BIOLOGY

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Contents

Foundation 8th Biology

Booklet 2

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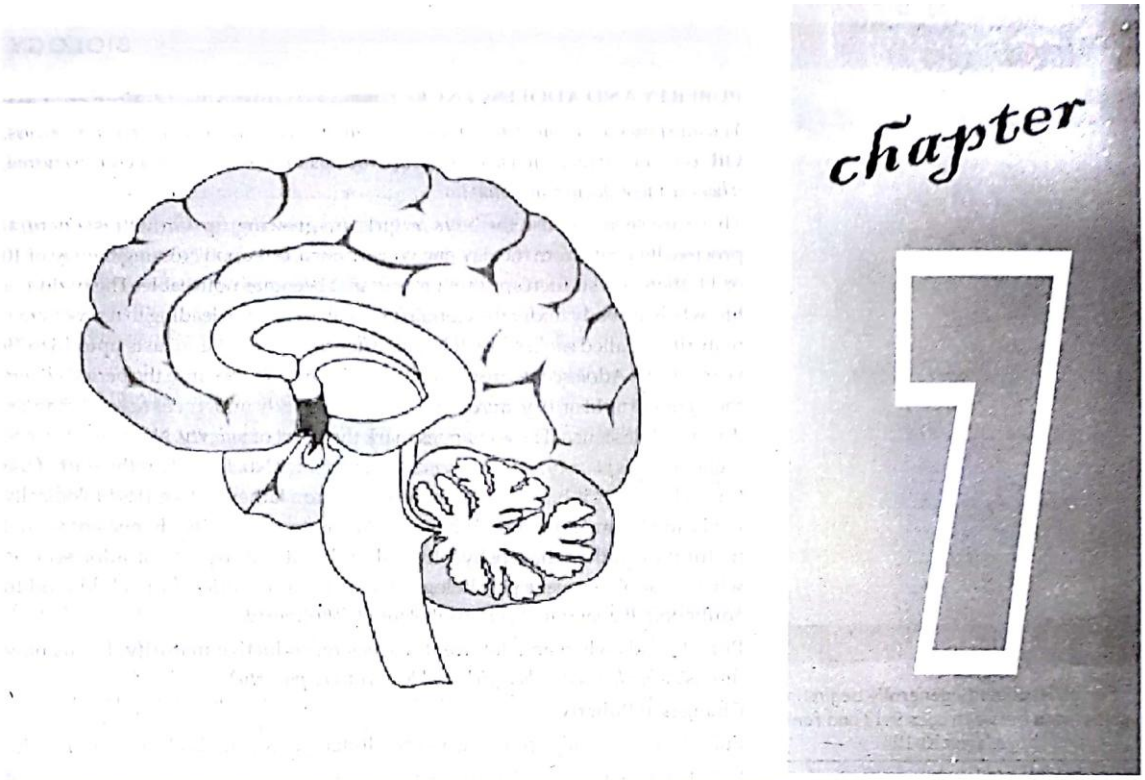


chapter 7

Reaching the Age of Adolescence

Humans passes through various stages in their life. These are-infancy, childhood, adolescence and adult-hood. *Infancy* is the first stage. A new born baby remains infant till one year. An infant can see, feel the touch, hear sounds and react by crying, smiling or moving hands and legs. *Childhood* is the stage between infancy and adolescence. During this time, a child learns about his surroundings and culture. As he grows up, he develops various ideas and thoughts. *Adolescence* is the stage between childhood and adulthood. It is the transitional stage during which various biological and psychological changes occur. Human beings become adults by the age of 18. An adult becomes physically psychological and socially mature. He reaches the maximum height, becomes sexually active and mentally and emotionally strong.

In this chapter we will learn about all such changes that take place in the human body after which a person becomes capable of reproduction. Also we will discuss the role playod by hormones in bringing changes in a child.

PUBERTY AND ADOLESCENCE :

You must have seen a sudden increase in height in some of the boys or girls of your class. **OR** *You must have seen hairy line above the lips in boys? Have you ever wondered, what are these changes all about?*

These are seen because the boys or girls are growing up. Growth is a natural process. It begins from the day one you are born, but upon crossing the age of 10 or 11, there is a sudden spurt in growth that becomes noticeable. The period of life, when the body undergoes certain noticeable changes, leading to reproductive maturity is called *adolescence*. It begins after the age of 11 and lasts upto 18 to 19 years of age. Adolescents are also called as "teenagers" because the period covers the teens (13 to 18 or 19 years of age) The human body undergoes several changes during adolescence. These changes mark the onset of *puberty*. Now you must be wondering, *Is puberty and adolescence the same thing*? No. Puberty is the start of the time when a boy is biologically ready to become a father and a girl is biologically ready to become a mother. It basically refers to the bodily changes of sexual maturation rather than pshycological and cultural aspects of adolescence, whereas adolescence is psychological and social transition from childhood to adulthood. It generally overlaps the period of puberty.

Puberty ends when an adolescent reaches reproductive maturity. Let us now discuss *what happens when girls and boys reaches puberty*?

do you know?

For girls, puberty generally begins sometimes between ages 9-13 and for boys, ages 10-15!!

Changes at Puberty :

Puberty involves all sorts of big and small changes to your body and your brain. During puberty, our body grows faster than at any other time in your life, except for when you were a baby.

The various changes that takes place in adolescents during puberty are :

1. **Increase in height :** This is the most conspicuous change during puberty. *When you go through puberty, it might seem like your sleeves are always getting shorter and your pants are creeping up your legs. Why it is happening so* ? It is because your body is going through a growth spurt that lasts for about 2 to 3 years. Spurt is a short burst of activity or something that happens in a hurry. When that growth spurt is at its peak, some kids grow 4 to more inches in a year. At the end of your growth spurt you will reach your normal adult height or just about. But, your height is not the only things that grows or changes during puberty. You can see that other parts of body especially your feet are growing faster than everything else. This makes you feel awkward or clumsy but eventually it will fill out and soon the body will regain its normal proportions. Hence, it is important that the body gets the correct nutrition during adolescence to ensure healthy growth of bones, muscles and other parts.

   Initially girls grow faster than boys but by about 18 years of her age, both will reach their maximum height. The rate of growth in height varies in different individual. Some children grow suddenly at puberty and then slows down, while some grows gradually. Have you ever thought *why do we stop growing after a period*. The average body is about one feet eight inches long at birth. Over the next twenty years, man triples the length of the body he was born with and reaches an average height of about five feet, eight inches. *But why doesn't an individual just keep on growing and growing? Any guesses*?

In the body there is a endocrine gland, thyroid in the neck, the pituitary attached to the brain, the thymus which is in the chest and sex glands, that control our growth and development. The pituitary gland is the one that stimulate our bones to grow. If this works too hard our arms and legs would grow too long and our hands and feet too big. If the gland doesn't work hard enough, we would end up as midgets.

We continue to grow, but only slightly, after the age of 25 and we reach our maximum height at about the age of 35 or 40. After that we shrink about half an inch every ten years. The reason for this is the drying up of the cartilages in our joints and in the spinal column as we get older.

CHECK Point

1. **Why the height of an individual is more or less similar to their mother or father or other family members?**

CHECK YOUR ANSWERS

1. The height of an individual depends on the genes inherited from parents. Genes are the instruction inside you that tell your body what to look like and how to work. There are genes that tell your hair to be curly or straight, to grow tall, to tell your stomach how to digest food and so on. It is the genes that instructs every little detail of our body. But though genetic help determines character, but environmental influence have a considerable impact on shaping an individuals physical appearance and personality. So really, the way your body looks and functions is a combination of your genes and your environment.

IDEA BOX

How to calculate the full height of an individual? The full height of an individual can be calculated using the following formula.

$$\frac{\text{Present height (cm)}}{\text{\% age of full height at this age}} \times 100$$

Now calculate your height using the given formula.

INFORMATION!!

Puberty attained before the normal age is called precocious puberty. Early puberty keeps the female shorter.

2. **Changes in Body Shape :** *During puberty, your body fills and changes shape. You must have seen that boys in your class have broader shoulders and wider chest than boys in junior class. Why such variations are present?* This is because the body have entered the age of puberty. During puberty,

   In boys -
   (i) The shoulders become broader
   (ii) The chest becomes wider
   (iii) The body becomes more muscular

   In girls-
   (i) The pelvic region widens
   (ii) Hips get broaden
   (iii) Breasts develop and increase in size. The mammary glands (milk secretion glands) develop inside the breasts.

3. **Voice changes :** Both boys and girls experience voice change as they grow older. *A boy's voice may change from sounding like a little bird to sounding like somebody's dad! Why it is so ?*

do you know?

Larynx is also responsible for preventing food from entering the airway and controlling the airflow during breathing.

Fig. 7.1 : *Larynx*

do you know?

Adam's apple is the largest cartilage of the larynx and is named so because it looks like a small, rounded apple located in front of throat.

do you know?

The process of sound production in the larynx is know as **phonation.**

The larynx, also known as voice box, actually gets bigger during puberty. It is a tube-shaped piece of cartilage, located in your throat. Larynx helps the individual to talk, sing, hum, yell, caught and make all sort of noises. When a boy reaches puberty his body starts secreting a hormone called testosterone. This testosterone causes the boy's larynx to grow and his vocal cords to get longer and thicker. Vocal cords are thin muscles that stretch across the larynx like rubber bands.

How sound is produced by an individual? When you speak, air rushes from your lungs and makes your vocal cords to vibrate and produce the sound of your voice. Before you reach puberty, your larynx is small enough and your vocal cords are kind of small and thin. That is why your voice is higher than an adult's. As you go through puberty, the larynx gets bigger and the vocal cords get lengthened and thickened. This makes your voice deeper. As your body adjusts to this changing structure (larynx) your voice may 'crack' or 'break'. But this process lasts only for few months. Once the larynx has finished growing, your voice won't make those unpredictable noises. The growing voice box in boys can be seen as a protruding part of the throat called *Adam's apple*. When the larynx grows bigger, it tilts to a different angle and part of it sticks out inside the neck. You can see it at the front of the throat.

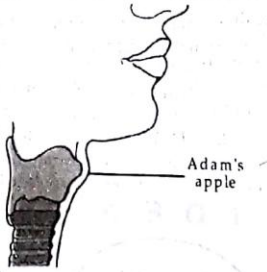


Fig. 7.2 : *Adam's apple*

For girls, the larynx also grows bigger but not as much as in boys. It means *there is no Adam's apple in a women's neck*. Generally, girls have a high pitched voice whereas the voice in boys is deep. Sometimes, the muscles of the growing voice box go out of control and voice becomes hoarse.

4. **Increased activity of sweat and sebaceous gland :** As you enter puberty, the puberty hormones stimulate the glands in your skin, including the sweat glands under your arms. When sweat and bacteria on your skin get together, it smells pretty bad. Another thing that comes with puberty is acne. The increased secretion of sebum from sebaceous glands makes the skin oilier. Pimples usually start showing up and you may get them through out the teenage years.
5. **Development of hair :** During puberty, in both boys and girls, hair start growing in the armpits and in the pubic area.
6. **Reaching Mental Intellectual and Emotional Maturity :** During puberty, you might feel confused or have strong emotions that you have never had before. You may feel overly sensitive or become upset easily. Some kids lose their tempers more often and get angry with their friends and families. Intellectual development also occurs during adolescence to transform the individual from a child to adult. In fact, it is the time in one's life when the brain has the greatest capacity for learning. The changes are natural part of growing. Hence during puberty :-

(i) There is mental growth of an individual. Individual is able to think in a more flexible and a logical way. The ability to see other's point of view, exploring ideas, developing concepts and memory skills improve.

(ii) There is an emotional growth. The individual is happy at one moment and the very next moment their mood changes. Interest in the opposite sex and desire for closeness arise.

(iii) There is a social growth. It includes developing a personal identity accepting oneself, developing independence and preparing for a career. Sometimes, it is hard to deal with all these new emotions. But it is necessary for you to know that while your body is adjusting to the new hormones, so is your mind.

7. **Sexual feeling :** At puberty, the adolescents may also have sexual feelings that they have never felt before. It causes the boys and girls to become interested in and attracted to the opposite sex.

8. **Development of sex organs :** During this period the male sex organs like testes and penis develops completely. Also, the testes begins to form sperm. In girls, the ovaries enlarge and eggs begin to mature. Also, ovaries start releasing matured eggs.

9. **Secondary sexual characters :** Secondary sexual characters are those features that help to distinguish the male from the female. In girls, during puberty, breast begin to develop and boys begin to grow facial hair that is moustaches and beard. As these features are used to distinguish male and female, hence they are called as *secondary sexual characters.*

Some of the secondary characteristics in girls during puberty are –

(i) Development of breast and increase in their size.

(ii) Development of hair under armpits and in the pubic region.

(iii) Widening of pelvic region and broadening of hips.

(iv) Start of menstrual cycle. (We will learn about this process in detail later in this chapter).

Some of the secondary sexual characteristics that develop in boys during puberty are –

(i) Growth of facial hair (beard and moustaches).

(ii) Voice becomes deeper.

(iii) Muscles develop and shoulders become broad.

(iv) Hair develop under the armpits, under chest and in the pubic region.

CHECK Point

1. **Why don't women have beards?**

CHECK YOUR ANSWERS

1. The various glands and hormones in the bodies of female deliberately act to prevent the growth of beards in women. The female sex hormone estrogen works in such a way that growth of hair on the head is developed while the growth of beard and body hair is inhibited

The male sex hormone, testosterone, on the other hand, works in such a way that beard and body hair are developed while the growth of hair on the head is inhibited or slowed down in the development.

By now you have learnt various changes that take place during puberty. But have you ever thought *what initiates changes at puberty?* The changes that occur at puberty or adolescence are controlled by hormones.

do you know?

- The custom of shaving was introduced to England by the saxons. Barbers first appeared in Roman times in 300 BC.
- Now a days there is a great variety of facial hair-styles- From beards and moustaches to the clean shavon effect.

Have you ever thought what makes you feel the hunger pangs? **OR** *What makes you feel tired and stressed at times?*

Fig. 7.3

Well, all these mood changes in our body occurs due to chemicals called hormones. *Hormones* are chemical messengers of the body that transfers information from one set of cells to another. Each hormone has a definite function and acts on a particular tissue.

Once a hormone is secreted, it travels through the bloodstream to the cells designed to receive its message. These cells are called target cells. When the hormones reaches its target cells, it trains chemical instruction to the cell.

Hormones are primarily controlled by endocrine system. Endocrine system operates as a chemical communication system. They work closely with the nervous system in regulating certain activities of the body. The nervous system and the endocrine system work together to help the body to function properly.

How nervous system is different from endocrine system?

1. Hormones are transported around (to their target organs) the body by the blood. Therefore, hormonal response are relatively slow compared with nervous responses.
2. Many hormonal responses (for example, growth) occur over relatively long period of time.
3. The main function of endocrine system is to maintain homeostasis within the body i.e. to keep the internal environment of body constant whereas the main function of nervous system is to receive and respond to stimulus.
4. Generally endocrine system is controlled by the nervous system through the hypothalamus, mediated by pituitary gland.

do you know?

Laughter increases the amount of natural killer cells which destroys tumours and viruses, lowers blood pressure and increases oxygen in the blood

Hormone producing cell

↓

Hormone is secreted in the blood

↓

Hormone then acts on the target cell

CHECK Point

1. Why hormones are important in body ?

CHECK YOUR ANSWERS

1. Hormones are important as they carry out several body functions such as growth and development, reproduction, metabolism and even regulate thoughts and moods.

GLANDS AND HORMONES :

The glands and hormones are the two key components of the endocrine system. *Glands* are groups of specialized cells which produce and secrete hormones into the bloodstream. Then these hormones travel inside our bodies and act like chemical messenger. Hence, it is the hormones that make you feel hungry or full, determine how you handle stress or how you sleep and much more. The glands control the body's day to day functioning. They affect its shape, its strength, its reproduction, its growth and its nourishment. A hormone from the pituitary gland causes us to grow to about average height. Other gland enable us to digest our food. Without them not even a feast would tempt us to eat.

Heterocrine glands are partly exocrine with duct and partly endocrine without duct. Exocrine part releases secretion in duct while endocrine part releases hormones in blood.

For example, pancreas and gonads.

Glands are divided into two types :-

(i) **Exocrine glands :** The glands that release their secretions with the help of ducts at specific site are called *exocrine glands*. For example, the salivary gland secrete saliva in the mouth through salivary duct. Similarly, digestive glands secrete their secretions in the digestive tract with the help of ducts. Sweat gland is also an example of exocrine gland.

(ii) **Endocrine glands :** The glands that pour their secretions directly into the blood are called *endocrine glands*. Endocrine glands are called ductless glands as they do not have ducts. The secretions reach their target through blood. The major endocrine glands that make up the human endocrine system are – Pituitary gland, hypothalamus, thyroid glands, parathyroid glands, adrenal glands, pineal body and reproductive glands that include the testes in the male and ovaries in the female.

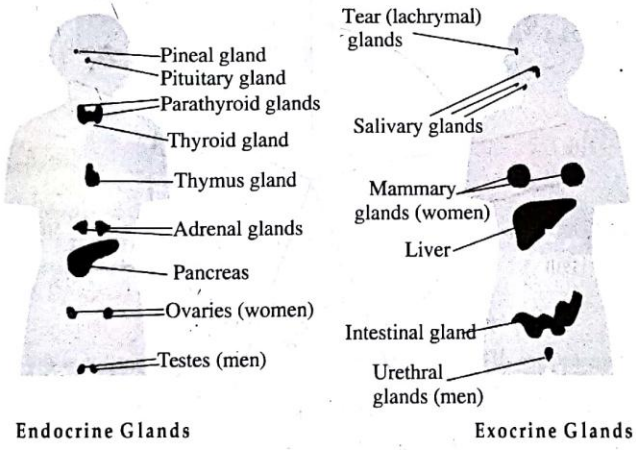
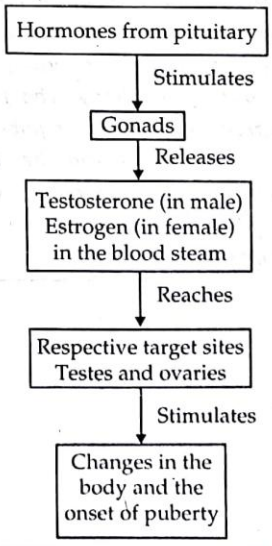


Fig. 7.4

ROLE OF HORMONES IN INITIATING REPRODUCTIVE FUNCTION:

The testes and ovaries are endocrine glands. During puberty, the testes begins to secrete the testosterone hormone. This hormones bring about the physical changes that make a boy look like an adult male. These changes are called male secondary sexual characteristics, which you have learnt in previous chapter. Similarly, in girls during puberty the ovaries begin secreting the hormones called *estrogen* and *progesterone*. These hormones develop female sexual features. The production of male and female hormone is under the control of a hormone from another endocrine gland called *pituitary gland*. Pituitary gland secretes follicle – stimulating hormone (FSH) that in turn form matured ova in the ovary and sperms in the testes.



REPRODUCTIVE PHASE OF LIFE IN HUMANS :

In females, the reproductive phase of life begins at puberty and generally lasts till the age of approximately 45 to 50 years. The ova begins to mature with the onset of puberty. During the reproductive period, the two ovaries inside a female body take turns to produce an ovum (or egg) and one egg is released every 28 days. The process of release of an egg by an ovary is called *ovulation*. During this period, the wall of uterus passes through several phases that are controlled by two hormones, called estrogen and progesterone. The inner lining of uterus gets thickened and is supplied with blood from which growing embryo draws nutrition. This is a natural preparation to receive the egg in case it is fertilized and pregnancy occurs. If fertilization does not occur, the lining of uterus breaks down slowly and is released out in the form of blood and mucous from the vagina. This process is called *menstruation*. *Menstruation* is a process in which blood and mucous flows out every month through the vagina. This is usually a 28 day cycle.

IMPORTANT TERMS

Ovulation (Ovum is released from ovary) : *During* ***ovulation****, the uterus lining becomes thick and cushiony, to prepare itself for receiving the fertilized egg. The blood supply to the uterus also increases due to hormones released by ovaries.*

Menstruation (Uterus lining is shed) : *In the absence of fertilization, the ovaries stop releasing hormones like estrogen and progesterone for a short period of time. The uterus lining is shed, and the lining of the uterus along with some blood and waste cells flow out though the vagina, and pass out of the body. The first menstrual flows begin at puberty and is termed as* ***menarche****. The stoppage of menstruation at 45 to 50 years of age is known as* ***menopause****.*

An egg is released in a mature female body every 28 days.

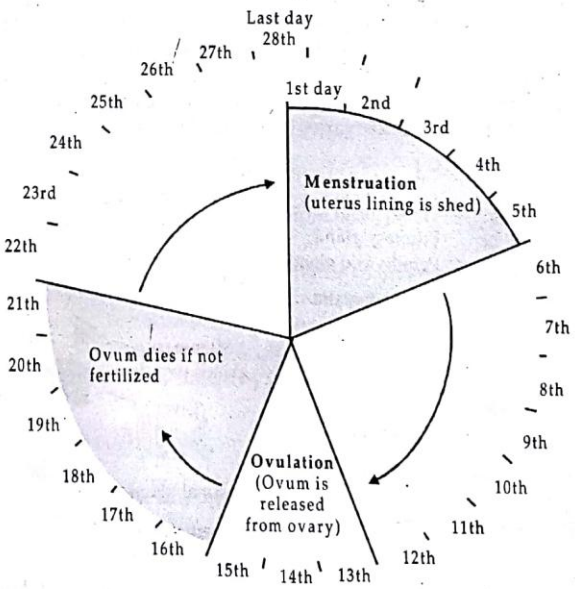


Fig. 7.5 : *Menstrual cycle*

SEX DETERMINATION – BOY OR GIRL :

What determine whether the baby developing inside the mother's womb is a boy or a girl? This is determined by a thread like structure called *chromosomes*, located inside the nucleus of zygote or fertilized egg. Chromosomes are thread like structure that carry information in the form of genes. Genes determine all inherited characters, including the sex of the baby. Each cell contains 23 pairs of chromosomes of these, one pair is called sex chromosomes. There are two types of sex chromosomes- X and Y. Female cell contains two X chromosome (XX) while male cells carry one X and one Y chromosomes (XY).

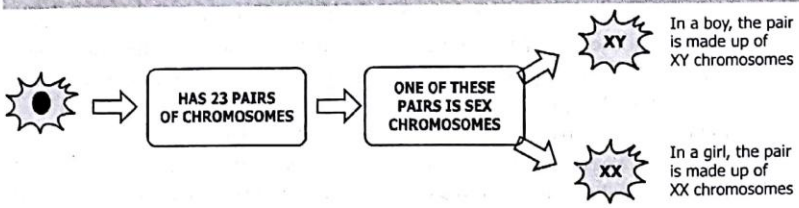


Fig. 7.6

When the egg gets fertilized, the sex of the child will depend on the kind of sperm that fertilizes the ovum.

- If the sperm carry X chromosome fertilizes the egg, it would be a girl, since the chromosome pair will be XX.
- If the sperm carrying Y chromosome fertilizes the egg, the baby will be a boy , since the chromosome pattern will be XY.

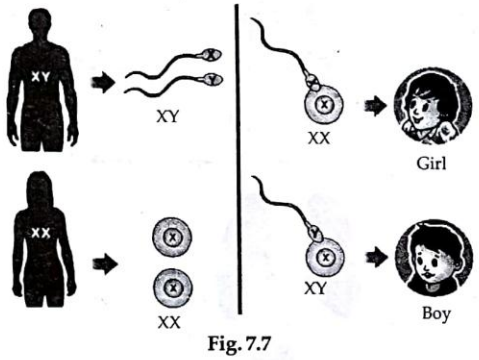


Fig. 7.7

DO YOU KNOW? do you know?

Sex of the child is determined at the time of fertilization.

CHECK Point

1. **The gender of the baby depends on the father's sperm and not on mother's egg cell. Many people blame the mother for the birth of a girl. *Do you think it is scientifically true?***

CHECK YOUR ANSWERS

1. No, this is not scientifically correct. Male gender is decided by the presence of Y chromosome. The sperm cell carrying either X or a Y chromosome determines the sex of the child because the egg cell from the mother (ovum) contains only X chromosomes.

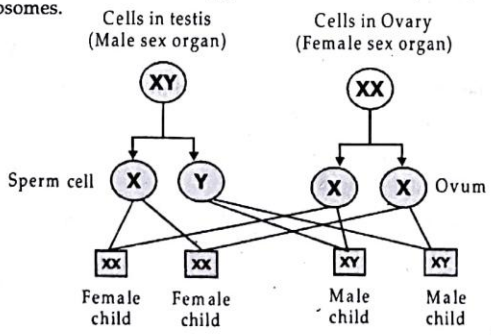


Fig. 7.8

Is it possible to find out the sex of the baby while inside the mother's womb. Yes. Doctors determine the sex of the child with the help of special techniques called sonography. Unfortunately, these days, people started misusing this test and are using it for killing a girl foetus if present inside the mother's womb. The process of killing foetus in mother's womb is called *abortion.* This killing of girl foetus is known as *female infanticide.* To put a stop to female infanticide the government has made it illegal and had banned techniques to find out the sex of growing foetus.

HUMAN ENDOCRINE SYSTEM :

Let us now learn about the different hormones present in our bodies. The major glands that make up the human endocrine system are – Pituitary, Thyroid, Adrenals, Pancreas, the Ovaries and the Testes.

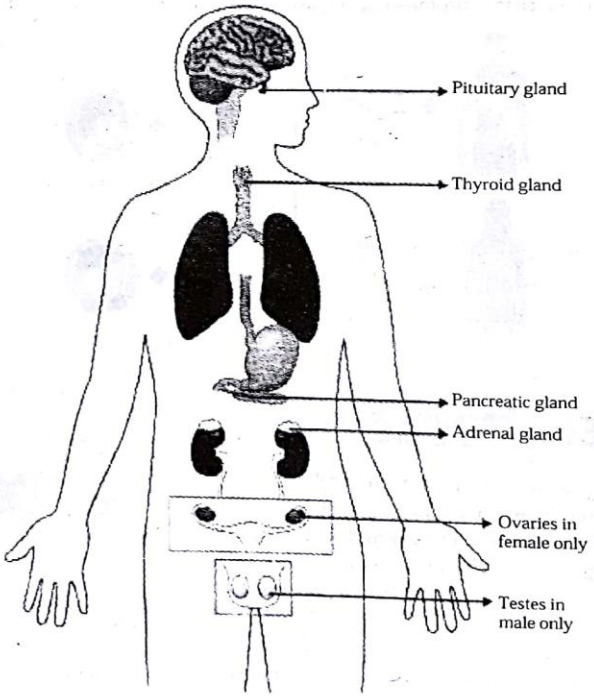


Fig. 7.9 : *Human Endocrine System*

do you know?

The branch dealing with the study of endocrine glands and actions of thier hormones is called endocrinology.

Fig. 7.10 : *Hypothalamus*

(1) **Hypothalamus :** Hypothalamus is located in the basal part of forebrain and it regulates wide range of body functions. It contains neurosecretory cells that produces hormones. These hormones regulate the synthesis and secretion of pituitary gland.

(2) **Pituitary Gland :** It is a pea-shaped gland located at the base of the brain and is attached to hypothalamus by a stalk.

The pituitary gland is anatomically divided into an anterior pituitary and posterior pituitary

The hormone secreted by pituitary gland influence the secretion of other glands. Therefore, they are known as *Trophic hormones*.

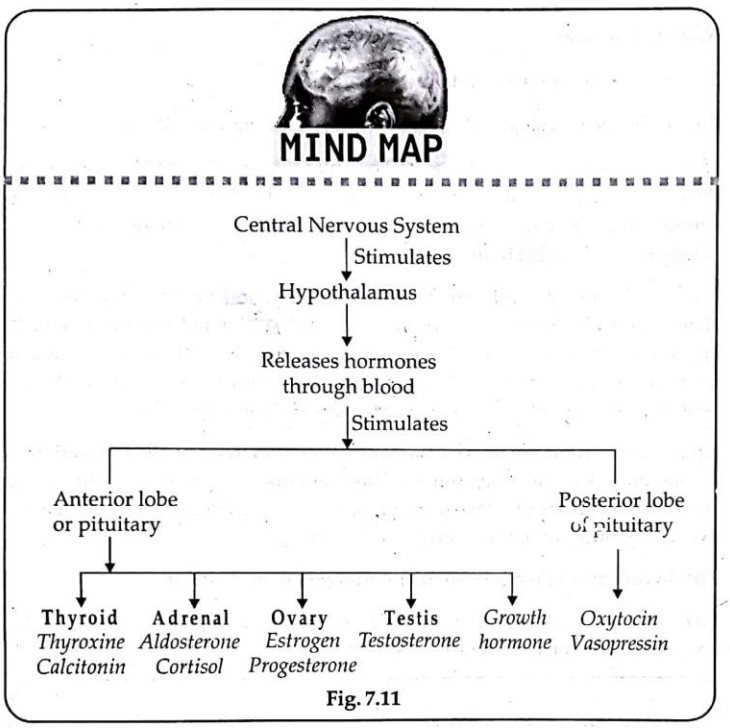


Fig. 7.11

INFORMATION!!

Pituitary acts as an "Executive Officer" of the hypothalamus and simply carries the instructions of the hypothalamus to other endocrine glands of the body.

Role of hormones secreted by pituitary :

(i) TSH stimulates the growth and functions of thyroid gland.

(ii) Growth hormone (GH) stimulates the growth and development of the body.

Pituitary gland is also called as master gland of the endocrine system. It is because:

(i) It is a hormone that controls the activity of many other endocrine system.

(ii) Its job is to receive messages about the need for a particular hormone and to secrete the hormones that cause the manufacture and release of the hormone.

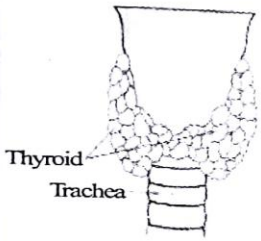


Fig. 7.12 : *Thyroid Gland*

(3) **Thyroid Gland :** It is located in the neck in front of wind pipe. The thyroid gland produces the hormone called thyroxine. Iodine is required for the production of this hormone

Role of thyroxine :

(i) Thyroxine regulates the body temperature.

(ii) It also plays a major role in growth and development of body.

Have you heard of goitre. What is it? The enlargement of thyroid gland due to deficiency of iodine in blood is termed goitre. This condition can be prevented by eating vegetables and fishes as they contain iodine in it. The abnormal secretion of thyroxine affects the body.

