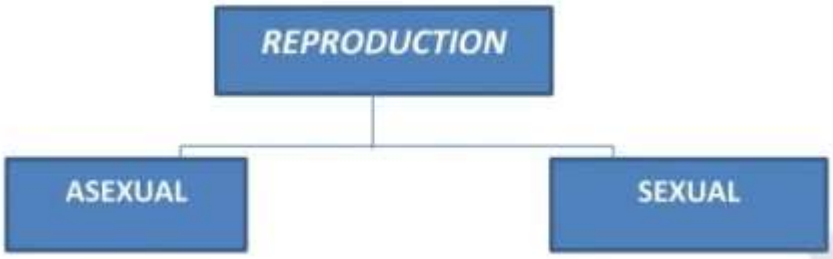
How do Organisms Reproduce

Reproduction is the process by which living organisms produce more living organisms of their own kind. The offspring grows, matures, and in turn, produces new offspring, Thus, there is a cycle of birth, growth, and death. Reproduction, therefore, ensures the continuity of life of a species on earth.

There are two main types of reproduction in living organisms. They are asexual reproduction and sexual reproduction.



(a) Asexual Reproduction: The process of reproduction in which new individuals are produced from a single parent. E.g., microorganisms.

Occurrence: Asexual reproduction is found in single-celled organisms such as the archaebacteria, eubacteria, and protists. Many plants and fungi reproduce asexually as well.

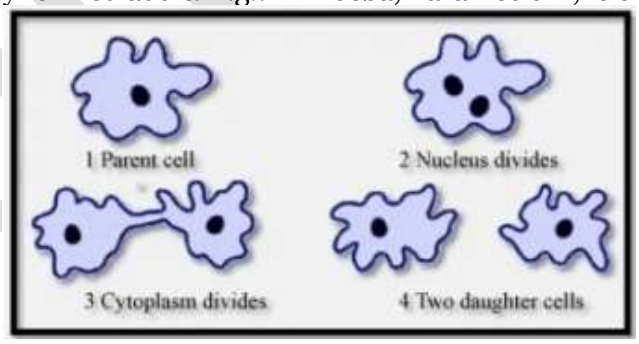
(b) Sexual Reproduction: The process of reproduction in which two individuals are involved to produce a new individual, E.g., Human, tiger.

Types of Asexual reproduction:

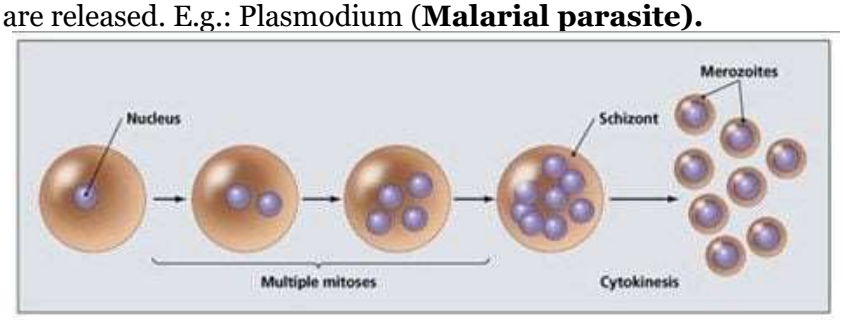
i) The word 'fission' means dividing, so binary fission is literally dividing in two. Fission is an asexual reproduction by which a unicellular organism divides and forms two or more new individuals. Fission is of two types.

Depending on the number of individuals formed, fission may be binary or multiple fission,

a) Binary Fission:- In this method, an organism divides and forms two daughter cells. First, the nucleus divides and forms two daughter nuclei, Then the cytoplasm in the mother cell divides into two daughter cells. This leads to the formation of the two daughter cells each having a nucleus and its own cell organelles which then develop into a fully formed adult. E.g.:- Amoeba, Paramecium, leishmania, etc.



(b) Multiple fission: In multiple fission, the nucleus of the parent cell undergoes repeated divisions to produce many daughter nuclei. The cytoplasm also divides and cleaves around each nucleus forming several daughter cells in the parent cell. In favorable conditions when the parent cell membrane raptures all the daughter individuals are released. E.g.: Plasmodium (**Malarial parasite).**

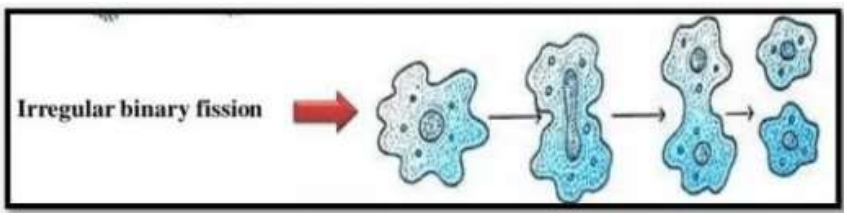


Types:

On the basis of the plane of cytokinesis (the process in which the cytoplasm of a single eukaryotic cell is divided to form two daughter cells), binary fission is of three types:

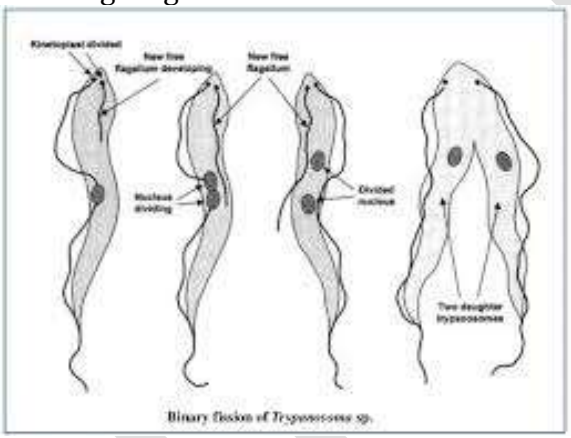
(i) Irregular or simple binary fission:

In unicellular organisms like amoeba, the splitting of cell division during division can take place along any plane



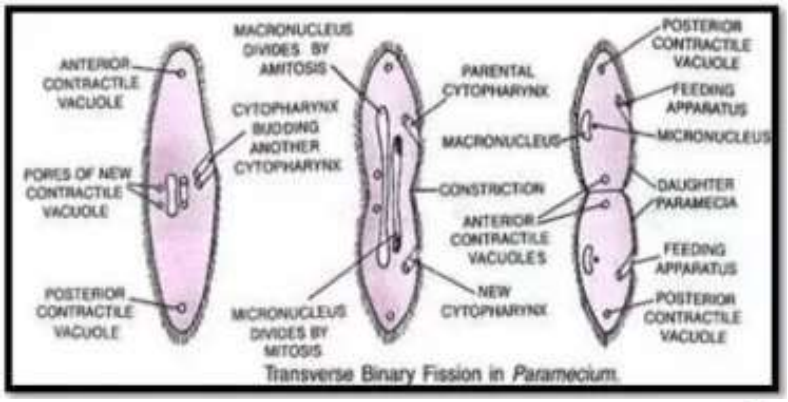
(ii) Longitudinal binary fission:

