

**ABDUR REHMAN
BIOLOGY**

16 Development of organisms and continuity of life

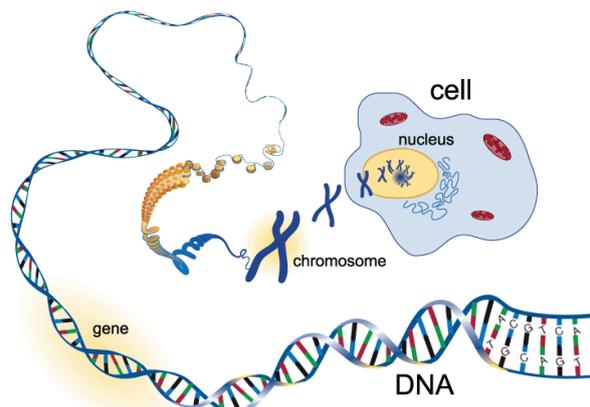
16.1 Nuclear division

Understand that chromosomes contain DNA, which carries genetic information in the form of genes.

Describe a haploid nucleus as a nucleus containing a single set of chromosomes.

Describe a diploid nucleus as a nucleus containing two sets of chromosomes. State that in a diploid cell there is a pair of each type of chromosome and in a human diploid cell there are 23 pairs.

Inside a nucleus are thread-like structures called chromosomes, which can be seen most clearly when the cell is dividing. A chromosome contains a DNA molecule which carries genetic information in the form of genes. Genes are specific sequences of DNA that contain the information required to produce proteins, which are the building blocks of cells and perform various functions within the body. Each gene carries the instructions for a particular trait or characteristic, such as eye color, blood type, or susceptibility to certain diseases.



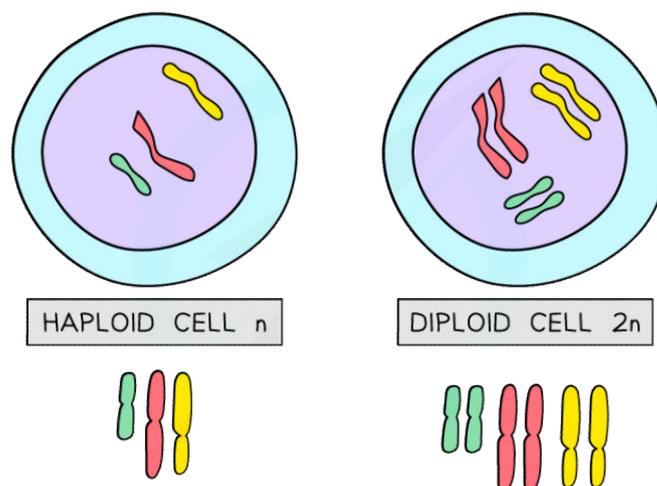
Haploid Nucleus

A haploid nucleus is a nucleus containing a single set of chromosomes. These haploid nuclei then serve as the genetic material for gametes (sex cells), such as sperm and eggs, which fuse during fertilization to form a new organism with a diploid genome.

Diploid Nucleus

A diploid nucleus is a nucleus containing two sets of chromosomes. In diploid organisms, such as most animals and plants, each somatic (non-reproductive) cell contains two complete sets of chromosomes, one inherited from each parent.

In humans, a diploid cell contains 23 pairs of chromosomes, for a total of 46 chromosomes. This includes 22 pairs of autosomes, which are chromosomes that determine non-sex-related traits, and one pair of sex chromosomes, which determine an individual's sex (XX for females and XY for males). Each pair of chromosomes in a human diploid cell consists of one chromosome inherited from the mother and one from the father, resulting in a total of 23 pairs.

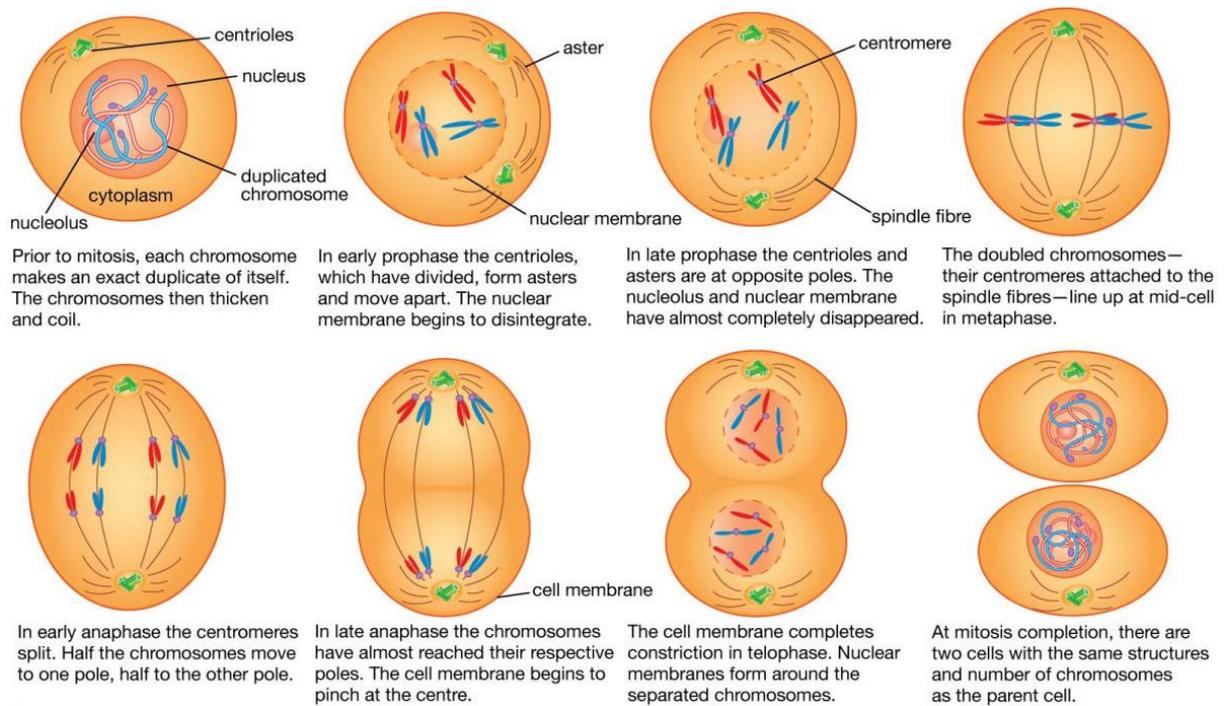


Describe mitosis as nuclear division giving rise to genetically identical cells in which the chromosome number is maintained (details of stages are not required)

Mitosis

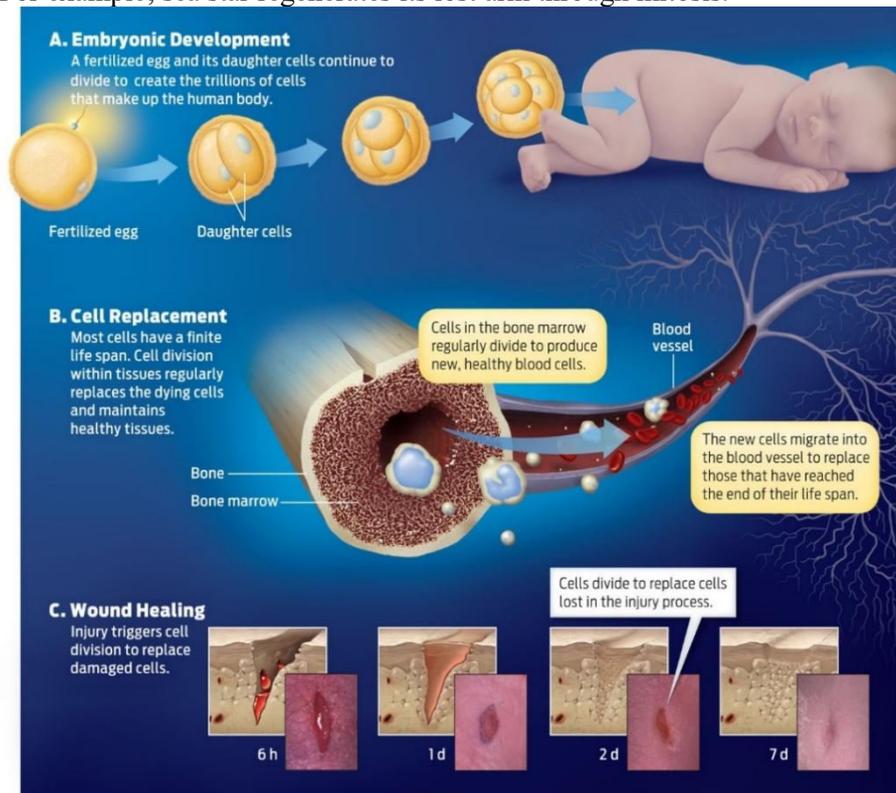
Mitosis is a process of nuclear division that gives rise to genetically identical cells in which there is an accurate distribution of replicated chromosomes to two daughter cells.

The main stages of mitosis include prophase, metaphase, anaphase, and telophase, followed by cytokinesis, where the cytoplasm divides to form two distinct cells. Before mitosis initiates, chromosomes undergo replication, producing exact copies composed of two parallel strands. Replication ensures the formation of replicas of each chromosome. During mitosis, these replicated chromosomes segregate, ensuring that each daughter cell receives the correct number of chromosomes. Thus, mitosis in a human cell with 46 chromosomes yields two identical daughter cells, each containing 46 chromosomes. Each cell divides into two daughter cells. Both of which may grow and divide again or may differentiate into a specialized cell. After differentiation, cell loses its ability to divide and it continues its growth.

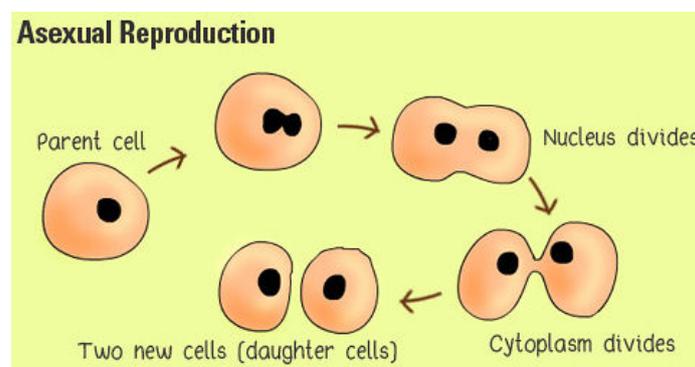


Outline the role of mitosis in growth, repair of damaged tissues, replacement of dying cells and asexual reproduction.

The number of cells within an organism increase by mitosis. This is the basis of the development of a multicellular body from a single cell i.e. zygote and also the basis of the growth of multicellular body. In some parts of body, e.g. skin and digestive tract, cells are constantly sloughed off and replaced by new ones. New cells are formed by mitosis and so are exact copies of the cells being replaced. Similarly, red blood cells have short life span (about 4 months) and new red blood cells are formed by mitosis. Some organisms can regenerate parts of their bodies. The production of new cells is achieved by mitosis. For example; sea star regenerates its lost arm through mitosis.



Some organisms produce genetically similar offspring through asexual reproduction. Mitosis is a mean of asexual reproduction. For example; hydra reproduces asexually by budding. The cells at the surface of hydra undergo mitosis and form a mass called bud. Mitosis continues in the cells of bud and it grows into a new individual. The same division happens during asexual reproduction (vegetative propagation) in plants.

