GOVERNMENT OF TAMILNADU

SCIENCE

VII STANDARD

Untouchability
Inhuman - Crime

Department of School Education

A publication under
Government of Tamilnadu
Distribution of Free Textbook Programme
(NOT FOR SALE)

First Edition - 2011

(This Book is published under uniform system of school education scheme)

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Textbook printing

Tamilnadu Textbook Corporation

College Road, Chennai - 600 006

Price : Rs.

This book has been printed on 80 G.S.M. maplitho paper

Printed by offset at :

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BIOLOGY

சின்னஞ்சிறு குருவி போலே – நீ
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மனதில் மகிழ்ச்சி கொள்ளு பாப்பா

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வாலைக் குழைத்து வரும் நாய்தான் – அது
மனிதர்க்குத் தோழனடி பாப்பா

– மகாகவி பாரதியார்

Chandra, while preparing for a competition, came across the above Bharathiar's poetry. She was astonished and admired that how Bharathiar loved animals and presented its characters and uses in sweet and short evergreen lines. She ran to her mother to show her the poem.

Amazed by her daughter's interest, Chandra's mother told her that since time immemorial man coexisted with birds and animals. Everyday from dawn to dusk man's life was influenced by animals. He woke up listening to the call of birds. He had to depend on animals for food, clothing, transport, fuel etc... The buzzing of bees was his first music and the dance of the peacock was his first entertainment. Dogs and cats were his first playmates.

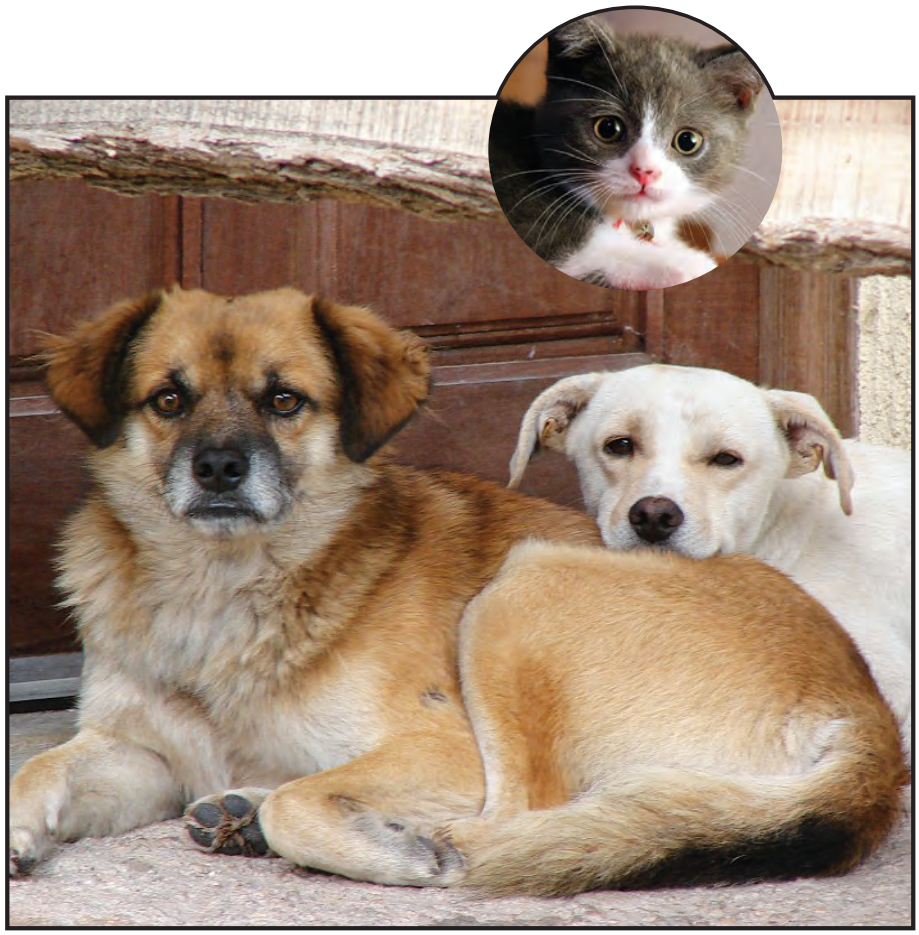


Fig 1.1 Pet animals

ACTIVITY - 1.1

Children, do you have a pet animal?. Shall we write down what we do when our pet is.....

a) hungry.....

b) feeling hot or cold .....

c) teased by someone .....

d) hurt .....

The life on this planet Earth is sustained by plants and animals. With the development of knowledge and technology, his dependance on animals for economic purpose increased. The balance in nature will be upset if the relationship between human and animals deteriorates.

ACTIVITY - 1.2

Children, shall we fill in the blank spaces?

Name of the Animal	Why do we keep them?
1. Dog	.....
2.	gives milk
3.	pulls cart
4. Ox	.....
5. Hen	.....
6. Fish	.....
7.	we love it
8. Honey bee	.....

Fig 1.2 (a) Jersey

Fig 1.2 (b) Kangeyam

1.1. USES OF ANIMALS

Animals and their products are of great use to man. Based on the utility of animals, they are classified into

1. Food yielding animals

Animals are reared for milk, eggs and meat. Breeds of cows are mainly raised for milk. Certain breeds of goat are reared for milk and meat. Honey bees give us honey. Fishes are a good source of protein.

2. Fibre yielding animals

Animals such as sheep, llama and goat provide us fur. The fur is processed into wool. Silk moth gives us silk fibre.

Fig 1.3 Llama

3.Draught animals

Animals which are used for ploughing and transporting are called draught animals.

Bullock, Ox, horse, elephant, donkey, etc are employed in farm activities and transport.

MORE TO KNOW

Some cows produce around 16 litres of milk a day or 6000 litres a year.

ACTIVITY - 1.3

Observe the care taken by milkman on the cow in the shed and the care taken by your family on your pet animal. List down your observations.

Dog	Cow
1.	
2.	
3.	
4.	

Fig 1.4 Honey

Fig 1.5 Milk

Fig 1.6 Silk

1.2. ANIMAL PRODUCTS

Animals provide us a variety of products like wool, silk, milk, honey, meat, leather, pearl, egg, lac and so on. Let us learn about some.

1. Wool: Wool is obtained from body hairs of animals such as sheep, llama and goat. It is used to make sweaters, shawls, blankets, socks, hand gloves etc.
2. Meat: Animals such as goat, sheep, pig, poultry birds, prawn, crab etc. yield flesh as food.
3. Silk: Silk is obtained from silk worm and it is used for making silk clothes.
4. Leather: The skin of animals such as goat, sheep, and cattle is used for manufacturing leather goods(bags, shoes, purses, suitcases, belts).
5. Pearl : Pearl is a valuable gem obtained from pearl oysters and is used in making ornaments.
6. Lac : Some insects secrete a resin like substance called lac. It is used for making paints, varnish, printing inks and cosmetics.
7. Milk: Animals like cows, buffaloes and goats give milk as food.
8. Honey: Honey is obtained from honey bees. It is consumed along with food and used in the preparation of certain medicines.
9. Egg: Poultry birds such as hen, duck, goose and turkey give us eggs as food.

MORE TO KNOW

In 2004 December, some tribes that live in the forests of Andaman islands noticed the animals behaving in a different manner. They guessed some danger. So they moved to a safer part of the island. Soon after the islands were hit by Tsunami, but the people were saved.

1.3. ANIMAL FIBRES

One day Selvan saw his grandmother wearing a shawl and his mother asked him

Fig 1.7 Sheep

to wear a sweater. He was curious to know why they should wear these clothes? His mother said that woollen clothes trap air and act as bad conductor of heat or cold . Hence they keep us warm during winter.

Wool

Wool is a thick coat of hairy fibres(fleece) obtained from sheep, goat, yak and other animals. It is a protein. Several breeds of sheep are reared in our country that yield different kinds of wool. The skin of sheep has two types of hair.

a) Coarse beard hair and b) Fine soft under hair.

MORE TO KNOW

Australian scientists have invented a way of removing wool from Sheep without shearing. The new wool harvest technology is called Bioclip.

ACTIVITY - 1.4

Let us collect pictures of animals that produce wool and paste them in the scrap book.

Normally fine hairs provide the fibres for making wool. **Yak wool** is common in Tibet and Ladakh. **Angora wool** is obtained from Angora goats which are found in Jammu and Kashmir. The underhair of Kashmiri goat (Pashmina) is woven into fine shawl. It is very soft and expensive.

Processing of wool

There are many steps involved in processing the fur into wool. The process of cutting off the woollen fleece of sheep with a thin layer of skin is called **shearing**.

The wool is used to manufacture sweaters, shawls, blankets, hand gloves etc.

Silk

Silk is also a natural animal fibre. Silk worm secretes the silk fibre. The best known type of silk is obtained from the cocoon of larvae of mulberry silk worm. Silk fabric was first developed in ancient China.

Uses of Silk

Silk is used for making silk clothes, parachutes, insulation coils for telephone and wireless receivers.

MORE TO KNOW

Pure silk is one of the finest natural fibres and is said to be the **"queen of fibres"**

1.4. SERICULTURE

Selvan and Valli attended a marriage function. They notice that some of the women are wearing colourful sarees. Selvan asked his mother, why those sarees are shining?. His mother told him that those sarees are made of silk.

The rearing of silk worms for obtaining silk is called **Sericulture**. It is a very old occupation in India. The silk fibre is obtained from the cocoon of the silk moth. There are varieties of silk moths and the silk they yield is different in texture.

The types of silk are

1. **Mulberry silk**
2. **Tassar silk**
3. **Eri silk**
4. **Muga silk**

The most common silk is mulberry silk. Mulberry silk is superior in quality because it is soft, lustrous and creamy white in colour. It is secreted by the silk producing glands of silk worm.

1. A female silk moth lays hundreds of eggs at a time.
2. The eggs are kept under hygienic conditions and under suitable temperature.
3. When the eggs hatch into larvae, they are fed on mulberry leaves.
4. After 25 to 30 days of feeding, they spin a protective case around them called cocoons.
5. The cocoons are dipped in hot water and the silk fibres are separated.
6. The process of taking out threads from the cocoon is called **Reeling**.
7. The thread is woven into silk cloth.

MORE TO KNOW

It is believed that silk was first dicovered in China by the Empress Si Ling Chi

India is the world's second largest producer of Silk.

Kancheepuram, Siruvanthadu, Thirubhuvanam and Arani are famous for silk in Tamil Nadu.

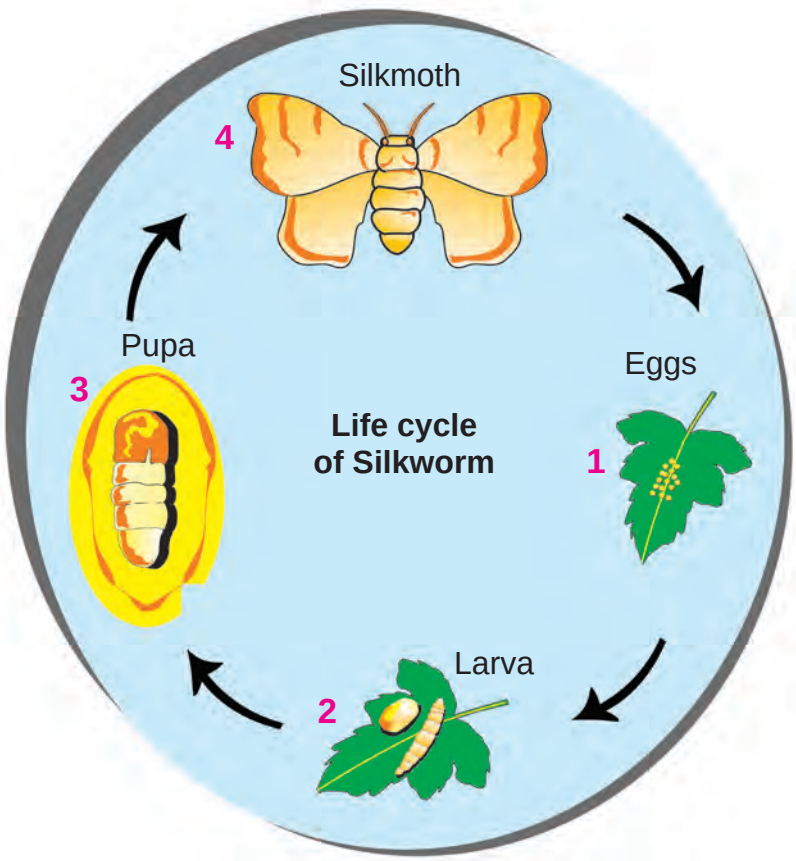


Fig 1.8 Life cycle of Silkworm

ACTIVITY - 1.5

Let us mark the places in the map of Tamil Nadu where silk is produced and woven into fibres and clothes.


Fig 1.9 Queen bee


Fig 1.10 Drone bee

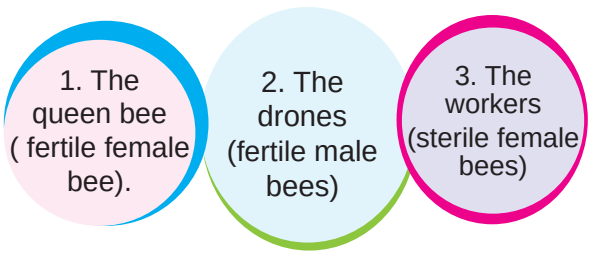

Fig 1.11 Worker bee

1.5. APICULTURE

I am used in cakes.
I am found in sweets.
I am used in medicines.
I am made by bees.
Can you guess who am I?
Yes, I am **HONEY**.

Where do bees live?

Honey bees live in bee hives. A bee hive consists of numerous small compartments called honey combs. Bees live in colonies. There are three kinds of bees in a bee hive. They are



There is only one queen bee in a bee hive. The work of the queen bee is to lay eggs. There are a few hundreds of male bees which help in reproduction. The worker bees are thousands in number. They perform various functions.

Honey is used as food. It is used in the preparation of certain medicines in Siddha, Ayurveda and Unani. Bees also produce wax, which is used for making candles. Some Indian varieties of bees are

1. Rock bee (*Apis dorsata*)
2. Little bee (*Apis florea*)
3. Indian bee (*Apis indica*)

MORE TO KNOW

Composition of Honey.

Sugar	-	75%
Water	-	17%
Minerals	-	8%

Nowadays, bee keeping is practised to produce more honey.The rearing of honey bees to produce honey in large scale is known as **apiculture.** A well known Italian breed called *Apis mellifera* is the best for bee keeping because it has high honey collecting capacity and it does not sting much.

ACTIVITY - 1.6

Shall we check if the honey is pure or not?

1. Let us take a glass of water.
2. Add a drop of honey to it.
3. If the drop of honey reaches the bottom without dissolving, then the honey is pure.
4. If the drop of honey dissolves before reaching the bottom then the honey is impure.

Fig 1.12 Poultry farm

1.6. POULTRY

Selvan and Valli eagerly wait for lunch everyday. They get an egg with their mid-day meal in school. Selvan wants to know from where they get huge amount of eggs.

Valli said that they get the eggs from poultry.

The rearing of hens and other fowls to produce eggs and flesh is called **Poultry farming**. Several kinds of birds like hen, duck, turkey, goose etc.. are reared for the production of eggs and flesh. The place where the fowls are reared is called **Poultry farm**.

Fig 1.13 Broiler Egg - Country Egg

Namakkal district in Tamil nadu is famous for poultry industry.

In our country, hen is the most favourite domestic bird. Poultry keeping has developed into a very big industry. Some varieties of hens are reared for the production of eggs only. Such hens are called **layers.** There are some varieties of hens grown for flesh. They are called **broilers**.

The poultry house should be well lighted and well ventilated. The common poultry feed is grains and lots of fresh water. Hens that hatch eggs are called **Broody hens**. They sit on eggs and keep them warm. This is known as **incubation**. The eggs hatch after 21 days.

Expand TAPCO - Tamil Nadu Poultry Development Corporation.

Silver Revolution

The massive step taken in India to increase egg production by adopting enlightened practices of poultry is called Silver Revolution.

ACTIVITY-1.7

1. Take a broiler egg and a country egg. Differentiate these two eggs.
2. Try making penguins out of egg shells and eye drop lids.

ACTIVITY-1.8

We can distinguish a fresh egg from a rotten one by putting them in a bowl of water.

The fresh egg will sink. But the rotten one will float.

1.7. ANIMAL PROTECTION AND MAINTENANCE

Ever since human beings appeared on the earth, they have been living with animals. Plants and animals are dependent on each other. We have to protect them to maintain the balance in nature because our own survival depends on this.

Domestic animals can be cared by

1. Providing animals with good feed and clean drinking water to keep them fit and healthy.
2. Providing shelters that are clean, airy and well lighted .
3. Protecting them from diseases

MORE TO KNOW

Some of the famous wildlife sanctuaries in Tamil Nadu are Vedanthangal, Mudumalai, Mundanthurai, Kalakadu and Kodiakarai.

Care of WildLife

As people use more and more land to cultivate crops, graze cattle, build houses and factories, animals and plants are being forced out of existence. Poaching, pollution and use of excess pesticides, have killed so many plants and animals. Some have been completely wiped out from the earth. If an animal no longer exists, it is said to be extinct. If they are in danger of becoming extinct, they are said to be **endangered**. Wildlife protection and maintenance is called **wildlife conservation**. Some of the conservation measures are :

1. setting up of National Parks and WildLife Sanctuaries.

2. stringent action against poaching.

3. discouraging deforestation.

Wildlife and forest are the wealth and pride of a country. So it is our moral duty to protect the plants and animals. We can protect our animals by

1. Not harming any animal or plant.
2. Growing trees that provide home to birds and insects.
3. Not buying animal products that are banned.

MORE TO KNOW

Blue Cross is a registered animal welfare society. It helps to find homes for uncared animals, and promote animal protection.

ACTIVITY-1.9

Collect different types of animal eggs. Display in the classroom.

Hen, duck, lizard, crow, turkey.

Varaiadu - The state animal of Tamil Nadu

EVALUATION

1. PICK OUT THE CORRECT ANSWER :-

1. Fibres obtained from an insect _____
   (Wool / Silk)
2. _____ is reared in a poultry farm.
   (Buffalo / Hen)
3. There is only one_____ bee in a bee hive.
   (queen / drone)
4. After incubation, the hen's egg hatch in _____ days.
   (21 / 31)
5. A sheep has a coat of wool for _____
   (man / itself)

2. The following jumbled words denote the stages in the life cycle of a silkworm. Could you write the correct sequence.

   THOM, GEGS, VARAL, APPU

   MOTH -> _____ -> _____ -> _____

3. On the way home you notice a goat with a broken leg. You feel sad and want to help it. Write down the things you would do.

   a) _____

   b) _____

   c) _____

4. Complete the chart given below by observing the following animals in your surrounding.

   crow, cow, lizard, goat, housefly, monkey, butterfly, mosquito, dog, cat.

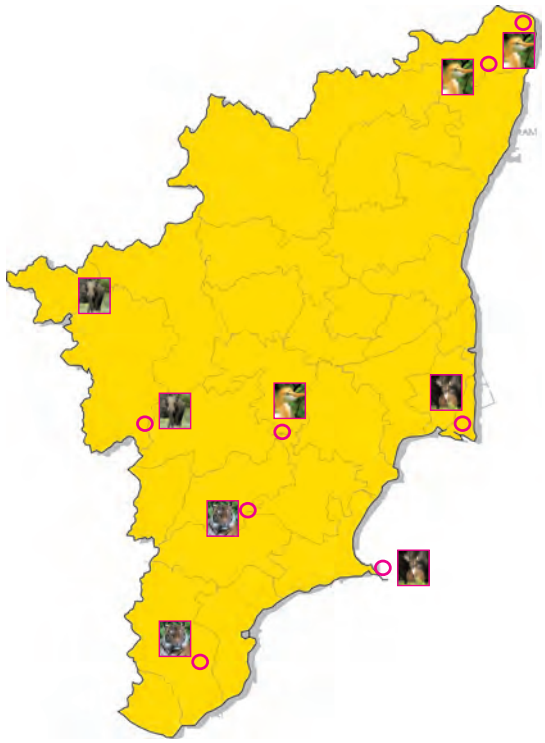
Sl.No.	Animal	Sound it makes	Food it eats	Where it lives	Relationship with man
1. 2. 3. 4. 5.	dog	wow, wow	rice, meat	kennel	friend, guard

5. In the given map of Tamilnadu some famous wildlife sanctuaries are marked.

(a) Name the places.

(b) Find out the animals / birds which are found there.

(c) Mark your place of residence and find the name of the sanctuary near your home.



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Aringar Anna zoologicial Park, Vandalur, Chennai.

CHAPTER 2

NUTRITION

IN PLANTS AND ANIMALS

BIOLOGY

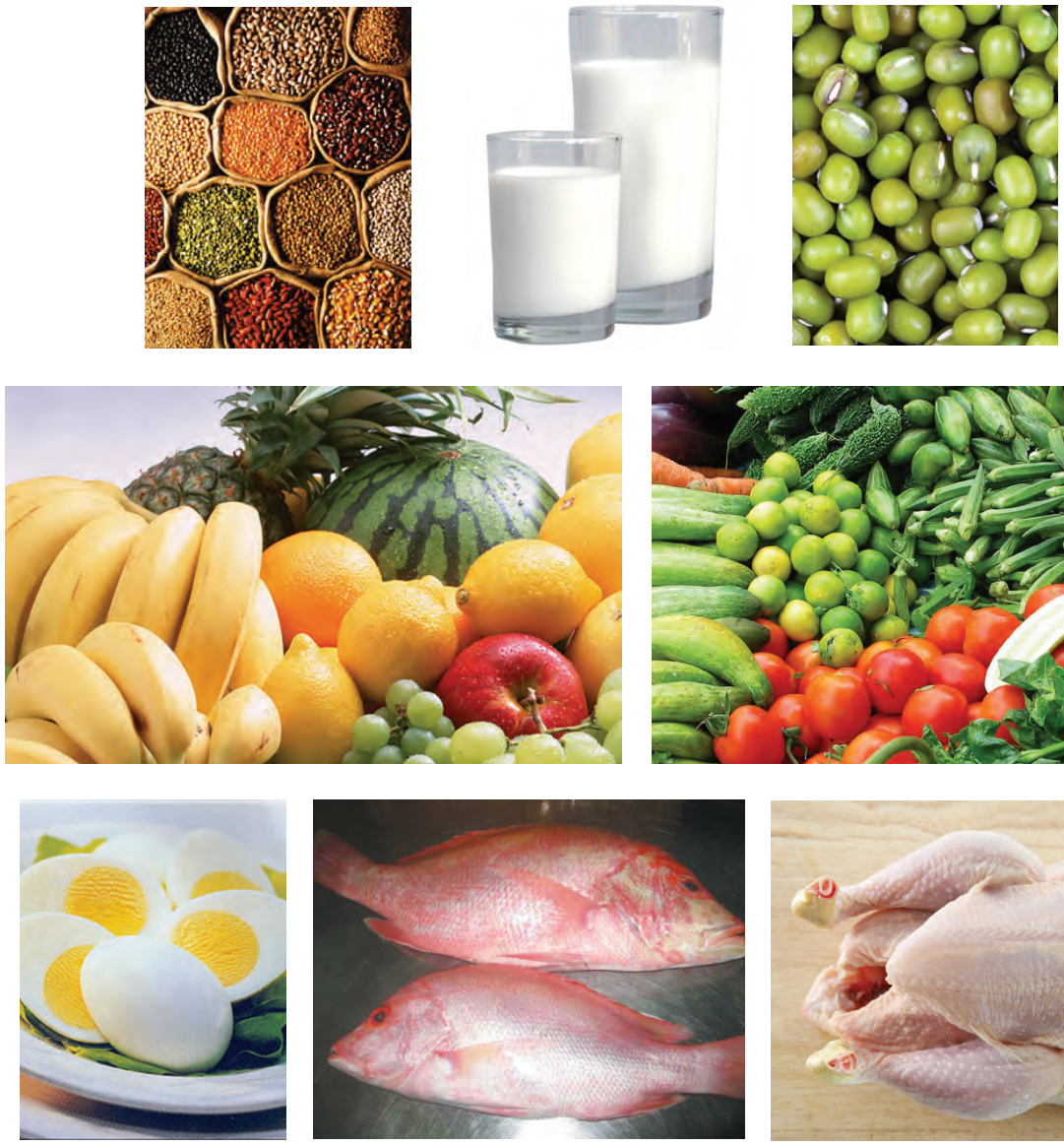


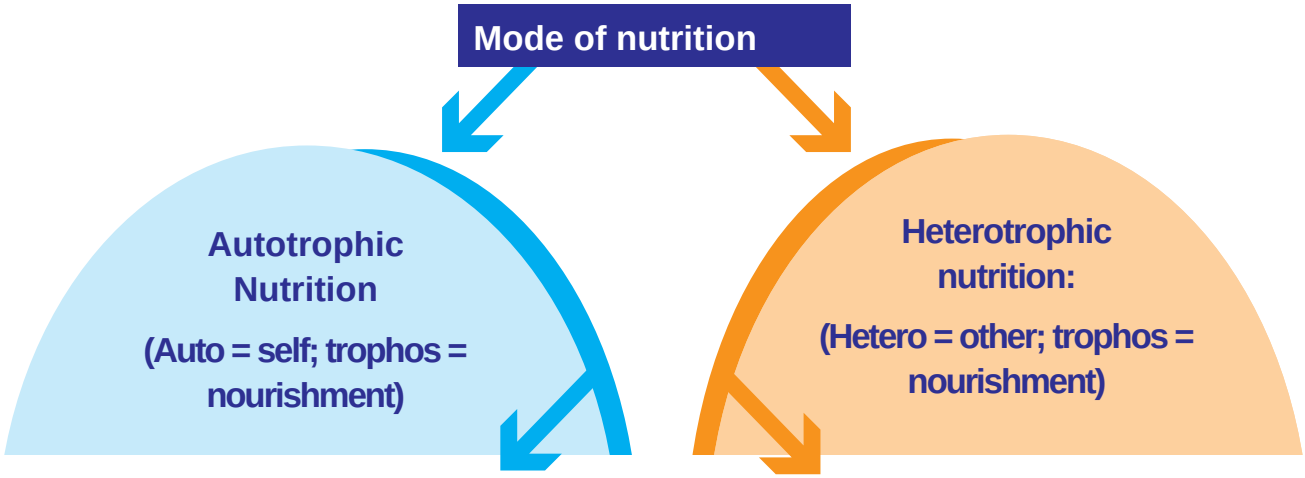
Fig 2.1. Nutritious food

Food is a basic necessity for all living organisms to survive. It is because food provides energy to all living organisms to do their life activities. Food also helps them to grow and build their bodies. How do living organisms obtain their food? Green plants can make their own food by using water and carbon dioxide. Animals cannot make their own food. They depend on plants directly or indirectly for their food. The mode of taking food by an organism and utilizing it by the body is called **nutrition**.

2.1. MODES OF NUTRITION IN PLANTS

There are two modes of nutrition in organisms. They are autotrophic and heterotrophic nutrition.

2.2. AUTOTROPHIC & HETEROTROPHIC NUTRITION



Green plants are the only organisms which can synthesize food for themselves and also for other organisms including us. The mode of nutrition in which organisms make their own food is called **Autotrophic Nutrition** and such organisms are called **autotrophs**.

eg. Green plants.

Non-green plants and most animals (like us) take in readymade food from plants and other animals. The mode of nutrition in which organisms depend on others for their food, is called **Heterotrophic Nutrition** and those organisms are called **heterotrophs**. eg. All animals, including human beings.