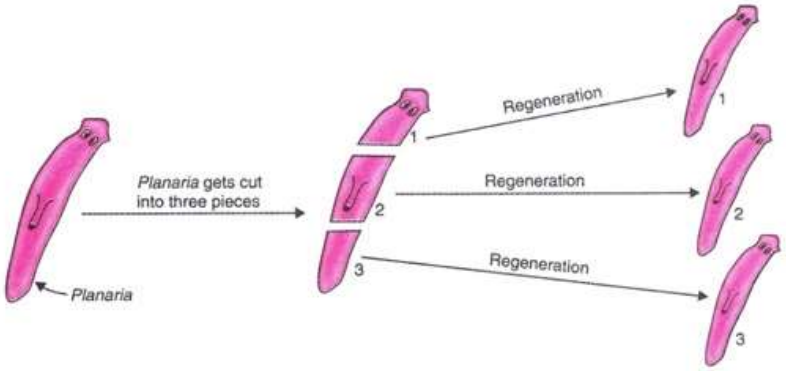
Some unicellular organisms show somewhat morn organization of their bodies, such as is seen in Leis mania (which cause **kala-azar**, Euglena etc which have a whip-like stricture at one end of the cell. In such organisms, binary fission occurs in along longitudinal axis in relation to these structures.



(iii) Transverse binary fission:

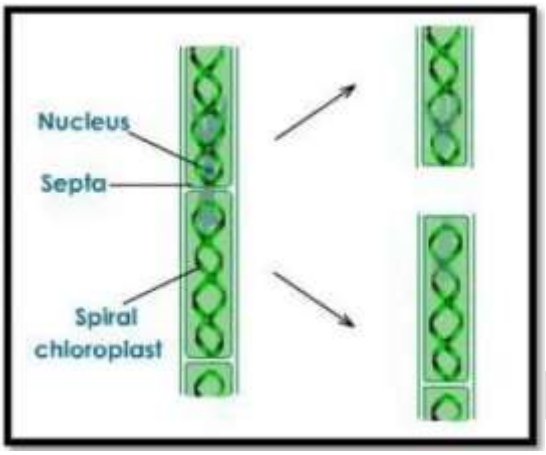
Here cytokinesis takes place along transverse axis e.g., in ciliate protozoan (Paramecium).





(a) One *Planaria* worm | (b) *Planaria* worm cut into three pieces | (c) Three *Planaria* worms produced

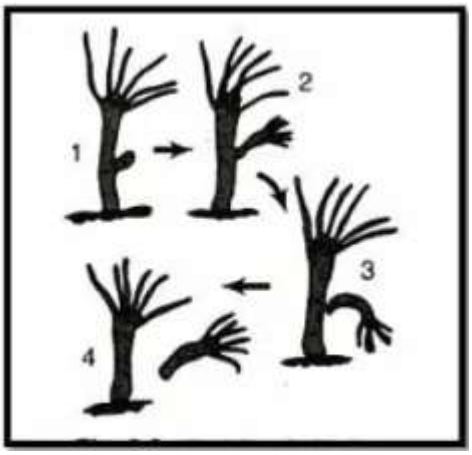
(iv) Fragmentation– Another type of asexual reproduction is called **fragmentation.** With this process, we see that an organism break up. into many pieces upon maturation. Each of those fragments develops into mature, grown up individuals that are a replica of the original organism. The splitting might or might not be deliberate. Fragmentation **occurs** in multi
cellular organisms with simple body organization.
E:g.: Spirogyra



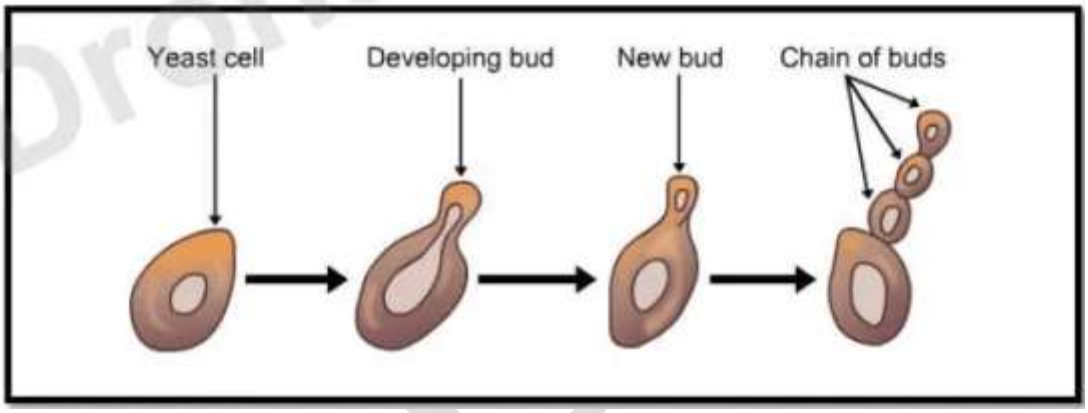
Difference between binary and fragmentation:

	Binary Fission	Fragmentation
Description	Binary fission is the asexual reproduction of a single-celled organism in which an organism divides and forms two daughter cells which then develop into a fully formed adult.	Fragmentation is a form of asexual reproduction or cloning where an organism is split into fragments. Each of these fragments develops into mature, fully grown individuals that are a clone of the original organism.
Occurs	Fission occurs in uni-cellular organisms.	Fragmentation occurs in multi cellular organisms with simple body organization.
	The process of fission is deliberately done by an organism to divide itself	The process of fragmentation might or might not be deliberate.
Example	Amoeba	Spirogyra

(v) Budding is a mode of asexual reproduction in which one or more outgrowths (buds) develop on the body of an organism which then separates to form new individuals. Hydra multiples by budding under favourable conditions. In Hydra, a bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and when fully mature, detach from the parent body and become new independent individuals.



Unicellular organisms yeast also reproduces by budding. The most common mode of vegetative growth in yeast is asexual reproduction by budding. Here, a small bud, or daughter cell, is formed on the parent cell. This nucleus of the parent cell splits into a daughter nucleus and migrates into the daughter cell. The bud continues to grow until it separates from the parent cell, forming a new cell. The daughter cell produced during the budding process is generally smaller than the mother cell.



(vi) Regeneration:

Many fully differentiated organisms have the ability to give rise to new individual organisms form their body parts. That is, if the individual is somehow cut or broken up into many pieces, many of these pieces grow into separate individuals. This is known as regeneration.

In regeneration, if a piece of a parent is detached, it can grow and develop into a completely new individual. For example, simple animals like Hydra and Planarian can be cut into any number of pieces and each piece grows into a complete organism.

