

THE RADIANT EDUCATION POINT

(MRITUNJAY MISHRA)

H.N. 1256, 33-FEET ROAD, S.G.M. NAGAR

FARIDABAD

MOB: 9643126470, 9643125430

REPRODUCTION IN PLANTS AND ANIMALS

Reproduction:

Reproduction is the process by which living organisms produce more living organisms of its own kind. Thus, there is a cycle of birth, growth and death. Reproduction, therefore, ensures a continuity of life of a species on earth.

Types of Reproduction

There are two main methods of reproduction in living.

Asexual reproduction.

Sexual reproduction.

Asexual Reproduction-

The production of new organism from a single parent without the involvement of sex cells (or gametes) is called asexual reproduction.

- A single individual give rise to new individual.
- Gametes are not formed.
- New individual is identical to parent.
- It is extremely useful as a means of rapid multiplication.
- Adopted by lower organisms.

Sexual Reproduction

The process of production of new organism from two parents by making use of sex cells.

- Two individuals i.e., one male and one female are needed to give rise to new individual.
- Gametes are formed.
- New individual is genetically similar but not identical to parents.
- It is useful to generate more variations in species.
- Adopted by higher organisms.

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

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Methods of Asexual Reproduction

It takes place by 6 methods.

- Fission
- Budding
- Spore formation
- Regeneration
- Fragmentation
- Vegetative Propagation

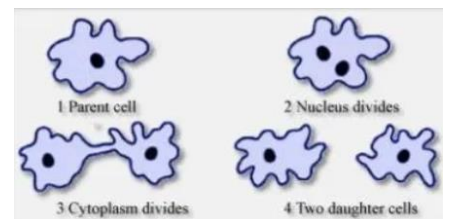
(1) Fission

Fission is of two types

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

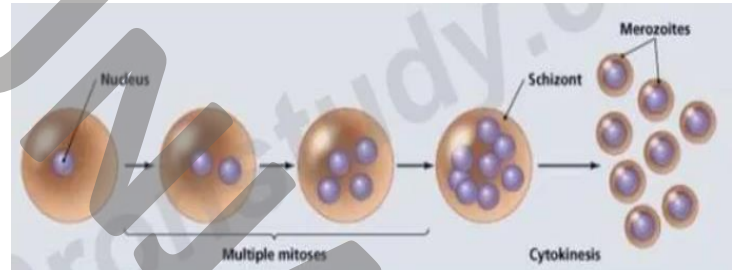
Binary fission:

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. Eg: - Amoeba, Paramecium, Leishmania etc.



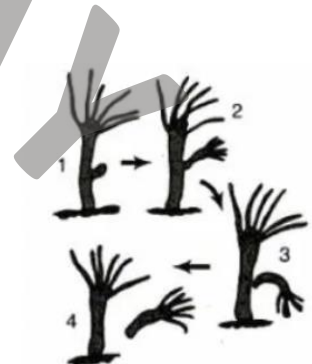
Multiple fission

In multiple fission, the nucleus of the parent cell undergoes repeated divisions to produce many daughter nuclei. First the nucleus divides and forms many daughter nuclei. Then the cytoplasm in the mother cell divides into many daughter cells. This leads to the formation of many daughter cells each having a nucleus and its own cell organelles which then develop into a fully formed adult. E.g.: Plasmodium (Malarial parasite).



(2) Budding

Budding is a mode of asexual reproduction in which one or more buds develop on the body of an organism which then separate to form new individuals. Hydra multiplies by budding under favorable 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.