Hypothyroidism is a condition caused by under production of thyroxine. It is characterized by low energy production, slowing down of heart beat, loss of appetite and lethargy. *Hyperthyroidism* is a condition caused by over production of thyroxine. It is characterized by increased energy production, increased heart-beat, increased appetite, frequent sweating and shivering of hands.

Apart from all these, it also causes a condition characterised by the retardation of mental and physical development. This condition is known as *cretinism.* In adult, the deficiency of thyroxine leads to a disease called *Myxoedema* while the over secretion of thyroxine leads to *exophthalmic goitre.*

The thyroid gland produces another hormone called *calcitonin.*

Calcitonin along with *parathormone,* produced by parathyroid gland regulates the level of calcium ions in blood. Let us see, how?

do you know?

Thyroid gland is the largest endocrine gland in the human body.

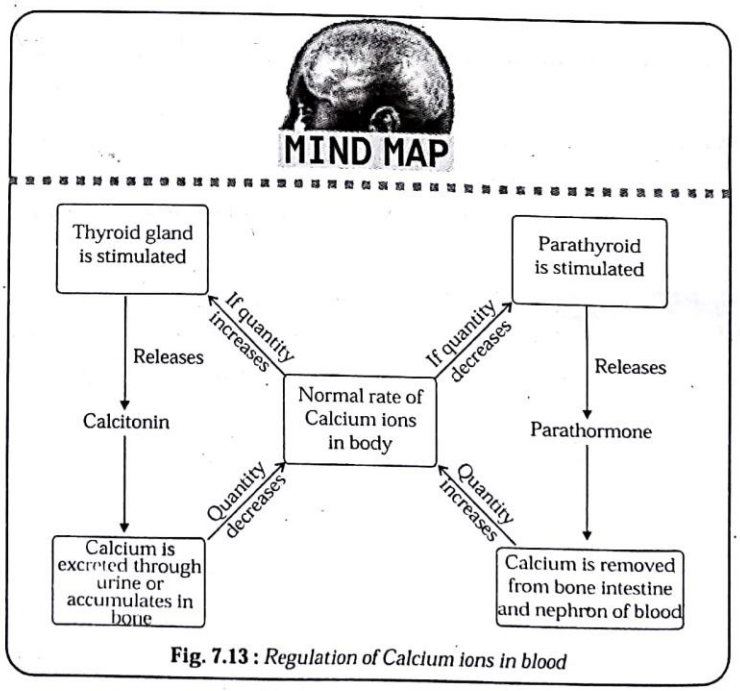


Fig. 7.13 : *Regulation of Calcium ions in blood*

(4) **Parathyroid Gland :** It is located on the posterior side of thyroid gland. It regulates the level of calcium ions in the blood.

What happens if there is increase production of parathormone in blood? Calcium salts are absorbed from the bones and added to blood. As a result, bones become brittle. Also, the kidney filter and excrete more calcium from the blood. This leads to stone formation in kidneys.

The deficiency of parathormone leads to deficiency called tetany. *Tetany* is manifested as strong spasms of muscles.

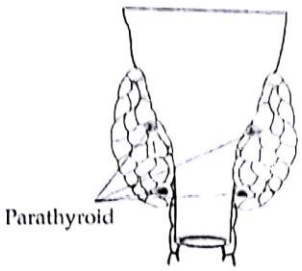


Fig. 7.14 : *Parathyroid Gland*

CHECK Point

1. **How can deficiency of calcium in blood be rectified?**
2. **What is the role of thyroid gland in regulating the level of calcium ions.**

CHECK YOUR ANSWERS

1. The deficiency of calcium in blood can be rectified by stimulating parathyroid to release parathormone. As a result, calcium is removed from bone, intestine and nephron to blood, there by increasing its quantity
2. When the level of calcium ions increases in blood, thyroid gland is stimulated to release calcitonin. Calcitonin, in turn causes the excess calcium to excrete through urine or to get accumulated in the bones.

(5) **Adrenal gland :** It is located at the top of each kidney. The hormone secreted by adrenal gland is adrenaline.

Role of adrenaline:–

(i) It helps in defence of the body in emergency situations.

(ii) It maintains the correct salt balance in the blood.

Adrenal gland is structurally and functionally divided into adrenal cortex and adrenal medulla.

(i) ***Cortex*** **:** The hormone secreted by cortex are aldosterone and cortisol.
   (i) *Aldosterone* - Aldosterone helps to maintain the balance of salts and water in the blood.
   (ii) *Cortisol* - Cortisol stimulates the break down of proteins and fats. It also stimulates synthesis of glucose from amino acids. Continuous use of cortisol causes elevation of glucose level in blood.

(ii) ***Medulla*** **:** Medulla is a source of two hormones called adrenaline and nor adrenaline. Both of these hormones prepare our body to overcome emergency stituation.

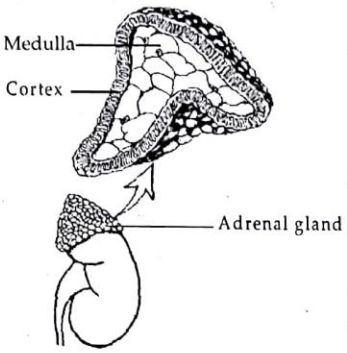


Fig. 7.15 : *Adrenal Gland*

IDEA BOX

Can you list down few physical and physiological changes that takes place when you experience fear, anger or anxiety.

- The rate and intensity of heart beat increases.
- Blood pressure increases
- Blood flow to the limbs inncreases
- Hair of skin rises
- Blood glucose level increases
- Blood flow to alimentary canal and skin reduces.

do you know?

Thyroid and adrenal gland secrete their hormones when they receive signal from pituitary gland through hormones.

The size of adrenal gland is smaller in males.

Adrenal gland is also called as 4s gland.

- Source of energy
- Sex hormone
- Salt retaining
- Sugar metabolism

ADRENALINE

Adrenaline is often known as the fight or the flight hormone because it prepares the body to act, especially when the body encounters stress. Hence it is also termed as stress hormone because it helps to calm down when one is very angry, embarrassed or worried. It is released under emergency situations. Some of the physiological changes brought about by adrenaline are –

(i) It increases the heart beat

(ii) It increases the blood-sugar level

(iii) It results in overall increase in energy level in the body.

INFORMATION!!

α-cells of islets of langerhans secrete glucagon and β-cells of islets of langerhans secrete insulin.

(6) **Pancreas :** It is located near the liver i.e. below the stomach. The hormones secreted by pancreas are insulin and glucagon. They are secreted by the cluster of cells called islets of Langerhans.

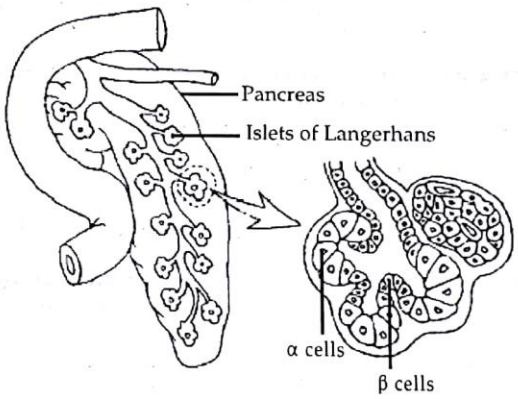


Fig. 7.16 : *Pancreas*

Role of pancreatic hormones **:–** It maintains blood-sugar level of body.

- **Insulin** – Lowers the blood sugar level.
- **Glucagon** – Raises the blood sugar level.

(7) **Ovaries :** They are two in number and located in the pelvic region of female body. The hormones secreted are oestrogen and progesterone.

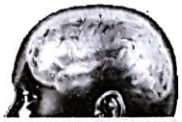
Role of hormones secreted by ovaries :

(i) Hormones control the development of secondary sexual characters in females such as development of breasts.

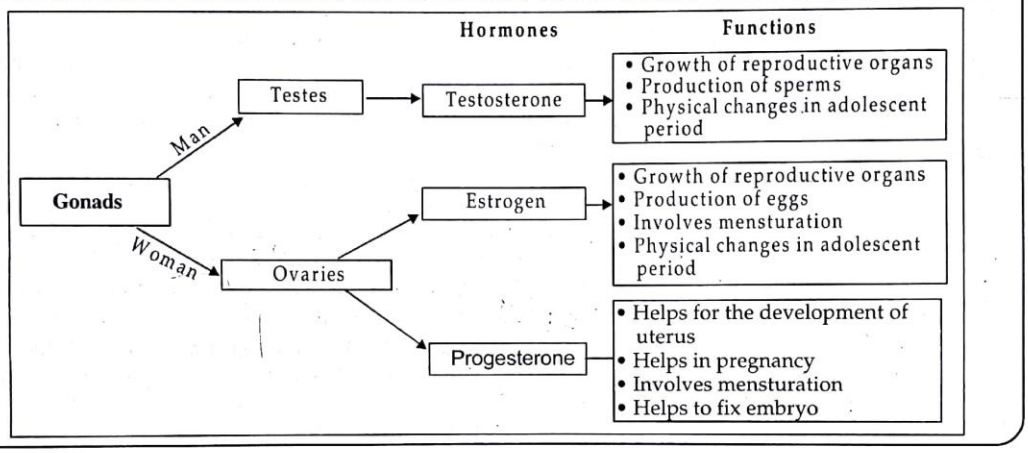
(ii) They play an important role in regulation of menstrual cycle and pregnancy.

(8) **Testes :** Like ovaries, they are also two in number. The testes are two oval organs in the scrotum. The hormone released is testosterone.

Role of Testosterone : It controls the development of secondary sexual characters in males such as facial hair.



MIND MAP



THYMUS GLAND

Our body also possesses a gland, which starts functioning in the embryonic stage itself, becomes active during childhood and undergoes regression and gradually stops functioning after adolescence. It is known as thymus gland.

Thymus produces the hormone thymosin that imparts resistance to diseases in children. However it continues to be the production centre of lymphocytes.

ROLE OF HORMONES IN COMPLETING THE LIFE CYCLE OF INSECTS AND FROGS :

In previous chapter, we have learnt about the life history of a butterfly and a frog. *Try to recall the stages of life history of the butterfly?* In the life history of a butterfly the caterpillar has to pass through various stages to become adult. This process of change from larva to adult is called *metamorphosis*. In insects, the process of metamorphosis is controlled by insect hormones like Ecdysone. Similarly, in frog metamorphosis it is controlled by thyroxine. The presence of thyroxine causes the tadpoles to become adult frog. But do you know, thyroxine production requires the presence of iodine in water. If the water in which tadpoles are growing does not contain sufficient iodine the tadpoles cannot get metamorphosed into adults.

IMPORTANT TERM

Hormones are secreted in plants also. Plant hormones are called phytohormones. Phytohormones control or regulate germination, growth, metabolism and other physiological activities of plants.

REPRODUCTIVE HEALTH :

During adolescence, there is rapid mental and physical growth. The physical and mental well being of an individual is regarded as an individual's health. *Therefore for proper individual health, every human being needs –*

(i) To have a balanced diet.

(ii) To observe personal hygiene and cleanliness regularly

(iii) To undertake adequate regular exercise.

IDEA BOX

Make a chart on the diet for adolescents. You can use your creative ideas and present it like an advertisement.

(i) **To have a balanced diet :** A balanced diet contains the right amount of proteins, carbohydrates, fats, vitamins and minerals. The diet should contain adequate amounts of cereals for carbohydrate, pulses for proteins, controlled amount of butter and ghee for energy and fruits and vegetable for protection against diseases. Our Indian meal of roti/rice, dal (pulses) and vegetable is a balanced diet. Milk is a balanced diet in itself. Fast food which is tasty but does not contain adequate nutrition. Hence, it should not be used as substitute for meals.

(ii) **Personal Hygiene :** Personal hygiene is necessary for adolescents because the increased activity of sweat glands sometimes make the body smelly. Taking a bath every day and cleaning all parts of the body is essential, otherwise, there are chances of catching bacterial infections. Girls should keep track of their menstrual cycle and should be especially careful about hygiene during menstruation.

(iii) **Regular physical exercise :** Walking, playing and jogging etc. in the fresh air keep the body fit and healthy. Since adolescence is a stage of insecurity and confusion, it is easy for the adolescent mind to get diverted by wrong company or advice and may fall prey to drug and alcohol abuse.

Adolescents are advised not to feel confused or insecure. You are just passing through a period of much activity in the body and mind, which is a normal part of growing up. So if anybody suggests that you will get relief by taking some drug just say 'No' to them. Drugs are actually addictive and once taken, there is a tendency to take them again and again. They harm the body in the long run, thereby ruining the health and happiness.

So, Remember!
Always say 'No' to drug!!

do you know?

The first recorded case of HIV infection dates back to 1959 from Democratic Rebublic of Congo in Africa.

AIDS (ACQUIRED IMMUNODEFICIENCY SYNDROME) :

You must have heard about AIDS. What is it? AIDS is a fatal disease caused by a dangerous virus called HIV (Human immunodeficiency virus). It destroys the body's ability to fight against illness and infections. AIDS stands for acquired immunodeficiency syndrome. HIV kills or damages cells of the body's immune system which slowly destroys the body's ability to fight infection and diseases. AIDS is the final stage of HIV infection.

Methods of transmission of virus are –

(i) By sharing the syringes used for injecting drug between normal and infected person.

(ii) From infected mother to an infant through milk.

(iii) Through sexual contact with a person infected with HIV.

Preventing measures that can be taken to prevent spread of AIDS are -

(i) Do not share syringes or needles.

(ii) Avoid receiving infected blood during transfusion

(iii) Use sterilised surgical instruments

- The period of life, when the body undergoes certain noticeable changes, leading to reproductive maturity is called *adolescence*.
- *Puberty* is the start of the time when a boy is biological ready to become father and a girl is ready to become mother.
- *Changes at puberty*
  - During childhood, girls and boys are similar in height. During puberty, both sexes rapidly become taller. But on average, boy grow more and so usually end up taller adults than girls
  - Girls develop a more rounded body outline, especially on the shoulders and hips while boys become more angular with broader shoulders.
  - The reproductive or menstrual cycle begins in girls while reproductive organs in the male body begins to develop sperm cells.
- *Secondary sexual characters* are those features that help to distinguish the male from the female. In girls, breast begin to develop and boys begin to grow facial hair.
- The changes at puberty are controlled by hormones.
- *Hormones* are chemical messengers of the body that transfers information from one set of cells to another.
- *Glands* are group of specialised cells that produce and secrete hormones.
- *Glands are of two types* -
  (i) *Exocrine gland* that releases their secretions with the help of ducts at specific site. Ex- Salivary gland
  (ii) *Endocrine gland* that releases their secretions directly into blood. Ex Adrenal gland.
- The endocrine glands play a vital role in controlling and co-ordinating activities of life.
- The various hormones of pituitary gland control the secretion of hormones from other endocrine gland.
- The pituitary and hypothalamus are connected by nerve fibres and blood vessels.
- The pituitary gland is controlled by the releasing hormones from hypothalamus.
- The under secretion or over-secretion of various hormones can cause health diseases.
- *Various types of glands and their secretions are as follows* :-
  - *Pituitary* - Master gland of body
  - *Thyroid* gland - Thyroxine and calcitonin
  - *Parathyroid* - Parathormone
  - *Adrenal glands* — Cortex - Aldosterone and Cortisone; Medulla - Adrenalin and nor- adrenalin
  - *Pancreas* - Insulin and Glucagon
  - *Gonads* — Testes - Testosterone; Ovaries - Estrogen and Progesterone

exercise 1

FIB FILL IN THE BLANKS :

DIRECTIONS : *Complete the following statements with an appropriate word / term to be filled in the blank space(s).*

1. When an adolescence reaches reproductive maturity, _____ ends.
2. The adolescence are also called as _____.
3. _____ is known as voice box.
4. _____ is absent in women's neck.
5. _____ glands makes the skin oiler.
6. Follicle stimulating hormone is secreted by_____ gland.
7. Chemically hormones are _____ .
8. Calcitonin is produced by _____ hormone.
9. _____hormone maintains salt balance in the body.
10. The first period of a girl is called _____.
11. The _____ gland produces hormones which stimulate other gland to release their hormones.
12. Every sperm has _____ sex chromosomes.
13. _____ hormone regulates the amount of sugar in blood.

T/F TRUE & FALSE :

DIRECTIONS : *Read the following statements and write your answer as true or false.*

1. Nervous system regulates many endocrine process in the body.
2. Thyroid stimulating hormone is responsible for the growth and development of body.
3. At puberty stage mammary glands develop inside the breasts.
4. 23 pairs of chromosome is found in every normal human cell.
5. The stage at which the body becomes capable of reproduction is called menstruation.
6. Deficiency of insulin hormone may cause diabetes.
7. At adolescence stage, adolescents get mental, intellectual and emotional maturity.
8. Metamorphosis in insects is controlled by adrenaline hormone.
9. Female cells contain XX chromosome.

MTF MATCH THE FOLLOWING :

DIRECTIONS : *Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.*

1.

Column-I		Column-II
A. Master gland of body	p.	Thymus
B. Stress hormone of body	q.	Pituitary gland
C. Disease resistance hormone in child	r.	Goitre
D. Deficiency of iodine causes	s.	Adrenaline

2.

Column I	Column II
(A) Parathyroid	p. Growth and development of body
(B) Calcitonin	q. Stimulate the function of thyroid gland
(C) Thyroxin	r. Regulation of level of calcium in blood
(D) Pituitary	s. Regulates body temperature

VSAQ VERY SHORT ANSWER QUESTION :

DIRECTIONS : *Give answer in one word or one sentence.*

1. Write the name of the medium by which endocrine gland release hormones?
2. What is an hormone?
3. Which hormone is responsible for maintenance of pregnancy?
4. Which organ is known as sound box?
5. Which hormone is responsible for the change of vocal cord in boys?
6. Write the role of hypothalamus in the body?
7. What is the age of puberty in boys and girls?
8. Write the names of hormones secreted by pituitary?
9. Write the location of parathyroid gland?
10. What is the important role of adrenaline hormone?
11. Which hormone controls the metamorphosis in caterpillar?
12. Write the name of the hormone, which is secreted from thymus.

13. What developmental changes occur in uterus at the time of menstruation?
14. What is menopause?
15. How many pairs of sex chromosomes are found in human being?
16. Which hormone is responsible for the growth of bones?
17. Write the name of the technique by which you can determine the sex of the child.
18. What is the functions of aldosterone in human body?

SAQ SHORT ANSWER QUESTION:

DIRECTIONS : *Give answer in 2-3 sentences.*

1. What is the difference between puberty and adolescence.
2. What is 'teenage"?
3. What are the secondary sexual characters in male and female?
4. What is infanticide?
5. What are tropic hormones?
6. What is the difference between hypothyroidism and hyperthyroidism?
8. What is the necessity of balance diet for adolescents?
9. Why personal hygiene is necessary for girls?
10. What are drugs?
11. Expand AIDS? Write different methods of transmission of AIDS virus.
12. List the changes in male body that take place at puberty.
13. Write a short note on Adrenal gland.
14. Draw a labelled diagram of pituitary gland.
15. Write a short note on : *Exocrine gland.*
16. Write the name of two hormones secreted by the thyroid gland.
17. What is ductless gland?
18. What are the main functions of pituitary gland?

LAQ LONG ANSWER QUESTION:

DIRECTIONS : *Give answer in 5-6 sentences.*

1. What are different endocrine glands found in human body? Write about their structure and functions.
2. Explain the role of hormone in your body?
3. What is a menstrual cycle?
4. Discuss the various habits that adolescents should acquire to have a proper physical health.

MCQ MULTIPLE CHOICE QUESTIONS:

DIRECTIONS : *This section contains* **15** *multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct. Choose the correct option.*

1. What is hormone?
   (a) Organic complex substances
   (b) Chemical messenger
   (c) Glandular secretion
   (d) Blood cells
2. Which of the following system exhibits body co-ordination?
   (a) Blood vascular system
   (b) Nervous system
   (c) Brain
   (d) Nervous and endocrine system
3. Which of the following flows directly into blood?
   (a) Enzyme (b) Hormone
   (c) Minerals (d) Proteins
4. Which of the following is not a gland?
   (a) Pancreas (b) Adrenal
   (c) Pituitary (d) Kidney
5. Endocrine glands
   (a) Do not possess ducts
   (b) Sometime have duct
   (c) Always have duct
   (d) Pour their secretion through ducts.
6. Which hormone regulates the process of spermatogenesis and sperm formation?
   (a) Follicle stimulating hormone
   (b) Growth hormone
   (c) Thyroxine hormone
   (d) Glucagon

7. Pituitary gland is found in
   (a) Pancreas (b) Brain
   (c) Gonads (d) Trachea
8. Which hormone controls secretion of oestrogen?
   (a) Progesterone
   (b) Follicle stimulating hormone
   (c) Aldosterone
   (d) Adrenaline
9. Which of the following disease results by endocrine disorder?
   (a) Typhoid (b) Jaundice
   (c) Goitre (d) Pneumonia
10. Which hormones regulates the growth of metamorphosis in frog?
    (a) Adrenalin (b) Insulin
    (c) Thyroxin (d) Cortisol
11. Which hormone is responsible for ovulation?
    (a) LH (b) Testosterone
    (c) Estrogen (d) FSH
12. Which hormone regulates calcium level in blood ?
    (a) Glucagon (b) Insulin
    (c) Thyroxin (d) Parathormone
13. Which hormone controls the blood pressure in emergency?
    (a) Thyroxine (b) Prolactin
    (c) Insulin (d) Adrenaline
14. Which hormone stimulates the stomach to secrete gastric juice?
    (a) Gastrin (b) Parathormone
    (c) Thyroxin (d) Insulin
15. Which hormone is associated with milk secretion in mammals?
    (a) Estrogen (b) Prolactin
    (c) Adrenaline (d) GH

MTOC MORE THAN ONE CORRECT

DIRECTIONS : *This section contains* **5** *multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which MORE THAN ONE may be correct.*

1. Which of the following factors are responsible for final height of an individual?
   (a) Environmental condition
   (b) Genes and hormones
   (c) Nutrition
   (d) Sex.
2. Which of the following is not a secondary sexual characterstics?
   (a) Development of hair in arm pits and pubic areas
   (b) Change in voice
   (c) Menstruation
   (d) Menopause
3. Which of the following are not considered as a balanced diet for adolescene?
   (a) Fast food (b) Aerated drinks
   (c) Alcohol (d) Milk
4. Effects of narcotic drugs on an individual are
   (a) Ruining health
   (b) Unstable mental condition
   (c) Healthy physical condition
   (d) Decent life
5. Which of the following animals undergo the process of metamorphosis?
   (a) Frogs (b) Insects
   (c) Mosquito (d) Rat

MMQ MULTIPLE MATCHING QUESTIONS

DIRECTIONS : *Each question has few terms in column I and column II. Any given term can have correct matching with one or more term given in column II. Match the entries in column I with entries in column II.*

1.

Column I	*Column II*
(A) Ovary	p. Insulin
(B) Pancreas	q. Growth hormone
(C) Thyroid	r. Calcitonin
(D) Pituitary	s. Adrenalin
(E) Parathyroid	t. Glucagon
	u. Estrogen
	v. Thyroid stimulating hormone (TSH)
	w. Progesterone
	x. Aldosterone
	y. Cortisol
	z. Thyroxin

A&R ASSERTION & REASON :

DIRECTIONS : *Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.*

(a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.

(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.

(c) If **Assertion** is **correct** but **Reason** is **incorrect.**

(d) If **Assertion** is **incorrect** but **Reason** is **correct.**

1. **Assertion :** The dietary deficiency of iodine causes goitre.
   Reason : Iodine is required for the formation of thyroid hormone.

2. **Assertion :** Prolactin is also called 'Milk ejection hormone'

   Reason : Prolactin stimulates contraction of smooth muscles of mammary glands.

3. **Assertion :** Adrenaline is known as fight, fright and flight hormone.

   Reason : The hormone adrenaline helps the body to combat against stress and emergency condition.

4. **Assertion :** A tadpole deprived of thyroid gland fails to metamorphose into adult.

   Reason : Thyroxine stimulates tissue differentiation therefore affects metamorphosis of tadpole into an adult.

5. **Assertion :** Excess amount of calcium is regulated by calcitonin.

   Reason : Parathormone is produced by parathyroid gland.

6. **Assertion :** Sweat glands sometimes make body smelly.

   Reason : It is due to infection by bacteria.

FTP FILL IN THE PASSAGE

DIRECTIONS : *Fill in the blank spaces in the given passage about menstuation cycle in women.*

A women's reproductive age starts at ___1____ and generally continues till she reaches her middle age. During reproductive period, the ____2___ ovaries inside a female body take turns to produce an ___3_____. One egg is released after every _____4____ days. The process of release of an egg by an ovary is called ____5_____, while the cycle of producing and releasing mature ova is called the ____6____. During this period, the wall of the uterus passes through several phases, which is controlled by ____7____ & ____8____ hormone. The first phase of the menstrual cycle usually last for ____9____ days. This duration of first phase is called ___10____.

PBQ PASSAGE BASED QUESTIONS

DIRECTIONS : *Study the given paragraph(s) and answer the following questions.*

Adolescence, the period between childhood and adulthood, is often a difficult time, both for parents and their children.

This is when young people establish an identity of their own, separate themselves from their parents, and create significant relationships outside their own families.

Many parents experience 'mourning' for this loss of their child as they adjust to the moody, obstinate person who has taken his or her place. Teenagers may also be mourning the loss of their own childhood and family relationships of earlier years.

It is important to keep the situation in perspective. Adolescence is an essential rite of passage which every adult has been through. Think about your own teenage years: How you rebel? What were your clothes look like? Does your parents complain about the music you listen to?

Parents' major task is to let teenagers grow up and become independent, learning to make the decisions that affect their own lives.

Limits need to be set, but within those boundaries there must be room for adolescents to spread their wings and get a sense of who they are and who they want to become. They will reject some excellent advice along the way - but that's part of growing up.

Adolescents are adversely affected by serious health and safety issues such as motor vehicle crashes, violence, substance use, and sexual behavior. They also struggle to adapt behaviors that could decrease their risk of developing chronic diseases in adulthood—behaviors such as eating nutritiously, engaging in physical activity, and choosing not to use tobacco. Environmental factors such as family, peer group, school, and community characteristics also contribute to the challenges that adolescents face.

To have the most positive impact on adolescent health, government agencies, community organizations, schools, and other community members must work together in a comprehensive approach. Providing safe and nurturing environments for our nation's youth can ensure that adolescents will be healthy and productive members of society.

Questions

1. What should be the parents task?
2. What are the major changes significant at the stage of adolescent?
3. What are the risk factors for adolescents?
4. What are the environmental factors that affects the adolescents?
5. How the adolescents gets safe and nurturing environment?

HSQ HOTS SUBIECTIVE QUESTIONS :

DIRECTIONS : *Answer the following questions.*

1. Many adolescents do not grow according to their age. Can you give reason, why?
2. Why expecting mothers are advised not to do heavy work at the first phase of pregnancy?
3. Initially girls grow faster than boys but at 18 years of age, both reach their maximum height. Given reason, why?

4. What is dwarfism? What are the reasons of dwarfism?

5. Some human female starts developing male characteristics like beard, degeneration of uterus and ovaries etc. in their growing period.

Give reason for these type of disorder.

6. During growth period, many adolescence get excessive growth, resulting in to a symmetrically giant body. Why it happens so?
7. Why do most of the people get acne and pimples on the face during puberty?
8. What is the reason for irregularity in menstrution?

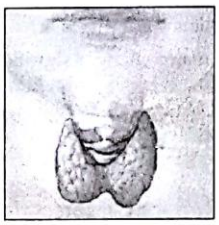
9. Heavy supplements are not good during physical exercise in adolescence

Do you agree. Give reason in support of your answer.

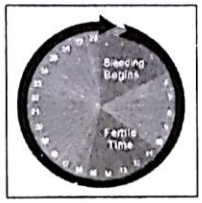
PBQ PICTURE BASED QUESTIONS

DIRECTIONS : *Study the given picture(s) and answer the following questions.*

1. Identify the gland. Which hormone is secreted from this gland?



2. Which term is used to refer this picture?

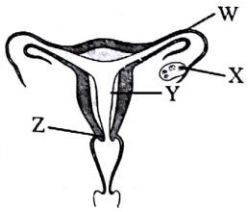


3. Name two endocrine glands present in this picture.

Write the name of hormones secreted form pituitary gland.

4. Identify the picture. Is this beverages healthy for adolescents?

5. Where do fertilisation and implantation occur?



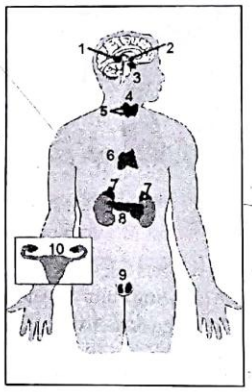
(a) W-fertilisation; Y-implantation
(b) X-fertilisation; Z-implantation
(c) Y-fertilisation; X-implantation
(d) Z-fertilisation; W-implantation

ABQ ACTIVITY BASED QUESTIONS :

DIRECTIONS : *Study the given activities and answer the following questions.*

1. Make a poster on the "drug abuse"
2. Collect information about different types of drugs. Find out how many adolescents are affected by drugs (According to latest report of government of India.)
3. Make a group of students and start a road show about the "sex education in adolescence" in your locality by using different posters, banners and samples etc.

4. Identify the glands and the hormones secreted by them.

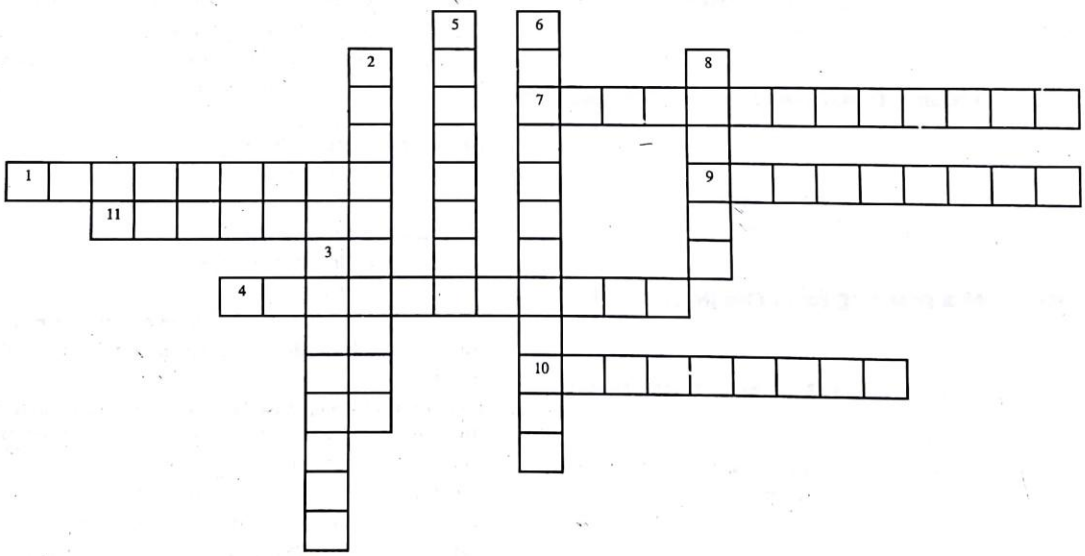


Human Endocrine System

	Glands	Hormones
(i)		
(ii)		
(iii)		
(iv)		
(v)		
(vi)		
(vii)		
(viii)		
(ix)		
(x)		

FUN TIME

CROSSWORD PUZZLE



Across

2. Hormone which maintains correct salt balance
4. Period or time during which a man or woman becomes reproductively matured.
7. Chromosomes present in males that determines their sex
9. The period of time when a women does not produce ovum.
10. The process of release of ovum from ovary
11. The hormone secreted from pancreas.

