Biolgy

14 Continuity of life

14.1 Reproduction

The life process that gives rise to a new generation from an existing generation is referred to as reproduction. Reproduction is a characteristic feature of organisms. It is essential to maintain the continuity of life. Reproduction is of two types,

- Asexual Reproduction
- Sexual Reproduction

• Asexual reproduction

Reproduction that occurs by spores and vegetative parts from a matured organism is known as asexual reproduction.

• Sexual reproduction

Reproduction that occurs due to fusion of two gametes produced in sexual structures of male and feamle organisms is known as sexual reproduction. Structures that are adapted for sexual reproduction can be found in evolutionary advanced organisms. In plants, the structure that is specially formed for sexual reproduction is flower. In animals, there are male and female reproductive systems.

Differences between sexual reproduction and asexual reproduction are given in the table below.

Table 14.1- Differences between sexual and asexual reproduction

Asexual reproduction	Sexual reproduction
• Contributes only one parental organism	• Contribute two organisms which are referred to as maternal and paternal
• Gives rise to offsprings which are more or less like maternal organism	• Gives rise to offsprings with mixed characteristics of parents
• No production of gametes	• Gametes are produced

• Meiosis does not occur • New species are not produced • A large number of offsprings can be produced in a short period of time • Can be seen in primitive plants and animals	• Meiosis occurs • New species with better adaptation to environment are produced • Increase of the number of offsprings is slow • Can be seen in plants and evolutionary advanced animals

14.2 Reproduction of plants

Reproduction of plants or the propagation of plants occurs mainly in two ways.

1. Asexual reproduction
2. Sexual reproduction

• Asexual reproduction of plants

Vegetative reproduction in plants is an asexual reproduction method.

The process of generating new plants from underground or aerial parts of a mother plant is referred to as vegetative reproduction. This gives rise to daughter plants that are identical to mother plant. Vegetative reproduction is of two types.

- Natural vegetative propagation
- Artificial vgetative propagation

• Natural vegetative propagation

Generation of new plants naturally from underground or aerial parts of a mother plant is known as natural vegetative propagation. This occurs from various vegetative parts of a plant. Some examples are given below.

- **Roots**

Eg :- Curry leaves, Bread fruit, Guava, Slime wood, Blue lotus

- **Leaves**

Eg :- Begonia, Akkapana/Sathaikkaraichchan, Queen of the night (Kadupul)

- **Suckers**

Small plants that rise horizontally from the basal part of stem under the soil are known as suckers.

Eg :- Paddy, Banana, Pine apple, Chrisanthemum, Hulankeeriya, Kaladuru

- **Runners**

Plant stems that run along the surface of soil connecting the stem to soil by adventitious roots are the runners.

Eg :- Gotukola/Vallarai, Sweet potatoes, Maharaavana raevula/Ravanan meesai

Bulbils

Special reproductive structure formed by a modification of a vegetative bud or a flower bud is known as a bulbil.
Eg :- Pine apple, Jute, Hondala

Underground Stems

Stems of plants which grow under the soil are known as underground stems. Vegetative propagation, storage of food and spending dormant period in adverse climatic conditions are some functions of underground stems. Underground stems are categorized into four types according to the external features.
They are;

(I) Rhizome - Eg :- Ginger, Turmeric, Cannas, Araththa
(II) Corm - Eg :- Big rooted Taro yam(Habarala/Nersshembu), Cocoyam (Gahala/Shembu),Taro, Elephant foot yam
(III) Bulb - Eg :- Red onion, Big onion, Leeks
(IV) Stem Tuber - Eg :- Potato, Coleus potato

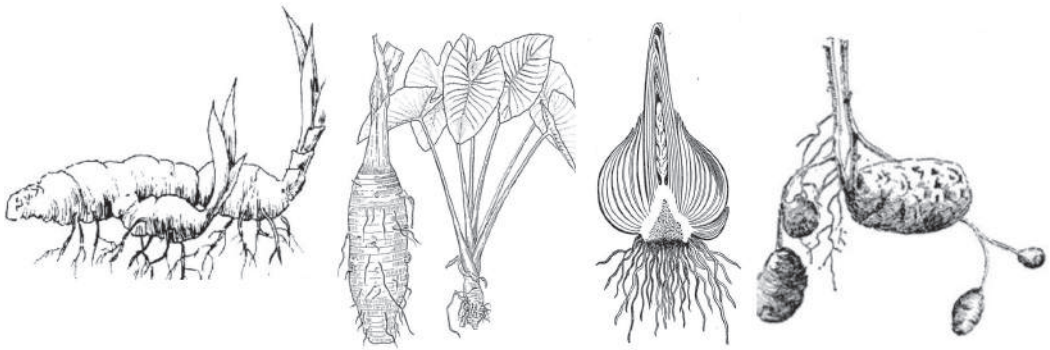


Figure 14.1 – Types of underground stems

Activity 14.1

- Observe the plants in your home garden and identify that are propagated by vegetative parts.
- Tabulate those plants and their methods of propagation.

• Artificial vegetative propagation

Production of plants vegetatively by man is known as artificial vegetative propagation. This can be done in several ways.

- Rooting of stem cuttings
- Grafting
- Layering
- Tissue culture

- **Rooting of stem cuttings**

New plants can be obtained by planting stem cuttings of a mother plant. It is more appropriate to select twigs from a healthy plant that do not bear tender leaves, flowers or fruits at that time. This method is widely used for some plants like Rose, Shoe flowers, Ixora, Bouguinvillea and Croton.

Assignment 14.1

- Find out and record various agro-chemicals in the market that are used to promote rooting of twigs.
- Prepare a list of plants that cannot be propagated by stem cuttings.
- Investigate the features of a twig that should be selected quick rooting.

- **Layering**

Initiate rooting while it is still attached to the mother plant is known as layering. Layering is of two types.

1. Ground layering
2. Aerial layering

- **Ground Layering**

Rooting is initiated from a branch of the plant closer to the ground level by this method. First a small cut is made on the underside of the selected twig. Then the twig is bent and burried under the soil. After few weeks, the twig will develop roots. Then the twig is separated from the mother plant and is planted.
Eg :- Jasmin, Lemon

- **Aerial Layering**

This method is used for the twigs which are high above the ground. A ring of bark of the twig is removed. a mixture of compost and coir dust is placed round that place and tied with a strip of polythene. After few weeks the twig will develop roots. Then the twig is separated from mother plant and is planted.
Eg :- Pomegranate, Lemon

Ground layering

Aerial layering

Figure 14.2 - Types of Layering

Following are some advantages of layering.

- Plants that do not produce seeds can be propagated successfully.
- Several number of plants can be produced easily.

Activity 14.2

Identify a plant in your home garden, which is suitable for ground layering. Follow the process of ground layering properly. After about two weeks, uproot twig and observe how roots are developed.

• Grafting (twig or bud)

Connecting a twig or a bud of a plant to a plant of same or closely related species is known as grafting. Two parts of the plants grafted are known as mentioned below.

(1) Stock

The rooted part of the plant is known as stock. Following are the characteristics that should be shown by a stock.

- Bearing a strong root system.
- Having a uniform growth.
- Withstanding environmental changes and diseases.

(2) Scion

The twig or the bud taken from another plant and grafted to a stock is known as scion. Following are the characteristics that should be shown by a scion.

- Should be a variety of good characteristics
- Should be free from pests and diseases

In the process of grafting, stock and scion are fused together by their cambium. Therefore grafting can be done only on the dicotyledonous plants, which have cambium tissues. Grafting can be done in two ways as follows.

1. Bud grafting
2. Twig grafting

• Bud grafting

Selecting a plant bud as the scion and grafting it to a stock is known as bud grafting It is done as follows.

- Cutting a live bud (which is located above the leaf scar) using a grafting knife.
- Making a cut on the stock and inserting the bud into the cut.
- Wrapping the place from bottom to top using polythene strips.
- After few days, when the bud is about to emerge, remove the wrap and re-wrap keeping the bud open.
- Cutting the stem of the stock about 15 cm above, from the bud after about three weeks.

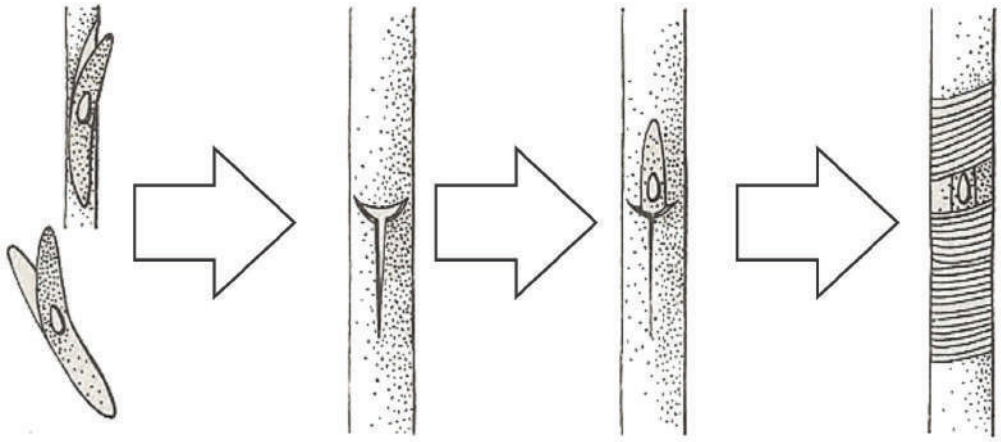


Figure 14.3 – Steps of bud grafting

There are several types of bud grafting according to the shape of the cut on the stock.