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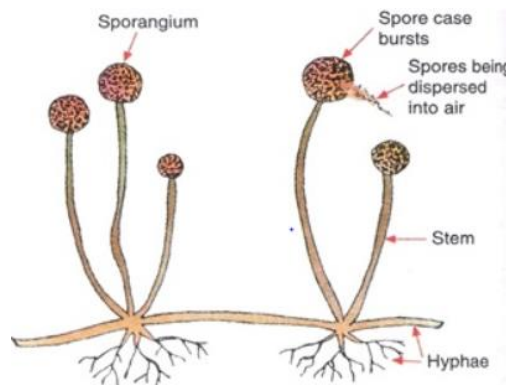
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(3) Spore Formation:

Spore formation: Spore formation is the method of developing new individuals by forming reproductive structures called spores.

Spores are very minute unicellular asexual reproductive bodies that are formed in special spore-bearing 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.

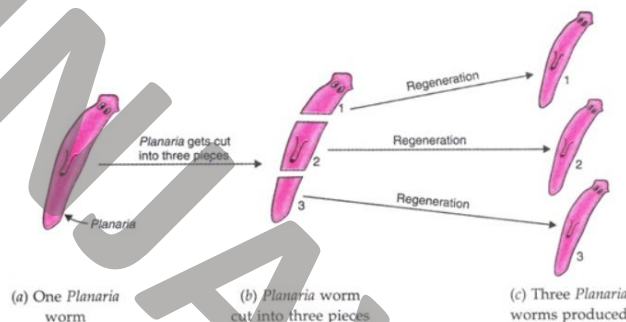


How will an organism benefited if it reproduces through spores?

The reproduction by spores take place in plants. Spores are covered by hard protective coat which enables them to survive under unfavourable conditions, like lack of food, lack of water and extreme temperature but when the conditions are favourable the spores can grow to produce new individual. Thus, the reproduction by spores benefits the plant because by surviving under adverse conditions, the spores make these plants live forever.

(4) Regeneration:

The process of getting back full organism from its body part is called regeneration. For example, simple animals like Hydra and Planaria show regeneration. Planaria (Flatworm) is found in freshwater ponds. If the body of planaria somehow gets cut into number of pieces then each body piece can regenerate into complete planaria. It occurs by the process of growth and development. The cells of cut body part divide rapidly to make various organs and body parts of an organisms.



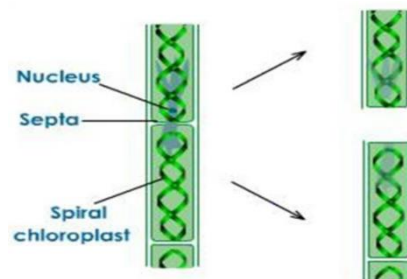
Why multicellular complex organism cannot show power of regeneration?

In multicellular complex organism, specialized cells make up tissue, tissue makes up organ, organ makes up organ system and finally organ system makes up organism. They have a high degree of complexity in their body so they cannot reproduce their body through regeneration.

(5) Fragmentation:

In this process, we see that an organism breaks up into many pieces upon maturation. Each of these 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



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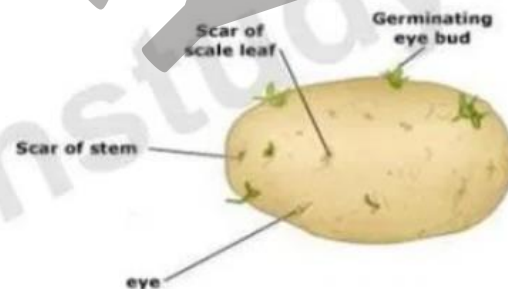
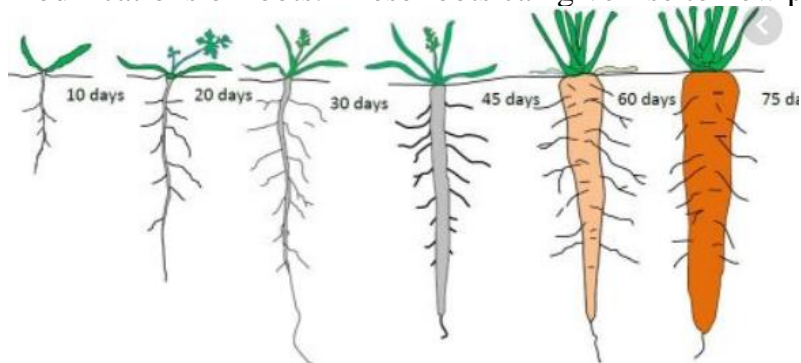
	Binary Fission	Fragmentation
Description	Binary fission is the asexual reproduction of a single-celled organism in which an organism divides and forms two daughter cells which then develop into a fully formed adult.	Fragmentation is a form of asexual reproduction or cloning where an organism is split 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