Down

1. Deficiency of this hormone may cause goitre.
3. Part that is known as larynx.
5. Chemical substances secreted from endocrine gland.
6. Sex hormone produced by testes.
8. The gland that is present behind the breast bone (near the heart)

SOLUTIONS

BRIEF EXPLANATIONS OF SELECTED QUESTIONS

EXERCISE 1

FIB FILL IN THE BLANKS :

1. Puberty
2. Teenagers
3. Larynx
4. Adam's apple
5. Sebaceous gland
6. Pituitary gland
7. proteins
8. Thyroid
9. Adrenaline
10. Menarche
11. Pituitary
12. Two
13. Insulin

T/F TRUE & FALSE :

1. False
2. False
3. True
4. True
5. False
6. True
7. True
8. False
9. True

MTF MATCH THE FOLLOWING :

1. A-q, B-s, C-p, D-r

VSAQ VERY SHORT ANSWER QUESTION :

1. Blood stream
2. Hormones are chemical messengers which regulate most of the metabolic and other activity inside the body.
3. Progesterone
4. Larynx
5. Testosterone
6. Hypothalamus regulates the synthesis and secretion of pituitary gland.
7. In girls, 11-14 years. In boys, 12-18 years
8. T S H & G H
9. At the posterior side of thyroid gland.
10. Prepares body to act against stress.
11. Ecdysone
12. Thymosin
13. The inner lining of uterus gets thickened and is supplied with blood by which growing embryo gets nutrition.
14. Menopause is the stoppage of menstruation of woman at the age of 45 to 50 years.
15. 1 pair
16. Pituitary
17. Sonography
18. Maintain balance of salt and water in body.

SAQ SHORT ANSWER QUESTION :

1. When the body undergoes certain noticeable changes, leading to reproductive maturity, it is called adolescence. These changes mark the onset of puberty.
2. The age of adolescence between 13 to 19 years of age is called teenage.
3. Secondary characters in male –
   - Growth of facial hair
   - Shoulder become wider.

   Secondary character in females –
   - Breasts develops
   - Pelvic region widens
   - Mammary glands develop inside breast.
4. Infanticide is the killing of foetus inside the mother's womb.
6. Hypothyroidism is caused due to under production of thyroxine hormone in the body. Hyperthyroidism is caused due to over production of thyroxin in the body.
13. Personal hygiene is necessary for girls, because due to unhygiene, different bacteria may cause odour and infection in their body.
16. **Exocrine glands :** The glands that release their secretions with the help of ducts at specific site are called *exocrine glands*. For example, the salivary gland secrete saliva in the mouth through salivary duct. Similarly, digestive glands secrete their secretions in the digestive tract with the help of ducts. Sweat gland is also an example of exocrine gland.
18. Thyroid gland secretes thyroxin and calcitonin hormone.

19. The gland which does not have duct and release the hormones directly into the blood stream, is called ductless gland.
20. Pituitary gland produces several hormones that control water balance, growth and also release of other hormones.

LAQ LONG ANSWER QUESTION :

3. When the egg is released from the ovary, the lining of the uterus begins to become thicker. If the egg gets fertilised, it attaches itself to the wall of the uterus and receives nourishment. If the egg is not fertilised, the lining of the uterus is shed. This is known as **menstruation** or **periods.** Once the wall is shed, it begins to build up again. This contituous building and shedding of the inner wall of the uterus occurs during a **menstrual cycle.** In a mature female, normally one egg is formed during the menstrual cycle. The duration of one menstrual cycle is about 28 days. At the end of the cycle, the egg is released from the ovary.
4. Proper physical health in adolescents is a need.
   - **A balanced diet** containing the right amounts of proteins, carbohydrates, fats, vitamins and minerals
   - Fast food which is tasty but does not have adequate nutrition, such as chips or aerated drinking, should not be used as substitute for meals.
   - **Personal hygiene** due to increased activity of sweat and sebaceous glands, proper personal hygiene is very important for adolescents, otherwise body odour and bacterial infection may result. Girls should be especially careful about hygiene during menstruation.
   - **Physical exercise** like walking, jogging, aerobics, outdoor games, etc., are good for the growing adolescent body.

2

MCQ MULTIPLE CHOICE QUESTIONS :

1. (b)
2. (d)
3. (b)
4. (d)
5. (a)
6. (a)
7. (b)
8. (b)
9. (c)
10. (c)
11. (c)
12. (d)
13. (d)
14. (a)
15. (b)

MTOC MORE THAN ONE CORRECT

1. (b, c)
2. (c, d)
3. (a, b, c)
4. (a, b)
5. (a, b)

MMQ MULTIPLE MATCHING QUESTIONS

1. (A)- u, w; (B) - p, t; (C) - r, z; (D)- q, v; (E) - s, x, y
2. (A)-r, p; (B)-r; (C)-p, s; (D)-p, q

A&R ASSERTION & REASON :

1. (b)
2. (c)
3. (d)
4. (b)
5. (b)
6. (a)

FTP FILL IN THE PASSAGE

1. Puberty
2. 2
3. Ovum
4. 28
5. Ovulation
6. Menstrual cycle
7. Oestrogen
8. Progesterone
9. 4-6 days
10. Menarche

PBQ PASSAGE BASED QUESTIONS

1. Parents' should keep friendly relationship with adolescence.
   – should let them to do their own decision
   – should cooperate them to take any independent work etc.
2. Major changes happens in adolescents are both physically and mentally. The physical changes are growing of hairs in pubic regions, appearance of beard and development of mammary glands.
   Mentally changes such as they rejects some advices of their parents or elders.
3. The risk factors are motor vehicle crushes, violence, substance use and sexual behavior.
4. Environmental factors are family, peer group, school and community.
5. Adolescents get safe and nurturing environment by the proper guidance of parents, teachers etc.

HSQ HOTS SUBJECTIVE QUESTIONS :

4. Dwarfism is caused by deficiency of growth hormone. From early age growth of long bones and of the body stops prematurely, making the patient dwarf.
5. Excessive secretion of male hormone (androgen) in a female fetus before complete formation of ovaries causes abnormal development of muscles, beard and moustache. Sometimes it results into female sterility.

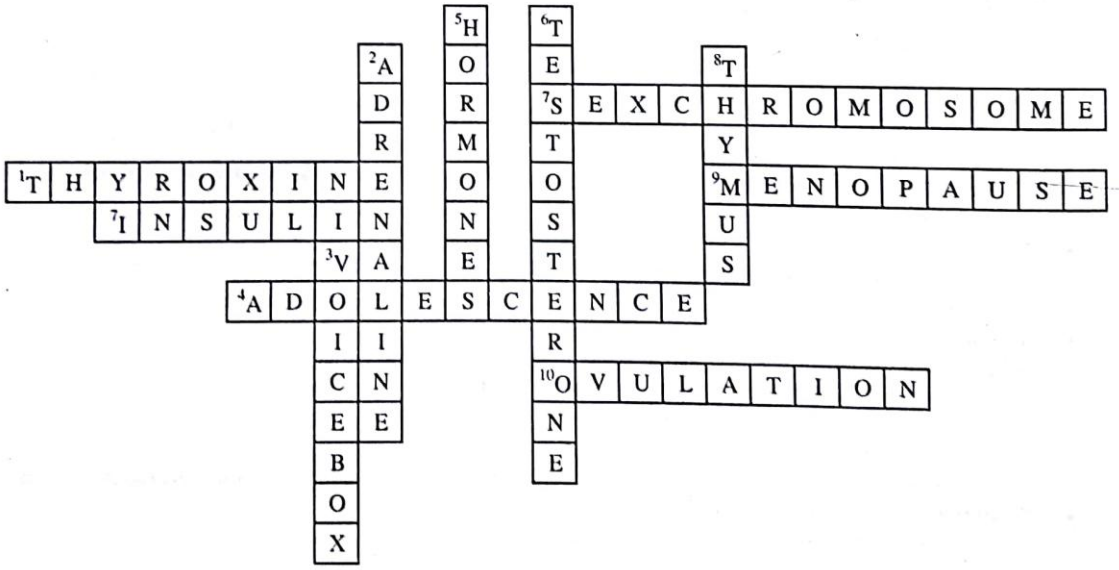
6. Many adolescence get excessive growth, which results into giant body during its growing period. It is caused due to secretion of excess of growth hormone after adolescence. As a result, the bones like lower jaw and limb (arms, hands, legs) become abnormally large.
9. Heavy supplement intake during physical exercise causes abnormal changes in growth of muscle, stiffness of muscle and maturity before age.

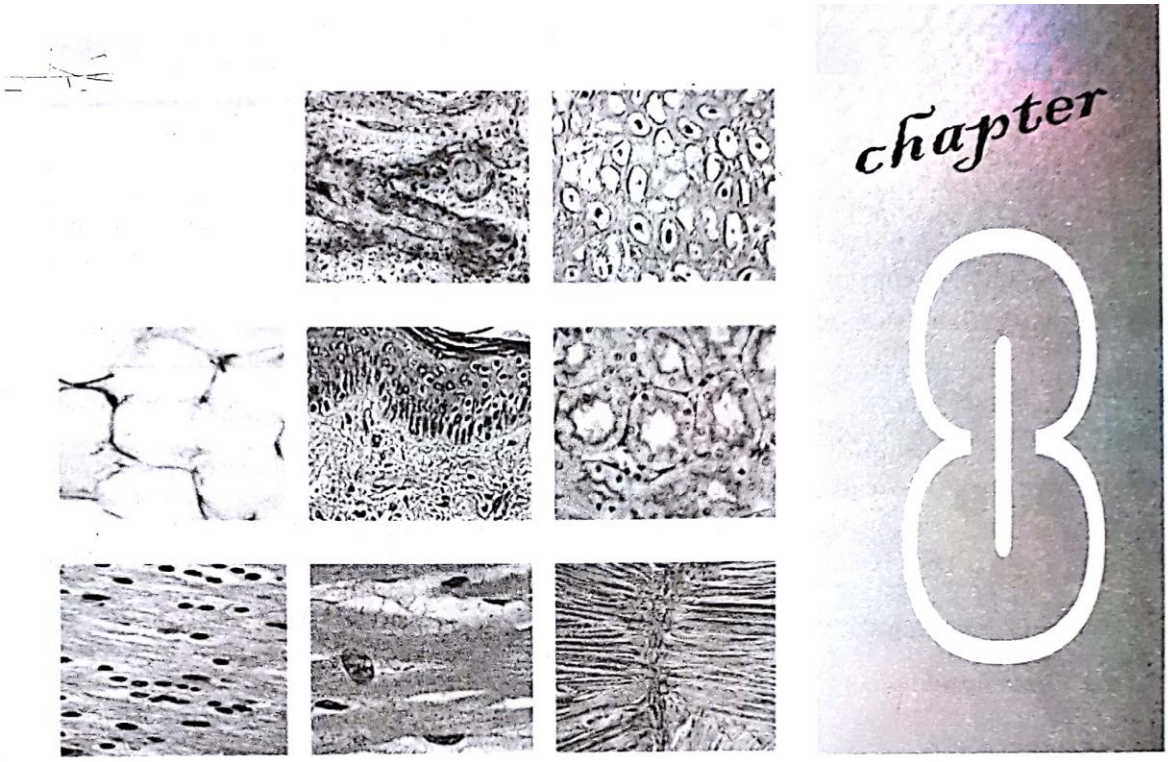
PBQ PICTURE BASED QUESTIONS

1. **Thyroid gland :** The hormone thyroxine is secreted from this gland.
2. Menstrual cycle.
3. Pituitary gland, Pineal gland. Hormones secreted by Pituitary are GH & TSH.
4. **Aerated drink :** It is not healthy for adolescence.
5. (a) W-fertilisation; Y-implantation

FUN TIME Fun TIME

CROSSWORD PUZZLE





chapter 8

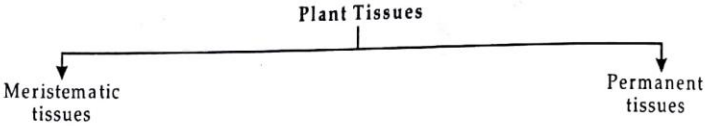
Tissues

All living organisms are made up cells. Some organisms are unicellular (made up of one cell) and the others are multicellular (made up of many cells). These cells are capable of performing different functions such as respiration, digestion and so on. In multicellular organisms, because of large body size it is difficult for each cell to efficiently cope with the vast variety of the physiological needs of the organism, so cells group together to form tissues. These tissues are specialised to carry out a particular function at definite place in the body. For example, the muscle cells form muscular tissues that help in movement. Similarly, Nerve cells form nervous tissue that helps in transmission of message. Likewise in plants, phloem cells form phloem tissue that conducts food from leaves to other parts of the plants. This is known as division of labour in multicellular organism. This division of labour allows the multicellular organism to perform all functions properly.

Tissues are group of cells similar in structure that work together to perform a particular function. In this chapter, we will be discussing about the different types of plant tissues and animal tissues. Let us first, discuss about plant tissues.

PLANT TISSUES

Plants are autotrophic organism that prepare their own food by photosynthesis. They are stationary organisms that need not have to move from one place to place in search of food. Most of the tissues of plants are supportive that provide them structural strength or support. Further, there are some tissues in plants that divide throughout the life. *Based on division in tissues, the various plant tissues can be classified as meristematic and permanent tissues.*



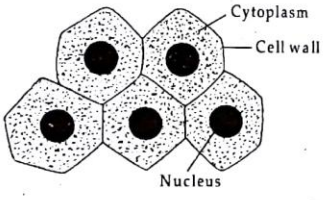


Fig. 5.1 : *Meristematic tissue*

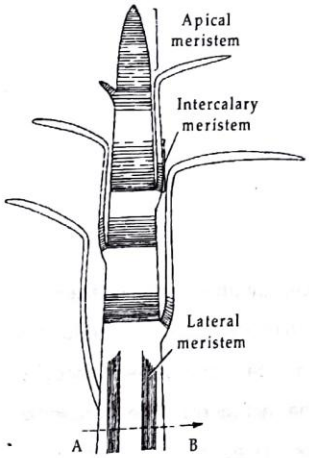


Fig. 5.2 : *Shoot apex showing location of meristem and young leaves.*

1. **MERISTEMATIC TISSUES :** Meristematic tissues are composed of cells that divide continuously. *These cells show the following characteristics :-*
   - (i) The cells may be spherical, oval, polygonal or rectangular.
   - (ii) The cells of meristematic tissue are similar in structure and have thin cell wall, made up of cellulose.
   - (iii) The cells are compactly arranged without inter cellular spaces.
   - (iv) The cells contain abundant – cytoplasm and nuclei are large.
   - (v) Vacuoles are absent and if present, they are few in number.

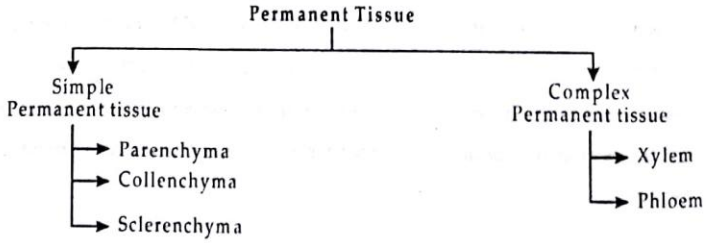
   Occurrence : Meristematic tissues are found in growing tips of root and shoot. *Based on their position in the plants, meristems are divided into three types :*

   (i) Apical meristem, (ii) Lateral meristem and (iii) Intercalary meristem

   - (i) ***Apical meristems*** are found at the growing tips of stems and roots. It helps to initiate growth in new cells of seedling, at the tip of roots and shoots. It results in increase in height of the plant.
   - (ii) ***Lateral meristems*** are found beneath the bark. It increases the diameter of the stem.
   - (iii) ***Intercalary meristem*** are located at the base of leaves or internode. It increases the length of internode.

   Cells derived from division of meristematic tissues take up specific function and thereby lose the ability to divide. Thus, they form permanent tissue. The developmental process by which cells take up a permanent shape, size and function is called *differentiation*.

2. **PERMANENT TISSUES :** Permanent tissues are tissues that are derived from meristematic tissues that have lost the power of division and have attained their definite forms. They are classified into two main types –
   - (A) Simple permanent tissue
   - (B) Complex permanent tissue



A. Simple Permanent Tissues : A simple permanent tissue is made up of one type of cells forming a uniform mass. *They are classified into three types* :

(i) Parenchyma (ii) Collenchyma

(iii) Sclerenchyma

(i) ***Parenchyma*** **:** Parenchyma is widely distributed in plant body such as stem, root, leaves, flower. They are found in the cortex of root, ground tissue in stems and mesophyll of leaves.

- Parenchyma form the bulk of the plant body. Hence, it is known as packing tissue.
- They are living and possess the power of division.
- Parenchymal cells are isodiametric having equal diameters in all directions.
- They are oval, round, polygonal and elongated in shape.
- The cell walls are thin and are made of cellulose.
- Cytoplasm is dense with a single large vacuole.
- Parenchyma has loosely packed cells that contains intercellular spaces.

Parenchyma that contain chlorophyll are called *chlorenchyma* while parenchyma specialised for gas exchange is called *aerenchyma.*

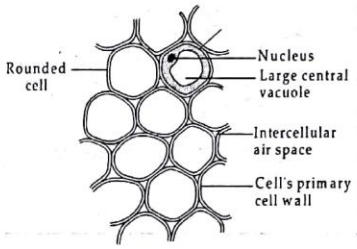


Fig. 5.3 : *Parenchyma tissue*

Functions :

1. They store and assimilate food. They serves as food storage tissue.
2. They give mechanical strength by maintaining turgidity.
3. They prepare food if chlorophyll is present.
4. They store waste products like tannin, gum, resins etc.

(ii) ***Collenchyma*** **:** Collenchyma are found below the epidermis of dicot stem and leaf stalk.

- Collenchyma are characterised by the deposition of extra cellulose at the corners of the cells.
- The cells are elongated in shape.
- Intercellular spaces are generally absent.

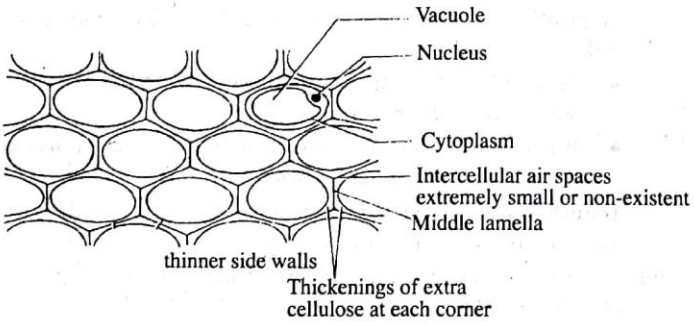


Fig. 5.4 : *Collenchyma tissue*

Functions :

1. Collenchyma is a mechanical tissue. It provides mechanical support to the stem.
2. They provide tensile strength with flexibility to those organs in which it is found.

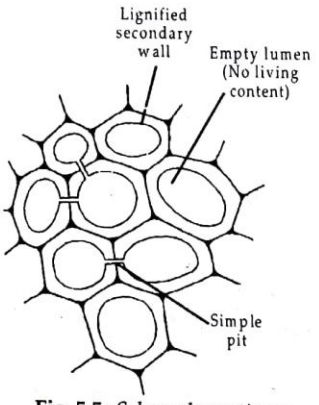


Fig. 5.5 : *Sclerenchyma tissue*

IMPORTANT TERM

Lignin is a complex polymer that hardens cell wall. It makes the cell wall impermeable so that substances can not pass through it.

do you know?

Husk of coconut is made of sclerenchymatous tissue. It is present in the mesocarp of fruit of coconut.

(iii) ***Sclerenchyma*** **:** Sclerenchyma are found abundantly in stems, roots, vein of leaves, and hard covering of seeds and nuts.

- These are dead cells that are devoid of protoplasm.
- The cell wall is evenly thickened with lignin. Due to excessive thickening of the wall of a sclerenchyma cell, its cell cavity or lumen becomes nearly absent.
- A conspicuous middle lamella exists between two sclerenchymatous cells.

Cells of sclerenchyma are of two types :-

(i) ***Fibres*** **:** They are usually pointed at both ends and are clustered into strands. They consists of very long, narrow, thick and lignified cells.

(ii) ***Sclereids*** **:** Sclereids, also called stone cells, are irregular-shaped. They are found in the cortex, pith, phloem, hard seeds, nuts and stony fruits. Their function is to give firmness and hardness to the part concerned.

You most have noticed that flesh of pear and guava are sometimes gritty . Can you guess why it is so? It is due to the presence of sclereids. These cells are thick-walled, hard and strongly lignified.

Function : They give mechanical support to the plant by giving rigidity, flexibility and elasticity to the plant body.

Difference table between parenchyma, collenchyma and sclerenchyma.

Parenchyma	Collenchyma	Sclerenchyma
Cell walls are relatively thin, and the cells in parenchyma tissues are loosely packed.	The cell wall is irregularly thickened at the corners and there is very little space between the cells.	The cell walls are uniformly thickened and there are no intercellular spaces.
The cell wall in this tissue is made up of cellulose	Pectin and hemicellulose are the major constituents of the cell wall.	An additional layer of the cell wall composed mainly of lignin is found.

Protective tissue :

(i) ***Epidermis*** **:** These tissues are usually present in the outermost layer of the plant body such as leaves, stem and root. It includes epidermis and cork.

- Epidermis is usually present in the outer most layer of plant body such as leaves, stem and roots.
- It is one cell thick and covered with cutin and protects the underlying tissue present in plant body.

The main function of epidermis is to protect the plant from desiccation and infection. It also helps in exchange of gases through the stomata.

(ii) ***Cork*** **:** As roots and stems grow older with time, tissues at the periphery become cork cells.

- Cork cells are dead, they have no intercellular spaces and the cell walls are heavily thickened by the deposition of suberin. Suberin makes the cork cell impermeable to water and gases.
- Cork is protective in function. They prevent loss of water from plant body, protect plant from infection and mechanical injury.

In The LAB

How epidermal cells help in gaseous exchange? Let us perform an activity :

Take a freshly plucked leaf of a Rhoe plant. Stretch it from upper side and break it by applying pressure. While breaking it , stretch gently so that peel projects out. Place this peel in a petri dish filled with a water. Add a few drops of safranine stain to it. Observe it under microscope.

What did you observe? You will find tiny pores of stomata along with the epidermal cells. The stomata are bound by a pair of guard cells. Guard cells are the two curved cells on the either side of the pore. By changing their shape they can open or close the pore. When guard cells absorb water, they bend outwards, so that the pore between them opens up. When they lose water they go back to a less curved shape, closing the pore between them.

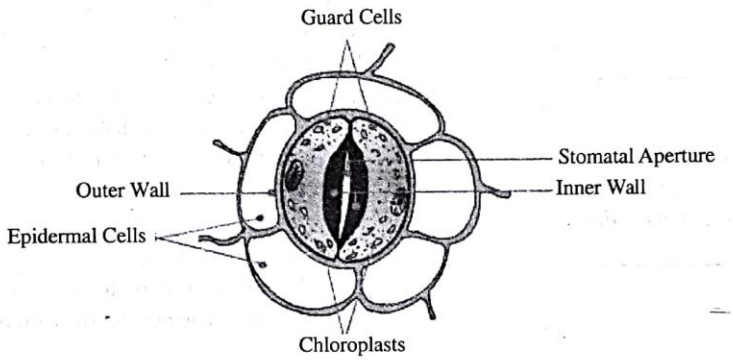


Fig. 5.6 : *Stomata*

Functions of stomata :-

(i) Stomata helps in transpiration. Transpiration is the process of evaporation of water from the leaf surface.

(ii) Stomata allows the exchange of gases (CO_2 and O_2) with the atmosphere.

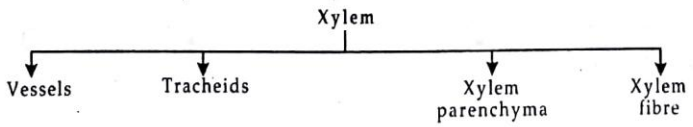
B. Complex Permanent Tissues : The complex permanent tissues consists of more than one type of cells. All these cells co-ordinate to perform a common function. They transport water, salt and prepared food material to various parts of the plant body.

Complex tissues are of two types :-

I. Xylem

II. Phloem

(I) ***Xylem*** **:** Xylem is a conducting tissue that conducts water and minerals to various parts of the body. It is composed of four different types of cells.



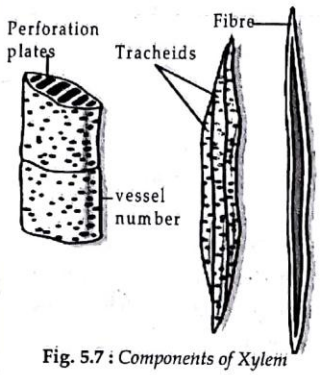


Fig. 5.7 : *Components of Xylem*

IMPORTANT TERM

Except for Xylem parenchyma, all other xylem elements are dead and bounded by thick lignified walls.

(a) ***Vessels*** – Vessels consist of dead, hollow cells with wide lumens. Cells are linked end to end in a drainpipe fashion. End walls have one or more perforations. It allows rapid transport of large volumes of water from roots up through the stem. Vessels have thick lignified walls that prevents the cells from collapsing, enabling them to withstand the negative pressure generated as water is pulled up through their lumens. Lignin also provides waterproofing

Side walls may have bordered pits (unlignified areas), which allows lateral movement of water. If for example, one xylem vessel becomes blocked, water moves sideways to another vessel and then move upward again.

Vessels are the main conducting cells in angiosperms. Large diameter of vessels enable large volumes of water to be moved through the plant.

(b) ***Tracheids*** – They have dead, hollow cells with narrower lumens than vessels. Tracheids are connected vertically to each other via bordered pits. They conduct water in conifers which, have needles, because they do not lose as much water as, for example, broadleaved trees. Narrower lumens encourages capillarity.

They are elongated cells with tapering ends. Their end walls are thickened with lignin. It provides mechanical strength to them.

(c) ***Parenchyma*** – They are made up of parenchymatous cells. They have thin cellulose walls with living contents which contribute support via turgidity.

(d) **Fibres** – They are sclerenchymatous cells that form wood in older plants. The cells are dead and provide strength.

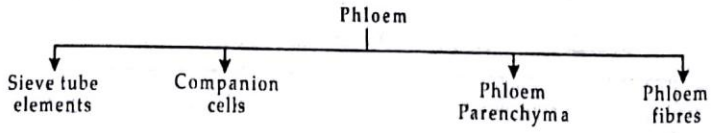
Functions :

(i) Xylem conduct water and minerals upward from the roots to the stem and leaves.

(ii) Cells that are lignified such as tracheids, vessels and parenchyma fibres are used to give mechanical strength to the plant body.

(iii) Xylem parenchyma stores food and helps in lateral conduction of water.

(II) *Phloem* : Phloem is also a conducting tissue that transports prepared food from leaves to other parts of plant. It is composed of four different types of cells.



(a) **Sieve tube elements :** They are living, tubular cells linked end to end. Their end walls are perforated and form a sieve plate, which allows bidirectional flow of solutes and hormones. Cytoplasm of sieve tube element is thin and peripheral. They have cellulose cell walls, which allows exchange to substances across them.

Each sieve tube element is directly connected via strands of cytoplasm known as plasmodesmata to its own companion cell. The companion cell controls movement of solutes in the sieve tube element. Plasmodesmata allows exchange of substances between the sieve tube element and the companion cell.

IMPORTANT TERM

Except for phloem fibres, phloem cells are living cells.

(b) **Companion cell :** They are small cells containing large nucleus and abundant other organelles e.g., ribosomes, mitochondria and golgi body. Nucleus controls the activities of sieve tube element. Ribosomes allow production of enzymes and mitochondria produce ATP for active transport in sieve tube element.

(c) **Phloem parenchyma :** Parenchyma provide support through turgidity.

(d) **Fibres :** They are sclerenchymatous cells that provide support and some protection for delicate sieve tube elements.

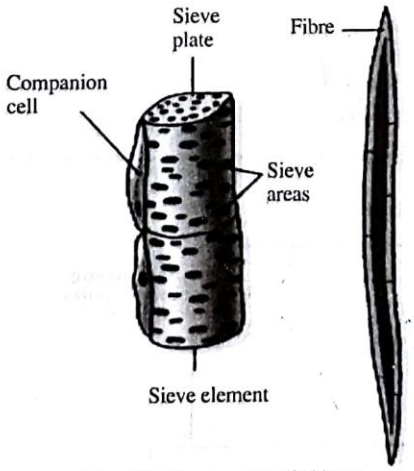


Fig. 5.8 : *Components of Phloem*

Let us now summarise how Xylem is different from phloem.