Regeneration is carried out by specialized cells. These cells proliferate and make large numbers of cells. From this mass of cells, different cells undergo changes to become various cell types and tissues. These changes take place in an organized sequence referred to as development. However, regeneration is not the same as reproduction, since most organisms would not normally depend on being cut up to be able to reproduce.

Regeneration in Planarian:

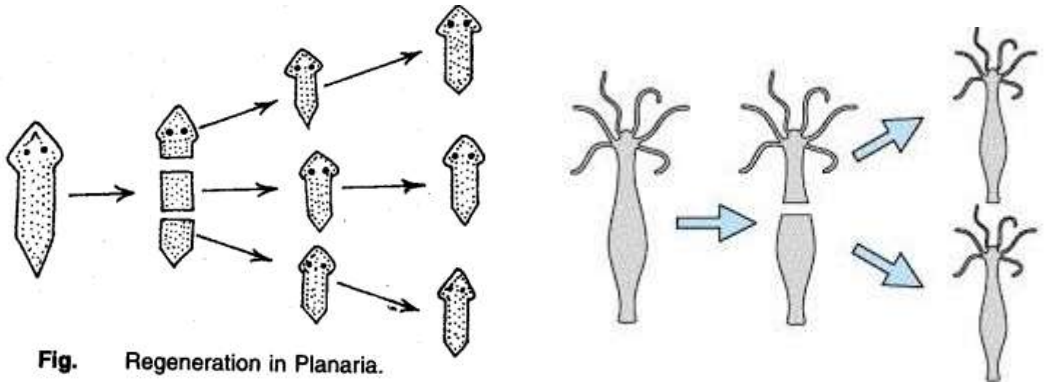
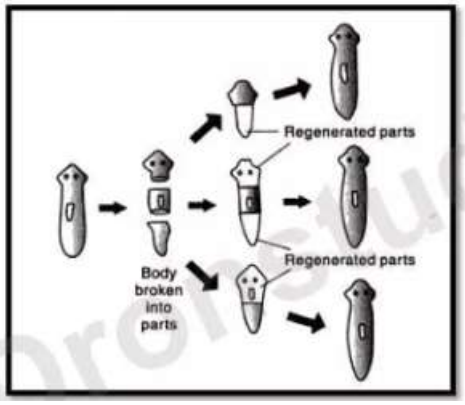
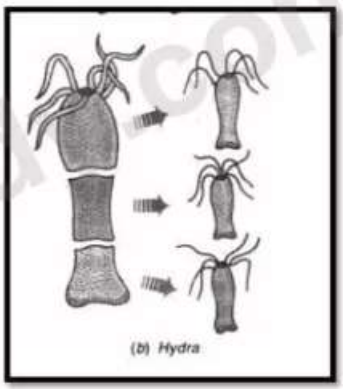


Fig. Regeneration in Planaria.





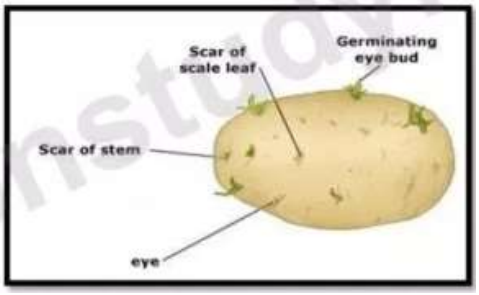
Planarians are masters of regeneration where an amputated fragment as small as 1/279th of the original worm can regenerate an entire adult. When a planarian is cut, cells move to the wound site and form a blastema (a mass of cells capable of growth and regeneration into organs or body parts) that will begin to form new tissues. Over time, these cells will divide, more and more of them will differentiate, and the form of the missing body part will take shape.

Complex organisms like dogs, humans, etc cannot reproduce by regeneration because their body is highly complicated as complex organisms have organ-system level of organization. All the organ systems of their body work together as an interconnected unit. Here, specialized cells form tissues, tissues form organs, organs form an organ systems, and the organ system continues to form an organism. Specific organs do the specific function and there is a division of labour in the body of the complex organisms. Moreover, they do not possess specialized cells that carry out regeneration as in simpler organisms.

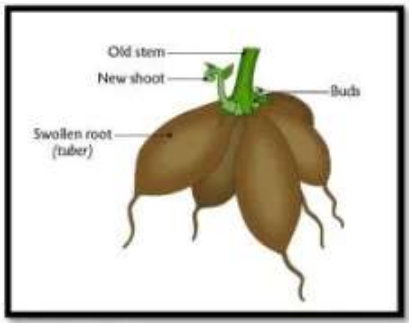
In a complex multicellular organism, the process of regeneration lakes place but only to a small extent. Under this process, a new organism cannot be produced but they can regenerate their lost body parts such as skin, muscles, blood, etc. But. Regeneration cannot be considered as reproduction because reproduction is creating a new life form. Regeneration is repairing or healing. An entire organism is developed from its fragmented body.

(vii) Vegetative Propagation— It is a method of reproduction in which a vegetative plant part (i.e., a non-reproductive part or a non-flowering part namely bulb of onion, runners of strawberry, tuber of potato, rhizome of ginger etc) produces a new plant. Such type of vegetative growth is natural vegetative propagation. Only one plant is involved and the new plant is genetically identical to the parent.

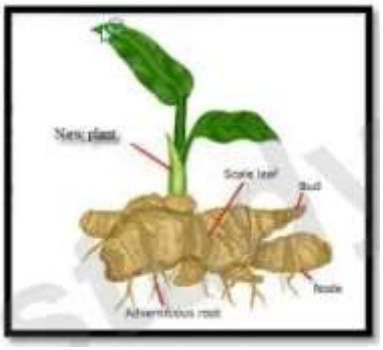
(a) Tuber of potato: The potato tuber is a modified stem. Many notches can be seen on the surface of potato. These are called 'eyes' of potato. Each 'eye' of a potato can give rise to a new potato plant under suitable conditions.



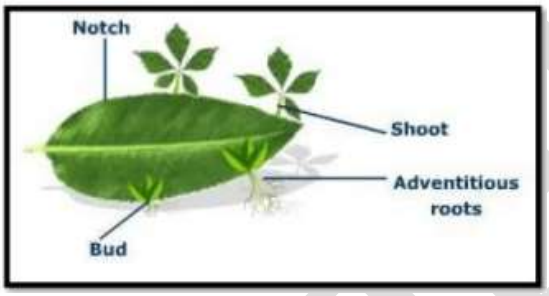
(b) Modified roots of carrot and sweet potato: Carrot and sweet potato are examples of modifications of roots; for food storage. These roots can give rise to new plants; when kept under the soil.