2.2.1. PHOTOSYNTHESIS

Dear children, we shall be surprised if we could peep inside a leaf and find that sunlight comes into a leaf through the leaf's skin. Inside, the leaves also have a wonderful green substance called **chlorophyll**.

At the same time air comes into the leaf through tiny openings named **stomata** and water moves up from roots below.

Fig 2.2 Leaf - (inset) Stomata

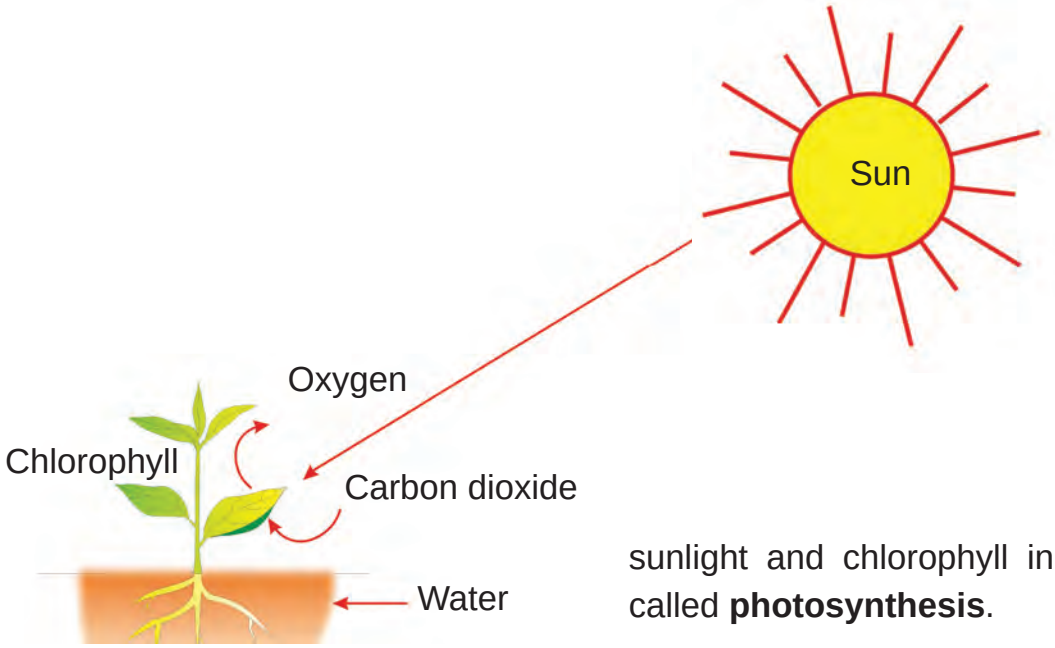


Fig 2.3. Photosynthesis chart

Using sunlight for energy, the chlorophyll changes water and carbon dioxide into food for the plant.

The process of preparing food with the help of water, carbon dioxide, sunlight and chlorophyll in plants is called **photosynthesis**.

Imagine what would happen if there is no sun? In the absence of the sun, there would be no photosynthesis. Hence, there would not be any food. In the absence of food, life would be impossible on earth. So, the **sun** is the **ultimate source** of energy for all forms of life.

Photosynthesis can be represented by the equation given below

$$\text{Water} + \text{Carbon dioxide} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Starch} + \text{Oxygen}$$

There are some leaves of plants which show different colours other than green. Can they do photosynthesis? Yes, they can. The huge amount of red, brown and other pigments eclipse the green colour.

ACTIVITY 2.1

When the weather is sunny, let us put a steel bowl on a patch of grass. Leave the bowl for 5 days. No peeking! Lift the bowl and look at the grass. How is it different from the grass exposed to sunlight?

Fig 2.4 Leaves of various colours

2.2.2. OTHER MODES OF NUTRITION IN PLANTS

There are some non-green plants which cannot prepare the food. They take readymade food prepared by other plants. They follow heterotrophic nutrition. They may be **saprophytes**, **parasites**, **insectivorous** plants etc.

ACTIVITY 2.2

Let us take a piece of bread. Moisten it and leave it for a few days. We can see the cotton like mass growing on it. What is it?

Fig 2.5 Bread mould

Saprophytes

Sometimes we see umbrella-like structures growing on decaying matter on the road side during the rainy season. What are they? How do they get their nutrients?

These organisms are called **fungi**. They grow on dead organic matter. They produce digestive enzymes on the dead matter and change it into simple nutrients. They absorb the nutrients in dissolved form (solution) and utilize it. Such a mode of nutrition is called **saprotrophic** nutrition and those plants are called **saprotrophs**. eg: mushroom, bread mould.

Fig 2.6 Mushroom

Parasites

Shall we look at the picture carefully. we can see yellow coloured tubular structures coiling around the stem of a tree. This is a plant called **cuscuta**. It cannot synthesize food. As it lacks chlorophyll, it depends on the tree on which it is climbing for food. The plant which provides food is called **host** and the plants which consumes it is called **parasite**.

Fig 2.7. Parasite cuscuta (Sadathari)

venus fly trap
(Insect entering)

Fig 2.8. Nepenthes (pitcher plant)

venus fly trap
(Insect trapped)

Insectivorous Plants

We know that many insects eat plants, but we shall be surprised to know that some plants eat insects.

Let us observe the pictures of venus fly trap, pitcher plant. They need to eat insects because their soil does not have certain nutrients like nitrogen for them to grow.

Symbiotic Plants

There is yet another mode of nutrition in which two different types of organisms live together and mutually help each other for nutrition. Lichens are organisms that consist of a fungus and alga. The algae gives food to the fungus and the fungus absorbs water and minerals and gives to algae. Here, both the organisms help mutually. The phenomenon by which two different organisms live together for mutual help is called **symbiosis.** The organisms are called **symbionts.**

Fig 2.9. Lichens

2.3. NUTRITION IN ANIMALS:

Let us observe machines like a car, bus or a train etc. How do they work? They get energy to do work from fuels. Our body is also a machine. We get energy from the food that we eat. Food contains not only energy but also the raw materials needed for body's growth, maintenance and repair. Mostly animals take in solid food. This mode of nutrition is called **holozoic nutrition**.

Fig 2.10 Ingestion

Nutrition includes five steps

1. Ingestion

The process of taking food into the body is called **ingestion**. The mode of intake of food differs in different organisms. eg: Butterflies and bees suck the nectar of the flowers. Snakes (Python) and frogs swallow their food. Aquatic animals (Blue Whale) filter feed.

2. Digestion

The process of breaking down of complex food into simple food with the help of enzymes is called **digestion**.

3. Absorption

The process by which the digested food passes into the blood vessels of the wall of the intestine is called **absorption**.

4. Assimilation

The ways in which the absorbed food is utilized in cells is called **assimilation**.

5. Egestion

The removal of undigested food through anus is called **egestion**.

2.4. NUTRITION IN AMOEBA

Amoeba is a unicellular organism. It lives in the stagnant water bodies. It feeds on microscopic organisms. Though amoeba is a one celled animal, it takes in solid food through its body surface. So the mode of nutrition is holozoic. Whenever the food touches the body surface of amoeba, it engulfs the food with the help of pseudopodia (false feet) and forms the food vacuole. The food is digested with the help of enzymes inside the food vacuole. The digested food reaches the entire cell by diffusion. Amoeba uses the food for getting energy, making proteins for growth, etc. The undigested food is thrown out of the body through its body surfaces.

2.5. HUMAN DIGESTIVE SYSTEM

Think of any food that you like, a sweet, a fruit etc. Let us find out what happens to it when eaten. It passes through the digestive system. This system is made of mouth, oesophagus, stomach, small intestine, large intestine and anus.

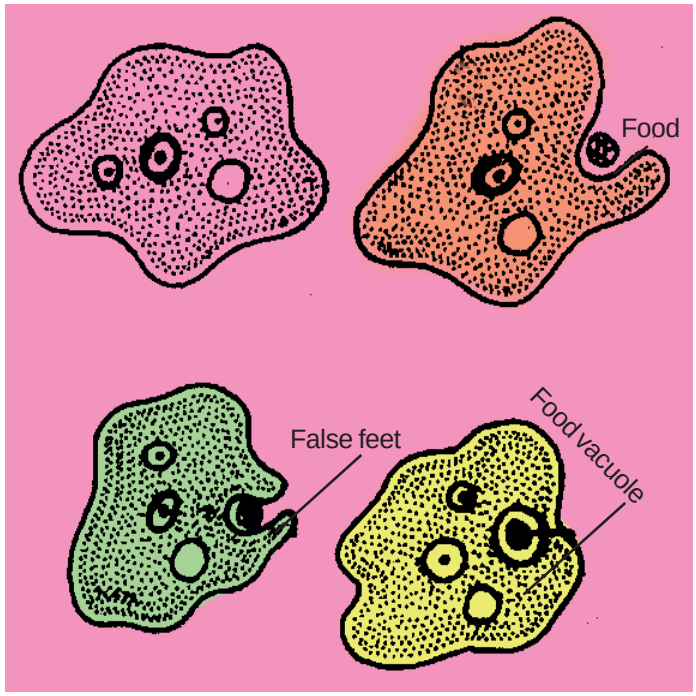


Fig 2.11 Ingestion of food in Amoeba

Mouth

We ingest the food into mouth cavity through mouth. Mouth cavity contains teeth, tongue and salivary glands.

Teeth

Teeth help us to cut the food into small pieces, chew and grind it.

Salivary Glands

There are three pairs of salivary glands in our mouth. These glands secrete a watery fluid called saliva. It makes the food wet so that we can easily swallow it. It contains an enzyme called amylase which helps in the digestion of starch

Tongue

The tongue is an organ of taste. It helps to mix the food with saliva and make it wet. It also helps in rolling and pushing the food while swallowing.

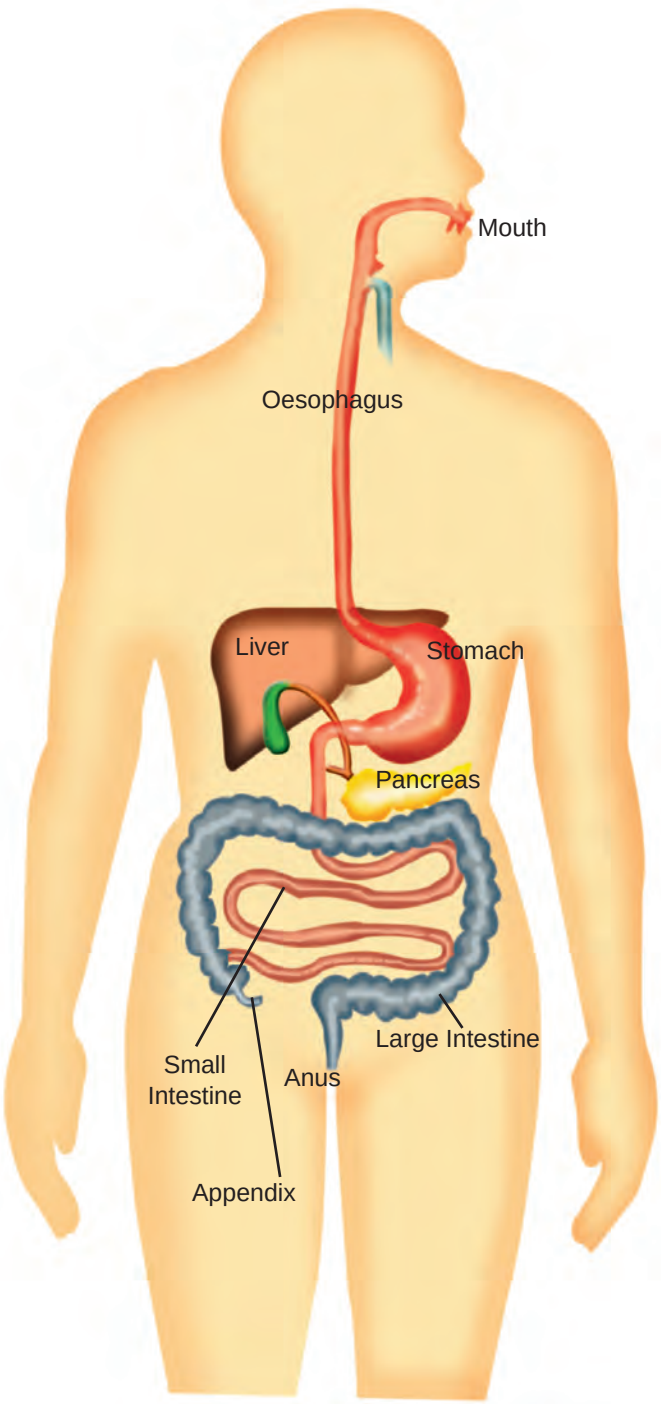


Fig 2.12. Digestive System of man

MORE TO KNOW

Food takes an average of 24 hours to pass all the way through the digestive system.

Oesophagus

It is a tube which connects mouth and stomach. It is also known as food pipe. It helps to pass the food from the mouth to the stomach.

Stomach

Stomach is a bag-like structure where the food is further digested. The food is churned. Stomach secretes digestive juice called gastric juice which helps to digest food.

Small Intestine

It is a very long tube and is about 7 metre in length. Here the food is mixed with bile juice, pancreatic juice and intestinal juice. These juices help in completing the digestion.

At the end of digestion, carbohydrates are broken down into glucose; proteins into amino acids and fats into fatty acids. This digested food is absorbed by the blood vessels in the small intestine.

Large Intestine

It is about 1.5 metre in length and helps in absorbing water. It is the place for temporary storage of undigested food. Digestion does not take place here.

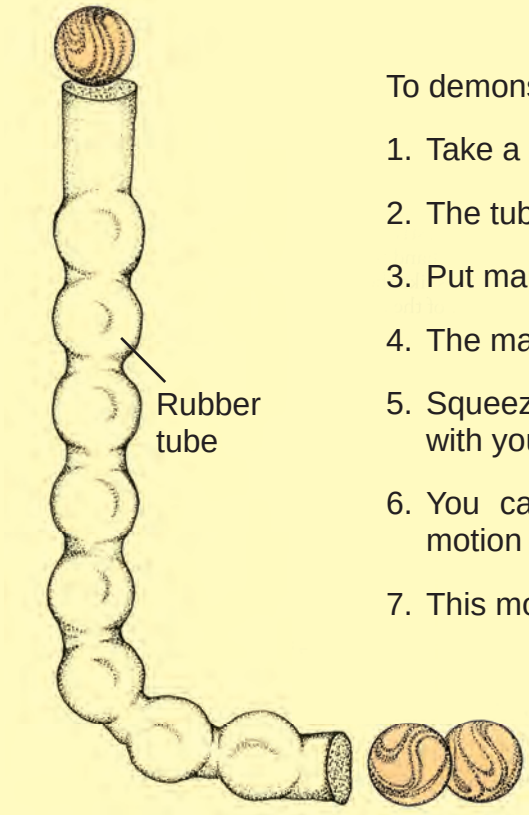
Anus

The undigested food (faecal matter) is eliminated through anus and the process is called egestion.

Let us find out how the food moves in our digestive system.

Food in the digestive system moves from oesophagus to anus by rhythmic contraction and expansion of the wall of digestive system. This movement is called **peristalsis**.

ACTIVITY 2.3



To demonstrate peristalsis.

1. Take a rubber tube and wet it inside.
2. The tube represents the food pipe.
3. Put many marbles into the tube.
4. The marbles represent food.
5. Squeeze the rubber tube from the top with your hand in a forward direction.
6. You can observe a kind of wave-like motion in the rubber tube.
7. This movement represents peristalsis.

2.5.1. TYPES OF TEETH

We all have two sets of teeth in our life time. The first set of teeth grows when a baby is about one year old. This set of teeth is called **milk teeth**. They are twenty in number. Milk teeth stay in a child up to the age of seven to eight years. When the milk teeth fall off, a new set of teeth grow. They are called **permanent teeth**. They are thirty-two in number. Of these, sixteen are in the upper jaw and sixteen are in the lower jaw. All the teeth in our mouth are not the same. There are four types of teeth. They are i**ncisors, canines, premolars** and **molars**.

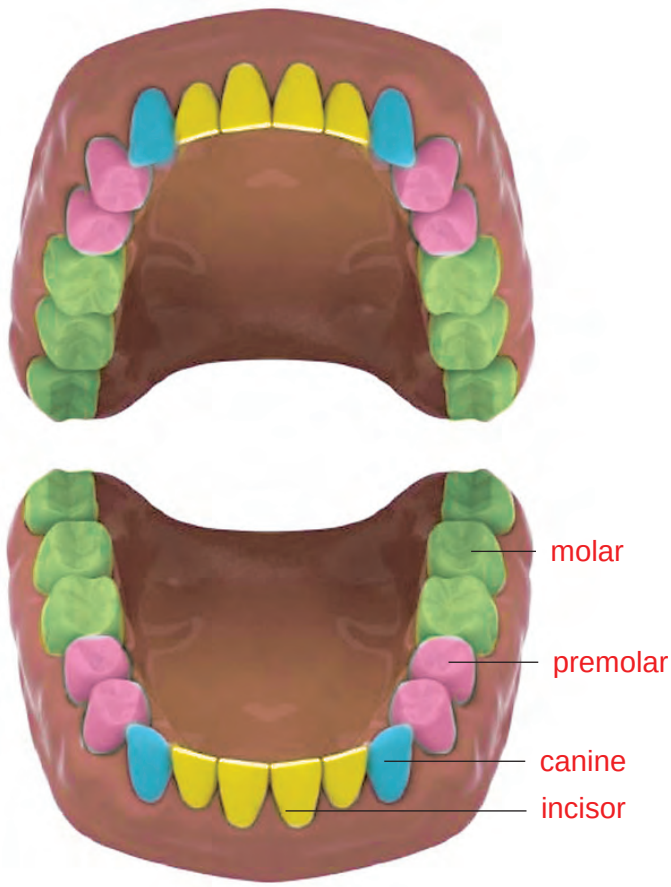


Fig 2.13. Types of Teeth

Incisors: These are chisel shaped teeth at the front of the mouth. They are eight in number. Four are present in each jaw. These are used for biting the food.

Canines: These are sharp and pointed teeth. They are four in number and two are present in each jaw. Canines are used for cutting and tearing of food.

Premolars: These are large teeth behind canines on each side. They have large surface. They are eight in number and four are present in each jaw. They help in chewing and grinding the food.

Molars: These are very large teeth present just behind the premolars. They have more surface area than premolars. They are used for chewing and grinding of food like premolars. They are twelve in number, and six are present in each jaw.

Tooth Care

Permanent teeth serve for life time. They are not replaced like the milk teeth. Hence, great care should be taken for keeping the teeth clean.

The enamel in the teeth of children is much thinner than on the teeth of adults. So, teeth of children are more liable to decay than those of adults. Children should avoid very cold or very hot food. They should brush twice a day. Teeth should not be rubbed with hard things like brick powder.

ACTIVITY 2.4

Let us take any fruit. Enjoy eating it. Now find out.

Function	Teeth
Biting	
Tearing and cutting	
Chewing and grinding	

"Valli... are there animals without teeth?"

"Yes Selva, Bluewhale, the largest mammal does not have teeth.

MORE TO KNOW

Interesting facts about teeth in other animals.

1. Birds have no teeth.
2. Rats have continuously growing teeth.
3. The tusks of elephants are actually incisors that have become very long.
4. Very few adult humans have all the 32 teeth.

2.6. RUMINANTS

Shall we observe some grass eating animals such as goat, cow and buffalo. They keep on chewing even when they are not eating or at rest. They have an interesting digestive system. In fact they eat grass hurriedly and swallow quickly and store it in the first chamber of the stomach called **rumen**.

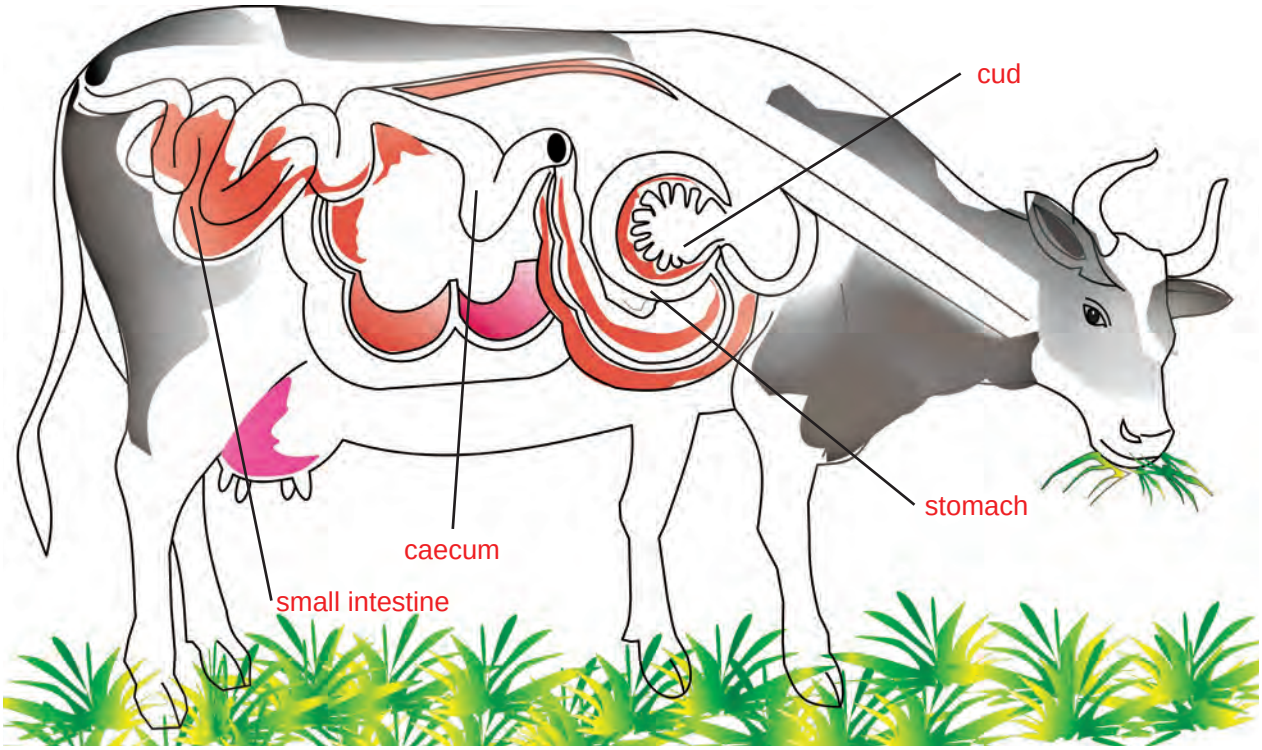


Fig 2.14 Ruminant - Cow

In the rumen, the grass is fermented with the help of certain bacteria and the partially digested grass is called cud. Later, the cud is brought back to the mouth in small quantities and the animal chews it. The process of chewing the cud is called **rumination**. Animals which chew the cud are called **ruminants**.

Grass is rich in cellulose which is a kind of carbohydrate. Herbivorous animals can digest it. The other animals and humans cannot digest cellulose. There is a sac-like structure called caecum between the small and large intestine in ruminants. This sac contains some bacteria which produce an enzyme called cellulase which digest the cellulose.

ACTIVITY 2.5

From the given list of animals, shall we find out the ruminants and the non ruminants:

Bison, deer, horse, camel, rabbit, and donkey.

MORE TO KNOW

A Cow makes 40,000 to 60,000 jaw movements per day while it keeps on chewing and rechewing.

EVALUATION

1. From the given list of living things list out the autotrophs and heterotrophs.

grass, snake, neemtree, man, mushroom, amoeba, mangotree, cabbage, cow, sunflower.

S.No.	AUTOTROPHS	HETEROTROPHS
1. 2. 3. 4. 5.		

2. Fill in the boxes with the given words to complete the equation for photosynthesis.

water, starch, oxygen, sunlight, carbondioxide, chlorophyll.

3. Given below is a list of food items with their constituents. In the table given below write the names of the food that you took yesterday and tick the constituents in it.

Idli	-	Carbohydrates
Dosai	-	Carbohydrates, protein
Sambar	-	Protein, vitamin, minerals, fat
Rice	-	Carbohydrates
Egg	-	Protein, fat
Channa sundal	-	Protein
Vegetable poriyal	-	Vitamins, minerals
Vadai, milk	-	Fat, protein
Fish	-	Protein
Millet (Kambu/Cholam)	-	Carbohydrates
Greens	-	Vitamins, minerals

	Food you took	Carbo hydrate	Protein	Fat	Vitamin	Mineral
Breakfast Lunch Snacks Dinner						

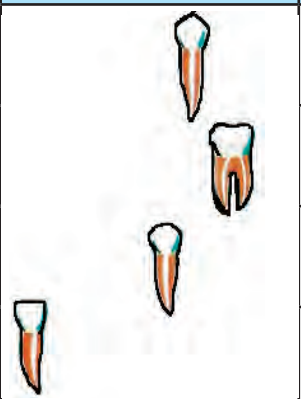
Could you find out the nutrient missing in your diet.

4. Observe the teeth of your family members. Count the teeth and record below.

S.No	Family member	Jaws	Incisors	Canines	Premolars	Molars
1.	Father	U				
		L				
2.	Mother	U				
		L				
3.	Self	U				
		L				
4.	Brother	U				
		L				
5.	Sister	U				
		L				
6.		U				
		L				

Dental formula of human being =I $\frac{2}{2}$; C $\frac{1}{1}$; PM $\frac{2}{2}$; M $\frac{3}{3}$ x2 = 32

5.Find out the teeth, (Look at the diagram) and list its use in human being.

S.No	Picture of teeth	Name of the teeth	Uses
1.			
2.			
3.			
4.			

FURTHER REFERENCE

Books

Biology(5th edition) - Sylvia.S.Mader, Brown publishers, U.S.A.

How the body works - Steve Parker, DK Ltd, London.

