Biology

Part 2

Standard IX

Government of Kerala
Department of General Education

Prepared by

State Council of Educational Research and Training (SCERT), Kerala

2024

THE NATIONAL ANTHEM

Jana-gana-mana adhinayaka, jaya he
Bharatha-bhagya-vidhata
Punjab-Sindh-Gujarat-Maratha
Dravida-Utkala-Banga
Vindhya-Himachala-Yamuna-Ganga
Uchchala-Jaladhi-taranga
Tava subha name jage,
Tava subha asisa mage,
Gahe tava jaya gatha
Jana-gana-mangala-dayaka jaya he
Bharatha-bhagya-vidhata
Jaya he, jaya he, jaya he,
Jaya jaya jaya, jaya he.

PLEDGE

India is my country. All Indians are my brothers and sisters.

I love my country, and I am proud of its rich and varied heritage. I shall always strive to be worthy of it.

I shall give respect to my parents, teachers and all elders, and treat everyone with courtesy.

To my country and my people, I pledge my devotion. In their well-being and prosperity alone, lies my happiness.

State Council of Educational Research and Training (SCERT), Kerala

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Dear friends,

The study of science aims at creating a scientific awareness and imbibing the methodology of scientific enquiry. It is with incessant explorations that the world of knowledge is being expanded. Inferences are reached through experiments, observations, recordings and analyses. The windows being opened through these researches enable us to take up the challenges of the changing times.

Through different learning contexts, this textbook presents the phenomena which are fundamental for the existence of the living world and the activities and processes along with the elements that are involved in it for the creation of life. It also offers a possibility of self- assessment in each learning context. This book is full of opportunities for the learner to get engaged in enquiry-based learning activities.

Ideas and activities which help to develop ecological awareness and ecological values along with an attitude for preserving biodiversity by identifying the diversity of the living beings and their evolution are also included in the textbook. The lesson offers opportunity for the learners to become links of a generation, aware of justice, by recognising physical and mental charateristics and to be formed as the best social beings by imbibing noble concepts like gender justice.

Contexts are offered for the learners to communicate the findings of their exploratory learning and to make possible the dissemination of knowledge. This textbook helps in understanding the new possibilities of science and technology and to internalise the life lessons like hygienic practices and first aid. May you all be able to pursue investigations and to make findings in the new vistas of science.

With love and regards

Dr Jayaprakash R. K.
Director
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Icons used in this textbook for convenience

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THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a [1]**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the [2][unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

---

1. Subs. by the Constitution (**Forty**-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (**Forty**-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

4

BEHIND MOVEMENTS

- Diversity in movement
- Muscles
- Skeletal system
- Different frameworks
- Muscles and exercise
- Bones, muscles-disorders
- Bones and evolution
- Plant movements

Observe the picture.

" How beautiful is this green earth! "

The Earth is made colourful by plants, animals and countless microorganisms that cannot be seen with our naked eyes. Don't these creatures make our world beautiful and dynamic, with many of their activities like procuring food, etc.?

What all types of movements can be observed in the organisms in the picture?

.....

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Don't such movements require energy? Most of the energy produced in the body is utilised by animals for movement. Therefore, animals require more energy compared to plants.

Observe illustration 4.1 and note down the importance of movement in each organism.

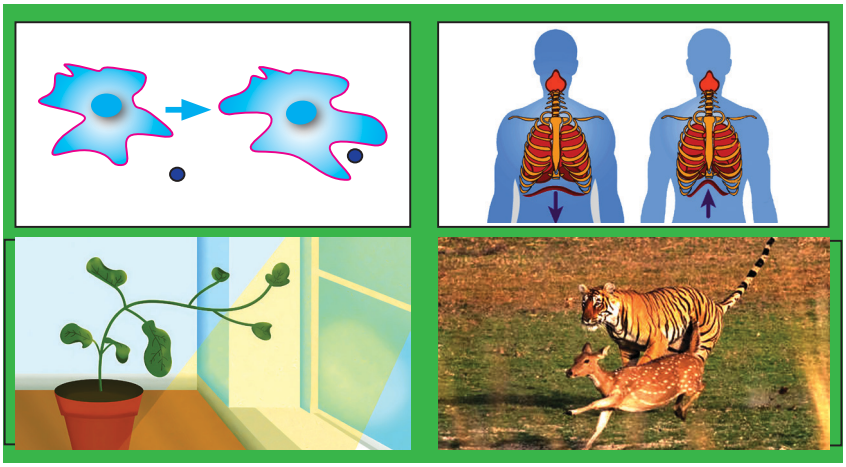


Illustration 4.1 : Different types of movements

- Food acquisition in amoeba
-
-
-

List out other kinds of movements that you are familiar with.

.....

.....

Haven't you understood that different organisms have adapted various types of movements to meet their diverse needs?

Various movements, both visible and invisible to the naked eye, as well as diverse adaptations for movement are seen in the living world. Analyse the illustration 4.2 based on the indicators and note down the inferences regarding the diverse movements in the living world.

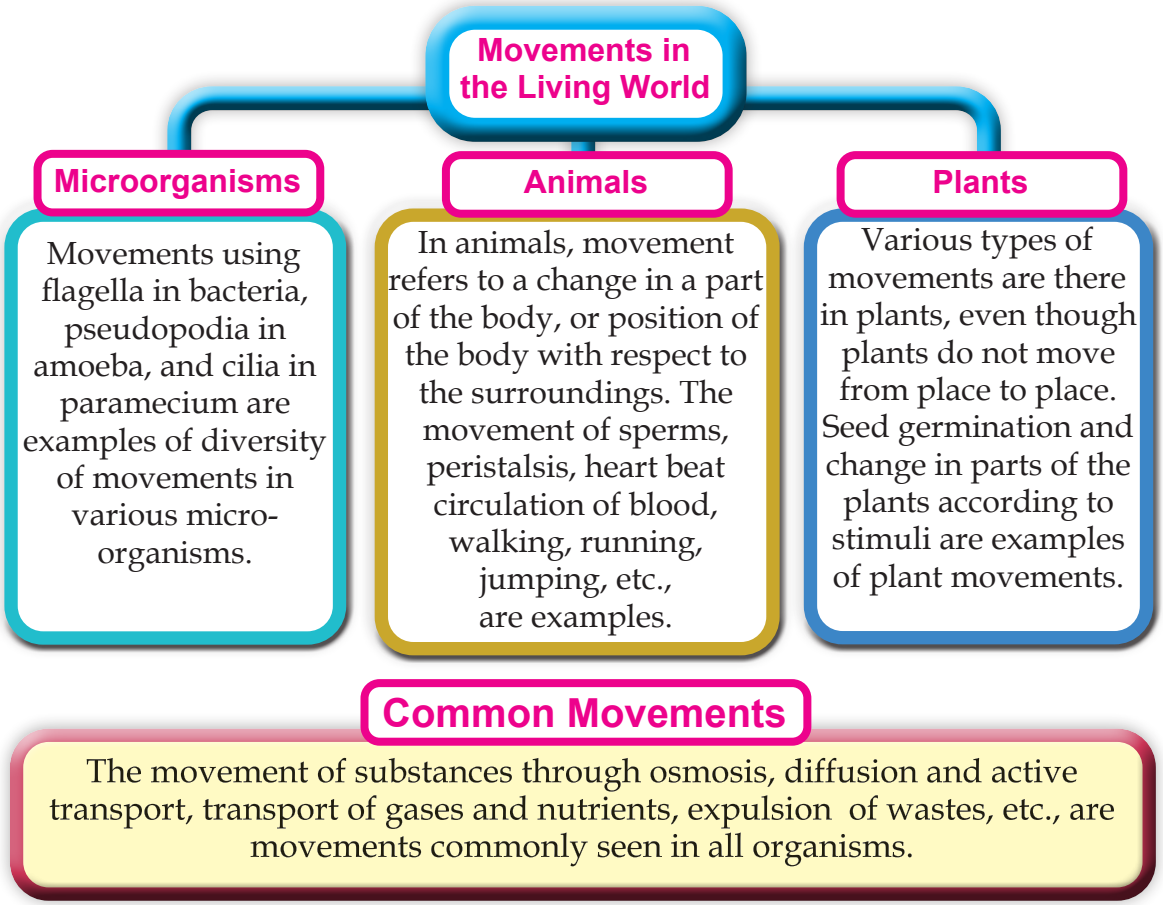


Illustration 4.2 : Movements in the living world

- Movement in plants
- Movement in animals
- Common movements
- Microscopic and macroscopic movements

Haven't you understood that there is great diversity in movements among organisms? There are different means in organisms which support these movements.

Identify the means of movement of the organisms shown in the illustration 4.3 and complete it.

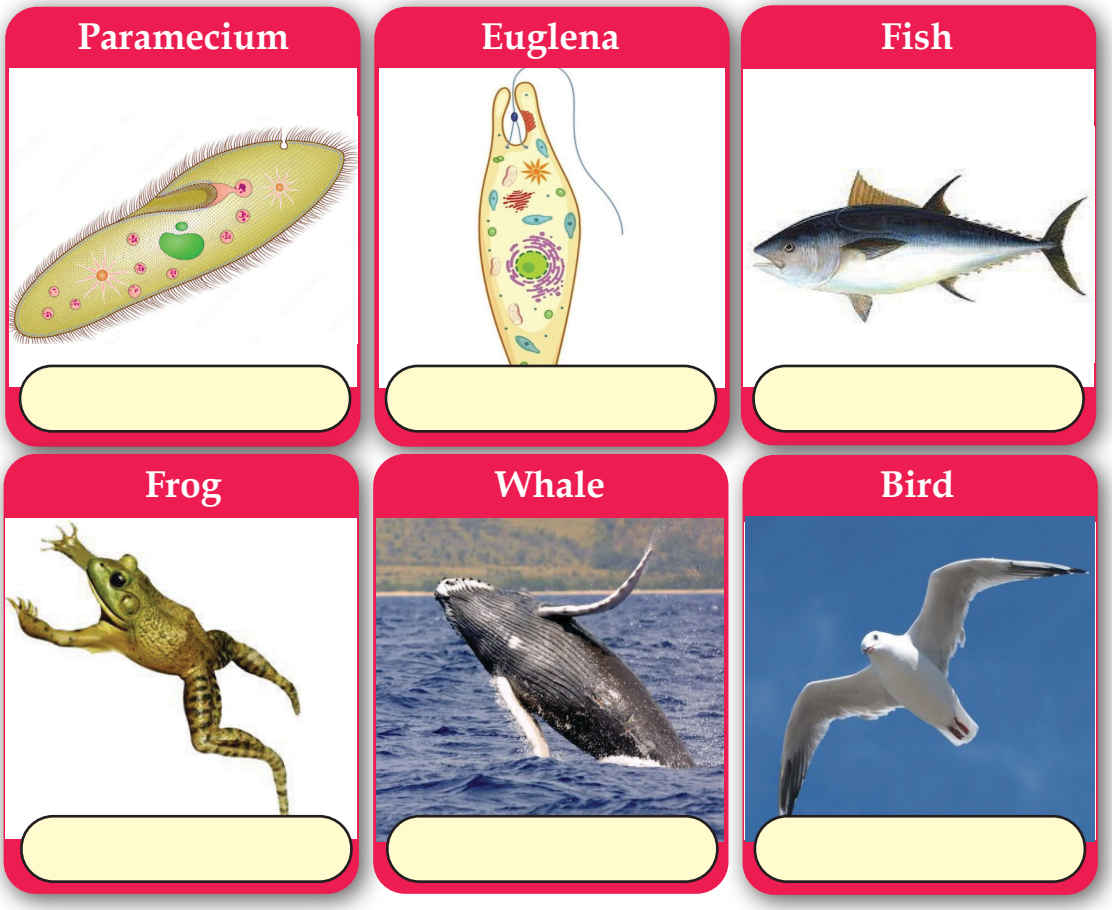


Illustration 4.3 : Means of movement in organisms

Expand Table 4.1 by including more organisms as given above.

Organisms	Means of movement
Bacteria	
Amoeba	
Hydra	

Table 4.1 : Means of movement in different organisms

Haven't you understood the means of movement in different organisms? How does movement occur in humans? What are the means involved? Discuss, collect more information and complete the illustration 4.4.

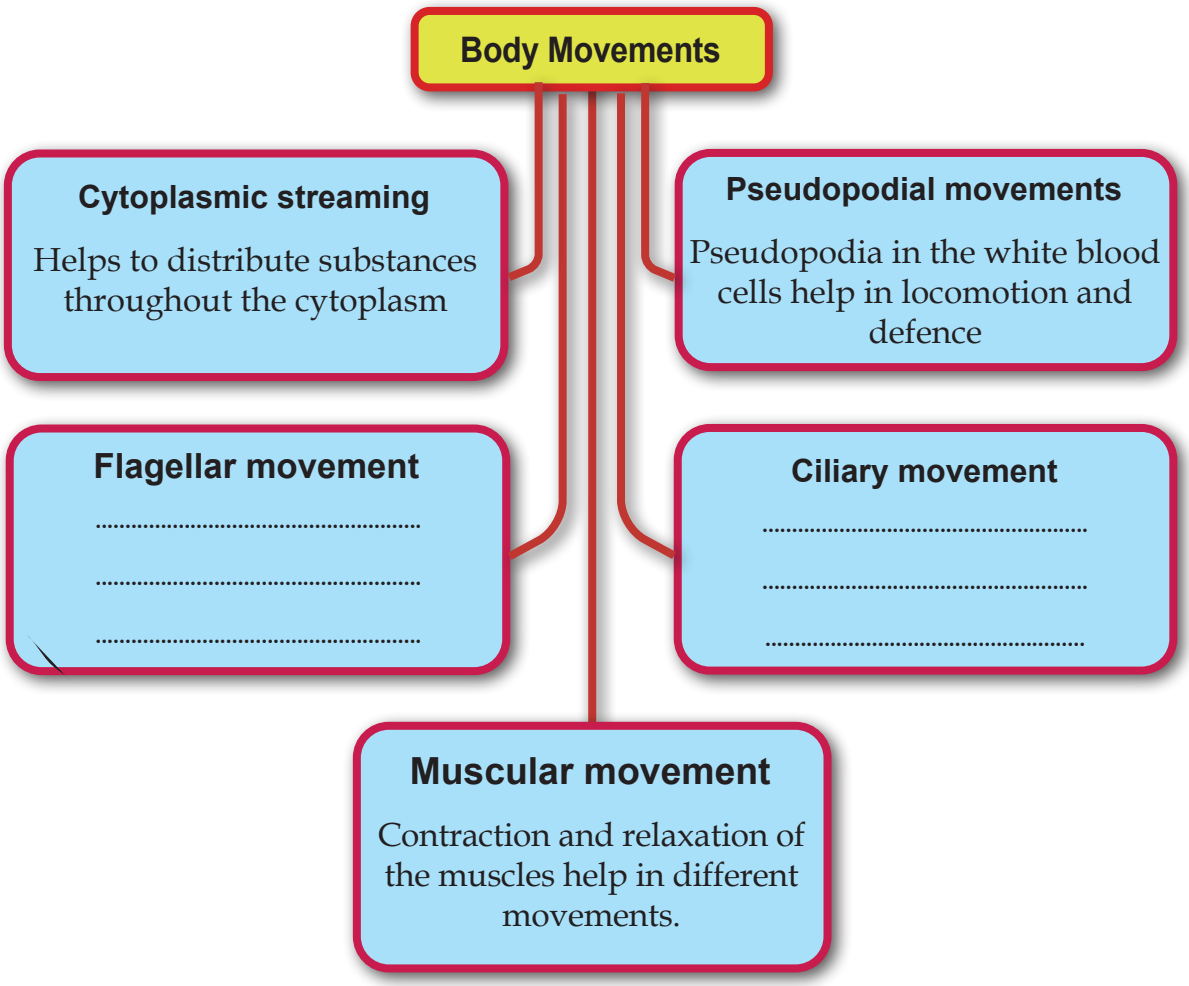
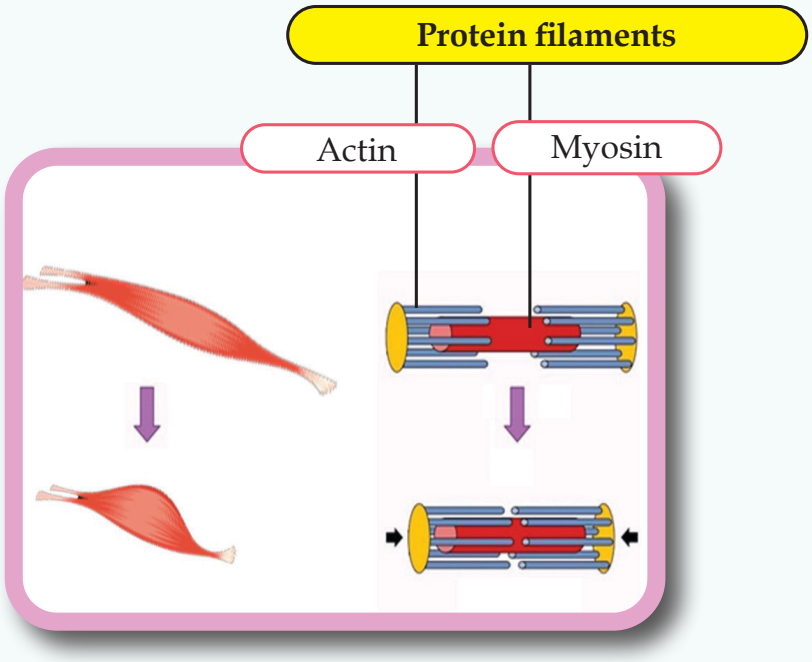


Illustration 4.4 : Movement and means of movement in human beings

The diversity of movements and locomotion in humans is caused by the functioning of muscles. Which characteristic of muscles helps in movement? Analyse the description provided and form inferences.