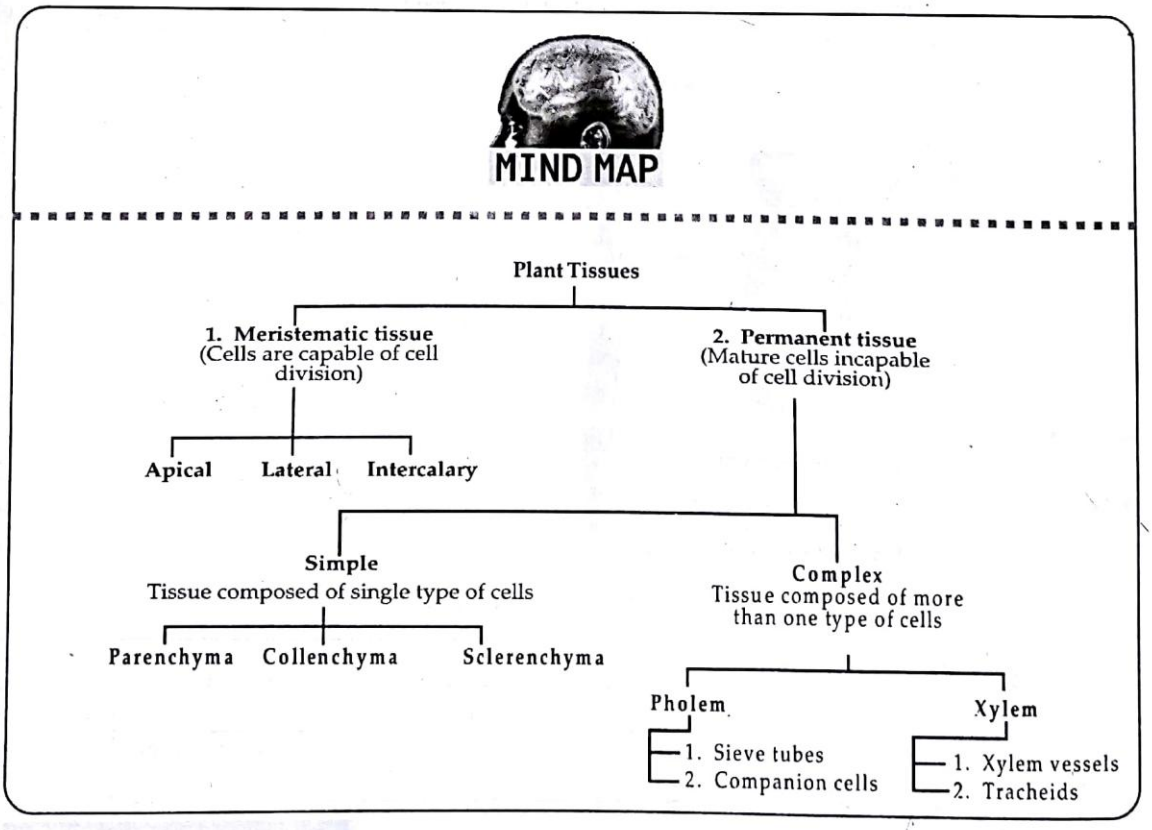
Xylem	Phloem
Xylem is a complex tissue that comprises dead elements.	Phloem is a complex tissue that comprises living tissue
Xylem conducts water and minerals from roots to other aerial parts of plant.	Phloem conducts prepared food from leaves to all parts of the body.

Difference table between simple tissue and complex tissue.

Simple tisse	Complex tissue
These tissues consist of only one type of cells	These tissues are made of up of more than one types of cells
The cells are more or less similar in structure and perform similar functions.	Different types of cells perform different functions. For example in the xylem tissue, tracheids help in water transport, whereas parenchyma stores food
Three types of simple tissues of plants are parenchyma, collenchyma and Sclerenchyma.	Two types of complex permanent tissues in plants are xylem and phloem.

Difference table between meristematic tissue and permanent tissue.

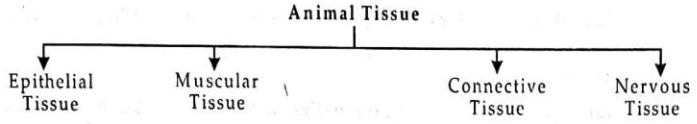
Sl. No.	Meristematic Tissue	Permanent Tissue
1	Meristematic tissue are composed of cells that divide continuously	Permanent tissue are cells that are derived from meristematic tissue that do not divide
2	The cells are undifferentiated	The cells are fully differentiated.
3	The cells are small in size and isodiametric	The cells are variable in shape and size
4	Intercellular spaces are generally absent	Intercellular spaces are present.
5	The cells walls are thin	Cell walls may be thin or thick.



ANIMAL TISSUES

Breathing is the most vital process that never stops. Along with heart, it is the body's most essential activity. When we breathe, we feel the movement of our lungs and diaphragm. Have you ever thought, *which part of our body helps them in moving*? Yes, it is muscle cells. The contraction and relaxation of these muscle cells result in movement. Every physical activity whether it is blinking an eyelid or turning a somersault, involves muscles into play. Muscle is a type of tissue in our body.

In higher animals like man, cells are organised into four types of tissues.

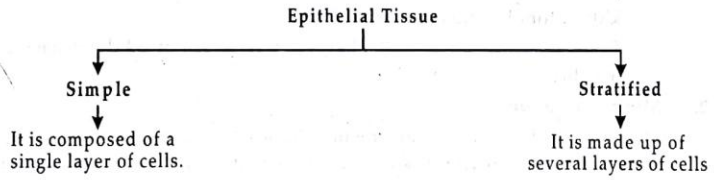


Let us now discuss, each of these tissues one by one.

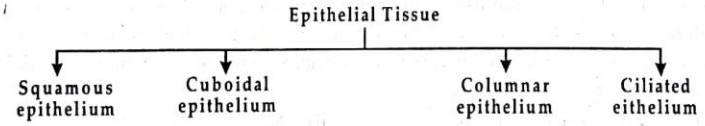
1. Epithelial Tissue :

It is the protective tissue of the animal body. The cells are compactly packed with little or no intercellular matrix. *The epithelial tissue is of two types* :-

(i) Simple epithelial tissue. (ii) Stratified epithelial tissue



Depending upon the shape and function of the cells, the epithelial tissues are further divided into four types.



(i) ***Squamous epithelium*** **:** It is made of thin flat, irregular shaped cells that fit together to form a compact tissue.

- It forms the delicate lining of cavities (like mouth, oesophagus, nose, etc.) and blood vessels.
- *Function :* It protects the underlying parts of body from mechanical injury and entry of germs.

Stratified squamous epithelium :

- Unlike squamous epithelium, cells of this tissue are arranged in many layers.
- They are found in skin and covers the external dry surface of the skin.
- This epithelium is water proof and highly resistant to mechanical injury.

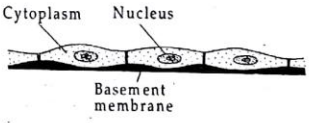


Fig. 5.9 : *Squamous epithelium*

Fig. 5.10 : *Stratified squamous epithelium*

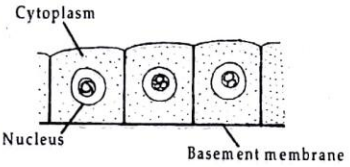


Fig. 5.11 : *Cuboidal epithelium*

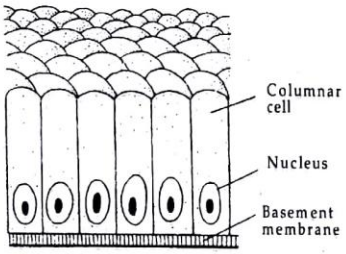


Fig. 5.12 : *Columnar Epithelium*

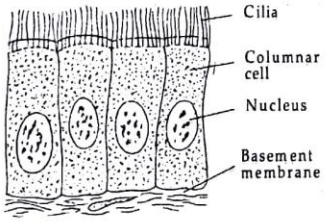


Fig. 5.13 : *Ciliated Columnar Epithelium*

do you know?

Over time the appearance of skin changes in our body. It becomes more wrinkled and creased. It is because as people change, the collagen fibres in their skin weaken, causing the skin to become looser.

do you know?

By weight, muscles make up more than 40 percent of the body. They include most of what we call our flesh, and they also form the main part of all our internal organs. Altogether, the body has about 650 separate muscles.

(ii) ***Cuboidal Epithelium*** **:** These comprises cube like cells.

- It is found in kidney tubules and in gland like salivary gland, sweat gland, pancreas etc.
- It forms germinal epithelium of testes and ovaries.

Functions :

(a) It provides mechanical support to the part where they are found.

(b) It helps in absorption, excretion and secretion.

(iii) ***Columnar Epithelium*** **:** It consist of cells that are pillar-like (i.e. taller than broader). The nuclei are towards the base. The free ends of cells has a brush border containing microvilli. It forms lining of stomach and small intestine, forming mucous membrane.

Functions :

(a) They help in absorption of digested food material from stomach and intestine.

(b) They help in secretion, for example, secretion of mucus by goblet cells or mucous membrane.

(iv) ***Ciliated Epithelium*** **:** The cuboidal or columnar cells (have a free border) that bear thread-like cytoplasmic outgrowth called cilia, forms the ciliated epithelium. Ciliated epithelium lines the trachea, bronchi, kidney tubules and oviducts.

Function : The beating of cilia helps in movement of solid particles in one direction.

2. Muscular Tissue :

Muscle tissue helps in the movement of internal organs such as heart and alimentary canal in your body. It helps in contraction and relaxation of body organs. Every movement, every breathe, every mouthful you chew- all these actions and more are carried out by the body's muscle cells.

Structure of a muscle : A muscle contains bundles of long, thin muscle fibres called myofibres, about the width of human hair. Each fibre is made of even thinner parts called muscle fibrils (called myofibrils) which is turn contains even narrower parts called myofilaments. There are two kinds of filament, made of different types of proteins.

(i) **Actin** which is thin and (ii) **Myosin** which is thick.

These slide past each other to shorten the fibrils causing the whole muscle to contract.

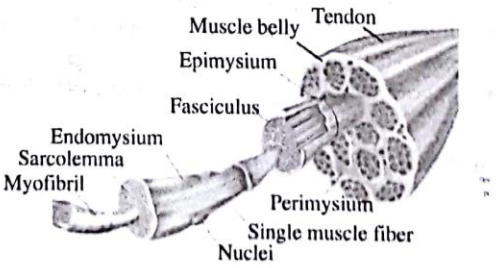


Fig. 5.14

Muscle tissues are made of muscle cell that are elongated and large-sized. A single muscle can do only one task that is to get shorter to pull on body parts. But by working together in a very precise and co-ordinated ways, the body's hundreds of muscle carry out thousands of different activities every day.

Can you recall from your previous knowledge, how does a muscle work? Muscles are attached to the bones of the skeleton by cords called tendons. If you want to lift your arms, your brain sends a signal to your arm muscles through nerves. Thus muscles contract (get smaller) and pull the bones of the forearm up.

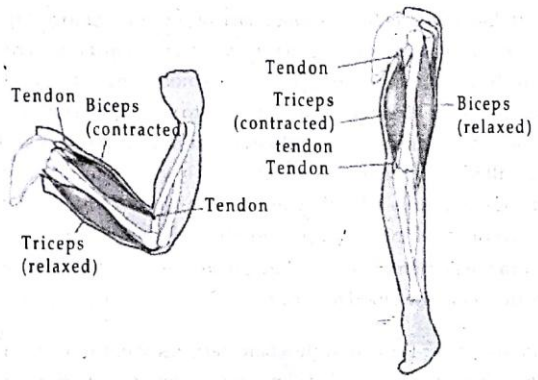


Fig. 5.15 : *Movement of Muscle.*

When a muscle works (contracts or relaxes), it uses energy. This energy comes from chemical action between glucose (stored in muscle) and oxygen from the blood. The chemical action forms lactic acid. As the acid builds up, the muscle begins to feel tired. However, when the muscle rests, the acid is reconverted to glucose.

On the basis of their location structure and function, there are three types of muscle fibres :

(i) Skeletal muscles

(ii) Smooth muscles

(iii) Cardiac muscles

(i) Skeletal muscle : The muscle that allows you to move around from one place to another is called *skeletal muscles*. Since, they are attached to bones and are responsible for body movement they are called skeletal muscles. They are also known as *striated muscle* because of light and dark parts of the muscle fibre that make them look striped. They are also *voluntary muscles* as these are the muscles that are under the control of will. They are long, cylindrical, unbranched cells with a number of nuclei, situated towards the periphery of muscle fibre.

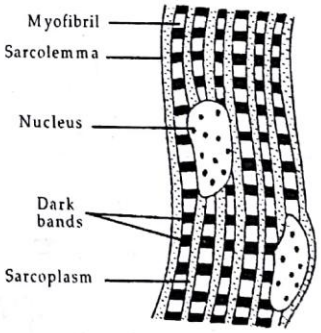


Fig. 5.16 : *Striated muscles*

do you know

Striated muscles are powerful and undergo rapid contraction. Hence, these muscles can easily get tired and therefore, needs rest.

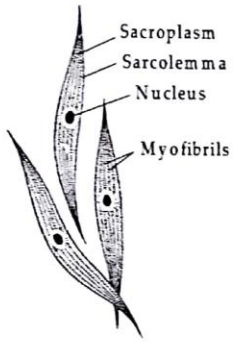


Fig. 5.16 : *Smooth muscle cells (fibres)*

do you know?

Smooth muscles contracts slowly but can remain contracted for long period of time.

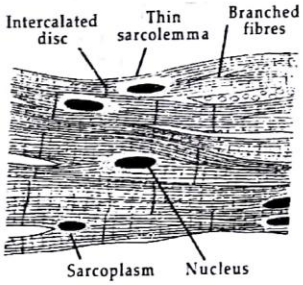


Fig. 5.17 : *Cardiac muscle*

do you know?

- The muscles used to smile are called voluntary muscles because we can control how and when we use them to express how we are feeling.
- More than 50 muscles work in each arm when playing sports such as volleyball.

How do skeletal muscle allows movement of body? Our skeletal muscle is attached to a tendon which in turn is attached to our bone. This tendon allows us to move our body. A tendon is a tough cord that attaches muscle to bone. Striated muscles are located in muscles of limbs, body wall, face, neck etc.

Function : Striated muscle provide the force for locomotion (movement) and all other voluntary movements of the body.

(ii) **Smooth muscles :** These are smooth and involuntary muscles. You cannot control this type of muscles as they work involuntarily. This means that your brain and body tell these muscles what to do without you even thinking about it. Each muscle fibre is long, narrow, spindle shaped tapering cells. Now *can you guess what causes the movement of food in alimentary canal?* Yes, it occurs by contraction and relaxation of smooth muscle, found in the wall of alimentary canal. Smooth muscle helps to push food from your stomach into your small intestine. They do not bear any stripes across the muscle, hence, called *unstriated or smooth muscles*.They are found in visceral organ except heart. That is why they are also called *visceral muscles*. They are found in wall of alimentary canal, urogenital duct, blood vessels etc.

Function : In alimentary canal, they cause movement of food and in blood vessel they help the blood to flow.

(iii) **Cardiac muscles :** They show the characteristics of both smooth and striated muscles. They are composed of non-tapering cells with faint cross-striations. Like striated muscles, cardiac muscles have stripes of light and dark bands. While like smooth muscles, they are involuntary. Cardiac muscle works all by itself with no help. The cells are cylindrical and branched.

Function : They are found in the walls of heart. Cardiac muscle causes the heart to contract and to pump blood out. Then it relaxes to let blood back in after it has circulated through the body. This means, cardiac muscles contract and relax rapidly rhythmically and tirelessly throughout the life. This contraction and relaxation of heart muscle helps to pump and distribute blood to various parts of the body.

KNOWLEDGE ENHANCER

VOLUNTARY AND INVOLUNTARY MUSLCES

There are two main kinds of muscles, voluntary and involuntary.

Voluntary muscle are those that we can deliberately use. For example, the muscles that come into use when we walk or talk.

Involuntary muscles are those muscles over which we have no control. They do their work without any knowledge on your part. For example, Breathing in and out of air.

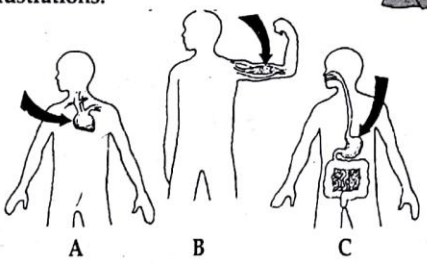
Heart muscles look like voluntary muscles, but act as involuntary muscles.

Difference table between striated muscle, unstriated muscle and cardiac muscle.

Striated muscle	Unstriated muscle	Cardiac muscle
On the basic of structure :		
Cells are cylindrical	Cells are long	Cells are cylindrical
Cells are not branched	Cells are not branched	Cells are branched
Cells are multinucleate	Cells are uninucleate	Cells are uninucleate
Alternate light and dark bands are present	There are no bands present	Faint bands are present
Its ends are blunt	Its ends are tapering	Its ends are flat and wavy
On the basic of location :		
These muscles are present in body part such as hands, legs, tongue etc.	These muscles control the movement of food in the alimentary canal, the contraction and relaxation of blood vessels,	These muscles control the contraction and relaxation of the heart.

CHECK Point

? **Identify the type of muscle shown in each of the given illustrations.**



CHECK YOUR ANSWERS

A – Cardiac muscle; **B** – Skeletal muscle; **C** – Smooth muscle.

3. Connective Tissue :

Have you ever thought how various body organs are connected to each other? OR *Why do organs do not get displaced during body movements?* Yes, it is because of connective tissue. The connective tissue is specialised to connect and anchor various body organs. It also give support to various parts of body forming packing around organs so that organs do not get displaced by body movements. The main functions of connective tissue are :

(a) It helps in binding of tissues

(b) It helps in supporting various parts of body.

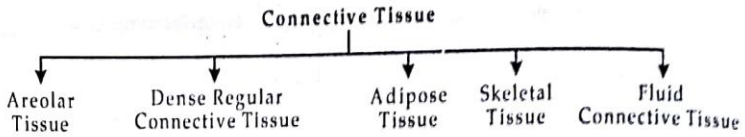
(c) It helps in packing different organs of the body.

Structure : The cells of connective tissue are living, loosely spaced and very less in number. Homogenous, gel-like substances called matrix forms the main bulk of connective tissue. The non-living matrix can be solid as in case of bone and cartilage and fluid as in blood. Matrix is fibrous in nature and bind other tissues. The nature of matrix decides the function of connective tissue.

Note

When a muscle is very active, it needs much greater supplies of glucose. So the heart beats faster than normal and the blood vessels to the muscles widen, supplying the muscle with three times more blood than it has when it is at rest.

There are five types of connective tissue.



(a) Areolar tissue : It is a loose connective tissue. The tissue has a matrix that consists of scattered special cells and fibres that may be yellow or white.

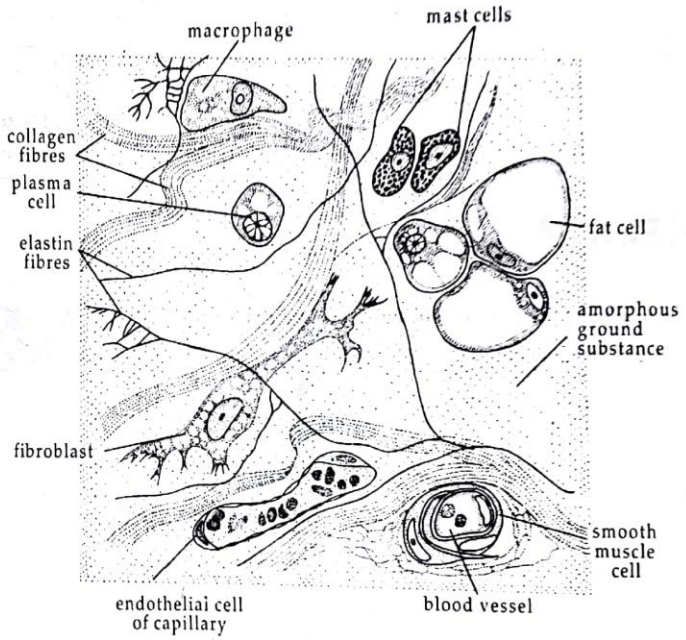


Fig. 5.19 : *Aerolar connective tissue*

It is the widely distributed connective tissue that joins skin to muscles. It is found around muscles, blood vessels and nerves.

Functions :

(i) It helps in supporting internal organs.

(ii) It helps in repairing the tissues of the skin and muscles.

(iii) It also helps in preventing infections.

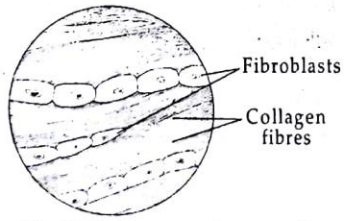


Fig. 5.20 : *Dense regular connective tissue*

(b) Dense Regular Connective Tissue :- It is a fibrous connective tissue, characterized by densely packed collection of fibres and cells. The principle components of dense regular connective tissue are tendons and ligaments

(i) *Tendons* are strong, inelastic structure that join skeletal muscles to bones. It has a great strength but its flexibility is limited.

(ii) *Ligaments*, on the other hand, are elastic structure that connects bones to bones. It is highly elastic and has great strength. *Ligaments* strengthen the joint and permit normal movement of bone but prevent over-flexion and over-extension.

(c) **Adipose Tissue :** These are basically oval in shape filled with fat droplets. It is found below the skin and in the bone marrow.

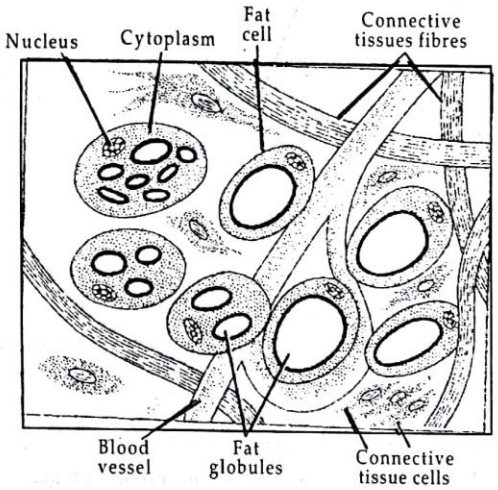


Fig. 5.22 : *Adipose tissue*

Functions :

(i) It act as a fat reservoir.

(ii) It acts as an insulator. It reduces loss of fat from the body, that is, it regulates body temperature.

(d) **Skeletal Tissue :** It is a connective tissue whose matrix is composed of elastin. It is of two kinds – bone and cartilage.

(i) **Bone :** *Touch your limbs or fingers. Do you feel something hard inside. What is it?* The hard parts in the body are the bones. More than 200 bones form the body's internal supporting frame work, called the skeleton. Bones are strong and stiff, giving the body its shape, protecting internal organs and holding together the soft parts such as blood vessels, nerves etc.

A single bone is rigid and tough and can hardly bend. But the whole skeleton can move because its bones are linked at flexible joints, designed to reduced rubbing and wear. Bones are very strong, yet they are also very light weight.

Structure of Bone : Most bones are not solid bone throughout. They have three layers. Outside is a shell of *hard or compact* bone, which is strong and stiff. Inside this is a layer of *spongy bone* with tiny holes for lightness. In the middle is the marrow, a soft and jelly like substance that makes new red and white cells for the blood. The whole bone is covered by a tough skin-like layer, the *periosteum*.

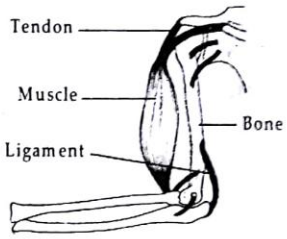


Fig. 5.21 : *Attachment of tendons and ligaments*

do you know?

Sprain is caused by excessive pulling of ligaments.

do you know?

There are 206 bones in the average skeleton of human body, but a baby's skeleton has over 340. This is because as the baby grows, some separate bones join together to form the bone.

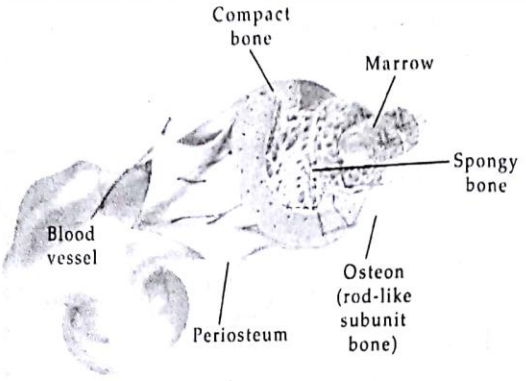


Fig. 5.24 : *Structure of a bone*

do you know?

A chemical agent called Acetycholine is secreted at the axonic ends of many neurons. It is responsible for the transmission of a nerve impulse across a synpase.

Bones forms endoskeleton of human beings. *The main functions of bones are* :

(a) It provides shapes to the body.

(b) It provides skeletal support to body.

(c) It serve as storage site of calcium and phosphate.

(d) It anchor the muscles.

Have you ever thought, what happens if a bone breaks ? It starts to repair itself. Bones are actually made of living tissues, so if they break, microscopic cells called osteoblast begin to make new bone that fills the break or gap. After a few months the gap is joined and the bone is repaired.

(ii) Cartilage : *Touch your can pinna, or your nose tip. Do you feel something hard but flexible. What is it?* It is specialized connective tissue that is compact and less vascular and very flexible. It is commonly known as cartilage. It is found in joints and discs between vertebrae.

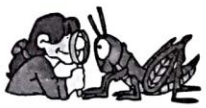
Functions :

(i) Cartilage provide support and flexibility to body parts.

(ii) It also smoothens surface at joints.

CHECK Point

? **What will happen, if there are no bones in the body?**



CHECK YOUR ANSWERS

Bones provide the strong framework that supports the whole body and holds its parts together. Without bones you would flop down in the floor like a jellyfish.

(e) Fluid connective tissue : This type of connective tissue links the different parts of body and forms a continuity in the body. It includes, blood and lymph.

(i) **Blood :** Blood is a fluid connective tissue, because in this tissue, cells move in a fluid or liquid matrix called blood plasma. Basically, blood consists of a fluid called plasma that contain three types of blood cells. These blood cells are :

1. Red blood cell or Erythrocytes that carry oxygen.
2. White blood cells or Leucocyte to fight diseases.
3. Platelets to help blood to clot and seal a wound.

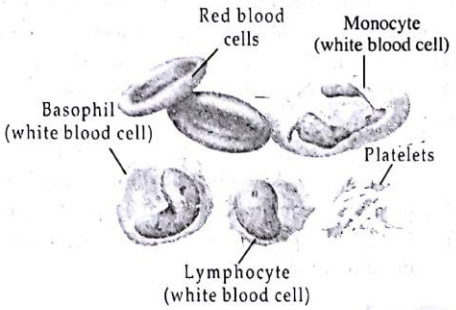


Fig. 5.23 : *Components of Blood*

Functions of Blood : Blood has more than hundred jobs to do.

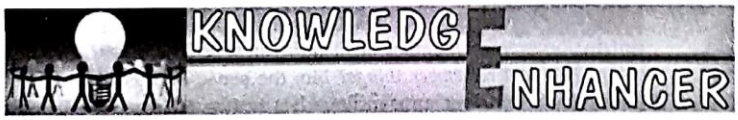
(i) They transports oxygen, nutrients and hormones to the tissues.
(ii) They transport excretory products from tissues to the liver and kidney.
(iii) The red blood cells (RBCs) carry oxygen to tissues for breakdown of food.
(iv) White blood cells (WBCs) play an important role in engulfing and destroying foreign bodies.
(v) Platelets help in the clotting of blood.

do you know?

One cubic mm of blood (the size of a pinhead) contains 5 million red cells, 8000 white cells and 350,000 platelets.

do you know?

About one twelfth of the body's weight is blood.



How does blood fight against germs or foreign organisms?

When germs enter the body, millions of white blood cells leave the blood stream and enter the infected tissue to attack and digest them. During the process, dead germs and cells are seen as pus.

A white blood cell moves towards a germ to attack it

It spreads round the germ and 'eats' it.

It digests the germ or kills it with chemicals.

It expels the remains of the germ as pus.

In the LAB

(i) Take a drop of blood on a clean slide.
(ii) Then observe it under microscope.
You will observe different types of blood cells in it. Identify them and write their functions.

do you know?

An adult has about 5 liters of blood. It is roughly enough blood to fill seven wine bottles. More than half is plasma.

(ii) **Lymph :** Lymph is a colourless fluid that has filtered out of blood capillaries. It is similar to blood but does not have RBCs and some blood proteins. In lymph, white blood cells are abundant. Lymph flows in special vessels called lymph vessels.

Functions :

1. They transport nutrients that have filtered out of blood capillaries back into heart to be circulated again in body.
2. It brings waste products from tissue fluid to blood.
3. Lymph also protects the body against infection. It forms the immune system of the body.

CHECK Point

? **Why blood is considered a vital fluid?**

CHECK YOUR ANSWERS

Without blood, the cells that make up the body's tissue could not live. Blood carries food and oxygen to them to nourish them and to enable new cells to develop. It also removes carbon dioxide and other waste products, so that they can be expelled harmlessly from the body.

Blood also carries hormones, the chemical substance that controls many of the body's activities. Its other function includes fighting infection, and helping to control temperature by carrying excess heat to skin surface.

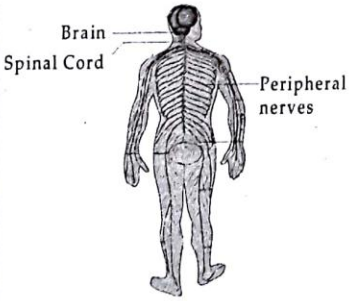


Fig. 5.24 : *Human Nervous Tissue*

do you know?

Different types of nerve fibres carry signals at different speeds. The fastest signals travels at more than 120 m/sec. The slowest signals travel at 1-2 m/sec.

4. Nervous Tissue :

Close your eyes and feel things. *Can you recognize the object*? Yes, you can do. *But have you ever thought, how do you remember things?. Do sense organs help you remember things*? No, the sense organs only collect information from your surroundings. It is the nervous system that helps you to remember and feel things. A tissue that is specialised to transmit messages in our body is nervous tissue. Like a computer network, it sends tiny electrical signals to and fro, carrying information from one part of body to another. The electrical signals are called nerve messages and they travel along wire-like nerves, which spread in a vast network through the entire body. The control of the whole nervous system and the whole body comes from the brain.

The nervous system has three main parts —

1. Brain; 2. Spinal cord; 3. Peripheral nerves

The *brain* consists of billions of nerve cells and other tissue in top half of the head. Its lower end merges into the spinal cord. *Spinal cord* is the body's main nerve. The spinal cord is inside a tunnel formed by the row of holes inside the vertebrae of the backbone (or spine). *Peripheral nerves* branch out from the spinal cord and brain to reach every body part.

Neuron : The nervous system is built up of billions of very specialised cells called nerve cells or neurons. *Neuron* is the basic functional unit of nervous system. They are unique and the only type of cells that stop reproducing shortly after birth. When neurons die, they are not replaced. They have specialised structure called axon and dendrites that send and receive information. There are more than 100 billion neurons in our body.