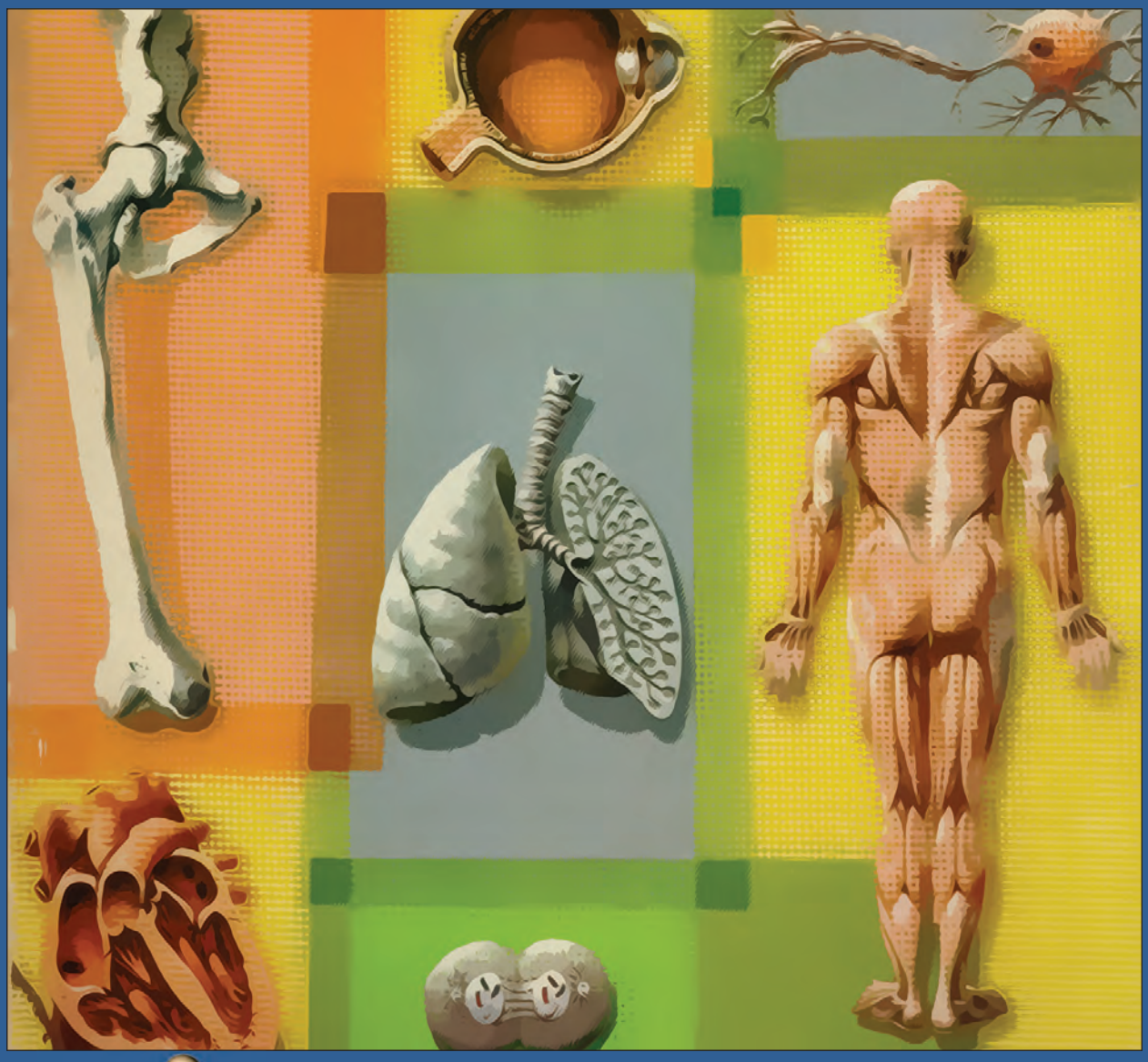
Websites

http;//www.jbpub.com/biology

www.phschool.com/science/biology/photosynth/overview.htm

BIOLOGY

CHAPTER 3



HUMAN

BODY FORM AND FUNCTION

BIOLOGY

Ravi visited the site of his newly built house. He asked his father how a house is constructed? His father explained that a house is made of sand, bricks, stones and cement. Ravi wondered what his body was made of.

When man and a building are compared as the structural organization the following matches are very striking.

Brick	**-**	**CELL**
Brick, mortar, Iron rod	**-**	**TISSUE**
Wall	**-**	**ORGANS**
Home	**-**	**ORGANISM**

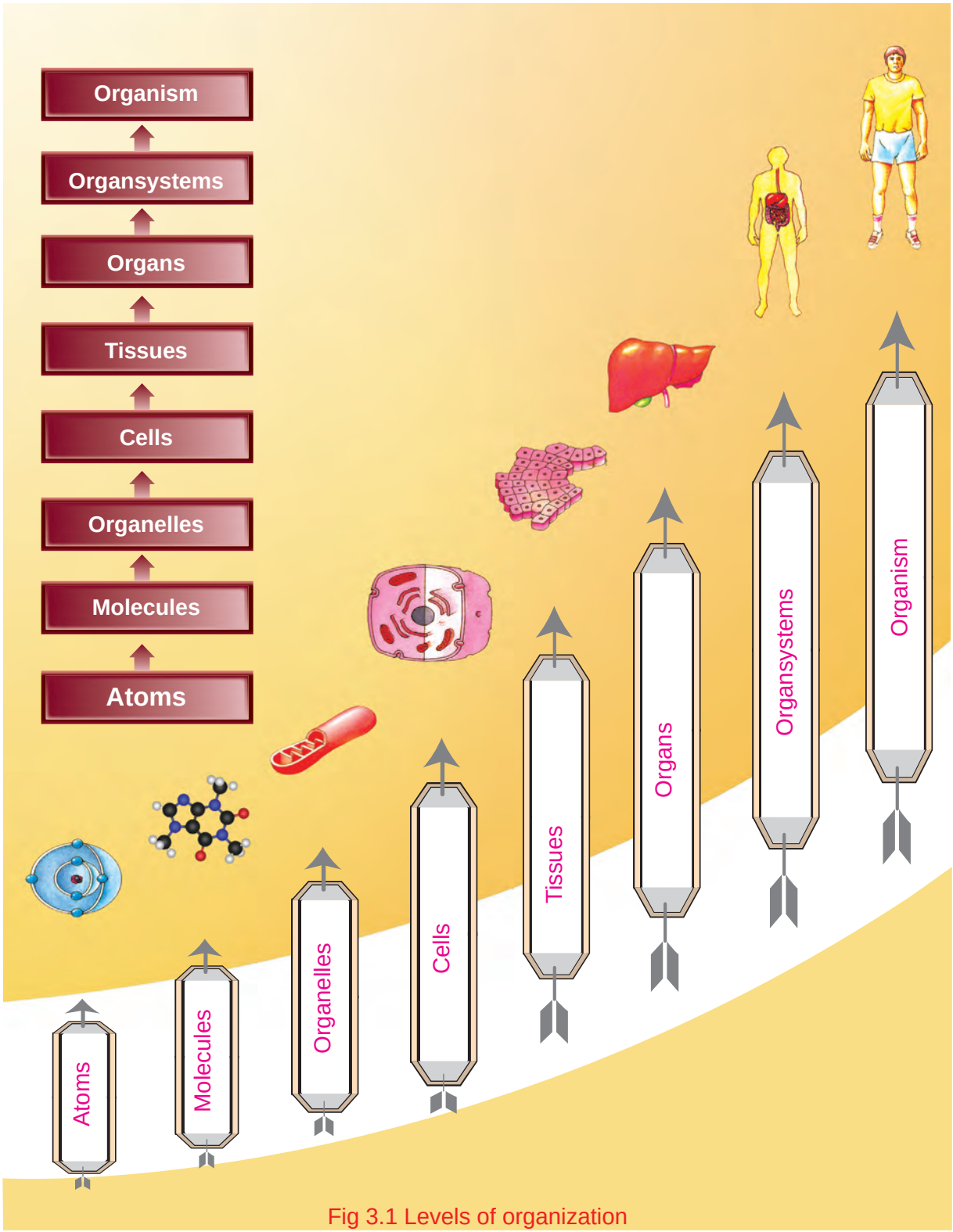


Fig 3.1 Levels of organization

Children, let us know....

that one of the striking features of all living things is their excellent organization. The human body is composed of special structures with specific forms and functions. All these structures work in coordination with one another.

3.1. STRUCTURE AND FUNCTIONS OF ALL THE HUMAN ORGAN SYSTEM

We have already learnt that our body is made up of organ systems. There are about ten organ systems in our body.

Let us study in brief about organ systems.

MORE TO KNOW

The skin is the heaviest organ of our body and weighs about 7 kg.

1. Integumentary System

The Integumentary System includes the skin, hair, nails, sweat glands and oil glands.

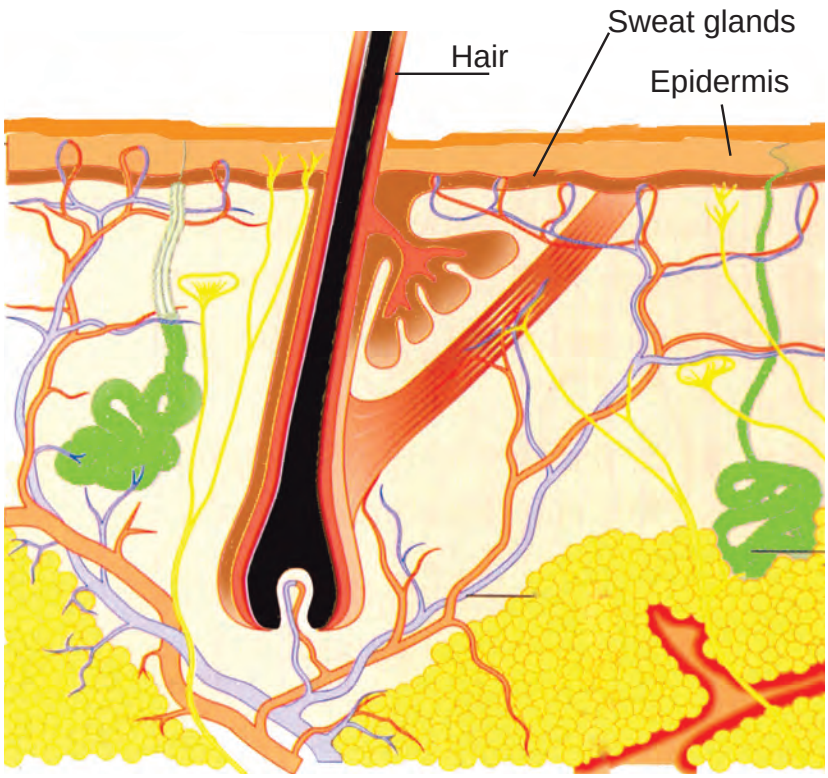


Fig 3.2 Cross section of Skin

Raju was playing in the field when he was pricked by a thorn. He was curious to know how we feel the pain.

Skin is a sense organ, it helps us to feel.

Functions of skin

1. Protects the inner parts of the body.
2. It works as an excretory organ by sweating.
3. It acts as a sense organ.

2. Digestive System

1.Ingests and digests the different types of food.

2.The digested food molecules are absorbed into the blood stream.

3 .Undigested waste is egested.

3. Respiratory system

1.Procures oxygen from the surroundings and conducts oxygen to blood stream.(Inspiration)

2.Oxygen is used to combust the food and carbondioxide produced in these process is eliminated to the surroundings.(Expiration)

Fig 3.3. Skeletal System

4. Skeletal System

The Skeletal System includes bones and other tissues such as cartilage, ligaments etc. In our body. The Skeletal System is made up of 206 bones. All the bones are connected by joints and form the framework to the body.

Function

1. Skeletal System provides a frame work to the body and helps in movements.

2. It protects many internal organs such as brain, heart, lungs etc.

3. It produces blood cells like Red Blood Cells, White Blood Cells and platelets.

5. Muscular System

The Muscular System is made up of three types of muscles. They are skeletal muscles, smooth muscles and cardiac muscles.Skeletal muscles are attached to the bones. Smooth muscles are found in the walls of blood vessels and in the lining of hollow organs such as stomach, intestine etc. Cardiac muscle is exclusively found in the heart.

Fig 3.4. Muscular System

Function

1. Skeletal muscles give shape to the body and makes possible the movements in our body.

2. These muscles generate heat required for maintaining our body temperature.

3. Other muscles bring out movement in the internal organs

6. Circulatory System

The Circulatory System transports substances from one part of the body to another. It is made up of the heart and blood vessels and blood flows through them. The heart is the pumping organ. It pumps the blood into the blood vessels which carry the blood to all parts of the body and brings back the blood to the heart.

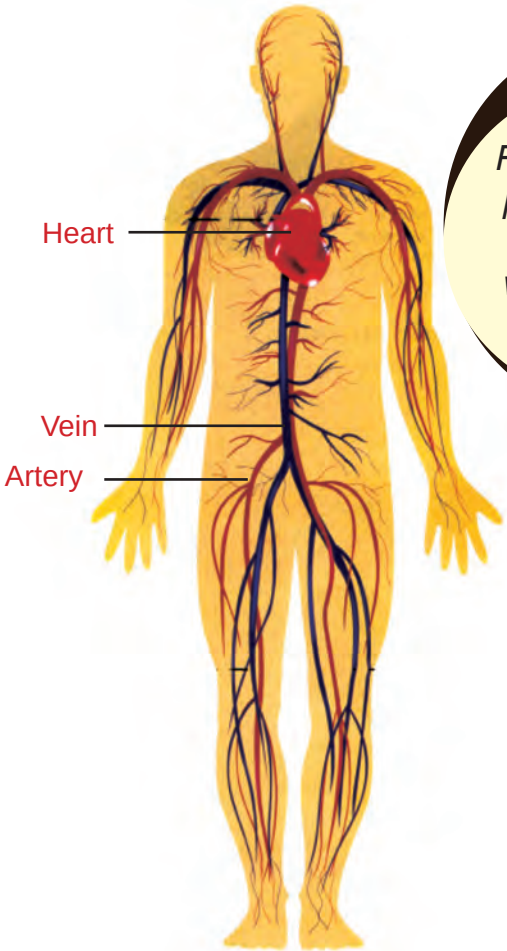
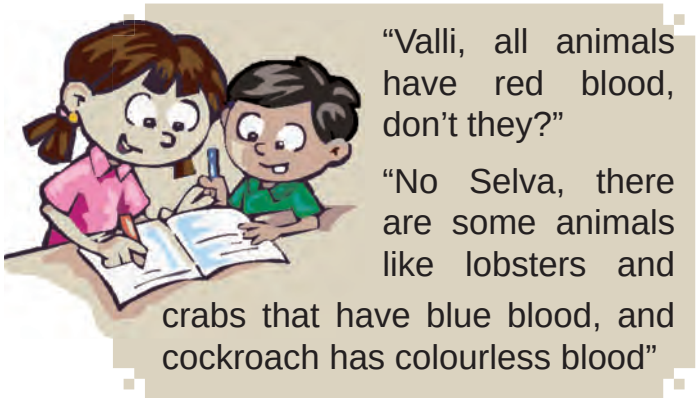


Fig 3.5 Circulatory system

RBC contain red pigment named haemoglobin, which gives red colour to the blood



"Valli, all animals have red blood, don't they?"

"No Selva, there are some animals like lobsters and crabs that have blue blood, and cockroach has colourless blood"

Functions

1. Blood transports nutrients, oxygen, wastes, hormones.

2. It regulates water level and body temperature.

3. Blood vessels are of three types: arteries, veins and capillaries.

7. Nervous System

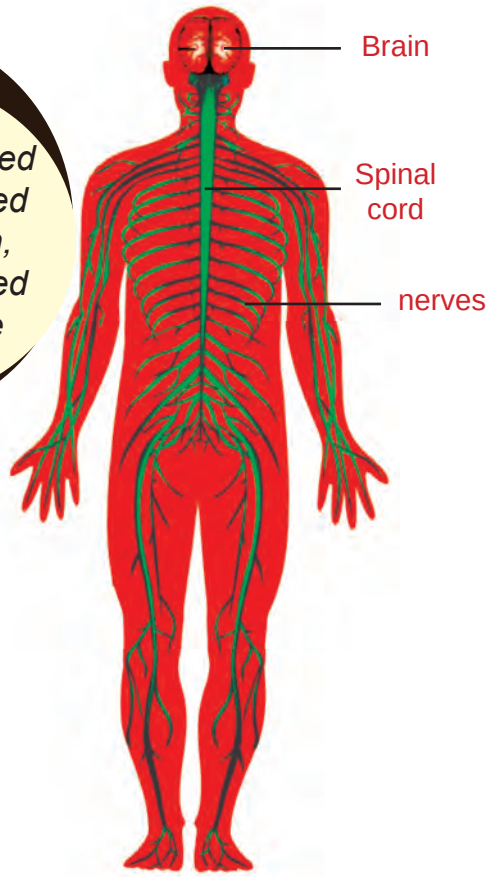


Fig 3.6 Nervous system

Nervous System is composed of the brain, spinal cord and nerves. The nervous system is divided into Central Nervous System (CNS) and Peripheral Nervous System (PNS). There are five sense organs which help us to know the outside world. They are eyes, nose, ear, tongue and skin.

The CNS is made of brain and spinal cord. The PNS consist of cranial nerves and spinal nerves.

MORE TO KNOW

Our facial expressions are made by the action of about forty muscles.

8. Endocrine System

A group of ductless glands form a system called Endocrine System in our body. These glands secrete chemicals called hormones. These hormones are transported to the target organs through blood. Hormones regulate body functions.

9. Excretory System

The Excretory System helps in the removal of wastes. It is made up of a pair of kidneys, a pair of ureters, a urinary bladder and urethra. The blood is filtered and the waste is separated to form urine and is expelled periodically.

10. Reproductive System

The Reproductive System is composed of mainly testes in males and ovaries in females. The testes produce male gametes called sperms. The ovaries produce female gametes called eggs. The purpose of this system is to produce new individuals for the survival of human race.

3.2. THE BODY AND HEALTH AS UNDERSTOOD IN THE INDIAN SYSTEM OF HEALTH CARE

Fig 3.7. Siddha vaidhya

Health Care is the prevention and treatment of illness. Most of the rural poor rely on Siddha and Ayurveda.

Siddha system of medicine (Tamil maruthuvam)

Siddha vaidhya is an indigenous traditional system originated in Tamilnadu. It has references from age old literatures such as 'Thirumandiram', 'Thirukkural' and 'Tholkappiam'. The siddha is a Dravidian system of medicine which has practisied in neighbouring states of Kerala, Karnataka and Andhra. The Siddha medical system was founded by a group of 18 spiritual people called Siddhars. The word Siddhar is derived from "Siddhi" which means "Eternal Bliss". Agastiyar, being the first Siddhar, is called the Father of Siddha medicine.

The concept of the Siddhars is **"FOOD IS MEDICINE, MEDICINE IS FOOD"**. Diet and lifestyle play a major role in health and in curing diseases. The medicines are manufactured from Mooligai (plant), Dhatu (metal and minerals) and Jeeva (animal products). Around 1,200 herbs are used in the preparation of medicine. The treatment concept of Siddhars is to treat initially with leaves, then roots of the herbs. If the severity is not reduced, then go for Paspam.

Some of the medicines used in Siddha are **Chooranam, Mathirai, Thailam, Legiyam, Rasayanam, Paspam, Chendooram** and so on.

Ayurveda

It is an ancient system of natural and medical healing that originated in India. Ayurveda means Science of Life (Ayur = Life, Veda = Science). The object of Ayurveda is to counteract the imbalance of Vatham, Pitham and Kabam from which the body originates. This system of healing believes in treating the ailments of body, mind and spirit. The most amazing part of Ayurveda is that it uses almost all methods of healing like Yoga, Meditation, Purification and so on. In Ayurveda, herbs, massages, diet and exercises which are individually used to heal a number of ailments.

Fig 3.8. Ayurvedha

MORE TO KNOW

Homeopathy Medicine

Homeopathy is a form of alternative medicine, first proposed by German physician Samuel Hahnemann in 1796.

Unani Medicine

Unani Medicine is a form of traditional medicine based on the teachings of Greek physician Hippocrates, and Roman physician Galen, and developed in to an elaborate medical System by Arab and Persian physicians.

3.3. DISEASES, DISORDERS AND PREVENTION

Diabetes mellitus

The food that we eat is broken down into glucose. Glucose is a source of energy needed for all living things. Insulin is a hormone secreted by pancreas to control glucose level. When the blood glucose level exceeds the normal limit (80-120mg/dl) the person is affected by Diabetes.

Diabetes is a not a disease but a disorder. It may lead to harmful conditions like obesity, hypertension, heart disease, etc., It is due to lack of physical activity, unhealthy food habits and lack of insulin.

Valli :- Can diabetes be prevented?

Inba:- Yes. Diabetes can be prevented by practising healthy food habits and regular physical activity.

Valli:- Inba, what are healthy food habits?

ACTIVITY 3.1

Given below are names of some medicinal plants. Shall we find out their uses.

Pepper	
Turmeric	
Garlic	
Thulasi	
Neem	
Aloe vera	
Mint	

Inba:- Healthy food habits are

1. eating right amount of right type of food at regular interval.
2. drinking 8 to 10 glasses of water per day.
3. increasing intake of fibre rich foods like greens, green leafy vegetables, whole grains and seasonal fruits.

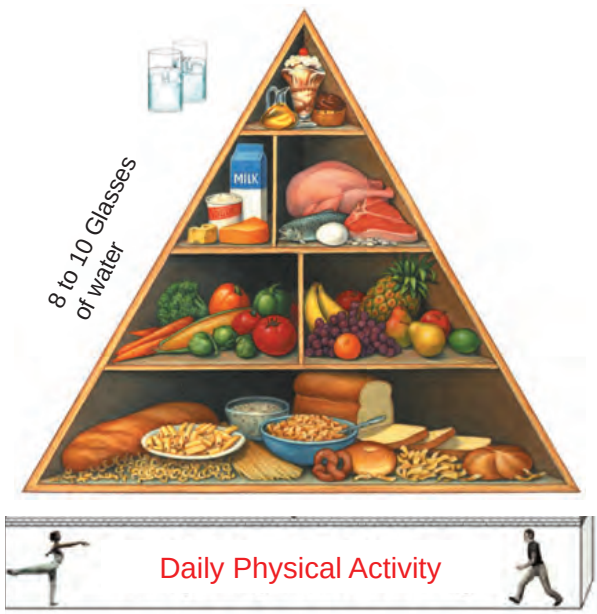


Fig 3.9. Healthy Indian diet pyramid

3.3.1 ADVANTAGES OF PHYSICAL ACTIVITY

One evening Chandra and Amara went with their grandfather to a park. The children were tired after playing but found their grandfather still walking. Chandra asked her grandfather how he could be so active. Grandfather replied that he had neither been to a hospital nor had he taken any medicine in his life. His body was fit because of the exercises that he did everyday.

Shall we find out the importance of physical exercise?

Exercise is essential for all human beings. Aerobic exercises supply oxygen efficiently to the muscles, heart, lungs and the circulatory system. A good supply of oxygen to the body is a sign of good health. Some examples of aerobic exercises are:

1. Jogging
2. Playing basketball
3. Playing football
4. Swimming
5. Cycling
6. Brisk walking for a long distance
7. Yoga and aerobic dancing

These exercises can be followed daily.

Advantages of physical exercise

1. Exercise makes the muscles of the heart, lungs and different parts of the body strong. Children must be physically active for atleast 60 minutes everyday.
2. It burns unwanted calories, reduces weight and prevents obesity.
3. It helps in lowering the blood glucose level.
4. It helps in reducing blood cholesterol level.
5. It reduces hypertension and improves the quality of life.

Playing

Cycling

Swimming

Walking

Fig 3.10

3.4. PRESERVATION OF FOOD

When milk or meat are left open on a table for a day, they get spoiled. But when rice or sugar is stored at room temperature, they do not get spoiled. Why? There are certain food items which gets spoiled soon at room temperature due to more moisture content in them. Such food items are called **perishable food**. eg. Fruits, vegetables, milk, meat etc.

There are certain food which do not get spoiled at room temperature as they are dry in nature. Such food are called as **non-perishable**.

In order to avoid wastage of food from spoilage, food items are processed and preserved in different ways. The milk we get in sachet is an example. There are several methods of preserving food. Some are age old methods and others are the results of modern development in science.

What is preservation of food?

The process of keeping the food for long time without spoilage is called preservation of food.

Purpose of Preservation

1. To prevent the loss of food from spoilage.
2. To retain the colour, taste and nutritive value of the food.
3. To make the food available throughout the year.
4. To add variety to our meal.

3.4.1. METHODS OF PRESERVATION

Preservation involves the prevention of growth of bacteria, fungi and other microorganisms in the food. Even action of the enzymes within the food should be prevented. There are some common methods of preserving food like drying, freezing, heating, addition of salt or sugar. Some modern methods like irradiation is also used to preserve food. Let us study some of the common methods of food preservation.

Drying

This method involves the removal of water from the food by drying. The harvested cereal grains are properly dried in the sun to reduce the moisture in them. This prevents the attack by insects, fungi and bacteria.

Heating

Heating is a method of food preservation. It kills the microorganisms and denature the enzymes present in the food. Hence food is stored safely. eg. Boiling milk before it is stored or used. Whenever we think of heating, the word ‘pasteurized milk’ comes to our mind. The process

Fig 3.11 Drying of Fish

of heating milk to a temperature of 70°C to 75°C for some times and suddenly cooling and storing it is

Fig 3.12 Milk

called **pasteurization**. This method was discovered by Louis Pasteur.

Freezing

Food like meat, and fish are frozen so that the very low temperature prevents water activity, thus the microbial growth and enzyme activity can be prevented.

Fig 3.13 Refrigerator

Addition of salt: When salt is added to food, salt removes the water from food by osmosis. When there is no moisture in the food, microorganism and enzymes cannot act on the food. Food like meat, fish, gooseberry , tamarind, raw mangoes etc. are preserved by salting.

Addition of sugar: When sugar is added to food, sugar dissolves in the water content of the food and does not allow the water to be available. So, in the absence of water, microbes do not grow. Hence the food is preserved. Preservation of food by adding sugar not only saves the food from spoilage, but also produces new food such as jam, jelly, murrabbas, squash etc.

3.4.2 FAST FOOD AND ITS ILL EFFECTS

Fast food is liked by almost everyone today for a variety of reasons. Fast food is easy and convenient to be cooked within a short time. It's taste and flavour can also be appreciated by everyone. Food, today is no more home cooked wholesome food but processed food and food with multiple additives.

Fast food, if eaten in large quantities on a regular basis can be the cause of an array of ailments like obesity. Fast food covers a wide range of products, like processed food, pre-prepared foods like burgers, fries, vadai, samosa, bajjis etc. These foods are highly unhealthy and can never give the nutrients and vitamins of a wholesome home-cooked meal.

They are low on the nutritional elements and hardly provide any benefit to the body. Foods like pastas, pizzas, burgers, noodles, bajjis, samosas etc are high on the taste quotient.

Fast food, if consumed on a regular basis over a period of time, can have devastating effects on the overall health of an individual. Most families have a number of earning individuals which leave them with no time or energy to do conventional cooking using fresh food ingredients.

Negative effects of Fast food

Fig 3.14 Fast Food

1. Fast foods have a very high energy density. Energy density refers to the amount of calories an item of food supplies in relation to its weight. Foods with a high energy density confuse the brain's control system.

2. Continuos in take of fast foods leads to weight gain and obesity. This is because fast food interferes with normal appetite control systems.

3. The human appetite was designed for low energy density foods and not for high energy dense foods.

4. Fast food may speed up the risk of clogged arteries which can lead to heart attacks.

The fast food meals are high in saturated fats and low quality carbohydrates, white bread and lots of baking soda. Our bodies require fibre and more healthy types of saturated fact. Fast food represents a dietary pattern that is the opposite of what is recommended for a healthy body.

"Fast Food can be delicious but a silent killer"

3.5. SCIENCE TODAY. IRRADIATED FOOD

Heating, drying, pickling, cold storage are some traditional methods of preserving food. But, nowadays, food can be preserved by some modern methods like irradiation - a process by which food is exposed to X-rays or Gamma rays or Ultraviolet rays. These rays are powerful enough to kill the bacteria and the moulds.

Will irradiation destroy the taste and nutritional value of the food? No, Irradiation does not destroy the taste

Fig 3.15 Irradiated foods

or nutritive value of foods. Onions, Potatoes, sprouted grams etc. remain fresh when exposed to radiation.

Some people are of the opinion that irradiation may lead to formation of toxic substances. But it is not so.

EVALUATION

1. The following words are the various levels of organization in man. Arrange them in correct sequences.

   Atoms, Cells, Organs, Organelles, Tissues, Organism, Molecule, Organ system.

2. Observe the given table with a set of organs in column A. In each set there is an odd organ. Pick out the odd one and write it in column B. Identify the remaining three. To which system does it belong. Note it down in column C.