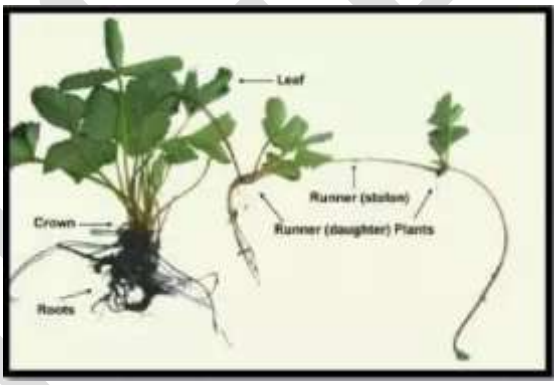
(c) Rhizomes of Ginger and Turmeric: Rhizomes are examples of modified underground sterns for food storage. These contain nodes, internodes and scaly leaves. When buried under the soil, the rhizomes produce new plants.



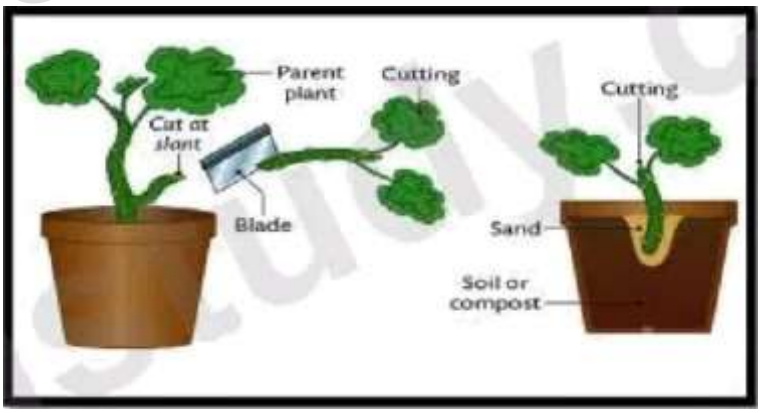
(d) Leaf of Bryophyllum: Leaves of bryophyllum have notches on the margin. If a leaf is put under the soil, small saplings grow from the notches on the leaf margin.



(e) Runners of Strawberry: Runners are also horizontal **stems** growing from the parent plant, but they grow above ground. When their terminal buds touch the ground they take root and produce new plants.

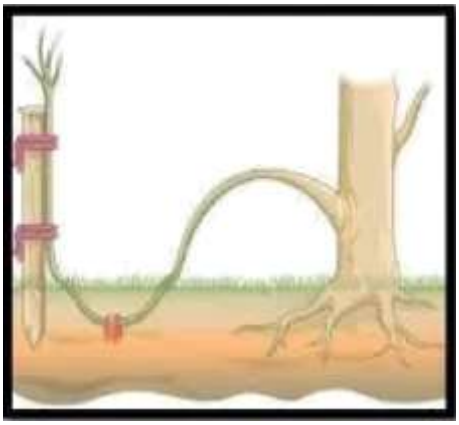


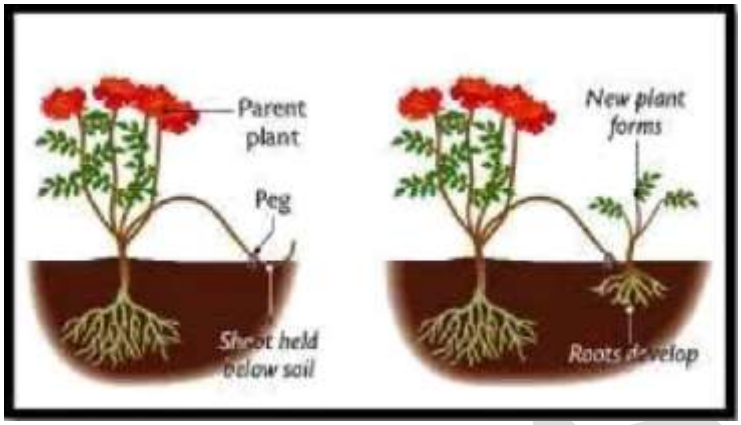
Vegetative reproduction can also be done artificially, **Artificial Propagation** includes growing plants by man-made methods and the commonly used methods are:



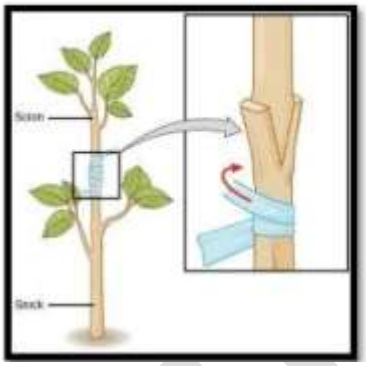
1. Cutting in which a stem is given an oblique cut and the cut stem is kept under appropriate conditions to give ri.se to an entirely new plant, e.g., Rose and China rose

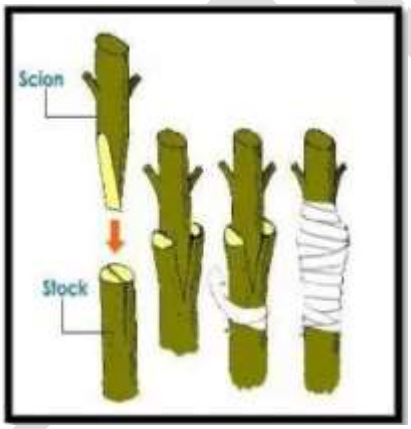
2. Layering is a process in which the stem, while still attached to the mother plant is buried under the soil for a while, till it strikes new roots. It is then detached from the mother plant, e.g. Jasmine.





3. Grafting – In this method, a twig (called the scion) is cut from the plant to be increased. it is then joined to the stem (called the stock) of a rooted plant. The cut surfaces are joined by bandaging them tightly. The graft heals on the rooted plant to give a new plant. The new plant will have the properties of both the plants. Bicoloured roses and different varieties of mangoes are made by this method



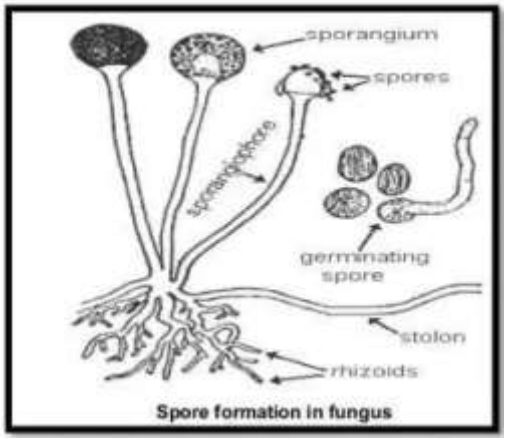


Advantages of Vegetative Propagation:

- It allows for quick and easy propagation.
- Better qualities of the plants can be maintained and the quality can even be enhanced as in seedless oranges.
- Plants raised by vegetative propagation bear fruits and flowers earlier as compared to those produced from seeds.
- Makes possible propagation of such plants that have lost the capacity to produce seeds.