Eg :- T-bud H-bud V-bud

- **Twig grafting**

In this method, a twig of a plant is taken as the scion. Procedure of grafting is given below.

- Selecting a twig of a fruit-bearing plant (It is more suitable to select a twig which has no tender leaves, flowers or fruits).
- Cutting the twig without damaging the cut.
- Fixing the twig to the stock, so that the cambium are contacted.
- Wrapping the place from bottom to top using polythene strips.
- Removing the wrap when the twig is observed to be growing.

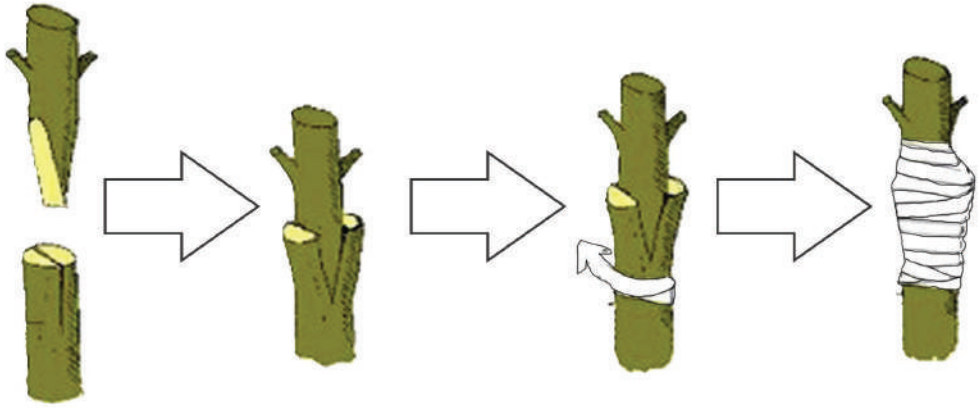


Figure 14.4 – Steps of twig grafting

According to the shapes of the cuts of the edges of stock and scion several types of twig grafting can be done.

Eg :- Arch grafting, Peg grafting

Activity 14.3

Try to perform a twig grafting or a bud grafting with the assistance of your teacher. If a grafting knife is not available for this, use any other sharp knife.

Following are some advantages of grafting and budding.

- Production of offsprings with characteristics of the scion
- Obtaining of disease resistant plants with strong root systems
- Propagation of plants that do not produce seeds successfully

Disadvantages

- Having a short life span
- Not successful with every plant
- Reduce wood value of the trees
- Low seasonal production

• Tissue culture

New offsprings, which are identical to the parental plant, can be produced by cultivating any vegetative tissue of a plant in a culture medium under controlled conditions. Offsprings thus obtained are called a **clone.**

Genetically identical clones can be obtained by tissue culture. Generally, tissues are taken from apical buds, lateral buds or root tips for this purpose.

Sucrose, mineral salts, vitamins and plant growth substances are included in the culture medium used for tissue culture. Agar is used to solidify the medium. Sterilized conditions and controlling of temperature and light should be practised for the success of tissue culture.

• Following are the principle steps followed in tissue culture

(1) Introducing the part of vegetative tissue, obtained from mother plant, into the culture medium.

(2) Allowing new roots and buds to be developed from the tissue called callus, which is grown from the vegetative tissue introduced.

(3) Separating the plantlets and placing them in test tubes or flasks to grow further.

(4) Gradually let the new plantlets to get adapted to natural conditions to be cultivated in the field.

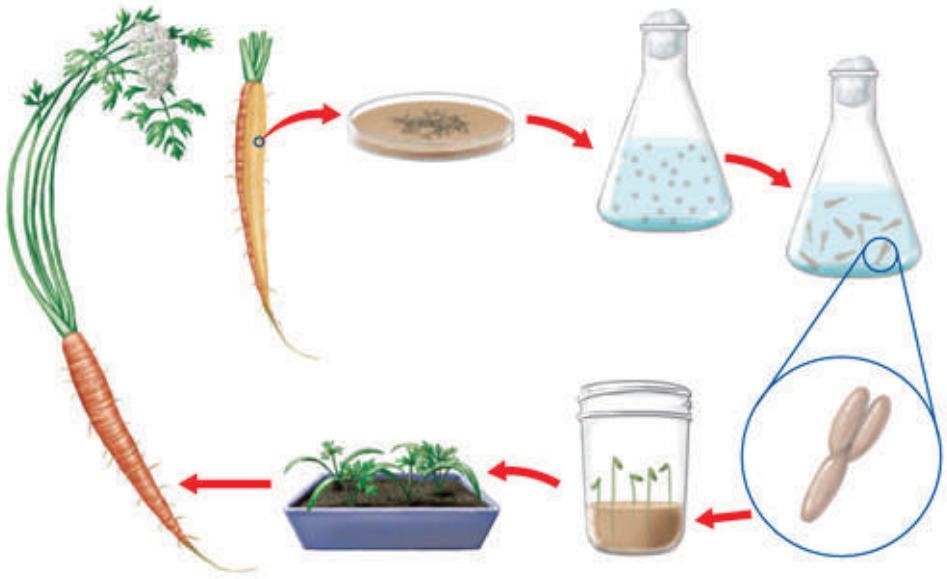


Figure 14.5- Steps of tissue culture

Following are some advantages of tissue culture.

- Production of offsprings which are identical to mother plant.
- Propagating a large number of plants at the same time.
- Production of a large number of plants in a short period of time.
- Propagation of a large number of healthy plants in a limited space.
- Can be obtained a large number of plants using a hybrid tissue with a favourable gene.

Assignment 14.2

- Prepare a list of places, where tissue culture is practising in Sri Lanka, using various sources.
- If possible, visit such a place and study the process of tissue culture.
- Name the plants, which are mostly produced by tissue culture in Sri Lanka.

Advantages of vegetative propagation

- Ability of propagating plants that do not produce seeds successfully.
- Ability of having offsprings that are identical to mother plant.
- Propagation of plants that bear fruits early.
- Ability of propagating selected plants which are resistant to diseases and pests.
- Ability of generating plant varieties which withstand harsh environmental conditions.

Disadvantages of vegetative propagation

- New varieties are not evolved

• Sexual reproduction of plants

Seeds are produced by fusion of gametes produced in sexual structures in matured plants. These seeds can grow into new plants.

Flower

The structure that bears sexual parts of a plant is the flower. Parts of a flower are arranged in whorls on the receptacle, which is located at the tip of the flower stalk or pedicel. There are four principle parts of a flower, which are given below.

- Calyx
- Corolla
- Androecium/Stamen
- Gynoecium/Pistil

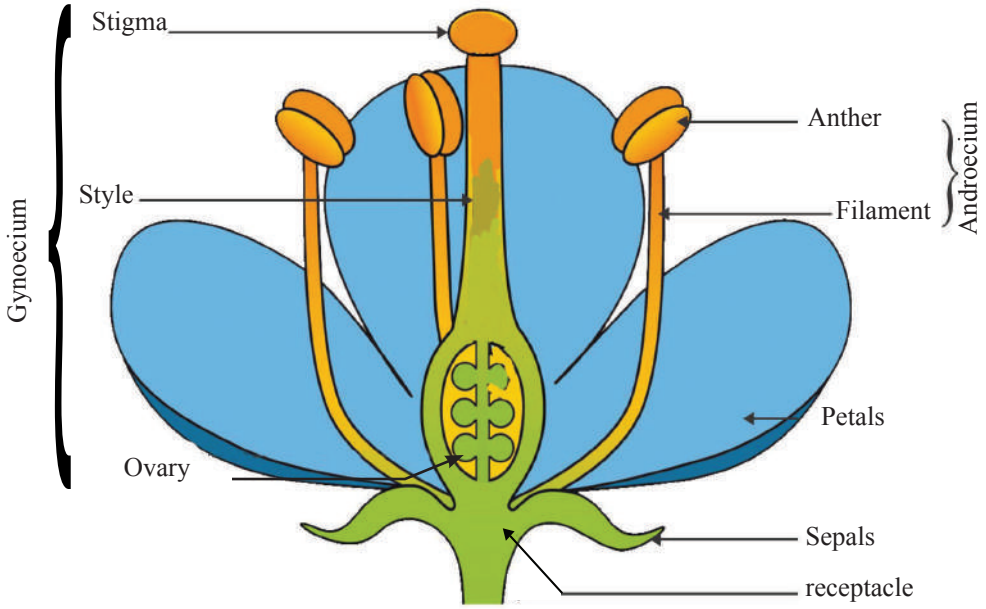


Figure 14.6 – Longitudinal section of a typical flower

(1) Calyx

Calyx is comprised of several sepals. This is the outer-most part of a flower. Calyx is the whorl of sepals located on the receptacle at the tip of the flower stalk (pedicel). This is green in colour. This protects the flower parts, when the flower is in bud stage.

