triple fusion. So in flowering plants two fusions take place during

fertilization. It is called double fertilization.

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### How Fertilization Takes Place



Post-fertilization changes: After fertilization the following changes takes place in the flower.

Zygote divides several times and forms an embryo inside the ovule.

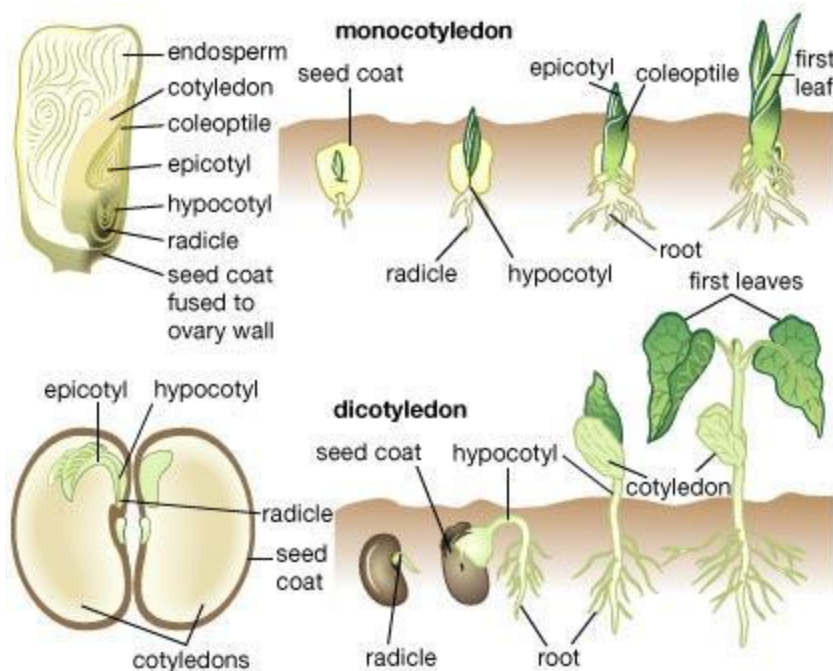
- The ovule develops a tough coat and changes into the seed.
- The ovary grows rapidly and ripens to form a fruit.
- Petals, sepals, stamens, style and stigma shrivel and fall off.

**Seed and its parts:** The advantage of seed is that it protects the future plant i.e. embryo.

**Seed has two parts:** Cotyledons and Embryo Cotyledons store food for the future plant.

**Embryo has two parts:** plumule and radicle. Plumule develops into shoot and radicle develops into root.

The process of development of a seedling from the embryo under appropriate conditions is known as germination.



**Reproduction in Human Being:** Human beings show sexual reproduction. Male parent produces male gametes called sperms. Female parent produces female gametes called ova. Sperms have tail and are therefore, motile. They are produced in large numbers in the testes. Ovum is bigger, non-motile and only one ovary produces one ovum in one month. There is no food stored in the sperms whereas ova contain stored food. Both the gametes are microscopic unicellular and have half the number of chromosomes as compared to the body cells.

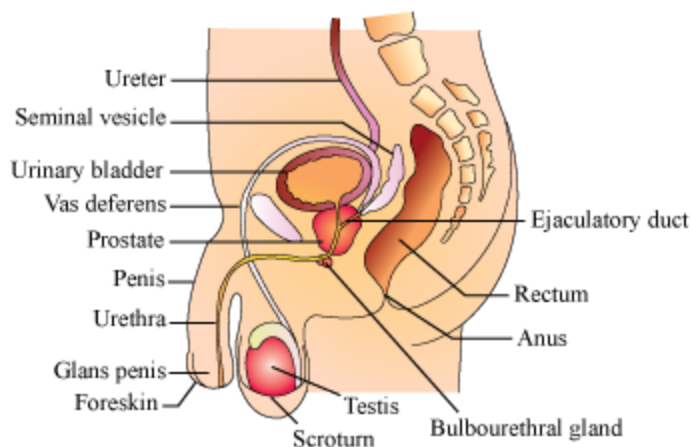
Human beings become reproductively active from the onset of puberty. Puberty is the period during adolescence when the rate of general body growth begins to slow down and reproductive tissues begin to mature. Onset of puberty in human males is between 11 to 13 yrs. of age, while in human females is between 10 to 12 yrs. of age. Puberty is associated with many physical, mental, emotional and psychological changes in boys and girls which occur slowly over a period of time. These are called secondary sexual characters. For instance, thick dark hair start growing in new parts of the body such as arm pits and genital area between the thighs. Thinner hair appears on legs, arms and face. Skin becomes oily and pimples may appear on the face. Individuals become more conscious of their bodies become more independent, more aggressive etc.