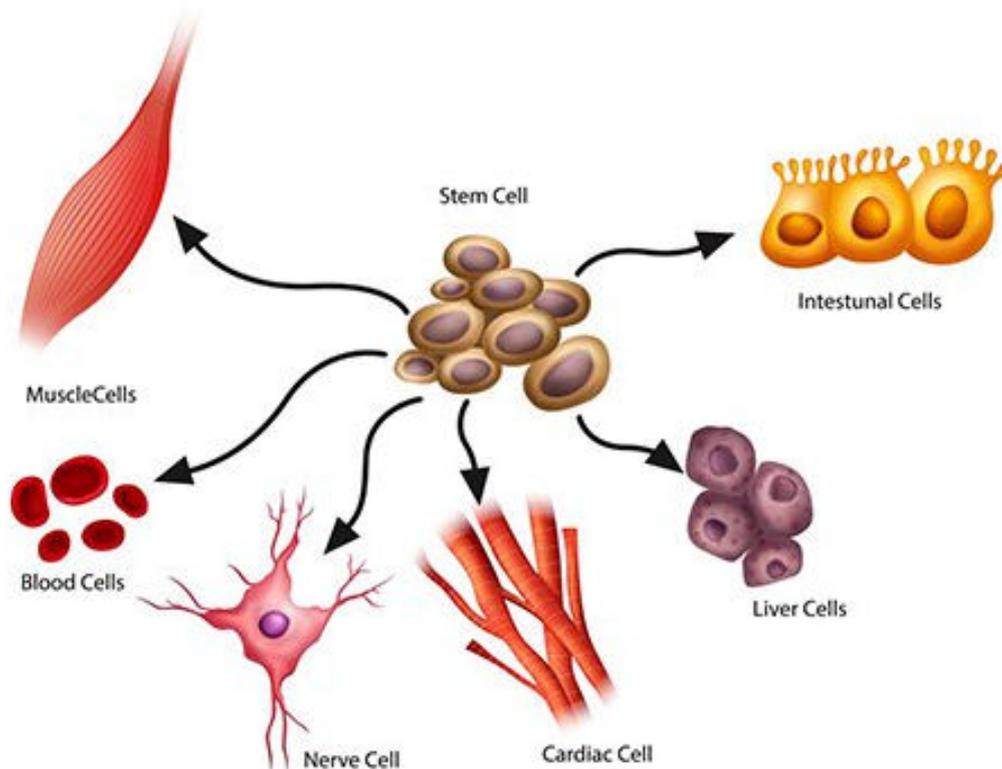


Describe stem cells as un specialised cells that divide by mitosis to produce daughter cells that can become specialised for specific functions.

Stem Cells

Stem cells are un specialised cells that divide by mitosis to produce daughter cells that can become specialised for specific functions.

These cells serve as the building blocks of tissues and organs in multicellular organisms, playing a crucial role in development, growth, and tissue repair. They divide by mitosis to produce daughter cells that can become specialised for specific functions. Cells in the red bone marrow, which constantly divide to produce the whole range of blood cells. The process of differentiation allows stem cells to generate daughter cells that are specialised for specific functions and contribute to the formation and maintenance of various tissues and organs in the body. Stem cells hold immense potential for regenerative medicine and therapeutic applications, as they offer the possibility of replacing damaged or diseased tissues with healthy, functional cells derived from stem cell populations.



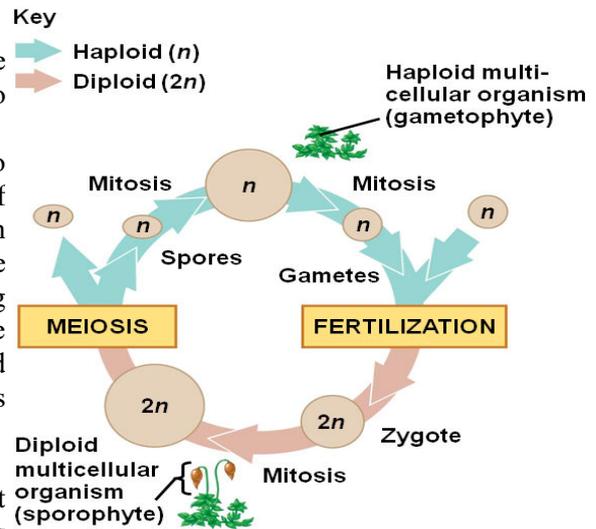
State that meiosis is involved in the production of gametes.

Describe meiosis as a reduction division in which the chromosome number is halved from diploid to haploid resulting in genetically different cells (details of stages are not required)

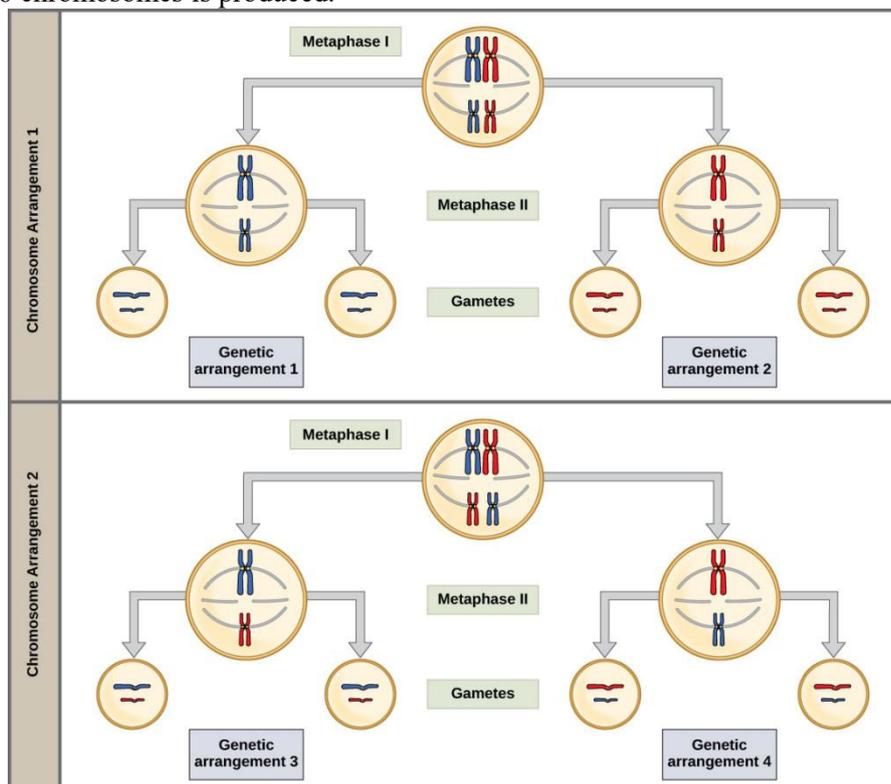
Meiosis

Meiosis is a reduction division in which the chromosome number is halved from diploid to haploid, resulting in genetically different cells.

During meiosis, a single diploid cell undergoes two rounds of cell division, resulting in the formation of four haploid daughter cells. These haploid cells, each containing half the number of chromosomes as the original diploid cell, serve as gametes and fuse during fertilization to restore the diploid chromosome number in the offspring. It takes place in the testes and ovaries of mammals, and the anthers and ovules of flowering plants.

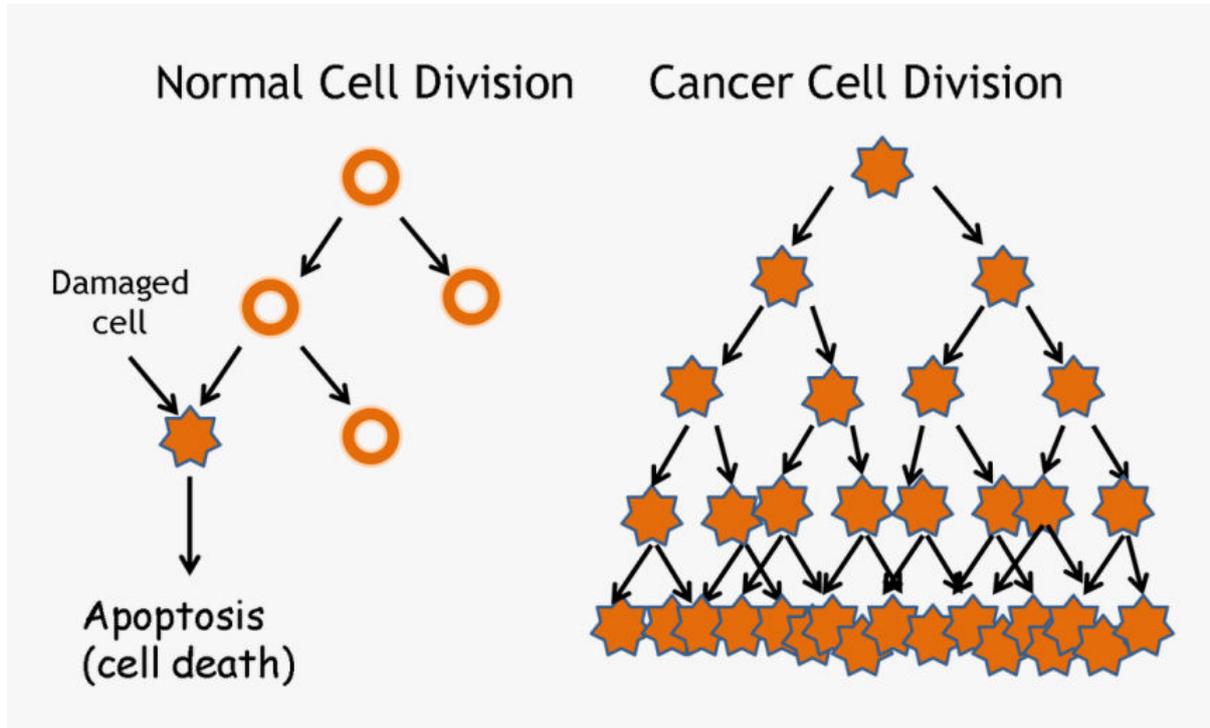


Meiosis is a specialized type of cell division that occurs in sexually reproducing organisms, resulting in the production of gametes (sperm and egg cells). One of the key features of meiosis is its role as a reduction division, where the chromosome number is halved from diploid ($2n$) to haploid (n). This reduction in chromosome number is crucial for maintaining the correct chromosome number in sexually reproducing species across generations. During meiosis, a single diploid cell undergoes two rounds of division, which produces cells with half number of chromosomes. When a female gamete is fertilized by a male gamete, the fertilized cell produced is diploid. So, the gametes must each contain only half the diploid number of chromosomes, otherwise the chromosome number would double each time an organism reproduced sexually. Each human sperm cell contains 23 chromosomes and each human egg cell has 23 chromosomes. When the sperm and egg cell fuse at fertilization the diploid number of 46 chromosomes is produced.



Understand that cancers form as a result of uncontrolled cell division.

All cells have genes that control the timing and number of mitosis. Sometimes mutations occur in such genes and cells continue to divide. It results in growths of abnormal cells called tumors. As long as these tumors remain in their original location, they are called benign tumors. For example, skin cancer results from uncontrolled cell division in the basal layer of the skin.



16.2 Asexual and sexual reproduction

Describe asexual reproduction as a process resulting in the production of genetically identical offspring from one parent.

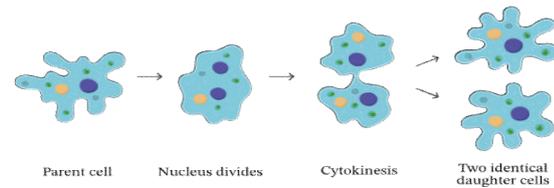
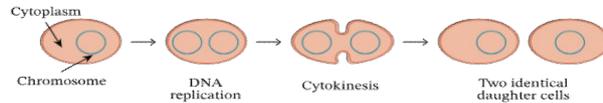
Identify examples of asexual reproduction.