(2) Corolla

Corolla is comprised of a whorl of petals, and is located inner to the calyx. This is white or colourful. Corolla protects the inner flower parts in the bud stage and attracts insects for pollination, when the flower blooms.

(3) Androecium/Stamen

Androecium is the male reproductive structure of a flower. This is comprised of a filament and an anther. There are pollen sacs in the anther which contain pollen. When matured anther bursts and pollen release. Pollen are the male gamete cells of plants.

(4) Gynoecium/Pistil

Gynoecium is the female reproductive structure of a flower. This is comprised of three parts, named stigma, style and ovary. Ovules are located in the ovary. Ovules are the female gamete cells of a flower.

Activity 14.4

- Collect some flowers. Observe and identify their parts using a hand lens.
- Invert a flower and cut longitudinally across the stalk and draw a labelled diagram.

• Bisexual flowers

Flowers that consist of both male and female parts are referred to as bisexual flowers.

Eg: Shoe flower, Passionfruit, Chilli, Kathurumurunga /Agathi

Unisexual flowers

Flowers that consist of either male or female parts are referred to as unisexual flowers. They are of two types.

(1) Staminate flowers :- The flowers that have only androecium or stamen.
Eg:- Sterile flowers of Pumpkin, apical flowers of Corn

(2) Pistilate flowers :- The flowers that have only gynoecium or pistil.
Eg:- Fruit bearing flowers of Pumpkin, fruit bearing flowers of Corn

• Monoecious plants

Plants that bear both staminate (male) flowers and pistilate (female) flowers are called monoecious plants.

Eg:- Pumpkin, Corn, Coconut, Bitter gourd

• Dioecious plants

When staminate flowers and pistilate flowers are born separately on two plants, they are called dioecious plants.

Eg :- Papaw, Vallisneria

• Pollination

The process of depositing matured pollen of a flower on the stigma of the flower of the same species is known as pollination. Pollination occurs in two ways.

(1) Self-pollination
(2) Cross-pollination

(1) Self-pollination

The process of depositing matured pollen of a flower on the stigma of the same flower is termed as self-pollination.

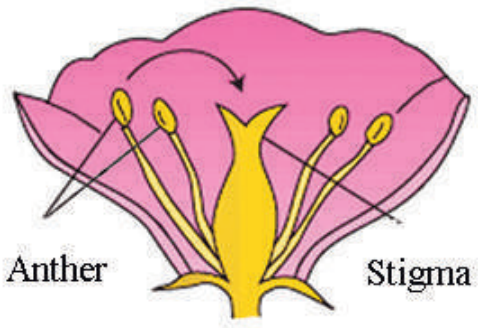


Figure 14.7 - Self- pollination

(2) Cross - pollination

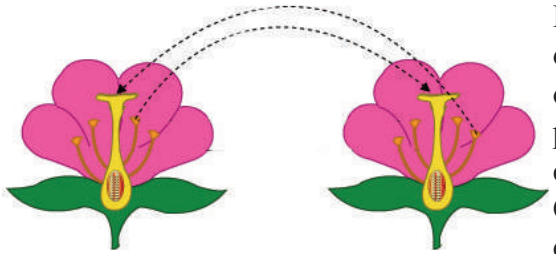


Figure 14.8 - Cross-pollination

Process of depositing matured pollen of a flower, on the stigma of a flower of same plant or a flower of another plant of the same species is termed as cross-pollination.

Cross-pollination allows to mix characteristics of two plants. It helps to give rise to a strong new generation with new characteristics. Therefore some flowers are adapted to avoid self-pollination and promote cross-pollination. Some of those adaptations are mentioned below.

1) Having unisexual flowers

Bearing of pistilate flowers and staminate flowers separately.

Eg :- Coconut, Corn

2) Self – Sterility

Fruits are not developed when pollen of a flower is deposited on the stigma of the same flower.

Eg :- Passion fruit

3) Hercogamy

This is the positioning of stamens and stigma of a flower at a distance.

Eg :- Orchid, Catharanthus

4) Having extrose stamens

Here, the stigma is positioned straight while stamens are bent aside or stamens are positioned straight while stigma is bent aside.

Eg :- Jasmin, Lebbek flower (Pinna)

5) Dichogamy

Here, Stamens are matured earlier than pistil (proterandry) or pistil is matured earlier than stamens (protogyny).

Eg:- Corn, Tridax

Passion fruit Orchid Jasmin

Figure 14.9- Flowers having adaptation to avoid self pollination

• Agents of pollination

Factors that contribute the pollination of flowers are known as agents of pollination. There are three principle agents of pollination.

1.Animals
2.Wind
3.Water

1. Animals

Flowers pollinated by animals are referred to as zoophilous flowers. Among the animals, insects contribute much for pollination. Flowers have adaptations to attract insects for the process of pollintation.

- Flowers having a fragrance
- Flowers being large
- Colourful flowers
- Having nectaries
- Pollen being sticky
- Stigma being sticky
- Stamens and stigma are located in such a way, that they are easily contacted with animals
- Flowers having shapes that cheat insects

Some examples for flowers pollinated by animals are passion fruit, winged bean, Kathurumurunga /Agaththi

Kathurumurunga /Agathi

Thunbergia

Figure 14.10- Flowers pollinated by animals

2. Wind

Flowers pollinated by wind are referred to as aerophilous or anemophilous flowers. Such flowers usually locate separately as staminate and pistilate flowers. Aerophilous flowers show following adaptations for successful pollination.

- Flowers are born at the apex of the plant
- Large amount of pollen are produced
- Pollen are very small and light
- Stigma is branched
- Flowers are in inflorescences

Examples for flowers pollinated by wind are Paddy, Corn, Grass and Coconut

Paddy

Corn

Coconut

Figure 14.11-Flowers pollinated by wind

3. Water

Flowers pollinated by water are referred to as hydrophilous flowers. Such flowers usually locate separately as staminate and pistilate flowers. When matured, staminate flower separates from the plant and floats in water. While floating it contacts with a pistilate flower and pollination takes place. Example for a flower pollinated by water is Vallisneria.

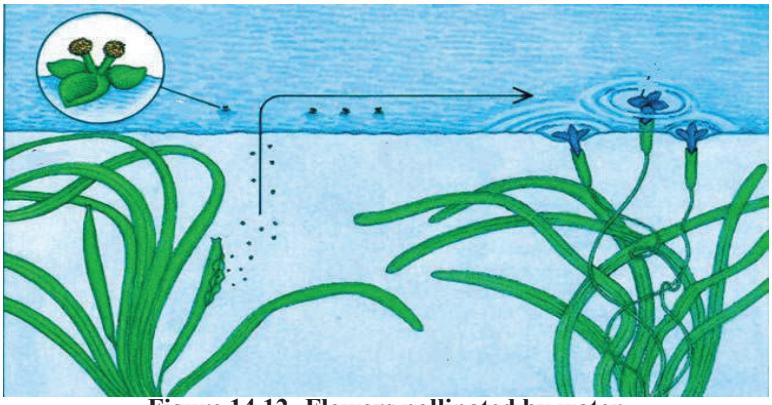


Figure 14.12- Flowers pollinated by water

For extra knowledge

Artificial pollination

The process of depositing the pollen of a flower artificially on the stigma of the same flower or on the stigma of a different flower of the same species is known as artificial pollination. This can be done with fingers or with a brush.
Eg:- Anthurium, Passion fruit