S.No.	A	B	C
1.	saliva, bones, liver, pancreas	bones	digestive system
2.	skin, hair, nail, tooth		
3.	arteries, veins, fingers, capillaries		
4.	brain, spinal cord, nerves, kidney		

3. Match the following:

a] Drying	Jam
b] Boiling	Fish
c] Addition of sugar	Silent killer
d] Freezing	Dry cereals
e] Fast food	Milk

4. Diet and life style play a major role in preventing sickness and keeping us healthy. Write down any 3 “I will do” and any 3 “I will not do”.

S.No.	I will do	I will not do
1.	exercise daily	eat fast food
2.		
3.		
4.		

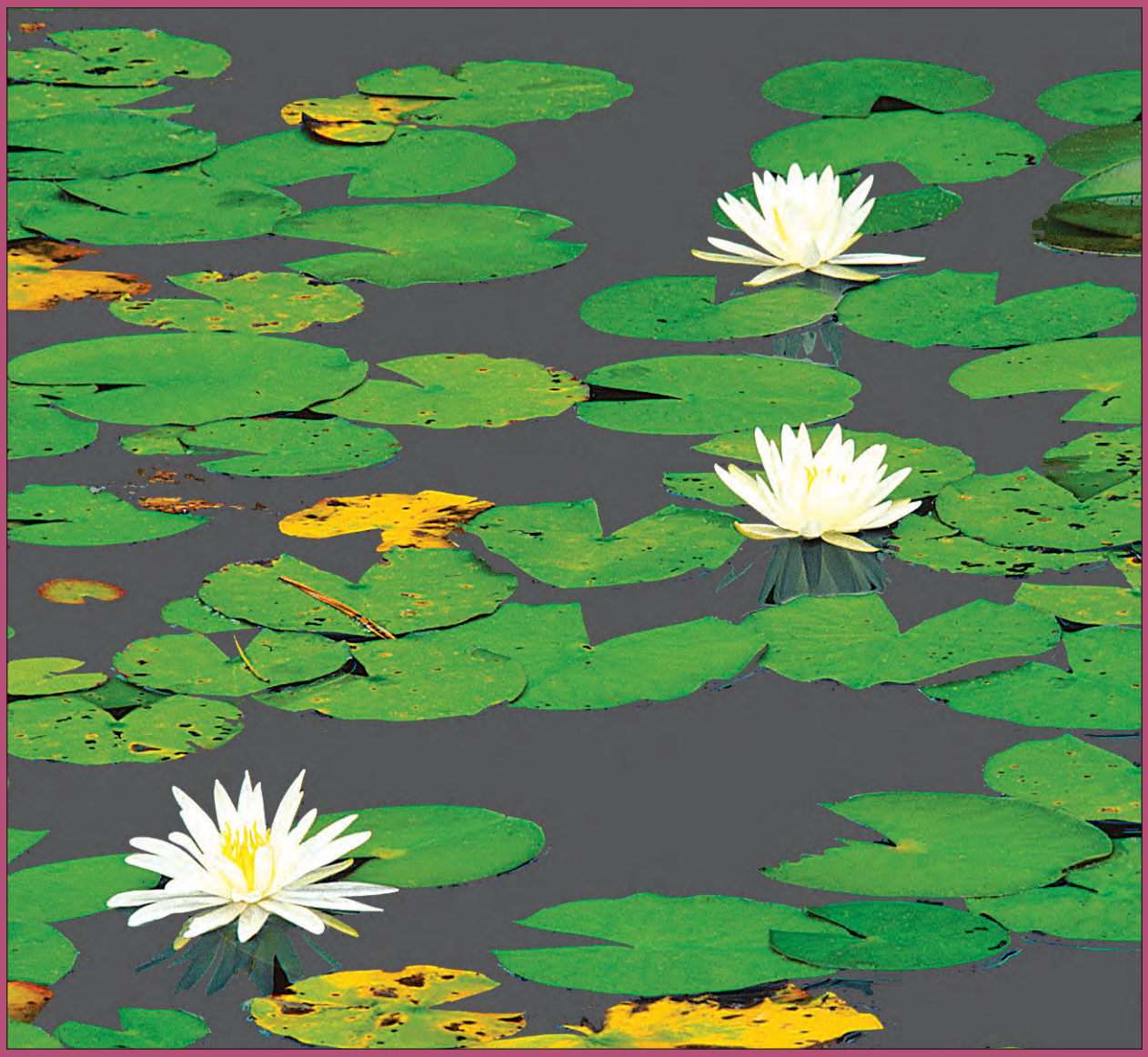
5. Ravi is obese and over weight. His glucose level is also high. His mother seeks the advice of a doctor. The Doctor suggests a daily activity. What could be the suggested activity?----------

FURTHER REFERENCE

Places of scientific importance for visit

IFGTB - GASS FOREST MUSEUM - Coimbatore.

CHAPTER 4



PLANT
MORPHOLOGY

BIOLOGY

Fig 4.1 Vegetables

Mani and Mythli are helping their mother in the kitchen.

Mother : Children, will you help me to make a fresh vegetable salad?

Mani : Sure Amma. We will be glad to help you.

Mother : Choose some vegetables that you want from the basket.

Mani and Mythli select tomato, spinach, cabbage, groundnut, cucumber, green peas, carrot and beetroot.

Shall we classify them.

Roots	Leaves	Fruits	Seeds

The Children make a tasty salad with the different parts of the plant.

4.1. CHARACTERISTICS OF LIVING THINGS

Things that have life are called living things.

eg. Plants and animals.

Things that do not have life are called non- living things.

eg. Rock, book.

Among living things, some are plants and some are animals. Now the question is, how do living things differ from non-living things?

Living things show the following characteristics, whereas non-living things do not.

All living things

- need food,
- respire to convert food into energy.
- grow at certain stages of life.
- respond to their surroundings.
- live for a definite span of time.
- reproduce their own kind.
- are made up of cells.

4.2. HABITAT - VARIOUS HABITATS OF PLANTS

Children, shall we go for a walk around our school and make a list of different plants and animals there. We see different varieties of plants around us. All plants are well adjusted to the place where they live. The living place of a plant provides food, shelter and suitable climate to survive and reproduce successfully. Such a place of living is called a habitat. In nature, plants live in different habitats such as water, land, desert, hills and so on.

WARMING (1909) classified the plants into three types on the basis of their water requirement. They are

1. Hydrophytes.
2. Mesophytes.
3. Xerophytes.

1. Hydrophytes

Hydrophytes means water plants

(Hydro = Water, and Phytes = Plants).

These plants live in the water of ponds, lakes and rivers. Plants which live in water are called hydrophytes. They are divided into three types:

a) Free-floating hydrophytes

These plants float freely on the water surface.

eg. Water hyacinth (Agayatamarai)

Fig 4.2 Water hyacinth (Agayatamarai)

b) Attached floating hydrophytes

These plants are fixed at the bottom of the pond and the leaves float on the surface of the water.

eg. Water- lily (alli).

Fig 4.3 Water- lily

c) Submerged hydrophytes

These plants are rooted in the mud and remain under- water.

eg. Vallisneria

Adaptations of Hydrophytes

1. Root system is poorly developed. In some cases roots are even absent.

2. Stem is thick, short and spongy with air spaces to float in water.

Fig 4.4 Vallisneria

3. Leaves have a waxy-coat that prevents their decay in excess water.

2. Mesophytes

These plants grow in places with moderate water supply. They cannot grow in places with too much of water or too little water. Most of the crop plants are mesophytes.

eg. Wheat, maize, sunflower, mango, neem.

Fig 4.5 Sunflower (Surya kanthi)

Adaptations of mesophytes

1. They have well developed root system.
2. Leaves are usually large and broad.

3. Xerophytes

Xerophytes means desert plants:

(Xero = Desert and Phytes = Plants) Plants which grow in dry areas (deserts) are called Xerophytes. The plant body is adapted to cope with the water scarcity, high temperature, strong winds, etc.

eg. Opuntia (chappathikalli).

Fig 4.6. Opuntia (chappathikalli)

ADAPTATIONS OF XEROPHYTES:

1. They have long roots which go deep into the ground so as to absorb water.
2. In Opuntia, the stem is thick, flat and green, and does the function of photosynthesis.
3. Leaves are reduced or modified into spines to prevent the loss of water from their surface.

4.3. HERBS,SHRUBS AND TREES

"Valli... the walk around the campus was very interesting wasn't it?

"Yes Selva, did you notice that all plants are not of the same size.

"You are correct valli.

Flowering plants can be grouped based on their size of stem.

They are herbs, shrubs and trees.

1.Herbs

- Small plants with soft and green stem are called herbs.
- They are non-woody plants and do not grow more than one metre in height.

Fig 4.7 Paddy

eg. Radish, wheat, paddy, sunflower.

2.Shrubs

- The medium sized plants with a thin but hard and woody stem are called shrubs.
- They do not have a clear main stem.
- They tend to branch and become bushy.

eg. Rose, jasmine, croton, Tulsi, lemon.

3.Trees

- Tall and big plants with a distinct hard and woody stem are called trees.
- The main stem is called trunk which gives out branches and leaves.

eg. Neem, mango, teak, coconut, banyan.

Fig 4.8 Mango tree

4.4. PARTS OF A PLANT

Shall we recollect the salad that Mani and Mythili made. It was made with different parts of the plant.

A typical flowering plant consists of two main systems, viz. Root System (underground part), and Shoot System (aerial part). The root System consists of main root and its lateral branches. The Shoot System has a stem, branches and leaves. The flowering plant produces flowers, fruits and seeds at maturity. Root, stem and leaves are called vegetative parts of a plant as they do not take part in reproduction. Flowers, fruits and seeds are reproductive parts of a plant as they take part in reproduction.

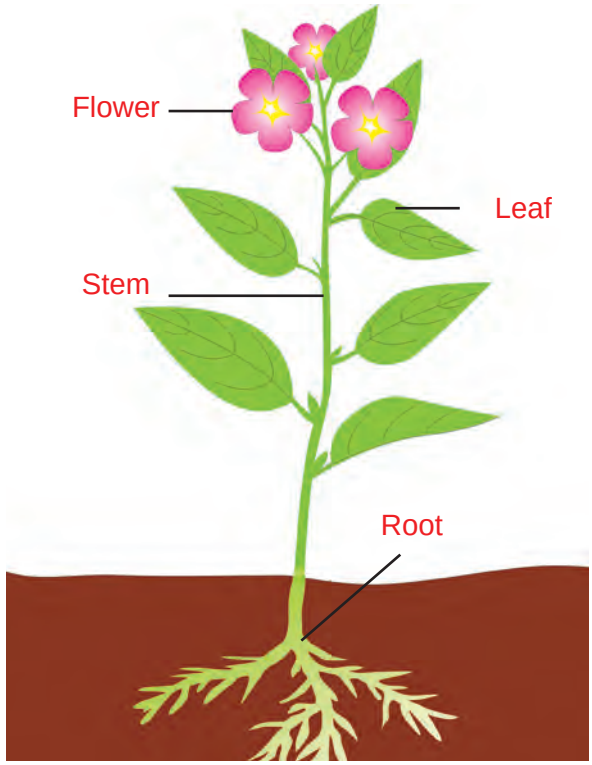


Fig 4.9 Parts of a plant

4.4.1. ROOTS, STEM, LEAVES AND FLOWERS

Root system

The part of the plant which grows under the soil is called Root System. It usually develops from the radicle of embryo. It is the descending part of the plant. It grows away from sunlight. It does not have chlorophyll. Nodes and Inter-nodes are absent. It does not bear leaves or buds. Root system is broadly classified in two types. They are

1. Tap root system
2. Adventitious root system

ACTIVITY 4.1

Let us take a jar and fill it with water. Place an onion in the neck of the jar and its base in the water. Observe the onion roots.

1. Tap Root System

The radicle of the embryo grows deep into the soil and becomes the primary root (tap root). This root gives rise to lateral roots such as secondary roots and tertiary roots. Generally dicot plants have tap root system.

eg. Mango, neem, carrot, radish, etc.

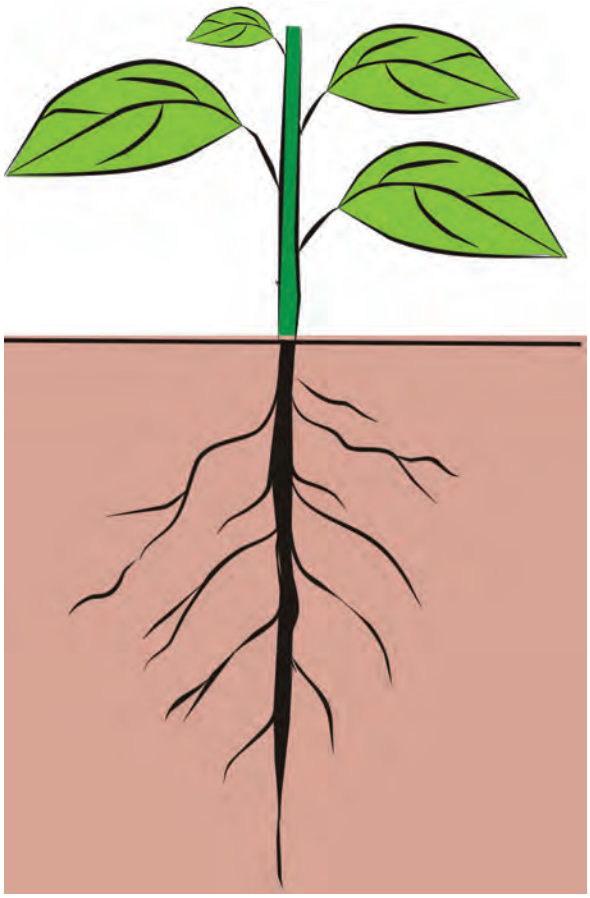


Fig 4.10 Tap Root

2. Adventitious Root System

Roots that grow from any part of the plant other than the radicle are called adventitious roots. These roots arise in cluster which are thin and uniform in size. As these roots arise in cluster, they are also called as fibrous roots. Most monocot plants show adventitious roots.

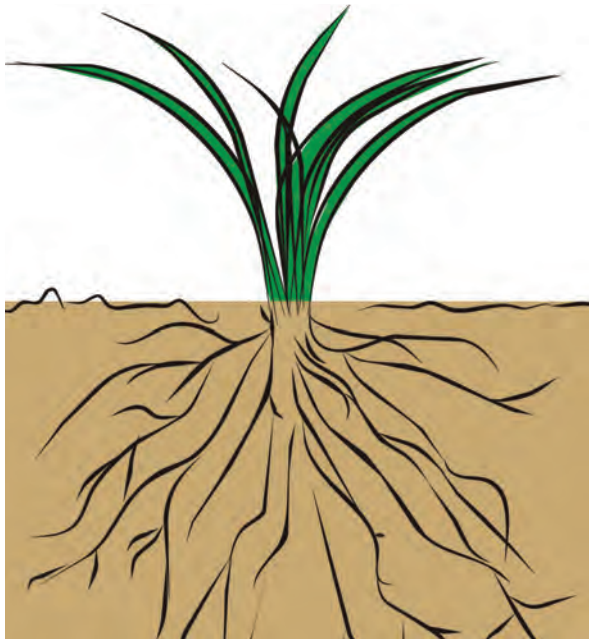


Fig 4.11 Adventitious Root

eg. Rice, grass, maize, bamboo.

Normal functions of roots

1. Roots absorb water and minerals from the soil and transport to the stem.
2. Roots fix the plant firmly to the soil.

Shoot system

The part of the plant which grows above the ground is called shoot system. It develops from the plumule of the embryo. Stem is the ascending part of the plant axis.It grow towards the sunlight. The shoot consists of main stem with a branches,nodes, inter-nodes, leaves, buds, flowers and fruits. Young stems are green and old stems are brown in colour. The place from where the leaf arises is known as node. The distance between the two successive nodes is called inter-node . It bears buds either in the axils of leaves or at the tip of the stem.

Normal functions of stem

1. Support: The stem holds the branches, leaves, flowers and fruits.

2. Conduction: The stem transports water and minerals from roots to the upper parts. It also transports the prepared food from leaves to other parts.

ACTIVITY 4.2

Children, it is very interesting to help our mother in the kitchen, and next time you clean greens (Keerai), try to observe the various parts of the plant.

Leaf

Leaf is thin, broad, flat and green part of the plant. The leaf consists of three main parts. They are leaf blade (leaf lamina), Leaf stalk (Petiole) and Leaf base.

Leaf blade (leaf lamina):

It is the expanded part of the leaf which is green in colour. It has a midrib (a main vein), in the centre of the leaf blade. The midrib has branches on either side which are called veins.

Petiole

The stalk of the leaf is called petiole. It connects the lamina to the stem.

Leaf base

The basal part of the leaf with which it is attached to the stem is called leaf base. The leaf base may bear two small lateral leaf-like structures called stipules.

Normal functions of leaf

1. Synthesis of Food: Leaves produce food by photosynthesis.

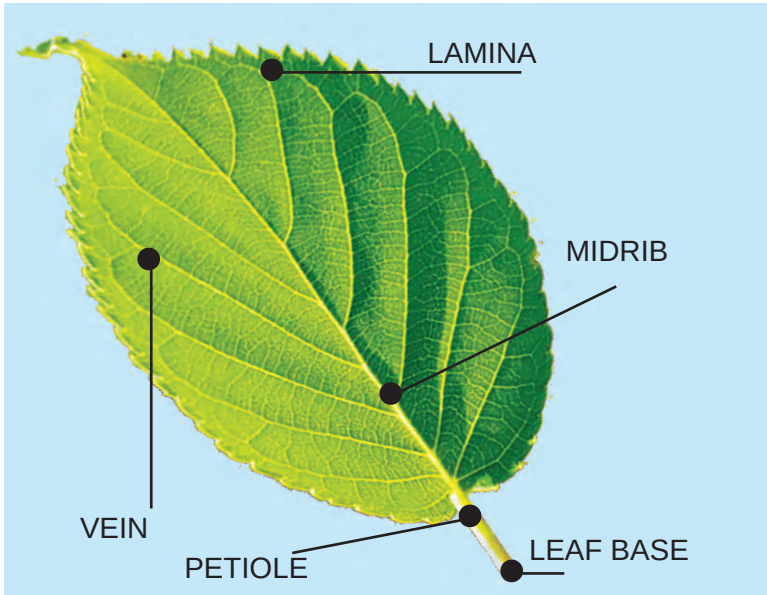


Fig 4.12. Leaf

2. Exchange of Gases: Leaves exchange gases through stomata. Plants take in carbon dioxide and give out oxygen during photosynthesis. They take in oxygen and give out carbon dioixide during respiration. This is called exchange of gases in plants.

3. Transpiration: The loss of excess water from the leaf in the form of water vapour through stomata is called transpiration.

Fig 4.13 Transpiration

ACTIVITY 4.3

Let us cover a leaf of a potted plant with a transparent polythene bag. Observe it after few hours. We will find water droplets in the polythene bag. This proves transpiration in leaves.

Flower

Flower is called the reproductive part of a plant because it helps in sexual reproduction. The flower changes into fruit after pollination and fertilization. Like leaves, flowers also have stalk. The stalk of a flower is called pedicel. There are stalk less flowers also.

eg. Banana.

Parts of a typical flower

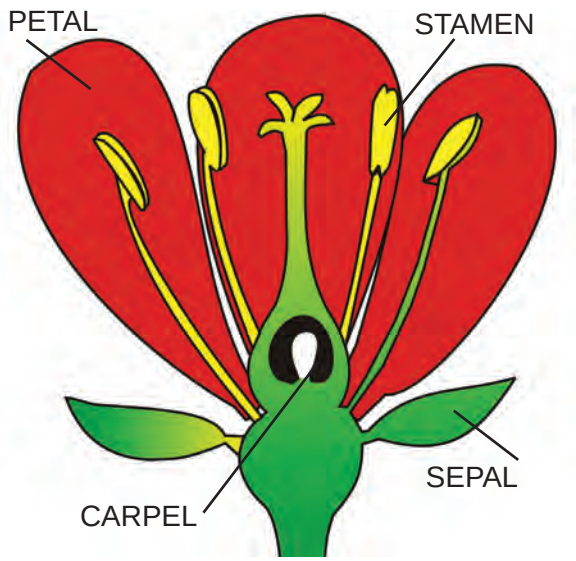


Fig 4.14 Parts of a flower

A flower has four parts, viz. Calyx, Corolla, Androecium and Gynoecium.

Calyx: The green, leaf like parts in the outermost circle of a flower are called sepals. They protect the flower when it is a bud.

Corolla: The brightly coloured parts of a flower are called Petals. They are the second part of the flower. They can be of different colours, shapes and sizes.

Androecium: The stamen is the third part of a flower. It is the male part of the flower. Each stamen consists of a stalk called filament and a bag like structure on the top of filament called anther. Anther forms pollen grains which are the male gametes.

Gynoecium: It is the inner most part of the flower. It is the female part of a flower. A carpel has three parts. The upper part of the carpel is the stigma. The middle part is called style. The lower swollen part is called ovary. Ovary contains ovule which has the egg (female gamete).

Function of a Flower

1. Reproduction: It is the organ of reproduction in plants and grows into fruits and seeds.

2. Perfume: It is extracted from some flowers.

Fig 4.15 Kurinji

MORE TO KNOW

Kurinji is a rare flower that blooms once in 12 years. It is endemic (found only) to Tamilnadu. The Nilgiris which literally means the "blue mountains" get's its name from the purplish blue flowers of Neelakurinji. The last blooming season was in 2006.

1. When is the next blooming season?

2. How old will you be then?

4.5. MODIFICATION OF ROOT, STEM AND LEAVES

Root, stem and leaf have their normal functions as mentioned earlier. In addition to the normal functions, some of the roots, stems and leaves change their shape and structure to do extra functions.

Modification of Tap Root:

1. Storage Roots:

The tap root becomes thick and fleshy due to storage of food materials. Based on the shape of the root, they are

a) Conical: The root is broad at the apex and gradually tapers towards the base like a cone.

eg: Carrot

b) Fusiform: When the root is swollen in the middle and tapers gradually towards both the ends like a spindle, it is called fusiform.

eg: Radish.

c) Napiform: When the root is swollen at the apex coming almost spherical and tapers suddenly towards the base give a top-like appearance, it is called napiform.

eg: Turnip, beet.

Fig 4.16 Carrot

Fig 4.17 Radish (Mullangi)

Fig 4.18 Beetroot

2. Respiratory Roots

Plants which grow in saline swamps near the sea shore develop numerous upright aerial roots called respiratory roots. They help in breathing.

eg. Avicennia (vellai alayatri).

Fig 4.19 Avicennia (vellai alayatri)

Modification of Adventitious Roots

Fig 4.20. Sweet potato (chakravalli kizhangu)

1. Storage Roots

a) Tuberous Roots: Some of the adventitious roots store food and become swollen without any definite shape.

eg. Sweet Potato (chakravalli kizhangu).

b) Fascsiculated Roots: The swollen tuberous roots occurring in clusters are called fasciculated roots.

eg. Dahlia.

Fig 4.21 Sugarcane (Karumbu)

2. Supporting Roots

a) Prop Roots: A number of roots are produced from aerial branches. These roots grow vertically downward and fix into the ground. These roots act as pillars and give additional support to the main plant. Such roots are called prop roots.

eg. Banyan.

Fig 4.22 Banyan (Aala maram)

b) Stilt Roots Plants with delicate stems develop short and thick supporting roots from the basal part of the stem. They fix to the ground and give support.Such roots are called stilt root.

eg. Maize, sugarcane

MORE TO KNOW

The big banyan tree in the Indian Botanical Garden near Kolkata has produced over 900 such prop roots from its branches. Its age is more than 200 years and its diameter is well over 360 metre .

3. Parasitic Roots

Roots of parasitic plants penetrate into the host tissue to absorb nourishment. Such roots are called parasiticroots.

eg. Cuscuta

Fig 4.23 Cuscuta

Fig 4.24 Vanda

4. Epiphytic Roots

There are some plants which grow on the branches of other trees for only shelter and not for food. These plants grow some roots which hang freely in the air and absorb moisture. Such roots are called epiphytic roots.

eg. Vanda (orchid)

Modification of stem

In addition to the normal functions of stem, the stem also performs certain special functions in some plants. In such cases, either the complete plant or a part of the stem is modified to do those special functions. Such stems are called modified stems.

ACTIVITY 4.4

Go to your kitchen, collect some vegetables. Make a list of the vegetables that are modified roots and stems

1. Underground Stem Modification

Stem of some plants remain underground and do the function of storage. They are of different types.

a) Tuber: It is modified underground stem which develops by swelling of tip of stem. It stores a large amount of food.

eg. Potato.

Fig 4.25. Potato
(Urulai kilangu)

Fig 4.26 Ginger (Inji)

b) Rhizome: These are thickened stem that grow horizontally under the soil.

eg. Ginger.

2. Sub-Aerial Modification of Stem

This modification is meant for vegetative propagation. In some plants, branches are weak and they lie horizontal on the ground or may become buried in top soil. Aerial branches and adventitious roots develop at nodes. These are called as Creepers.

The Creepers are of two types.

(a) Runners: eg. Grass.

(b) Stolons: eg. Strawberry.

Fig 4.29 Bougainvillea (Kakitha Poo)

Fig 4.30 Passion flower

Fig 4.27.Grass

Fig 4.28 Strawberry

3. Aerial Stem Modification

Normally buds develop into branches or flowers. In some plants, the buds undergo modification for definite purpose. Some of the aerial stem modifications are:

a) Stem Tendril: In some plants , the axillary bud is modified into tendril, which helps the plant to coil around a support.

eg. Passion flower

b) Thorn: In some plants, the axillary bud is modified into thorn for protection.

eg. Bougainvillea.

c) Phylloclade: In some xerophytes, the leaves are reduced to spines. The function of the leaves is taken over by the stem which is green and flat. Such a stem is called Phylloclade.

eg. Opuntia

Fig 4.31 Nepenthes

Fig 4.32 Pea (Pattani) - Utricularia

MORE TO KNOW

The Amazon Water Lilly bears leaves measuring upto 7 feet in diameter and flowers between 12 and 16 inches.

MODIFICATIONS OF LEAF:

In some plants, the leaf is modified as under:

a) Leaf Tendril: In some plants, the leaf is modified into slender, wiry coiled structure, known as tendril. They help in climbing.

eg. Pea

b) Leaf-Spine: In opuntia, the leaves are reduced to spines. They are protective in function and prevent transpiration.

eg. Opuntia.

c) Pitcher: In some plants, the leaves are modified into pitcher to trap insects to fulfill their nitrogen deficiency.

eg. Nepenthes.

d) Bladder: In Bladder-wort, the leaf is modified into a bladder, to trap insects.

eg. Utricularia.

4.6. KINDS OF STEM

Stems of flowering plants attain diverse forms in order to perform their various functions. Based on the texture, stems of plants are grouped under three broad categories.

1) Reduced Stems: In some plants, the stem is reduced to small disc. Nodes and inter-nodes are absent in the disc.

eg. Radish, carrot, turnip, onion.

2) Erect Stems: Most of the flowering plants possess upright erect woody stems.

eg. Bamboo, banyan, eucalyptus, coconut

Fig 4.33 Onion

3) Weak Stems: There are thin, soft and delicate stems which cannot stand erect without support. They are two types.

1. Upright Weak Stems: They may be twiners or climbers

a) Twiners: The stems are long, slender and flexible and very sensitive. They coil around an upright support on coming in its contact without any special structure.

eg. bean.

b) Climbers: They climb up the support with some clinging structures

eg. Betelvine (vetrilai), pepper (Milagu).