Each neuron consists of :-

(1) *Cell body* or *cyton* with a nucleus and cytoplasm. Cell body has two extensions known as axons and dendrites.

(2) An *axon* is a long thread like extension of nerve cells that transmits impulses away from the cell body.

(3) *Dendrites*, on the other hand, are thread like extensions of cell body that receive nerve impulses.

Thus, axon transmit impulses away from the cell body while dendrites receives nerve impulses. This coordinated function helps in transmitting impulses very quickly.

Nervous tissue exhibits two unique properties :-

(i) **Irritability :** It is the capacity of tissue to respond to the stimulus.

(ii) **Conductivity :** It is the capacity to transfer the response from one region to another.

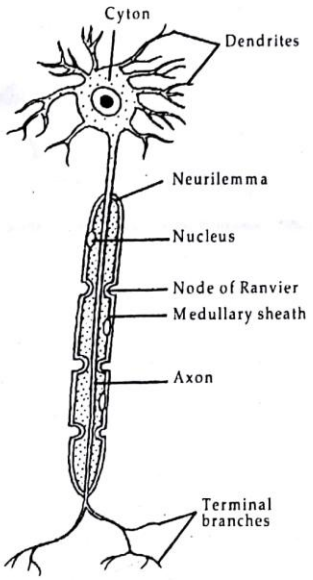
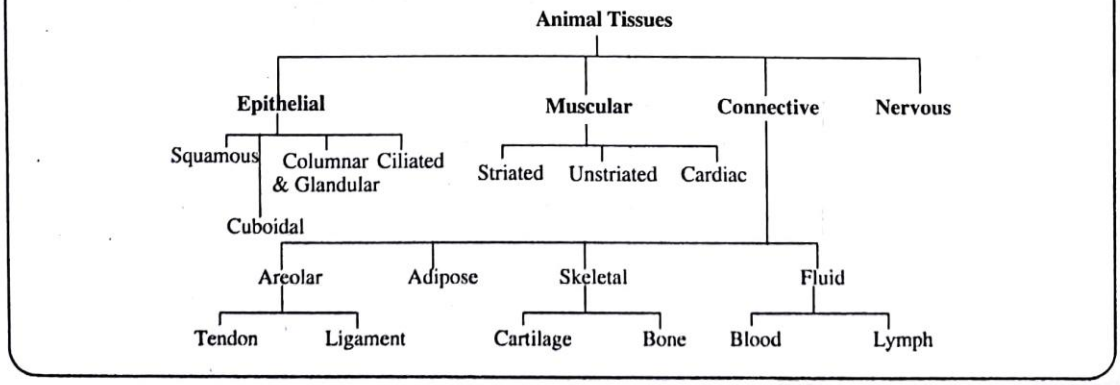


Fig. 5.25 : *A neuron – a unit of nervous tissue*

FACT ABOUT BRAIN

A new born baby's brain grows almost three times during the course of its first year. The left side of the human brain controls the right side of the body and the right side of the body controls the left side of the body.

MIND MAP



- *Tissues* are group of cells similar in structure that work together to perform a particular function.
- **Plant tissues are of two types :**
  - *Meristematic* - Cells that are capable of cell division.
  - *Permanent* - Mature cells that are incapable of cell division
- Meristematic tissues are further classified as - Apical, lateral and intercalary meristems
- Permanent tissues are classified as simple and complex tissue.
- Parenchyma, collenchyma and sclerenchyma are three types of simple tissues while xylem and phloem are two types of complex tissues.
- **Animals tissues are of four types**
  - *Epithelial tissue* - It comprises squamous, cuboidal, columnar and glandular epithelium.
  - *Muscular tissues* - It comprises striated, unstriated and cardiac muscles.
  - *Connective tissue* - It comprises areolar tissue, adipose tissue, bone, cartilage, tendon, ligament and bone
  - *Nervous tissue* - It is made of neurons that receives and conduct impulses
- Neuron is the basic functional unit of nervous system. Each neuron consists of cell body, axon and dendrites.

exercise 1

FIB FILL IN THE BLANKS :

DIRECTIONS : *Complete the following statements with an appropriate word / term to be filled in the blank space(s).*

1. A group of cells alike in form, function and origin is known as _____.
2. Plant tissues are divided into _____ and _____ tissues.
3. Parenchyma tissues are found in _____ part of body.
4. Water and minerals are conducted by _____.
5. Parenchymatous tissue, that contains chlorophyll are called _____.
6. Parenchyma tissue which are specialised for gas exchange is called _____
7. Mechanical tissue consisting of living cells is called _____ tissue
8. Walls of sclerenchyma are_____.
9. Blood is an example of_____ tissue.
10. Fibres are absent in _____ a type of connective tissue.
11. Cardiac muscle is found in _____.
12. Nerve impulse comes to the cell body of a neuron along the _____ and goes away from the cell body along the _____.

T/F TRUE & FALSE :

DIRECTIONS : *Read the following statements and write your answer as true or false.*

1. A mature sieve tube differs from vessel in absence of lignified walls.
2. Cambium has the apical meristem.
3. Fibres are absent in blood.
4. Cuboidal epithelium is found in salivary glands.
5. Bone is an example of connective tissue.
6. Intercalary meristem increases the length of internode.
7. Vessels, tracheids, wood fibres and parenchyma tissues are example of xylem.
8. Increase in length of plant axis is by apical meristem..
9. Parenchyma provides support through turigidity.
10. Cell wall of meristematic tissue is thick.

MTF MATCH THE FOLLOWING :

DIRECTIONS : *Each question contains statements given in two columns which have to be matched. Statements in column I have to be matched with statements in column II.*

1.

	Column-I (Tissue)		Column-II (Function)
A.	Parenchyma tissue	p.	Transports prepared food from leaves to different part of plant
B.	Collenchyma tissue	q.	Conducts water and mineral from root to leaves
C.	Sclerenchyma tissue	r.	Serves as food storage
D.	Xylem	s.	Provides mechanical support to stems
E.	Phloem	t.	Provides firmness and hardness to different parts.

2.

	Column-I (Tissue)		Column-II (Function)
A.	Epithelial tissue	p.	Transfers the response from one region to another
B.	Muscular tissue	q.	Helps in binding different organs and tissue.
C.	Connective tissue	r.	Provides the force for locomotion
D.	Nervous tissue	s.	Protects the body from mechanical injury

VSAQ VERY SHORT ANSWER QUESTION :

DIRECTIONS : *Give answer in one word or one sentence.*

1. From which type of meristematic tissue intercalary meristem is derived?
2. Where lignins are found?
3. Where does lateral meristems are found?
4. Which type of fibres are found in phloem?
5. Write the name of the tissues which supports your body.
6. What are the functions of xylem?
7. Write the name of the tissue which connects muscle to bone in humans.
8. Which type of xylem tissue is responsible for conduction in tissues?
9. What is the function of companion cells?
10. What is visceral muscles? Where it is found?

11. Give an example of voluntary muscle.
12. What are the main function of connective tissue?
13. What is ligament?
14. What is cartilage? Give two functions of it.

SAQ SHORT ANSWER QUESTION :

DIRECTIONS : *Give answer in 2-3 sentences.*

1. Define the term tissue.
2. Write a short note on – Epithelial tissue.
3. How meristematic tissue is different from permanent tissue?
4. What is cork ? Why does it act as a protective tissue?
5. Write a short note on sclerenchyma tissue.
6. What are tracheids ?
7. Give difference between tracheid and a vessel?
8. What are companion cells?
9. How columnar epithelium is different from cuboidal epithelium?
10. What is the nature and function of ciliated epithelium?
11. What is the nature and function of cardiac tissue?
12. What are conjoint, collateral and open vascular bundles?
13. Distinguish between – sieve cell and sieve tube elements.
14. What are the characteristics of nerve cell?
15. How blood is a connective tissue?
16. Give the names of dead tissues found in the body of a higher plants.
17. What are the main part of nervous system in the body of any animal?
18. How skelatal muscle is necessary for body?
19. What is the difference between voluntary and non–voluntary muscle?

LAQ LONG ANSWER QUESTION :

DIRECTIONS : *Give answer in 5-6 sentences.*

1. Describe different type of plant tissues.
2. What are the main tissues found in animal cells?
3. What are meristematic tissues? Describe each type of meristematic tissue.
4. What is the difference between simple permanent tissue and complex permanent tissue? Discuss different tissues found in complex permanent tissue.
5. Write about the structure, function and location of different muscle tissue.
6. How connective tissues are classified? Write a short note on different connective tissue.

exercise 2

MCQ MULTIPLE CHOICE QUESTIONS :

DIRECTIONS : *This section contains* **17** *multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.*

1. Which type of tissue forms glands?
   (a) Epithelial (b) Connective
   (c) Nervous (d) Uterus
2. Which tissue provides flexibility to plants?
   (a) Parenchyma (b) Collenchyma
   (c) Sclerenchyma (d) Aerenchyma
3. Which of the following are the components of Xylem?
   (a) Sieve tube (b) Sclereid
   (c) Companion cells (d) Tracheid
4. Which of the following tissues is composed of dead cells?
   (a) Phloem (b) Epidermis
   (c) Xylem (d) Endodermis
5. Which of the following are simple tissues?
   (a) Parenchyma, xylem and phloem
   (b) Parenchyma, collenchyma and sclerenchyma
   (c) Parenchyma, xylem and sclerenchyma
   (d) Parenchyma, xylem and sclerenchyma
6. In which of the following, growth is sub– apical?
   (a) Root (b) Shoot
   (c) Petiole (d) Pedicle
7. Which of the following tissue evolved first in animals?
   (a) Muscular tissue (b) Skeletal tissue
   (c) Epithelial tissue (d) Connective tissue
8. Which of the following helps in maintaining body temperature?
   (a) Sweat glands (b) Connective tissue
   (c) Adipose tissue (d) Hair
9. Which of the following tissue is more elastic?
   (a) Bone (b) Cartilage
   (c) Ligament (d) Adipose tissue
10. Which of the following cells are associated with immune system of body?
    (a) Platelets (b) WBC
    (c) Macrophages (d) RBC
11. Which of the following is not a part of nervous tissue?
    (a) Cyton (b) Axon
    (c) Myelinated (d) Nephron
12. Pseudo stratified epithelium is present in
    (a) Urinary bladder (b) Nephron
    (c) Larynx (d) Trachae
13. Which type of permanent tissue helps in storing food in plants.
    (a) Parenchyma (b) Collenchyma
    (c) Xylem (d) Phloem
14. Skin has
    (a) Stratified squamous epithelium
    (b) Simple squamous epithelium
    (c) Columnar epithelium
    (d) Cuboidal epithelium
15. Ciliated columnar epithelium is found in the lining of
    (a) Respiratory tract (b) Kidney tubules
    (c) Oesophagus (d) Mouth
16. Smooth muscles are likely to be found in
    (a) Muscles of legs (b) Muscles of arms
    (c) Stomach (d) Heart
17. Which connective tissue helps in storing fats?
    (a) Tendon (b) Ligament
    (c) Adipose (d) Areolar tissue

MTOC MORE THAN ONE CORRECT

DIRECTIONS : *This section contains* **7** *Multiple Choice Questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONE OR MORE may be correct.*

1. Which types of cells are found in sclerenchyma?
   (a) Sclereids
   (b) Tracheids
   (c) Fibres
   (d) Companion cells
2. Which of the following is the main function of companion cells?
   (a) Provide support through turgidity
   (b) Controls the activities of sieve tube element
   (c) Controls the movement of solutes in the sieve element
   (d) Exchange of gases (CO_2 and O_2)
3. What is/are the function of adipose tissue?
   (a) Fat storing tissue
   (b) Supporting various part of body
   (c) Binding together other tissues.
   (d) Acts as shock absorber

4. Involuntary muscles are
   (a) Under the control of will
   (b) Not under the control of will
   (c) Controlled by nervous system
   (d) Not controlled by nervous system
5. Which of the following are the characters of cardiac muscles?
   (a) Striped muscle (b) Unstriped muscle
   (c) Actomyosin (d) Myoglobin
6. Which of the following is not essentially a part of nervous system?
   (a) Cyton (b) Axon
   (c) Skeletal tissue (d) Gland cells
7. Which of the following is regarded as a unit of nervous tissue?
   (a) Neurons (b) Axon
   (c) Nerve (d) Dendrite

PBQ PASSAGE BASED QUESTIONS

DIRECTIONS : *Study the given paragraph and answer the following questions.*

Blood is a fluid connective tissue. In this, tissue cells (called corpuscles) move in a fluid or liquid matrix or medium called **blood plasma.** The blood plasma does not contain protein fibres but contains cells called **blood corpuscles** or **cells.** These blood corpuscles are:

1. Red blood corpuscles (RBCs) or erythrocytes;
2. White blood cells, (WBCs) or leucocytes;
3. Platelets

RBCs and WBCs are living, while plasma and platelets are non–living. Plasma forms 55 per cent of the total volume of blood. It is a complex fluid and includes in it inorganic salts and organic compounds. Organic substances of plasma are soluble proteins such as **albumins** (maintain osmotic pressure of blood), **globulins** (some act as antibodies) and **fibrinogen** (used in blood clotting); and glucose, amino acids, lipids, vitamins, enzymes, hormones and waste materials (urea, uric acid).

Red blood corpuscles (RBCs) are most numerous and have iron–containing red respiratory pigment, the **haemoglobin.** The erythrocytes of most vertebrates are oval shaped, nucleated and biconvex. However, erythrocytes of mammals are circular, biconcave, disc–like and lack nuclei. In this way, mammalian erythrocytes have the increased surface area for gaseous exchange and they accommodate much more haemoglobin in them than RBCs of other animals. Erythrocytes play a vital role in the transport of oxygen.

White blood cells (WBCs) are of two main kinds: phagocytes and immunocytes. **Phagocytes** are capable of phagocytosis and they carry out the function of defence by engulfing bacteria and other foreign substances. Phagocytes are of two types : **Granulocytes** which have irregular–shaped nuclei and cytoplasmic granules with specific staining properties. They include **neutrophils, basophils** and **eosinophils. Agranular leucocytes** have no cytoplasmic granules and include the **monocytes.** Monocytes have a large nucleus indented on one side and large amount of cytoplasm. They ultimately migrate to body tissues and transform into **macrophages** and **histiocytes.** They include **lymphocytes** which have a nearly spherical nucleus and little cytoplasm with no granules. Some lymphocytes later on transforms into **plasma cells.**

(1) What are the main constituents of blood?
(2) What organic compound are found in plasma?
(3) What is the most important role of RBC?
(4) How phagocytes are necessary for any animal?
(5) What is the main function of monocytes in the body?

A&R ASSERTION & REASON :

DIRECTIONS : *Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.*

(a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.
(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.
(c) If **Assertion** is **correct** but **Reason** is **incorrect.**
(d) If **Assertion** is **incorrect** but **Reason** is **correct.**

1. **Assertion :** Muscle cells are also called myofibrils.
   Reason : Muscle cells are very thin and elongated.
2. **Assertion :** Epithelial tissues protect the under lying and over lying tissues.
   Reason : Materials are exchanged between epithelial cells.
3. **Assertion :** Permanent tissue is composed of mature cells.
   Reason : Meristematic tissue is a group of actively dividing cells.
4. **Assertion :** Xerophytic leaves may contain sunken stomata.
   Reason : Spongy parenchyma is more in xerophytic plants.
5. **Assertion :** Tendon is present in all bone joints.
   Reason : Tendon connects the bones at the joints & hold them in position.
6. **Assertion :** Ciliated epithelium helps in movement of particles.
   Reason : Cilia helps in movement.

MMQ MULTIPLE MATCHING QUESTIONS

DIRECTIONS : *Each question has four statements (A, B, C and D) given in Column I and eight statements (p, q, r, s, t, u, v and w) in Column II. Any given statement in Column I can have correct matching with one or more statement(s) given in Column II. Match the entries in column I with entries in column II.*

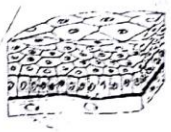
1.

Column I	*Column II*
(A) Connective tissue	p. Xylem
(B) Permanent tissue	q. Axon
(C) Meristematic tissue	r. Lateral meristem
(D) Nervous tissue	s. Blood
	t. Lymph
	u. Phloem
	v. Cyton
	w. Inter calary meristem

PBQ PICTURE BASED QUESTIONS :

DIRECTIONS : *Diagrams of different epithelial cells are given below. Identify, list main characters and give examples in each case.*

1. 

2. 

3. 

4. 

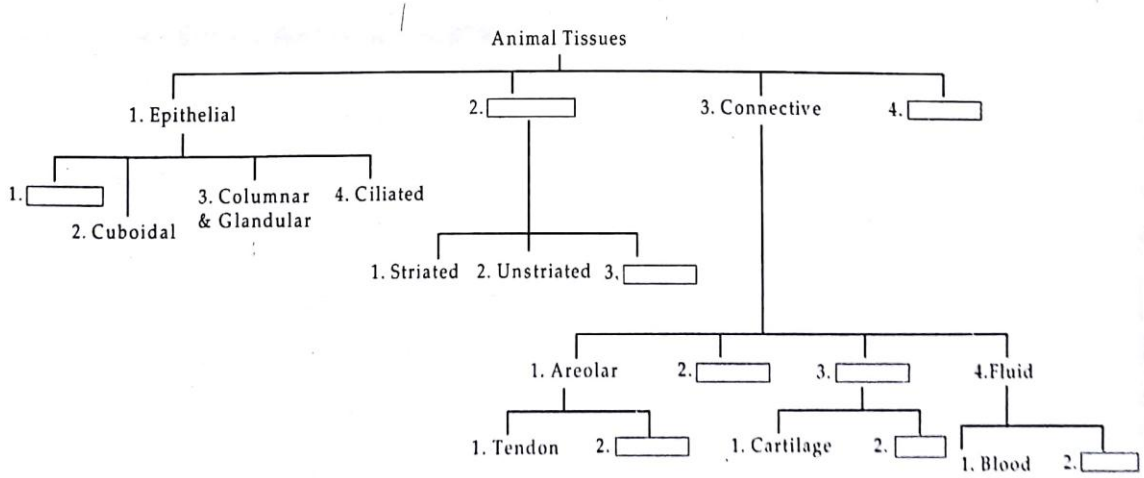
HSQ HOTS SUBIECTIVE QUESTIONS :

DIRECTIONS : *Answer the following questions.*

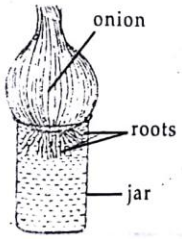
1. During an injury nasal septum gets damaged and for its recovery, cartilage is preferred. Why cartilage is preferred?
2. What is the reason that the new born mammals generally do not shiver inspite of lower temperature outside?
3. A small insect lands on your nose and you remove the insect with your hand. Explain what happens in your nervous, muscular and skeletal systems from the moment the insect lands to the moment it is removed.
4. Which tissue is called river of life. Write a short note on it.
5. Why almond fruit has a hard covering over its seed?

ABQ ACTIVITY BASED QUESTIONS :

1. Complete the given table.



3. Take two glass jars and fill them with water. In next step, take two onion bulbs and place one on each jar. Placement of the onion bulbs on the mouth of each jar should be in such a way that the stem and roots parts of each onion remain in contact with water. Observe the growth of roots in both the onion bulbs. Measure the length of roots on day 1, day 2 and day 3. However, on day 4 cut the root tips (i.e., up to 1 cm) of onion kept in jar B. Observe the growth of roots in both jars for a few more days and record your observation in the following table:



Method of putting of onion bulb in a jar

Length of root	Day 1	Day 2	Day 3	Day 4	Day 5
Jar 1					
Jar 2					

3. Name the tissues where the following structures are found.
(i) Axon; (ii) Fibroblasts; (iii) Smooth muscles; (iv) Oesteocytes; (v) Fat cell.

FunTIME

Ten words related to cell biology are hidden in the following word maze. Go up, down, up, down, left, right diagonally, any which way you wish and find the words.

S	S	O	N	M	J	L	Q	Q	N	L	C	T	C
N	X	T	S	O	M	M	S	L	M	I	N	T	B
C	S	L	J	M	N	A	X	Q	T	G	G	N	O
N	P	T	X	A	T	L	Q	A	S	A	T	T	O
N	G	O	X	Y	L	E	M	M	D	M	M	G	B
O	N	X	N	Y	T	E	X	A	O	E	S	D	T
R	R	S	S	Y	T	P	Q	D	O	N	M	M	O
U	L	T	R	S	N	A	A	L	L	T	B	O	G
E	E	Q	I	T	M	H	H	S	B	A	S	A	A
N	Q	R	A	A	A	P	L	M	B	G	A	S	Q
T	E	N	D	O	N	L	X	T	N	T	O	T	N
M	A	M	Y	H	C	N	E	L	L	O	C	O	B
T	A	Y	Y	C	H	L	L	T	G	B	T	X	M

Hidden Words
1. Meristematic
2. Ligament
3. Phloem
4. Blood
5. Collenchyma
6. Tendon

SOLUTIONS

BRIEF EXPLANATIONS OF SELECTED QUESTIONS

EXERCISE 1

FIB FILL IN THE BLANKS :

1. Tissue
2. Meristematic and Permanent
3. Whole
4. Xylem
5. Chlorenchyma
6. Aerenchyma
7. Collenchyma
8. Thick
9. Connective
10. Connective
11. Heart
12. Dendrite, axon

T/F TRUE & FALSE :

1. True; 2. False; 3. True; 4. True; 5. False; 6. False; 7. True; 8. True; 9. True; 10. False

MTF MATCH THE FOLLOWING :

1. A – r, B – s, C – t, D – q, E – p,
2. A – s, B – r, C – q, D – p

VSAQ VERY SHORT ANSWER QUESTION :

1. Apical meristem
2. Tracheids
3. Beneath the bark
4. Bast fibres
5. Skeletal
6. Conducts water and mineral to various part of body
7. Tendon
8. Vessels
9. Companion cells transports water in sieve tube elements.
10. The muscles which are found in visceral organs. Ex:- Wall of alimentary canal, urinogenital duct etc.
11. Heart muscle is an example of voluntary muscle.
12. Main function of connective tissues are :
    (i) Helps in binding of tissues
    (ii) Supports various organs of the body.
13. Tissue that connects one bone to another bone.
14. Cartilage is one of the connective tissue, that is compact, less vascular and very flexible. The bones found in joints and discs between vertebral are the example of cartilage.
    Functions of cartilage are :
    — It provides support and flexibility to body part.
    — It smoothens surface at joints.

SAQ SHORT ANSWER QUESTION :

1. A group of cells similar in structure that work together to perform a particular function forms a tissue.
4. Cork cells are dead cells and have no intercellular space. The function of cork is to give protection to plant by preventing loss of water from plant body, from infection and mechanical injury.
6. Tracheids are dead, hollow cells with narrow lumen than vessels. They conduct water in conifers. It provides mechanical strength to plants.
8. Companion cells are small cells containing large nucleus and abundant other organelle like ribosome, mitochondria and golgi body. It is connected with sieve tube by numerous plasmodesma.
11. Cardiac muscles are both smooth and striated muscles. It is composed of branched fibres. The branches join to form a network.
    Function of cardiac tissues are :
    (i) Cardiac muscles contracts and relax rapidly, rhythmically and tirelessly.
    (ii) Contraction and relaxation of heart muscles is to pump and distribute blood in various parts of body.
15. Blood is a connective tissue because it transparts O_2 and food material to every organ of body. It connects to every part of the body.

EXERCISE 2

MCQ MULTIPLE CHOICE QUESTIONS :

1. (a)	2. (b)	3. (d)	4. (c)	5. (b)
6. (a)	7. (c)	8. (d)	9. (b)	10. (b)
11. (d)	12. (d)	13. (a)	14. (a)	15. (a)
16. (c)	17. (c)			

MTOC MORE THAN ONE CORRECT

1. (a, c)	2. (b, c)	3. (c, d)
4. (a, d)	5. (b, c)	6. (a, b)
7. (c, d)	8. (a, c)	

PBQ PASSAGE BASED QUESTIONS

1. Main constituents of blood is blood corpuscles and blood plasma.
   Blood corpuscles consists of RBCs, WBCs, platelets and plasma consists of soluble proteins.
2. Plasma consists of soluble proteins such as albumin, globulin and fibrinogen. Other than that glucose, amino acid, lipids, vitamins, enyzmes, hormones and uric acid are also present.
3. The most important role of RBC is to transport oxygen
4. Phagocytes have capable of engulfing bacteria and other foreign substances.
5. Monocytes have migratory tissue and transform into macrophages and histiocytes, which act as a defence mechanism to body.

A&R ASSERTION & REASON :

1. (b)	2. (b)	3. (c)
4. (a)	5. (b)	6. (b)

MMQ MULTIPLE MATCHING QUESTIONS

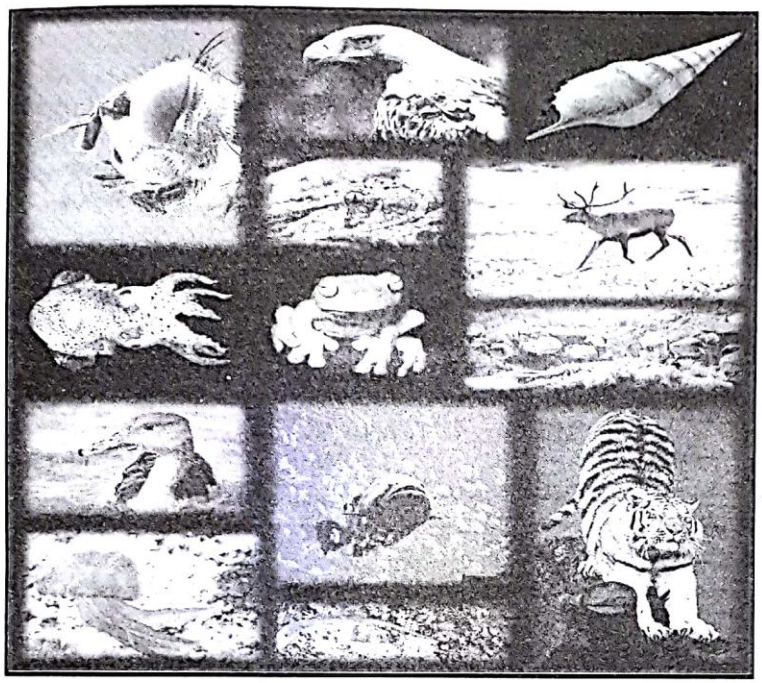
1. (A)–s,t; (B)–p, u; (C)–r,w; (D)–q,v;

HSQ HOTS SUBIECTIVE QUESTIONS :

1. Cartilage is firm but slightly elastic with clear matrix. It is present in larynx, trachea, bronchi, nose etc.
4. Blood
5. Almond fruit has hard covering over its fruit because of presence of sclerenchyma. Sclerenchyma is made up of dead cells. It is long and narrow with thick cell walls made of lignin.

ABQ ACTIVITY BASED QUESTIONS :

1. (i) Nervous tissue; (ii) Areolar connective tissue; (iii) Muscular tissue; (iv) Bone (Skeletal tissue); (v) Adipose tissue (Connective tissue)



chapter 9

Diversity in Living Organisms

INTRODUCTION

There is a wide range of life forms (about 10 million-13 million species) around us. These life forms have existed and evolved on the Earth over millions of years ago. The diversity we see today is the result of 3.5 billion years of organic evolution. There is a wide diversity in the flora (plants) and fauna (animals) in the world. Every organism, whether plant or animal, is unique in itself. Plants and animals have different body plans and internal structures that help them to survive.

INFORMATION!!

Biodiversity refers to variety of life forms found in a particular region.

DIVERSITY AND CLASSIFICATION

There is variety of living organisms in terms of size, which ranges from microscopic bacteria to tall trees of 100 metres. Also, like in animals, the colour, shape, and size of snakes are completely different from those of lizards. The life span of different organisms is also quite varied. For example, a crow lives for only 15 years, whereas a parrot lives for about 140 years.

Such huge range of these life forms makes it very difficult to study them one by one. Therefore, we look for similarities among them and classify them into different classes to study these different classes as a whole. Thus, classification makes our study easier. Classification is a system of categorizing living things.

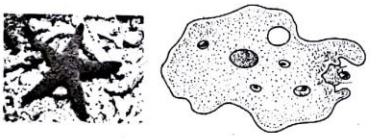
Importance of classification:

(i) It determines the methods of organizing the diversity of life on Earth.

(ii) It helps in understanding millions of life forms in detail.

(iii) It helps in understanding the interrelationship among different groups of organisms.

(iv) It also helps in predicting the line of evolution. Evolution is a complex process by which the characteristics of living organisms change over many generations.



starfish amoeba

Fig. 9.1

Based on evolution, organisms can be divided into two types: Primitive and advanced organisms. A *primitive organism* or lower organism is the one which has a simple body structure and ancient body design or features that have not changed much over a period of time. An *advanced organism* or higher organism has a complex body structure and organization. For example, an *Amoeba* is more primitive as compared to a starfish. *Amoeba* has a simple body structure and primitive features. Also, it is considered more primitive than a starfish. Thus classification helps in predicting the line of evolution.

BASIS OF CLASSIFICATION

Organisms are classified on the basis of characteristics. It could be in terms of appearance or behaviour. These characteristics give clues about how species evolved.

The broadest divisions are based on the most basic characters. For example, the primary characteristic on which the first division of organisms is made is the nature of the cell. It is considered to be the fundamental characteristic for classifying all living organisms. Nature of the cell includes the presence or absence of membrane-bound organelles. Therefore, on the basis of this fundamental characteristic, we can classify all living organisms into two broad categories of eukaryotes and prokaryotes. Then, further classification is made on the basis of cellularity or modes of nutrition.

Some basic characters used in classification are-

1. Prokaryotes and eukaryotes
2. Unicellular and multicellular organisms
3. Autotrophs and heterotrophes
4. Level of organization of organisms
5. Type of body development.

BINOMIAL NOMENCLATURE

Nomenclature is the process of giving scientific names to plants and animals. Carl Linnaeus devised a binomial system of nomenclature (naming system) in which an organism is given two names:

(i) A *generic name* which it shares with other closely related organisms which has features similar enough to place them in the same group.

(ii) A *specific name* which distinguishes the organism from all other species. No other organism can have the same combination of genus and species.

The scientific name derived by using the system of nomenclature is followed all over the world as they are guided by a set of rules stated in the International Code of Nomenclature.

Certain conventions are followed while writing the scientific names:

1. The name of the genus begins with a capital letter.
2. The name of the species begins with a small letter.
3. When printed, the scientific name is written in italics.
4. When written by hand, the genus name and the species name have to be underlined separately.