Figure 14.13 - Performing artificial pollination

- **Fertilization**

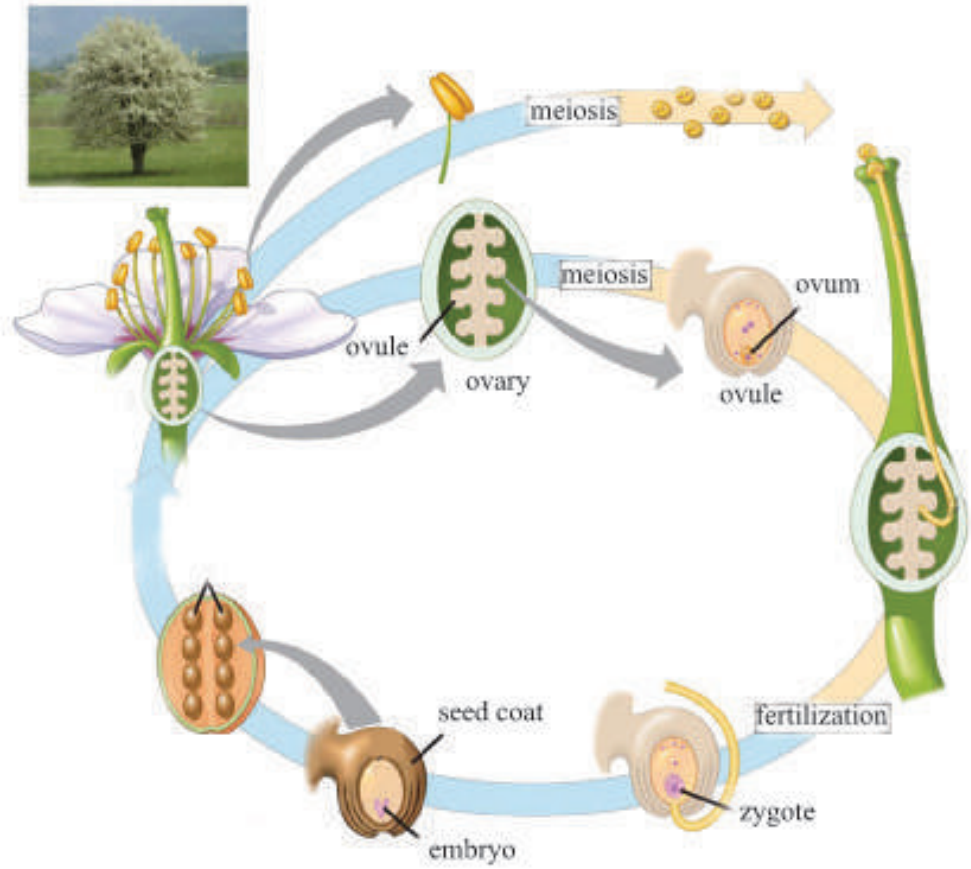


Figure 14.14 - Fertilization of gametes and formation of seeds and fruits of plants

- Pollen are deposited on stigma of the same flower or in another flower of the same species.
- When a pollen grain is deposited on the stigma, it is stimulated by the sugar solution on the stigma and germinates.
- Pollen tube grows through the style towards an ovule in the ovary.
- The male gamete in the pollen cell fuses with the ovum in the ovary and this phenomenon is known as fertilization.

• Production of fruits and seeds

After fertilization zygote develops to form an embryo. The flower undergoes several changes after fertilization.

- Ovary develops to form the fruit.
- Wall of the ovary becomes the pericarp.
- Fertilized ovule develops to a seed, and wall of the ovule becomes the testa or the seed coat.
- Normally sepals, petals, stamens and stigma are worn out. But in some flowers, sepals become fleshy and are attached to the pericarp after fertilization.
  Eg :- Guava, Brinjal, Mangosteen, Rose apple

Process of developing fruits without fertilization is known as parthenocarpy. Artificial growth substances are used to develop fruits in that manner. Such fruits are seedless.
Eg :- Grapes, Orange, Apple

• Dispersal of fruits & seeds

Spreading away of the fruits and seeds from the mother plant is referred to as dispersal of fruits and seeds. Plants fulfil their following requirements by that process.

- Competition for essential requirements is minimized
- New habitats are found
- Diversity is increased
- Protection from pests and agents of diseases

• Methods of dispersal of fruits and seeds

There are four principle methods of dispersal of fruits and seeds, as mentioned below.

- By animals
- By water
- By wind
- By explosive mechanism

Assignment 14.3

- Identify and name the agent of dispersal of fruits that you come across.
- Mention two adaptations that each fruit has for its method of dispersal.

• Dispersal of fruits and seeds by animals

Fruits and seeds that are dispersed by animals may have following adaptations.

- There are succulent edible parts
  Eg :- Mango , Papaw
- There are attractive colours
  Eg :- False fruit of Cashew, Banana
- There are hooks or hairs assist to be attached
  Eg :- Nagadarana/Maramunthigai, Epala/Amanakku, Love grass (Tuththiri)
- There are shapes and patterns to cheat animals
  Eg :- Oil castor, Red bead (Madatiya/Manjadi), Olinda/Kunrimani, Bitter gourd

Mango | False fruit of Cashew | Bittergourd

Figure 14.15- Fruits and seeds dispersed by animals

• Dispersal of fruits and seeds by wind

Fruits and seeds dispersed by wind have following adaptation.

- Having structures like threads to float in air
  Eg :- Milk weed (Wara/Erukkala), Cotton, Imbul
- Possess wing – like structures to float
  Eg :- Hora/Ennei, Gammalu, Drum sticks.
- Fruits and seeds born at the apex of the plant.
  Eg :- Mahogani, Hora/Ennei
- Seeds being very light
  Eg :- Orchid
- Production of fruits and seeds in large numbers.
  Eg :- Grass, Mahogni, Milk weed (Wara/Erukkalai), Cotton


Cotton


Hora


Mahogani


Grass

Figure 14.16 - Fruits and seeds dispersed by wind

• Dispersal of fruits and seeds by water

Fruits and seeds dispersed by water possess following adaptations.

- Having porous or fibrous pericarps

  Eg :- Coconut, Ceylon almond, Sea mango (Diya kaduru/ Kalliththi)

- Possess pericarps that are suit for floatation.

  Eg :- Lotus

- Having air-filled shells

  Eg :- Water lily


Coconut


Ceylon almond


Lotus

Figure 14.17 - Fruits and seeds dispersed by water

• Dispersal of fruits and seeds by explosive mechanism

Pericarp of the fruit of some plants explodes and the seeds are dispersed far away. Touch, moisture or dry weather conditions can cause explosion.

Eg :- Rubber, Ladies fingers, Koodalu, Red bead (Madatiya/ Manjadi)


Rubber


Madatiya/Manjadi

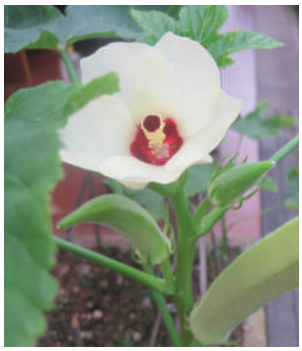

Ladies fingers

Figure 14.18- Fruits and seeds dispersed by explosive mechanism

Germination of seeds

Activation of the embryo in a seed and its development to form a seedling is known as seed germination. Following factors are essential for seed germination.

1) Viability of seed
2) Air (Oxygen)
3) Water or moisture
4) Optimum temperature

When a seed is germinating, water activates the enzymes in the cotyledons, and stored complex food is digested to simple nutrients. The nutrients help to develop the radical and the plumule.

Dormancy of seeds

Sometimes seeds do not germinate, though the essential factors for germination are fulfilled. This condition is known as dormancy.

Seeds show dormancy as an adaptation for adverse environmental conditions. Following factors affect the dormancy of seeds.

1) Embryo being not matured
2) Impermeability of testa for water or oxygen

Various methods are practised to remove the dormancy of seeds before germinating them. Some of them are mentioned below.

1) Storing seeds for some period of time
2) Burning the villi on the seed coat or testa of Teak seeds
3) Removing the seed coat of Orange seeds
4) Keeping the seeds of Lead tree (Ipil Ipil) in hot water
5) Gently cracking the seed coat of (Nelli/Nellikai) seeds

Activity 14.5

Design a suitable activity to investigate the external factors for seed germination.

For extra knowledge

Seed germination occurs mainly in two ways.

1) Hypogeal germination
2) Epigeal germination

Hypogeal germination

Here, when the seed germinates, plumule emerges up from the soil, but cotyledon does not emerge up from the soil. Cotyledon and endosperm supply food for the seedling at its early stage. But colyledon does not produce food by photosynthesis. Most of the monocotyledonous plants show hypogeal germination.

Eg :- Coconut, Corn

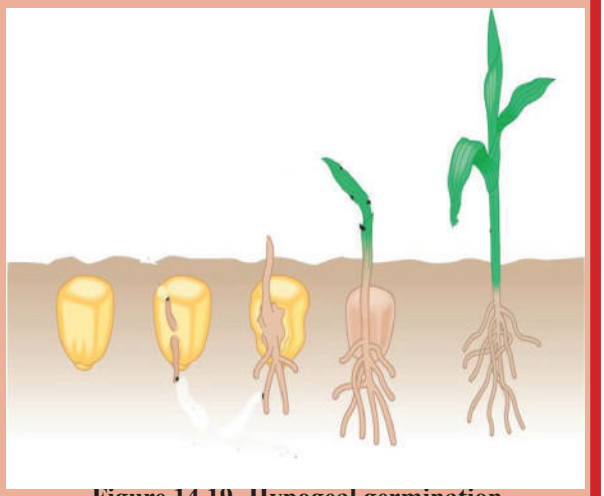


Figure 14.19- Hypogeal germination

Epigeal germination

Here, when the seed germinates, plumule emerges up from the soil, cotyledons also emerge up from the soil. Moreover, cotyledons produce food by photosynthesis in addition to supply stored food for the seedling in its early stage. Most dicotyledonous plants show epigeal germinaton

Eg :- Bean, Tamarind

Figure 14.20- Epigeal germination

14.3 Reproduction of man

• Puberty (Adolescence)

Sexual matuarity or attaining adolescence is referred to as puberty. Secondary sexual characteristcs which differentiate males and females begin to appear from the puberty

• Secondary sexual characters

Characters that appear in male and female from puberty are known as secondary sexual characters.

• Secondary sexual characters of males

These changes start to appear between the age of 13-16 years. The action of Testosterone hormone is responsible for this.