Asexual Reproduction

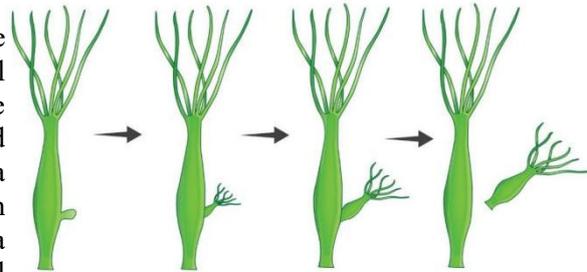
Asexual reproduction is the process resulting in the production of genetically identical offspring from one parent.

In asexual reproduction offspring are produced from a single parent organism, without the fusion of gametes or genetic recombination. In this process, the offspring are genetically identical to the parent organism, as they inherit an exact copy of the parents genetic material.

As there is no fusion of gametes and no combination or assortment of chromosomes there is no genetic variation. The number of chromosomes remain constant and genetically identical organisms are produced.

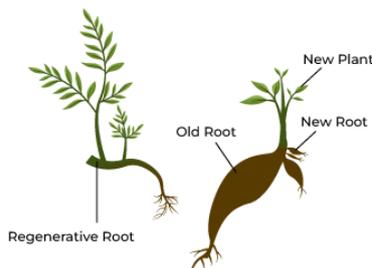


In the single-celled Protocista or in bacteria, the cell simply divides into two and each new cell becomes an independent organism. In more complex organisms, part of the body may grow and develop into a separate individual. For example, a small piece of stem planted in the soil may form roots and grow into a complete plant. Bacteria reproduce by cell division (fission). Any bacterial cell can divide into two and each daughter cell becomes an independent bacterium. In some cases, this cell division can take place every 20 minutes so that, in a very short time, a large colony of bacteria can be produced. This is one reason why a small number of bacteria can heavily contaminate our food products. This kind of reproduction, without the formation of gametes (sex cells), is called asexual reproduction. Fungi have sexual and asexual methods of reproduction. In the asexual method they produce single-celled, haploid spores. These are dispersed, often by air currents, and they grow new organism.

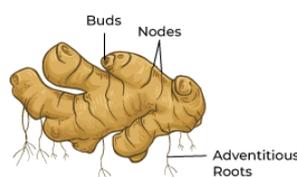


Some members of the invertebrate animals can also reproduce asexually. Hydra reproduces asexually through budding in which it forms an outgrowth on its body which separates and develops into a new organism. Plants also reproduce asexually, the examples of which are given in the following figure.

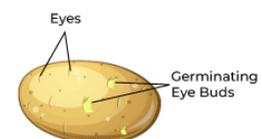
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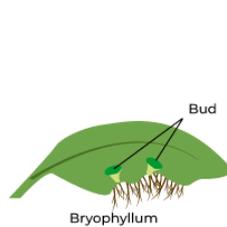
Root propagation (Sweet Potato)



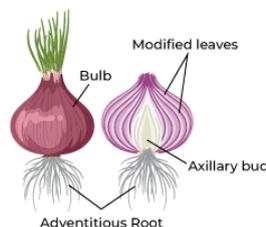
Rhizome (Ginger)



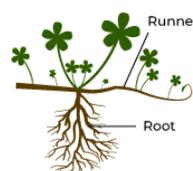
Tuber (Potato)



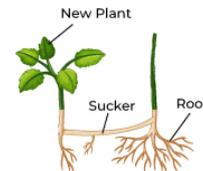
Leaf Bryophyllum



Bulb (Onion)



Runner (Oxalis)



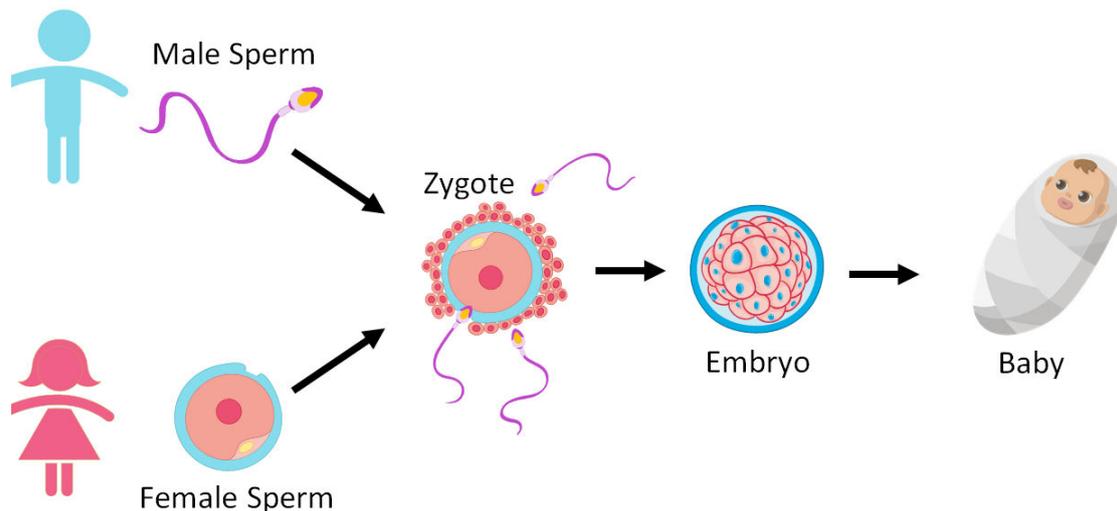
Sucker (Mint)

Describe sexual reproduction as the process involving the fusion of haploid nuclei (fertilisation) to form a diploid zygote and the production of genetically different offspring.

Discuss the advantages and disadvantages of asexual reproduction and sexual reproduction.

Sexual reproduction is a biological process characterized by the fusion of gametes, resulting in the formation of genetically diverse offspring. This process begins with the production of specialized haploid cells called gametes through gametogenesis. During sexual reproduction, fertilization occurs when a sperm cell (haploid) from the male parent fuses with an egg cell (haploid) from the female parent, resulting in the formation of a diploid zygote. The zygote contains a complete set of chromosomes (2n), with half contributed by each parent. After fertilization a diploid zygote is formed, containing a complete set of chromosomes. The zygote undergoes developmental stages, ultimately giving rise to a new organism with a unique genetic makeup inherited from both parents. The genetic diversity in offspring arises from the random assortment of chromosomes during gamete formation and genetic recombination during fertilization, ensuring variability and adaptability within populations.

SEXUAL REPRODUCTION

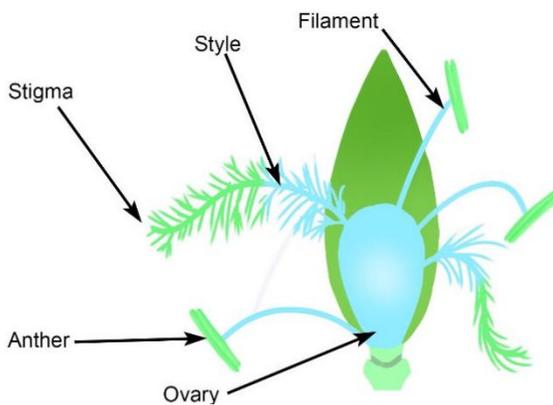
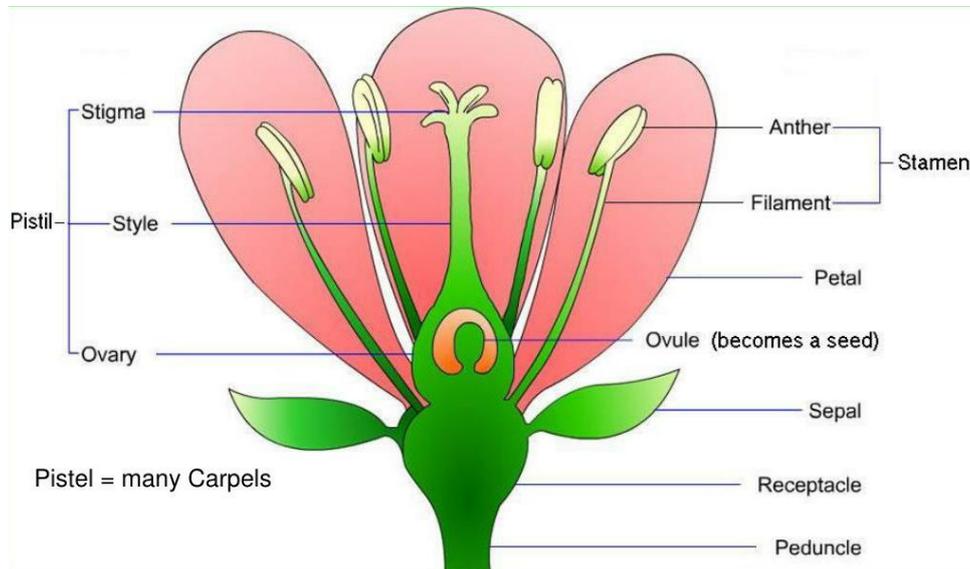


Advantages And Disadvantages of Sexual and Asexula Reproduction

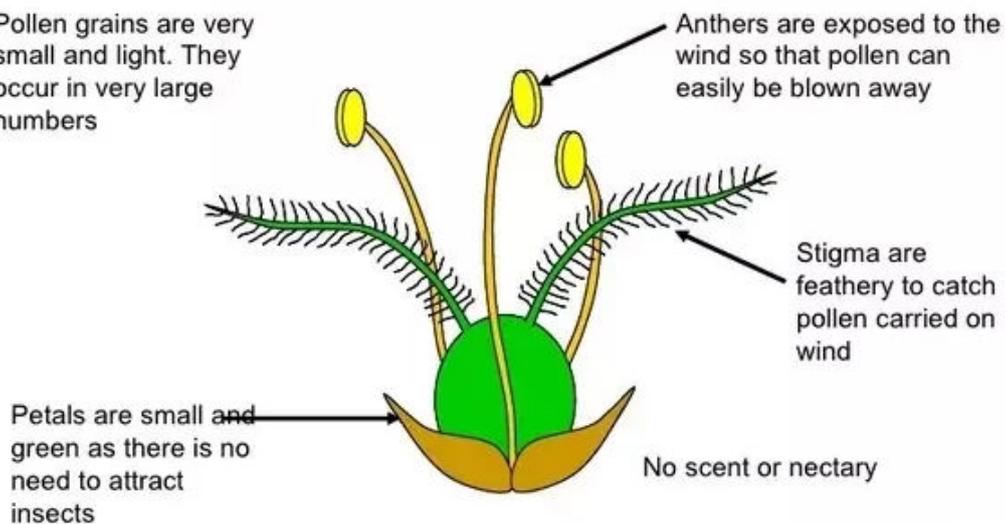
Sr. No.	Asexual Reproduction	Sexual Reproduction
1.	No mate is needed.	Mating is required.
2.	Gametes are not required.	Gametes are formed from meiosis.
3.	Low genetic variability	High genetic variability.
4.	Genetically identical offspring are produced which results in uniform crops.	There is crossing over which produces variation in the next generation.
5.	It saves energy and courtship is a non-issue.	It requires energy and courtship.
6.	Retards evolution.	Speeds up evolution.