2. Prostrate Weak Stems: These stems spread over the ground. They may be trailers or creepers.

eg. Tridax (vettukaya poondu).

Fig 4.34 Tridax

Fig 4.35 Bean (Avarai)

4.7. MOVEMENTS IN PLANTS

Plants generally do not move from place to place like animals. But the parts of the plant show growth movements in response to some stimuli like sunlight, water, soil, etc. Therefore, the tendency of the plant parts to grow towards or away from the direction of stimuli,is called tropism.

MORE TO KNOW

J.C.Bose, an Indian Botanist invented Crescograph which showed that plants have feelings

1.Tropism

There are three types of tropism.

a) Phototropism: The tendency of the plant parts to grow either towards or away from the direction of sunlight, is called phototropism.

Fig 4.36 Phototropism

Stem grows towards the sunlight. So, stem is positively phototropic. Root grows away from the sunlight. So, root is negatively phototropic.

b) Geotropism: Roots tend to grow towards the soil or gravity. This

is called geotropism. Root is positively geotropic and stem is negatively geotropic.

c) Hydrotropism: The roots tends to grow towards the direction of water, whereas stem does not. So, root is positively hydrotropic and stem is negatively hydrotropic.

Fig 4.37 Geotropism

2. Nastic movement

The plant Mimosa - Touch Me Not (Thotta surungi) is sensitive to touch. When the plant is touched, the leaves fold. The folding of leaves in Mimosa is not due to growth. It is an irregular movement and it is called nastic movement.

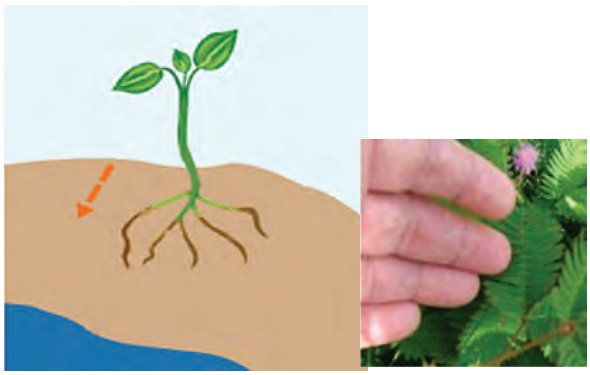


Fig 4.38 Hydrotropism - Nastic movement

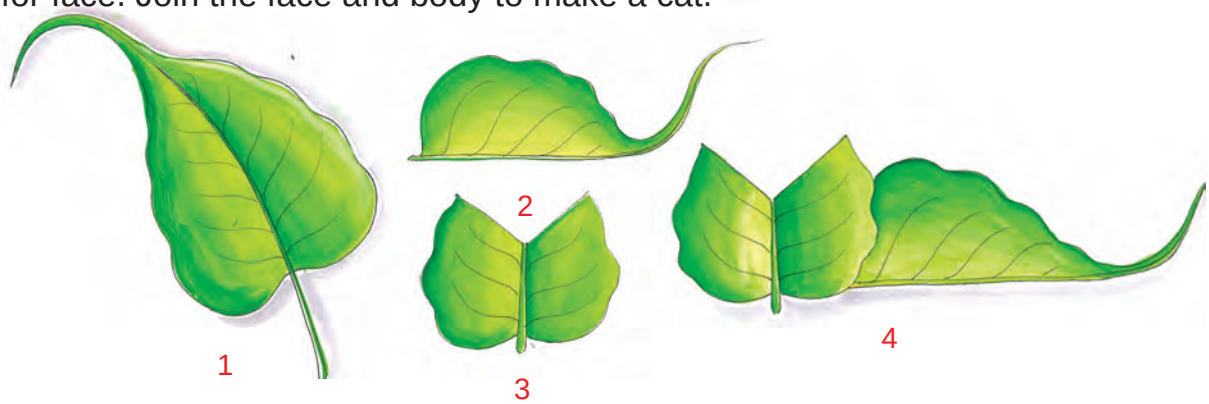
4.8. OBSERVATION OF PLANTS AND TREES

1. Recording data and drawings

Children, we are planning to go for a trekking during the holidays to the hills or the forest area which is nearer to our school. We shall observe the types of plants present over there. Collect different kinds of leaves, flowers, seeds, etc. We shall place the leaves and flowers that we have collected between the pages of our used old note-books, After drying, paste them in a scrap book.

2. Let us make

Children, Let us make animals with leaves. Collect some leaves of peepul tree (Ficus tree). Tear along the midrib to make the body of a cat. Tear V shape for face. Join the face and body to make a cat.



Try to make elephant, deer, tortoise, peacock with different leaves.

EVALUATION

1. Pick out the correct answer:-

   a. Absorption of water is a function of _____ system. (Shoot / root)

   b. Thulasi is an example of a _____ (herb / shrub)

   c. The stalk of a leaf is called _____ (stipule / petiole)

   d. _____ protects the flower when it is a bud. (calyx / corolla)

   e. Movement of plant towards _____ is called phototropism. (Water / light)

2. The diagram of a flower is given below. Label the following parts.

   a) sepal b) petal c) androecium d) gynoecium

3. The jumbled words below are the various movements of a plant. Write the correct word.

   a. SICTAN NASTIC

   b. PSIMORTOEG _____

   c. PISOMTRORDHY _____

   d. SIMPTROOOTHP _____

4. The answers to the following are found in the word grid below. Find the answers and fill in the blanks.

   a. I am a hydrophyte _____

   b. I am a herb _____

   c. I grow in desert _____

   d. I am a tree _____

e. I produce food in the plant _____

f. I am a fusiform root _____

P	K	U	R	I	N	J	I	O	P
O	Z	Y	R	E	P	P	E	P	Q
T	T	R	A	D	I	S	H	P	T
A	E	O	P	U	N	T	I	A	Q
T	A	L	E	A	F	X	W	D	R
O	K	M	I	M	O	S	A	D	A
W	A	T	E	R	L	I	L	Y	A

g. I am a tuber _____

h. I am a climber _____

i. Touch-me not _____

j. I am a flower found only in Tamil Nadu _____

5. Match the following.

1. Vallisneria	-	Sugarcane
2. Stomata	-	Opuntia
3. Stilt root	-	Pepper
4. Phylloclade	-	Submerged hydrophyte
5. Climber	-	Transpiration

FURTHER REFERENCE

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Websites

www.aravindguptatoys.com.

www.mhhe.com/life

Places of scientific importance for visit:

The Botanical Garden at Ooty, Kodaikanal and Yercaud

CHAPTER 5

BASIS
of classification

BIOLOGY

Fig 5.1 All animals

Inba and Valli are going to their uncle's house in their village. Their uncle takes them around his farm. They see number of animals neatly kept in coops and paddocks. They asked their uncle how he had arranged them. Uncle replied that he classified them according to their kind, the food they eat etc. There are many varieties of living things in the world. Are they also arranged in a similar way?.

Yes, we call the arrangement as classification.

There is great diversity among living organisms found on the planet earth. They differ in their size, shape, habitat, mode of nutrition, and other ways of life. The biodiversity of the earth is enormous.

We call such a variety among living organisms as biodiversity. Even though there is such a variety and diversity among them, the living organisms show a lot of similarities and common features so that they can be arranged into many groups. In order to understand and study them systematically, these living organisms, mainly the plants and animals are grouped under different categories.

The system of sorting living organisms into various groups based on similarities and dissimilarities is called classification.

5.1. NEED FOR CLASSIFICATION

It is not possible for anyone to study all the organisms. But if they are grouped in some convenient way, the study would become easier. Classification allows us to understand diversity better.

Necessity for classification

1. Classification helps us to identify the living organisms easily.
2. It helps us to learn about different kinds of plants and animals, their features, similarities and differences.
3. It enables us to understand how complex organisms evolve from simple ones.

ACTIVITY 5.1

Shall we name some common vegetables and find out if they have any other name...

Common name	Other name
1. Brinjal	Egg plant
2.	
3.	

5.2. THE FIVE KINGDOM CLASSIFICATION

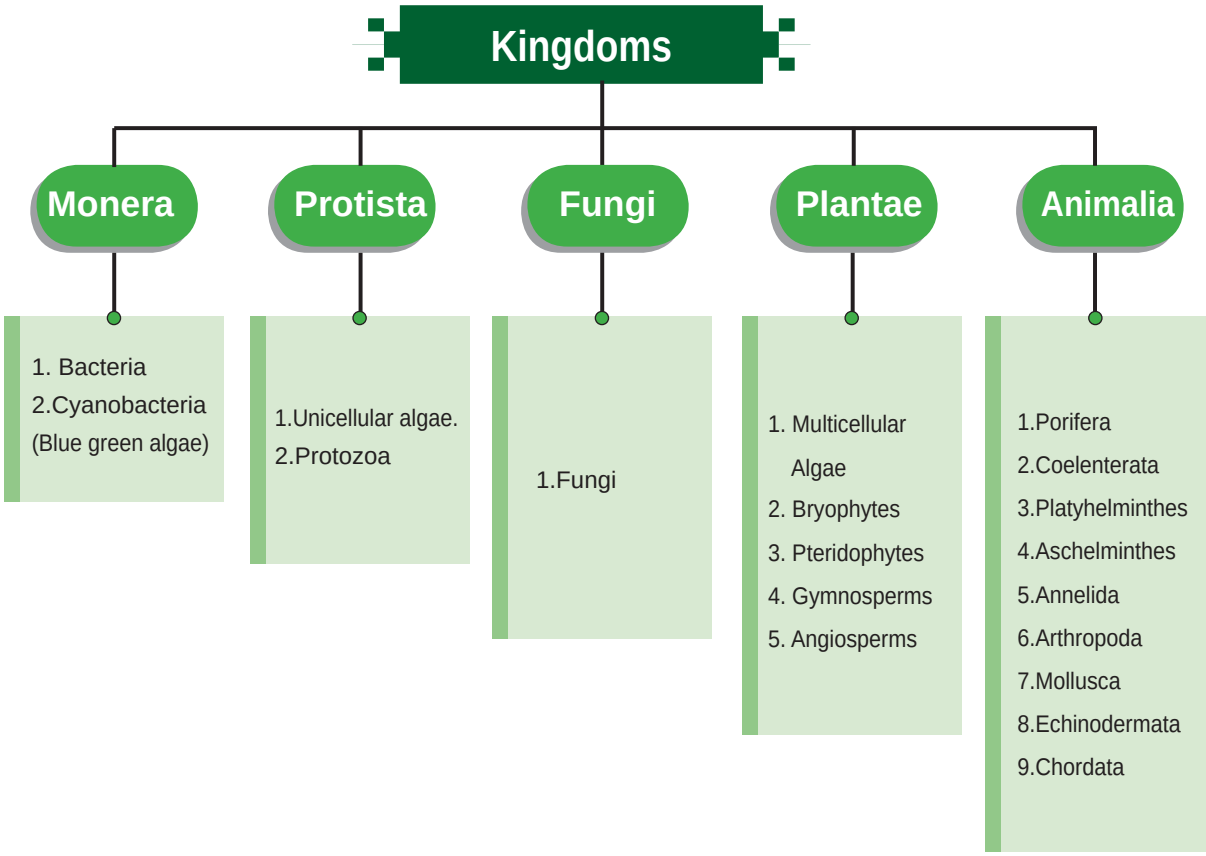
Robert Harding Whittaker (1920–1980)

R.H.Whittaker (1920–1980) was an American plant ecologist. He was the first to propose the five-kingdom classification of the world's biota, based on their evolutionary relationships. In 1969 he classified the organisms into five kingdoms. This classification has been accepted by all scientists.

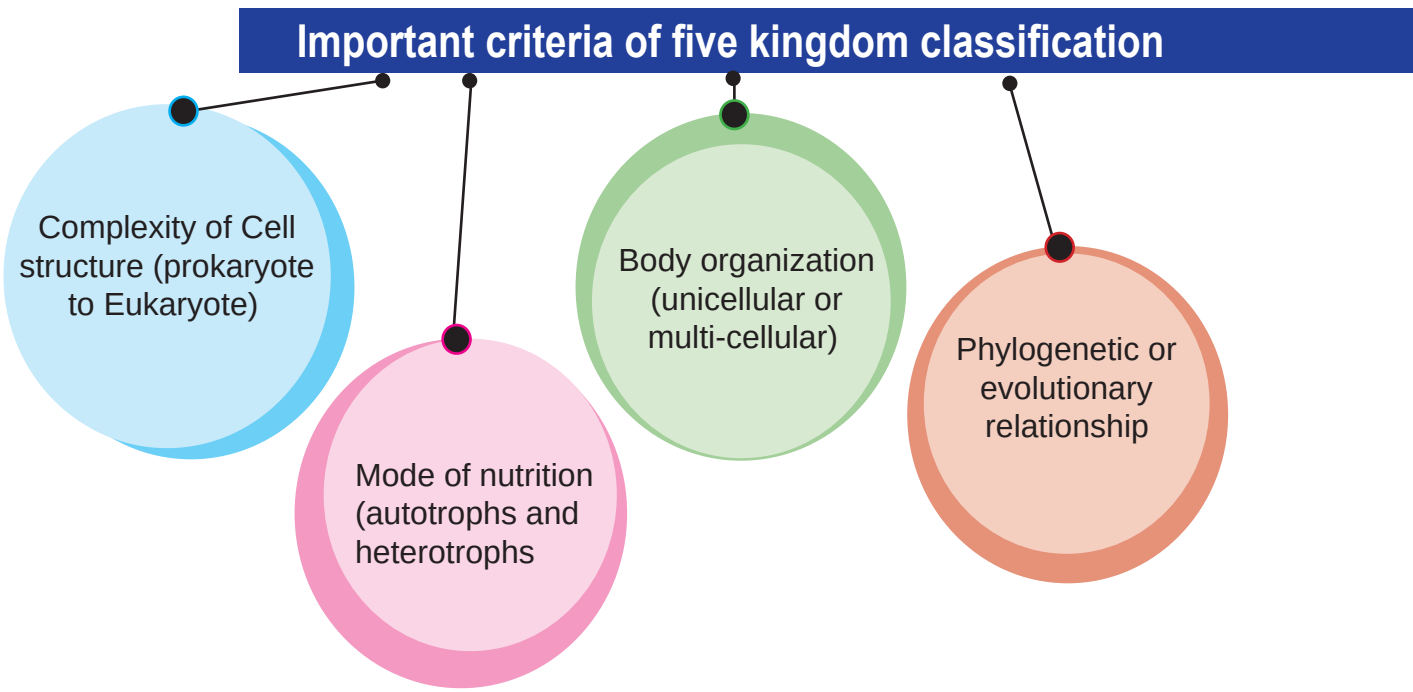
MORE TO KNOW

About 9,000 species are identified under Kingdom Monera. The number of species in Kingdom Protista is about 59,950. The number of species under Fungi is about 100,000. The number of species identified under the Kingdom Plantae is about 289,640. The total number of species identified under Animalia is about 1,170,000.

The Five Kingdoms are Monera, Protista, Fungi, Plantae and Animalia.



This classification takes into account the following important criteria.



5.2.1. KINGDOM OF MONERA

General features

- The kingdom Monera comprises all bacteria and the cyanobacteria.
- They are Primitive unicellular single celled organisms.
- They do not have a true nucleus (prokaryotic).
- Their mode of nutrition is autotrophic or heterotrophic.
- They cause diseases like diphtheria, pneumonia, tuberculosis, leprosy etc.
- They are also used in manufacture of antibiotics to cure many diseases.

ACTIVITY 5.2

Children, shall we find out what converts milk into curd, ferments idli batter, causes disease like cholera, and produces medicines

Yes. the organism is bacteria.

Discovery of Bacteria

In 1675 Anton Von Leewvenhoek, a Dutch scientist, discovered bacteria. He called the bacteria as 'animalcules'. Anton Von Leewvenhoek is called as the father of bacteriology. Bacteria are considered as the first formed organisms in the world.

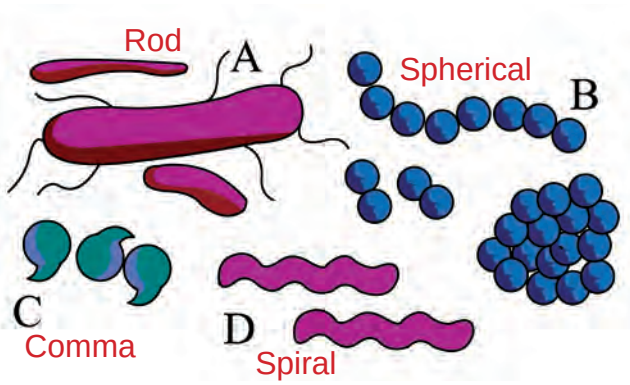


Fig 5.2 Bacteria shapes

Shape of Bacteria

The shape of bacteria varies in different species.The important shapes are

(A) rod
(B) spherical
(C) comma
(D) spiral.

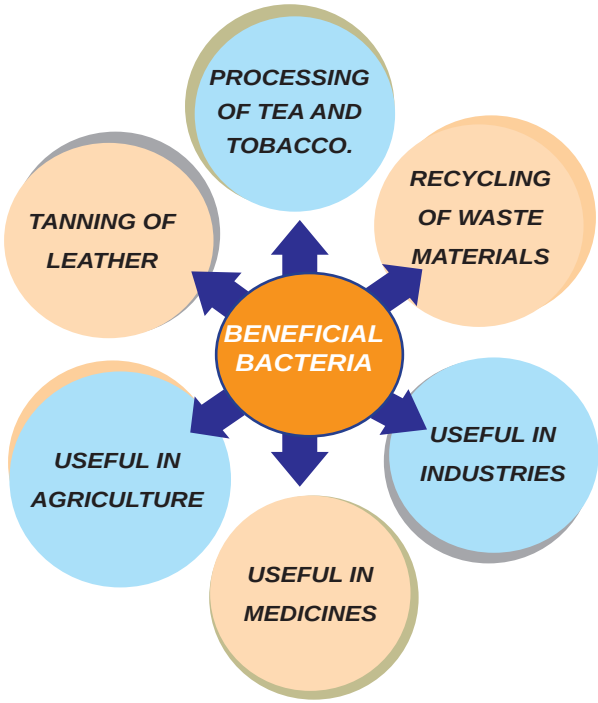
ACTIVITY 5.3

Children, shall we keep a drop of curd on clean glass slide and observe under microscope. We can see rod shaped lacto bacillus.

MORE TO KNOW

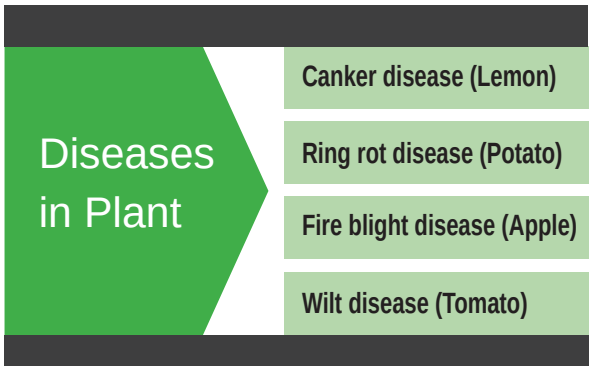
The average human gut contains about 1kg of bacteria. Their presence is essential for normal health.

Beneficial bacteria



Harmful Bacteria

Bacteria cause many diseases in plants and human beings.



5.2.2. KINGDOM OF PROTISTA

General features

- The kingdom Protista includes unicellular eukaryotes.
- Animals and plants of protista live in sea as well as in fresh water. Some are parasites. Though they are single celled, they have the capacity of performing all the body activities.
- They have nucleus enclosed by a nuclear membrane (eukaryotic).
- Some of them posses chloroplast and make their food by photosynthesis. e.g.Euglena
- There are two main groups of protista.

1. Plant like protista called photosynthetic and are commonly known as Micro-algae. They can be seen only under microscope. They occur as single cells or filaments or colonies. eg. Chlamydomonas, Volvox etc. Algae are autotrophs.
2. Animal like protista are often called protozoans. Protozoans include Amoeba and Paramoecium like animals. The Paramecium, which consists of cilia, belongs to class Ciliata. Amoeba which consists of pseudopodia belongs to class Sarcodina.

- All unicellular plants are collectively called phytoplanktons and unicellular animals as zooplanktons.

Euglena, a protozoan possesses chloroplast and make their food by photosynthesis.It has two modes of nutrition. In the presence of sunlight it is autotrophic and in the absence of sunlight it is heterotrophic. This mode of nutrition is known as myxotrophic and hence they form a border line between plants and animals.

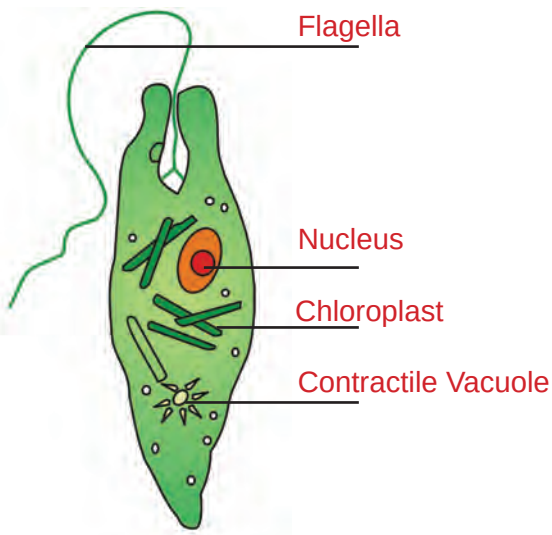


Fig 5.3 Euglena

5.2.3. KINGDOM OF FUNGI

General features

- This kingdom Fungi includes Yeast, moulds, mushrooms (Kaalaan), toadstools, puffballs and Penicillium
- Fungi are eukaryotic, and mostly multicellular.
- Their mode of nutrition is heterotrophic (obtain their nutrients from other organisms) since they lack the green pigment chlorophyll.
- They have cell walls, made of a tough complex sugar called chitin.
- Fungi act either as decomposers (decay-causing organisms) or as parasites(live in other organisms) in nature.
- Mould fungi grows on stale bread, cheese, fruit or other food.

Fig 5.4. Mushroom (Kaalaan)

Penicillium is a fungus. It lacks chlorophyll. It lives as saprophyte. The body consists of filamentous structures. The antibiotic penicillin is extracted from it. The

Fig 5.4 Pencillium

Penicillin is also known as **"the queen of drugs"**.

Yeast is an unicellular organism and oval in shape. It is a saprophytic fungus. It is useful for the preparation of alcohol by fermentation process. Conversion of sugar solution into alcohol with the release of carbon dioxide by yeast is called fermentation. It is also used in bakery.

ACTIVITY 5.4

Let us mix the yeast powder with the sugar solution. After a few days you can see the formation of whitish layer on the surface of the extract. When it is observed under the microscope, yeasts can be seen.

MORE TO KNOW

Children, some fungi are extremely poisonous. Never touch or eat wild fungi without asking an adult first.

5.2.4. KINGDOM OF PLANTAE


Moss


Ferns (perani)


Pinus


Sunflower (Suryakanthi)

Fig 5.6.

General features

- It includes all multi-cellular plants of land and water.
- Kingdom Plantae includes.

1. Algae (Multicellular)

   eg. Laminaria, spriogyra, chara
2. Bryophytes

   eg. Riccia, moss
3. Pteridophytes

   eg. Ferns
4. Gymnosperms

   eg. Cycas, pinus
5. Angiosperms

   eg. Grass, coconut mango, neem (veppa maram)

- Plantae are multicellular eukaryotes.
- The plant cells have an outside cell wall that contain cellulose.
- They show various modes of nutrition. Most of them are autotrophs since they have chlorophyll.
- Some plants are heterotrophs. **eg. Cuscuta is a parasite.**
- Nepenthes and Drosera are insectivorous plants.

MORE TO KNOW

Kingdom Plantae includes

Bryophyta - 24,000 species

Pteridophyta - 10,000 species

Gymnosperms - 640 species

Angiosperms - 255,000 species

5.2.5 KINGDOM OF ANIMALIA

General features

- This kingdom includes all multicellular eukaryotic animals.
- All animals show heterotrophic mode of nutrition. They directly or indirectly depend on plants for their basic requirements particularly the food.
- They form the consumers of an ecosystem.
- The cells are without cell wall.
- They have contractibility of the muscle cells.
- They have well-developed control and coordination mechanisms.
- They can transmit impulses due to the presence of nerve cells
- Some groups of animals are parasites e.g. tapeworms and roundworms.
- Most members of the animal kingdom can move from place to place. However, some animals, such as adult sponges and corals are permanently attached to a surface.
- Kingdom Animalia includes the following phyla.

S.N	PHYLUM	CHARACTERS	EXAMPLES
1.	Porifera	Pore bearers	**eg. Sponges**
2.	Coelenterata	Common body cavity and digestive cavity	**eg. Hydra, jelly fish**
3.	Platyhelminthes	Flatworms	**eg. Tape worm (Taenia)**
4.	Aschelminthes	Thread-like worms	**eg. Round worm (Ascaris)**
5.	Annelida	Body is segmented	**eg. Nereis, earthworm**
6.	Arthropoda (insect group)	Have jointed legs	**eg. Centepede, cockroach, scorpion**
7.	Mollusca	Soft bodied with shells	**eg. Snail, octopus, sepia.**
8.	Echinodermata	Spiny skinned	**eg. star fish, sea-cucumber.**
9.	Chordata	Have backbone	**eg. fish, frog, man.**

MORE TO KNOW

Tamil Nadu ranks first among all states in the country to have endemic animals.

5.3.BINOMIAL NOMENCLATURE

History of classification

- Aristotle categorized organisms into plants and animals.
- Hippocrates, the Father of Medicine, listed organisms with medicinal value.
- Aristotle and Theophrastus classified the plants and animals on the basis of their form and habitat.
- John Ray introduced the term species.
- Carolus Linnaeus organized a simple naming system for plants. So, he is known as Father of Taxonomy. He developed the Binomial System of nomenclature, which is the current scientific system of naming the species.

Necessity for Binomial Nomenclature

- In the earlier period, organisms were referred by their common names. Since common names or vernacular names were in the local languages, they differed at different places resulting in total confusion. They were not universally applicable.

Carolus Linnaeus

- In order to avoid this confusion, a scientific system of naming organism which is universally followed was evolved. So Linnaeus devised a system of naming animals and plants with two names. This is called binomial nomenclature.

Basic Principles of Binomial Nomenclature

1. Scientific names must be either Latin or Latinized.
2. The name of the genus begins with a capital letter.
3. The name of the species begins with a small letter.
4. When printed, the scientific name is given in italics.
5. When written by hand, name should be underlined.

ACTIVITY 5.5

Shall we observe some plants and animals and find their binomials.

ZOOLOGICAL NAME	
Cockroach (Karapan Poochi)	*Periplaneta americana*
Housefly (Ee)	*Musca domestica*
Frog (Thavalai)	*Rana hexadactyla*
Pigeon (Pura)	*Columba livia*
Man (Manithan)	*Homo sapiens*

BOTANICAL NAME	
Hibiscus (Chemparuthi)	*Hibiscus rosasinensis*
Tomato (Thakkali)	*Lycopersicon esculentum*
Potato (Urulai)	*Solanum tuberosum*
Mango (Maankai)	*Mangifera indica*
Rice (Nel)	*Oryza sativa*

EVALUATION

1. Pick out the correct answer:-

a) The five kingdom system of classification was proposed by _____
(R.H.Whittaker / Carl Linnaeus)

b) Kingdom Monera includes _____ organisms.
(multicellular / unicellular)

c) The queen of drugs is _____
(yeast / penicillin)

d) Plant cells have it. Animal cells do not have it. What is it? _____
(Nucleus / cell wall)

e) Oryza sativa is a binomial of _____
(rice / wheat)

2. Place the following animals in their phylum.

tapeworm, sponges, hydra, ascaris, scorpion, human, snail, starfish, earth-worm.