- Pubertal hair grows on face , chest, under arm pits and in genital areas.
- Shoulders grow wide.
- Larynx enlarges and voice becomes deep.
- Bones and muscles grow faster and the growth of body is accelerated.
- Testes start to produce sperms.
- Genitals start to grow larger.

• Secondary sexual characters of female

These changes start to appear between the age of 10-14 years. The action of Oestogen and Progesterone are responsible for this.

- Pabertal hair graws on arm-pits and on genital area.
- Pubic region widens.
- Mammary glands start to grow.
- Fat deposits in the subcuticle and body becomes fat.
- Bones and muscles grow fast and the growth of body is accelerated.
- Releasing of ova from ovaries (menstrual cycle) starts.

• Process of reproduction

Reproductive cells or gametes should be produced for the process of reproduction. This occurs in reproductive systems.

• Male reproductive system

Main parts of the male reproductive system

■ Testes / Testicles

A pair of testes which are oval in shape are located in a sac called scrotum or testes sac. Sperms are produced in these structures. A testes is comprised of about 250 testical lobules. There are about 1000 convoluted tubles which are called seminiferous tubules in them. Sperm mother cells are produced in seminferous tubules.

- Pair of epididymis

All the vas efferenses in a testes emerge out of the testes and are opened to a single convoluted tube called epididymis. Sperms are temporarily stored in it.

- Pair of vas deferenses

The tube that brings sperms from epididymis is called vas deferens. The other end of it is joined to the tube coming from seminal vesicles.

- Pair of seminal vesicles, prostrate gland and pair of Cowper's glands

These are the glands associated with male reproductive system. These glands secrete a white fluid. This secretion is released into the urethra. This fluid is improtant to provide nutrition to the sperms and their transportation. Sperms and this white fluid is collectively known as seminal fluid or semen.

- Penis

This is the muscular organ which is important in ejection of semen into female reproductive system. This becomes rigid when blood supply is increased. Urethra opens out through penis. The tip of the penis is called glans penis and it is covered by prepuce or foreskin.

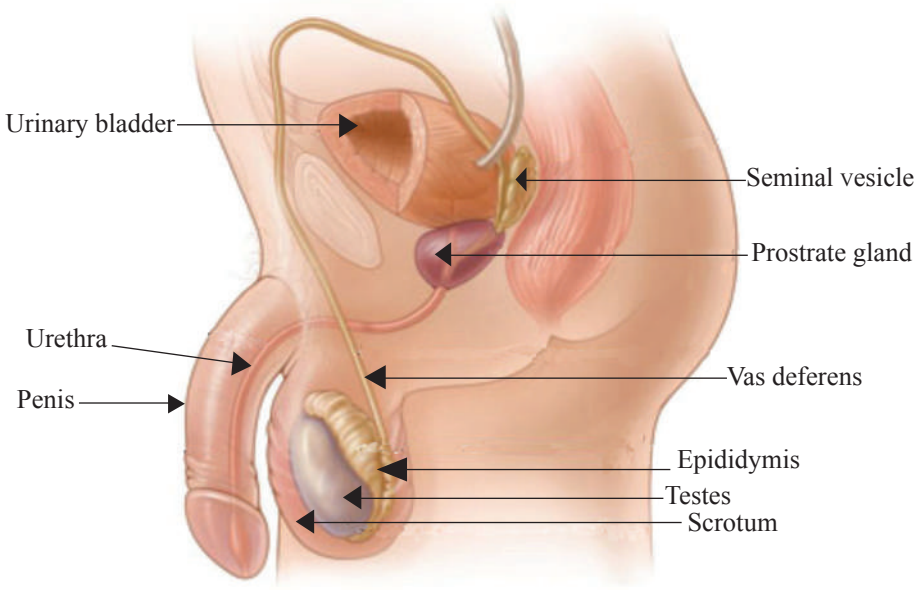


Figure 14.21 - Male reproductive system

Functions of male reproductive system

Production of sperms begins when a male attains his puberty. Sperms are formed from the sperm mother cells which are in the seminiferous tubules. When sperms are temporarily stored in epididymis. During the copulation, sperms pass through

vas deferens and are collected to the urethra. At the same time, the secretion of the prostrate gland and Cowper's glands are also mixed with sperms. The secretion mixed with sperms is called semenal fluid or semen. There are millions of sperms in one milliliter (1 ml) of semen.

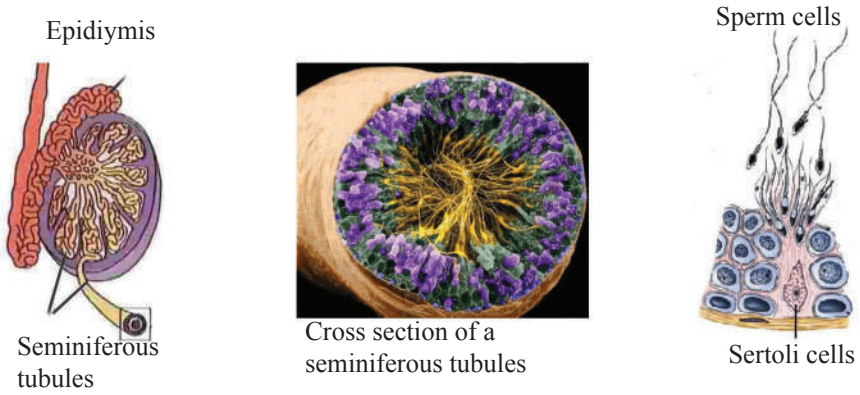


Figure 14.22 - Structure of seminiferous tubule

Process of generating sperms is very sensitive to temperature. The temperature in the testes should be lower than body temperature for the production of healthy sperms. That is the reason for testes to be in a sac called scrotum out side the body. Matured sperm is motile and consists of three parts named head, body and tail.

• Functions of male reproductive system

- Production of sperm cells
- Ejection of sperms into female reproductive system
- Production of Testosterone

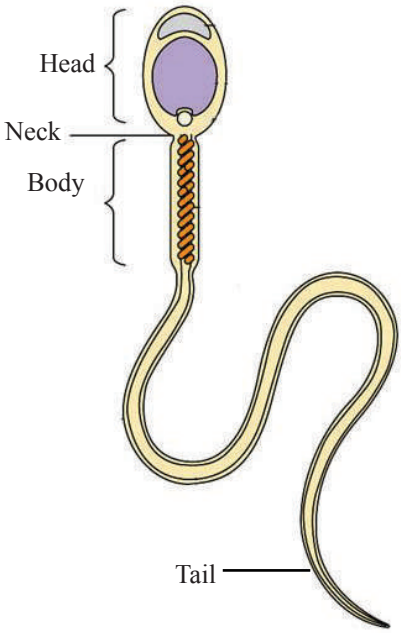


Figure 14.23 - Structure of a sperm under electron microscope

• Female reproductive system

Main parts of the female reproductive system

- Ovary

There is a pair of ovaries close to the lateral walls of pelvic area in the abdominal cavity. In a cross section of an ovary, there are two zones known as cortex and medulla. Ova are produced in follicles. Each ovary contains primary follicles and various stages of production of ova such as graafican follicles, corpus luteum and corpus albicans. Production of ova starts at the birth of a female.

- Fallopian tube

Ovum that comes out of the ovary enters into long musculer tube called fallopian tube. The end of this tube, which is close to the ovary is funnel-like and has finger-like projections called fimbria. These are important in transferring the ovum into fallopian tube.

- Uterus

This is a hollow structure positioned in pelvic area. There are three zones in uterus named as fundus, body and cervix. Two follopian tubes are connected to the zone called fundus. The other end of uterus is cervix.

- Vagina or Endocervical canal

Vagina starts from the cervix and opens to the exterior from the opening called vulva.