(6)Vegetative reproduction (Vegetative propagation):

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 growth is vegetative propagation. Only one plant is involved and the new plant is genetically identical to the parent.

Tuber of potato: The potato 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.

Modified roots Of Carrot and Sweet potato: Carrot and sweet potato are examples of modifications of roots. These roots can give rise to new plants; when kept under the soil.



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

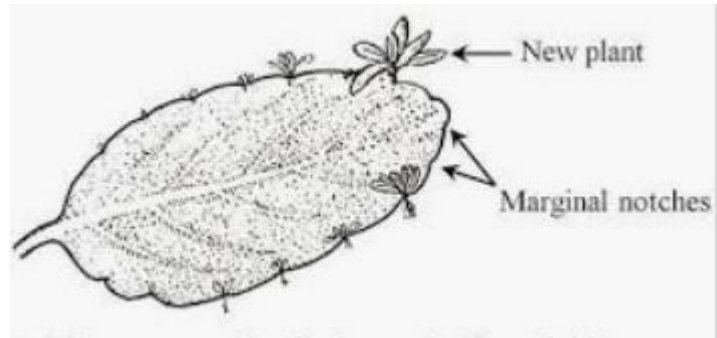
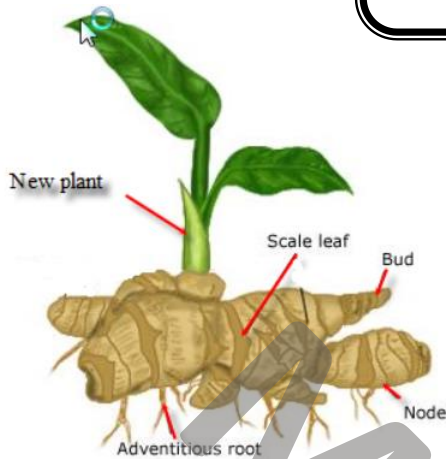
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Leaf of Bryophyllum: Leaves of bryophyllum have notches on the margin. If a leaf is put under the soil, small saplings grow from the notches on the leaf margin.

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:

(i) **Cutting:** in which a stem is given an oblique cut and the cut stem is kept under appropriate conditions to give rise to an entirely new plant, e.g., Rose and China rose.

(ii) **Layering:** it 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.



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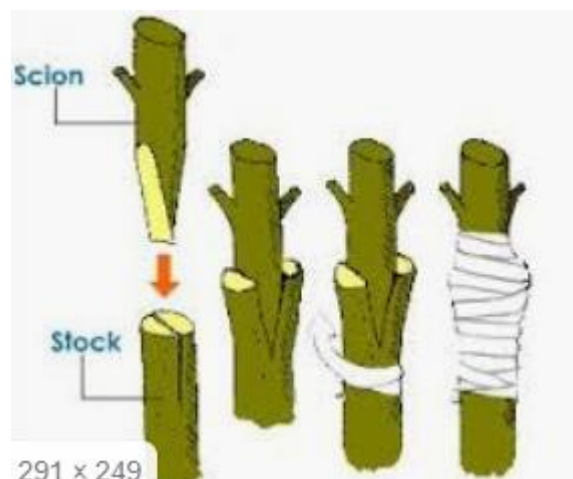
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Grafting: in this method, a twig (called the scion) is cut from the plant to be increased. It is then joined to the stem (called the stock) of a rooted plant. The cut surfaces are joined by bandaging them tightly. The graft heals on the rooted plant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