Muscle tissue

Muscles are specialised tissues which are responsible for the movements of the body. There are various types of muscles in the body. These are formed of muscle cells. Muscle cells contain nucleus and almost all cell organelles. However, unlike other cells, they contain more micro filaments made of proteins such as **Actin** and **Myosin**. By the action of these filaments, muscles contract and relax. This enables the body movements.



- Characteristics of muscle tissues
- Proteins in muscle cells and their importance

You have understood the various types of muscles in the human body.

Analyse the illustration 4.5, do the given activity and complete table 4.2.

How does Actin and Myosin help in the contraction of muscles? Find out.

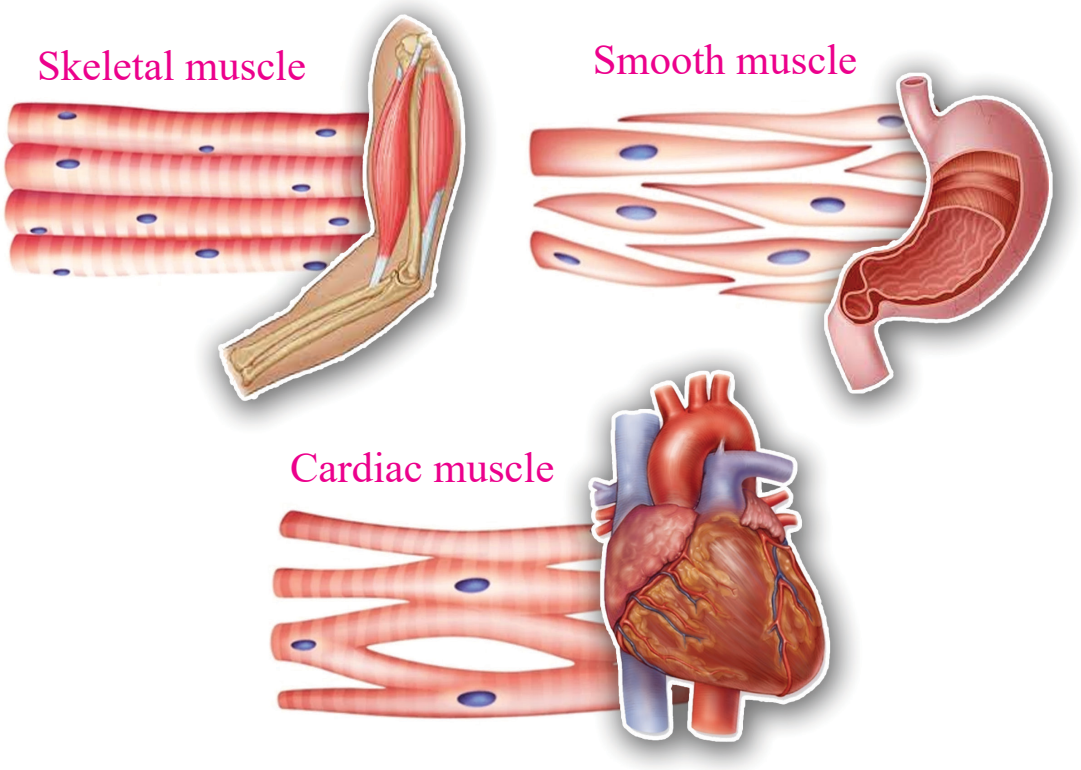


Illustration 4.5 : Different types of muscles

You have observed the illustration.

Observe the permanent slide of the muscles through a microscope in the laboratory.

Let's observe the muscles

To identify the minute characteristics of various muscles, observe the permanent slides of muscle tissues at different magnifications through a microscope. Illustrate your observations. Compare this with the illustration 4.5 and form inferences.

	Muscles attached to the bones	Muscles in the hollow internal organs	Muscles in the walls of the heart
Name of the muscle			
Shape of the cells			
Presence of striations			
Branches			
Control of the muscles according to one's will.			

Table 4.2 : Different types of muscles

Some muscles in our body that can be controlled (voluntary muscles) and some others cannot be controlled (involuntary) according to our will. In which all parts of the body are each one of these found? Find out examples through discussion and note them down in the table provided.

How is the action of involuntary muscles controlled? Find out.

Voluntary muscles	Involuntary muscles
• Muscles in the hands • •	• Muscles in the oesophagus • •

Table 4.3 : Voluntary and Involuntary Muscles

You know that folding and stretching of hands is a voluntary action. How does this movement take place?

Two muscles are mainly involved in this process.

By folding and stretching your hands and analysing the illustration 4.6, understand the contraction and relaxation of muscles. Discuss on the basis of indicators and prepare notes.

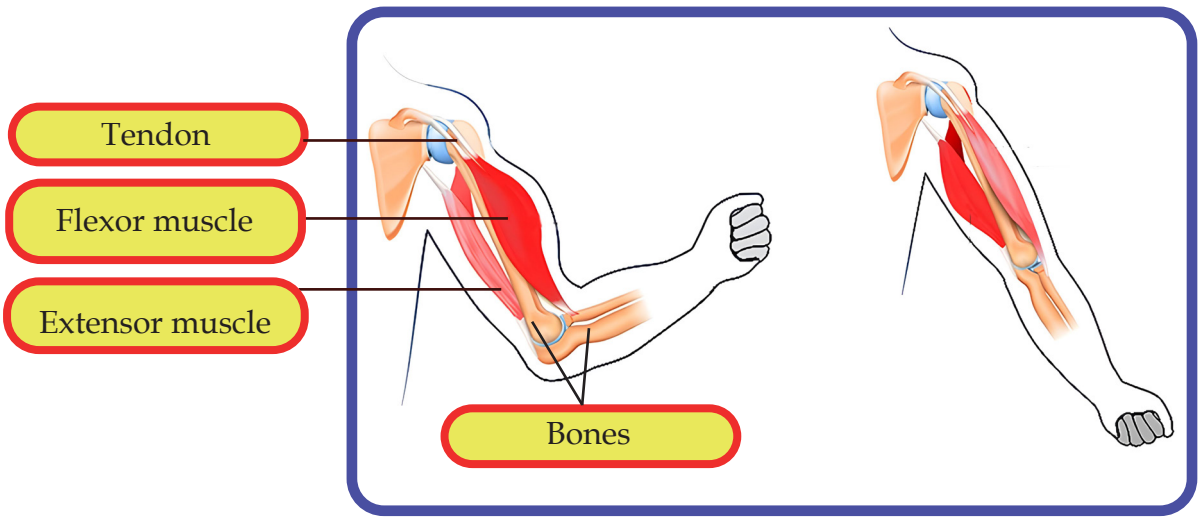


Illustration 4.6 : Movement of hands

- The part that connects muscles to bones.
- Muscles involved in the movement of hands.
- The importance of connecting the two tips of the muscles to two bones.
- The change that should occur to the two muscles in order to fold the hands.
- The changes that should occur to the two muscles in order to stretch the hands.

The antagonistic actions of the two muscles make the folding and stretching of hands possible. Most of the movements in the body are made possible with such actions of the muscles.

Muscle fatigue

While engaging in physical activities, muscles need to function continuously. This requires a lot of energy. You have understood that ATP is formed in muscles in the presence of oxygen due to cellular respiration. Muscles function, receiving energy from ATP molecules. When skeletal muscles have to function continuously (e.g. during exercise), if required oxygen is not available, muscles become weak and they may temporarily lose the capacity to contract. This condition is called **Muscle Fatigue**. What would be the reasons for this? Find out.

Is movement possible solely by the action of muscles?

Note down your assumption.

.....

In human beings, muscles are connected to either bones or to cartilages. Diversity of movements are made possible due to the combined action of muscles and bones. Observing the skeleton in your school lab, and analysing the illustration 4.7 develop an understanding of the two divisions in the human skeletal system. Label the parts and complete the illustration. Prepare notes based on the indicators.

Human skeleton

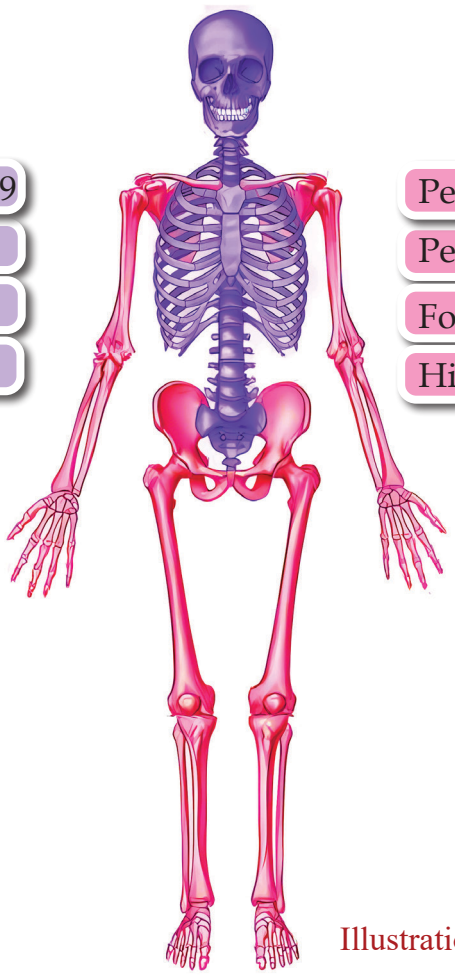
Axial skeleton

It consists of the bones seen in the central axis of the body.

Appendicular skeleton

It consists of the bones which are connected to the central axis.

- Skull - 29
- Sternum -
- Ribs -
- Vertebral column -



- Pectoral girdle - 4
- Pelvic girdle -
- Forelimb -
- Hindlimb -

Illustration 4.7 : Human skeleton

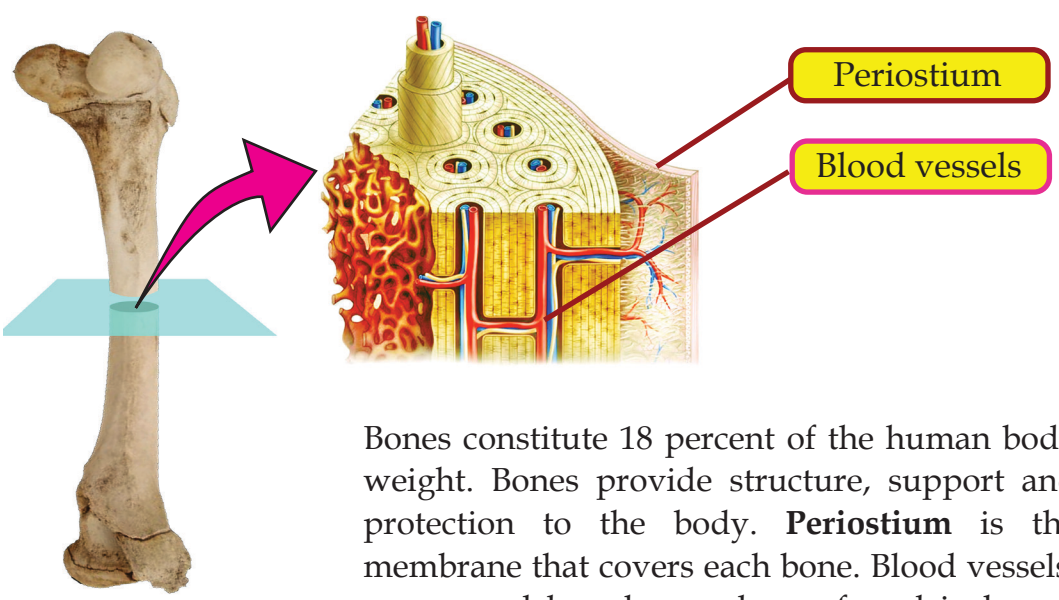
Is the number of bones same in children and adults?

What is the reason? Find out.

- Two divisions of human skeleton
- Total number of bones
- Number of bones in the axial skeleton and appendicular skeleton

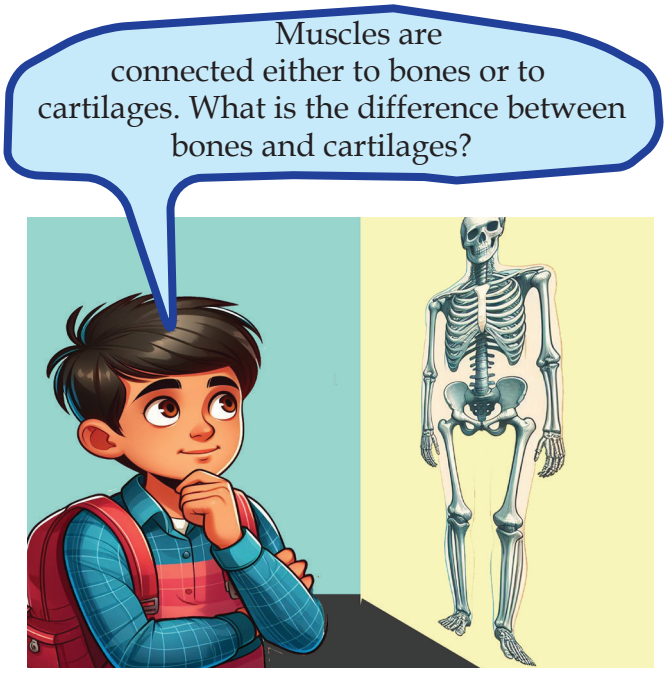
You have understood the position and the number of bones in each part of the skeleton. What are the structural peculiarities of bones? Analyse the description given below based on the indicators and prepare a note.

Structure of bone



Bones constitute 18 percent of the human body weight. Bones provide structure, support and protection to the body. **Periostium** is the membrane that covers each bone. Blood vessels, nerves and lymph vessels are found in bones. Calcium, phosphate, collagen proteins and salts provide hardness and strength to bones. **Osteoblast cells** of bones deposit minerals in the bones, make them strong and firm and also help in growth and repair.

- Hardness of bones
- Function of osteoblast cells

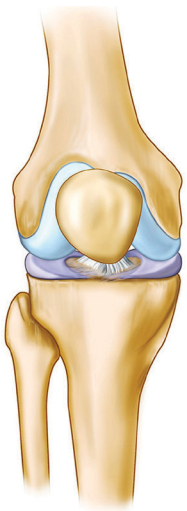


Analyse the information provided and find out the answer to the child's doubt.

Do all living organisms have a skeletal framework like that of humans?

Observe the figure 4.1 and based on the discussion, form inferences.

Cartilage



Cartilage is the connective tissue which is softer and more flexible than bones. These are present in elbows, knees, ankles, at the tip of ribs, between the vertebrae of the vertebral column, pinna, at the tip of the nose and in the trachea. Cartilages present at the tip of the bones reduce friction in the joints. Blood vessels and nerves are absent in them. Due to the absence of blood vessels their growth is slower than the rest of the cells.