For example, Humans are referred to as *Homo sapiens*. Similarly, Mango are referred to as *Mangifera indica*

do you know ?

Carl Linnaeus was a father of modern botany. He was a Swedish naturalist who laid the foundation of modern classification and nomenclature in 1758

HIERARCHY OF CLASSIFICATION

For developing a hierarchy of classification, we choose the fundamental characteristic among several other characteristics. For example, plants differ from animals in the absence of locomotion, chloroplasts, cell wall, etc. But, only locomotion is considered as the basic or fundamental feature that is used to distinguish between plants and animals. This is because the absence of locomotion in plants gave rise to many structural changes such as the presence of a cell wall for protection, and the presence of chloroplast for photosynthesis (as they cannot move around in search of food like animals). Thus, all these features are a result of locomotion. Therefore, locomotion is considered to be a fundamental characteristic. By choosing the basic or fundamental characteristic, we can make broad divisions in living organisms as the next level of characteristic is dependent on these. This goes on to form a hierarchy of characteristics.

R.H. Whittaker proposed a five kingdom classification of living organisms on the basis of Linnaeus' system of classification. The five kingdoms proposed by Whittaker are Monera, Protista, Fungi, Plantae, and Animalia.

KNOWLEDGE ENHANCER

IMPORTANT TERM

Species is the basic unit of classification. It is defined as group of organisms capable of interbreeding and producing fertile offspring.

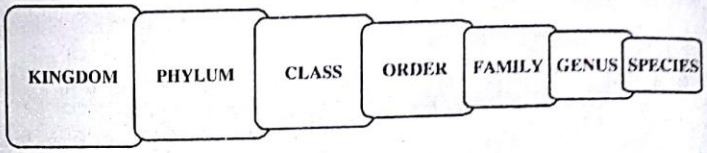
Classification of human beings:
Kingdom- Animalia
Phylum- Chordata
Class- Mammalia
Order- Primates
Family- Hominoidea
Genus- Homo
Species- sapiens

MNEMONIC:

Try this memory tool to help you remember the order of the groups from kingdom to species : Keep Putting Chocolate Out For Goodness Sake. The first letter of each word stands for one of the taxa.

Try to make the similar classification for DOG, TIGER, and CAT.

The kingdoms are further classified using the following subgroups:



Living organisms are divided by groups called taxa (singular, taxon). The taxa ranges from having very broad characteristics to much more specific characteristics. The smallest taxon is *species*. At the species level, organisms look alike and are able to breed with one another. The next largest taxon is *genus*. At the genus level, there is a group of similar species that are closely related.

As you can see from the figure, a *species* is the most specific group. A *genus* is a group of similar species. A *family* is a taxon of similar genera. Take an example, Lion (*Panthera leo*) and tiger (*Panthera tigris*) are different species but they belong to the same genus. This genus (*Panthera*) and another genus (*Felis*) which includes the domestic cat, also share some common characteristics. Therefore, there is the larger cat-family (Felidae) which includes the genus of lion and tiger, and the genus of the domestic cat. An *order* is a taxon of similar families. For example, the family of cats (lions, tigers, cats) and the family of dogs (dogs, foxes, jackals, etc.) possess some common features and so they make an order. In the example cited here the order is "Carnivora". A *class* is a taxon of similar orders. For example, the orders of different animals like those of dogs, cats, bats, whales, monkeys etc., have some common features such as hairy skin and milk-glands. The particular class of the animals mentioned here is "Mammalia". A *phylum* is a taxon of similar classes. For example, the classes of different animals like the mammals, birds, reptiles, frogs, fishes, etc., together constitute the phylum chordata. (Plant taxonomists use the taxon division instead of phylum). A *kingdom* is a taxon of similar phyla (plural for phylum). The Plant Kingdom consisting of all kinds of plants. The Animal Kingdom consisting of all kinds of animals.

The basis for grouping organisms into five kingdoms is as follows:

(i) On the basis of the presence or absence of membrane-bound organelles, all living organisms are divided into two broad categories of eukaryotes and prokaryotes. This division led to the formation of kingdom *Monera*, which includes all prokaryotes.

(ii) Then, eukaryotes are divided as unicellular and multicellular, on the basis of cellularity. Unicellular eukaryotes form kingdom *Protista*, and multicellular eukaryotes form kingdom *Fungi*, *Plantae*, and *Animalia*.

(iii) *Animals* are then separated on the basis of the absence of a cell wall.

(iv) Since *fungi* and *plants* both contain a cell wall, they are separated into different kingdoms on the basis of their modes of nutrition. *Fungi* have saprophytic mode of nutrition, whereas *plants* have autotrophic mode of nutrition. This resulted in the formation of the five kingdoms.

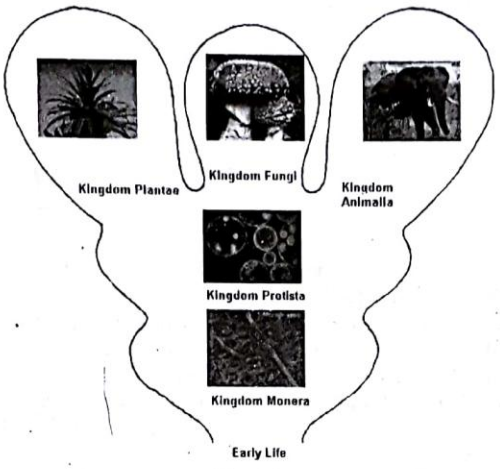
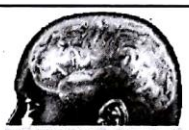
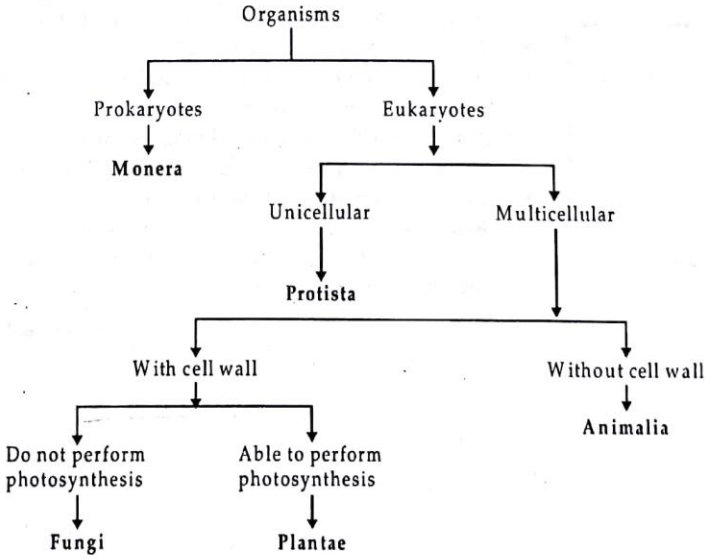


Fig. 9.2



MIND MAP

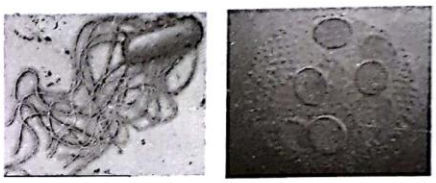
Five Kingdom classification by R. H. Whittakar



Let us now study each of these kingdoms one by one in detail.

I. KINGDOM MONERA

- The organisms belonging to this group are unicellular prokaryotes.
- The mode of nutrition may be autotrophic or heterotrophic.
- Cell wall may or may not be present.
- *Examples:* Bacteria and Blue green algae



Bacteria Blue Green Algae

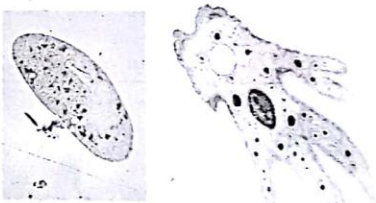
Fig. 9.3 : *Monera*

do you know?

Protists include all microscopic organisms that are not bacteria, not animals, not plants and not fungi.

II. KINGDOM PROTISTA

- The organisms belonging to this group are unicellular eukaryotes.
- The mode of nutrition may be autotrophic or heterotrophic.
- Cell wall, like monerans may or may not be present.
- *Examples*: Diatoms, Protozoans (*Amoeba*).



Paramecium *Ameoba*

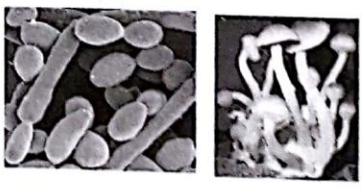
Fig. 9.4 : *Protista*

III. KINGDOM FUNGI

THINK IT OVER

What are the two types of symbiotic relationships that fungi share with other organisms?

- They are unicellular or multicellular eukaryotes.
- Cell walls in fungi are made of chitin.
- These do not contain chlorophyll and hence are heterotropic. They may be saprophytic (depend on dead or decaying organic matter for their food) or may be parasitic (depend on living organisms for their food).
- *Examples:* Yeast, Mushrooms, Bread mould (*Mucor*), Lichen etc.
- Lichen is a group which has two varieties of plants, an alga and a fungus living together. They co-exist for mutual benefit. This relationship is known as *symbiosis*. The fungus absorbs water and mineral salts and supplies it to the alga. The alga prepares food and supplies it to the fungus.



Yeast **Mushroom**

Fig. 9.5 : *Fungi*

IV. KINGDOM PLANTAE:

- They are multicellular eukaryotes.
- They are usually autotrophic. They prepare their own food by the process of photosynthesis.
- Their cells have cell wall, made of cellulose.
- They do not move from one place to another. They are stationary.
- *Examples:* Moss, *Riccia*, Pinus, Mango etc.

Pinus Cedar

Fig. 9.6 : *Plantae*

do you know?

With over 250,000 species, the plant kingdom is the second largest kingdom. Plant species range from the tiny green mosses to giant trees.

CHECK Point

1. List two ways fungi and plants are different.

CHECK YOUR ANSWER

1. The cell wall in fungi are made of chitin, a complex carbohydrate. Plants have cell wall made of cellulose.
   Also fungi do not contain chlorophyll and hence are heterotropic. They may be saprophytic (depend on dead or decaying organic matter for their food) or may be parasitic (depend on living organisms for their food). Plants, on the other hand, are autotrophic. They prepare their own food by photosynthesis.

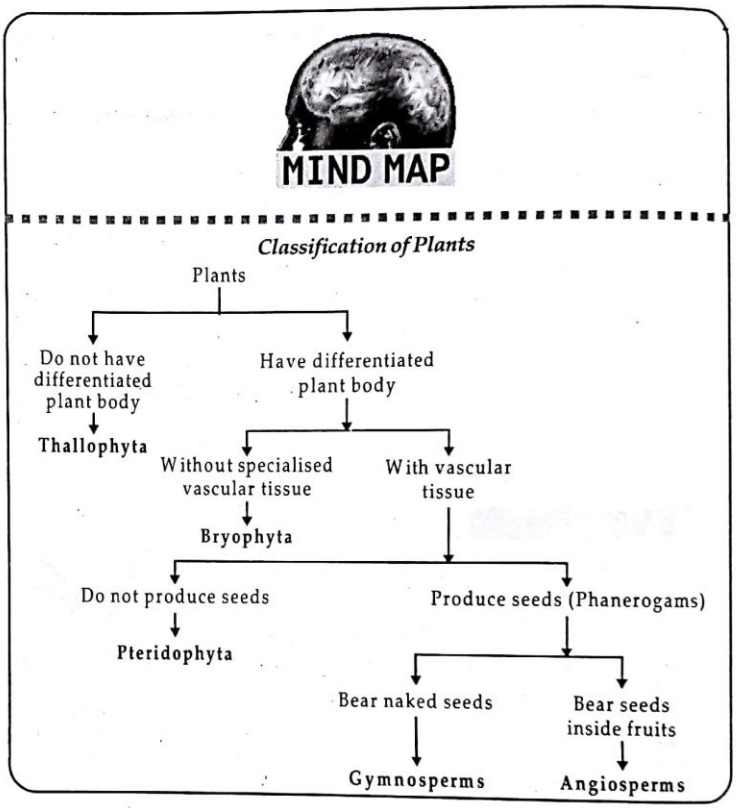
The classification of kingdom Plantae depends on the following criteria:

(i) **Differentiated/ Undifferentiated plant body :** The first level of classification depends on whether a plant body is well differentiated or not. A group of plants that do not have a well differentiated plant body are known as *Thallophyta*.

(ii) **Presence /absence of vascular tissues :** Plants that have well differentiated body parts are further divided on the basis of the presence or absence of vascular tissues. Plants without specialised vascular tissues are included in division *Bryophyta*, whereas plants with vascular tissues are known as *Tracheophyta*.

(iii) **With/without seeds :** Tracheophyta is again sub-divided into division *Pteridophyta*, on the basis of the absence of seed formation.

(iv) **Naked seeds/ seeds inside fruits :** The other groups of plants having well developed reproductive organs that finally develop seeds are called *Phanerogams*. This group is further sub- divided on the basis of whether the seeds are naked or enclosed in fruits. This classifies them into gymnosperms and angiosperms. *Gymnosperms* are seed bearing, non-flowering plants, whereas *angiosperms* are flowering plants in which the seeds are enclosed inside the fruit.



(1) Division: Thallophyta (Thallus-undifferentiated, Phyta-plant)

- It is the simplest organisms.
- This group includes plants that do not contain a well differentiated plant body.
- Their body is not differentiated into stem, root and leaves but is in the form of thallus.
- They are commonly known as algae.

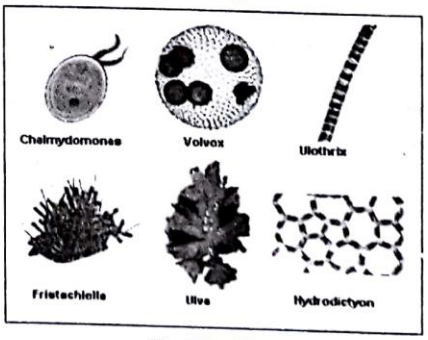


Fig. 9.7 : *Algae*

do you know ?

Eichler in 1883 suggested a system to classify the plant kingdom which is well accepted. He said that the plant kingdom is subdivided into two subkingdoms: Cryptogamae and Phanergamae

The plant kingdom is broadly divided into two groups on the basis of reproductive organs and embryo structure.

(2) Division Bryophyta

- There are the simplest forms of land plants. The plant body is flat and lack true leaves and roots. *Example: Riccia, Marchantia, Funaria*

Riccia

Marchantia

Funaria

Fig. 9.8 : *Bryophytes*

(3) Division Pteridophyta

- They grow in damp cool shady places.
- The plant body is differentiated into stem, leaves and roots.
- Vascular system is present.
- They have inconspicuous or less differentiated reproductive organs.
- They produce naked embryos called spores.
- *Example:* Ferns

Ferns

Fig. 9.9 : *Pteridophyta*

(4) Division Gymnospermae

- Gymnosperms are intermediate between cryptogams and angiosperms.
- They have well developed reproductive organs.
- The male flower is a cone which produces pollen. The female flower is much larger and consists of a rosette of carpels which bear ovules along the two margins.
- *Example: Cycas, Pinus* and Coniferous trees.

Cycas

Pinus

Fig. 9.10 : *Gymnosperms*

do you know?

The plant with the largest flower is the Rafflesia, which grows up to 1 m across.

The Welwitschia plant of the southern African scrub has two leaves, each many metres long, which last for hundreds of years

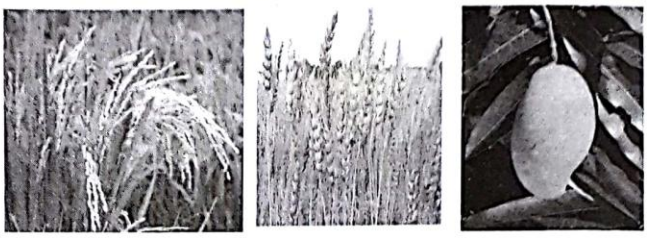
(5) Division Angiospermae

- This group constitutes the largest group of plants.
- Seeds are produced inside an ovary which later becomes the fruit.
- These are highly evolved group of plants.
- The plant body is distinctly differentiated into roots, stem and leaves.

Based on the number of cotyledons (seed-leaves) that form the seed, this group is divided into:

(i) *Monocotyledons:* Example: Rice, Wheat

(ii) *Dicotyledons:* Example: Beans, Mango



Rice Wheat Mango

Fig. 9.5 : *Angiosperms*

CHECK Point

1. How gymnosperm is different from angiosperms?

CHECK YOUR ANSWERS

1.

Gymnosperm	*Angiosperm*
They are non-flowering plants	*They are flowering plants*
They have naked seeds not enclosed inside fruits.	*They have seeds enclosed inside fruits.*
Examples include, Pinus, Cedar, Cycas etc	*Examples include, Coconut, mango etc.*

KNOWLEDGE ENHANCER

CRYPTOGAMAE AND PHANEROGAMAE

(I) Sub Kingdom Cryptogamae : (*Crypto*-hidden, *Gammous*-marriage) These are lower plants that do not bear flowers or seeds. Their reproductive organs are inconspicious. They have naked embryos called spores. Thallophyta, Bryophyta and Pteridophyta belong to Cryptogams.

(II) Sub Kingdom Phanerogamae : This division is made up of plants that bear flowers and seeds and make up the majority of the larger plants. The body is differentiated into true stem, leaves and roots. Propagation of the plant takes place with the help of seeds. Seeds are formed as a result of sexual reproduction. The male and female gametes (sex cells) fuse together inside the ovary (female part of the flower) and develop into the seed. In some plants seed is not produced inside an ovary.

Phanerogamae is made into two further divisions. Gymnosperms (naked seeded plants) and angiosperms (Seed borne within a fruit)

V. KINGDOM ANIMALIA

- They are multicellular eukaryotes
- They have heterotrophic mode of nutrition.
- Cell wall is absent.
- *Examples:* Round worm, Tape worm, House fly, Man etc.

Animals are arranged progressively from simple single-celled protozoans to highly complex mammals. *Kingdom Animalia is divided into two major groups on the basis of the presence or absence of a notochord.*

Non-chordates do not possess a notochord, while all members of the phylum chordates possess a notochord.

Non-chordate is further divided into subgroups on the basis of the following features:

True tissue- Absent or Present

Body cavity- Absent or Present

Type of body symmetry- Radial or Biradial

Type of coelom development- Acoelom, Pseudocoelom or True coelom.

Type of true coleom- Enterocoelom or Schizocoelom

On the basis of the above features, non-chordates are divided into the following subgroups: Porifera, Coelenterate, Platyhelminthes, Nematodes, Annelids, Molluscs, Arthropoda, and Echinodermata.

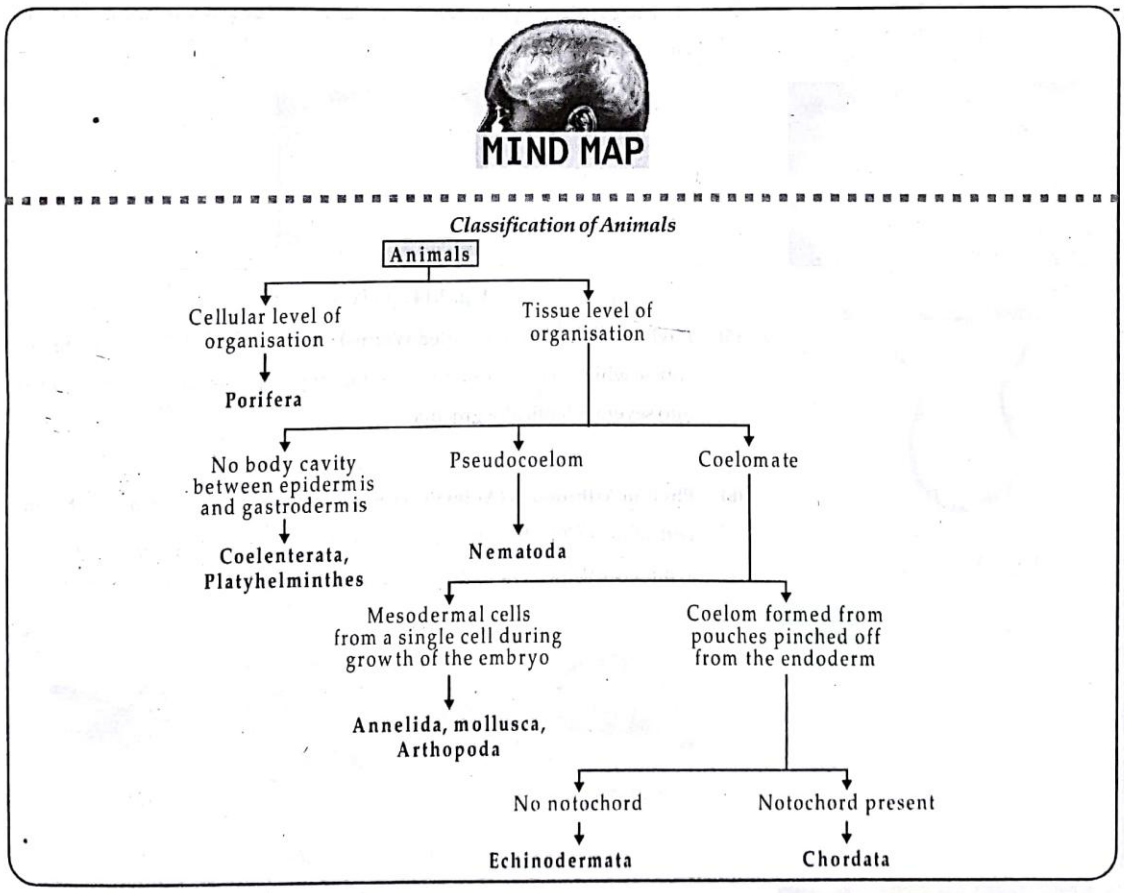
do you know

The animal kingdom is the largest kingdom with over 1 million known species.

do you know

Members of the animal kingdom are found in the most diverse environments in the world.

MIND MAP



Sycon
Fig. 9.11 : *Poriferans*

(1) **Phylum Porifera (Sponges):** These are simplest multicellular animals. They are mostly marine, non-motile and found attached to the rocks. The cells are loosely held together and do not form tissues. *Example, Spongilla* and *Euplectella.*

Jellyfish
Fig. 9.12 : *Coelenterates*

(2) **Phylum Coelenterata (Cnidaria):** They are exclusively marine animals that either live in colonies or have a solitary life span. *Example* includes *Hydra,* Corals etc.

(3) **Phylum Platyhelminthes (Flatworms) :** Body in dorsoventrally flat and leaf like or ribbon-like with bilateral symmetry. The body cavity has only one opening which serves as both the mouth and the anus.

(4) **Phylum Aschelminthes (Round Worm):** They have triploblastic body showing bilateral symmetry. Alimentary canal begins with the mouth and ends with the anus.

Fig. 9.13 : *Platyhelminthes*

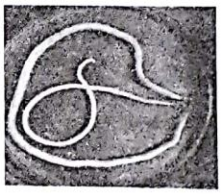


Fig. 9.14 : *Aschelminthes*

Earthworm
Fig. 9.15 : *Annelids*

(5) **Phylum Annelida (Segmented Worms) :** Body is covered by a non-chitinous cuticle which may have chitinous setae, or parapodia. The body is divided into several identical segments.

(6) **Phylum Arthropoda (Animals with jointed legs):** This is the largest phylum with almost 80% of the animal's kingdom in these phyla. Body is bilaterally symmetrical and segmented. It is divided into head, thorax and abdomen.

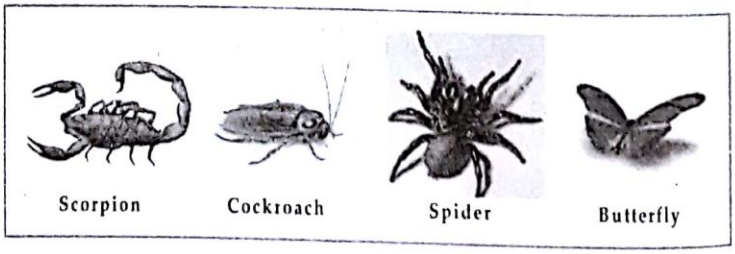


Fig. 9.16 : *Arthropoda*

(7) **Phylum Mollusca :** They are aquatic in habitat but some land forms are also seen. Body is soft and divided into three regions- head, dorsal visceral mass and ventral foot.

Pila

Fig. 9.17 : *Mollusca*

(8) **Phylum Echinodermata:** Body is radially symmetrical, star shaped, spherical or elongate. Exoskeleton is spiny. Head is absent and five radially arranged arms are present.

Starfish

Fig. 9.18 : *Echinoderms*

(9) **Phylum Hemichordata :** They have characteristics of both invertebrate and chordate. Body is divided into proboscis, collar and trunk.

(10) **Phylum Chordata :** All members of the phylum chordate possess

(i) A notochord

(ii) A dorsal nerve cord

(iii) Paired gill pouches

(iv) Post anal tail

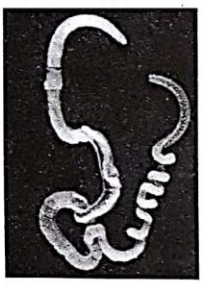
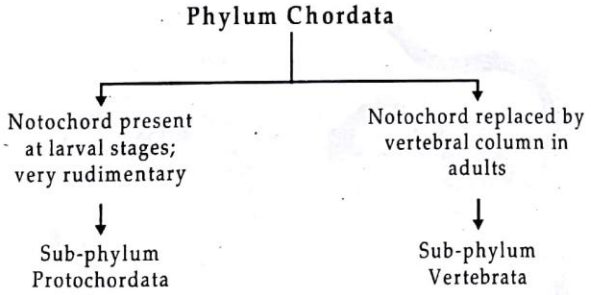
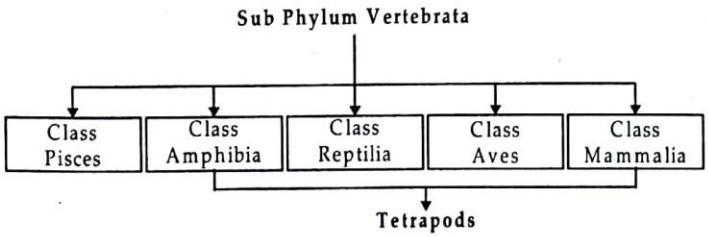


Fig. 9.19 : *Phylum Hemichordata*

However, some animals such as *Balanoglossus, Amphioxus, Herdmania,* etc. have a notochord, which is either absent or does not run the entire length of the animal's body. Therefore, these animals are kept in a separate sub-phylum called *Protochordata*, and the rest of the chordates are included in the sub-phylum *vertebrata*.



The members of the sub-phylum vertebrata are advanced chordates. They are divided into five classes: Pisces, Amphibian, Reptilia, Aves, and Mammalia.



(i) **Class Pisces:** This class includes fish such as Scoliodon, Tuna, Rohu, Shark, etc. These animals mostly live in water. Hence, they have special adaptive features such as a streamlined body, presence of a tail for movement, gills, etc. to live in water.

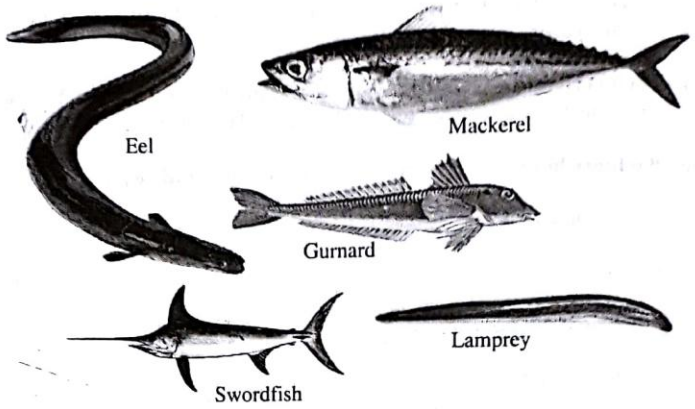


Fig. 9.20 : *Pisces*

(ii) **Class Amphibia:** It includes frogs, toads, and salamanders. These animals have a dual mode of life. In the larval stage, the respiratory organs are gills, but in the adult stage, respiration occurs through the lungs or skin. They lay eggs in water. *Examples :* Frogs, toads and salamanders are amphibians

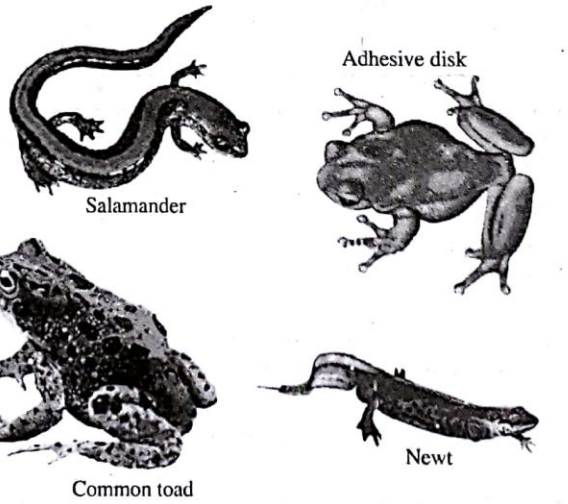


Fig. 9.21 : *Amphibians*

KNOW? do you know?

Amphibians were the first animals to venture on to land. They emerged from the oceans over 300 million years ago.

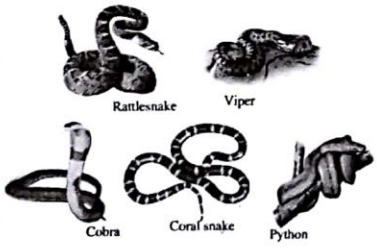


Fig. 9.22 : *Reptiles*

(iii) **Class Reptilia:** It includes reptiles such as lizards, snakes, turtles, etc. They usually creep or crawl on land. The body of a reptile is covered with dry and cornified skin to prevent water loss. They lay eggs on land.

(iv) **Class Aves:** It includes all birds such as sparrow, pigeon, crow, etc. Most of them have feathers. Their forelimbs are modified into wings for flight, while hind limbs are modified for walking and clasping. They lay eggs.

(v) **Class Mammalia:** It includes a variety of animals which have milk producing glands to nourish their young ones. Some lay eggs and some give birth to young ones. Their skin has hair as well as sweat glands to regulate their body temperature.