16.3 Sexual reproduction in plants

Identify and draw the sepals, petals, stamens (anthers and filaments) and carpels (stigmas, styles, ovaries and ovules) of an insect-pollinated flower. Identify and draw the anthers and stigmas of a wind-pollinated flower.

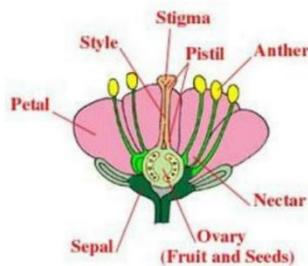


Pollen grains are very small and light. They occur in very large numbers



Relate the structure of the parts of flowers to their functions, limited to the parts listed in 16.3.1

FLOWER PARTS AND FUNCTIONS



- pollen grains----contain male nuclei
- anther-----contain pollen grains
- filament-----holds or support anther
- stigma-----receives pollen grains
- style-----supports the stigma
- ovary-----contains ovules
- ovule-----contains female sex cell
- petals-----attract insects to visit the flower
- sepals-----protect the flower in the bud stage
- -----prepares food when green

Outline the process of pollination and distinguish between self-pollination and cross-pollination.

Discuss the potential effects of self-pollination and cross-pollination on a population, in terms of variation, capacity to respond to changes in the environment and reliance on pollinators.

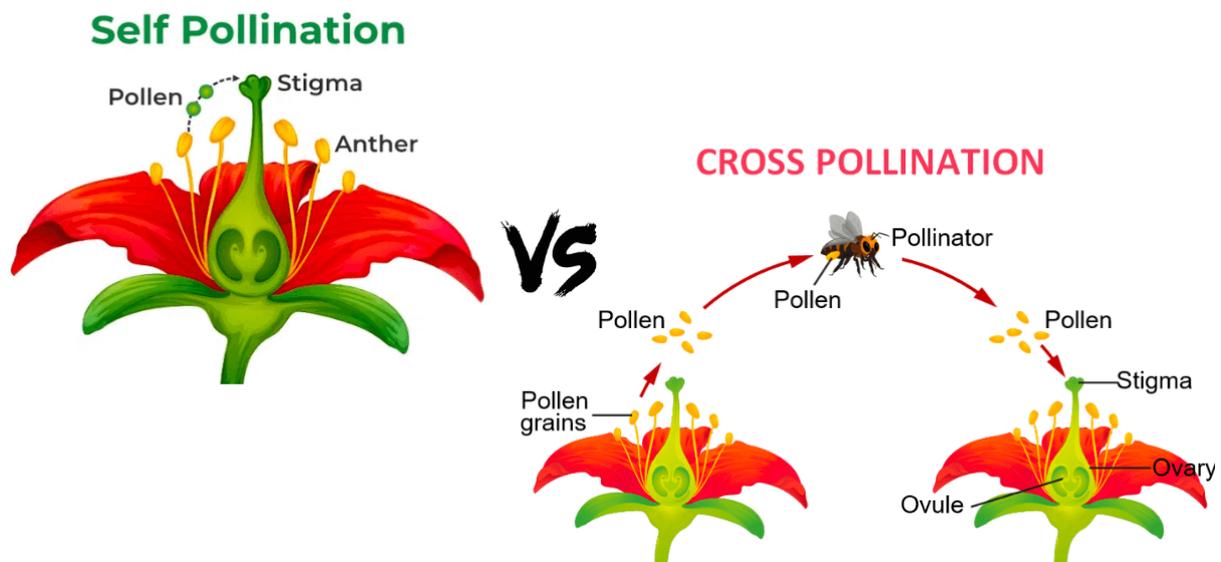
Pollination is the transfer of pollen grains from the male reproductive organ (anther) of a flower to the female reproductive organ (stigma) of the same or another flower of same or different plant.

Self-pollination

Pollen is transferred from the anther to the stigma of the same flower or another flower on the same plant. This can occur through various mechanisms, including wind, gravity, or pollinating agents like insects.

Cross-pollination

Pollen is transferred from the anther of one flower to the stigma of another flower on a different plant of the same species. This can happen via wind, insects, birds, or other animals.



Character	Self-Pollination	Cross-Pollination
Variation	Limited variation	Guarantees variation
Adaptability	Less	More
Reliance on pollinator	Less	More

Self-pollination can happen even if there are no pollinators, because the flower's own pollen may drop onto its stigma. This means that even if there are not many pollinators (perhaps because of the over-use of insecticides) the plant can produce seeds and prevent extinction.

Compare the flower structure and the pollen from insect-pollinated and wind-pollinated flowers.

Insect-pollinated flowers

Insect-pollinated flowers typically have large, colorful petals with conspicuous markings or patterns. These petals serve to attract pollinators such as bees, butterflies, and birds.

Pollen grains produced by insect-pollinated flowers are often large, sticky, and spiky or rough-textured. These characteristics help the pollen adhere to the bodies of visiting insects, ensuring effective transfer between flowers.

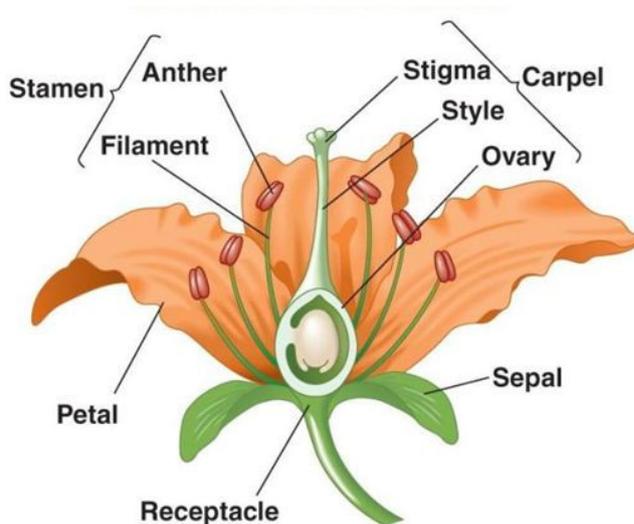
Wind-pollinated flowers

Wind-pollinated flowers, tend to have inconspicuous, small, and often dull-colored petals. They may lack petals altogether in some cases. Instead, they often have exposed stamens and pistils to facilitate the efficient dispersal of pollen by the wind.

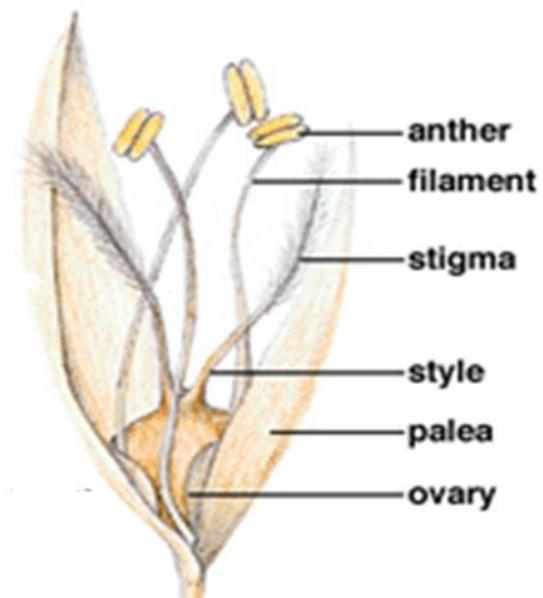
Pollen grains are typically small, lightweight, and smooth-textured. These characteristics enable them to be easily carried by air currents over long distances, increasing the chances of encountering female reproductive structures for pollination.

Flowers and Pollination

How are the flower structures different in Insect-pollinated and wind-pollinated flowers?



Insect-pollinated flower

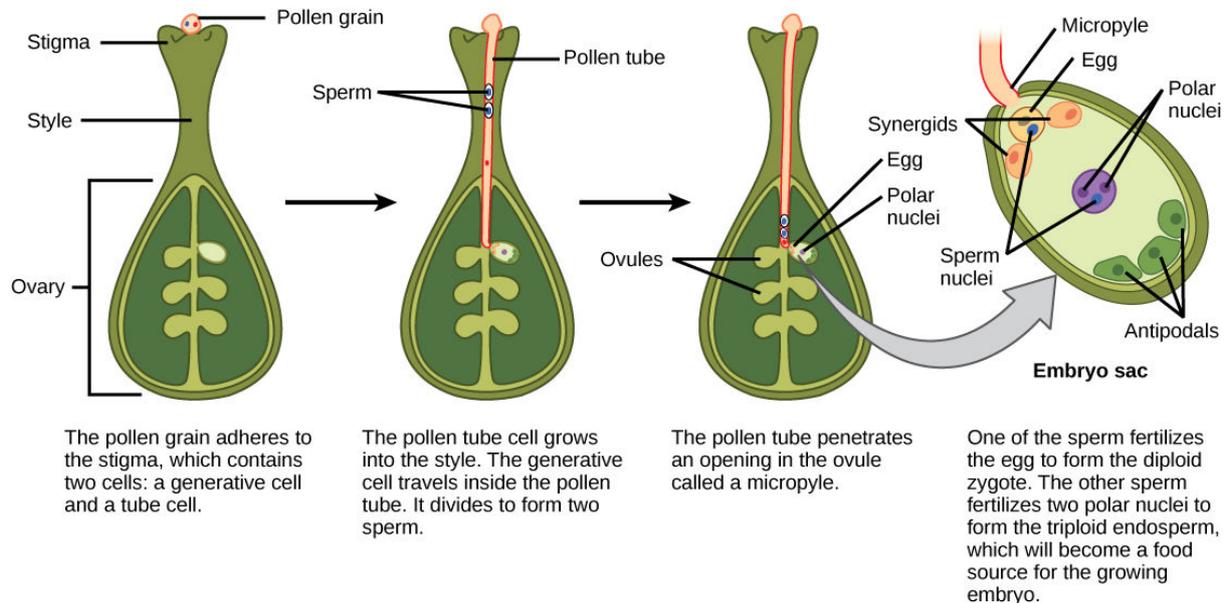


Wind-pollinated flower

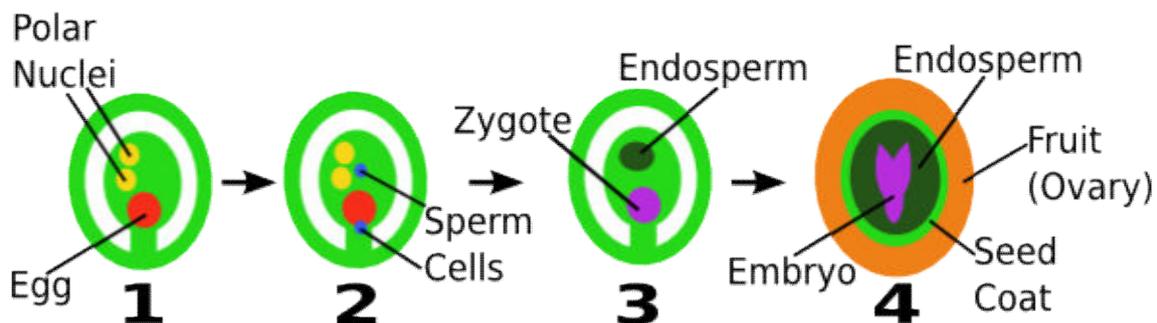
Describe the growth of the pollen tube and its entry into the ovule followed by fertilisation (production of endosperm and details of development are not required)

Understand that after fertilisation the ovules develop into seeds and the ovary develops into a fruit.