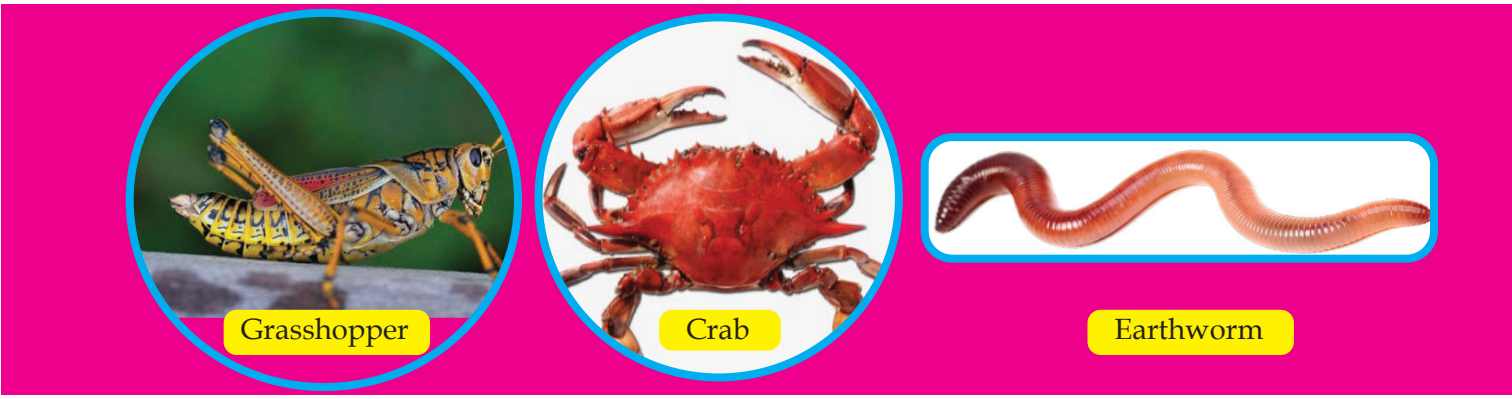


Figure 4.1 : Structural frameworks of various organisms

You have understood that all organisms do not have skeletal framework (Endoskeleton) like humans beings.

The structural framework is different in each of these organisms.

Analyse the description and complete illustration 4.8.

Diversity in the Structural Framework

Hydroskeleton

Fluid filled chambers are present in the body of the earth worm. Here, water is the means to maintain body structure and locomotion. This mechanism is commonly called hydroskeleton. **Hydroskeleton** helps in the movements of hydra and snail.

Exoskeleton

Hard shells present in crabs, mussels and oysters which is made mainly of calcium carbonate, and the outer covering of grasshoppers and cockroaches which is made of chitin, are **exoskeleton**. These connect muscles in respective places and help in movement, locomotion and protection of the body.

Endoskeleton

Vertebrates including human beings have a framework made of cartilages and bones. This mechanism which provides shape to the body, protects internal organs and helps in movement and locomotion is called **endoskeleton**.

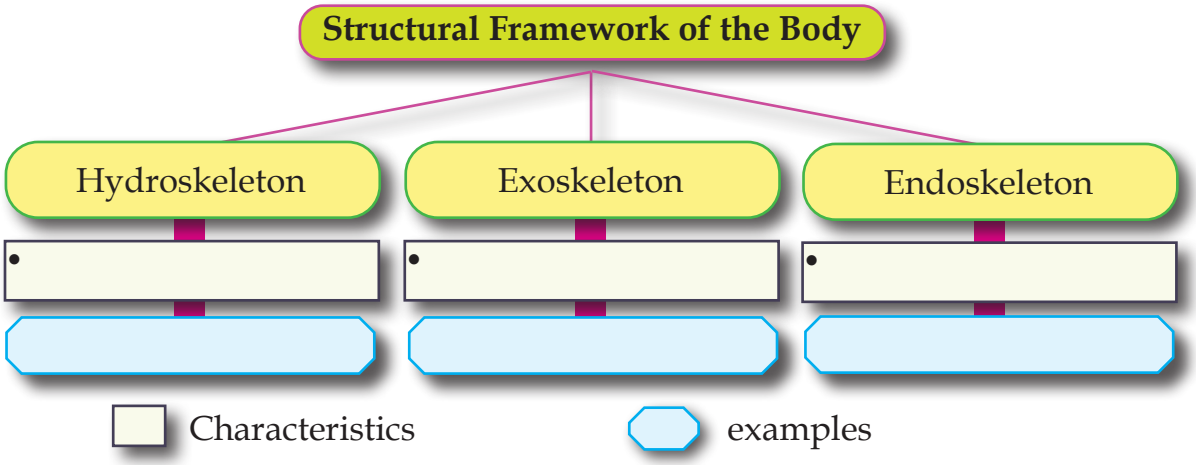


Illustration 4.8 : Diversity in structural framework

Are there parts of exoskeleton in organisms with endoskeleton? Discuss and find out.

Collect the exoskeleton and endoskeleton of various organisms and organise an exhibition in the Science Lab.

Some organisms having exoskeleton shed their outer covering. Why? Find out.

Joints

The bones are connected to each other by joints. Connecting the bones in this way makes movement easier. The skeletal joints have some peculiarities. Analyse the illustration 4.9 and the given hints, prepare a note on the structure of a joint.

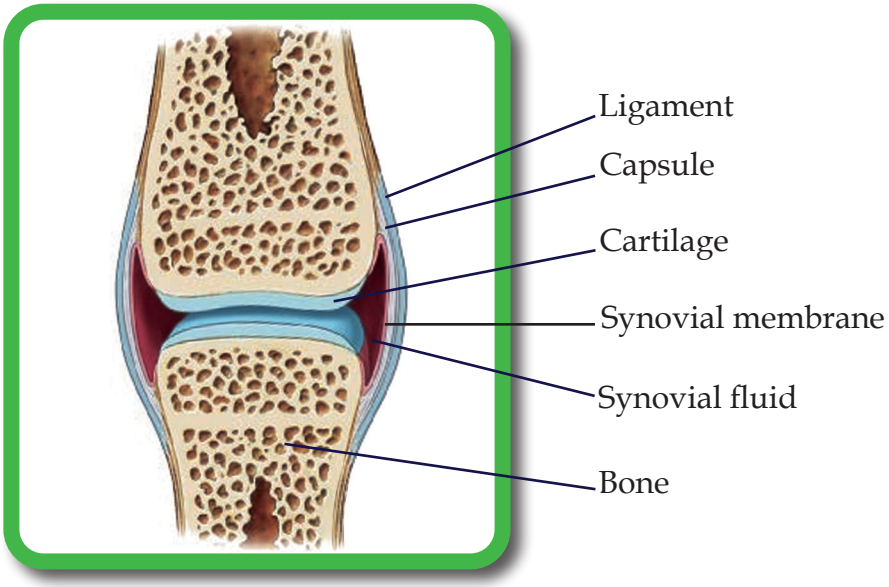


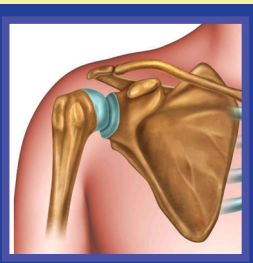
Illustration 4.9 : Structure of a Joint

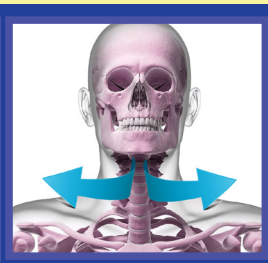
- **Ligaments** are found connecting two bones. The **capsule** seen inside this helps in the smooth movement of bones.
- **Cartilage** is found covering the tip of each bone. This reduces friction between the bones.
- **Synovial flluid** is the fluid present between the two bones of a joint. This also reduces friction between the bones.
- Synovial fluid is produced by the **synovial cells** of the synovial membrane.

Are all the joints in the body alike? Joints differ according to their function. You have studied different types of joints in the body.

Analyse the figure of the joints and complete the Table 4.4.

Different Types of Joints






Name	Ball and Socket joint	Hinge Joint	Pivot Joint	Gliding Joint
Peculiarities				
Position				

Table 4.4 : Different types of Joints

Collect more information about joints in different parts of the body. Prepare a chart and exhibit it in the class.

Body growth and Bone Development

Growth during childhood and adolescence is associated with the development of the skeletal system. It is essential that calcium should deposit in the bones to ensure their hardness and strength. Food rich in calcium such as dairy products (milk, yogurt, butter), fish and leafy vegetables should be consumed in abundance at this stage. Vitamin D is necessary for the absorption of calcium. For the natural production of vitamin D in the skin, engage in activities that expose us to sunlight. Egg and fishes like sardines, mackerel, etc., are rich sources of Vitamin D. Since protein is essential for bone development, meat, beans, peas etc can be abundantly included in the diet. As age advances, the density of bones decreases, making them weaker and more prone to fracture. Nutritious diet plays a crucial role in preventing the degradation of bones.

How does the deficiency of vitamin D affect the body? Find out.

You have understood that the combined action of muscles and bones enables body movement. What are the other functions of bones? Discuss and expand the list.

- Formation of blood cells
-
-
-
-

Muscles and Exercise

We can ensure the active functioning of muscle cells through movement. Exercise helps to strengthen muscles and increase their efficiency. In what all ways is exercise beneficial for the body? Examine the activity book of health and physical education, discuss and complete the table 4.5.

Part of the body	The Benefits of Exercise
Lungs	Vital capacity increases, gaseous exchange becomes efficient
Hands and legs	
Muscles, bones	
Heart and blood vessels	

Table 4.5 : The benefits of exercise

Vital Capacity

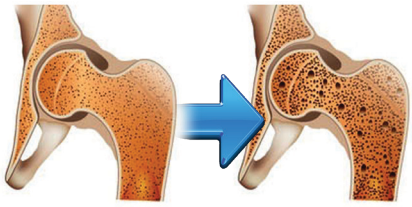
The total volume of air exhaled forcefully after a deep inhalation is called vital capacity. This is the maximum amount of air a person can breathe. This is the measurement of a person's respiratory health. In men, it is approximately 4.5 litres, and in women, it is 3 litres. A decrease in vital capacity may be an indication of pulmonary diseases.

Disorders of Bones and Muscles

Continuous and excessive muscle activity will adversely affect the functioning of muscles. Bones are prone to injuries just like muscles. Analyse the description and complete the table 4.6 on the disorders of bones and muscles.

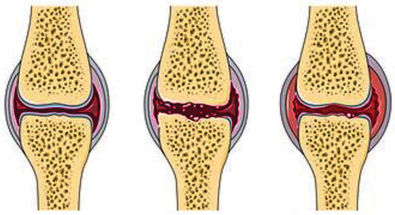
Osteoporosis

This is a condition in which parts of bones get damaged and the density of bones deteriorates as they become porous. The deficiency of protein, calcium and vitamin D also leads to this disease.



Rheumatoid arthritis

In some people the immune system may destroy their cartilages and synovial membrane. This causes severe pain and swelling in the joints. This disorder is found more in women than men.



Why is this disorder more in women than men? Find out.

Muscular dystrophy

This is a condition in which muscles get damaged due to various reasons. Muscles become weak. This is often seen in boys. The change that occurs in the genes is the chief reason for this.

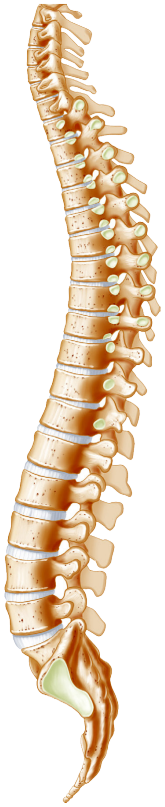
Sprain

A sprain is an injury which is caused by the stretching or breaking of ligaments which connect the bones in a joint. This usually affects the joints in the ankle, wrist, knees, etc. Pain, swelling, bruises, difficulty in moving the joints, etc., are the symptoms of sprain.

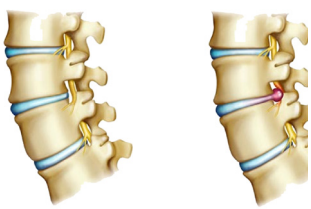
Disease	Causes	Symptoms

Table 4.6 : Various bone and muscular disorders

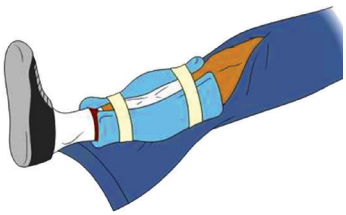
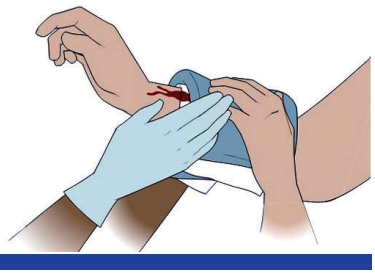
Disc Prolapse



Vertebral column is the part that gives protection to the spinal cord along with support to the body. Each bone in the vertebral column is called vertebra. A peculiar part called intervertebral disc, which is filled with a gel-like substance is found in between two vertebrae. They provide flexibility to the vertebral column and protects it from external shocks. It is the presence of the intervertebral disc that enables us to be involved in such activities like bending and straightening up. These discs also distribute the body weight equally through out the vertebral column. The wearing of the vertebrae, sudden shock and continuous strain on the vertebral column can cause the bulging out of the gel-like part inside the intervertebral disc. This condition is called **disc prolapse**. As this bulging causes pressure in the spinal nerves, it results in numbness and pain in the body parts. If it aggravates, it will cause severe back pain, weakening of the legs and a loss of sensation. This situation requires immediate medical aid.



Have you understood the first aid measures to be given when bones and muscles become injured? Identify the situations in which the first aid measures shown in the pictures are used and complete the illustration 4.10.

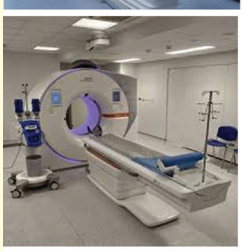
Sling	Splint	Bandage
....	....	....

Illustration 4.10 : First aid measures

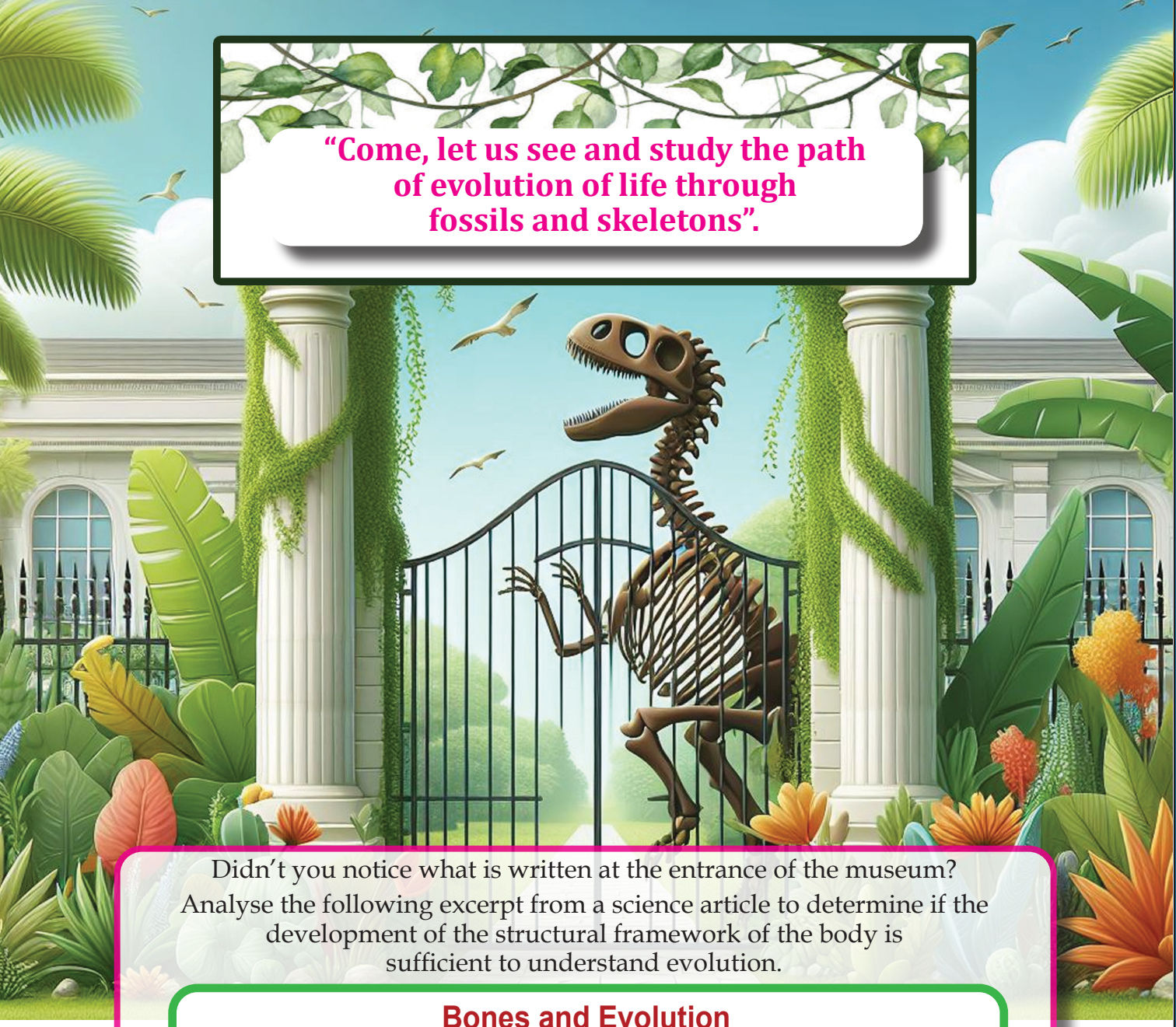
Organise an awarness class by a health expert about the first aid measures in cordination with the Health Club. Get a hands-on training on the first aid measures given.