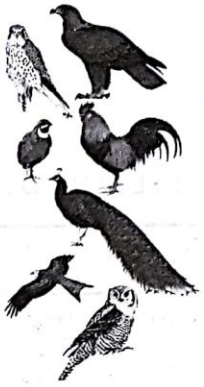


Fig. 9.23 : *Aves*

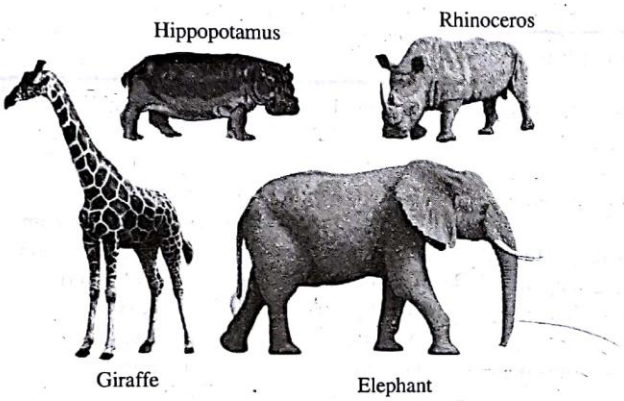


Fig. 9.24 : *Mammals*

do you know?

Blue whale is the largest mammal and water shrew is the smallest mammal.

- Living world is rich in variety of plants and animals.
- In order to facilitate the study of kinds and diversity of organisms, biologists have evolved certain rules and principles for identification, nomenclature and classification of organism.
- *Nomenclature* is defined as system of naming objects (plants and animals).
- *Identification* determines the exact place or position of an organism in the set plan of classification.
- Generic and specific names are from latin language. First letter of the generic name starts with capital letter and of the species name with a small letter.
- *Taxonomy* is the branch of biology that deals with the framing of laws and principles of classifying the organisms on the basis of their evolutionary relationship.

exercise 1

FIB FILL IN THE BLANKS :

DIRECTIONS : *Complete the following statements with an appropriate word / term to be filled in the blank space(s).*

1. The process of giving scientific names to plants and animals is called _____.
2. According to binomial nomenclature, every name comprises two words- _____ and _____.
3. The basic unit of biological classification is _____.
4. Five kingdom of classification was given by _____.
5. _____ is formed by combination of algae and fungi.
6. The prokaryotes are included in _____ kingdom.
7. Plants possess chlorophyll, hence, they are known as _____.
8. _____ is the largest phylum and includes about 80% of total animals.
9. Animals with jointed legs belong to class _____
10. Thallophyta, Bryophyta and Pteridophyta belongs to _____.
11. Binomial nomenclature of was first used by _____
12 Kingdom _____ includes multicellular decomposers.

T/F TRUE & FALSE :

DIRECTIONS : *Read the following statements and write your answer as true or false.*

1. A group of related genera are classified as species.
2. In *Homo sapiens*, *Homo* is genus and *sapiens* is species.
3. Tiger belongs to phylum non chordata.
4. Cyanobacteria is also known as blue green algae.
5. Organisms belonging in kingdom Protista are prokaryotic.
6. All fungi are heterotropes.
7. Notochord is present in Annelids.
8. Hemichordata has characteristics of both non chordata and chordata.
9. Scoliodon and shark belongs to class Reptilian.
10. Angiosperms are non-flowering plants.

MTF MATCH THE FOLLOWING :

DIRECTIONS : *Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D and E) in column I have to be matched with statements (p, q, r, s, t) in column II.*

1.

Column I		Column II	
A	*Euglena*	p	An angiosperm
B	*Saccharomyces*	q	Fungi
C.	*cerevisae*	r	Protista
D.	Bread mould	s	A generic name
E	Mango tree	t	A specific name

2.

Column I (Examples)		Column II (Class)	
A.	Frog	p	Aves
B.	Shark	q	Reptilia
C.	Pigeon	r.	Mammals
D.	Hippopotamus	s	Pisces
E.	Lizard	t.	Amphibian

VSAQ VERY SHORT ANSWER QUESTION :

DIRECTIONS : *Give answer in one word or one sentence.*

1. What is biodiversity?
2. Who proposed five kingdom system of classification?
3. What is genus?
4. Organisms belonging to kingdom "X" is multicellular. They bear eukaryotic cells and lack stiff cell walls. They reproduce sexually. Identify the Kingdom "X".
5. Which type of nucleus is present in protistans?
6. Why all fungi are heterotrophic in nature?
7. Animals which have milk producing glands to nourish their young ones belong to which class of Animalia?
8. Give two examples of Protista.
9. Name five kingdoms classified by Whittakar in five kingdom classification.
10. In which kingdom will you place an organism which is unicellular, eukaryotic and photosynthetic?
11. Which division among plants has the simplest organism?
12. Which division is known as amphibians of plant kingdom?

13. Give two examples of plants that belong to Bryophyta.
14. Why pteridophytes are known as cryptogamae?
15. Phanerogams that bear naked seed are- Gymnosperms or Angiosperms.
16. Butterfly, housefly and scorpions have jointed appendages. They belong to which phylum- Arthropoda or Colenterata.
17. Vertebratas are classified into how many classes? Name them.
18. Animals that have scales and breathe through lungs belong to which class of animalia?

SAQ SHORT ANSWER QUESTION :

DIRECTIONS : *Give answer in 2-3 sentences.*

1. What is the need of classifying living organisms?
2. Write down the identifying traits of Protista.
3. List down two distinguishing characters of plants from fungi.
4. What do you understand by binomial system of nomenclature?
5. Make an outline of five kingdom classification.
6. Write down the general characteristics of kingdom Monera.
7. Name a plant that forms fruits but no seeds and another plant that forms seed but no fruits.
8. How angiosperms are different from gymnosperm?
9. Give two important distinguishing characters of- Arthropods, Reptiles and Mammals.
10. Give the characteristic features of turtles and tortoise.
11. What are distinguishing characters of class mammalian?
12. What were the bases of classifying all organisms into five major kingdoms?
13. Write a short on hierarchy of classification. Explain with the help of a suitable example.
14. What are the rules for assigning scientific names to any organism?
15. How cryptogams are different from phanerogams?

MCQ MULTIPLE CHOICE QUESTIONS :

DIRECTIONS : *This section contains* **20** *multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct. Choose the correct option.*

1 A kingdom of unicellular eukaryotes is
(a) Monera (b) Protista
(c) Fungi (d) Plantae

2. A diverse group of terrestrial organisms separated from other plants by lack of chlorophyll is
(a) Algae (b) Fungi
(c) Protista (d) Animalia

3. Who gave the term binomial nomenclature?
(a) Linnaeus (b) Whittakar
(c) Aristotle (d) Robert Hooke

4. Which of the following statements is correct about yeast?
(a) It lacks chlorophyll
(b) It lacks nucleus
(c) It lacks cell wall.
(d) It lacks cytoplasm

5. Which is the highest category of taxonomy?
(a) Kingdom (b) Phylum
(c) Genus (d) Species

6. A group of related genera are classified as
(a) Family (b) Order
(c) Genus (d) Species

7. The scientific name of mango is written as
(a) *Mangifera Indica* (b) *Mangifera indica*
(c) *mangifera Indica* (d) *mangifera indica*

8. In *Solanum tuberosum*, *Solanum* is
(a) *Species* (b) *Genus*
(c) *Order* (d) *Class*

9. A plant that produces seed but not fruit is
(a) *Cycas* (b) *Riccia*
(c) Mango (d) *Spirogyra*

10. Notochord is present is
(a) Star fish (b) Earthworm
(c) Pila (d) Shark

11. The difference between algae and protozoan is that algae are
    (a) Heterotrophic
    (b) Always multicellular
    (c) Photosynthetic
    (d) Always unicellular
12. Unlike animals, fungi
    (a) Ingest their nutrients before digesting them.
    (b) Secrete enzymes and then absorb the digested nutrients through their cell wall.
    (c) Have cell walls made of cellulose without chitin.
    (d) Do not store energy in the form of glycogen.
13. Ferns are a type of
    (a) Bryophyta (b) Pteridophyta
    (c) Gymnosperm (d) Angiosperm
14. The body of an organism "X" is covered with dry and cornified skin to prevent water loss. They lay eggs on land. The animal "X" belongs to which class of Chordata?
    (a) Amphibian (b) Reptilian
    (c) Avian (d) Mammalian
15. Which of the following organisms belongs to Phylum echinoderm?
    (a) Starfish (b) Earthworm
    (c) Sponges (d) Butterfly
16. Which of the following characteristics is unique to avians?
    (a) Presence of lungs
    (b) Presence of feathers
    (c) Presence of scales
    (d) Presence of mammary glands
17. The scientific name of humans is *Homo sapiens*. It belongs to genus
    (a) *Homo* (b) *sapiens*
    (c) Man (d) Humans
18. Which of the following correctly represents the correct order of various levels of classification?
    (a) Species → Genus → Family → Order → Class → Phylum
    (b) Phylum → Genus → Order → Family → Class → Species
    (c) Species → Family → Class → Order → Genus → Phylum
    (d) Class → Family → Order → Genus → Phylum → Species.
19. Which of the following produces seeds which are enclosed in fruits?
    (a) Gymnosperms (b) Angiosperms
    (c) Pteridophytes (d) Bryophytes
20. Which of the following is absent in ferns?
    (a) Flowers, fruits and seeds
    (b) Roots, leaves and stems
    (c) Vascular tissues
    (d) Spores

MTOC MORE THAN ONE CORRECT

DIRECTIONS : *This section contains 6 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d). Out of which ONE OR MORE may be correct.*

1. Which of the following are examples of arthropods?
    (a) Butterfly (b) Cockroach
    (c) Earthworm (d) Starfish
2. Which of the following divisions belong to Cryptogams?
    (a) Thallophyta (b) Bryophyta
    (c) Pteridophyta (d) Gymnosperm
3. Which of the following statements is correct about the kingdom Plantae?
    (a) They are multicellular eukaryotes.
    (b) They are usually autotrophic.
    (c) Their cells have cell wall, made of cellulose.
    (d) Their cells have cell wall, made of chitin
4. The rules for assigning scientific names are
    (a) The name of the genus begins with a capital letter.
    (b) The name of the species begins with a small letter.
    (c) When written by hand, the scientific name is written in italics
    (d) When printed, the scientific name is underlined.
6. Animals belonging to phylum annelida are
    (a) Earthworm (b) Leech
    (c) Scorpion (d) Spider

MMQ MULTIPLE MATCHING QUESTIONS

DIRECTIONS : *Each question has four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with one or more statement(s) given in Column II. Match the entries in column I with entries in column II.*

1.

Column I	*Column II*
A. Prokaryotes	p. Protista
B. Eukaryotes	q. Monera
C. Unicellular	r. Plantae
D. Multicellular	s Fungi
	t. Animalia

2.

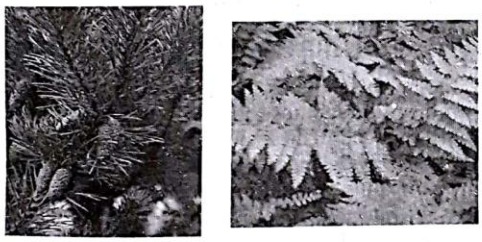
Column I	Column II
A. Presence of Notochord	p. Starfish
B. Absence of Notochord	q. Lizard
C. Lays eggs on land	r. Humans
D. Give birth to young ones	s. Butterfly
E. Spiny skinned animals	t. Turtles
F. Presence of jointed legs	

PBQ PICTURE BASED QUESTIONS

DIRECTIONS : *Study the given picture(s) and identify them.*

1. Identify the given animals and write down the characteristics that are common to all animals in the given illustrations.

2. Study the given plants.



(a) Identify the given plants and write down the division to which they belong.
(b) Write down the characteristics of each identified division.

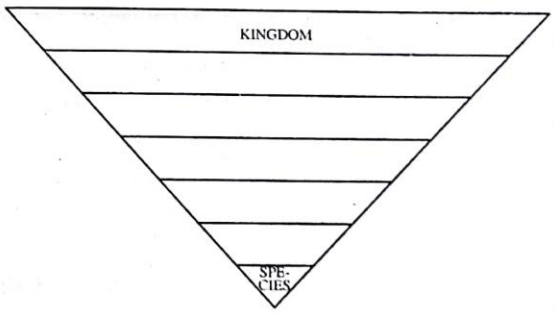
HSQ HOTS SUBIECTIVE QUESTIONS :

DIRECTIONS (Qs. 1-10) : *Answer the following questions.*

1. What characters do fungi share with animals?
2. In what ways fungi are similar to unicellular protists?
3. The common name of mango is simpler than its scientific name-*Mangifera indica*. Is there an advantage of giving scientific names to organisms?
4. Compare fungi and bacteria with respect to their importance to man.

ABQ ACTIVITY BASED QUESTIONS :

1. Study the relationship between first two words and fill the suitable word in fourth place.
   (i) Bacteria: Prokaryotes:: *Amoeba*: _____
   (ii) Fungi: Heterotrophic:: Algae: _____
   (iii) Producer: Plants:: Decomposer: _____.
   (iv) Monera: Prokaryote:: Plantae: _____
   (v) Angiosperm: Mango:: Gymnosperm: _____
   (vi) Feathers: Birds:: Hair: _____
2. Out of the given pairs, which of the following cover the greater number of organisms?
   (i) PHYLUM or GENUS
   (ii) CLASS or PHYLUM
   (iii) FAMILY or ORDER
   (iv) GENUS or SPECIES
   (v) PHYLUM or KINGDOM
3. Fill in the line of triangle to show the taxonomic classification system.



SOLUTIONS

BRIEF EXPLANATIONS OF SELECTED QUESTIONS

EXERCISE 1

FIB FILL IN THE BLANKS :

1. Nomenclature, 2. Genus, Species, 3. Species, 4. R.H.Whittakar, 5. Lichen, 6. Monera, 7. Autotrophs, 8. Arthropoda, 9. Arthropoda, 10. Cryptogams, 11. Linnaeus, 12. Fungi

T/F TRUE & FALSE :

1. False, 2. True, 3. False, 4. False, 5. False, 6. True, 7. False, 8. True, 9. False, 10. False.

MTF MATCH THE FOLLOWING :

1. A- r, B- s, C- t, D- q, E- p 2. A- t, B- s, C- p, D- r, E- q

VSAQ VERY SHORT ANSWER QUESTION :

2. R. H. Whittakar.
3. Genus is a group of similar species that are closely related.
4. Animalia
5. Eukaryotic
6. They lack chlorophyll.
7. Mammals
8. *Amoeba and Paramecium*
9. Monera, Protista, Fungi, Plantae, Animalia
10. Protista
11. Thallophyta
12. Bryophyta
13. *Riccia* and *Funaria*
14. Their reproductive organs are inconspicious.
15. Gymnosperms
16. Arthropoda
17. Five classes are Pisces, Amphibians, Reptilia, Aves and Mammalia
18. Reptilia

EXERCISE 2

MCQ MULTIPLE CHOICE QUESTIONS :

1. (b)	2. (b)	3. (a)	4. (a)
5. (a)	6. (a)	7. (b)	8. (b)
9. (a)	10. (d)	11. (b)	12. (b)
13. (b)	14. (b)	15. (a)	16. (b)
17. (a)	18. (a)	19. (b)	20. (a)

MTOC MORE THAN ONE CORRECT

1. (a), (b) 2. (a), (b), (c) 3. (a), (b), (c)
4. (a), (b) 5. (a), (b)

MMQ MULTIPLE MATCHING QUESTIONS

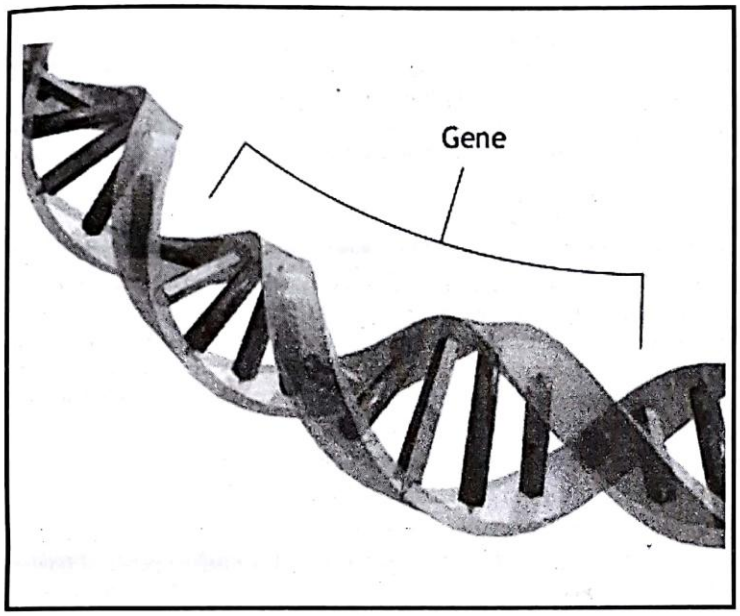
1. A- q, B- p, r, s t, C- p, q, D- r, s, t
2. A- q, r, t; B- p, s; C- q, t; D- r; E- p; F- s

PBQ PICTURE BASED QUESTIONS

1. The animals shown in the figure are butterfly, scorpion and spiders. These animals belong to Phylum Arthropoda. All these animals have jointed legs.
2. (a) (i) Fern- Belongs to Pteridophyta
   (ii) Pinus- Belongs to Gymnosperm
   (b) *Pteridophytes*: They have inconspicuous or less differentiated reproductive organs. They produce naked embryos called spores.
   Gymnosperms: They have well developed reproductive organs. The male flower is a cone which produces pollen. The female flower is much larger and consists of a rosette of carpels which bear ovules along the two margins.

ABQ ACTIVITY BASED QUESTIONS :

1. (i) Eukaryotes, (ii) Autotrophs (iii) Fungi, (iv) Eukaryotes, (v) Pinus, (vi) Mammals
2. (i) PHYLUM, (ii) PHYLUM, (iii) ORDER, (iv) GENUS, (v) KINGDOM



chapter

10

Genetics

Every living being produces offsprings that resemble, their parents in certain fundamental characters. For example, Mango plant produces seeds that germinate to mango plants. Similarly dogs produce puppy that grows into dogs, and humans produce baby that grows into adult human. Hence, similarities intends to increase between members of a family i.e. parents and offsprings. These similarities are not merely due to coincidence but due to some inherent mechanism called *heredity*. It is genetic continuity between successive generation. But in some offsprings the heredity is never complete, the offsprings differ from their parents. This difference is called ***variation***. *Genetics is the branch of biology that deals with the study of heredity and variation."*

Modern genetics began in 19th century with the work of Gregor Johann Mendel, who formulated the basic concept of heredity. Gregor Johann Mendel (1822-1884) was a monk at Brunn, Austria. In 1856 to 1865 he worked as a teacher in natural history and mathematics at university of vienna. During this period Mendel developed curiosity over the pattern of inheritance of characters from parent organism to offspring. Mendel is regarded as the ' *father of modern genetics*' for his significant and pioneering contributions to the field of genetics.

IMPORTANT TERM

Hybrid *: A plant and animal produced by parents that have different hereditary characteristics.*

The puzzle of how characteristics are passed on from one generation to the next, or even why some characteristics skip a generation, was solved by an Austrian monk called Gregor Mendel (1822- 1884). Mendel grew peas, and studied their sizes and colours. By recording how these characteristics were passed on from one generation to the next, he worked out on a set of the basic rules of genetic inheritance on how different characteristics are passed down through the generations.

MENDEL'S WORK ON HEREDITY

Gregor Mendel was the first scientist to study the pattern of inheritance. He did this by using different varieties of pea plants (*Pisum sativum*) which he grew in his garden. Mendel chose pea plants for studying inheritance because pea plants had a certain clear cut difference to identify them. For example, some pea plants were tall while others were dwarf. Some pea plants produce round-yellow seeds while other produced wrinkled-green seeds.

The advantage characters found in pea plants are :

(i) Life cycle in the pea plant is very short.

(ii) Pea plant produce a large number of seeds.

(iii) Pea plants exhibit natural self pollination, because the petals of flowers remain closed.

(iv) It was possible to conduct cross pollination by transforming pollen grain from one flower to another.

MENDEL'S EXPERIMENT

Mendel performed experiments in three stages :

(i) Selection of pure or true breeding parents.

(ii) Hybridisation and obtaining first (F_1) generation.

(iii) Self pollination of hybrid to get generations like F_2 and F_3 and So on.

(i) Selection of Parents:

Mendel selected fourteen pure breeding variety of peas as the material for his experiments. Mendel satisfied himself as pure breeding nature of each variety through self pollination. He eliminated the plants which did not form similar offsprings. The true breeding plants formed the **parent (P) generation.**

Mendel employed seven characters with easily distinguishable contrasting forms. The characters were seed colour, seed shape, flower colour, pod colour, pod shape, flower position and plant height.

The following table represents the contrasting characters:-

	Parameters	Contrasting characters
1	Length of stem	Tall and dwarf
2	Position of flower	Axial and terminal
3	Nature of the pod (fruit)	Inflated and constricted
4	Colour of unripe pod	Green and yellow
5	Colour of seed coat	Grey and white
6	Nature of the seed coat	Round and wrinkeld
7	Colour of flower	Purple and white

Note:

A pure breeding variety produces offspring having similar characterstics. For example : white flower plant produces white flowered offsprings etc.

INTERESTING FACT !!

Mendel appeared in 1850 for passing a teaching certificate. Though he studied little science in school and has never attended a university, he succeeded in passing the examination in physics but failed in Geology and classification of mammals. He spent his last day in a conflict of church and died in 1884, without even knowing that he will be father of genetics in future.

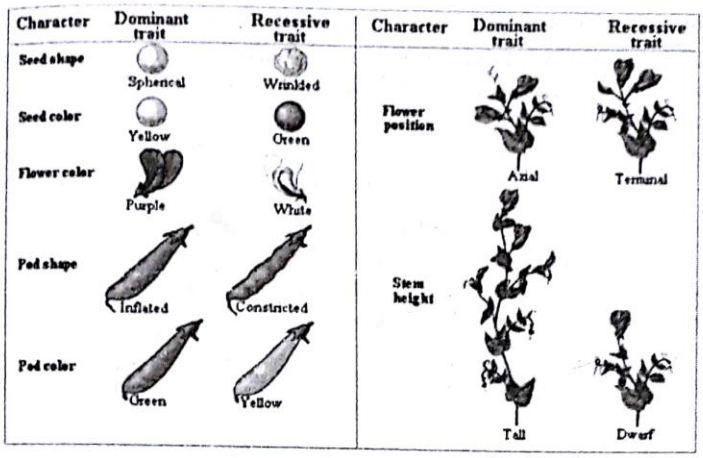


Fig. 10.1

(ii) Hybridization and obtaining first generation :-

Mendel selected true breeding tall (TT) and dwarf (tt) pea plants. Then, he crossed these two plants. The seeds formed after fertilization were grown and these plants that were formed represent the first filial or F_1 generation. All the F_1 plants obtained were tall.

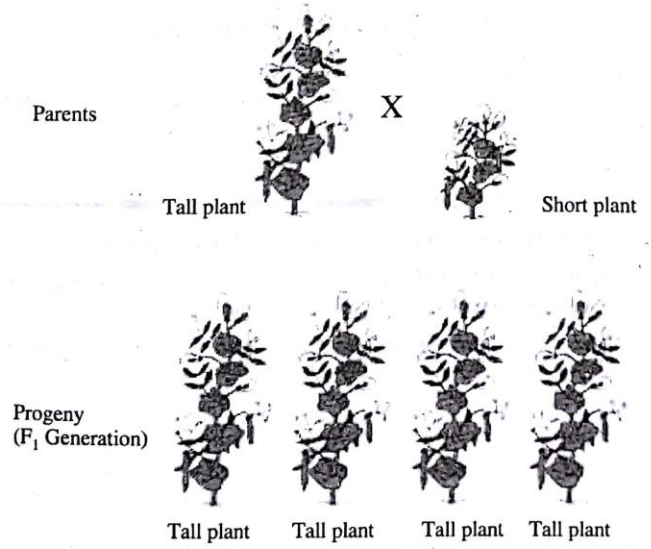


Fig. 10.2 : *Cross pollination of tall and short plant*

do you know?

An organism is Homozygous for a trait, when it has two copies of same allele. An organism is Heterozygous for a trait when it has two different alleles.

Note

In genetics, genes are represented by letters. A capital letter shows that a gene is dominant, and a small one that it is recessive.

do you know?

The gene which decides the appearance of an organism even in the presence of an alternative gene is known as **dominant gene**. On the other hand, the gene which can decide the appearance of an organism only in the presence of another identical gene is called a **recessive gene**.

(iii) Self pollination of hybrids to get generations like F_2 and F_3:

Then, Mendel self-pollinated the F_1 plants and observed that all plants obtained in the F_2 generation were not tall. Instead, one-fourth of the F_2 plants were short.

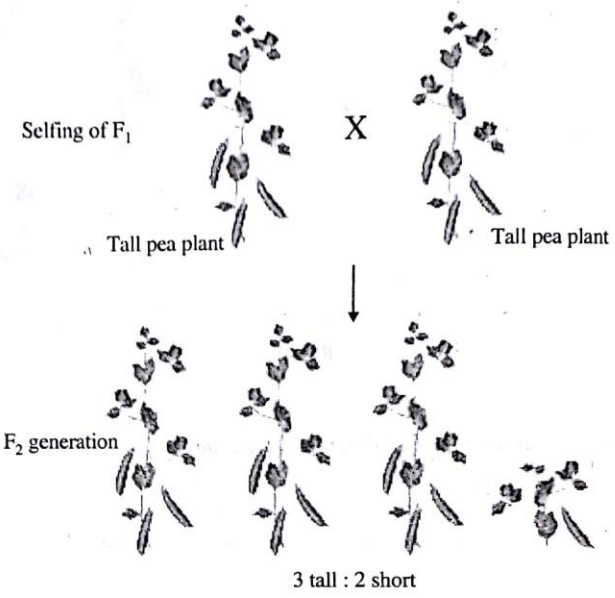


Fig. 10.3 : *Self pollination of F_1 plants.*

From this experiment, Mendel concluded that the F_1 tall plants were not true breeding. They were carrying traits of both short height and tall height. They appeared tall only because the tall trait is dominant over the dwarf trait.

Note:

Genotype is the description of genes present in an organism. For example, TT, tt or Tt.

Phenotype is the characteristic which is visible in an organism. For example, tall or dwarf are phenotypes of a plant.

MENDEL'S OBSERVATION

(i) The F_1 hybrids always showed one of the parental forms of the trait.

(ii) Both the parental forms of the trait (contrasting forms of the trait) appeared without any change in the F_2 generation.

(iii) The two contrasting forms in a trait did not show any blending either in the F_1 generation or in the F_2 generations.

(iv) The form of the trait that appeared in the F_2 hybrids is called *dominant* form and it appeared in the F_2 generation about three times in frequency as its alternate (recessive) form.

MENDEL'S FINDINGS

On the basis of the experiment, Mendel postulated three laws which is known as Mendel's law of heredity. These are:

(i) Law of dominance

(ii) Law of segregation

(iii) Law of independent assortment.

(1) Law of Dominance

This law has its basis for monohybrid cross. According to this law "when a cross is made between two homozygous (pure line) individuals considering contrasting offspring of simple characters, then the offspring appear in F_1 hybrid is called dominant and the other is recessive traits".

(2) Law of segregation or law of purity of gamete

According to this law "In F_1 hybrid the dominant and recessive character though remain together for long time but they do not mix with each other and separate or segregate at the time of gamete formation. Thus the gamete formed, receive either dominant or recessive character out of them. This law is called law of purity of gametes i.e., a gamete when formed is always pure for a particular trait, just because of the fact that they always contain the factors which determines single trait pertaining to a particular character.

(3) Law of independent assortment

In dihybrid cross the phenotype observed round yellow, wrinkled yellow, round green and wrinkled green appeared in the ratio of 9 : 3 : 3 : 1. Such a ratio was observed for several traits.

Mendel crossed pea plants having round green seeds (RRyy) with pea plants having wrinkled yellow seeds (rrYY).

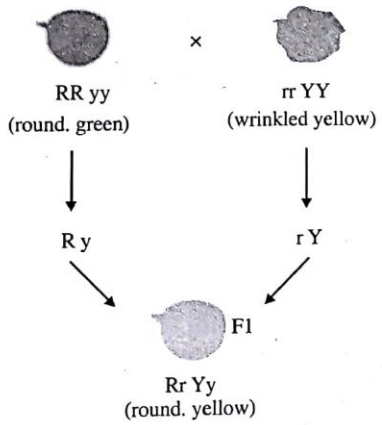


Fig. 10.4 : *An example of dihybrid crosses*

Since the F_1 plants are formed after crossing pea plants having green round seeds and pea plants having yellow wrinkled seeds, F_1 generation will have both these characters in them. However, as we know that yellow seed colour and round seeds are dominant characters, therefore, the F_1 plants will have yellow round seeds.

Then this F_1 progeny were self-pollinated and the F_2 progeny was found to have yellow round seeds, green round seeds, yellow wrinkled seeds, and green wrinkled seeds in the ratio of 9:3:3:1.

Note

Monhybird cross : *It involves cross between two parents that differ only in one heritable character. For example : Tallness and dwarfness.*
Dihybrid cross: It involves cross between two parents that differs in two heritable characters. For example, round-yellow seeds and wrinkled green seeds.

Note

Trihybrid ratio shows the same pattern of inheritance as dihybrid. The phenotype ratio will be 27 : 9 : 9 : 9 : 3 : 3 : 1

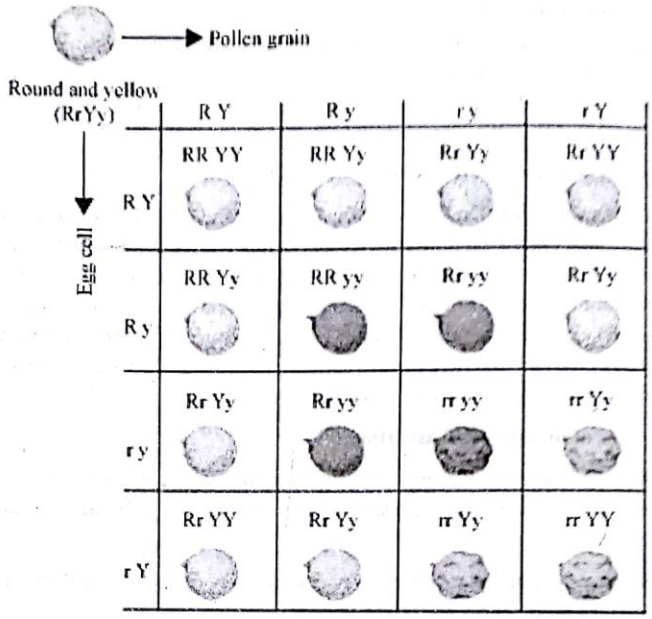


Fig. 10.5 : *Independent inheritance of two different traits*

In the above cross, more than two factors are involved, and these are independently inherited.