After pollination, the pollen grain lands on the stigma of a compatible flower. It absorbs water and nutrients from the stigma and begins to germinate. The pollen grain develops a microscopic pollen tube that grows out of the grain. This tube grows down the style and into the ovary, where it enters a small hole the micropyle, in the ovule. The micropyle is a small pore in the integuments (protective layers) of the ovule, providing an entry point for the pollen tube to access the female gametophyte within the ovule. Once it reaches the ovule it releases two sperm cells, one of which combines with the nucleus of the egg cell. This process is called as fertilization. The second sperm cell fuses with two polar nuclei in the central cell of the female gametophyte to form a triploid cell. This triploid cell undergoes multiple rounds of cell division to develop into the endosperm, a nutrient-rich tissue that nourishes the developing embryo. Due, to the combination of two male and female gametes, this is also known as double fertilization.



After fertilization, the fertilized ovule develops into a seed. The zygote within the ovule undergoes cell division and differentiate, eventually forming an embryo. The endosperm, which formed from the fusion of the second sperm cell with the polar nuclei, provides nutrients to support the growth of the developing embryo. Once fully developed, the seed typically contains the embryo, endosperm, and a protective seed coat derived from the integuments of the ovule. The ovary undergoes significant changes after fertilization. Hormonal signals triggered by fertilization stimulate the ovary to develop into a fruit. This process involves the enlargement and often the fleshy or protective modification of the ovary wall.



Investigate and describe the structure of a seed, limited to embryo (radicle, plumule and cotyledons) and Testa.

Embryo

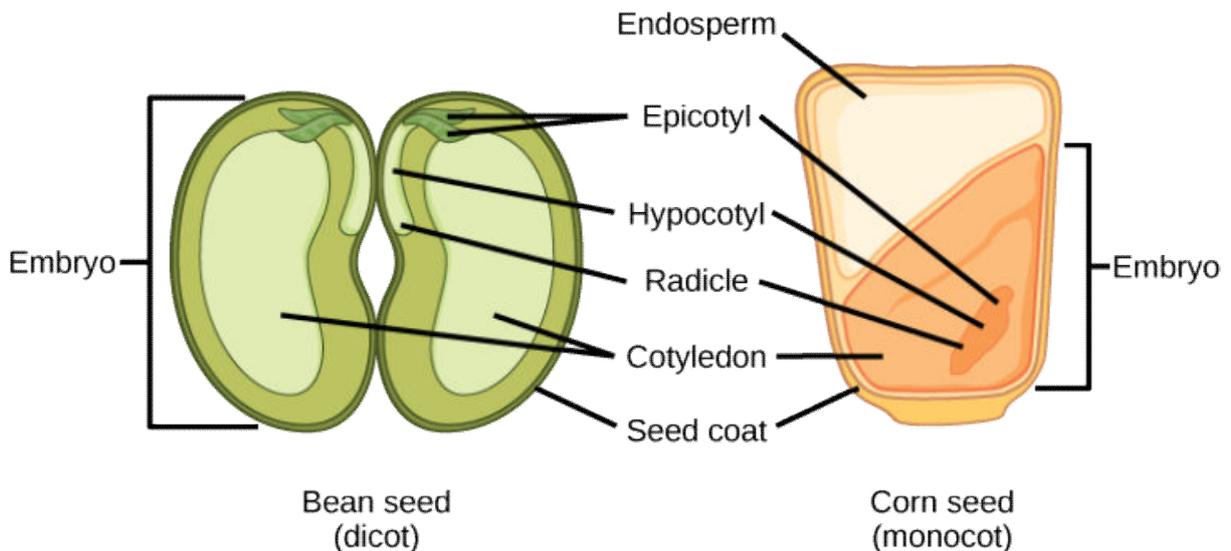
The embryonic root of the plant, serving as the primary organ for anchorage and initial nutrient absorption upon germination is called as radicle.

Plumule is the embryonic shoot, containing meristematic tissues that give rise to the aerial portions of the plant, including stems and leaves.

Cotyledons are seed leaves integral to the embryo, acting as reservoirs of stored nutrients for early seedling development and often contributing to photosynthesis in dicots.

Testa (Seed Coat)

The testa, derived from ovule integuments post-fertilization, forms the outer protective layer of the seed. This protective layer guards the embryo and endosperm against mechanical damage, desiccation, and microbial pathogens during dormancy and dispersal. Variations in testa thickness, texture, and morphology are species-specific adaptations facilitating seed dispersal and survival.



Understand that seed and fruit dispersal by wind and by animals is a means of colonising new areas and of reducing competition.
Relate the features of wind-dispersed fruits and animal-dispersed fruits to their functions.

Seed and fruit dispersal by wind and animals is a key strategy plants use to colonize new areas and reduce competition for resources such as light, water, and nutrients. By spreading seeds away from the parent plant, the likelihood of survival increases because the offspring are less likely to compete with the parent or with each other for the same resources.

Wind dispersal:

Seeds adapted for wind dispersal often have lightweight structures, such as wings or feathery attachments, allowing them to be carried over long distances. This enables them to colonize open spaces or disturbed areas.

Animal dispersal:

Animals help disperse seeds by either eating fruits and excreting seeds at a distance or by carrying seeds that stick to their fur. This mode of dispersal allows seeds to reach habitats far from the parent plant, including locations where conditions may be more favorable for germination.

In both cases, dispersal helps plants spread to new environments, minimizing competition in crowded or resource-limited spaces. This is vital for their survival and adaptation in changing ecosystems.

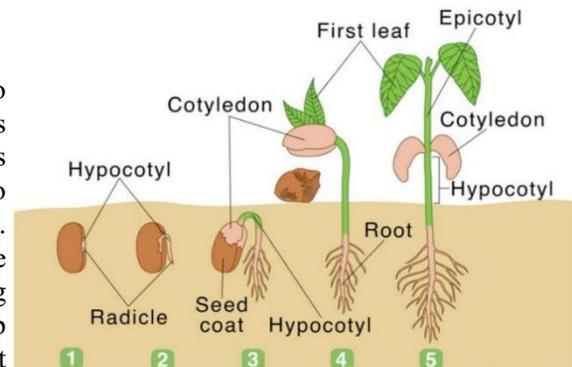
Features	Insect Dispersal	Wind Dispersal
Petals	Present, often large, coloured and scented, with guidelines to guide insects into the flower.	Absent or small and green
Stamen	Present inside flower	Long filaments allowing the anther to hang freely outside the flower so the pollen is exposed to the wind.
Stigma	Small surface area, inside the flower.	Large and feathery, hanging outside the flower to catch pollen carried by the wind.
Pollen	Smaller amounts; grains are often round and sticky or covered in spikes to attach to the furry bodies of insects.	Large amounts of smooth and light pollen grains, which are easily carried by the wind.
Nectar	Produced by nectaries to attract insects.	Absent
Bracts	Absent	Sometimes present.
Diagram		

Describe the process of germination, including the role of enzymes.

Investigate and state the environmental conditions that affect germination of seeds, limited to: suitable temperature, water and oxygen.

Germination

Germination is the process by which a seed begins to sprout and grow into a seedling. Germination begins when a seed absorbs water, a process known as imbibition. The absorption of water causes the seed to swell, activating metabolic processes within the seed. The radicle grows first and bursts through testa. The radicle continues to grow down into the soil, pushing its way between soil particles and small stones. Its tip is protected by the root cap. The microscopic root hairs make close contact with soil particles and absorb water from the spaces between them.



When the radical has firmly anchored in the soil it starts growing rapidly and the hypocotyl moves upward through the soil pulling the cotyledons with it. Once the cotyledons are above the soil, the hypocotyl straightens and the leaves of the plumule open out. The cotyledons get smaller as their food reserve is used up and they fall off soon after they have been brought above the soil. The leaves grow and absorb light and make their own food by photosynthesis. Between the plumule leaves is a growing out, which continues the upward growth of the stem and the production of new leaves. The embryo has now become an independent plant, absorbing water and mineral ions from the soil, carbon dioxide from the air and making food in its leaves.

For the movement of cotyledons above the soil and before the formation of leaves, energy is required which is provided from the starch, proteins and lipids stored in the cotyledons. Enzymes play a crucial role in breaking down the stored nutrients. Amylase breaks down starch into maltose, that can be used for energy. Protease hydrolyzes proteins into amino acids, which serve as building blocks for new proteins needed for seedling growth. Lipase breaks down lipids (fats) into fatty acids and glycerol, providing energy for seedling growth and development.

The germination of seeds is influenced by various environmental conditions, including temperature, water availability, and oxygen levels. Here's how each factor affects seed germination.

Water

Water is essential for initiating the germination process because it triggers the imbibition, leading to metabolic activation and enzyme activity. It activates the enzymes in the seed, help the conversion of stored starch to sugar, and proteins to amino acids. It also transports the sugar in solution from the cotyledons to the growing regions and expand the vacuoles of new cells, causing the root and shoot to grow and the leaves to expand. It maintains the turgor of the cells. This keeps the shoot upright and the leaves expanded. It provides the water needed for photosynthesis when the plumule and young leaves are above ground. It also transports mineral ions from the soil to the shoot.

Temperature

Temperature plays a crucial role in regulating the rate and success of seed germination. Different plant species have specific temperature requirements for germination, often determined by their native habitat and evolutionary adaptations. Generally, seeds germinate best within a specific temperature range, known as the optimal germination temperature of about 40°C. Low temperatures can inhibit germination by slowing down metabolic processes, while high temperatures than 45°C can denature enzymes and damage cellular structures.