- How to prepare a sling
- How to use a splint
- How to prevent blood loss when a wound occurs
- The use of bandage and band-aid
- First aid to be given when there is a spinal injury


Medical Imaging Technology

X ray technology has been widely used for the accurate detection of fracture, dislocations, tumours and other bone damages. Ultrasound scanning, Magnetic Resonance Imaging (MRI) and Computed Tomography (C.T.Scan) are latest techniques for diagnosis. This field of medical science is known as Medical Imaging Technology. Courses on Medical Imaging Technology provide attractive job opportunities to interested students.



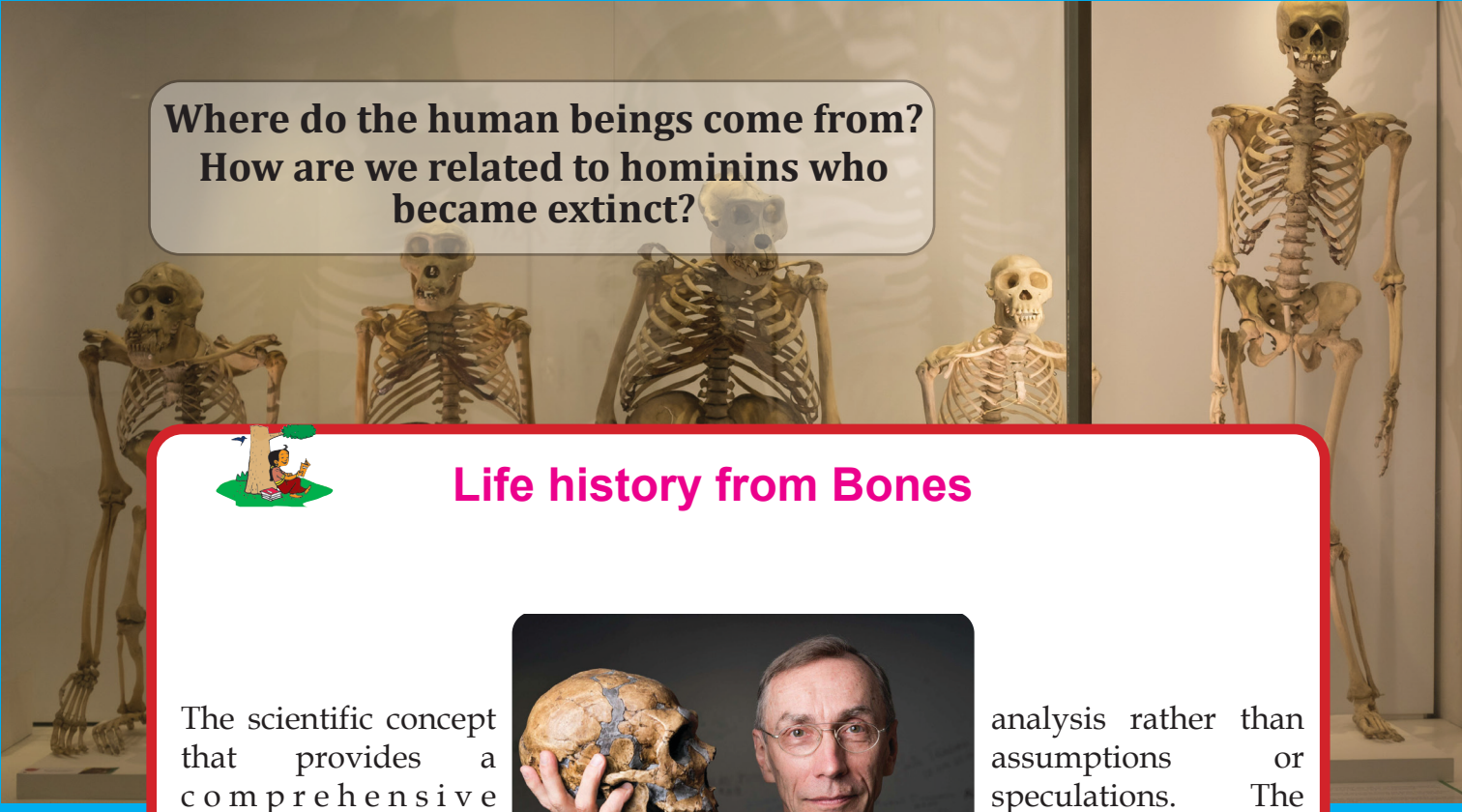
"Come, let us see and study the path of evolution of life through fossils and skeletons".

Didn't you notice what is written at the entrance of the museum?

Analyse the following excerpt from a science article to determine if the development of the structural framework of the body is sufficient to understand evolution.

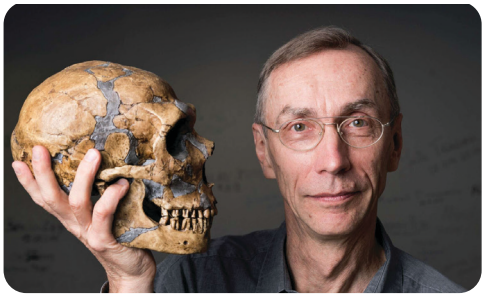
Bones and Evolution

The study on the framework of organisms give, several evidences for the scientific concept that all living beings have involved sequentially. The hydroskeleton helps in the movement of organisms like jellyfish, earthworms, etc. Organisms like crabs and mussels having exoskeleton also appeared gradually along with these organisms. Later, vertebrate organisms with endoskeleton evolved. Endoskeleton provided more flexibility and movement and also supported their large bodies. Bipedal walking is an important phase in human evolution. Such changes in the skeletal system helped human beings to travel long distances and find suitable habitat, thus helping in the expansion of human race.



Where do the human beings come from? How are we related to hominins who became extinct?

Life history from Bones



Swante Pabo

The scientific concept that provides a comprehensive explanation about the formation of the diversity of life that evolved on Earth over millions of years is called evolution of life. The picture of evolution of life is made up of many evidences from various spheres such as genetics, embryology and palaeontology or the study of fossils. The study of fossils is an effective means of study that sheds light into the past.

The study of fossils ranging from simple structured bacteria to the complex structured organisms including dinosaurs and mammals tells the story of the dynamic nature of life. The study including fossils helps to explain scientifically the evolutionary interrelationship of all living organisms based on observation, evidence, and scientific analysis rather than assumptions or speculations. The process of evolution of life helps in identifying the importance of scientific inquiry in revealing the mysteries of nature and the role of science in formulating inferences based on evidences.

The Swedish evolutionary geneticist Swante Pabo analysed DNA extracted from the ancient piece of bone and made crucial discoveries about the genetic similarities and differences between human ancestors and modern man. With the help of modern technology which retrieves and analyses DNA from fossils, he laid the foundation for the branch of science called Paleogenomics. He was awarded the Nobel Prize in 2022 for his latest discoveries in the genome of the extinct hominins and about human evolution.

Movements in Plants

You know that there is movement not only in animals but also in plants.

Plant movements occur according to stimuli. The internal or external instigation that evokes a response in living organisms is called a stimulus. Light, water, gravity, touch, chemical substances, etc. are stimuli that cause plant movements.

Analyse figure 4.2, discuss and find out the various plant movements and the stimuli that cause movements in plants.

Figure 4.2 : Plant movements

Are all the plant movements that you have listed related to the direction of stimulus? Discuss.

Analyse illustration 4.11 and examine the validity of your findings.

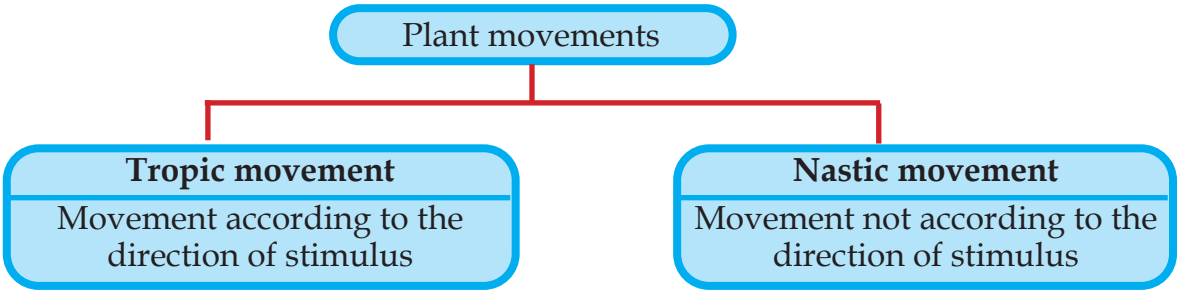
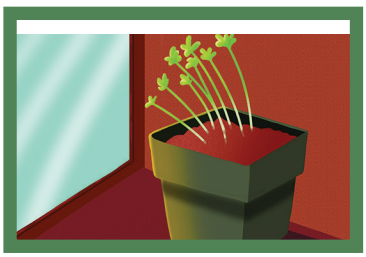
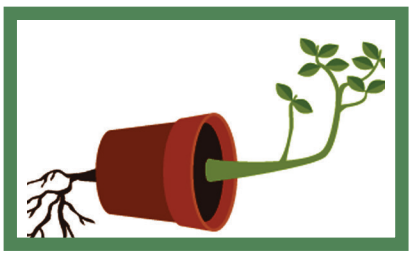


Illustration 4.11 : Plant movements

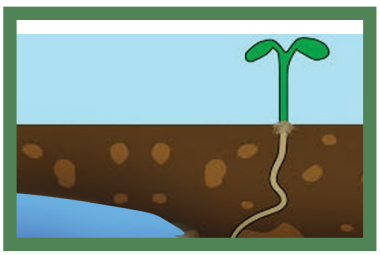
Analyse illustration 4.12, identify how the movement of the shoot and root are related to the direction of stimulus and complete table 4.7.



Phototropism



Geotropism



Hydrotropism

Illustration 4.12 : Tropic movements

Plant movements	Stimulus	Direction of movement of the shoot	Direction of movement of the root
Phototropism			
Geotropism			
Hydrotropism			

Table 4.7 : Tropic movements

Two other tropic movements found in plants are given in illustration 4.13. Find out the characteristics of these and record them in the science diary.

Haptotropism

Chemotropism

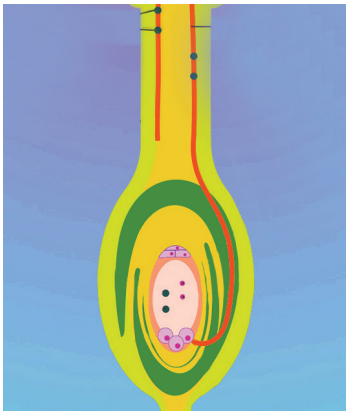
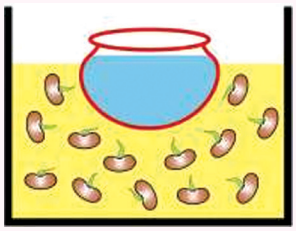


Illustration 4.13 : Other tropic movements



Arrange saw dust and an earthen pot filled with water, in a box as shown in the figure. Place some gram seeds at different parts of the box. Take the pot out carefully after a few days. Observe the direction of growth of the roots.

Observation : .....

Inference : .....

Have you ever touched a Touch-me-not plant? How is the movement of the leaves of a Touch me not plant?

Which type of movement is this? What is the peculiarity of such movements?

Such type of movements are called as nastic movements.

List out more examples for nastic movements.

-
-

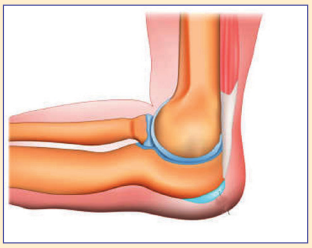
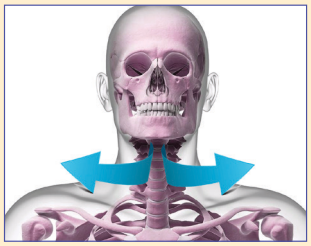
Adaptations of organisms for their existence ranges from the movement of molecules in the cells to the various movements of organisms. Knowledge about these not only reveals the wonders in the diversity of movements of the living world, but also gives insight into the evolution of life. Evolution helps organisms to adapt themselves to the changing environment. Society also should undergo transformative movements in order to face problems which keep arising continuously. These movements help us to survive, progress and to follow a more just world.

Let us Assess

1. Identify the plant movement mentioned in each of those given below.
   (a) The pea plant twines around a support
   (b) The coconut tree near the bank of a river grows leaning towards the river.
   (c) The pollen tube grows towards the ovary.
   (d) The leaf of Touch-me-not plant folds while touching.
2. Identify the disease mentioned in the statement given below.

   In some people certain cells of the immune system may destroy the cartilages and synovial membrane.
3. Identify the muscle from the peculiarities given below.

   - Cells with single nucleus.
   - Spindle shaped cells
4. Observe the joints denoted as X, Y, Z and choose the one which comes in the correct order.

X	Y	Z
		

	X	**Y**	**Z**
a)	Ball and Socket joint	Gliding joint	Pivot joint
b)	Pivot joint	Ball and Socket joint	Hinge joint
c)	Gliding joint	Hinge joint	Pivot joint
d)	Hinge joint	Ball and Socket joint	Gliding joint

5. Disorders of the bones and muscles are given in column 1 and their causes are given in coloums 2. Analyse them and choose the option including the correct pairs.

Column 1	Column 2
P) Sprain	i. Destruction of cartilage by certain defence cells
Q) Osteoporosis	ii. Changes that occur in genes
R) Rheumatoid arthritis	iii. Stretching or breaking of ligaments
S) Muscular dystrophy	iv. Deficiency of protein, calcium and Vitamin D

(a) P – ii , Q - iv, R - i, S - iii
(b) P – iv, Q - iii, R - ii, S - i
(c) P – i, Q - ii, R - iii, S - iv
(d) P – iii, Q - iv, R - i, S - ii

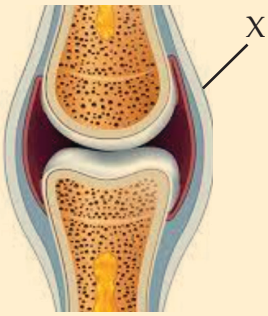
6. Re-draw the diagram and answer the following questions.

(a). Identify the parts mentioned below and label them.

i) Fluid present between the bones

ii) The part seen at the tip of bones which reduces friction

(b). Identify the part labelled as 'X' in the diagram and write its function.



Extended activities

1. Collect pictures and information related to the diversity of locomotion in the living world and display them in the class.
2. Prepare posters indicating the importance of exercise using graphics software and display them in the notice board.
3. Observe various organisms in your surroundings and record the diversity in their movements in your Science diary.

5 Reproductive Health

- Gender Justice and Sex
- A Healthy Pregnancy
- Foetal Growth
- Antenatal Care
- Motherhood
- Importance of Breast Milk
- Vaccination
- Sexually Transmitted Infections

Kerala has the Lowest Maternal and Child Mortality Rate

Kerala has once again taken the lead in terms of maternal and child health. The state has recorded the lowest maternal and child mortality rate in the country.

Haven't you noticed the news?

What can be the reasons for the decrease in the maternal and infant mortality rate in Kerala?

- High literacy rate of women
- Best Maternal and Child Health Care Centers
- High quality public health projects
- …….

Access to proper nutrition, education and health care reduce maternal and infant mortality rate.

The service of health experts is essential for the health of woman and child during pregnancy and postpartum.

The physical and social well-being of girls ensure the safety of future generations. Therefore, good quality health care service is the right of women. Prepare and exhibit posters based on this idea.

Is there any obstacle for women in getting respect and care all over the world?

Analyse the extract given below and comment.