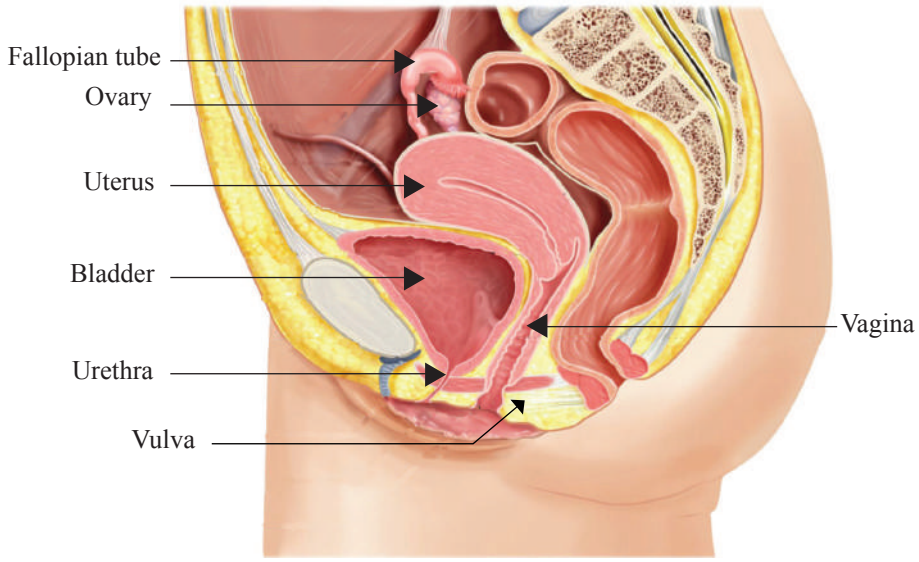


Figure 14.24 - Location of female reproductive system

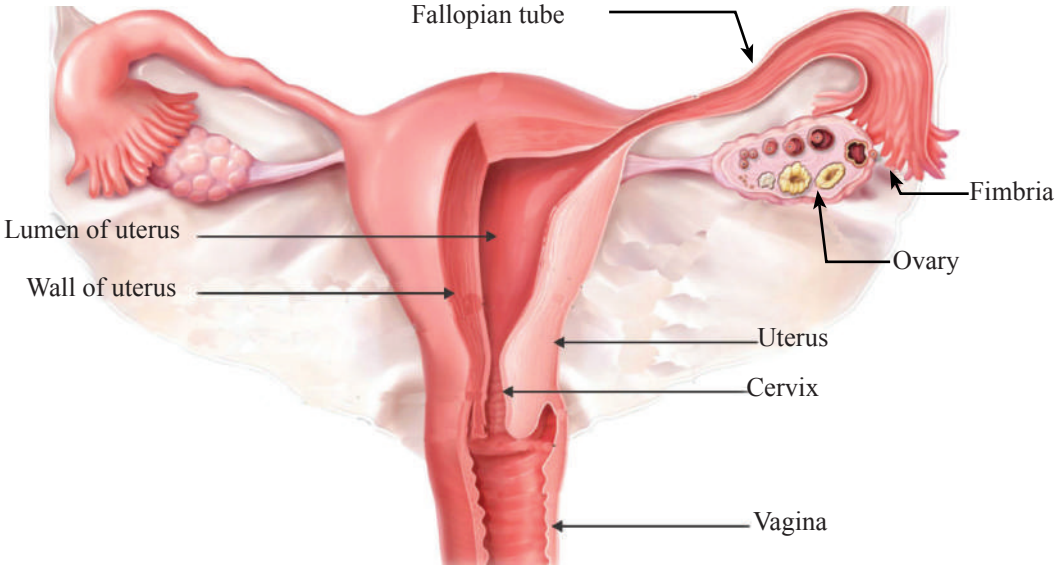


Figure 14.25 - Female reproductive system

Functions of female reproductive system

Production of ova in females initiate since foetal stage. At birth each ovary contains 200 000 - 400 000 primary follicles. Nearing puberty, one of the primary follicles develops to form a multicellular structure called graafian follicle. It reaches the peripheral area of the ovary.

When matured, graafian follicle bursts to release the ovum which is directed towards the fallopian tube by fimbria. Then the ovum passes through the fallopian tube towards the uterus.

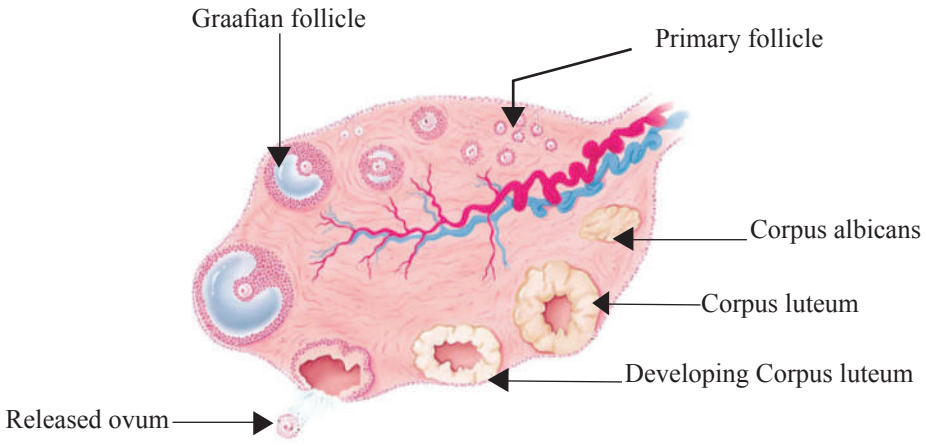


Figure 14.26 - Cross section of an ovary with various stages of ovum

• Activities of female reproductive system

- Developing of ova which are the female reproductive cells
- Facilitate the developing of foetus
- Production of hormones Oestrogen and Progesterone

• Menstrual cycle

The cyclic process associated with the reproductive systems of sexually matured females as known as menstrual cycle. For one menstrual cycle, it takes appoximately 28 days.

Here the pair of ovaries releases the egg cells or ova alternatively. The whole process of menstrual cycle takes place associated with two locations.

1. Changes that take place in the ovary
2. Changes that take place in the uterus

1. Changes that take place in the ovary

Development and release of ova, which are the female reproductive cells, are carried out by ovary. Changes that occur in the ovary can be divided into two stages.

1. Follicular phase
2. Luteal phase

Follicular Phase

This is the initial phase. Under the influence of Follicle Stimulating Hormone (FSH), secreted by pituitary, a primary follicle in the ovary develops to form a graafian follicle, which is ready to release an ovum. This takes about 14 days. During this phase, ovary secrets Oestrogen.

Luteal Phase

This is the final phase. When graafian follicle is matured, it bursts and the ovum inside it is released from the ovary into the fallopian tube, under the influence of Lutenising Hormone (LH), secreted by pituitary gland. If fertilization does not occur, when the ovum is passing forward through fallopian tube, the remaining part of graafian folicle changes to form corpus luteum and finally to corpus albicans and fades off. This whole process occurs during luteal phase and it takes about 14 days, During this phase ovary secrets progesterone.

2. Changes that take place in uterus

If an ovum is feritlized, the embryo develops in the uterus. Changes that occur in uterus are divided into three phases.