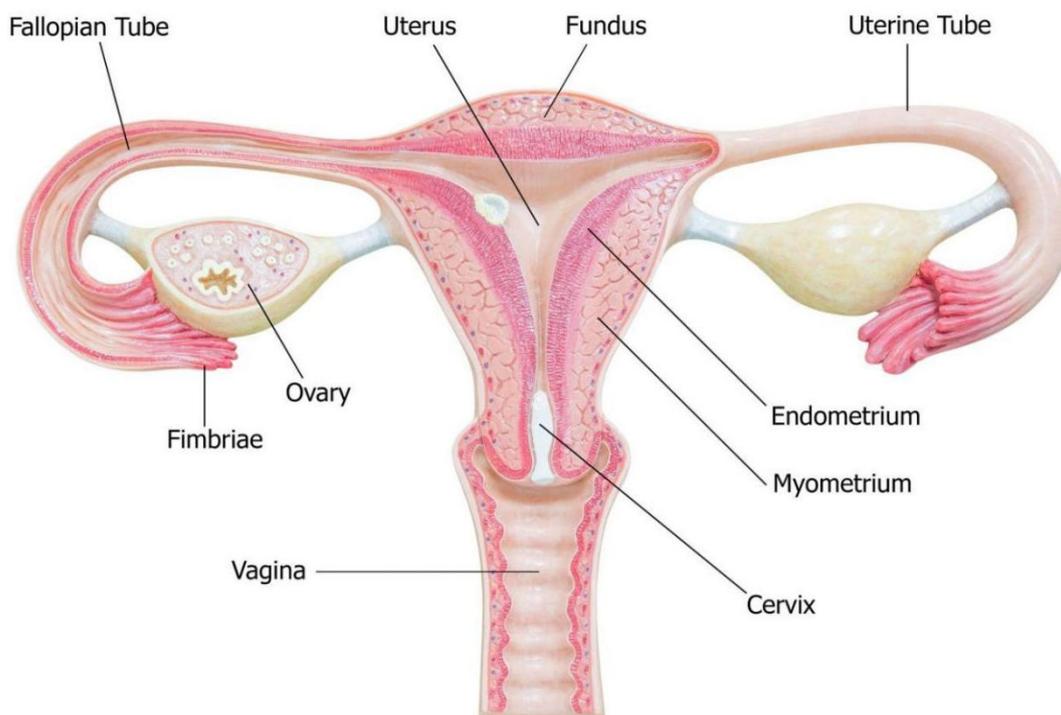
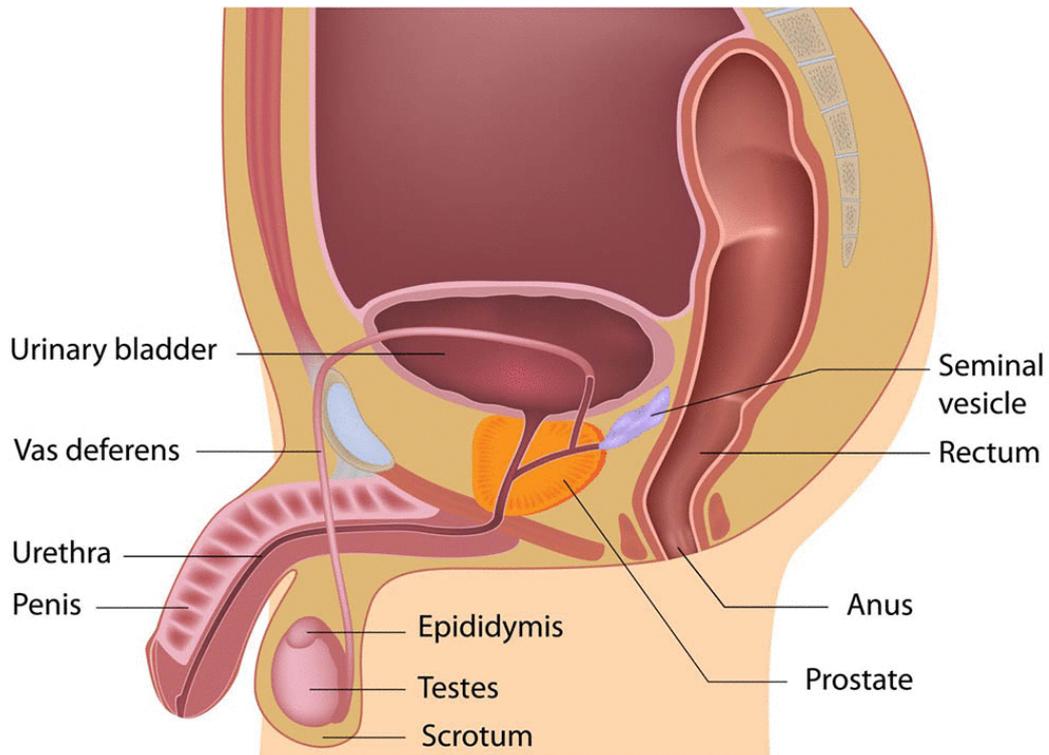
Oxygen

In some seeds the seed coat is not very permeable to oxygen, which suggests that the early stages of germination are anaerobic. When soaked or split open, the seed coat allows oxygen to enter. The oxygen is used in aerobic respiration. This provides the energy for the chemical changes involved in activating the food reserves and making the new cytoplasm and cell walls of the growing seedling.

16.4 Sexual reproduction in humans

Identify, on diagrams of the male reproductive system: the testes, scrotum, sperm ducts, prostate gland, urethra and penis, and describe their functions.

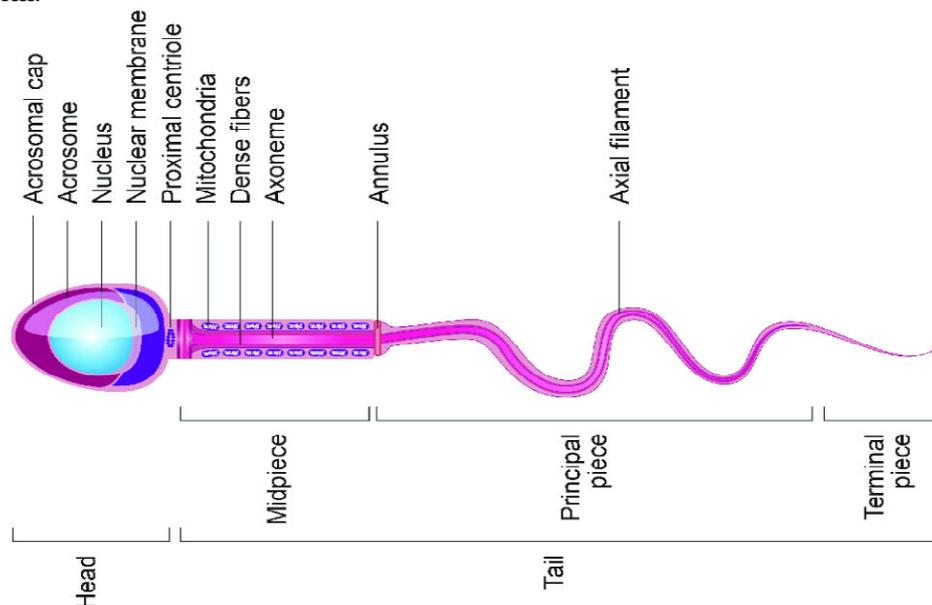
Identify, on diagrams of the female reproductive system: the ovaries, oviducts, uterus, cervix and vagina, and describe their functions.



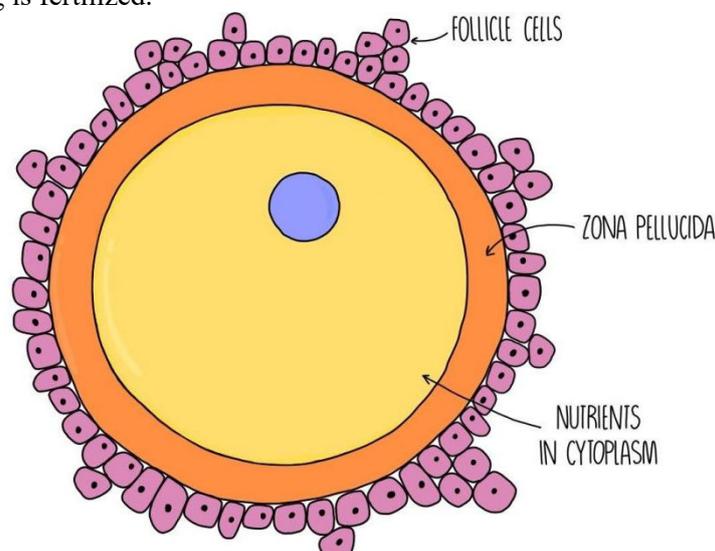
Explain how the structure of a sperm cell is related to its function, limited to: flagellum, mitochondria and enzymes in the acrosome.

Explain how the structure of an egg cell is related to its function, limited to energy stores and the jelly coat that changes at fertilisation.

Sperm cells are smaller in size and are produced in millions per ejaculation. The structure of a sperm cell is intricately related to its function of fertilizing an egg. The acrosome (specialized structure located at the tip of the sperm head) contains enzymes. These enzymes can digest the jelly coat of an egg. The cytoplasm of the sperm contains many mitochondria. In sperm cells, ATP produced by mitochondria fuels the flagellar movement, providing the energy required for sperm motility. This energy is essential for sperm to swim efficiently over long distances and penetrate the protective barriers surrounding the egg. The flagellum is long whip like structure responsible for the movement of the sperm.



The egg cell produced by the female reproductive tract is much larger as compared to a sperm cell. A functional female reproductive tract produces only a single egg each month. Its function is correlated to its structure. It is surrounded by a jelly coat. It provides protection for the egg cell, shielding it from physical damage, pathogens, and desiccation. It prevents more than one sperm cell from entering and fertilizing the egg. The cytoplasm of egg contains abundant energy stores in the form of yolk, which consists of lipids, proteins, and carbohydrates. The lipid acts as energy stores. Proteins are available for growth if the egg is fertilized.

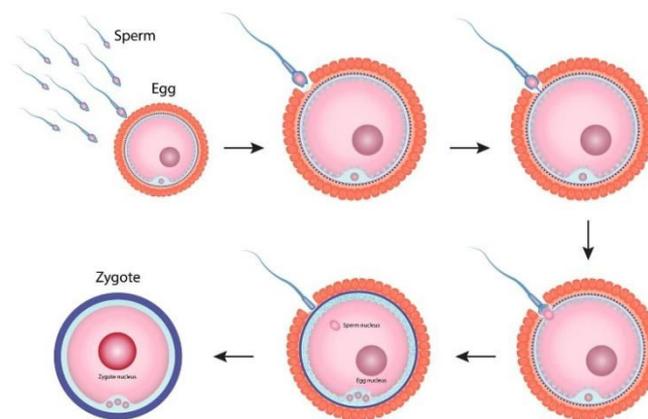


Describe fertilisation as the fusion of the nuclei from a male gamete (sperm) and a female gamete (egg cell)

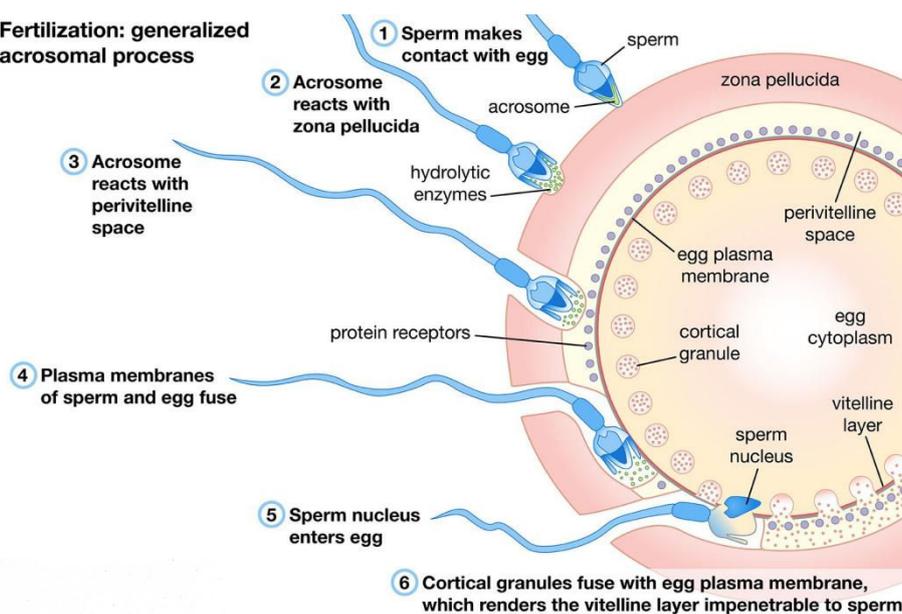
Fertilization is the biological process by which a male gamete (sperm) fuses with a female gamete (egg cell or ovum), leading to the formation of a genetically unique diploid cell called a zygote. Sperms are deposited in the female reproductive tract from where they travel through the cervix and uterus via undulating tail movements. Upon reaching the oviduct, they may encounter an egg cell, where only one sperm can adhere to its surface. Utilizing enzymes from the acrosome, located at the sperm's head, a passage is created through the egg's jelly coat and membrane. Subsequently, the sperm penetrates the egg's cytoplasm, leading to the fusion of the male and female nuclei. Despite the potential presence of over three hundred million sperms in a single ejaculation, only a fraction successfully reaches the oviduct, with typically only one achieving fertilization. The precise function of the remaining sperm remains incompletely understood.