Tape worm - Platyhelminthes

a) _____- _____ e) _____- _____

b) _____- _____ f) _____- _____

c) _____- _____ g) _____- _____

d) _____- _____ h) _____- _____

3. Some beneficial and harmful effects of bacteria are given below. Write (B) for BENEFICIAL and (H) for HARMFUL.

a) Leprosy - Beneficial / Harmful ☐

b) Ring rot of potato - Beneficial / Harmful ☐

c) Recyciling of waste - Beneficial / Harmful ☐

d) Tuberculosis in man - Beneficial / Harmful ☐

e) Tanning of leather - Beneficial / Harmful ☐

f) Wilt of tomato - Beneficial / Harmful ☐

g) Processing of tea - Beneficial / Harmful ☐

4. Draw different shapes of bacteria.

5. Euglena possess chloroplast. In the absence of sunlight it is heterotrophic. In which kingdom will you place it? Animal or plant?

6. Find out the names of the following in as many languages as you can with help of your teachers and parents.

1. Lion 2. Mango 3. Dog 4. Potato 5. Hibiscus 6. Groundnut






Sl.No	English Name	Tamil Name	Binomial Name
1.	Lion	Singam	Panthera leo
2.	Mango		
3.	Dog		
4.	Potato		
5.	Hibiscus		
6.	Groundnut		

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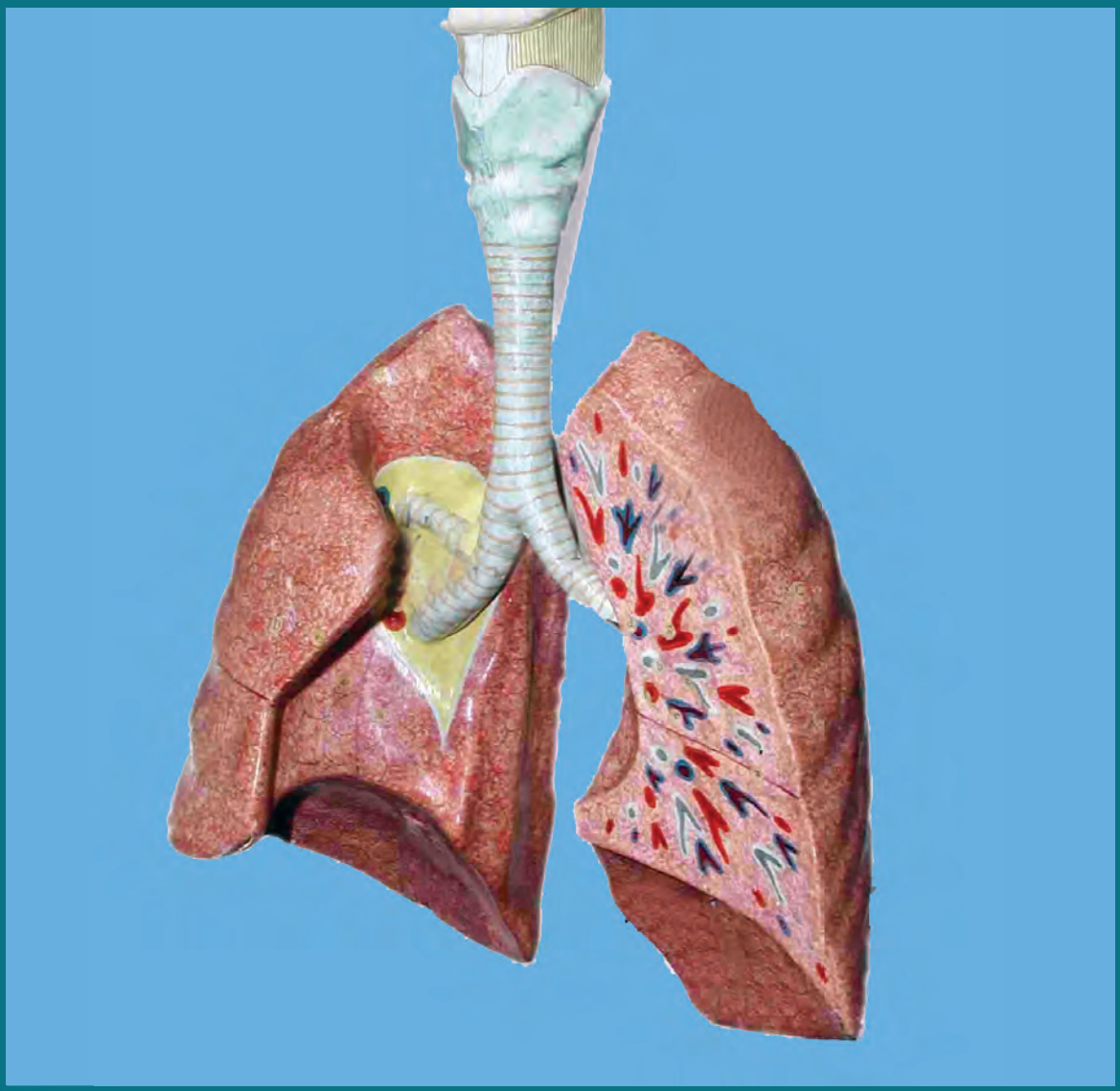
BIOLOGY

CHAPTER 6



RESPIRATION
IN PLANTS AND ANIMALS

BIOLOGY

Chandru, Murugan and their friends are playing in the ground. After some time they find that they are breathing faster and they are tired. Shall we find out why we breathe? and why we breathe faster after a hard work?

6.1. NEED FOR RESPIRATION

Energy is needed for the living things to do work. They stop doing work without energy. Our body needs energy to carry on all its activities. Even when, we are not working , some organs of our body, such as the heart, brain, kidney and lungs, are working. Hence, all the 24 hours energy is needed by the body.

From where do we get energy? We eat food. Food contains energy. The food is broken into simpler forms in the alimentary canal. They are then absorbed by the small intestine and carried by the blood to all parts of the body. The energy of the food is of no use until it is released from the food

Why do your parents insist that you should eat food regularly? We get energy from the food. From the food energy is released during respiration. So, respiration is a vital process in living organisms.

When we breathe, oxygen is transported to the lungs and mixed with blood. The oxygen mixed blood goes to all the parts of the body and finally to all the cells. When oxygen combines with the food in cells, oxidation (burning) of food takes place. During this process, energy is released along with water and carbon dioxide as wastes. So, the process of oxidation of food to release energy along with water and carbon dioxide as wastes in living cells is called respiration or cellular respiration.

ACTIVITY 6.1

Let us sit quietly and count how many times we breathe per minute. The average is 16 to 18 times per minute.

Types of respiration

Respiration may be of two types, (a) Aerobic respiration and (b) Anaerobic respiration. Most of the living organisms use oxygen to break down the food in order to get energy. So, the respiration which takes place in the presence of oxygen is called aerobic respiration. It is represented by the equation below:

Glucose + Oxygen $\longrightarrow$ Carbon dioxide + Water + Energy

Anaerobic respiration

Some micro organisms like yeast and bacteria obtain energy from food in the absence of oxygen. So, the respiration which takes place in the absence of oxygen is called anaerobic respiration. Anaerobic respiration takes place in our skeletal muscles.

Glucose $\xrightarrow{\text{absence of Oxygen}}$ Ethyl alcohol + Carbon dioxide + Energy.

MORE TO KNOW

Bacteria and fungi can respire anaerobically, which is useful in converting sugar into alcohol. Alcohol, on one hand can be bad for the society. On the other hand, it can be used as a fuel.

Yeast is one- celled fungus and respires anaerobically to produce alcohol. Therefore, they are used to make wine and beer.

ACTIVITY 6.2

Shall we find out number of breathing moments per minute.

Name of your friend	Normal	Brisk walk	Run fast	At rest
1.				
2.				
3.				

Differences between breathing and respiration

Breathing	Respiration
1. It is a physical process because only the air moves from one place to another .	1. It is a chemical process because the food undergoes chemical changes.
2. During this, energy is not released.	2. During this, energy is released.
3. It involves breathing organs.	3. It takes place in living cells.

Respiration means burning of food with the help of oxygen to release energy. Then, what is the difference between the burning of food in cells and burning of wood?

Respiration	Burning of wood
1. It takes place in living cells.	1. It takes place outside.
2. Heat energy is liberated.	2. Heat and light energy are liberated.
3. Energy is released step by step in small quantity.	3. Energy is released all of a sudden in large quantity.

You have learnt about photosynthesis in chapter 2. Can you distinguish respiration from photosynthesis?

Respiration	Photosynthesis
1. It takes place throughout day and night.	1. It takes place during day time.
2. All living organisms do it.	2. Only green plants do it.
3. Food is consumed.	3. Food is synthesized.
4. During this process oxygen is taken in and carbon dioxide is given out.	4. During this process carbon dioxide is taken in and oxygen is given out.

6.2. RESPIRATION IN MAN:

The human respiratory system consists of nose, nasal cavity, trachea, bronchi and lungs. The lungs are present in the chest cavity. We have muscles in our chest that make us breathe. Some are fixed to our ribs and make rib cage move in and out. Below the lungs is a strong, flat sheet of muscle called diaphragm.

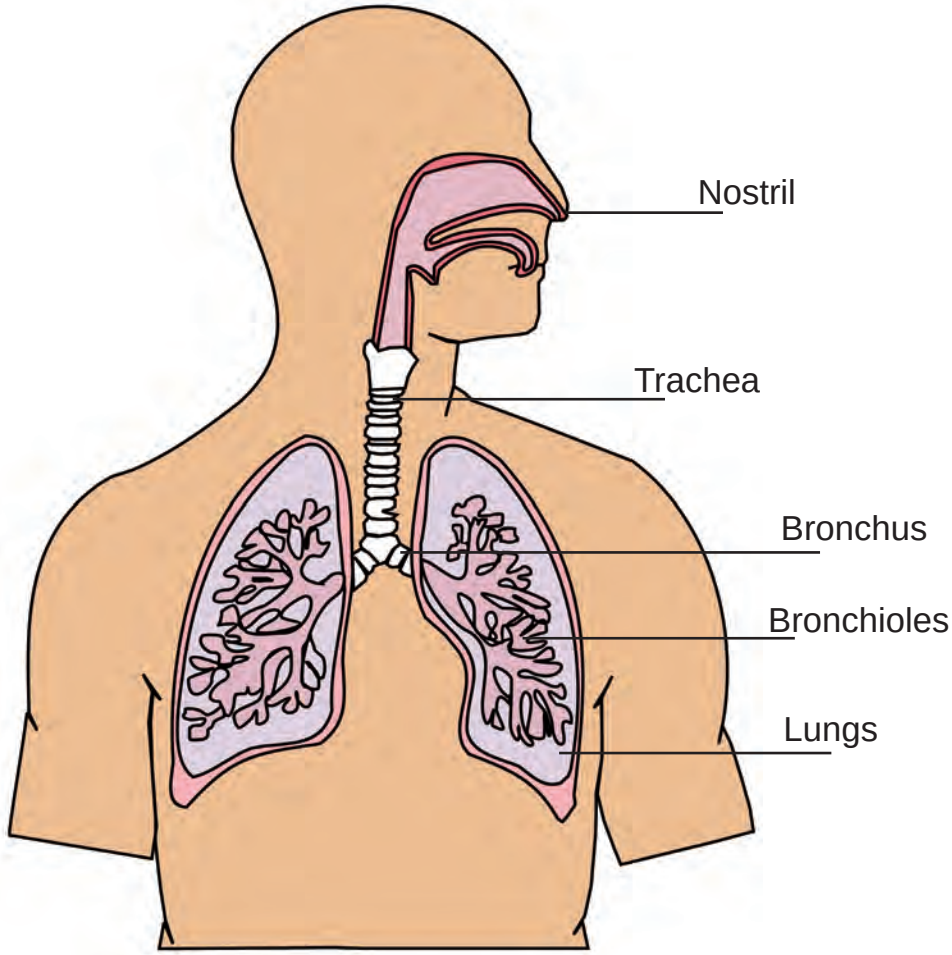


Fig 6.1 Respiration in human

Our nose has two holes which are nostrils. Nostrils lead to nasal cavity which in turn leads to trachea (wind pipe). The trachea divides into two branches called bronchi. (singular – bronchus). Each bronchus enters the lungs and divides into small tubes called bronchioles. The bronchioles end up in air sacs called alveoli. (singular – alveolus).

The walls of alveoli are supplied with thin blood vessels called capillaries which carry blood in them. Oxygen from the lungs enters the blood and carbon dioxide from the blood reaches the lungs in the regions of alveoli.

How do we breathe ?

Breathing involves both inhalation and exhalation. It is a continuous process which goes on all the time and throughout the life span of organisms. The number of times a man breathes in a minute is called the breathing rate.

As we breathe in, the diaphragm moves down and ribs move up or expands. This movement increases space in our chest cavity.

Then the air rich in oxygen rushes into our lungs from outside through the route given below:

Nose ⟶ Nasal Cavity ⟶ Trachea ⟶ Bronchi ⟶ Bronchiole ⟶ Alveoli

As we breathe out, the diaphragm moves up to its original place and ribs move down. This reduces the size of the chest cavity and air is pushed out of the lungs through bronchi, trachea and nose.

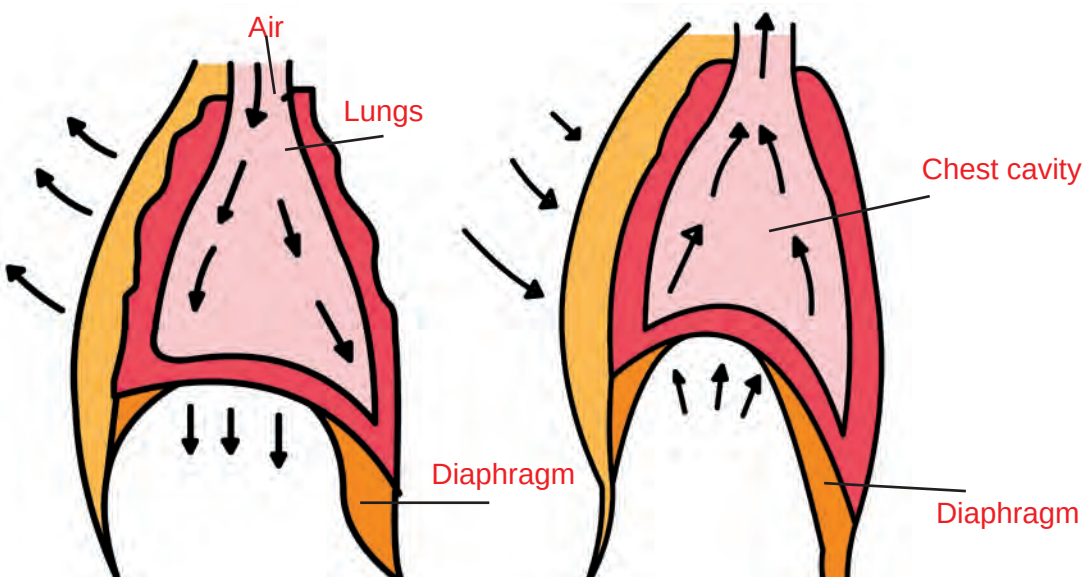


Fig 6.2 Inhalation - Exhalation

Exchange of gases

When oxygen-rich air goes to alveoli, oxygen is absorbed by the blood and combines with haemoglobin and is carried as oxy-haemoglobin to all cells of the body. In the cells, oxygen is used for oxidation of food to release energy along with water and carbon dioxide. This carbon dioxide is picked up by the blood and is transported to the lungs where it is exhaled.

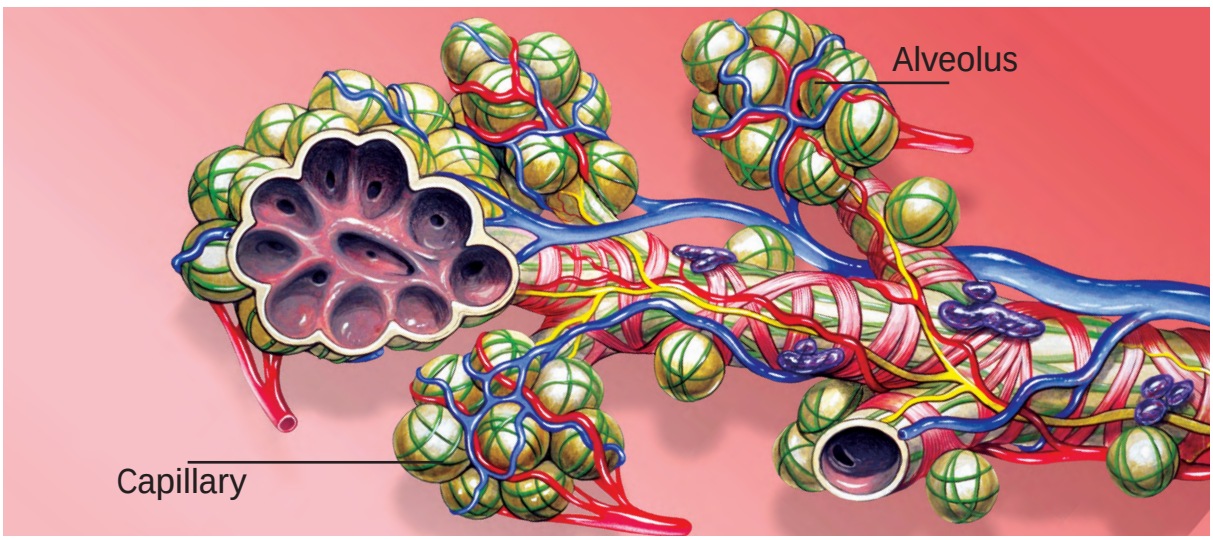


Fig 6.3 Structure of alveoli

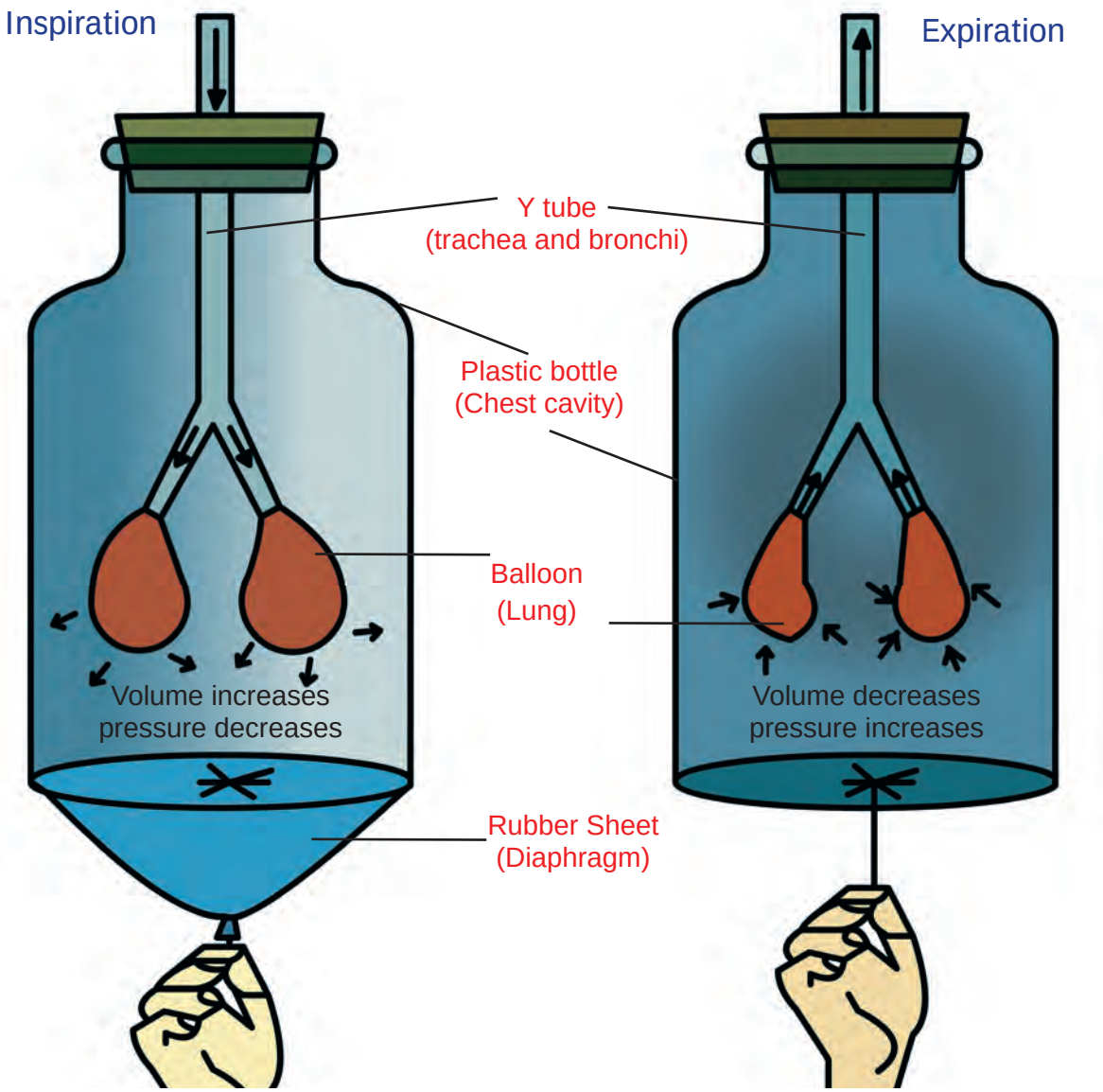
MORE TO KNOW

Shall we find out why we sneeze?

We sneeze when foreign particles such as dust or pollen enter and irritate the nasal cavity. A sneeze expels unwanted harmful particles from the nasal cavity.

ACTIVITY 6.3

Let us take a wide plastic bottle. Remove the bottom. Get a Y shaped glass tube. Make a hole in the lid so that the tube may pass throught it. To the forked end of the tube fix deflated balloons. Introduce the tube into the bottle. To the open base of the bottle, tie a thin rubber or plastic sheet. When the plastic sheet is pulled air from outside rushes into the balloon to inflate them. When the sheet is pushed to original place the volume inside the bell jar reduces and the air in the balloon is sent out. This shows breathing mechanism.



MORE TO KNOW

- Air pollution causes many respiratory diseases.
- Smoking can cause lung cancer
- Sound is the useful by product of respiratory system.

6.3. RESPIRATION IN ANIMALS

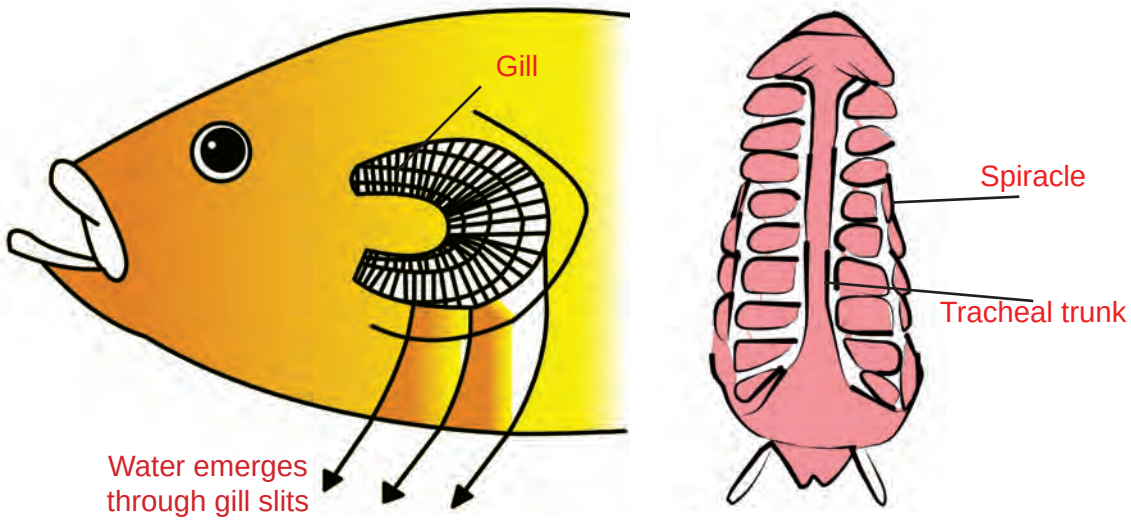


Fig 6.4 Fish - Cockroach

Like human beings, animals and plants also breathe and respire. The basic process of respiration is same in all organisms. Let us study some examples of animals and what structures help them to respire.

(a) In unicellular and smaller multicellular animals, all the cells take up oxygen from the surrounding air or water and give out carbondioxide by diffusion.

eg. Amoeba, Paramecium

(b) Animals like earthworm and leeches respire through the skin which is moist and slimy.

Fig 6.5 Earthworm (Mannpuzhu)

(c) Animals such as frogs respire through their skin and lungs.

(d) Fishes have special organs called gills which are used to absorb the dissolved oxygen in water.

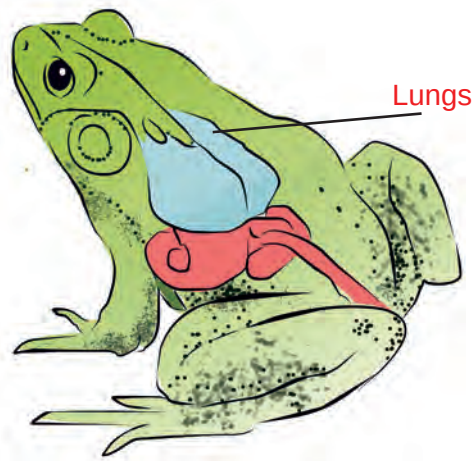


Fig 6.6 Frog

(e) Animals like reptiles, birds and mammals have lungs for breathing.

(f) In animals such as insects, there are several small openings called spiracles on the lateral sides of their bodies. These spiracles lead to air tubes called trachea. Exchange of gases takes place through spiracles into trachea.

6.4. RESPIRATION IN PLANTS

Like other living organisms, plants also respire to get energy from the food. Generally plants do not have any special organs for breathing and do not show breathing movements like animals. Plants breathe through tiny pores in the leaves called stomata. Oxygen from the air diffuse into the leaves and the carbon dioxide from the leaves diffuses out through **stomata**. Stems have minute openings on their surfaces. These openings help in the exchange of gases. Roots also respire independently. Roots take up air from the air spaces present between the soil particles. Thus, all parts of the plant like root, stem and leaves respire independently. Aquatic plants directly exchange gases with the water surrounding their leaves, roots and stems.

The process of photosynthesis in plants takes place during the day. During this process carbon dioxide is used up and oxygen is released.

A part of the oxygen released during photosynthesis is used by the plants for respiration and the rest is sent out through the stomata. Carbon dioxide released during respiration is used up by the plant for photosynthesis.

But at night since no photosynthesis takes place carbon dioxide released as a result of respiration is sent out through the stomata into the atmosphere and oxygen is taken in and used for respiration.