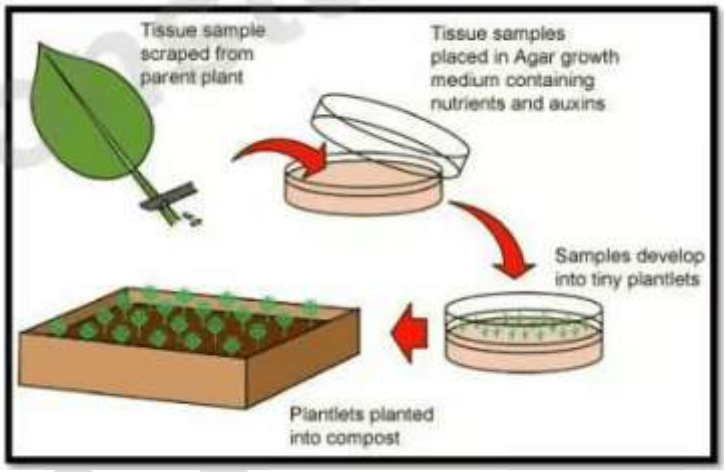
viii. Spore formation: **Spore formation** is the method of developing new individuals by forming reproductive structures called spores. Some types of mould reproduce through sporulation. They produce reproductive cells called spores. Spores are very minute unicellular asexual reproductive bodies that are stored in special spore cases until they are ready to be released. Spores are formed in special spot-being organ called sporangia. When spores mature; the sporangium bursts open to release them. After they are released, each spore germinates and grows into new individual organisms. Some organisms like ferns, mosses, some groups of fungi reproduce by spore formation. Bread mould reproduces by sporulation.

Fungus like Rhizopus (bread mould) produces spores which germinate on moist organic surfaces. The cottony white mass on bread formed by fungus after spore germination is called a mould, Spores can survive in extreme conditions because of the protective hard coat.



Spore formation in fungus

(ix) Tissue Culture: It is a method of cultivation of plants where in new plants are grown by removing tissue or separating cells from the growing tip of a plant. The cells are then placed in an artificial medium (containing nutrients and auxins) where they divide rapidly to form a small group of cells or callus. The callus is transferred to another medium combining hormones for growth and differentiation. The plantlets are then placed in the soil so that they can grow into mature plants. Using tissue culture, many plants can be grown from one parent in disease-free conditions. This technique is commonly used for ornamental plants. Oil palm, date palm, begonia, tomato, banana, apple, etc. are produced by this method.



Advantages of tissue culture:

1. Very last growing technique.
2. The plants produced using this technique are disease resistant.
3. Many plants can be developed from a single plant.

Difference between sexual and asexual reproduction:

Asexual reproduction	Sexual reproduction
(i) New individual is produced from a single parent.	(i) New individual is produced from two parents (male and female).
(ii) It does not involve the union of gametes.	(ii) It involves the union of gametes.
(iii) The young ones are genetically identical to the parents. They are clones	(iii) The young ones are not genetically identical to the parents.
(iv)There is very little chance of variation with asexual reproduction.	(iv) Sexual reproduction leads to genetic variation in new generations of offspring.
(v)Takes place in lower organisms	(v) Takes place in higher invertebrates and all vertebrates

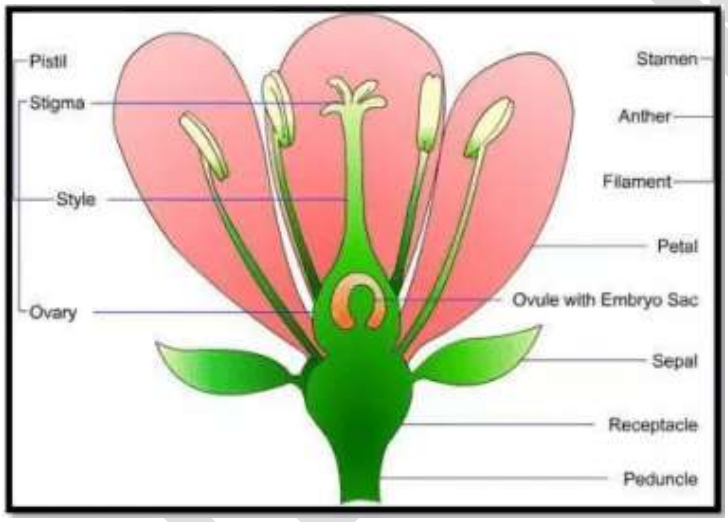
Sexual reproduction:
This is the most evolved process of reproduction. It involves two sexes, namely male and female in the form of gametes produced by two different parents.

Sexual reproduction occurs nearly in all animals including those which reproduce asexually. In most animals there are two sexes male and female, and the differences between them are genetically determined.

Males have male sex cells/male gametes/male germ cells. Similarly, females have female sex cell/ female gametes / female germ cell.

Sex Cells– Gametes, also known as sex cells or germ cells, are the cells that come together during fertilization or conception in organisms that reproduce sexually. Their genetic complement consists of a single set of unpaired chromosomes.

Sexual Reproduction in flowering plants:
Angiosperms – Angiosperms are seed-bearing vascular plants. Their reproductive structures are flowers in which the ovules are enclosed in an ovary.
In angiosperms (flowering plants) reproductive organs are located in the flower. A flower is a part of the shoot modified for sexual reproduction. Flower parts are arranged in rings or circles called as whorls. The different parts of a flower are— sepals, petals, stamens and carpets.



(a) Sepals: They resemble like small leaved and they protect the flower in the bud.

(b) Petals are the coloured and scented part of the flower. Petals attract insects and birds. Petals also protect other delicate parts of the flower-like the anther.

(c) Stamen is the male reproductive part and it produces pollen grains that are yellowish in colour. Pollen grains produce male germ cells. The stamen also has a filament, the stalk that holds the anther.

(d) Carpel is present in the centre of a flower and is the female reproductive part. It is made of three parts. The swollen bottom part is the ovary, middle elongated part is the style and the terminal part which may be sticky is the stigma. The ovary contains ovules and each ovule has an egg cell/ovum.

The flower may be **unisexual** (papaya, watermelon) when it contains either stamens or carpets or bisexual (Hibiscus, mustard) when it contains both stamens and carpals.

Pollination: Pollination is the transfer of pollen grains from the authors of the stamens to the stigma of a carpet. There are two methods of pollination namely-

1) Self-pollination
2) Cross-pollination

If the transfer of pollen grains from the anthem to the stigma occurs in the same flower or another flower of the same plant, it is referred to as **self-pollination**.

If the pollen is transferred from one flower to another, it is known as **cross-pollination**. This transfer of pollen from one flower to another is achieved by agents like wind, water, or animals.

Fertilization:

The fusion of male and female gametes is called fertilization. The product of fertilization is called a zygote. The zygote undergoes several rounds of mitosis and develops into an embryo. Subsequently, the embryo develops into a new individual.