The released egg cell exhibits a lifespan of approximately 24 hours, while sperm retain fertilization capacity for about 2 to 3 days. Consequently, a brief window of approximately 4 days each menstrual cycle permits the possibility of fertilization. Following fertilization, the resulting zygote inherits 23 chromosomes from each parent, thereby acquiring a total of 46 chromosomes, akin to other somatic cells within the human body.

FERTILIZATION

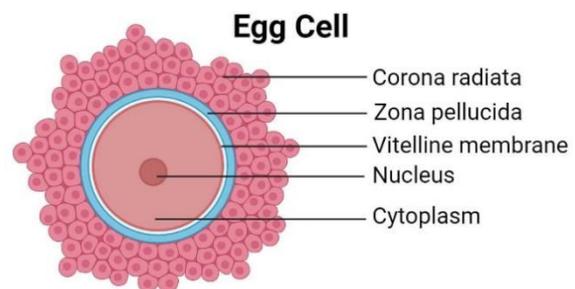
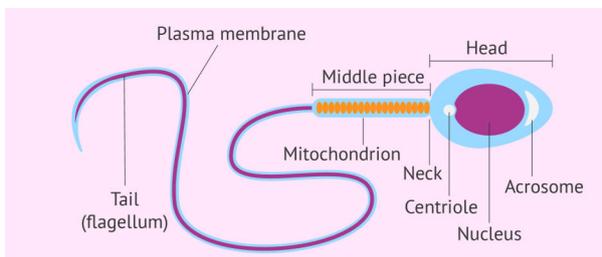


Fertilization: generalized acrosomal process



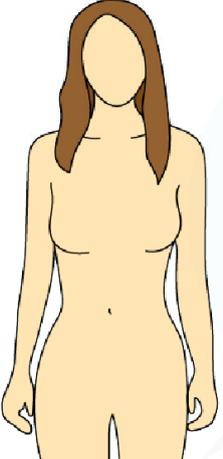
Compare male and female gametes in terms of size, structure, numbers and motility.

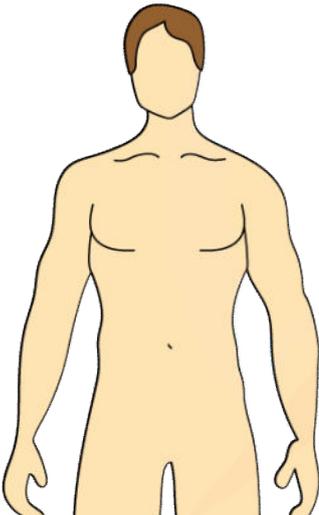
Male gametes	Female gametes
the male gametes are known as sperms and are produced by the process of spermatogenesis .	the female gametes are known as ovum and are produced by the process of oogenesis .
They are usually small and motile .	They are large and nonmotile .
They are produced in large numbers to ensure successful Fertilization .	Only a single gamete is formed.
Produced in the testes	Produced in the ovaries
Corn-shaped cells	Spherical-shaped cells
Contain a small cytoplasm	Contain a large cytoplasm to nourish the embryo
Contain a tail which helps in swimming	Do not Contain tails
Comprise a lot of mitochondria to produce energy to swim.	Comprise a few mitochondria
Unite with the female gamete to produce the zygote .	Unite with the male gametes to produce the zygote .



Describe the roles of testosterone and oestrogen in the development and regulation of secondary sexual characteristics during puberty.

Puberty is a developmental stage in human growth marked by the onset of sexual maturation and the emergence of secondary sexual characteristics. During puberty, testosterone and estrogen play crucial roles in the development and regulation of secondary sexual characteristics, which are physical traits that distinguish males and females and emerge during adolescence.

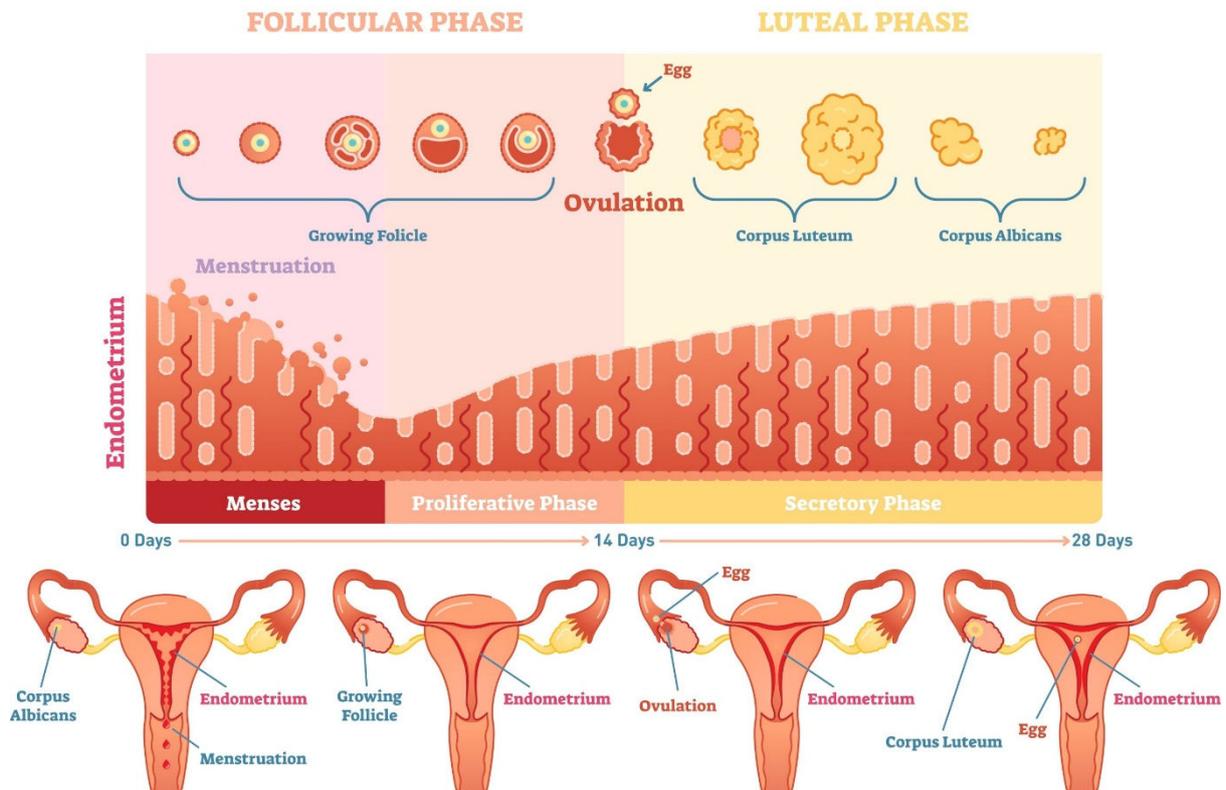
FEMALE	EFFECTS OF OESTROGEN
	BREASTS DEVELOP
	BODY HAIR GROWS
	MENSTRUAL CYCLE BEGINS
	HIPS GET WIDER

MALE	EFFECTS OF TESTOSTERONE
	GROWTH OF PENIS AND TESTES
	GROWTH OF FACIAL AND BODY HAIR
	MUSCLES DEVELOP
	VOICE BREAKS
	TESTES START TO PRODUCE SPERM

Describe the menstrual cycle in terms of development and release of an egg and changes in the lining of the uterus.

In human females, the periodic reproductive cycle is completed in approximately 28 days and involves changes in the structure and function of the whole reproductive system. It is called the menstrual cycle. If the egg cell, released after every 4 weeks is not fertilized and no embryo implants, the uterus lining breaks down. The cells, along with blood, are passed out of the vagina. The appearance of the first menstrual period is one of the signs of puberty in girls. After menstruation, the uterus lining starts to re-form and another egg cell starts to mature.

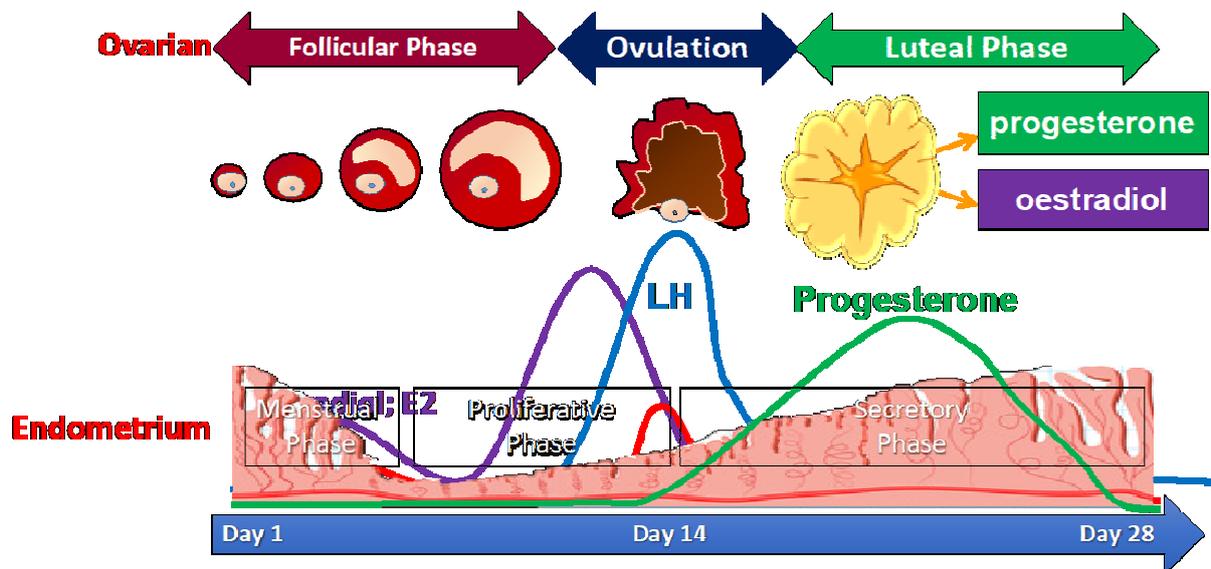
FEMALE SEXUAL CYCLE



Explain the roles of follicle-stimulating hormone (FSH), luteinising hormone (LH), oestrogen and progesterone in controlling the menstrual cycle.

The pituitary gland on the onset of puberty, releases follicle stimulating hormone (FSH) which stimulates the development of several primary follicles. Only one of these follicles continues to grow with its primary oocytes while the rest break down by a degenerative process known as follicle atresia. The ovary, under the stimulus of FSH, also produces estrogen hormone. This, on one hand, stimulates the endometrium (internal living of the uterus wall) and vascularizes and on the other hand, inhibits the secretion of FSH from pituitary gland.