1. Menstrual phase
2. Proliferation phase
3. Secretory phase

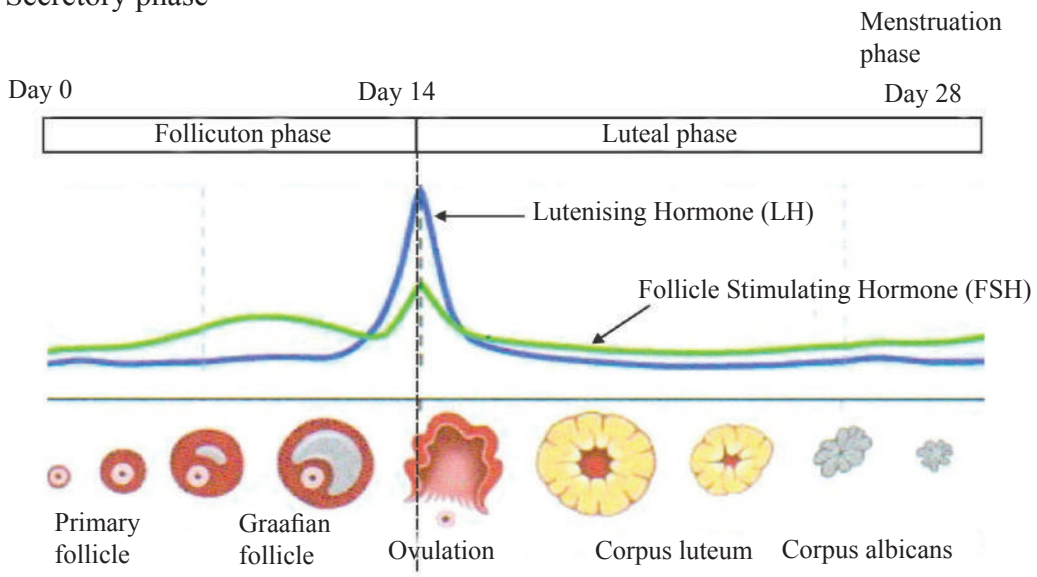


Figure 14.27 - Changes in the ovary during menstrual cycle

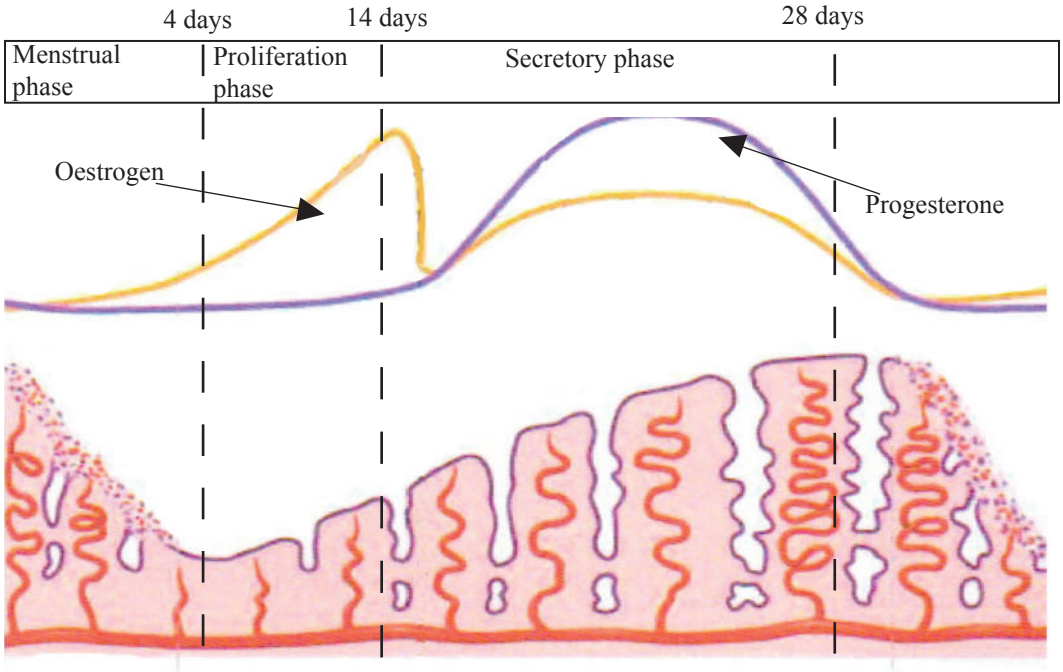


Figure 14.28 - Changes that take place in uterus

Menstrual phase

This is the initial phase. If fertilization does not take place, level of Progesterone decreases. This causes the degradation of the wall of uterus and it is expelled out from the body through vagina with blood. This is referred to as menstrual flow and occurs for about four days.

Proliferation phase

This is the second phase. Degraded wall of uterus starts to re-build because of the influence of Oestrogen. New cell layer and blood capillaries grow on the inner wall of the uterus. It takes about 10 days for this.

Secretory phase

This is the final phase. Uterine wall thicknes and blood supply is also increased. Glands on the uterine wall are activated and it becomes secretory. This happens because of the influence of hormone Progesterone. It takes about 14 days for this. Body temperature also increases slightly during this period.

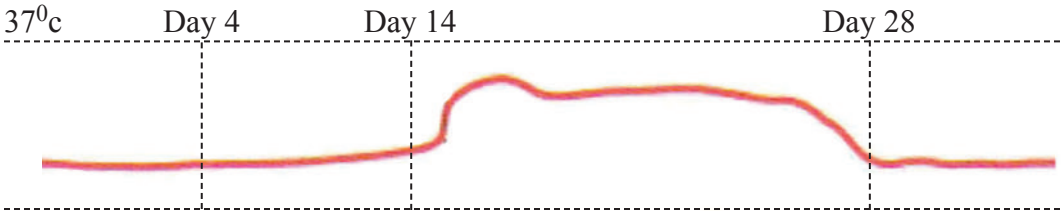


Figure 14.29 - Changes of body temperature during menstrual cycle

• Fertilization and Implantation

During the copulation, seminal fluid (semen) is released into the vagina. Sperm cells in semen, swimming in the fluid, pass through uterus towards the upper part of fallopian tube. Then one of the sperms fuses with the ovum passing down toward the uterus. Here nucleic matter of the ovum and the sperm fuses together. This phenomenon is called fertilization.

Figure 14.30 - Fertilization of a sperm and an ovum

Fertilized ovum is referred to as zygote. While it is rolling towards uterus, it divides to increase the number of cells. Then it is known as morula. Morula distintegrates the tissues of uterine wall, sinks and deposits in the wall. This is known as implantation or interplantation.

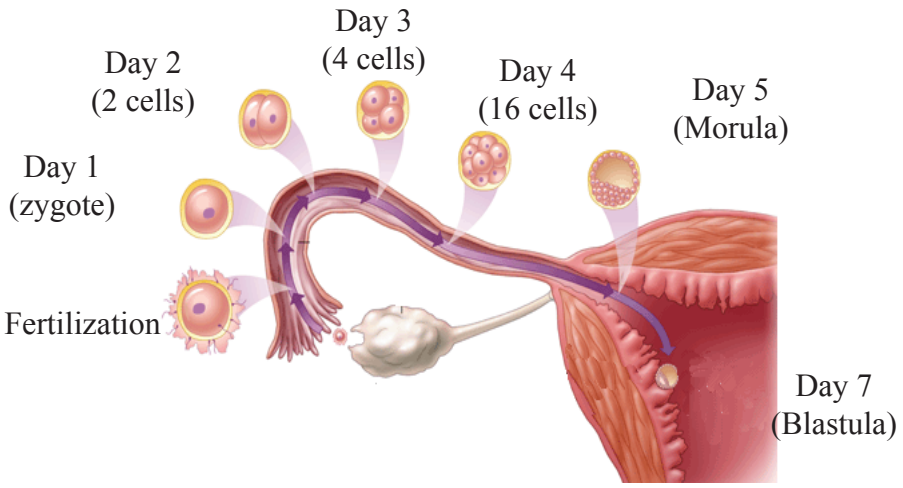


Figure 14.31- From fertilization to implantation

• Development of foetus

After implantation, foetal development occurs with the division of cells. In about six weeks, protective membrances called embryonic membrances develop. There is a fluid in them. Foetus is sunk in this fluid. The place that the embroyonic membranes connect with uterine wall is known as placenta. Material exchange from mother to foetus and foetus to mother occurs through umbilical cord. Umbilical cord is the tissue in placental mammals, through which nutrients and oxygen are exchanged between the mother and the foetus. Though nutrients, oxygen and agents of diseases (some disease causing microoganisms like virus) transfer from mother to foetus, Blood exchange does not occur through umbilical cord. Removal of excretory products and carbondixoide also occurs through umbilical cord. Principle changes in foetal development with time are given in the table below.

Table : 14.2- Principle changes of foetus with time

Time period (Months)	Principle changes of foetus with time
03	■ Takes human form ■ Head of foetus is large, with respect to other body parts ■ Development of nails starts ■ Male and female sex organs are developed
04	■ Development of skeleton starts ■ Hair begins to grow
05	■ Foetus is completely covered with hair ■ Mother can feel the movements of foetus for the first time ■ Heart beat of foetus can observe from out side (average rate of heart beat is 120-140 per minute)
06	■ Eyebrows and eyelashes have developed
07	■ Eyelids open ■ Skin is in wrinkled nature
08	■ Subcutaneous fat begins to deposit ■ Weight of foetus is about 2 1/2 kg
09	■ Nails of fingers have completely grown ■ Testes are positioned in scrotum ■ Body shows a full grown nature ■ Weight of foetus is about 2 1/2 -3- 1/2 kg

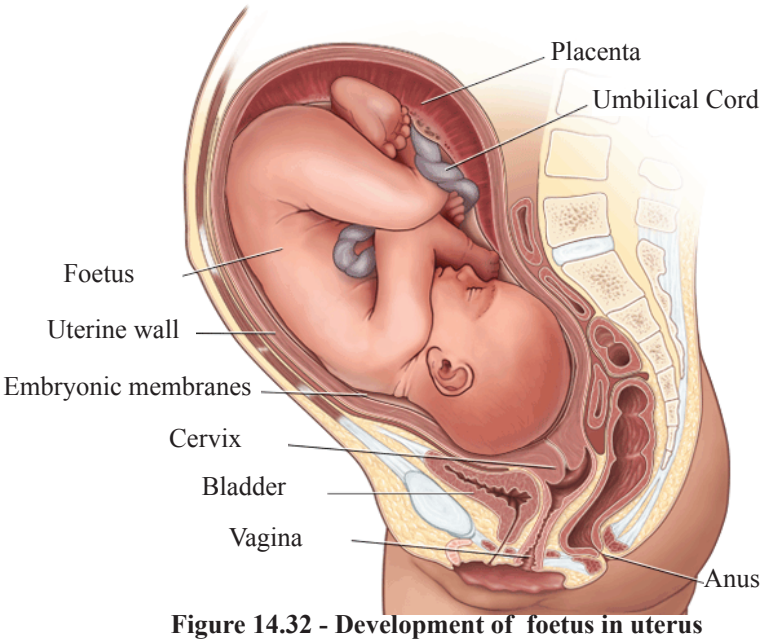


Figure 14.32 - Development of foetus in uterus

• Child birth or Parturition

When it is close to child birth, head of the foetus in uterus, turns towards vagina. After completion of development for about 280 days, foetus is pushed outside through vagina by the contraction of muscles of uterus. This process is known as child birth or parturition. Further contraction of uterine wall, disconnects the placenta and associated tissues.

After parturition the umbilical cord that connected placenta and foetus is cut and tied.

Assignment 14.4

- List out the materials that pass from mother to foetus through umbilical cord.
- List out the materials that pass from foetus to mother through placenta.

Hormonal co-ordination

Human reproduction process is completely regulated by hormones. This can be seen in both males and females. Here several hormones such as FSH, LH, Testosterone, Oestrogen, Progesterone, secreted by several endocrine glands are important.

14.4 Sexually transmitted diseases

Diseases transmit from one person to another, mainly because of a sexual contact and sexual secretions are known as sexually transmitted diseases.These are transmitted due to blood transmission too. Symptoms of such diseases can usually be found on sex organs. About 20 of such diseases are identified so far. Some of them, which are common , are discussed below.