The main events leading to fertilization are:

a) A ripe stigma secretes a substance which induced the pollen grains on it to germinate by sending out pollen tube all the way down tire style to the ovary.

b) The pollen tubs continue to grow until it reaches the ovule. It passes through the micropyle into the ovule.

c) This pollen tube carries a male gamete to meet a female gamete in an ovule. The ovary contains ovules and each ovule has an egg cell. The male germ-cell produced by pollen grain fuses with the female gamete present in the ovule. This fusion of the germ-cells or fertilisation gives us the zygote which is capable of growing into a new plant.

The changes that take place in a flower after fertilization:

a) The ovule develops a tough coat and is gradually converted into u seed which contains the future plant or embryo which develops into a seedling under appropriate conditions.

b) The zygote divides several times to form an embryo within the ovule. i.e., The ovum develops into the embryo of the seed. The embryo develops into a seedling. This process is called germination.

c) The ovary grows rapidly and ripens to form a fruit. Meanwhile, the petals, sepals, stamens, style, and stigma may shrivel end fall off.

Germination:

Seed germination is the basic stage of the growth of any plant. A seed contains the essence of a plant in a resting, embryonic condition. Whenever a seed gets a favorable environment, the stages of germination start taking place. A dormant seed lying in the ground needs warmth, oxygen, and water to develop into a plant.

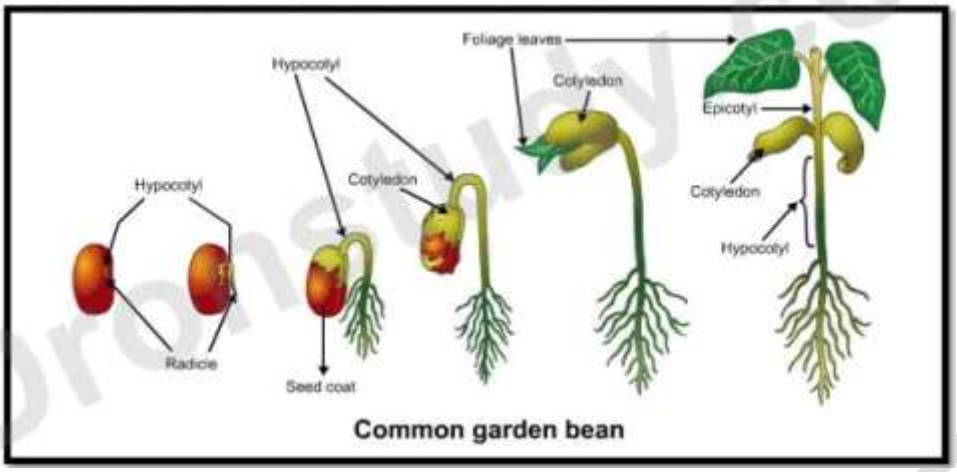
The seed coat is the outer covering of a seed which protects the embryo from any kind of damage, caused by the natural elements or due to the invasion of parasites, and prevents it from drying. The endosperm inside the seed coat contains a temporary nutritional reserve, which is packed around embryo in the form of cotyledons or seed leaves. **Germination** is the process which involves the emergence of a plant from the seed when proper temperature, humidity, and sunlight are provided.

Various Stages of germination:

Germination starts with the rapid uptake of water by the send through its micropyle. The first visible indication of germination is the swelling of the seed with a resultant increase in weight. It is also accompanied by the softening of the seed coat. Absorption of water causes a number of physiological changes in the seed. Germinating seeds exhibit increased respiratory activity. The embryo produces enzymes which convert the food material stored in the cotyledons or endosperm into soluble form usable by the growing embryo. Once the food is made available, cell division activity starts in the growing embryo, i.e. radical and plumule. The growth of the embryonic tissue ruptures the seed coat.

The growing plant emerges out. The part of the plant that first emerges from the seed is the embryonic root known as the radicle. The radicle allows the seedling to anchor itself to the ground and start absorbing minerals and water mom the soil.

After the root starts absorbing water, an embryonic shoot emerges from the seed. This shoot comprises of three main parts- the cotyledons (seed leaves}, the hypocotyl (section of shoot below the cotyledons), and the epicotyls (section of shoot above the cotyledons).



Common garden bean

Sexual reproduction-Human:
Organisms that reproduce sexually do so via the production of sex cells called **gametes**, In humans, male sex cells or spermatozoa (sperm cells), are relatively motile. Female sex cells, called ova or eggs, are non-motile and much larger in comparison to the male gamete. When these cells fuse in a process called fertilization, the resulting cell (zygote) contains a mix of inherited genes from the father and mother. Human sex cells are produced in reproductive system organs called gonads. Gonads produce sex hormones needed for the growth and development of primary and secondary reproductive organs and structures.

Puberty is the age or period, when the reproductive organs of a child start functioning and the child attains sexual maturity. In girls, puberty is achieved at the age of 10-12 yrs of age. In boys, puberty is achieved at the age of l3-14 yrs of age.
Both the male and the female reproductive systems do not perform their function continuously from birth onwards in the same way as, for instance, the respiratory system, nervous system, or digestive system. In fact, the reproductive organs do not start to function until puberty. When this happens, the reproductive system also has effects on other systems, all round the body **- Secondary sexual characteristics**. Obviously, these changes are different in the two sexes, but there are some similarities.

Changes are seen in boys at the time of puberty:

(i) There is slow-growth of thick hairs on face {mustaches, beard)
(ii) Hairs in the armpit and pubic region
(iii) Broadening of shoulders
(iv) Their voice begins to crack and their shoulders become broad.
(v) The penis occasionally begins to become enlarged and erect, either in daydreams or at night.

These changes are caused by the male sex hormone known as **testosterone**.

Changes are seen in girls at the time of puberty:

(i) In girls. breast size begins to increase, with darkening of the skin of the nipples at the tips of the breasts.
(ii) Hairs in the armpit and pubic region.
(iii) Broadening of hips and thighs
(iv) Girls begin to menstruate at around this time.

These changes are caused in girls by the female sex hormone known as **Oestrogen and Progesterone.**

Primary sex organ– The sex organs which produce the germ cells or gametes are called primary sex organs. They are — testis in males and ovaries in females.

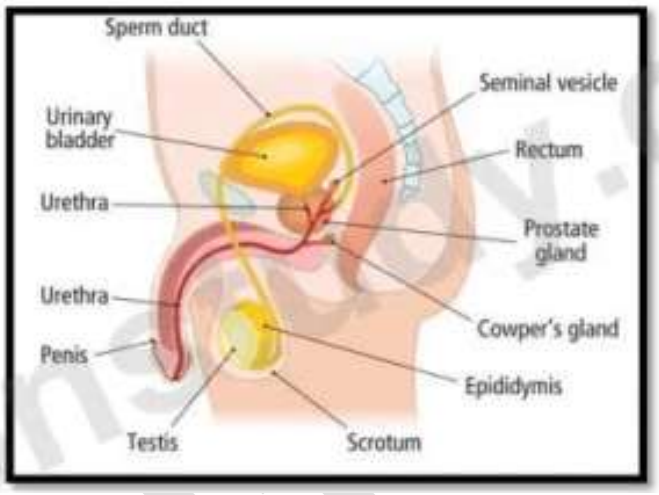
Secondary sex organs– The sex organs which conduct and nourish the gametes are known as secondary sex organs.