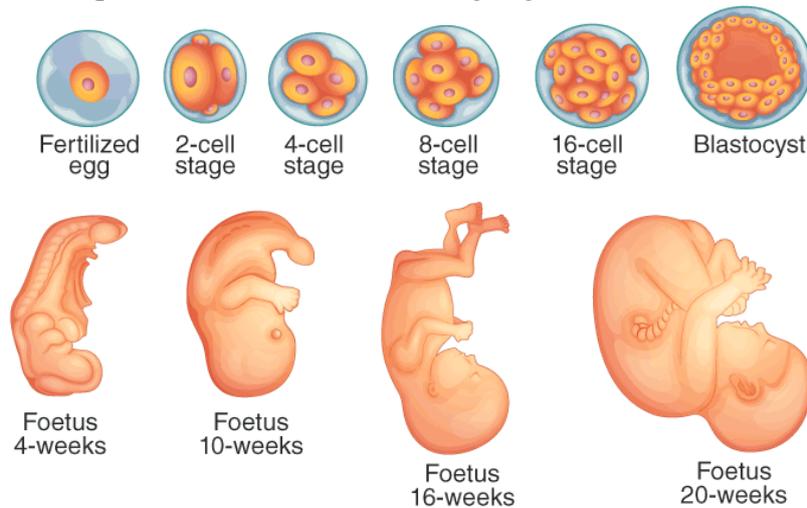
Decrease of FSH and increase of estrogen, causes the pituitary gland to secrete luteinizing hormone (LH) which induces ovulation the release of ovum from the follicle. The follicle cells, after release of the egg, are modified to form a special structure called corpus luteum. This yellowish glandular structure starts secreting hormone called progesterone. This hormone develops the endometrium and make it receptive for the implantation of the zygote (placenta formation). If fertilization does not occur. the corpus luteum starts degenerating. The progesterone secretion diminishes and its supporting effect on the spongy endometrium is reduced, which suffers a breakdown. This causes the discharge of blood and cell debris known as menstruation. This stage usually lasts for 3-7 days



Hormone	Secreted From	Function
FSH	Anterior pituitary	<ul style="list-style-type: none"> Stimulates follicular growth Stimulates estrogen secretion (from developing follicles)
Estrogen	Ovaries (developing follicle)	<ul style="list-style-type: none"> Development of endometrium Stimulates LH secretion (follicular phase) Inhibits LH and FSH (luteal phase)
LH	Anterior pituitary	<ul style="list-style-type: none"> Surge causes ovulation Development of corpus luteum Stimulates progesterone secretion
Progesterone	Ovaries (corpus luteum)	<ul style="list-style-type: none"> Thickening of endometrium Inhibits LH and FSH (luteal phase)

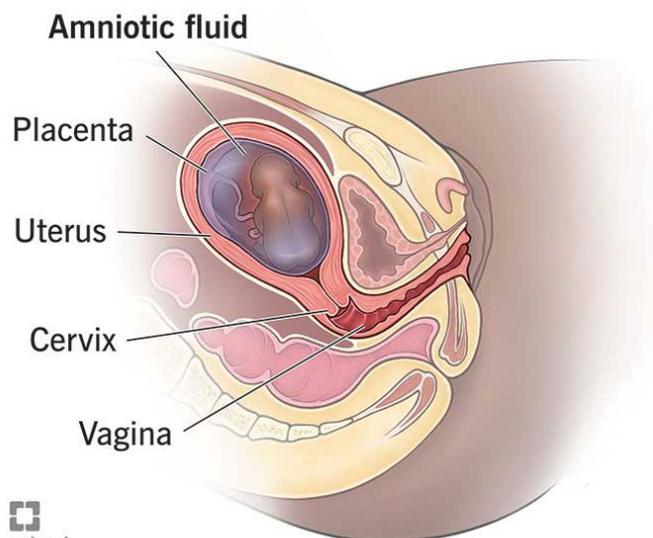
Describe the early development of the zygote, limited to the formation of a ball of cells (embryo) that becomes implanted in the lining of the uterus.
State the functions of the amniotic sac and the amniotic fluid.

The fertilized egg cell (zygote) is protected from other sperm by changes to the jelly coat, which now acts as a barrier. The zygote first divides into two cells. Each of these divides again, so producing four cells. The cells continue to divide in this way to produce a solid ball of cells, an early stage in the development of the embryo. This early embryo travels down the oviduct to the uterus. Here it implants or sinks into the lining of the uterus. The embryo continues to grow and produces new cells that form tissues and organs. After 8 weeks, when all the organs are formed, the embryo is called a fetus. One of the first organs to form is the heart, which pumps blood around the body of the embryo.

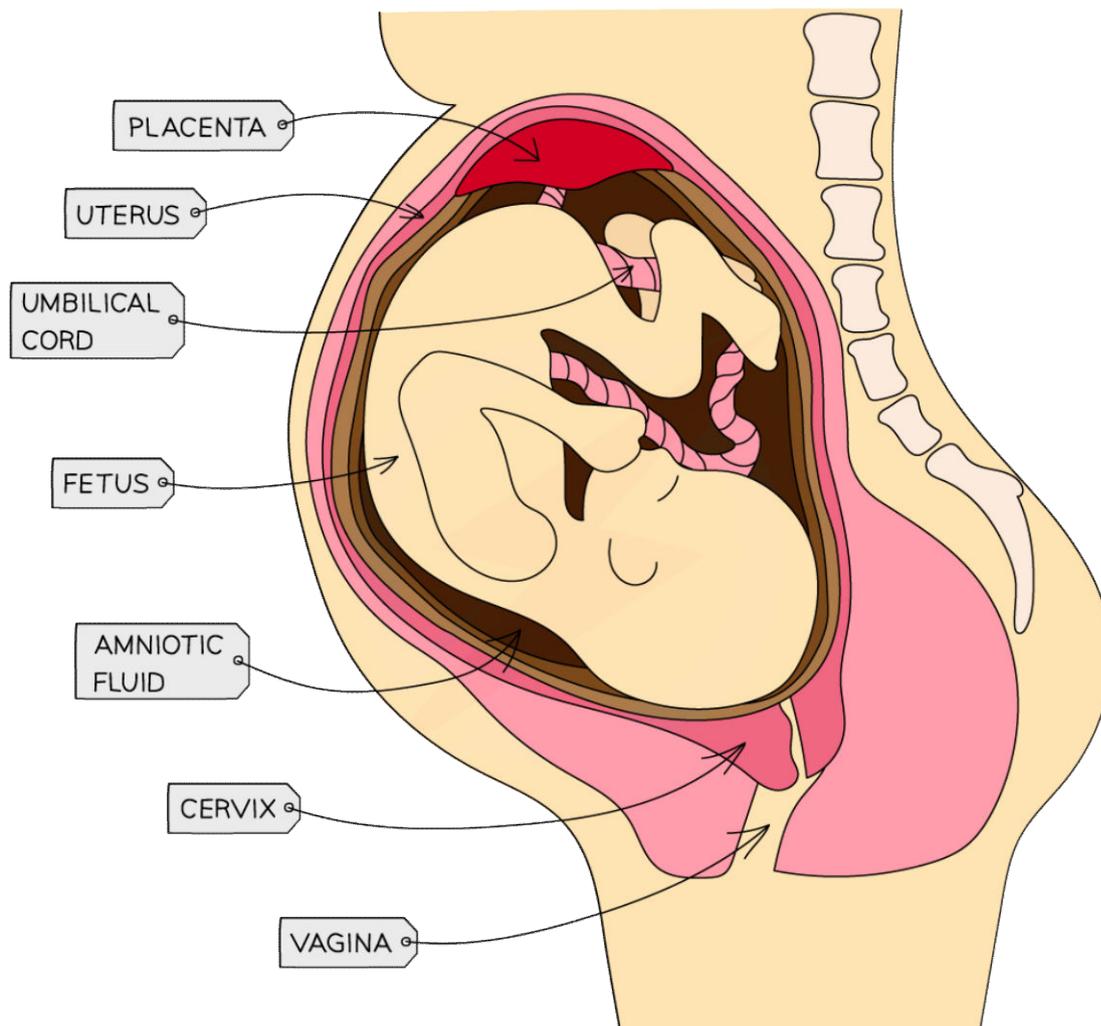


As the embryo grows, the uterus enlarges to contain it. The amniotic sac encloses the fetus, protecting it from external shocks and infections, while also regulating temperature and supporting the umbilical cord. Amniotic fluid cushions the fetus against impacts, promotes lung development, facilitates symmetrical growth, and allows for buoyancy, enabling unrestricted movement. Together, they ensure the fetus remains safe and properly nurtured throughout pregnancy.

Amniotic Fluid



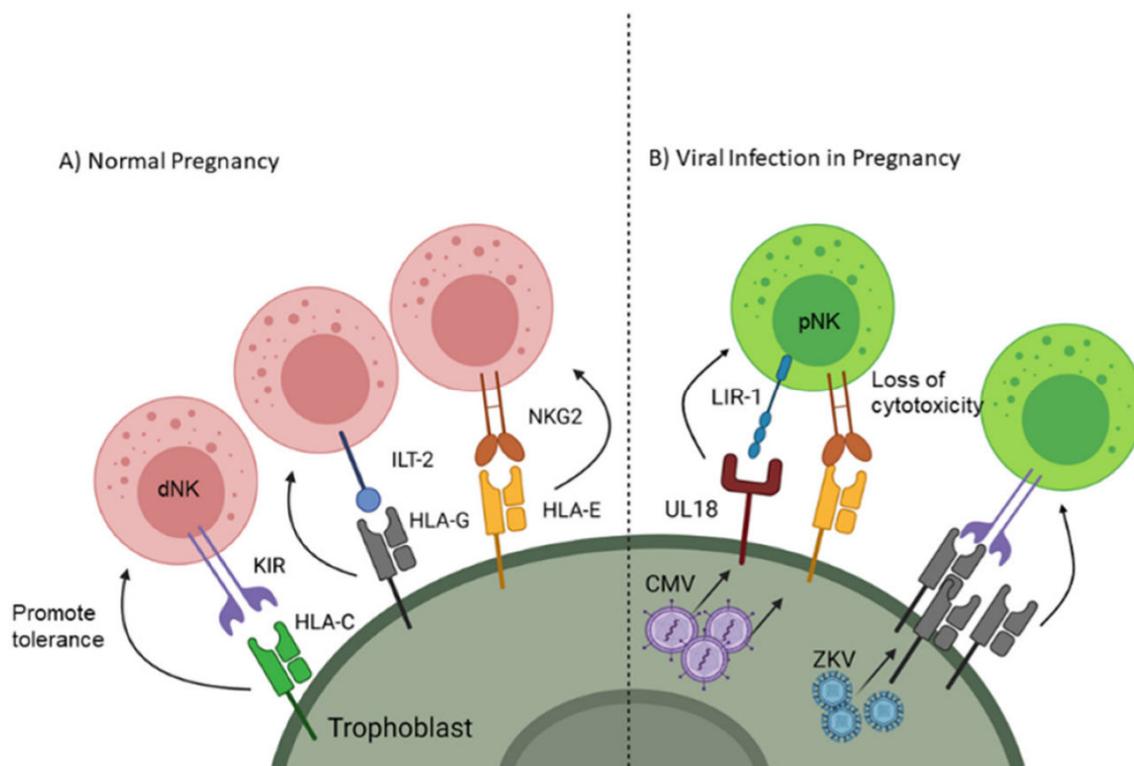
Identify, on diagrams, the placenta and umbilical cord and describe their functions in relation to the exchange of dissolved nutrients, gases and excretory products between the blood of the mother and the blood of the fetus (structural details are not required)



State that some viruses can pass across the placenta and affect the fetus.

During pregnancy, the placenta serves as a barrier between the maternal bloodstream and the fetal bloodstream, facilitating the exchange of nutrients, gases, and waste products while providing protection for the developing fetus. However, some viruses possess the ability to bypass this barrier and cross the placenta, gaining access to the fetal circulation. Some viruses like the rubella virus and HIV can pass across the placenta. Rubella (German measles), although a mild infection for the mother, can infect the fetus and results in major health problems. These include deafness, congenital heart disease, diabetes and mental retardation. HIV is potentially fatal.

Preventing viral transmission to the fetus is a critical aspect of prenatal care. Pregnant individuals are advised to take precautions to avoid exposure to viruses known to cause congenital infections, such as practicing good hygiene, avoiding contact with individuals who are ill, and receiving recommended vaccinations before pregnancy or during prenatal care visits.





**ABDUR REHMAN
BIOLOGY**