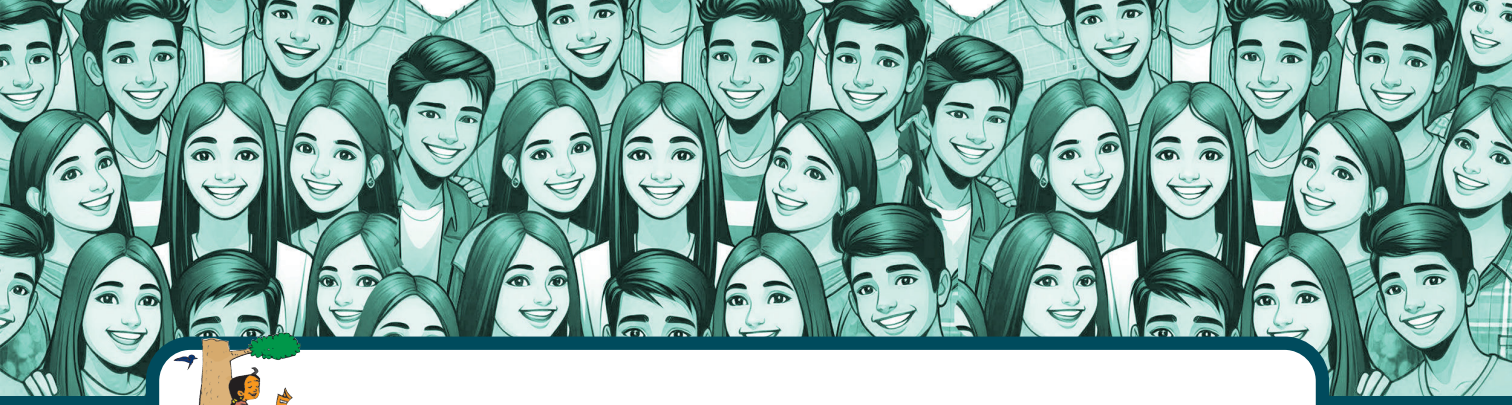
Although the human society has attained progress in several parts of the world, there is a situation that denies accessibility to adequate education for girls. They are forced to give up their studies at an early stage and are confined to marriage, child care and raising their families. There still exists a situation in which girls are forced to engage in cooking and in household chores while boys play and go to school. It is not uncommon to be denied the right to go to work or to choose a career. Women often face restrictions not only in social relationships and economic independence, but also in personal decision making.

Shouldn't society undergo further changes to ensure equality for women? This is where the concept of gender justice becomes relevant.

What all can be done to ensure gender justice?

Based on the hints given below discuss and summarise the ideas and prepare a note.

- Equal opportunities in leadership, decision making and positions
- Opportunity to travel anywhere at any time with freedom and security
- Equal right to education for boys and girls
- Equal wages for equal work
- Shared responsibilities for men and women in family care and household chores



Sex and Gender

The sex of an individual is usually identified at birth. Choromosomes, hormones and many external and internal physical characteristics are the basis for the biological differentiation of male and female sex. The category Intersex includes those who are born with reproductive organs that are neither fully female nor male, or a combination of both or with chromosomes having variations. About forty intersex types have been identified

Transgender is a general term used to denote individuals who identify themselves as non-conforming to their sex at birth and wish to live according to the gender identity in which one is convinced of.

Society prescribes or imposes on men and women different characteristics of conduct and behaviour as well as responsibilities and duties, regardless of the individual's skills or peculiarities. Gender is shaped by prescriptions such as 'Boys shouldn't cry' and 'Girls should not do certain jobs'. This often becomes discrimination based on gender, which are against human rights.

People who are conscious of gender justice shape a just society that ensures equal rights, opportunities and dignity.

Children acquire awareness on gender justice, discriminative power and social interactions during their adolescence. Adolescence is an important phase in every child's life as the knowledge and awareness they acquire during this phase is shaping them into better social beings. So, it is very important for children to get proper adolescent education.

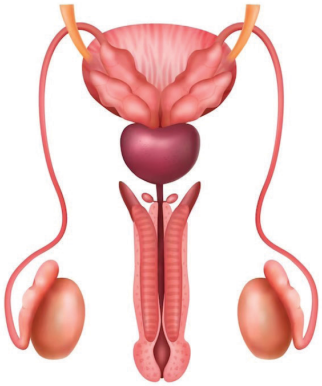
What is your response to the extract of an article given below?

Physical changes and sexual development in teenagers can make them curious and anxious. Unscientific information from various sources, including social media, can be taken to be true and that may lead to risky behavioural patterns. Adolescence should be a stage to discern undesirable gestures like gaze, touch and physical temptation directed towards them. It is also a stage to develop courage and capacity to say 'No' to what is wrong. In any situation the demeanour should be in such a way that words and actions should be restricted according to social norms and the freedom and dignity of others are to be valued and respected. The information gained through various means needs to be carefully evaluated before putting into practice. Help from parents, teachers, health workers and school counsellors can be sought, if one is not capable of doing it by oneself.

Isn't adolescence an important phase in a child's life. Many changes occur in the body during this phase. Haven't you understood these changes? What are the main changes and their causes? List them.

-
-

Puberty is attained when **semen production** begins in boys and **menstruation** in girls. During this stage, the body undergoes certain unique changes.



With puberty, the growth and development of male reproductive organs accelerate. Semen production begins. Erection of penis occurs as the blood flow to it increases. At this stage, **ejaculation** may occur during sleep at night. Such natural physical changes are signs of growth. Each person attains puberty at a different pace and speed.

Haven't you understood the major changes in girls such as ovulation and menstruation?

Based on the indicators, analyse the given illustration 5.1 and, its description and formulate inferences.

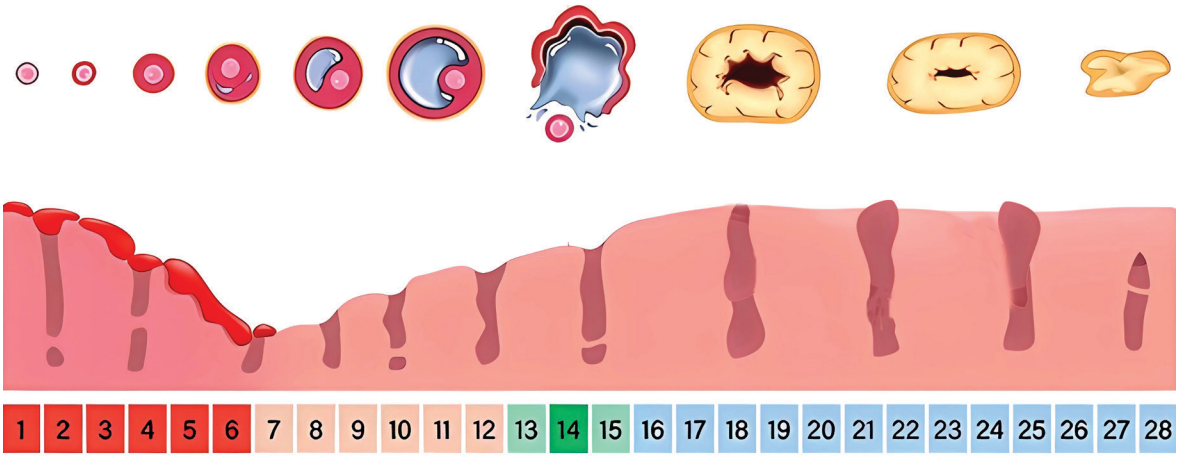


Illustration 5.1 : Ovulation and changes in the uterine wall

Genital infections are more likely to occur during puberty. To prevent this, special care should be taken to wash these parts with mild soap solution. Moisture can lead to fungal infections. So, it is essential to keep the genital area without moisture. Wearing dry, cotton undergarments facilitating air circulation and changing them daily will help to keep the genital area dry and decrease bacterial and fungal growth.

- The change in uterus during the menstrual cycle
- Menstrual hygiene

Fertilisation may possible in each menstrual cycle. Through sexual intercourse fertilisation takes place and the **zygote** is formed.

From conception to parturition the body undergoes many changes. This is initiated by the process of fertilisation. Based on the indicators, analyse the given description and understand the process of **fertilisation**.

Fertilisation

The semen deposited by the penis into the vagina during sexual intercourse contains approximately 400 million sperms. From the vagina they move to the uterus through the cervix. Sperms move with the help of their tails at a speed of about 1.5 millimeter per minute. But only about one hundred of these sperms enter the **oviducts (Fallopian tube)**. Others get disintegrated.

Haven't you understood that the zygote is formed in the oviduct by the fusion of a sperm with an egg? Fertilisation is more possible during the days from 10^{th} - 17^{th} of the menstrual cycle.

- The ways by which sperms reach the oviduct
- The part where the fertilisation takes place
- Formation of zygote

Isn't the zygote a single cell? How does it become a multicellular baby?

An egg can survive up to 72 hours after ovulation. Sperms remain in the female body only for 48 hours. But, the sperm can fuse with the ovum only for 36 hours.

Only one of the sperms that reaches the ovum fuses with it. Why? Find it out.

What are the changes that happen to the zygote? Based on the indicators, analyse illustration 5.2 and the description and, find answer to the child's doubt.

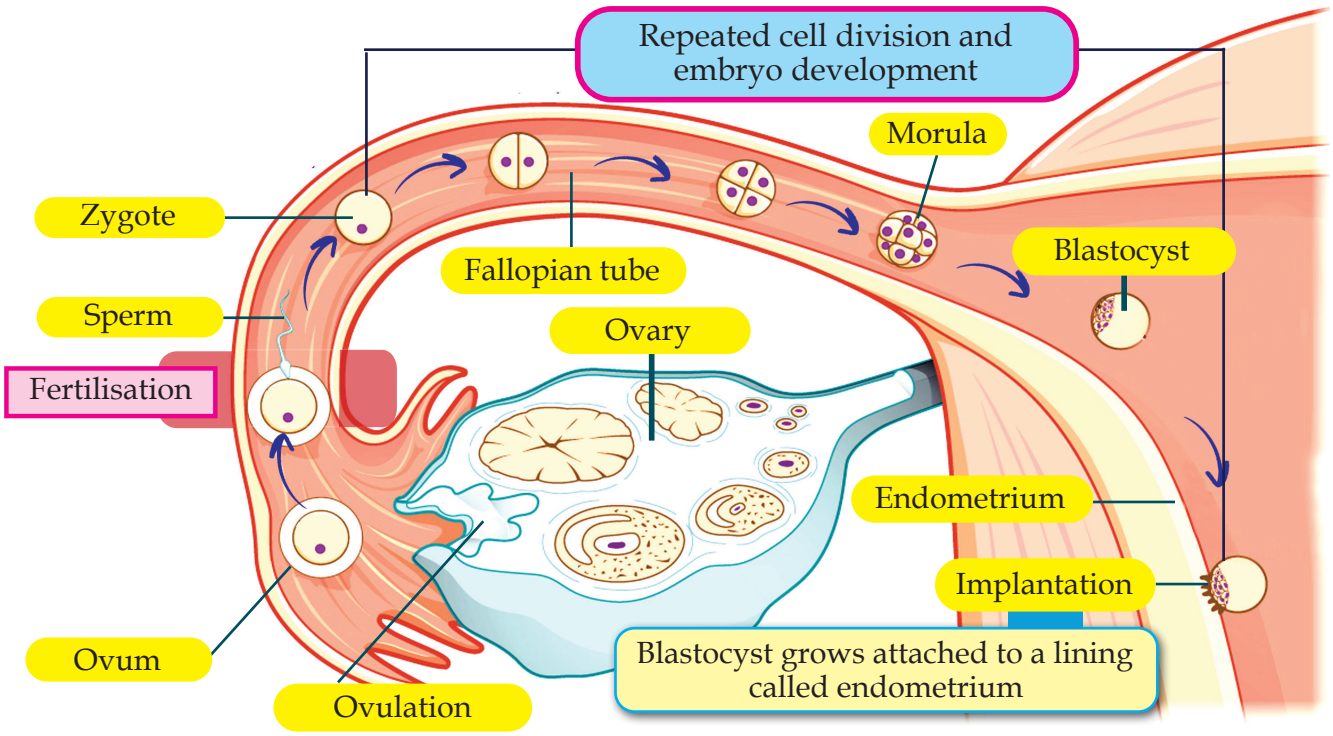


Illustration 5.2 : Growth of the Zygote

Development of an Embryo

Following fertilisation, the zygote undergoes cell division. A cluster of cells called morula (16-32 cells) is formed within 3-4 days. **Morula** develops into a fluid filled blastocyst from 5 to 6 days. The blastocyst attaches to the inner lining of the uterus called endometrium and begins to grow. This process is called Implantation. Pregnancy begins with this. The **blastocyst** becomes an embryo and develops into a foetus through growth and differentiation.

- Morula, Blastocyst
- Implantation

Prepare a flowchart including the various steps from fertilisation to implantation.

How does the foetus get nutrients and how is waste removed from its body?

Haven't you noticed the child's doubt?

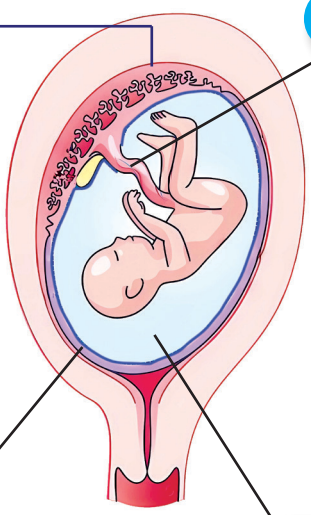
Analyse illustration 5.3 and find an answer to the doubt.

Placenta

A temporary structure formed after the blastocyst adheres to the uterine wall - It is formed by embryonic and uterine tissues

Umbilical cord

Formed from the placenta - Oxygen and nutrients reach the body of the foetus and wastes are removed through this cord



Amnion

The membrane formed from embryonic cells during the early stages of development

Amniotic fluid

Found within the membrane called amnion - Prevents dehydration of the foetus and protects it from external shock

Illustration 5.3 : Nutrition and protection of the Foetus

- Placenta - formation, function
- Amniotic fluid, function

Does the foetus urinate and defecate? Find out.

The duration from conception till the birth of the baby is called gestation period. In humans it ranges from 270-280 days.

Based on indicators, analyse the illustration 5.4 indicating the development of the foetus. Discuss and develop an understanding.

Development of the foetus

1 - 3 months	4 - 6 months	7 - 9 months
First trimester	**Second trimester**	**Third trimester**
• The heart beat begins • Formation of limbs fingers and toes • Sex organs and organ systems are formed	• Growth of hair on the head and the body. • Movement of the foetus • Eyelids open, eyelashes are formed	• Lungs attain complete growth • The body size increases • Gaining of body weight

Illustration 5.4 : Development of foetus

- The progressive development of the foetus
- Position of the foetus

HCG hormone

The placental cells produce a hormone called **Human Chorionic Gonadotropin (HCG)**. During the first weeks of pregnancy, the level of this hormone increases rapidly in the body. This hormone maintains the inner lining of the uterus and stimulates the production of the hormones progesterone. Presence of HCG in the urine or blood can confirm pregnancy. This test can be done even at home with the help of the pregnancy testing kit.

The mother's body undergoes many changes for the healthy development of the foetus. These changes are due to the action of the hormones produced during pregnancy.

Note the changes that occur in the body during pregnancy. What are the other changes that occur? Find out.

- Gains body weight
- The thickness of the inner lining of the uterus increases.
- Menstruation stops temporarily.
-
-

Along with this, mood swings, emotional instability and anxiety may also occur during this time. Most of these changes are reversible after parturition.

Antenatal care

During pregnancy, women may experience nausea, vomiting, fatigue, gestational diabetes, high blood pressure and depression. Emotional support from dear ones can help to reduce all of these. Family members and health workers should ensure that the pregnant woman takes a balanced diet, gets enough rest and attends regular antenatal check up.

Medical Termination of Pregnancy

Medical Termination of Pregnancy (MTP) refers to legal abortion. It is the process of medically terminating the foetus before the completion of the pregnancy period. Foetus is terminated under the guidance of health professionals using drugs or surgical techniques taking into account; factors such as age, complexities of pragnancy and the health conditions of the pregnant woman. MTP should be done only under safe and legally accepted procedures.

What are the various factors that influence the physical and mental health of a pregnant woman? Discuss andprepare a note.

What all things have to be taken care of, to ensure the physical and mental health during pregnancy? Expand the list.

- A healthy diet
- .....
- .....
- .....

How important is the diet during pregnancy for the growing foetus?

Observe the cartoon and record your opinion.

.....

.....

Analyse the given description and check the validity of your opinion.

Iron, folic acid, calcium and vitamin D are essential for pregnant women. For this, vegetables, fruits, leafy vegetables, grains, fish, meat, egg, milk and milk products should be included in the diet. Along with this, drinking adequate amount of water is a must.

Fibre rich food helps digestion and prevents constipation. It is important to include in the diet, food items that provide protein needed for the development of the foetus and carbohydrates and fats needed for the energy required for the mother.

Excessive consumption of food containing salt, sugar and fat should be controlled.

Nutritional quality of the food is more important than its quantity.