Advantages 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 (Micro propagation):

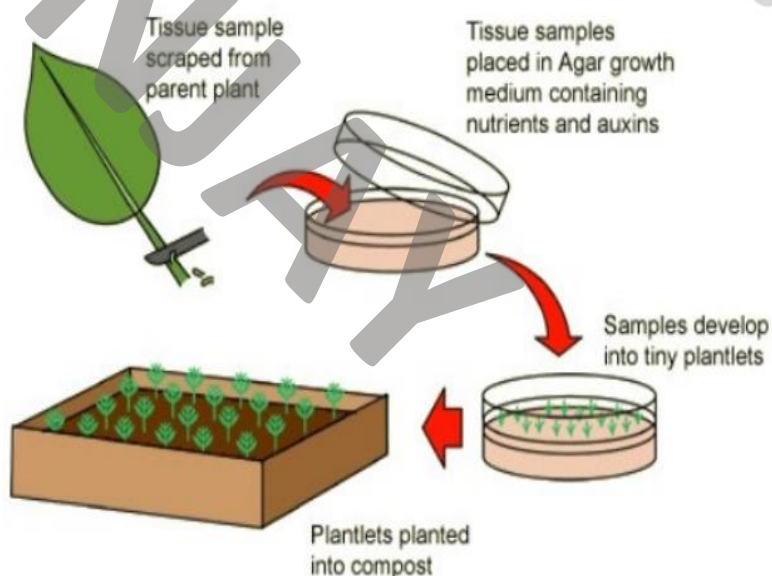
The production of new plants from a small piece of plant tissue removed from a growing tip of plant in a suitable growth medium (culture or jelly like synthetic medium) is called tissue culture.

Procedure:

- The tissue is placed on a culture medium which contain nutrients and plant hormones, which make the cells in the plant tissue to divide rapidly to form callus.
- This callus is transfer to another medium containing plant hormone which stimulates the callus to develop roots.
- Then it is put on another medium containing another plant hormone which stimulates the development of shoot.
- The plantlets are then transplanted into soil where they can grow to form mature plant. This technique is used to the production of ornamental plants like orchids, carnation etc.

Advantages:

1. It is a very fast technique.
2. New plant produced by tissue culture are disease free.
3. Very little space is needed.
4. By this method plants can be grown around the year irrespective of weather or seasons.



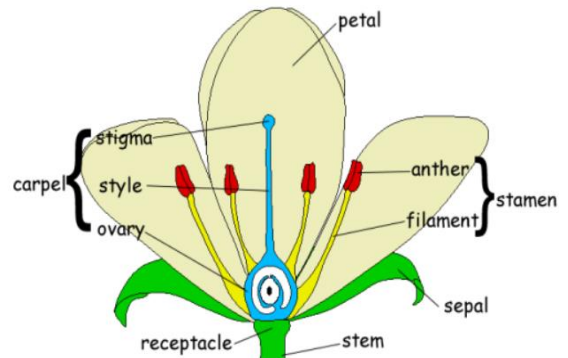
Sexual reproduction in Flowering plants:

- The plants in which the sex organs are present in the flowers and the seeds are enclosed in a fruit are called angiosperms (flowering plants).
- The flowering plants reproduce by sexual reproduction method.

Parts of a Flower:

The main parts of flower are:

1. **Receptacle:** The base of a flower to which all the parts of a flower are attached is called receptacle.
2. **Sepals (group name calyx):** Sepals are green outermost leaf-like floral organs which protect the flower in the bud stage.
3. **Petals (group name corolla):** The colourful parts of a flower are called petals. The petals lie inside the sepals. Petals attract insects to flowers for pollination. They also provide protection to centrally placed reproductive organs.
4. **Stamen:** Stamen is the male reproductive part and it produces pollen grains that are yellowish in colour. The stalk of stamen is called filament and the swollen top of stamen is called anther. The anther of stamen makes the pollen grains and stores them.
5. **Carpel:** Carpel is present in the centre of a flower and is the female reproductive part.