(1) Gonorrhoea
This is transmitted by the bacterium called *Neisseria gonorrhoeae.* Secretions from sex organs, pain, blockage of fallopian tube are some of its symptoms. This disease can be cured and if not treated it will result in blindness and lameness.

(2) Syphilis
This is transmitted by the bacterium called *Treponema pallidum.* After about three months of infection, painless blisters appear on sex organs.They are automatically cured. After about six months, fever and pain in throat appears. If treated in early stages this disease can be cured. Pathogens can exist in blood for a long time and can spread to other organs also.

(3) Herpes
This is transmitted by a virus called *Herpes simplex.* Highly painful blisters on sex organs are the symptoms. This inactivates the nervous system and is deep-rooted. Though it is not fatal, it has no permanant treatment.

(4) Acquired Immuno-Deficiency Syndrome (AIDS)
This is transmitted by *Human Immunodeficiency Virus (HIV).* Symptoms may appear in about 2- 15 years after infection. This may be fatal and cannot be cured. AIDS is tranmitted by sexual secretions and blood. To keep off from this disease, risk activities and vectors should be avoided.

It is possible to avoid sexually transmitted diseases by being responsible during sexual activities.

Summary

- Reproduction of organisms is of two types. They are sexual reproduction and asexual reproduction.
- Sexual reproduction is the reproduction, associated with sexual structures and sexual processes.
- The principle method of asexual reproduction in plants is the vegetative propagation. There the plants reproduce by aerial or underground parts.
- Natural vegetative propagation of plants occur by roots, leaves, suckers, runners, bulbils and underground stems
- Artificial vegetative propagation of plants is carried out by methods like stem cuttings, layering, grafting and tissue culture
- Flower, which is the sexual structure of plants, consists of calyx, corolla, androecium and gynoecium.
- Animals, wind and water contribute, for pollination of flowers. Flowers have special adaptations for pollination by each agent.
- After pollination, flowers produce fruits and seeds. Animals, wind, water, and explosive mechanism contribute for dispersal of fruits and seeds.
- Sexual maturity of man is referred to as puberty. Secondary sexual characters appear at this stage.
- Male reproductive system produces sperms and female reproductive system produces ova for sexual reproduction.
- Embryo is developed by the zygote which results in the process of fertilization of a sperm and an ovum.
- The cyclic process that is associated with the reproductive system of sexually matured females is called menstrual cycle.
- Gonorrhoea, Syphilis, Herpes and AIDS are some of the diseases that are sexually trasmitted.

Exercises

(1) Mention the differences between sexual reproduction and asexual reproduction.

Sexual Reproduction	Asexual Reproduction

(2) State the structures associated with vegetative propagation of plants with examples.

(3) Mention some practical problems that you may face in grafting plants.

(4) "Vegetative propagation is more suitable than sexual reproduction for a better yield in plants". Clarify this idea.

(5) Name the main parts of a flower and write down their functions.

Plant part	Functions
.....	.....
.....	.....
.....	.....
.....	.....

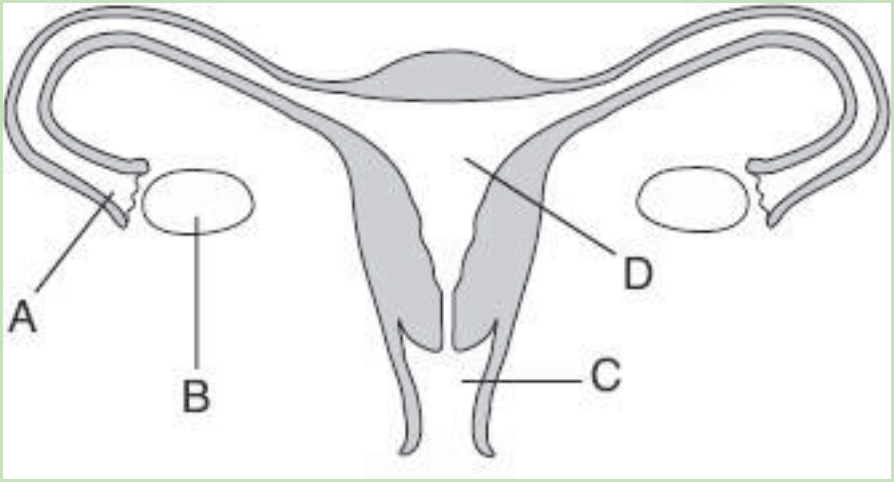
(6) What are the advantages of cross-pollination when compared with self-pollination?

(7) Write down the problems that may arise if dispersal of fruits and seeds does not occur .

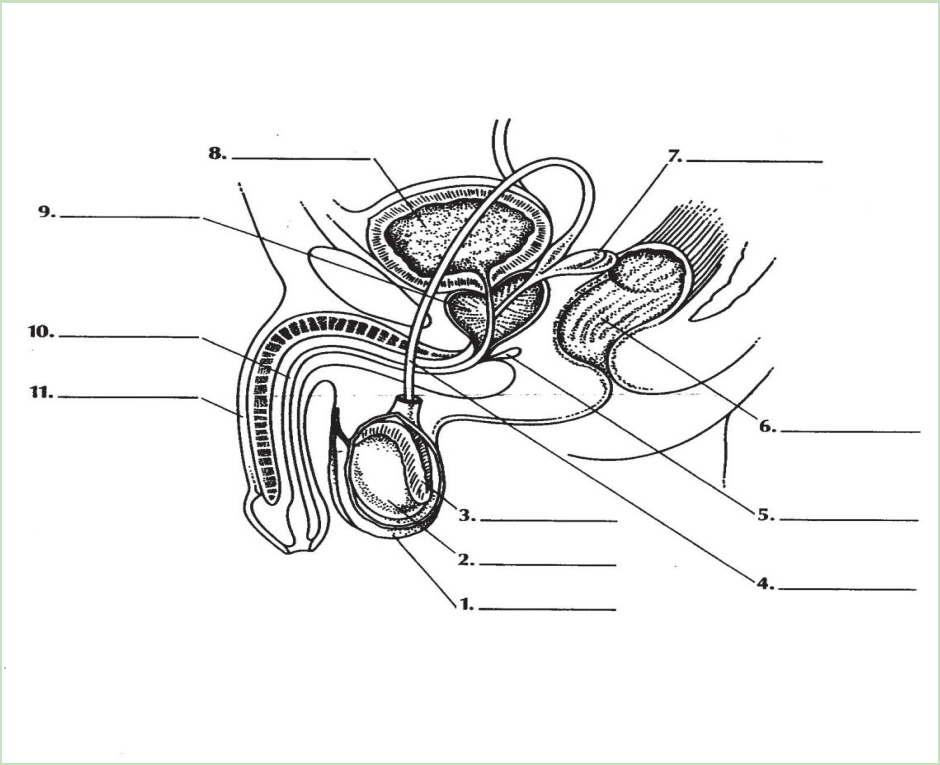
(8) Enlist the changes in males and females during puberty.

Changes occur in males	Changes occur in females

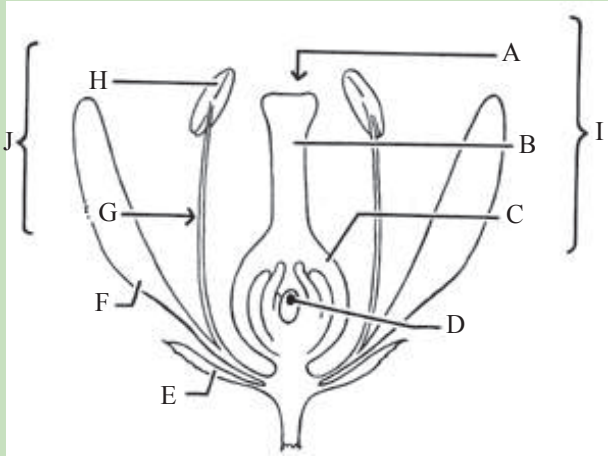
(9) Given below is a diagram of a female reproductive system. Name the parts indicated



(10) Given below is a diagram of a male reproductive system. Name the parts indicated.



(11) A line diagram of a typical flower is given below. Name the parts indicated.



Technical terms				
Reproduction	-	ප්‍රජනනය	-	இனப்பெருக்கம்
Asexual reproduction	-	අලිංගික ප්‍රජනනය	-	இலிங்கமில்முறை இனப்பெருக்கம்
Sexual reproduction	-	ලිංගික ප්‍රජනනය	-	இலிங்கமுறை இனப்பெருக்கம்
Vegetative propagation	-	වර්ධක ප්‍රචාරණය	-	பதியமுறை இனப்பெருக்கம்
Tissue culture	-	පටක රෝපණය	-	இழைய வளர்ப்பு
Pollination	-	පරාගණය	-	கருக்கட்டல்
Fertilization	-	සංසේචනය	-	கருக்கட்டல்
Seed dormancy	-	බීජ සුප්තතාව	-	வித்துக்களின் உறங்குநிலை
Zygote	-	යුක්තාණුව	-	நுகம்
Foetus	-	භ්‍රූණය	-	முதிர் மூலவுரு