Discuss with adults, the food items to be included in the diet of a pregnant woman, and those to be regulated. Now, complete the table 5.1.

Food items to be included	Food items to be regulated
•	• .....
•	• .....
•	• .....

Table 5.1: Food items to be included and regulated during pregnancy

SAY NO TO

Bad habits affecting reproductive health

Alcoholism, use of drugs and smoking can cause hormonal imbalance, irregular menstruation and ovulation disorders in women. In men, this can lead to decreased sperm efficiency and motility. Smoking, alcoholism and drug abuse during pregnancy can cause developmental disorders in the foetus, **ectopic pregnancy** and miscarriage. In short, substance abuse affects fertility and reproductive health. So, these habits should be avoided. Organise a seminar in the class based on the topic **'The challenges posed by alcohol, drugs and smoking'**.

Sub topics

- Reproductive health
- Other health issues
- Social and economic issues

Routine check-up and vaccination play a major role in antenatal care by diagnosing, treating and preventing health issues during pregnancy. Discuss the given facts based on the indicators and present the findings.

Physical Examination

Check blood pressure, weight, height and physical condition of the pregnant woman. After the first three weeks, a pregnant woman should gain a weight of 2 kg every month, and so, body weight should be checked at regular intervals.

Blood and Urine Tests

Check the blood group, haemoglobin in blood, Glucose and TSH (Thyroid Stimulating Hormone) levels. Test Urinary Tract Infection, HIV infection, Anaemia, Gestational Diabetes and Malaria. After seven months, a urine albumin test is done to check high blood pressure (preeclampsia).

Ultrasound Scans

Assess the position of placenta, growth of the foetus, genetic abnormalities and the presence of more than one embryo. An ultrasound scan is usually done between 8-14 weeks.

Vaccinations

Certain vaccines are given to protect the mother and foetus from various types of infection.

e.g. TT, Rubella vaccine

To identify genetic disorders

Specific examinations (scanning and blood test) performed between 11-13 weeks of pregnancy can detect genetic abnormalities of the foetus. It checks the possibility of a genetic disorder called **Down Syndrome**. If there is a possibility of disease, then tests such as chorionic villus sampling and amniocentesis will be done.

Chorionic Villus Sampling

This test detects chromosomal abnormalities by taking tissue samples from the villi of placenta within 10-12 weeks of gestation.

Amniocentesis

Foetal cells are found in the amniotic fluid surrounding the foetus. In certain specifc situations it is possible to determine the genetic abnormalities and nervous disorders of the child by examining cells in this fluid.

- Importance of physical examination and blood-urine tests
- Importance of scanning
- Vaccination
- Use of amniocentesis

Pregnancy Counselling

The government ensures the services of community health officers to ensure the physical and mental health of pregnant women. Counselling systems of the government can be used to get necessary guidelines to identify health issues during pregnancy at an early stage and solve them accordingly. Pregnancy counselling helps in getting proper guidance on the diet to be followed during pregnancy, a healthy home environment, family planning and importance of breast feeding. The service of Family Health centre Field Staff, JPHN (Junior Public Health Nurse), ASHA workers, MLSP (Mid Level Service Provider), Public Health Nurse and Anganwadi staff can be availed in antenatal health care programmes.

Parturition

It is a natural process that marks the end of pregnancy and the beginning of a new life outside the womb. Analyse the illustration 5.6, description and gain more understanding.

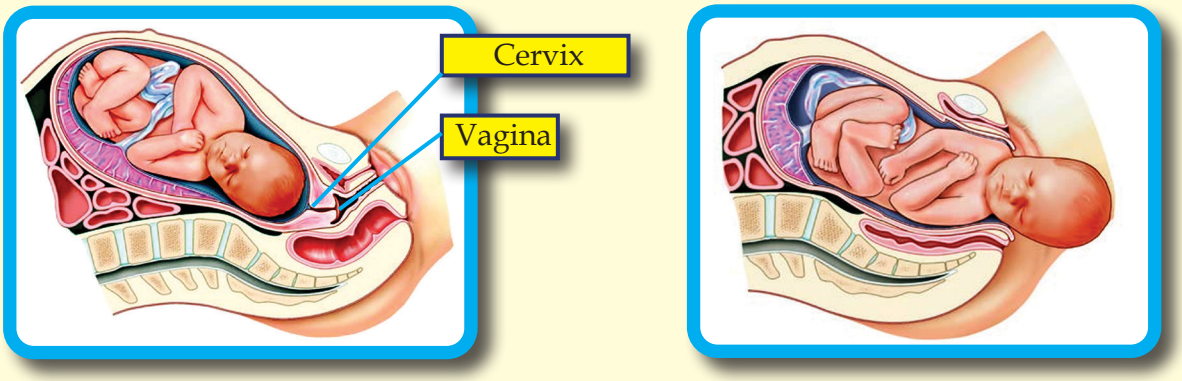


Illustration 5.6 : Parturition

Normal delivery is the process of expelling the foetus through the vagina following strong contractions of the uterine wall. When the baby's head is positioned to face the vaginal opening, the uterus contracts and the cervix dilates to push the baby out. **Caesarean (C-section)** is the surgical removal of the baby when normal delivery is not possible, or if there is a risk to the health of the mother or the baby.

Motherhood

Uterus is the unique organ where the growth and development of the foetus takes place. The uterus is strong enough to hold an additional weight of 10-12 kg, with about two litres of amniotic fluid in which the foetus grows along with the placenta. During this period, the uterus expands 500-1000 times. It is the uterus that plays a main role in child birth, through strong contractions. What else is greater in this world than motherhood that involves child birth and lactation?

You have understood the importance of care and nutrition during pregnancy and parturition. How should the nutrition and care of a newborn baby be?

Analyse the given poster and description and gain understanding.

What else is as valuable as breast milk?

Colostrum, a light yellow coloured milk produced immediately after giving birth, must be compulsorily fed to the baby. This will give the baby lifelong immunity.

Only breastfeed should be given, up to six months. There is no need to give porridge or other liquid food items to the baby.

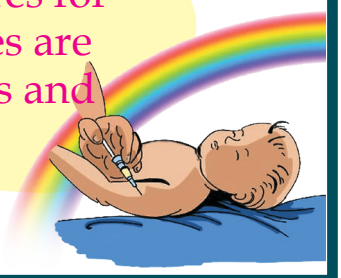
A baby should be breastfed for at least two years. Breast milk provides the nutrients needed for growth and cognitive development.

Breast milk contains antibodies that protect the baby against infection, diarrhoea, respiratory diseases and allergies. Breast milk helps to maintain body temperature and to prevent dehydration.

What are the benefits of a mother who breastfeeds? Find out.

Like breast milk, vaccines are also a baby's birth right. **Vaccination** or immunisation is the best way to acquire artificial immunity. It is the responsibility of the parents to protect their children's right by administering vaccines at the right time.

You can approach the nearest government health centres for vaccination. All vaccines are given for free, for babies and pregnant women.



What are the main vaccines given to newborns? What is the time schedule for vaccination? Visit the nearest health centre, check the National Immunisation Schedule and complete table 5.2. Prepare a chart and display it in the class.

Find out the disease which is prevented by each each vaccine.

National Immunisation Schedule	
At birth	BCG, OPV (zero dose), Hepatitis B
6 weeks	OPV-I, Pentavalent-I, IPV-I
10 weeks	
14 weeks	
9 months	
16-24 months	
5-6 years	
10 years	
16 years	

Table 5.2 : National Immunisation Schedule

How about conducting a study on creating awareness among the public in your area about antenatal and postnatal care and the intervention of health workers? Prepare a report after interviewing health workers and, the public by including the given topics.

- Antenatal care
- Intervention of health workers
- Diet, Treatment
- Home birth
- Vaccines

Teenage Pregnancy

Pregnancy between 10-19 years is commonly called teenage pregnancy. The adolescent body may not have the physical capacity to handle extreme stress such as child birth. There are chances of many complications during pregnancy and child birth in this period. It is dangerous for the health of the mother and the baby. As they are not mentally prepared to shoulder the responsibilities of motherhood, they may be affected by psychiatric issues like depression. Premature births, babies having low weight at birth, occurrence of various morbidities and high maternal and infant mortality rates are common in teenage pregnancy. Adolescent pregnancy with or without sexual exploitation often leads to unsafe termination of pregnancy.

Sexual assault is an act that violates a person's rights and dignity. Anyone can be a victim regardless of one's age, gender or background. It is important to recognise that sexual assault is never the victim's fault and that everyone has the right to feel protected and respected in all circumstances.

Understanding what sexual assault is and how it happens, is the first step to prevent it. Consenting to sexual activity and becoming a victim to sexual exploitation are both equally dangerous. If you are experiencing sexual violence or having concerns about your safety, you should seek the necessary support from the members of your family or from the legal system. The sexual assaults against those who are below 18 years come under POCSO Act in India. Counsellors at Adolescent Friendly Health Centres can be approached confidentially for real-time solutions to such problems and health concerns. Health Department's 24-hour **Disha helpline numbers (1056/104)** can be accessed to avail their services.

Variations in the birth rate

Analysing the statements given below, discuss your opinions and form inferences.

Frequent pregnancy may affect the health of the mother and children.

Increase in population creates adverse effects in the environment and in the utilisation of resources.

In some countries where the bith rate is lesser, extra time and financial assistance for child care are given.

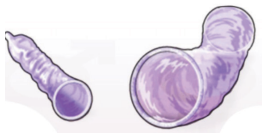
The countries in the world face issues of a high birth rate and a low birth rate.

Contraceptive methods are important in controlling birth rate. Based on the indicators, analyse the excerpt from the doctor's article and illustration 5.7 and make a note.

Contraceptive Methods

Contraceptives are methods or devices used to interrupt the process of conception. It plays a vital role in family planning. This gives an opportunity for the couple to decide when to give birth to children. A gap of 2 - 5 years between pregnancies can improve the mother's health and it gives opportunity for the parents to provide adequate care for the first child. There are contraceptive methods available for both men and women.

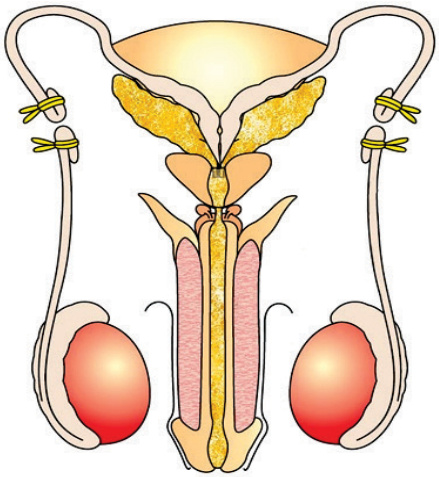
Oral contraceptive pills
(Interrupt ovulation)



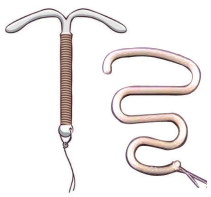
Condoms
(Prevent the deposit of sperms in the vagina)

Diaphragm
(Prevents sperm from reaching the uterus)

Vasectomy
(By cutting or tying the vas deferens, the passage of the sperm is blocked)

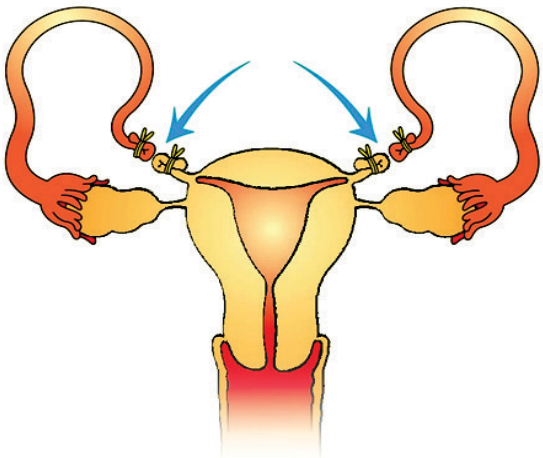


Spermicides
(Used to destroy sperms near the cervix in the uterus)



Intra Uterine Devices
(Prevents implantation)

Tubectomy
(By cutting or tying the oviduct, the passage of the ovum is blocked)



- Temporary contraceptive methods
- Permanent contraceptive methods
- Contraceptive methods in women
- Contraceptive methods in men

Illustration 5.7 : Contraceptive methods

Infertility

If a couple is unable to conceive naturally, even after one year from the time they decided to conceive can be considered as infertility. Based on the indicators, analyse the description given below and make a note.

One or both the partners may have the physical conditions leading to infertility. Defects in sperm production, decrease in the number of sperms and their motility and certain diseases can cause male infertility.

Ovulation disorders, blockage in the fallopian tube and hormonal imbalances such as **Polycystic Ovary Syndrome (PCOS)** can cause infertility in women.

Toxins, pollution, smoking, drug abuse, consumption alcohol, sexually transmitted infections and inflammation of the reproductive organs can reduce the chances of fertility in both.

Hormone and semen tests in the laboratory, ultrasound scanning and genetic tests can diagnose the cause of infertility. Medicines and **Assisted Reproductive Technologies (ART)** such as **In vitro Fertilization (IVF)** can be beneficial for infertility treatment.

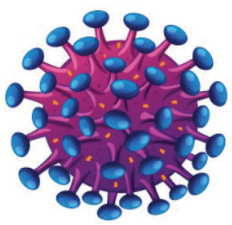
- Male infertility
- Female infertility
- Treatment

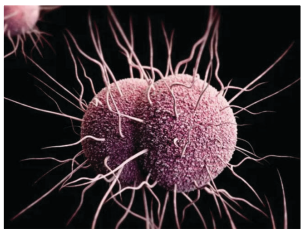
Sexually Transmitted Infections / STIs

Sexually transmitted diseases are mainly transmitted through sexual contact. These diseases are caused by bacteria, virus, fungi or parasites. Most common STIs are **AIDS, Chlamydiasis, Gonorrhea, Syphilis, Genital Herpes, Human Papilloma Virus (HPV) infection, Hepatitis B, Trichomoniasis and Candidiasis.**

Vaccinations against HPV and Hepatitis B infections are available. In addition, ensuring genital hygiene and seeking immediate medical attention if symptoms occur can help preventing long-term consequences and reducing transmission.

Interview a doctor to clear your doubts about sexually transmitted diseases. Collect more information and prepare and display a poster on the pathogens causing the above diseases, their transmission and prevention.


HIV

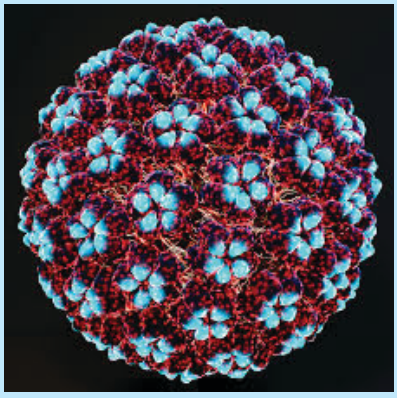

Gonococci


Treponima pallidum

Certain pathogens causing STIs

HPV Infection and Cervical Cancer

Human Papilloma Virus (HPV) infection is one among the most common sexually transmitted diseases. This is a type of virus that causes genital warts and various cancers including cervical cancer. The greatest challenge in preventing HPV is the absence of manifestation of symptoms in affected persons. Chronic infection with high-risk HPV types cause certain changes in the cells of the cervix. If left untreated, these changes can turn into **cervical cancer**. The risk of cervical cancer is higher in girls who have sex before the age of 18. The virus infection is severe among them. **Pap smear test and HPV testing** are helpful in early detection of infection. Since cervical cancer is the second most common disease among women in Kerala after breast cancer, vaccination has been started for girls in the higher secondary section to prevent this disease. There are vaccines that can be given up to 26 years in females and up to 21 years in males.



Evolution of the Reproductive Process

Traces of evolution can be seen in reproduction also. The development from egg-laying organisms to mammals which give birth and lactate their young ones indicates the same. This is very obvious in the evolution of vertebrates.

Fish and amphibians reproduce through **external fertilisation** whereas in reptiles and birds, it is through **internal fertilisation**. Even then, the egg is hatched outside the body. The embryo is fully developed using the nutrients inside the egg. When it comes to mammals, the egg is limited to a cell (ovum) required for fertilisation. The foetus completes its growth by receiving nutrients from the mother's body.

With the process of reproduction too, nature continues to convince us that the history of living beings is that of evolution. By understanding the life process called reproduction, we should also be able to enjoy the continuity of life based on the ongoing process of evolution in nature.