It is made up of three parts. The swollen bottom part is 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.

6. **The flowers which contain only sex organ, either stamens or carpels are called unisexual flower. For example: papaya and watermelon plants**
7. **The flowers which contain both the sex organs, stamens as well as carpel, are called bisexual flowers. For example: *Hibiscus* and mustard plants.**
8. **A new seed of the plant is formed when the male gamete in a pollen grain unites with the female gametes present in the ovule.**

Pollination:

- The transfer of pollen grains from the anther to the stigma is called pollination.
- If the transfer of pollen occurs in the same flower or another flower on the same plant, it is called self-pollination.
- If the pollen is transferred from the anther of a flower on one plant to the stigma of a flower on another similar plant, it is called cross-pollination.
- Pollination is done by insects, birds, winds and water.

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:

- When a pollen grain reaches the stigma, a ripe stigma secretes a substance which induced the pollen tube to grow all the way down to the ovary.
- The pollen tubes continue to grow until it reaches the ovule.
- This pollen tube carries a pollen grain to meet a female gamete in an ovule. The ovary contains ovules and each ovule has an egg cell. The male 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:

1. The ovule develops a tough coat and is gradually converted into a seed which contains the future plant.
2. The zygote divides several times to form an embryo.
3. The ovary grows rapidly and ripens to form a fruit. Meanwhile, the petals, sepals, stamens, style, and stigma may shrivel and 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 condition. Whenever a seed gets a favourable 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.

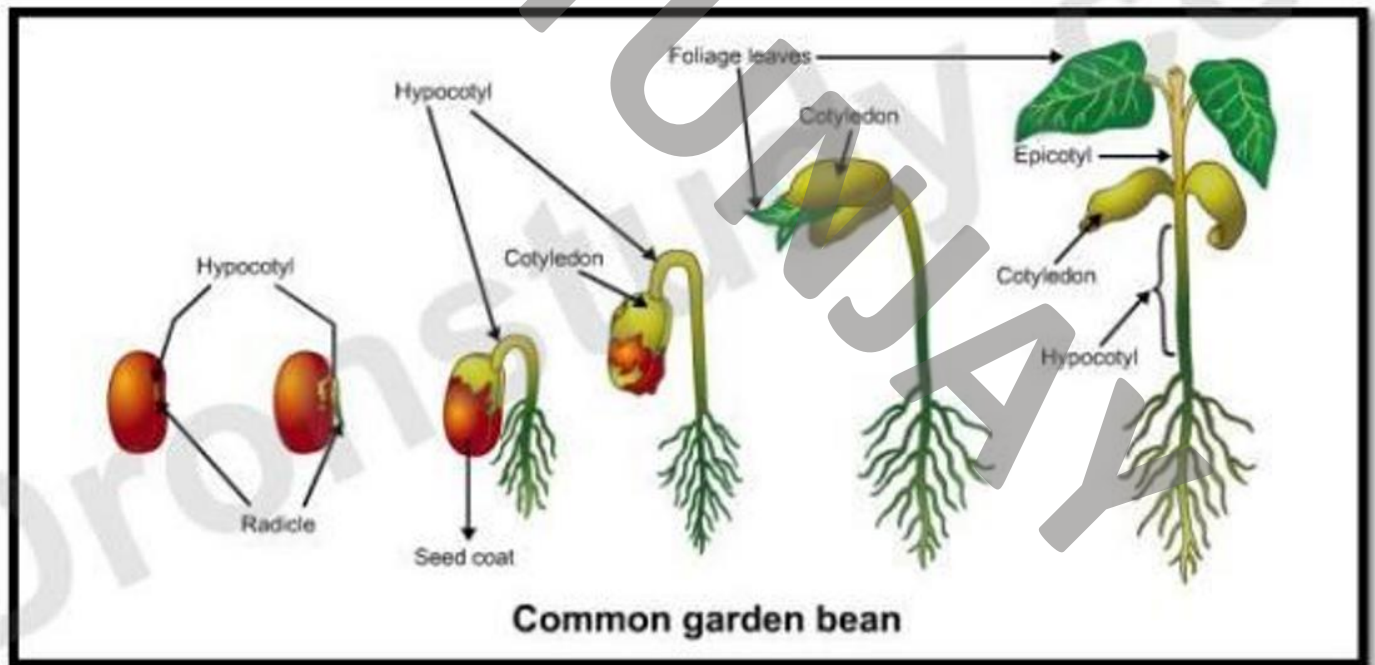
The seed coat is the outer covering of a seed which protects the embryo from any kind of damage, caused by the natural elements or due to the invasion of parasites, and prevents it from drying. The endosperm inside the seed coat contains a temporary nutritional reserve. **Germination** is the process 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. 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 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 from the soil.