In case of boys beard and mustache start appearing, voice begins to crack, reproductive organs develop and start producing releasing sperms.

In case of girls, breast size begins to increase, skin of the nipples darkens, menstruation starts.

The act of mating between the male and female partner is termed as copulation.

**Male Reproductive System:** Male reproductive system consists of the following components



- 1 pair of testes
- A system of ducts
  - Epididymis
  - Vas deferens or the sperm duct
  - Urethra
- A system of glands
  - Seminal vesicles
  - Prostate gland
  - Cowper's gland
- A copulatory organ called a penis.

One pair of testes are present in a bag-like structure called scrotum which lies outside the abdominal cavity; hence they are extra abdominal in position. This is so because the testes have to be maintained at 1-3-degree lesser temperature than the body in order to produce functional sperms.

### Functions of testes

- To produce male gametes i.e. the sperms.
- To produce a male reproductive hormone called testosterone which is responsible for producing sperms as well as secondary sexual characteristics in males.

Attached to each testis is a highly coiled tube called epididymis. The sperms are stored here and they mature in the epididymis.

Each epididymis leads into the sperm duct or the vas-deferens. Each vas-deferens rises up and enters into the abdominal cavity. It unites with the duct coming from the urinary bladder to form a common duct called urethra which passes through the penis and opens to the outside. Along the way the ducts of the three glands also open and pour their secretions into the vas deferens.

**Function of the vas-deferens:** It is meant for the passage of the sperms in the male body.

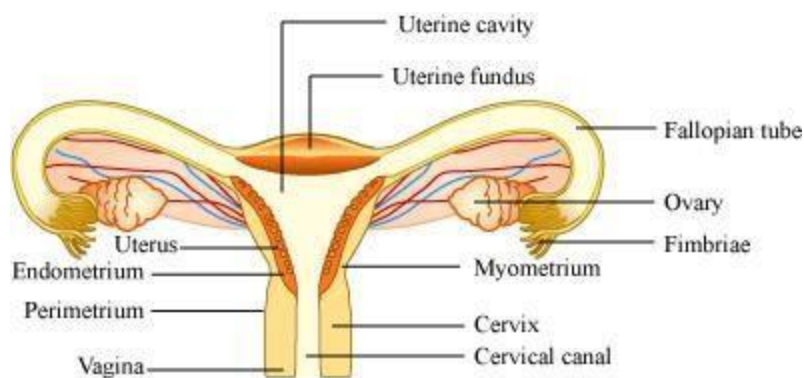
**Functions of the glands:** They produce different secretions which provide nutrition as well as medium for locomotion to the sperms.

The secretions of the three glands along with the sperms is known as semen.

**Function of the urethra:** It is the common passage for both semen and urine from the body to the outside.

**Penis:** It is the organ which is used to introduce semen into the female body. It is richly supplied with blood vessels.

**Female Reproductive System:** It consists of the following components



**The female reproductive system**

- 1 pair of ovaries
- 1 pair of fallopian tubes or oviducts

- A uterus/womb
- A vagina/birth canal.

Each ovary is almond shaped and present inside the abdominal cavity. At the time of birth each girl child already contains thousands of immature ova. These ova start maturing only from the time of puberty. Only one ovum is produced by one ovary in one month and each ovary releases an ovum in alternate months. The release of an ovum from the ovary into the abdominal cavity is known as ovulation.

### Functions of ovary

- To produce and release ova
- To produce female reproductive hormones: estrogen and progesterone.

There are two fallopian tubes. The end lying close to the ovary has finger like structures called fimbriae. The two fallopian tubes unite to form an elastic bag like structure called uterus.

**Function of the fallopian tubes:** It is the site of fertilization between the male and the female gametes and formation of the zygote early embryo.

The inner lining of the uterus is richly supplied with blood vessels and is known as endometrium. The narrow end of the uterus is called cervix.

**Function of the uterus:** The embryo formed in the fallopian tube comes down and gets attached to the endometrium (implantation) and develops for the next nine months till the baby is delivered.

**Vagina:** The uterus opens into the vagina through the cervix. The vagina is a muscular tube through which the baby is delivered at the end of nine months. It also serves as the canal for receiving the semen at the time of copulation.

The semen is discharged into the vaginal tract during copulation. The sperms travel upwards and reach the fallopian tube where one sperm fuse with the ovum to form the zygote. The zygote divides and redecides as it descends into the uterus and the embryo gets implanted in the endometrium. The endometrium thickens so as to receive the embryo.