Let us Assess

1. What is the duration of full term pregnancy in humans?

   a) 200-210 days b) 210-220 days

   c) 270-280 days d) 280-290 days

2. Choose the one which is used to observe the growth of the foetus.

   a) ultrasound scan b) stethoscope
   c) ECG d) thermometer

3. The fluid filled sac that surrounds and protects the foetus is .....

   a) amnion b) placenta c) uterus d) ovary

4. Implantation means

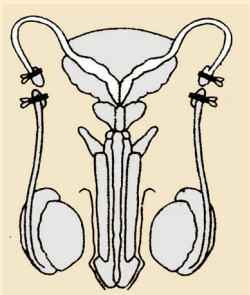
   (a) Deposition of sperms in the vagina

   (b) Blastocyst attaches to the endometrium and grows

   (c) The fusion of sperm and the ovum

   (d) Surgical removal of the baby

5. The illustration given below shows a surgical procedure that men can adopt for contraception.



   (a) Identify the contraceptive method in males.

   (b) How is contraception possible through this surgery?

6. Which of the following organisms reproduce by external fertilisation?

   a) Amphibians b) Reptiles
   c) Birds d) Mammals

7. "First breast milk, First defence". These are the words in the poster released by the Department of Women and Child Development, Government of Kerala. What is your response to the phrases in the poster?

8. What are the factors that reduce fertility in both men and women?

9. Describe the physical changes of the foetus during each trimester of pregnancy.

10. What are the chief ways to avoid Sexually Transmitted Infections (STIs)?

Extended activities

1. Prepare a poster on adolescent health and food habits and display in the class.

2. Prepare the list of vaccines to be administered to newborns with the help of imaging software and post them in the social media.

3. Prepare a manuscript on the importance of motherhood by including pictures and descriptions.

6 Classification

- Three Domain classification
- Classification of Animals
- Classification of Plants
- Classification of newly Discovered Organisms
- Evolutionary Tree
- DNA Barcoding

Haven't you noticed the doubt raised by the child watching the programme on KITE VICTERS channel?

What will be your response?

.....

It is from such doubts that classification methods have been evolved and updated.

Identifying organisms and understanding their characteristics lead to additions and updations in classification methods. The five-kingdom classification system has also been subjected to updations. Analyse the description and illustration 6.1 based on the indicators and prepare a note.

Three Domain Classification


Carl Woese

A scientist named **Carl Woese (1928- 2012)** tried to study more about the organisms that belonged to Kingdom Monera. Through scientific observation, he realised that these microorganisms are distinct from bacteria. He also noted the structural differences between these organisms and their diverse adaptations for surviving the environmental changes. He identified that the genetic materials of such organisms were different from that of bacteria. Based on this, he classified **Kingdom Monera** into two, namely **Bacteria** and **Archaea** and further included another classification level called **Domain** above the Kingdom. Organisms belonging to all six kingdoms were organised into three domains. These were named as **Domain Bacteria, Domain Archaea** and **Domain Eukarya.**

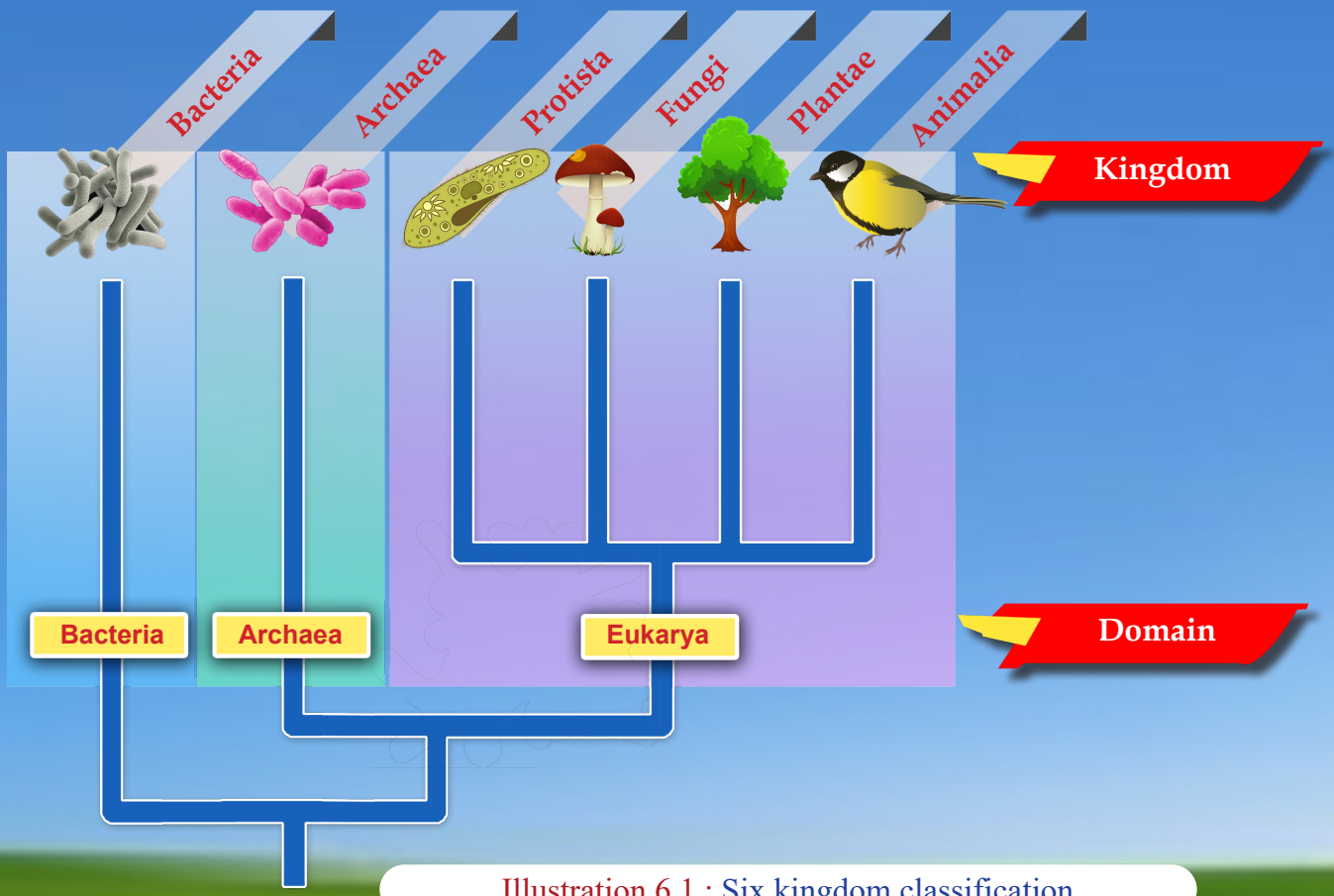


Illustration 6.1 : Six kingdom classification

- Contribution of Carl Wouse in Taxonomy
- Relevance of dividing the Kingdom Monera into different kingdoms such as Archaea and Bacteria
- Domains and their corresponding kingdoms.

Now you understood how organisms are classified into different kingdoms.

Complete the illustration 6.2 by including the peculiarities of kingdoms, citing suitable examples.

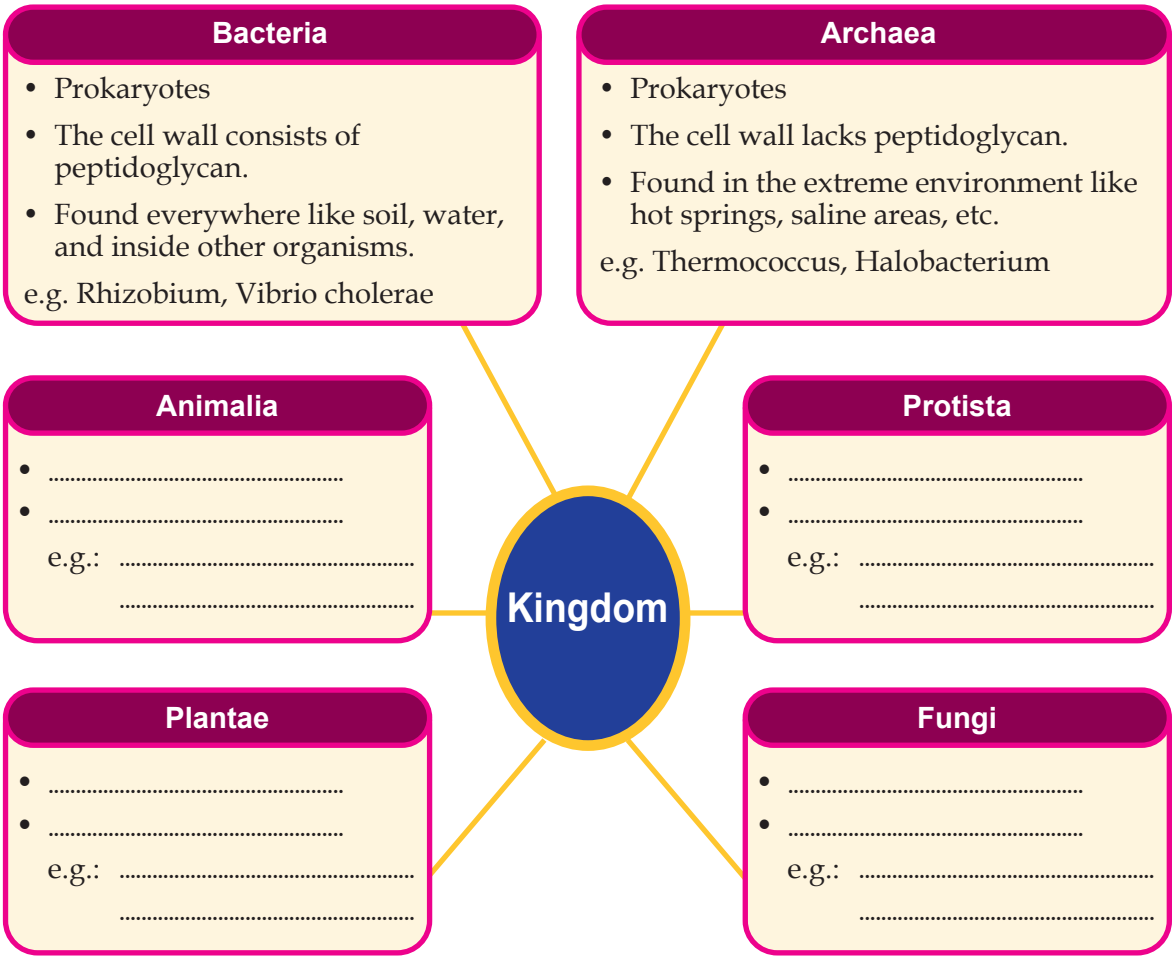


Illustration 6.2 : Kingdoms and their peculiarities

Shall we learn more about the diverse animal world and the plant world?

Classification of Animals

Animals are grouped into different phyla based on their structure, body cavities, germ layers and symmetry. Within the classification hierarchy of certain animals, there are additional subdivisions between phylum and class, such as subphylum, division and superclass. After analysing illustrations 6.3 (a, b, c), understand how organisms in the animal kingdom are classified into different phyla, and complete the worksheet 6.1.

Phyla included in the Kingdom Animalia	
Porifera	**Cnideria (Coelenterata)**
	
Aquatic organisms with minute pores throughout the body	Aquatic organisms with tentacles bearing cnidoblast
e.g. Sponges	e.g . Hydra, Jelly fish, Sea anemone
Platyhelminthes	**Nematoda**
	
Small, soft and flat bodied worms	Long and round bodied worms
e.g. Planaria, Tape worm, Fluke	e.g. Round worm, Hook worm, Pin worm

Illustration 6.3 (a) : Classification of animals

Annelida	Arthropoda
	
Segmented-bodied organisms	Organisms with jointed legs and exoskeleton
e.g. Earth worm, Leech	e.g. Prawn, Cockroach, Crab

Mollusca	Echinodermata
	
Soft body, in most organisms a shell made of calcium carbonate covers the body.	Marine organisms with spiny body.
e.g. Snail, Octopus, Clam	e.g. Sea Urchin, Star Fish.

Illustration 6.3 (b) : Classification of animals

Chordata

Organisms with rod shaped notochord or vertebral column

e.g. Man, Fish, Frog

Illustration 6.3 (c) : Classification of animals

Notochord and Vertebral column

The notochord is a rod-like structure that appears in the place of the vertebral column during the early stages of growth, or throughout the life of animals in the phylum Chordata. Phylum Chordata derived its name due to the presence of the notochord. **Urochordata, Cephalochordata** and **Vertebrata** are the three sub phyla of Phylum Chordata. Notochord is seen in different forms in these organisms. In the sub phylum Urochordata, the notochord is restricted only to the tail region during the larval stage. However, in organisms included in the **subphylum Cephalochordata,** the notochord which extends as a rod-like structure from head to tail remains till the end of life. Whereas in subphylum Vertebrata, the notochord is present only during the embryonic stage, and as the embryo grows, it transforms into the vertebral column.

Peculiarity	Phylum	Example
Marine organisms with a spiny body		Sea Urchin, Star Fish
	Nematoda	
Aquatic organisms with minute pores throughout their bodies		Sponges
Aquatic organisms with tentacles bearing cnidoblast		
		Snail, Octopus
Segmented bodied organisms		
	Arthropoda	
		Tape worm, Planaria
	Chordata	

Worksheet 6.1

Phylum Chordata consists of organisms having notochord. Vertebrates are included in subphylum **vertebrata** of Phylum Chordata. Analyse the table 6.2 and gather additional information to understand how the organisms included in this list are further classified. Based on this, complete the table by including the organisms given in the box.

Super class	Class	Peculiarities	Examples
Pisces (having fins)	Chondrichthyes (Cartilaginous fishes)	Scales are there in the body. Heart is two-chambered. Habitat ---------- Means of Locomotion ---------- Respiratory organs ----------	
	Osteichthyes (Bony fishes)		
Tetrapoda (Having limbs)	Amphibia (Amphibians)	Complete the life cycle in land and water, Moist and slimy skin, Lay eggs, Respiratory organs----- Number of heart chambers -------	
	Reptilia (Reptiles)	Reptiles, dry skin, scales are there in the body, nails on digits (except in snakes) Respiratory organs----- Number of heart chambers ------- Reproductive method --------	
	Aves (Birds)	Body is covered with feathers, wings, claws on digits, Respiratory organs----- Number of heart chambers ------- Reproductive method --------	
	Mammalia (Mammals)	Body is covered with hair/fur, nails on fingers and toes, lactate, respiratory organs----- Number of heart chambers ------- Reproductive method --------	

Table 6.2 : Classification of sub phylum vertebrata

Find out the number of heart chambers of crocodile and alligator.

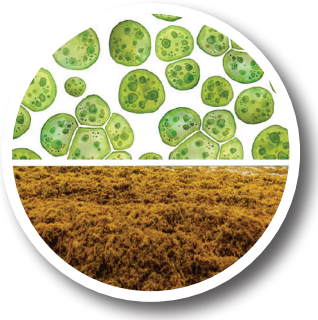
Frog, Rohu, Cat, Crocodile, Mackerel, Tree frog, Kiwi, Viper, Crow, Wall lizard, Garden lizard, Domestic Fowl, Cow, Pigeon, Tiger, Pearl spot, Shark, Dolphin, Salamander, Alligator, Snake, Elephant, Penguin

Observe the other animals in your surroundings and group them into different classes. Now, create a digital presentation and present it in the class.

Classification of Plants

You have understood the classification of animals into different groups. Kingdom Plantae is classified into different divisions on the basis of the similarities and differences in the body structure, vascular system and seed formation. Analyse the illustration 6.4 and prepare a note on the basis of indicators.

Divisions of Kingdom Plantae

Algae	Bryophyta	Pteridophyta
		
Most of them are aquatic. The body called as Thallus is not differentiated into root, stem and leaves as in higher plants. Both sexual and asexual modes of reproduction are seen. Vascular tissues are absent.	Mostly found on moist surfaces. There are parts like root, stem and leaf. Reproduction is done through gametes and spores. Vascular tissues are absent.	Mainly terrestrial plants. Root, stem and leaf have been formed. Reproduction is mainly through spores. Vascular tissues with simple structure are seen.
e.g. Spirogyra, Sargassum	e.g. Riccia, Funaria	e.g. Lycopodium, Pteris

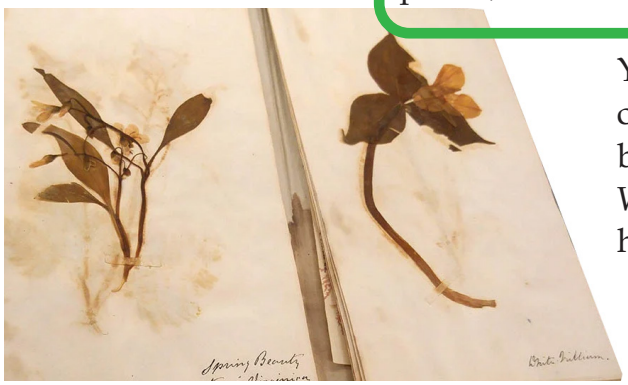
Gymnosperms	Angiosperms
	
Reproductive structures known as cones are present. Even though seeds are formed, they are not embedded fruits. Complex vascular tissues are seen, but xylem vessels are absent.	Reproductive parts are present in the flowers. Fruits are seen covering the seeds. Complex vascular tissues are seen. Xylem vessels and tracheids are present.
e.g. Cycas, Pine	e.g. Hibiscus, Mango tree, Coconut tree.