After the root starts absorbing water, an embryonic shoot emerges from the seed.



Sexual reproduction-Human:

Fertilisation: - In humans, when male sex cells or spermatozoa (sperm cells), is fused with Female sex cells, called ova or eggs, this process called fertilization, the resulting cell (zygote) contains a mix of inherited genes from the father and mother.

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 10-12yrs of age. In boys, puberty is achieved at the age of 13-14yrs of age. The reproductive organs do not start to function until puberty. When this happens, the reproductive system also has effects on other systems (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:

1. There is slow-growth of thick hairs on face {moustaches, beard}
2. Hairs in the armpit and pubic region
3. Broadening of shoulders
4. Their voice begins to crack and their shoulders become broad.

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

Changes are seen in girls at the time of puberty:

1. In girls, breast size begins to increase, with darkening of the skin of the nipples at the tips of the breasts.
2. Hairs in the armpit and pubic region.
3. Broadening of hips and thighs
4. Girls begin to menstruate at around this time.

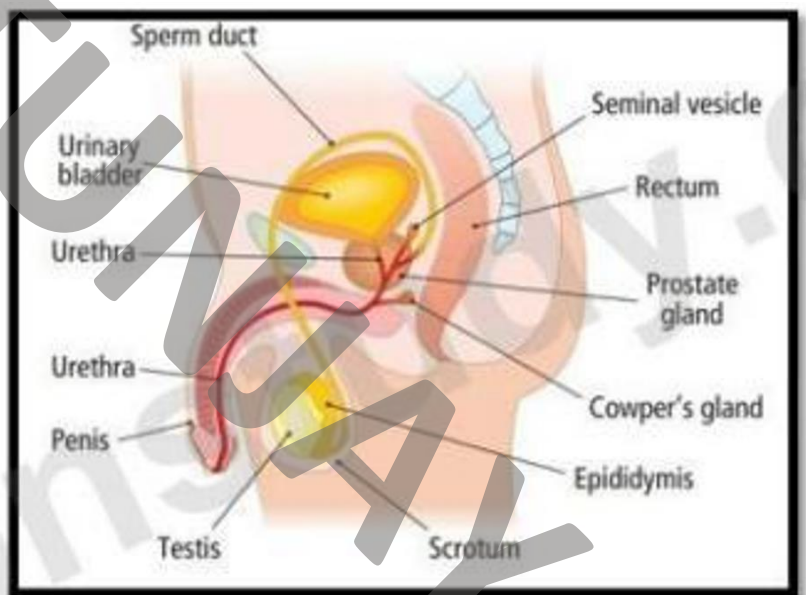
These changes are caused in girls by the female sex hormone known as **Oestrogen and Progesterone**.