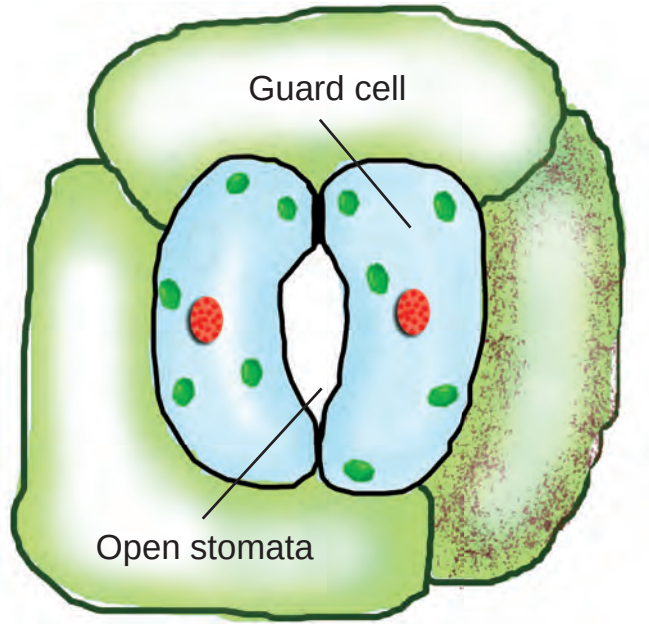


Fig 6.7 Stomata

Types of Respiration

Respiration is of two types depending upon the presence or absence of oxygen.

1) Anaerobic respiration and 2) Aerobic respiration.

In lower organisms like yeast and bacteria anaerobic respiration takes place.

In higher plants aerobic respiration takes place.

MORE TO KNOW

Plants take in O_2 and give out CO_2 during respiration. They take in CO_2 and give out O_2 during photosynthesis.

They are two contrasting and yet complimentary processes

EVALUATION

1.Match the animals with its organs of respiration.

S.No.	ANIMALS	ORGANS OF RESPIRATION
1.	Cockroach	Gill
2.	Frog	Lungs
3.	Fish	Lungs and skin
4.	Earthworm	Spiracle
5.	Dog	Skin

2. Rearrange the following parts of the Respiratory system in order.

Trachea, nose, alveoli, bronchi, nasal cavity, bronchiole.

3. Given below is the diagram of the Respiratory System of man. Label the following parts in it.

Nose, trachea, bronchi, lungs, bronchiole.

4. Pick out the correct answer:-

a) The clean air we breathe is rich in ……..... (oxygen / carbon dioxide)

b) Respiration in the absence of oxygen is called ……. (aerobic / anaerobic) respiration.

c) Plants breathe through tiny pores in the leaves called ……. (trachea / stomata)

5. Fill up the missing words in the equation given below.

a) ---------- + Oxygen ⟶ ----------+----------+ Energy

b) Glucose ----------⟶ ----------+ Carbon dioxide + ----------

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CHAPTER 7

ECO SYSTEM

BIOLOGY

Dear children, given above is a beautiful picture of a house with a garden in front. But you will be surprised to know that there are ten animals hidden in it. shall we find them?

The picture shows a good relationship between plants and animals in a non-living environment.

7.1. ECO SYSTEM

"Wild elephants stray into human habitation near Hosur"

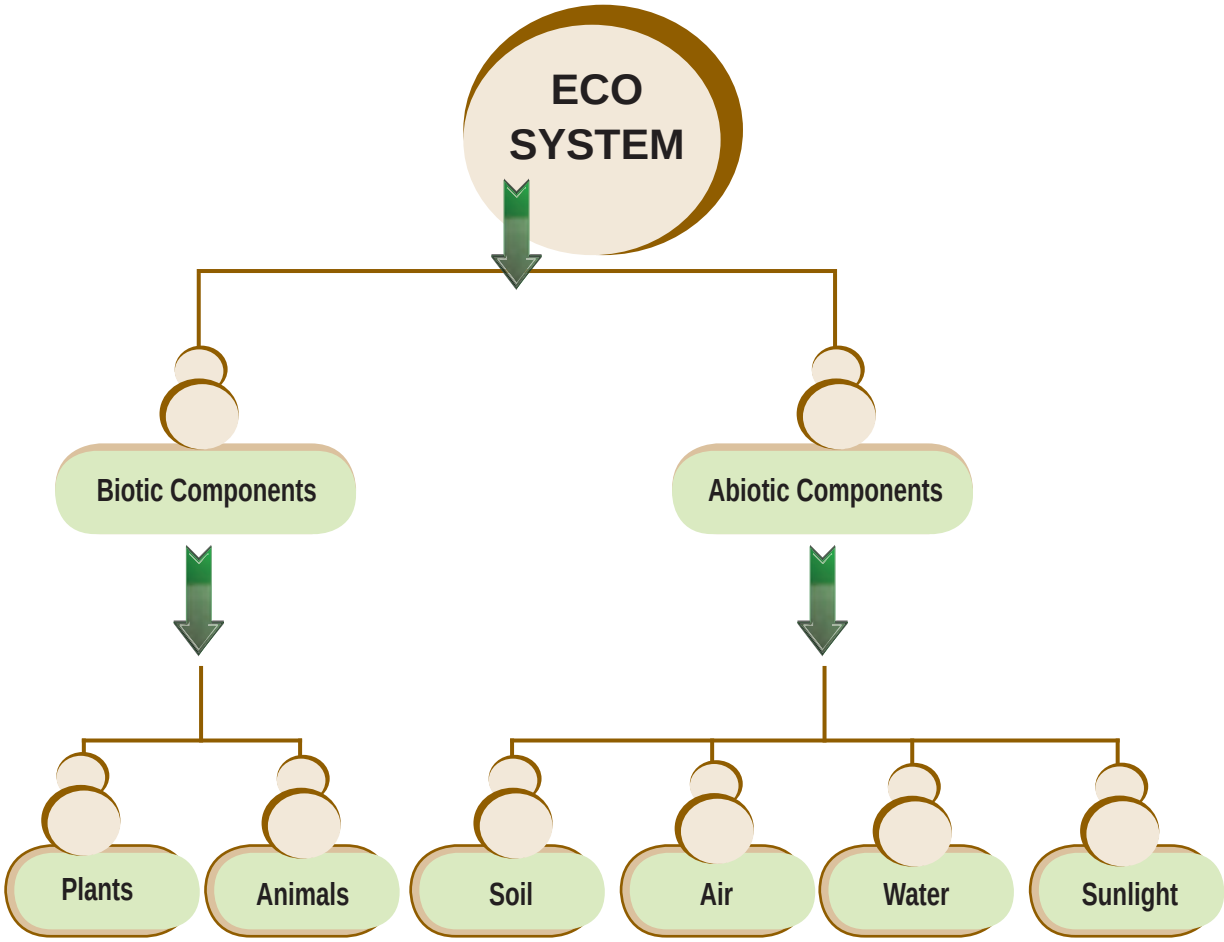
Krishnagiri March 24, 2010. wild elephants which entered into Kumudepalli village are being driven into the Sanamavu Forest near Hosur on Tuesday. Three male wild elephants strayed into human habitation near Hosur on Tuesday.

According to forest officials, the elephants aged between fifteen and twenty strayed into Kumudepalli village in the morning. On information , the officials led by District Forest Officer V.Ganesan, Assistant Conservator of Forest K.Rajendran and Hosur Ranger R.Madheswaran drove the pachyderms to the nearby Sanamavu Reserve Forests with the help of the villagers by bursting crackers.

Wild elephants entering into the human habitations have become an order of the day for the past three to five months. They did not harm anybody during the operation. Of the three elephants one is sub male elephant with the age of fifteen. And the other two are about twenty, an official said.

The above information is a newspaper report. Why do you think the elephants have come out of the forest? What is disturbed here?

Elephants live in forests. Forest is an ecosystem. Forest are the natural habitats of elephants. People have been cutting down trees , and reducing forest cover for cultivation and other purposes. The elephants loose their habitations in the reduced forest area. So they are forced to come out of their forest homes (Ecosystems) and move in the areas where people live.



A community of organisms living together with its non-living environment constitutes an eco-system.

Eco-systems may be natural or artificial. A pond, a grassland, a forest, a lake, a desert etc. are examples of natural eco-systems. An aquarium, a park, a paddy field, etc. are examples of artificial eco-system.

Components of Eco-system

An eco-system consists of two main components. They are biotic (living) and abiotic (non-living) components.

Biotic Components

The living components are broadly classified into three categories.

1. **Producers:** They are green plants that prepare their own food by the process of photosynthesis.
2. **Consumers:** They are animals which depend on plants and animals for their food.
3. **Decomposers:** They are organisms which feed upon dead matter to get energy and bring back the minerals to the soil. **eg. Bacteria and Fungi.**

Abiotic Components

These include the soil, water, air and climatic factors such as temperature, sunlight, humidity etc.

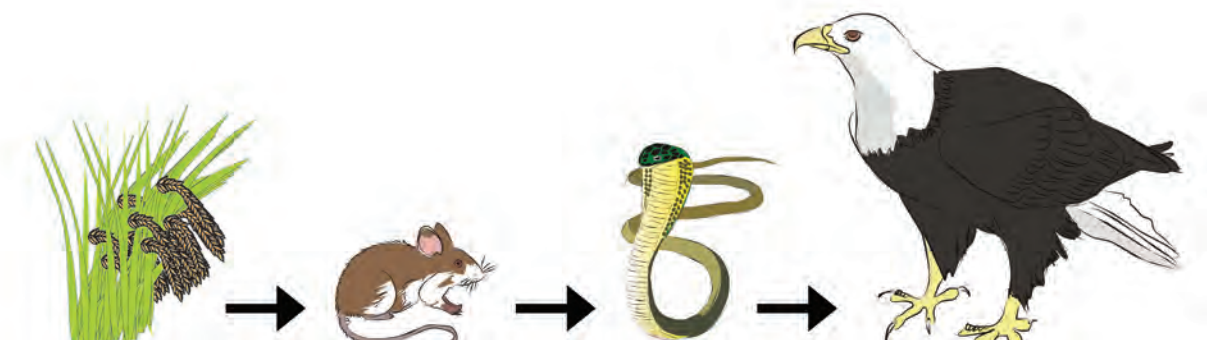
ACTIVITY - 7.1

Let us observe the picture and name the biotic and abiotic factors in it.

7.2. FOOD CHAIN

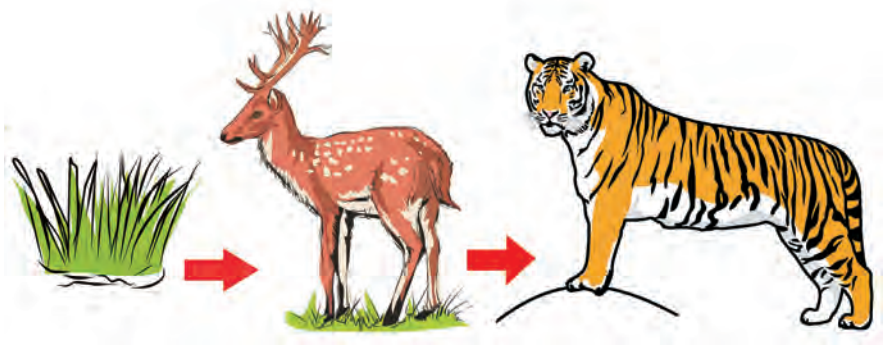
The sun is the ultimate source of energy to all living things. Green plants capture solar energy and convert carbondioxide and water into food by photosynthesis. This food energy is transferred to the primary consumer when they eat plants. Then the primary consumer is eaten by secondary consumer who in turn is eaten by a tertiary consumer. So, in a given ecosystem, there is a process of organisms eating or being eaten. The path of energy transfer from one organism to another in a single direction is called a food chain.

1. Food chain in a grassland



Paddy (Producer) → Mouse (Herbivore) → Snake (Carnivore) → Eagle (Top Carnivore)

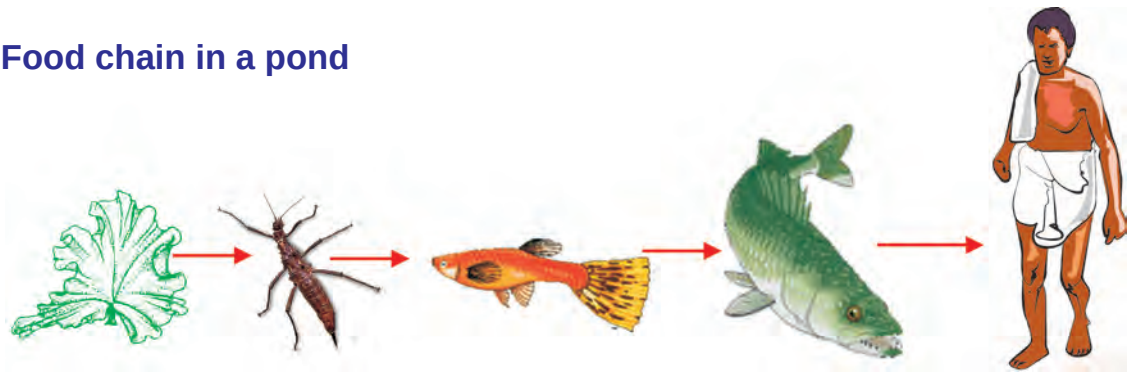
2. Food chain in a forest



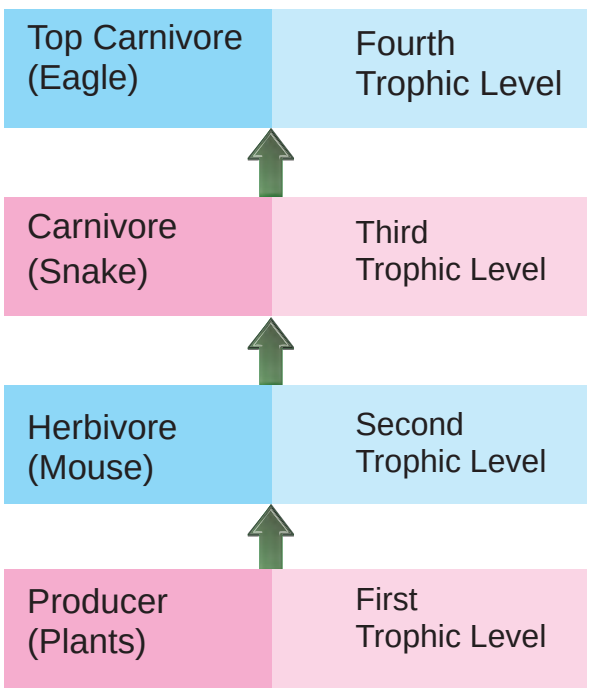
Grass ⟶ Deer ⟶ Tiger

(Producer) (Herbivore) (Carnivore)

3. Food chain in a pond



Phytoplankton ⟶ Insect ⟶ Small fish ⟶ Large fish ⟶ Man



In a food chain, each group of organisms occupies a particular position. The position of organisms in a food chain is called **trophic level**.

The first trophic level is of producers. The second trophic level is of herbivores. The third trophic level is of carnivores. The fourth trophic level is of top carnivores.

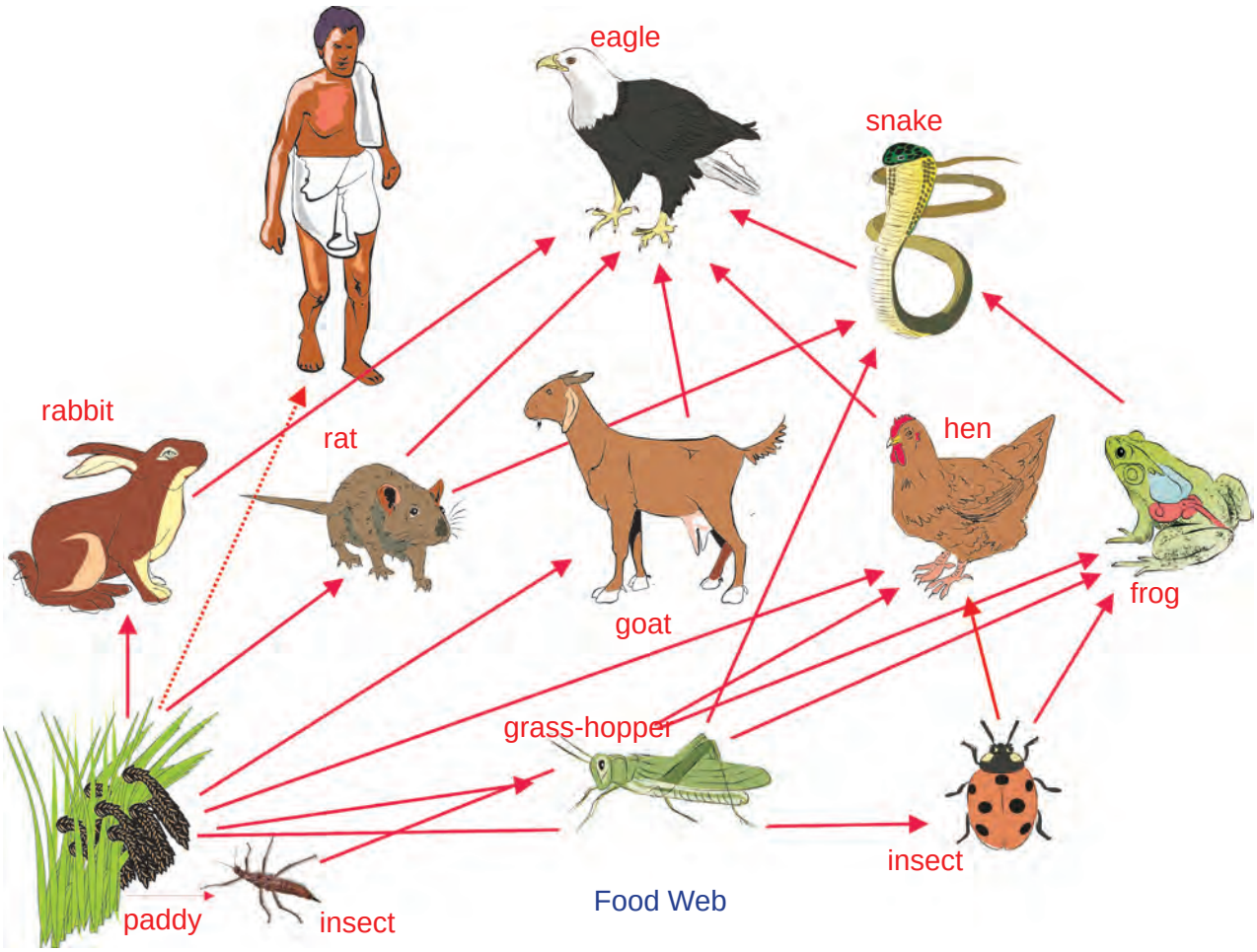
MORE TO KNOW

If one link in a food chain is broken it would result in the extinction of a species.

7.3. FOOD WEB

ACTIVITY 7.2

Find out what trophic level are you in when you eat vegetables or meat? With dotted lines show few more links to man.



Food Web

In a given ecosystem, a single food chain may not exist separately. An animal can eat more than one kind of food. For eg. An eagle can eat rabbit, mouse or a snake and a snake can feed on a mouse or a frog. So, many food chain get interlinked.

A net work of interlinked food chains is called a **food web**.

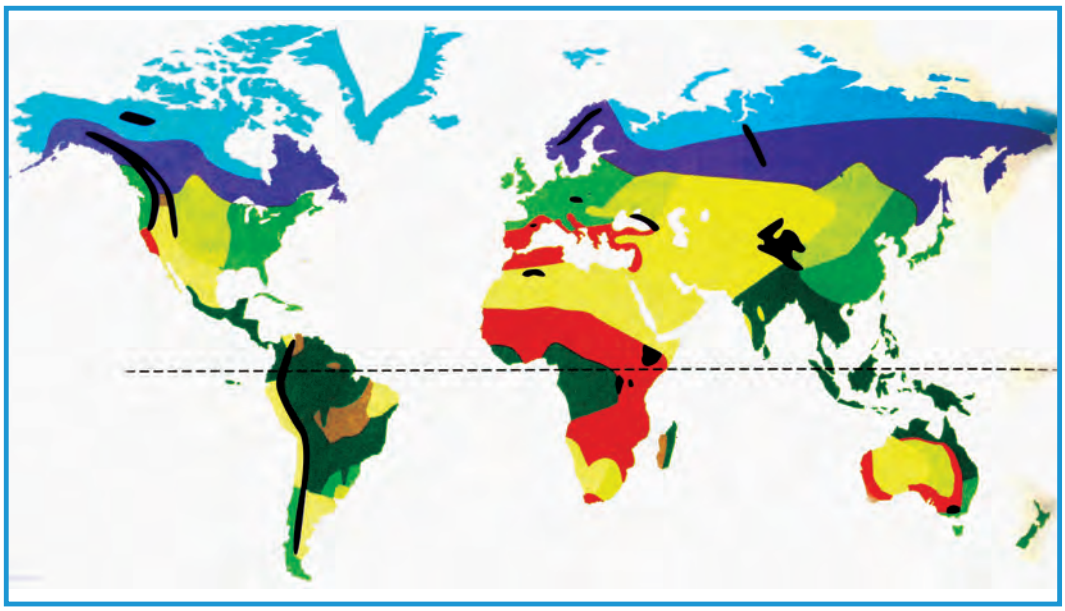
7.4. FLOW OF ENERGY

The sun is the ultimate source of energy for all living things. At first, the solar energy flows from the sun to the surface of the earth. Green plants trap the solar energy and convert it into chemical energy (food).

The amount of energy decreases from one trophic level to another. The flow of energy is always in one direction only.

7.5. BIOME

We know that all organisms acquire energy from the sun directly or indirectly. But, does the sun have any other effect on us? Yes. The rotation of the earth around the sun has an effect on climate of a place. You have already studied about ecosystem. An ecosystem may be small or big. When small ecosystems are put together, it forms a vast geographical area which supports a wide variety of flora and fauna. At the same time such a vast area has the same type of climate. Such a vast geographical area is called **biome**.



7.5.1. THE DIFFERENT BIOMES

We can view our earth as various biomes based on their climate and also the latitude and longitude on which they are present. Based on the types of flora and fauna, the biomes are classified into many types.

1) Tropical Rain Forest: They are found in South America, Africa and Indo Malaysia region near the equator. The weather is warm (20°C-25°C). Rainfall is plentiful, 190 cm per year. In India, they are found in Andaman

Fig. 7.1. Tropical Rain Forest

and Nicobar Islands, Western ghats, Assam and West Bengal.

2) Savannah: They are found in South Africa, Western Australia, North West India and Eastern Pakistan. A dry weather alternate with wet weather. The rainfall is about 25cm per year. Frequent fires occur during dry season. In India, grassy plains are found in the Nilgiris, Khasi hills and Naga hills.

3) Deserts: They are found in Africa, Arizona in America, Mexican desert in Mexico. The days are hot and nights are cold. The annual rainfall is less than 25 cm. In India, it is found in Rajasthan (The Thar Desert).

Fig. 7.2. Desert

4) Temperate Grassland: It is found in North and South America and parts of Europe. The annual rainfall is 25cm to 100 cm. They have two very severe dry seasons. They have windy hot summers and cold winters. In India, it is found in Uttar Pradesh.

5) Deciduous Forests: They are found in North America, Eastern Asia and Europe. They receive 75 to 100 cm of rainfall. The climate is moderate with mild winters. In India, it is found in Punjab, Tamil Nadu, Uttar Pradesh, Bihar, Orissa and Madhya Pradesh.

6) Taiga: It is found in Canada, Europe and Russia. They are also called Boreal Forest. The climate is short cool summer and a long winter with abundant snowfall. Annual rainfall is 20cm to 60 cm. Most of it is covered with snow and ice. It is found in Himachal Pradesh, Punjab and Kashmir in India.

7) Tundra: It is found south of the ice covered poles in the Northern hemisphere. Though it receives 25 cm of rainfall, it has permanently frozen soil. The climate is extremely cold and windy. The temperature is less than 10^{o}C. In India, it is found in the Himalayas.

7.5.2. IMPORTANCE OF FORESTS

1. Forests are the sources for the formation of rivers.
2. They increase the rainfall.
3. They prevent soil erosion and floods.
4. They become habitat to animals.
5. They maintain oxygen-carbon dioxide balance in nature.

Forests are considered as God's first temples. They play an important role in our day to day life.

MORE TO KNOW

Vanamahotsav is an annual Indian tree planting festival celebrated in the month of July. It is to create an enthusiasm in the minds of people to conserve forests.

7.5.3. DIFFERENT FLORA AND FAUNA

The biomes have a variety of plants and animals. The flora and fauna found in one biome is completely different from other biome due to the different climatic conditions. The kind of flora and fauna found in different biomes are given below: India is one of the 12 mega biodivesity centres in the world with immense flora and fauna.

S.NO	BIOME	FLORA	FAUNA
1.	Tropical Rain Forest	Lofty trees like teak, rubber, lianas, epiphytes, orchids, ferns.	Herbivores, insects rodents, monkeys, bats, birds, large cats, snakes.
2.	Savannah	Grasses	Birds, kangaroos, lions, zebras, giraffes, cheetahs, elephants, termites.
3.	Desert	Succulent plants like cactus, acacia, calotropis, datepalm etc.	Chinkara,lizards,snakes,scorpions, camels
4.	Temperate grassland	Perennial grasses.	Wolves. bisons, coyotes, antelopes. insects etc.
5.	Deciduous forest	Oak, maple, mosses, acacia, pine, fir	Deers, squirrels, black bears, beetles, birds, small mammals.
6.	Taiga	Spruce, fir, pine, aspen, birch,willows, mosses, lichens, fungi.	Porcupines, red squirrels, hares, grey wolves, insects etc.
7.	Tundra	Sedge, broad leafed herbs, lichens.	Reindeers, owls, foxes, wolves, migratory birds, polar bears, penguins.

ACTIVITY - 7.3

Let us match the product with its use.

1.	Timber	Pencil
2.	Shelter	Neem
3.	Music	Wood
4.	Tool	Coffee
5.	Medicine	Veena
6.	Drink	Palm Leaves

EVALUATION

1. Pick out the correct answer:-

a) Forest is an area with high density of …….. (trees / grass)

b) ……. is an example of a natural ecosystem. (Paddy field / Desert)

c) The third trophic level in a food chain is called as …… (herbivore / carnivore)

d) A network of interlinked food chain is called a …….. (food web / food cycle)

e) The festival of "Vanamahotsav" is celebrated in the month of …….. (June / July)

2. Rearrange the following words to form a food chain.

(a) snake, mouse, paddy, eagle, grasshopper.

…….. -> …….. -> …….. -> …….. -> ……..

(b) man, big fish, phytoplankton, small fish, insects.

…….. -> …….. -> …….. -> …….. -> ……..

3. Place the following types of forests to its unique characteristic feature.

Rain forest, savannah, desert, grassland, taiga, tundra.

S.No.	Characteristic feature	Types of Forest
a.	Frequent forest fire	……
b.	Windy weather	……
c.	Snow and ice	……
d.	Hot days and cold night	……
e.	Ice covered frozen soil	……
f.	Rainfall is plentiful	……

4. Given below are list of animals. Match it with the biome where they are found.

Snake	-	Savannah
Cheetah	-	Tundra
Camel	-	Tropical rain forest
Antelope	-	Taiga
Black bear	-	Desert
Grey wolf	-	Deciduous forest
Penguin	-	Grassland

FURTHER REFERENCE

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Ecology - Shukla and Chandel, S.Chand & Company, New Delhi.

Environmental Science (9th edition) - Enger and Smith, McGraw Hill, New York.

Websites

www.national geographic.com.

www.mongabay.com.