Illustration 6.4 : Classification of plants

- Different divisions of Kingdom Plantae
- Peculiarities in reproduction
- Presence of vascular tissues

Difference in the classification

Earlier, the Kingdom Plantae was classified into five divisions: Thallophyta, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms. Algae and fungi were included in the Thallophyta. However, in subsequent classification systems, fungi were placed in a separate kingdom based on their unique characteristics. In many modern classification systems, some algae are included in the Kingdom Protista. Algae, which share many characteristics with plants, are still classified within the Kingdom Plantae.



You have understood how plants are classified. Find out more plants that belong to each level and tabulate them. With the help of your teacher, prepare a herbarium of locally available plants. How will the plants included in the herbarium be scientifically classified and given names?

Pay attention to the following extract from a science article.

The fame within the name

Something interesting can also be found in the scientific names of organisms.

Sandracottus vijayakumari

A new species of beetle discovered in Nelliampathi

Litsea vagamonica

A new plant in the category of Kuttippanal from Vagamon

Brucethoa ISRO

A kind of parasite found in fishes at Kollam coastal area

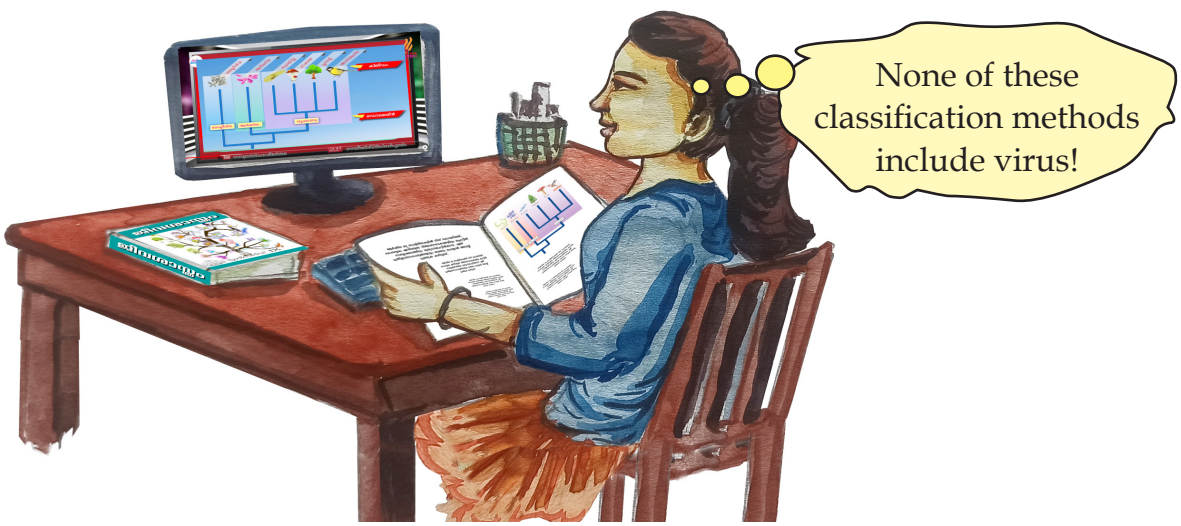
New organisms are being discovered like this. There are continuous efforts to classify them as well. How can we understand that a newly discovered organism is not currently classified? Write down your assumption.

.....

Analyse the description and check the validity of your assumption.

If a new organism is discovered...

The characteristics of an organism are examined and compared with that of other known species and its classification is done. This includes morphological features, peculiarities of body structure and biomolecules. Comparative analysis of the organism's DNA with that of other species is also crucial. If there are significant genetic differences, it can be confirmed that this organism belongs to a new species. This discovery is then published in an international science journal and made available to the scientific community and the general public.



You have noticed the doubt of the child. What would be your response to this doubt?

Analyse the characteristics of viruses based on the given indicators and prepare a note.

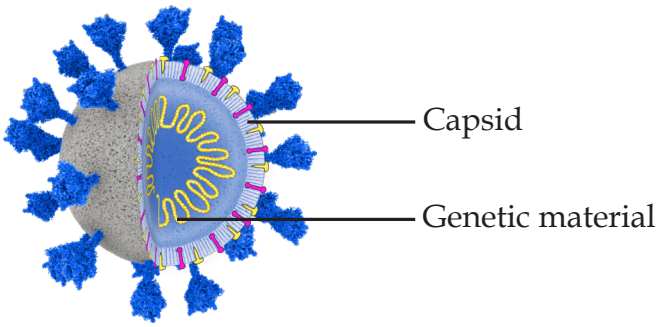


Fig. 6.1 : Virus

Viruses and classification

Viruses could not be included in any category of the six-kingdom classification system. However, considering their structure, mode of division, genes, etc., virologists and taxonomists have classified viruses into families, genus and species which are meant only for them. This classification of viruses helps scientists to study their nature, evolution, development, etc. and develop methods to combat viral diseases.

Viruses have a simple structure devoid of cytoplasm, cell organelles and nucleus. Genetic materials (DNA or RNA) are found inside an outer protein coat called a capsid. They infect a wide variety of organisms, including plants, animals, bacteria and archaea.

Organisms having the ability to reproduce, respond to the environment, to grow, and do metabolic activities are included in the process of classification. Viruses cannot multiply without the help of a host cell. They are inactive outside any living cell. Due to these unique characteristics, they are not included in any category of the current six-kingdom classification.

- Structure of the virus
- Difference between Viruses and other Cells
- Reasons for not including Viruses in the classification.

Isn't it clear that none of the classification methods are complete?

Efforts to develop more scientific classification methods are going on.

Analyse the given description about modern techniques in classification and gain an understanding about it.

Evolutionary Tree

The biodiversity of earth was developed as a result of the evolutionary processes. The evolutionary relationship between different organisms can be illustrated as branches of a tree. This is called an **Evolutionary Tree**. Here, the place where branches develop indicates ancestral organisms. The classification becomes more accurate by illustrating evolutionary relationships. It helps in developing an indepth understanding about biodiversity. In short, the Evolutionary Tree plays a crucial role in the studies of classification.

How is the Evolutionary Tree illustrated?

Observe the table 6.3 showing four peculiarities of organisms such as Lung Fish, Wall Lizard, Dog and Man. Analyse them on the basis of the indicators.

Organisms	Peculiarities			
	Skull	Forelimbs	Hair/Fur	Lactation
Lung Fish	Yes	No	No	No
Wall Lizard	Yes	Yes	No	No
Dog	Yes	Yes	Yes	Yes
Man	Yes	Yes	Yes	Yes

Table 6.3 Organisms and Peculiarities

- Features considered
- Organisms having all these features.

Analyse the illustration 6.5 and record your inferences about how the Evolutionary Tree of these organisms is constructed based on the characteristics given in the table.

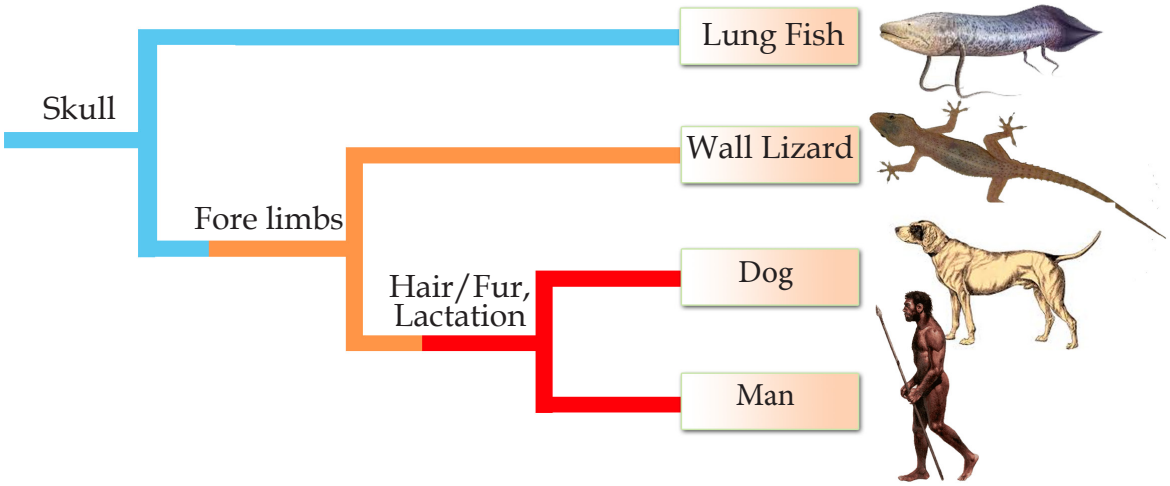
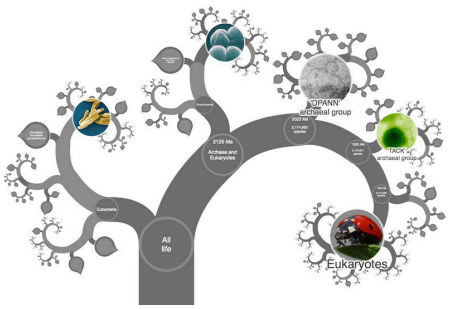


Illustration 6.5 : Evolutionary Tree

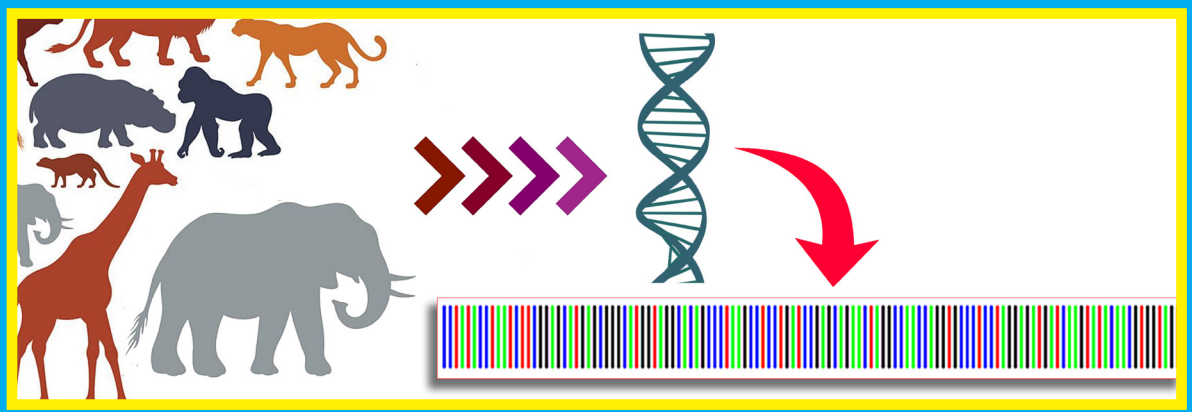


You have understood how to prepare an Evolutionary Tree based on similarities and differences between organisms.

To know more about the Evolutionary Tree and the relation between the organisms, visit the website **https://www.onezoom.org/.**

The most modern technology for classifying organisms is DNA barcoding.

DNA Barcoding



Analyse the given description on the basis of indicators, collect more information and gain knowledge about this.

DNA bar coding is the technology of classifying organisms by comparing the special molecular sequences (codes) of DNA. It is the most scientific technology for identifying the species in modern biological researches. Unlike the traditional methods, it helps to recognize the species at molecular level. This is made possible by the creation and sharing of DNA barcodes by the researchers and laboratories all over the world.

- DNA bar coding
- Importance of Barcoding

Classification has an impact on all areas such as characteristics of organisms, ecological interactions, biological evolution, biodiversity conservation, and biotechnology. There are millions of species on earth that are yet to be identified. Some became extinct even before they had a name of their own. Certain others are facing the threat of extinction. It is the responsibility of mankind to recognise all these species and protect them as they stand at the highest level of the taxonomical hierarchy. Only through this can man also ensure his survival.

Let us Assess

1. Draw an Evolutionary Tree of the organisms by analysing the table given below.

Peculiarities	Shark	Frog	Kangaroo	Man
Vertebral column	Yes	Yes	Yes	Yes
Two pairs of limbs	-	Yes	Yes	Yes
Mammary glands	-	-	Yes	Yes
Placenta	-	-	-	Yes

2. Different animals and the phyla to which they belong are given below. Make pairs as shown in the model.

   Model : Man – Chordata

Man, Sponges, Snail, Hydra, Round Worm, Starfish, Earthworm, Cockroach, Planaria	Porifera, Cnidaria, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca, Echinodermata, Chordata

3. How is the DNA barcoding technology used for identifying different species?
4. Plants without conducting tissues are included in a single group in Kingdom Plantae. Comment.
5. The peculiarities of certain divisions of Kingdom Plantae are given below. Identify and name the divisions by analysing them.
   a) Vascular tissues are present, Reproduction through spores.
   b) No fruits to cover the seeds. Reproduction through seeds.
   c) No vascular tissues. Reproduction with the help of gametes and spores.

6. Make corrections if any, in the underlined portions of the given statements.

   a) Species is the taxonomic level placed above the Kingdom.

   b) Vertebrates are included in sub phylum vertebrata of Phylum Chordata.

   c) Mammalia is the class containing organisms that complete their life cycle on land and in water.

7. Analyse the statement and reason, find the correct answer and write down.

   Statement : Viruses are not included in any category of the current six-kingdom classification.

   Reason : Viruses are inactive outside any living cell.

   a) Statement correct, reason false.

   b) Statement and reason are correct.

   c) Statement false, reason correct.

   d) Statement and reason are false.

8. Identify the relation and fill in the blanks.

   a) Jelly fish : Cnidaria; Hook worm : ----------

   b) Crab : Arthropoda; Octopus : ----------

9. Which of the following category includes Mango tree and Coconut tree?

   a) Bryophyta

   b) Pteridophyta

   c) Gymnosperms

   d) Angiosperms

Extended Activities

1. Prepare a Local Biodiversity Register including the common name and scientific name of various organisms in your locality and submit it to the local self government institution in your area.
2. Set up a Seed Library by collecting available seeds from your locality.
3. Collect data on the organisms recently discovered in Kerala, prepare a wall magazine and exhibit it in your class.
4. Observe the organisms that can be seen in your school campus and surroundings and classify them.

NOTES

NOTES

CONSTITUTION OF INDIA

Part IV A

FUNDAMENTAL DUTIES OF CITIZENS

ARTICLE 51 A

Fundamental Duties- It shall be the duty of every citizen of India:

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievements;

(k) who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between age of six and fourteen years.

CHILDREN'S RIGHTS

Dear Children,

Wouldn't you like to know about your rights? Awareness about your rights will inspire and motivate you to ensure your protection and participation, thereby making social justice a reality. You may know that a commission for child rights is functioning in our state called the ***Kerala State Commission for Protection of Child Rights.***

Let's see what your rights are:

- Right to freedom of speech and expression.
- Right to life and liberty.
- Right to maximum survival and development.
- Right to be respected and accepted regardless of caste, creed and colour.
- Right to protection and care against physical, mental and sexual abuse.
- Right to participation.
- Protection from child labour and hazardous work.
- Protection against child marriage.
- Right to know one's culture and live accordingly.
- Protection against neglect.
- Right to free and compulsory education.
- Right to learn, rest and leisure.
- Right to parental and societal care, and protection.

Major Responsibilities

- Protect school and public facilities.
- Observe punctuality in learning and activities of the school.
- Accept and respect school authorities, teachers, parents and fellow students.
- Readiness to accept and respect others regardless of caste, creed or colour.

Contact Address:

Kerala State Commission for Protection of Child Rights

'Sree Ganesh', T. C. 14/2036, Vanross Junction

Kerala University P. O., Thiruvananthapuram - 34, Phone : 0471 - 2326603

Email: childrights.cpcr@kerala.gov.in, rte.cpcr@kerala.gov.in

Website : www.kescpcr.kerala.gov.in

Child Helpline - 1098, Crime Stopper - 1090, Nirbhaya - 1800 425 1400

Kerala Police Helpline - 0471 - 3243000/44000/45000

Online ***R. T. E Monitoring : www.nireekshana.org.in***