The embryo gets nutrition from the mother's blood with the help of a special tissue called placenta, which is a disk-like structure embeded in the uterine wall. It contains finger-like villi on the embryo side, while on the mother's side blood spaces surround the villi. Villi provides a large surface area for glucose and oxygen to pass from the mother to the developing embryo and the wastes to pass from the embryo to the mother



through the placenta. When the embryo starts resembling a human is formed, it is termed as a fetus. The fetus continues to develop inside the uterus for almost nine months after which the baby is delivered as a result of rhythmic contractions of the uterine muscles.

**Menstruation:** It is the loss of blood, mucous along with the unfertilized ovum and the ruptured cells and tissues of the endometrium through the vagina of the female. It is a 28-day cycle which occurs in every reproductively active female (from puberty). The flow of blood continues for 2 to 8 days. If the ovum does not get fertilized, then the endometrium starts sloughing off and there is loss of blood and mucous etc. through the vagina. In case the ovum gets fertilized, then the endometrium becomes thick and spongy for nourishing the embryo and hence menstruation does not occur. A lady with a developing embryo in her womb is termed as pregnant. The beginning of menstruation at puberty is known as menarche. The stoppage of menstruation when the woman is 45-55 yrs. of age is called menopause.

**Reproductive Health:** Sexually transmitted diseases and birth control. A number of diseases occur as a result of sexual intercourse if one of the partners is infected. These are known as sexually transmitted diseases (STD's). They can be caused by bacteria for example; syphilis, gonorrhoea; or caused by a virus for example; HIV-AIDS, warts etc. The transmission of these diseases can be avoided by using birth control measures such as wearing a condom during the sexual act.

**Birth control measures:** They can be mechanical, chemical and surgical.

**Mechanical methods:** These are used to prevent the passage of semen to the fallopian tube :

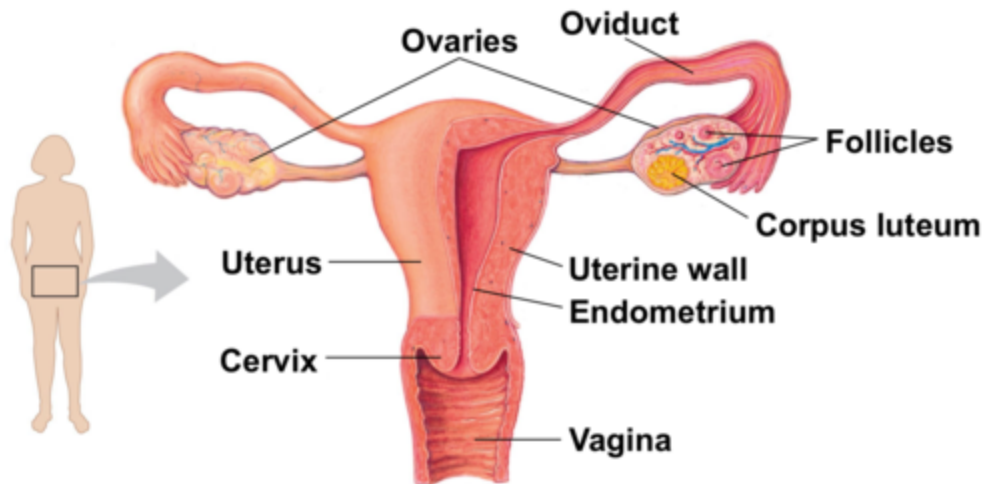
**(i) Use of condoms:** Condoms are thin rubber tubes worn over the penis before sexual intercourse. The semen gets collected in this and is not discharged into the vagina.

**(ii) Diaphragm:** It is a thin rubber fixed over a flexible metal ring which is fitted over the cervix in a woman's body by a doctor.

**(iii) Intra Uterine Contraceptive Device (IUCD) or loop:** It is inserted in the uterus and its insertion causes certain secretion which prevents the implantation of the embryo in the uterine wall.

Both methods (ii) and (iii) cause side effects.

Figure 46.10b



### Chemical methods

- Use of spermicides: These are strong sperm-killing chemicals available in the form of creams, jellies etc. which are injected into the vagina just before copulation.
- Oral contraceptive pills: These are hormonal pills which prevent ovulation but do not stop menstruation.

### Surgical methods

- Vasectomy: It involves cutting and ligating the vas deferens in males.

- Tubectomy: It involves cutting and ligating Reproductive organs the fallopian tubes in females.
- Medical termination of pregnancy (MTP) or abortions is carried out to eliminate the developing embryo. This practice can, however, be misused to carry out female foeticide which involves the killing of the female fetus. It should be avoided at all cost as it disturbs the male-female ratio in a population.