Primary sex characters- Characters which distinguish a male from a female at the time of birth are called primary sex characters.

Secondary Sex Characters– Characters which develop later on during puberty are known as secondary sexual characters. E.g., breasts in females, beard in males. The reproductive phase is the phase in the life of every individual which makes the individual capable of reproducing the offspring. In the early reproductive phase, individuals acquire changes in the body which result in the formation of germ cells. Sperms are male germ cells and eggs are female germ cells. The reproductive phase (puberty) involves the changes in the appearance and size of the bodily organs.

Male reproductive system:
It is active and functional only after puberty (13-14 yrs)

Male reproductive system: This system includes a pair of the testis, vas deferens and a muscular organ, the penis.



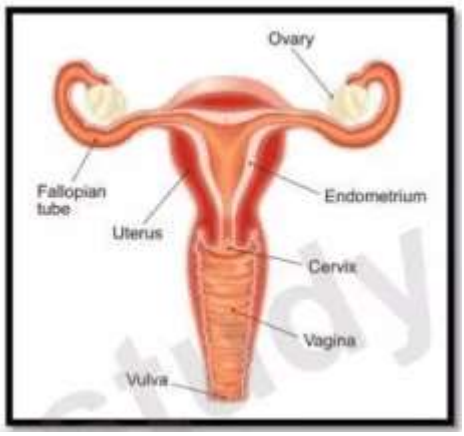
(a) Testes: Testis is the main reproductive organ in males. A pair of the testis is placed in a structure called the scrotum which is located outside the abdominal cavity because sperm formation requires a lower temperature than the normal body temperature. The sperms are tiny bodies that consist of mainly genetic material and a long tail that helps them to move towards the female germ-cell. Testes also secrete male sex hormones like testosterone to regulate the development of sperms and the secondary sexual characteristics leading to puberty.

(b) Vas deferens: The sperm duct is also known as vas deferens. They are two in number, each one arising from testis played on either side. They transport sperms into the penis. They also collect fluids secreted by different glands. These secretions are rich in proteins to enrich the sperms. Sperms along with these secretions form a thick liquid called semen. Semen is conveyed to the urethra through which it is discharged outside. The prostate gland and seminal vesicles secrete semen to make the movement of sperms easier.

(c) Urethra: Urethra forms a common passage for both the sperm and urine as it is just one tube that connects both the glands — urinary bladder and vas deferens.

(d) Penis: It is a part of the male reproductive system. The penis is a muscular organ which transfers semen into the female reproductive tract. Penis receives both urinary tube and sperm duct and serves as a common transporting organ for urine and semen. It opens out through a small tube called the urethra. The penis is underlined by thin blood vessels which give it a continuous supply of blood.

Female reproductive system: This system includes a pair of ovaries, a pair of oviducts, uterus, and vagina opening out through the urethra.



(a) Ovary: A pair of ovaries forms the gonads in females. They are oval-shaped and are close to the kidney. Ovaries are the female sex organs that lie one on either side of the abdominal cavity. Ovaries by the process of oogenesis four eggs or ova which are released as one per month. Ovaries produce two hormones, namely, estrogen and progesterone. Ovaries have thousands of follicles. After puberty, these follicles develop into eggs. Estrogen controls the changes that occur during puberty, like feminine voice, soft skin and development of mammary glands, growth of pubic hair and controls the release of mature eggs. Progesterone controls the uterine changes during the menstrual cycle and helps in the maintenance of pregnancy.

(b) Oviducts: A tube-like structure arising from each ovary on either side is called as an oviduct. This is also called a fallopian tube. The egg is carried from the ovary to the uterus through a thin oviduct also known as the fallopian tube. The two oviducts combine and open into an elastic bag-like stricture known as the uterus.

(c) Uterus: Uterus is a hollow muscular organ which has the capacity to bear the child. It is otherwise called as womb. The zygote formed after fertilization in the fallopian tube travels downward by dividing itself continuously to form an embryo. Embryo as it reaches the uterus gets implanted into the wall of the uterus. After fertilization, female reproductive hormones bring in many changes to the uterus, so as to bear the growing embryo. As the embryo grows, it transforms into foetus. The uterus is the organ which bears the foetus.

(d) Cervix is located at the top of the vagina – it is the junction between the vagina and uterus.

(e) Vagina: It is the reproductive part situated at the end of the uterus in female reproductive tract. It is also called the **birth canal** and it opens outside the body. It connects the uterus to the outside world. The vagina secretes mucous to keep the track wet. It opens out through the vulva.

Eggs, the female gametes develop inside the ovaries, One mature egg is released by either of the ovaries per month. Ovaries secrete two hormones namely estrogen and progesterone which bring about secondary sexual characters in females. The egg is carried from the ovary to the uterus through a thin oviduct also known as the fallopian tube. The two oviducts combine and open into an elastic bag-like structure known as the uterus. The uterus opens into the vagina through the cervix. The uterus helps in the development of the foetus.

Process of reproduction:

(i) Fertilization– During copulation, millions of sperms are released into the vagina. Sperms are highly active and motile. They move up to the female body through the cervix, uterus and finally reach the fallopian tube. As they move up, most of the sperms are destroyed by the female secretions. The few sperms that have survived make it to the ovum present in the fallopian tube. Only one sperm and one egg are involved in fertilisation. Once one sperm enters the egg, the egg forms a membrane that prevents other sperm from entering. Once the sperm fuses with the ovum, it fertilises it and a zygote is formed (fertilised ovum).

(ii) Implantation: About 6-9 days after fertilisation, the fertilised egg (zygote) descends from the fallopian tube into the uterus. During its movement towards the uterus, the division of the zygote starts. On contact, the zygote will attach itself to the uterine wall, usually in the upper pan of the uterus. The inner wall of the uterus develops and partially envelops the embryo. This process is called implantation. The

fertilised egg (zygote) is called an embryo as soon as it implants which is around 7 to 10 days after fertilization. It continues to be called an embryo until the week 8.

The lining of the uterus becomes thick and is richly supplied with blood to nourish the growing embryo. The embryo gets nutrition from the mother's blood with the help of a special tissue called placenta. This is a disc which is embedded in the uterine wall. It contains villi on the embryo's side of the tissue. On the mother's side are blood spaces, which surround the villi. This provides a large surface area for glucose and oxygen to pass from the mother to the embryo. The developing embryo will also generate waste substances which can be removed by transferring them into the mother's blood through the placenta.

A woman with an embryo or foetus developing her uterus is called pregnant and the physical condition of the woman is called pregnancy.

(iii) Gestation period- The period during which the embryo development takes place in the uterus is called the gestation period. The development of the child inside the mother's body takes approximately nine months (36 weeks).