Based upon such observation on dihybrid cross (crosses between plants differing in two traits), Mendel proposed a set of generalisations that we call Mendel's law of independent assortment. The law states that. "When two pairs of traits are combined in a hybrid, segregation of one pair of characteristics is independent on the other pair of characters.

LINKAGE AND CROSSING OVER

Linkage : Linkage is the phenomenon of certain genes staying together during inheritance through out the generations without any change or separation. It is because of their presence on the same chromosome. Linkage was discovered by Morgan (1910). Linkage maintains specific traits of race and also of a newly developed variety.

Crossing over : Crossing over is the reciprocal exchange of segments between non-sister chromatids of a pair of homologous chromosomes. It results in recombination of genes and hence variation.

CHROMOSOMES - THE CARRIERS OF HEREDITY

Chromosomes are only visible when a cell nucleus is about to divide. The chromosomes number is constant for the individuals of a species and every cell has the same number. Humans have 46 chromosomes.

In 1915, T.H. Morgan noted peculiar similarity between chromosomal behaviour and Mendelian factors and supported the chromosomal theory of inheritance propounded by N.S. Sutton in 1902. *According to the chromosomal theory of inheritance*, the Mendelian factors came to be known as 'genes'. Genes occur on the chromosome in a linear fashion. Each characteristic or trait seems to be controlled largely by gene.

do you know?

Chromosomes are thread like bodies found in the nucleus of a cell. We have a total of 46 chromosome in our cell.

do you know?

Frederick Meisher was the first who proved that DNA is a genetic material.

DEOXYRIBONUCLEIC ACID (DNA)

Watson and Crick (1953) at Cambridge proposed the double helical structure of DNA. The X-ray photographs showed that the DNA was a helix and the width of the helix is 2nm. The purine and pyrimidine base were stacked 0.34 nm apart in a ladder. The helix made one full turn every 3.4 nm. Thus, there are 10 layers of bases stacked in one turn. Since the width of the helix is 2 nm it can accommodate only two stands and not three.

They found that the best model, which satisfied all the X-ray data, was a double helix with the sugar phosphate chain on the outside and the bases on the inside. The two chains run in an antiparallel fashion with one chain having a 5′ – 3″ orientation and the other DNA, adenine (A) pairs with thymine (T), and guanine (G) pairs with cytosine (C) The two strands of DNA are held together by hydrogen bonds.

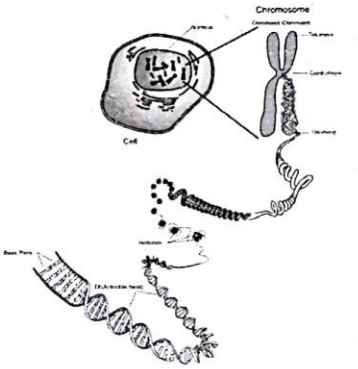


Fig. 10.6 : *Chromosome*

IMPORTANT TERM

Autosomes: *The chromosomes other than the sex chromosome. Each member of an autosome pair (in diploid organisms) is of similar length and in the gene it carries.*

CHECK Point

1. **Why are genes important?**

CHECK YOUR ANSWER

Genes are important as they are responsible for transmitting traits, characteristics, diseases and all other hereditary information from one generation to another. Genes are the basic chemical units of DNA molecules found in chromosomes. Our behaviour and personality traits are determined by our genes. Each gene carries instruction for specific characteristic such as curly or straight hair, eye colour, or albino skin.

You must have noticed that brothers or sisters often look alike. Have you ever thought, how it happens?

It is the inherited traits that makes their physical appearance so similar. An inherited trait is a particular genetically determined characteristic that distinguishes a person. The traits of children are determined by the traits that are passed on from their parents. Some traits are obvious in a family a child's nose is shaped like their mother's nose, but some traits are less obvious. You may have similar traits to many of your classmates even though you are not related to them. For example you roll tongue but your friend may not.

There are numerous traits in humans, but some traits occur more frequently than others. Between 70-90% of the human population have free-hanging earlobes, can roll their tongue. The traits which occur more commonly are called dominant and those which are less are called recessive trait.

HUMAN GENETICS

The process of creating new life is called reproduction. A man's body makes male sex cells, which are called sperm, and a woman's body produces ova, which are female sex cells. When a sperm joins with an ovum, a new cell is formed. This cell contains all the information needed to build a unique human being.

The instructions that tell the body how to develop are genes, and the study of genes is genetics. Genes are sections of a chemical called DNA (Deoxyribonucleic acid), which is packed in bundles, called chromosomes. Chromosomes are packed inside a control unit called nucleus. Human cells have 46 chromosomes, which is inherited from parents.

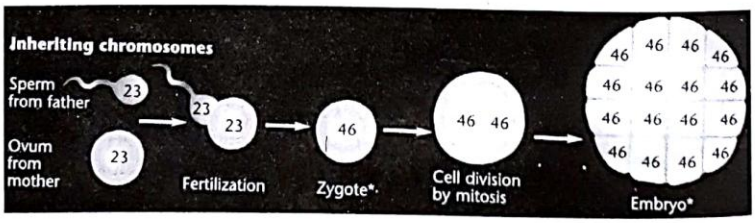


Fig. 10.7

Let us discuss, how these genes work ?

Human have 23 pairs of homologous chromosomes. Each gene, or gene group, on one of these chromosomes, act together with its partner on the other paired chromosome. This gives an instruction to create or control characteristics.

Genes for certain features, such as eye or hair colour, or blood group, have different forms, called *alleles*. So a gene pair might be made up of alleles giving identical instructions, or alleles giving different instructions.

One gene may order green eyes, for example, and the other blue eyes. In such cases, either one gene will be dominant, overruling the other , recessive gene, or they will both have an effect, in which case they are called *co-dominant genes*. For example, a green eye colour gene is dominant over a blue one, so if you have one of each, you have green eyes. You need two blue colour genes to have blue eyes.

HUMAN BLOOD GROUP

The blood group character is controlled by a set of three alleles. I^A, I^B and i. Genes I^A and I^B both are dominant over gene I^O or i, but not over each other.

- For blood group B, the genotype would be $I^B I^B$ or $I^B i$.
- For blood group AB, the genotype would be $I^A I^B$.
- For blood group O, the genotype would be ii.

Blood groups are inherited in a simple Mendelian pattern. Children with all the four type of blood groups are possible in a cross between blood groups A ($I^A i$) and blood group B ($I^B i$).

Result of Cross between a male $I^A i$ and female $I^B i$.

Male ($I^A i$)

Female ($I^B i$)	I^A	i
I^B	$I^A I^B$ AB Blood group	$I^B i$ B Blood group
i	$I^A i$ A Blood group	ii O Blood group

SEX DETERMINATION (GIRLS OR BOY)

In human beings, the females have two X chromosomes and the males have one X and one Y chromosome. Therefore, the females are XX and the males are XY.

The gametes, as we know, receive half of the chromosomes. The male gametes have 22 autosomes and either X or Y sex chromosome.

Type of male gametes: 22+X OR 22+ Y.

However, since the females have XX sex chromosomes, their gametes can only have X sex chromosome.

Type of female gamete: 22+X

do you know?

DNA is a double-straned coiled molecular chain held together by linearly held nucleotide. They make gene.

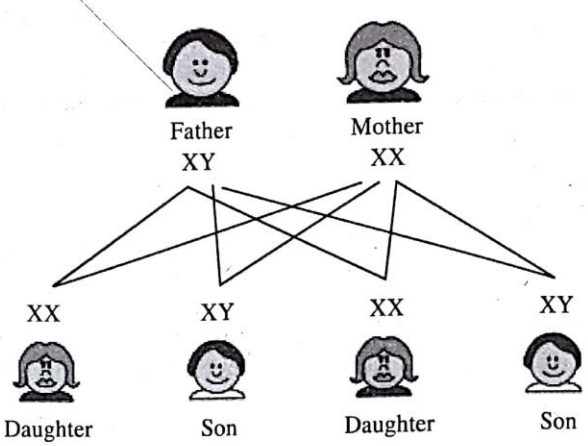


Fig. 10.8 : *Sex determination in Human*

Thus, the mother provides only X chromosomes. The sex of the baby is determined by the type of male gamete (X or Y) that fuses with the X chromosome of the female.

GENETIC DISORDERS

A large number of diseases are known to be inherited from the parents to the offspring. Such diseases are known as genetic disorder. Most of this diseases are caused by the expression of recessive genes.

Most common and prevalent disorders are haemophilia, cystic fibrosis, sickle cell anaemia, colour blindness, Thallasemia etc.

Some genetic diorders are discussed below :

(i) Haemophilia:

- It is a sex linked recessive disease. It transmits from unaffected carrier female to some of the male progeny.
- In this disease a single protein that is a part of the cascade of proteins involved in the clotting of blood is affected. Due to this, in an affected individual a simple cut will result in non-stop bleeding.
- The heterozygous female (carrier) for haemophilic may transmit the disease to sons.
- The possiblity of a female becoming a haemophilic is extremely rare because mother of such female has to be at least carrier and father should be haemophilic. It is called royal disease, because it shows a number of haemophilic descents as queen Victoria was a carrier of the disease.

Cross between haemophilic carrier female and normal male :

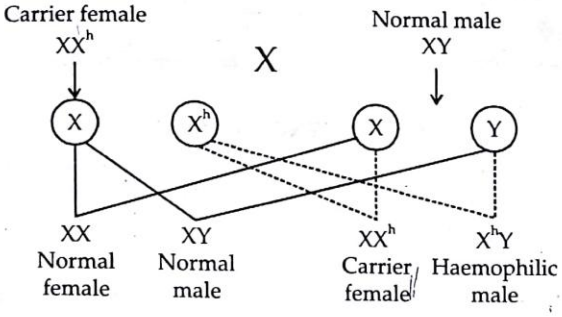


Fig. 10.9

CHECK Point

1. When was haemophilia discovered in the royal line?

CHECK YOUR ANSWER

Haemophilia is an inherited deficiency whereby the substance necessary for blood clotting is missing. The transmission of this condition is sex linked, being present mostly in males but carried solely by females. Sons of a haemophilic male are normal, but daughters, although outwardly normal, may transmit this deficiency to half their sons. The existence of haemophilia in certain royal families of Europe is well known. Working from family trees it seems probable that Queen Victoria naturally produced the gene for haemophilia.

(ii) Sickle cell anemia

- This is autosome linked recessive trait that can be transmitted from parents to the offspring when both the partners are carrier for the gene.
- It is caused by a recessive mutant allele on chromosome 11. The defective haemoglobin under low oxygen tension and changes the shape of RBC from biconcave cell to sickle shaped elongated cell.

Cross between two carriers (Hb^A Hb^S) for Sickle cell anaemia

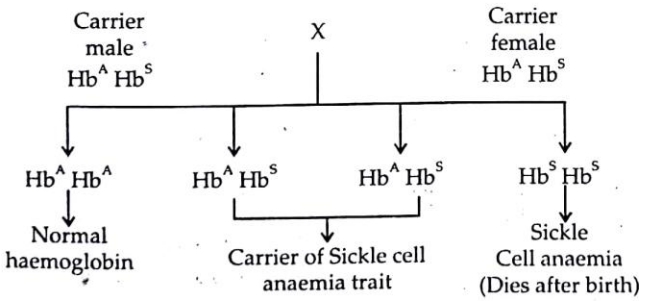


Fig. 10.10

GENETIC ENGINEERING

Scientists have discovered how to extract genes and use them in different ways, for instance in medicine, farming and industry. This manipulation of genes is known as genetic engineering.

The main technique used in genetic engineering is called gene splicing. Chemicals called restriction enzymes are used to cut specific genes out of DNA. Other enzymes, called ligases, are used to splice, or join, the genes with DNA taken from a suitable organism.

This modified DNA, known as recombinant DNA (rDNA), can then be used in different ways. For example, it may be placed in a fast-breeding bacterium. This reproduces very quickly to create lots of bacteria, each containing the rDNA with the specific gene.

A method of gene splicing

1. The gene that is needed (called the target DNA) is taken out of a cell's nucleus.
2. The target DNA is spliced with a plasmid, a special piece of DNA from a bacterium.
3. The recombinant DNA is then put into a host bacterium of a type which divides rapidly.
4. The host bacterium divides many times, creating many identical copies, each containing the target DNA (the desired gene).

SUMMARY

- The process by which characters or traits are passed from the parents to the offspring is called *heredity*.
- *Variations* means differences between the individuals of the same species.
- The science which deals with the study of heredity and variations is known as *genetics*.
- An Austrian monk namely Gregor Johann Mendel was the first person to study genetics. He is known as *'Father of Genetics'*.
- Mendel proposed that a pair of factors which are now called genes, control inheritance.
- Genes were found to occupy specific position on thread like structure called chromosome.
- The paired condition is known as diploid.
- DNA is the most important constituent of a chromosome.
- DNA is a macromolecule in which a large number of nucleotide units are present.
- The females carry two X-chromosomes as sex chromosome.
- The males carry one X and one Y chromosome as sex chromosome.

FIB FILL IN THE BLANKS :

DIRECTIONS : *Complete the following statements with an appropriate word / term to be filled in the blank space(s).*

1. Mendel is famous for his work on _____.
2. Term 'genetics' was given by _____.
3. The branch of biology dealing with hereditary and variation is called_____.
4. Mendel was the native of _____.
5. In genetics, the chequer board is called_____.
6. The first law of Mendel is _____.
7. Chromosomes are made up of _____.
8. Mendel formulated some laws which are known as _____.
10. A complete set of chromosome inherited as a unit from one parent is known as _____.

T/F TRUE & FALSE :

DIRECTIONS : *Read the following statements and write your answer as true or false.*

1. Peas are generally self-pollinated.
2. Pure gametes are produced during gametogenesis.
3. Genotype ratio of monohybrid cross is 9 : 3 : 3 : 1.
4. The terms genotype refers to external appearance of an individual.
5. Genotype ratio of dihybrid cross is 3 : 1.

MTF MATCH THE FOLLOWING :

DIRECTIONS : *Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column I have to be matched with statements (p, q, r, s) in column II.*

1.

Column I	Column II
(A) Genetics	(p) Chromosomes similar in size and shape.
(B) Autosomes	(q) The alternative forms of a gene
(C) Recessive gene	(r) Study of law of inheritance of characters
(D) Allele	(s) A gene that can express only when in a similar pair.
(E) Homologous chromosomes	(t) Chromosomes other than the pair of sex chromosomes

VSAQ VERY SHORT ANSWER QUESTION :

DIRECTIONS : *Give answer in one word or one sentence.*

1. Define a gene.
2. What is a sex chromosome?
3. What is variation ?
4. Where are the genes located? What is the chemical nature of gene?
5. Why did Mendel choose pea plant for his experiment?
6. Write the different contrasting characters found in pea plants?
7. What is offspring?
8. Who is the father of genetics?
9. What do you mean by the term 'genotype'?
10. What is phenotype?

SAQ SHORT ANSWER QUESTION :

DIRECTIONS: *Give answer in 2-3 sentences.*

1. How gene is related to heredity?
2. Define the term 'allele'.
3. What is meant by punnet squre?
4. State Mendel's law of dominance.
5. What is dihybrid cross?
6. Name two Mendelian disorders that are sex-linked.
7. What is the cause for sickle-cell anaemia?
8. Give difference between-Homozygous and Heterozygous.
9. State difference between Dominance and Recessive allele.

LAQ LONG ANSWER QUESTIONS :

DIRECTIONS: *Give answer in four to five sentences.*

1. Write the contribution of Mendel in genetics. Why did Mendel selected garden pea for his experiment.
2. Explain the law of dominance using a monohybrid cross.
3. How are genetic disorders broadly classified? Explain with two example for each.

MCQ MULTIPLE CHOICE QUESTIONS :

DIRECTIONS (Qs. 1-7) : *This section contains 7 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.*

1. Which genotype characteristics in an organism is heterozygous for two genes?
   (a) RRYy (b) RrYY
   (c) RRYY (d) RrYy
2. Which one is a sex–linked disorder?
   (a) Leukemia (b) Cancer
   (c) Night Blindness (d) Colour blindness
3. Which one can have sex chromosomes?
   (a) Unisexual flower (b) Bisexual flower
   (c) Unisexual Plant (d) Hermophrodite Plant
4. Which of the following is considered as a recessive character of Mendel?
   (a) Round seed (b) Wrinkled seed
   (c) Axial flower (d) Green pod
5. Which is the functional unit of inheritance?
   (a) Chromosome (b) Gene
   (c) Cistron (d) Allele
6. Which of the following is not true to haemophilia?
   (a) Royal disease (b) Bleeder's disease
   (c) X-linked disease (d) Y-linked disease
7. Which of the following is not a hereditary disease?
   (a) Cretinism (b) Cystic fibrosis
   (c) Thalassaemia (d) Haemophilia

MTOC MORE THAN ONE CORRECT

DIRECTIONS : *This section contains 4 Multiple Choice Questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONE OR MORE may be correct.*

1. Which of the following is homozygous for two pair of alleles?
   (a) TTRR (b) TrRR
   (c) ttrr (d) TrtR
2. Which of the following is true for expressing recessive characters?
   (a) They are true breeding
   (b) They are homozygous
   (c) They produce different type of gamete for concerning characters
   (d) They produce one type of gamete for concerning characters.
3. Which of the following is carrier of hereditary material?
   (a) Gene (b) DNA
   (c) Hormones (d) RNA
4. Which of the following is not a sex-linked character?
   (a) Baldness (b) Colour blindness
   (c) Polio (d) Heart disease

PBQ PASSAGE BASED QUESTION :

DIRECTIONS : *Study the given paragraph(s) and answer the following questions.*

Mutation is defined as change in the genetic material. A point mutation is a change of a single base pair in DNA. Sickle-cell anemia is caused due to change of one base in the gene coding for beta-chain of hemoglobin. Inheritable mutations can be studied by generating a pedigree of a family. Some mutations involve changes in whole set of chromosomes (polyploidy) or change in a subset of chromosome number (aneuploidy). This helped in understanding the mutational basis of genetic disorders. Down's syndrome is due to trisomy of chromosome 21, total number of chromosome becomes 47. In Turner's syndrome, one X chromosome is missing and the sex chromosome is as XO, and in Klinefelter's syndrome, the condition is XXY. These can be easily studied by analysis of Karyotypes.

Based on above passage, answer the following questions.

1. What is point mutation?
2. How Down's syndrome is a genetic disorder disease?
3. How sickle cell anemia is caused?
4. What is Turner's syndrome?

FTP FILL IN THE PASSAGE

DIRECTIONS : *Fill in the blank spaces in the given passage about human genetics.*

Human have 46 chromosomes out of which 22 pairs or 44 chromosomes are called .....1..... and one pair of chromosome (XX in females and XY in male) are called .....2..... The females have .....3..... XX sex chromosome and males have .....4.....in XY. Chromosome, Y- Chromosome is shorter than X-chromosome.

A&R ASSERTION & REASON :

DIRECTIONS : *Each of these questions contains an Assertion followed by reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.*

(a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.

(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.

(c) If **Assertion** is **correct** but **Reason** is **incorrect**.

(d) If **Assertion** is **incorrect** but **Reason** is **correct**.

1. **Assertion :** Workers prior to Mendel could not work on the principles of inheritance

   Reason : They considered the individuals as a whole complex of characters.

2. **Assertion :** The law of segregation is one of most important contribution to biology.

   Reason : It introduced the concept of hereditary factors as discrete physical entities which do not become blended.

3. **Assertion :** The genetic complement of an organism is called genotype.

   Reason : Genotype is the type of hereditary properties of an organism.

4. **Assertion :** Mendel successed to know the process of inheritance.

   Reason : He considered a single character at one time

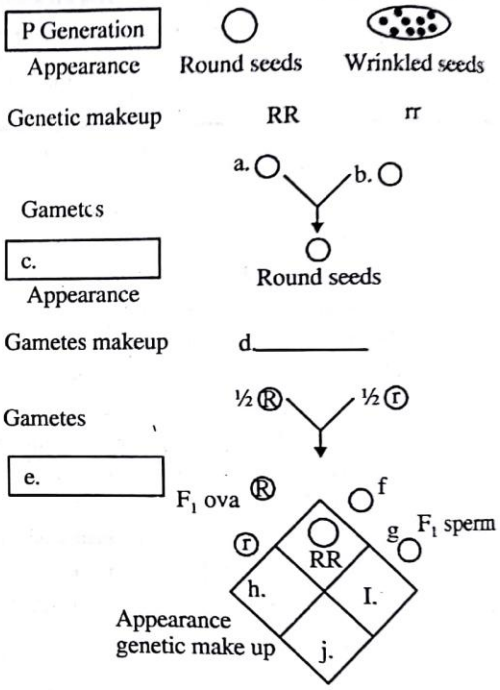
5. **Assertion :** Mendel's seven characters are confined to only four chromosome.

   Reason : Test cross is a cross between F, hybrid and recessive parent.

HSQ HOTS SUBJECTIVE QUESTIONS :

DIRECTIONS : *Answer the following questions.*

1. Fill in this diagram of a monohybrid cross of round and wrinkled-seeded pea plants. The round allele (R) is dominant and the wrinkled allele (r) is recessive.



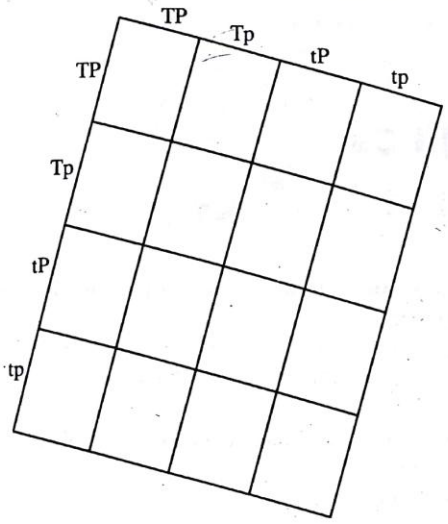
2. A true-breeding tall, purple-flowered pea plant (TTPP) is crossed with a true-breeding dwarf, white-flowered plant (ttpp).

   (a) What is the phenotype of the F_1 generation?

   (b) What is the genotype of the F_1 generation?

   (c) What four type of gametes are formed by F_1 plants?

   (d) Fill in the following Punnett square to show the offspring of the F_2 generation.



(e) List the phenotype and ratios found in the F_2 generation.

3. How many different types of gametes can be formed by F_1 progeny, resulting from the following cross

AA BB CC × aa bb cc

4. Give a graphical presentation of 4O′ Clock plant.

(Take the flower of Red colour and white colour)

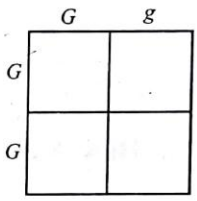
5. A boy is colour blind. He has two sisters one is colour blind and one is carrier (normal). Find out who is colour blind in his family?

6. Do all plants and animals have the same genes?

7. Marriage between close relatives and cousins is not advisable. What is the reason behind it?

8. A person meets with an accident and great loss of blood has occurred. There is no time to analyse his blood group. Which type of blood group is safe to transfer?

9. (a) Two pea plants which green pods, $Gg \times GG$, were crossed. Complete the Punnett square below to show the results of this cross.



(b) What percentage of the offspring produced by this cross will most likely have green pods?

ABQ ACTIVITY BASED QUESTIONS :

DIRECTIONS : *Study the given activities and answer the following questions.*

1. Study Mendelian inheritance using seeds to differ colours/ sizes of any plant.

2. Study prepared pedigree chart of genetic traits such as rolling of tongue, blood groups, colour blindness.

SOLUTIONS

BRIEF EXPLANATIONS OF SELECTED QUESTIONS

EXERCISE 1

FIB FILL IN THE BLANKS :

1. Garden pea plant.
2. Gregor Johan Mendel
3. Genetics
4. Austria
5. Punnet square
6. Law of segregation
7. DNA
8. Laws of inheritance
9. X chromosome
10. Genome

T/F TRUE & FALSE :

1. True 2. True 3. False
4. False 5. True

MTF MATCH THE FOLLOWING :

1. A- r; B-t; C-s; D-q; E-p

VSAQ VERY SHORT ANSWER QUESTION :

1. Genes are the specific parts of a chromosome (DNA segment) which determine the hereditary characteristics.
2. The chromosome which is found to be associated with sex determination, is called sex chromosome.
3. Variation is the differences between the individuals of same species.
4. Genes are located on chromosomes. Genes are made up of DNA.
5. Pea plants were having seven pair of contrasting characters.
6. Different contrasting characters are stem length, colour of flower, seed colour, seed shape, pod colour, pod shape, position of flower.
7. The baby produced after fertilisation of female and male gamete is called offspring.
8. Gregor Johann Mendel
9. When genetic characters are considered, it is called a genotype.
10. The characters influenced by the surroundings are called phenotype.

SAQ SHORT ANSWER QUESTION :

1. Genes are the specific parts of a chromosome which determine the heredity characteristics. Genes are responsible for transmission of hereditary characters.
2. Allele are alternative form of a gene, occupying the same position of a chromosome and affecting the same characteristics but in different ways.
3. Punnet square is a device that has been created to yield a diagram that allows an easy representation of hybridisation data.
4. Mendel's law of dominance denotes when a cross is made between two homozygous (pure line) individuals considering contrasting trait of simple character then the trait that appear in F_1 hybrid is called dominance and the other one is called recessive trait.
5. Dihybrid cross is a cross made between individuals of a species, considering the inheritance of contrasting pair of two traits.
6. Haemophilia, colour blindness and myotonic dystrophy.
7. Sickle cell anaemia is caused by a mutant recessive allele on chromosome 11. That defective haemoglobin under goes polymerisation under law oxygen tension and changes the shape of RBC to sickle-shaped elongated cell.

8.

Homozygous	Heterozygous
It is an individual organism in which the members of a pair of alleles for the characters are same.	It is an individual organism in which the members of a pair of alleles for the character are dissimilar or different.

9.

Dominant	Recessive
Dominant allele is the allele which expresses itself in a hybrid, where the members of a pair of alleles for the character are different.	It is the allele which is suppressed (or does not express itself) in the hybrid, where the members of a pair of alleles for the character are different.

LAQ LONG ANSWER QUESTIONS :

1. Gregor Johann Mendel was monk of Austria. He is known as father of genetics. He explained the principle of inheritance based on his experiments with garden pea.

Mendel selected garden pea for his experiment due to following reasons:

(i) Garden pea has clear contrasting characters.

(ii) It can be raised, maintained and handled conveniently.

(iii) It is a self pollinated plant but successfully cross pollinated.

(iv) It produced many seeds in one generation, which helped in drawing the correct conclusion.

2

MCQ MULTIPLE CHOICE QUESTIONS :

1. (d) 2. (d) 3. (c) 4. (b)
5. (b) 6. (d) 7. (a)

MTOC MORE THAN ONE CORRECT

1. (a, b, c) 2. (a, b, d) 3. (a, b) 4. (c, d)

PBQ PASSAGE BASED QUESTION :

1. Changing of single base pair of DNA in chromosome is called point mutation
2. Down's syndrome is caused due to trisomy of Chromosome 21.
3. Sickle cell anaemia caused due to change of one base of genetic coding
4. Turner's syndrome is caused the missing of one X-chromosome in sex chromosome and that denoted as XO.

FTP FILL IN THE PASSAGE

1. Autosome
2. Sex chromosome
3. Homozygous
4. Heterozygous

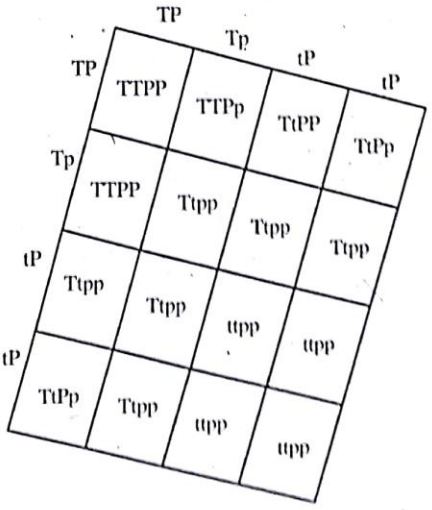
A&R ASSERTION & REASON :

1. (a) 2. (b) 3. (b)
4. (b) 5. (b)

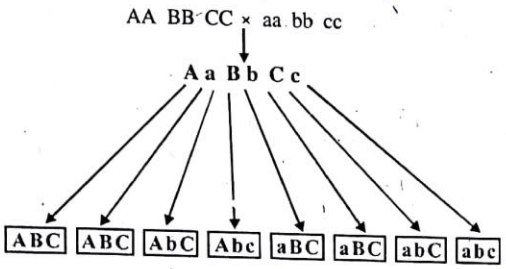
HSQ HOTS SUBJECTIVE QUESTIONS :

1. (a) R, (b) r, (c) F_1, generation; (d) Rr, (e) F_2 generation (f) R, (g) r, (h) Rr, (i) Rr, (j) rr (k) 3 round: 1 wrinkled; (l) IRR; 2Rr : 1 rr

2. (d)



3.



4. In **4 O'clock** plant (*Mirabilis jalapa*) when plants with red flower (Homozygous RR) are crossed with plants having white flower (Homozygous rr), the heterozygous F_1 hybrid (Rr) bear pink flower. When these pink flowers are self pollinated they develop Red (RR), Pink (Rr) and white (rr) flowers in the ratio 1 : 2 : 1 respectively. Similar case of incomplete dominance is seen in **snapdragon** (*Antirrhinum*).

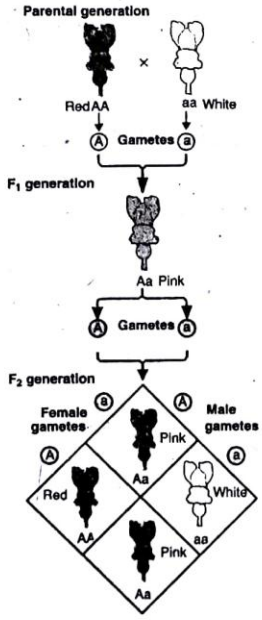


Fig.: *Incomplete dominance*

5. When a colourblind man marries a carrier woman then half of his sons will be colourblind and rest half normal and half of his daughters will be colourblind and rest half carriers.
6. No, all the plants and animals do not have the same genes.
7. Marriages between close relatives and cousins is not advisable because recessive lethals are carried in heterogenous conditions which expresses themselves only when mating takes place between two carrier individuals or close relatives.
8. 'O' group is an universal donor. Rh^+ blood can be given to a Rh^- person only once, so O Rh^- is safer.