Male reproductive system:

It is active and functional only after puberty (13-14yrs)

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.



(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. This secretion helps in the transport of the sperms and also provide nutrition to the sperms.

(c) Seminal vesicle: seminal vesicle is a pair of male reproductive glands present between the rectum and urinary bladder. it secretes seminal fluid which is alkaline and neutralise the acidity of urine and activates sperms.

(d) Prostate gland: it is a single, large sized and lobulated gland present just below the urinary bladder. It adds its secretion to the seminal fluid which provides nutrition to the sperms.

(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 form eggs or ova which are released as one per month. Ovaries produce two hormones, namely, estrogen and progesterone.

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 oviduct also known as the fallopian tube. The two oviducts combine and open into an elastic bag-like structure 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.

(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.

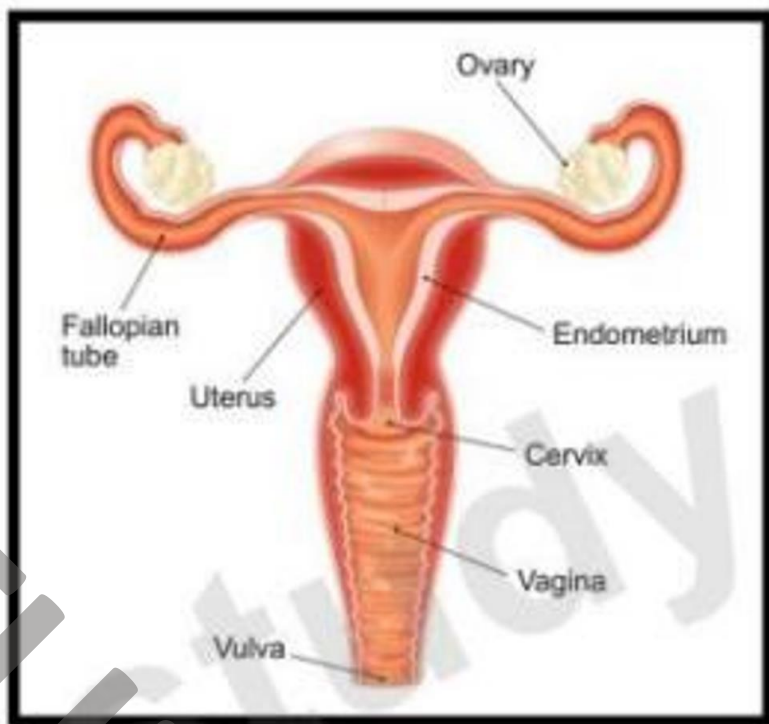
It is also called the **birth canal** and it opens outside the body. It connects the uterus to the outside world. The vagina secretes mucous to keep the track wet

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**– 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. 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 part of the uterus. 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.

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. Placenta contains many villi which is surrounded by mother's blood spaces. 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.

The placenta is connected to the embryo with the help of a tube-like structure named as Umbilical cord. The movement of food and waste material between mother and foetus will take place through this cord.

(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.

Ovulation in females:

At about the age of 10 to 13 years, the ovaries of females are stimulated by the follicle-stimulating hormone (FSH) 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 ovary 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 mucus. This cycle takes place once every month and is called menstruation.

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**.

Birth Control:

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

Methods of contraception:

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

- (i) Barrier method- The creation of a mechanical barrier so that sperm does not reach the egg. Condoms on the penis or similar coverings worn in the vagina can serve this purpose.
- (ii) Chemical method- Ovulation and fertilisation can be prevented by changing the hormonal balance of the body. It can be done by taking oral pills. Oral pills used by women contain hormones which alter the ovulatory cycle.
- (iii) IUCD- 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 – If the vas deferens in the male is blocked, sperm transfer will be prevented. The procedure is called vasectomy (males). If 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) Gonorrhoea
- (iii) Syphilis
- (iv) Genital herpes