(iv) Birth- Few days before birth, the foetus moves in the uterus until its head points towards the cervix. The child is born as a result of rhythmic contractions of the muscles in the uterus. Contractions of the muscular uterine wall force the fully-grown foetus through the cervix into the vagina. Contractions of the uterine and the abdominal muscles at regular intervals are called labour. The cervix dilates, the head of the foetus passes through and the amnion bursts discharging the amniotic fluid through the vagina. The repeated contractions of the uterus along with the contractions of the abdominal muscles forces the child out of the uterus through the vagina and the infant is thus born. The umbilical cord remains attached which is later cut off and tied up. The remaining cord on the infant shrivels and becomes its navel.
After the baby is born, the placenta and the uterine lining are discharged through menstruation.

Ovulation in females:

At about the age of 10 to 13 years, the ovaries of females are stimulated by the follicle-stimulating hormone (PSH) of the pituitary. This is called the **onset of puberty** and is accompanied by the release of hormones oestrogen and progesterone. These hormones control the production of ova or eggs and the appearance of secondary sexual characteristics. Unlike males where sperms can be produced throughout the life of man. in females, the reproductive phase only lasts till the age of 45-50 years. This phase is characterized by the presence of the menstrual cycle.

The oval has thousands of follicles in it. These follicles are present right from the birth of the girl child. But they remain inactive till puberty. After puberty, the follicles become eggs, the process of making of eggs from follicles is called ovulation.

After puberty, the body of the females has some periodic activity.

The ovary **produces one** egg every 28th and the uterus prepares to receive the fertilised egg. Its wall becomes thick and spongy with blood vessels for nourishing the embryo. If fertilisation does not take place then the uterus wall breaks and comes out of the
vagina as blood and mucous. This cycle takes place once every month and is called menstruation. It occurs in response to the low level of estrogen and progesterone hormone.

The menstrual cycle is the series of changes a woman's body goes through to prepare for a pregnancy. Menstruation (menstrual phase) lasts for the first 3-4 days. During this phase, the inner lining of the uterus is shed which causes the blood vessels to rupture. This causes bleeding and is called **menstruation.** The first occurrence of menstruation is termed menarche. It stops by the age of 45-50 years and is called **menopause**.

Most women ovulate on the 14th day but 14 is an average, and most women will actually ovulate on a different day of the menstrual cycle. The day of ovulation will vary from cycle to cycle.

After ovulation:

Once the egg (or ovum) has been released, it moves along the fallopian tube towards the womb. The egg can live for up to 24 hours. Sperm survival is more variable, but typically 3-5 days, so the days leading up to ovulation and the day of ovulation itself are the most ferrite — when a roman is most likely to get pregnant.
As soon as ovulation has started, the follicle starts producing another hormone: progesterone.
Progesterone causes further build up the lining of the womb in preparation for a fertilized egg. Meanwhile, the empty follicle within the ovary starts to shrink, but carries on producing progesterone.

Preparing for the next period:

As the empty follicle shrinks, if the egg is not fertilized, levels of estrogen and progesterone decrease. Without the high levels of hormones to help maintain it, the thick womb lining that has been built up starts to break down, and the female body sheds the lining. This is the start of the period and the beginning of the next menstrual cycle.
If the egg has been fertilised, the menstrual cycle may temporarily stop till the birth of the child.

Birth Control:

Contraceptive methods are adopted to present unwanted conception and to have a sufficient gap between successive births.

Methods of contraception:

A number of methods have been developed to parent and regulate childbirth. Some of them are-

(i) The creation of a mechanical barrier so that sperm does not reach the egg. Condoms on the penis or similar coverings worm in the vagina can serve this purpose.

(ii) Ovulation and fertilisation can be prevented by changing the hormonal balance of the body. It can be done by taking oral pills. Ora1 pills used by women contain hormones which alter the ovulatory cycle.

(iii) Use of Intrauterine Contraceptive Device (IUCD) such as the loop or the copper-T are placed in the uterus to prevent pregnancy. The drawbacks with these devices are bleeding and discomfort.

(iv) Surgical methods – lf the vas deferens in the male is blocked, sperm transfer will be prevented. The procedure is called vasectomy (males). lf the fallopian tube in the female is blocked, the egg will not be able to reach the uterus. The procedure is called tubectomy (female), In both cases, fertilisation will not take place. Surgical methods can be used to create such blocks

Sexually Transmitted Diseases (STD's):

During the process of reproduction, some diseases can be transmitted between males and females. The diseases which are **spread** by sexual contact from an infected person to a healthy person are called sexually **transmitted** diseases **or STDS.**

(i) AIDS (Acquired Immune Deficiency Syndrome)
(ii) Gonorrhea
(iii) Syphilis
(iv) Genital herpes

'AIDS' — damages the immune system of the human body

Do Organisms Create Exact Copies of Themselves?

Organisms took similar because their body designs are similar. If body designs are to be similar, the blueprints for these designs should be similar. Thus, reproduction involves making copies of the blueprints of body design.

The chromosomes in the nucleus of a cell contain information for the inheritance of features from parents to the next generation in the form of DNA (Deoxyribo Nucleic Acid) molecules. The DNA molecule present in the chromosome defines the characteristics of organisms. The DNA in the cell nucleus is the information source for making proteins. If the information is changed, different proteins will be made. Different proteins will eventually lead to altered body designs more the difference in DNA, the more the difference between organisms.

Therefore, DNA is responsible for inheritance. During reproduction, there is the formation of new cells which must carry the same amount and type of hereditary information, as present in the parent cell. This is accomplished by DNA copying, prior to each cell division. As a result, DNA division takes place; very often the DNA does not divide to form exact copies. The process of copying DNA will have some variations each time. The DNA copies generated will be similar but may not be identical to the original.

This is because DNA division is a biochemical reaction. When a cell divides, the two copies of the cell may be similar but not identical. When DNA of a cell is changed, it will behave in a slightly different

manner. Such differences that take place during the division of DNA are called variation and this is the reason why organisms cannot make identical copies of themselves.

lf a cell makes an exact copy of itself, then it is engaging in asexual reproduction. Asexual reproduction uses genetic material from a single parent. During asexual reproduction, the genetic material is copied and passed to the forming daughter cell. When replication is complete, the daughter cell divides away from the parent and becomes an EXACT replica or clones. Sexual reproduction uses genetic material from two different individual parents. During the process of reproduction, the genetic material (DNA) Horn both the parents are taken. This results in offspring's having similarities to both parents but are not an exact copy of either one.

The Importance of Variation:

The consistency of DNA copying during reproduction is important, which leads to the stability of population species. Changes in the ecological system, which are beyond our control like varying temperature, varying water levels, and natural calamities, can wipe out the population species. So, if there are some variations that are present in some individuals of the population species then there is a chance for the survival of these species over time. The process of reproduction results in the production of offspring's which are exactly similar to parents.