Places of scientific importance for visit

1. Coral reefs in Mandapam, Ramanathapuram District.
2. Mangrove forest in Pitchavaram, Cuddalore District.

CHAPTER 8

WATER

A PRECIOUS RESOURCE

BIOLOGY

Fig. 8.1. Mettur dam

Valli, Inba and Selva have gone for a picnic to Mettur dam. Valli is shocked to see so much of water available on our planet Earth, but why do we still feel a shortage of water? Selva tells them that 70% of our Earth is made of water but only 3% of it is fresh water. Hence only a fraction is fit for human consumption.

Children shall we find out why we celebrate March 22 every year as World Water Day.

It is to attract ----------

8.1 AVAILABILITY OF WATER

Water is a natural resource that is vital for both plants and animals. Water exists in abundance on our planet Earth. However, only a very small fraction of it is fit for human consumption.

Most of the water that exists on the earth is in the seas and oceans. Sea and ocean water is highly salty and hence unfit for drinking. Most of the fresh water is frozen in the glaciers and in the polar regions, and is thus not readily available.

The United Nations recommends that “The amount of water for drinking, washing, cooking and maintaining proper hygiene is a minimum of 50 litres per person per day”. This amount is about two and a half buckets of water for a person per day.

MORE TO KNOW

IMPORTANT DAYS

World Wetland Day - Feb 2

World Forest Day - March 21

Earth Day - April 22

World Environment Day- June 5

Natural Resources Day - October 5

Nature Conservation Day - Nov - 25

ACTIVITY 8.1

Shall we collect clippings from newspapers and magazines on the news items, articles and pictures related to water shortage. Paste them in your scrap book and share it with your teachers and friends.

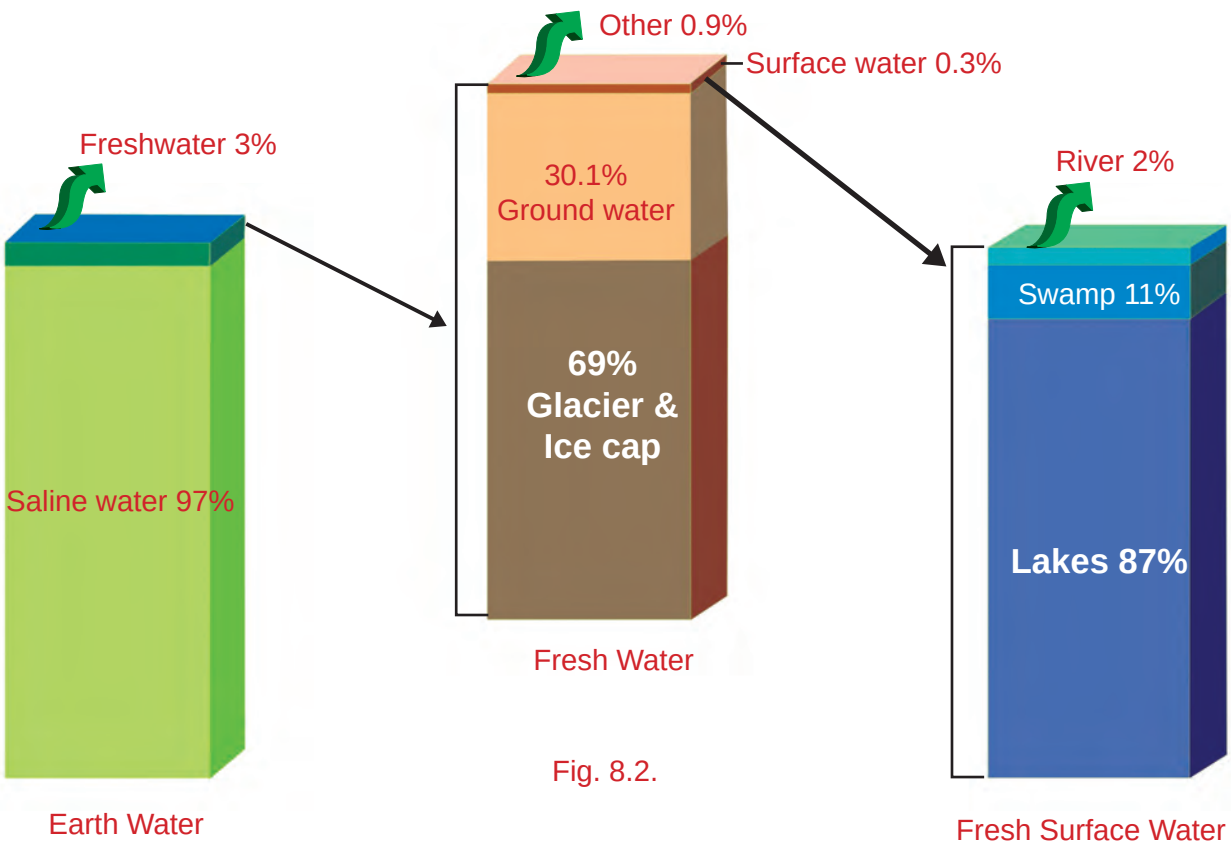


Fig. 8.2.

8.2. SOURCES OF WATER

1. Rain water

Rainwater is the purest form of water. As water from the seas and rivers evaporate to form water vapour under the heat of the sun, it leaves behind all the impurities. When precipitation occurs, the first showers dissolve certain gases present in air and also bring suspended impurities along with it. Subsequent showers, however, contain pure water.

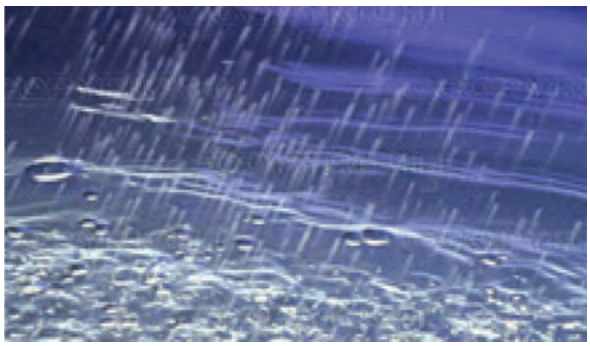


Fig. 8.3. Rain Water

2. Glaciers, ice and snow

Of the 3 percent of all water that is fresh, about three – fourths are tied up in glaciers, ice caps and snowfields. They occur only at high altitudes or high latitudes.

Fig. 8.4. Glaciers

3. River water

The water in the rivers comes either from rainfall or melting of snow (glaciers) on the mountains.

4. Sea and Ocean water

Oceans are a huge store of water. Millions of litres of water is present in them. But the water is salty and is not fit for any domestic or agricultural use.

5. Lake and Pond water

Lakes are inland depressions that hold standing fresh water almost all the year round. Ponds are small, temporary or permanent bodies of shallow water. They are still a minor component of total world water supply.

MORE TO KNOW

All oceans and seas have salty water. The saltiest of all is the Dead sea. It is called “dead” because the high salinity prevents any fish or other visible aquatic organism to live in its water. Imagine 300 grams of salt in one litre of water. Interestingly, even if a person does not know how to swim, he would not drown in this sea. He will float in it.

8.3. FORMS OF WATER

We already know that water exists in three states i.e., solid, liquid, and gas. All the three states are reversible or interchangeable.

All the three states of water are also present in our natural environment at any given time.

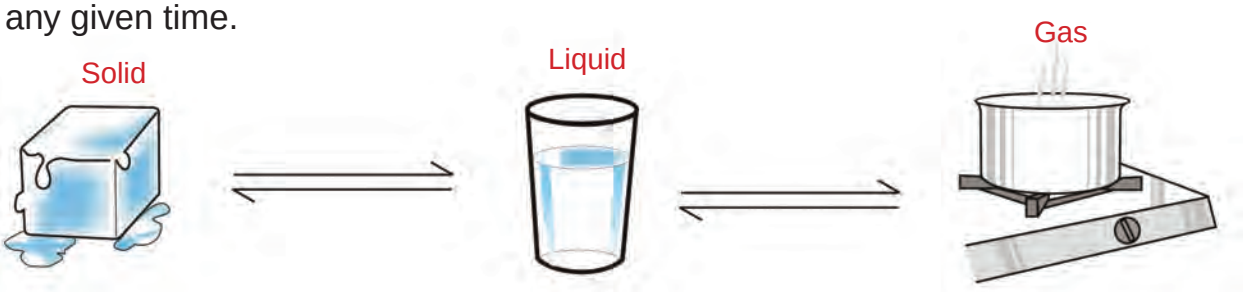


Fig. 8.5. (a) Water freezes to ice at 0^0C

Fig. 8.5. (b) Water remains liquid between 0^0C and 100^0C

Fig. 8.5. (c) Water Changes to steam at 100^0C

1. Solid: Ice is the solid form of water. It can be found in the atmosphere in the form of ice crystals, snow, ice pellets, hail, and frost. It is also found in the polar regions and high mountain peaks.

2. Liquid: Rain and dew are formed of water droplets. Also liquid water covers three quarters of the surface of the earth in the form of lakes, rivers, and oceans.

3. Gas : Water vapour is the gaseous form of water and exists as mist, fog, steam, and clouds.

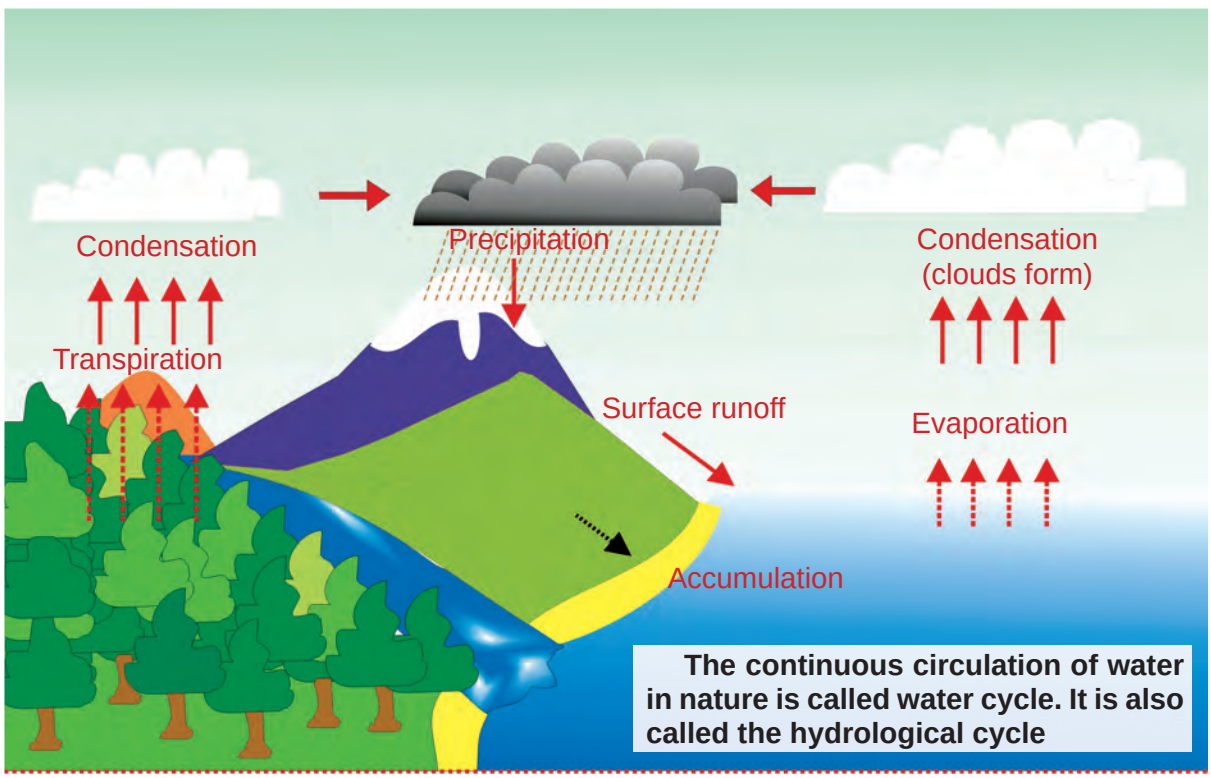


Fig. 8.6. Water cycle

8.4. GROUND WATER

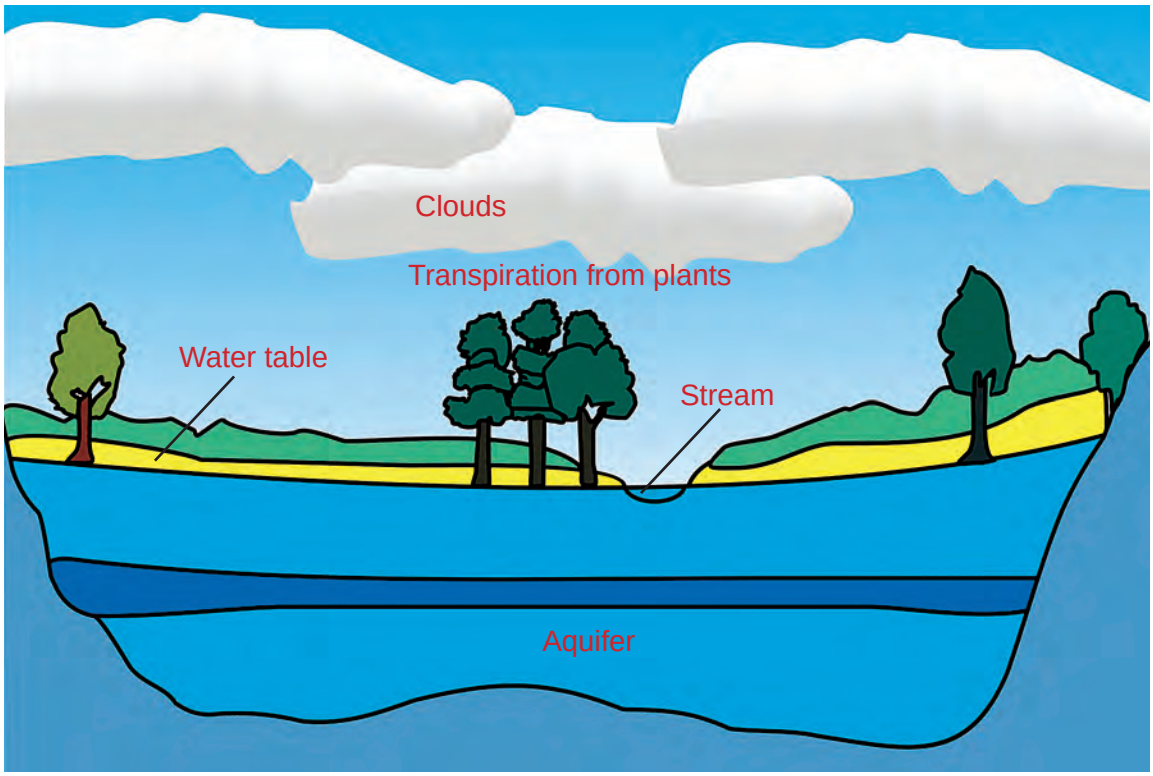


Fig. 8.7. Underground Water or Aquifer

- Precipitation in the form of rain or snow provides fresh water to our earth.
- Most of the fresh water returns to the oceans through rivers.
- A small portion of rain water seeps into the soil and is stored as underground water.
- Underground water is also called an **aquifer**.

MORE TO KNOW

A World Bank report says, “India is the largest user of groundwater in the world, and its underground aquifers are being depleted at an alarming rate”.

- The top level of this underground water is called the water table. If we dig a hole in the ground near a water body we may find that the soil is moist.
- The moisture in the soil indicates the presence of water underground.
- If we dig deeper and deeper, we would reach a level where all the space between particles of soil and gaps between rocks are filled with water. The upper limit of this layer is called the **water table**.
- The water table varies from place to place, and it may even change at a given place.
- Water in the aquifers can usually be pumped out with the help of tube wells or hand pumps.

8.5. DEPLETION OF WATER

1. Natural forces

Scanty rainfall and hot winds are natural forces that may deplete the water table.

2. Human causes

Deforestation, increased popu lation, rapid urbanization, over-grazing by cattle, excess tapping of ground water are human causes.

3. Salt water intrusion

Many parts of the world are losing freshwater sources due to saltwater intrusion. Over use of underground freshwater reservoirs often allows salt water to intrude into aquifers and affect the water table.

Fig.8.8. Deforestation

4. Commercialization of water resources

Some of the private companies suck a large quantity of water from river, and underground acquifers.

5. Sand grabbing from rivers

Some rivers are deeply affected by sand grabbing. **eg. Palar river**

8.6. DISTRIBUTION OF WATER

Water availability in India depends greatly on the seasonal monsoons. The monsoons bring heavy rains over most of the country between June and October. Only Tamil Nadu is the exception and receives over half of its rain in October and November. India has places ranging from desert condition (Thar desert) to places with rainforest climate (North Eastern States). In general, the northern half of the country sees greater extremes in rainfall. India has a large network of rivers too. The three major rivers the Indus, the Ganga and the Brahmaputra originate in the Himalayas and drain nearly two-thirds of the land area.

During the monsoon, water levels in rivers increases greatly and may result in floods. On the other hand, during the dry season, water level goes down quite a bit in most large rivers. Smaller tributaries and streams generally dry up completely.

To regulate water flow in these rivers and distribute water more evenly throughout the year, large dams have been built on a number of rivers.

MORE TO KNOW

- India receives nearly 4 per cent of the global precipitation and ranks 133 in the world in terms of water availability per person per annum.
- The total renewable water resources of India is estimated at 1,897 sq km per annum.
- By 2025, it is predicted that large parts of India will join countries or regions having absolute water scarcity.

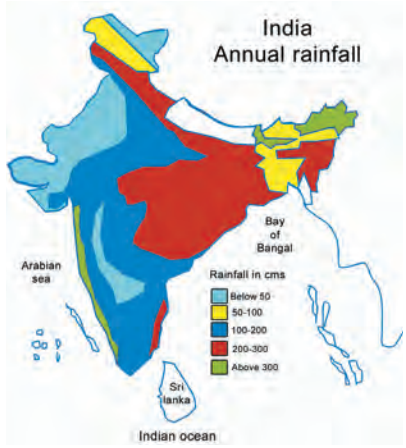
ACTIVITY 8.2

Given here is the rainfall map of India .It gives the average annual rainfall in different regions of our country.

1. Locate on the map the place you live in.

2. Are you blessed with sufficient rainfall?

3. Is there sufficient water available in your area throughout the year?



8.7. SCARCITY OF WATER

Scarcity of water is defined as a situation where there is insufficient water to satisfy normal requirements.

Though water is a renewable resource, we, the humans are using it at a faster rate than it is being replenished.

There are various factors contributing to the depletion of water table.

- Growing population has resulted in a growing demand for houses, offices, shops, roads etc. As a result, open areas like parks and playgrounds are used for construction. This reduces the seepage of water into the ground.
- Growing population has also resulted in an increase in the number of industries. Water is used in almost every stage of production of things that we use.
- As we already know India is an agricultural country and farmers have to depend on rains for irrigating their fields. However, erratic monsoons result in excess use of groundwater thereby decreasing the underground water
- Uncontrolled use of bore well technology for extracting groundwater.
- Pollution of freshwater resources. This is due to the flow of untreated sewage from homes, toxic chemicals from industries, and of pesticides and insecticides used by farmers into water bodies
- No effective measures for water conservation.

Fig. 8.9. Water is vital for the survival of organism on earth

MORE TO KNOW

A design of a toilet in which human excreta is treated by earthworms has been tested in India. It has been found to be novel. Toilets that required little water is safe for processing of human waste. The operation of toilet is very simple and hygienic. The human excreta is completely converted to vermicakes – a resource much needed for soil.

8.8 WATER MANAGEMENT - RAIN WATER HARVESTING

The activity of collecting rainwater directly or recharging it into ground to improve ground water storage in the aquifer is called rain water harvesting. To recharge the groundwater, rainwater that falls in the terrace of the buildings and in the open space around the buildings may be harvested. Roof top rain water can be diverted to the existing open / bore well. Rainwater available in the open spaces around the building may be recharged into the ground by the simple but effective methods. The Government of Tamil nadu leads the nation in implementing rain water harvesting programme. It has made it mandatory for all houses and buildings in the state to install rain water harvesting facility

Rain water harvesting techniques

There are two main techniques of rain water harvesting.

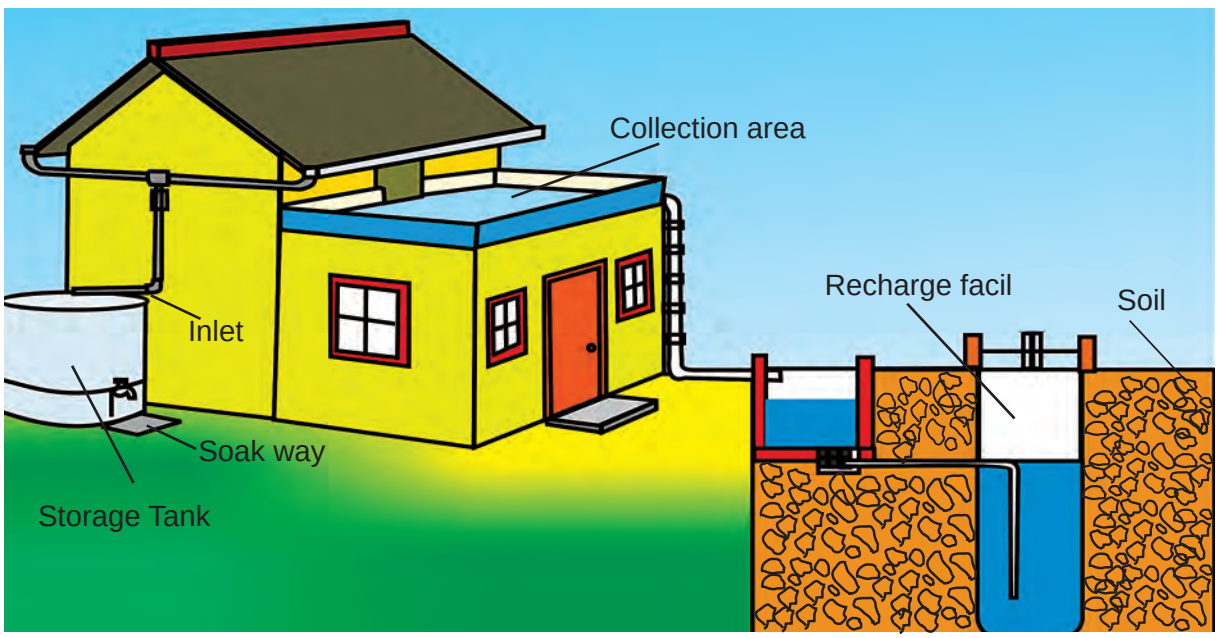


Fig. 8.10. Rain water harvesting

1. Storage of rainwater on surface for future use.
2. Recharge to ground water

Advantages of rain water harvesting

- Surface water is inadequate to meet our demand and we have to depend on ground water.
- Due to rapid urbanization, infiltration of rain water into the sub-soil has decreased drastically and recharging of ground water has diminished.
- Rainwater harvesting can reduce flooding in city streets.
- Sea water intrusion in coastal areas can be arrested.
- The ground water can be conserved.
- Rainwater Harvesting can reduced topsoil loss.
- It can improve plant growth.

ACTIVITY 8.3

Shall we discuss the ways in which we can conserve water.
1. Save a drop today. Keep the drought away.
2. Rain drops - life giving drops.
3. .....

8.9. SCIENCE TODAY

8.9.1. DRINKING ICE BERG

Fig. 8.11. Melting of glacier

Icebergs are pieces of glaciers that have drifted into the ocean and would otherwise melt and become saltwater. Icebergs are mostly white because the ice is full of tiny air bubbles. The bubble surfaces reflect white light giving the iceberg an overall white appearance. Ice that is bubble free has a blue tint which is due to the same light phenomenon that tints the sky. Drinking iceberg water is one of the most environmentally conscious methods of meeting the world's increasing demand for clean fresh water. All the North Indian Rivers originate in the glaciers of Himalayas

There are two very positive environmental impacts from the use of icebergs as drinking water

1. It decreases human dependency on traditional watersheds, such as rivers and lakes, and therefore decreases human impact on these delicate and overstressed ecosystems.
2. It helps to reduce rising sea levels, which have been caused by polar icecap melting. Since most glacier ice was formed thousands of years ago from falling snow, and snow results from condensed water vapour in the atmosphere, the water from icebergs is quite pure. Icebergs are comprised of pure fresh water.

8.9.2. DESALINATION OF SEA WATER

Desalination is an artificial process by which saline water (sea water) is converted to fresh water.

The most common desalination processes are :

1. Distillation 2. Reverse osmosis

1. Distillation

The process in which both evaporation and condensation go side by side is called distillation

2. Reverse osmosis

The process of forcing water under pressure through a semi permeable membrane whose tiny pores allow water to pass but exclude most salts and minerals.

The state government of Tamil Nadu has taken up a venture to convert sea water into potable water by the Reverse osmosis process to solve the problem of scarcity of water at Chennai.

The Minjur desalination plant

It is the largest desalination plant in India. It is located in Kattupalli village near Minjur about 35km north of Chennai. The plant is established on 60 acre site at a cost of Rs.600 crore. It consists of 8,600 sea water reverse osmosis (RO) membranes to convert sea water into potable water. The RO technology of the plant produces 100 mld (million-litres-a-day) of freshwater from 273 million litres of sea water. The Minjur desalination plant supplies 100 mld of fresh water to the Chennai Metro water at the rate of Rs.48.66 per 1,000 litres. The desalination plant serves potable water to an estimated population of 5 lakh in Chennai.

The Nemmeli desalination plant

The State Government has decided to alleviate the freshwater problems by the desalination of sea water. Besides the Minjur plant, the Chennai Metropolitan Water Supply and Sewage Board (CMWSSB) is also constructing desalination plant at Nemmeli at a total cost of Rs.908.28 crore. The plant has a capacity to convert 100 million litres per day as potable water from seawater. Water from Nemmeli plant would be carried for 40 km to the city to be supplied to its residents.

Fig. 8.12. The desalination plant at Minjur, Thiruvallur D.t.,

MORE TO KNOW

Water obtained through distillation is called distilled water. This water is normally pure enough for use in school science and medical laboratories.

8.9.3. SWEET WATER ON EARTH

1. The 2006 Mumbai "sweet" seawater incident was a phenomenon during which the residents of Mumbai claimed that the water at Mahim Creek had suddenly turned "sweet". Mahim Creek is one of the most polluted creeks in India that receives thousands of tonnes of raw sewage and industrial waste every day,
2. Within few hours of Mumbai "sweet" seawater incident, residents of Gujarat claimed that seawater at Teethal beach had turned sweet as well.

Geologists at the Indian Institute of Technology in Bombay offered the explanation that water turning sweet is a natural phenomenon. Continuous

Fig. 8.13. Teethal Beach (Gujarat)

rainfall over the preceding few days had caused a large pool of fresh water to accrue in an underground rock formation near to the coast. Then this water discharged into the sea as a large "plume" as fractures in the rocks widened. Because of the differences in density, the discharged fresh water floated on top of the salt water of the sea and spread along the coast. Over time, the two would mix to become normal sea water once more.

ACTIVITY 8.4

Calculate the amount of water we used daily.

ACTIVITY	AMOUNT OF WATER USED IN LITRES
Drinking	
Cooking	
Bathing	
Washing	

Water is a resource . Water is essential for hygienic well being of all humanbeings.So water must be used optimally .

EVALUATION

1. Pick out the correct answer.

a. Water exists in abundance on the planet ---------- (Earth/ Mars).

b. ---------- are a huge store of water. (Oceans / Ponds)

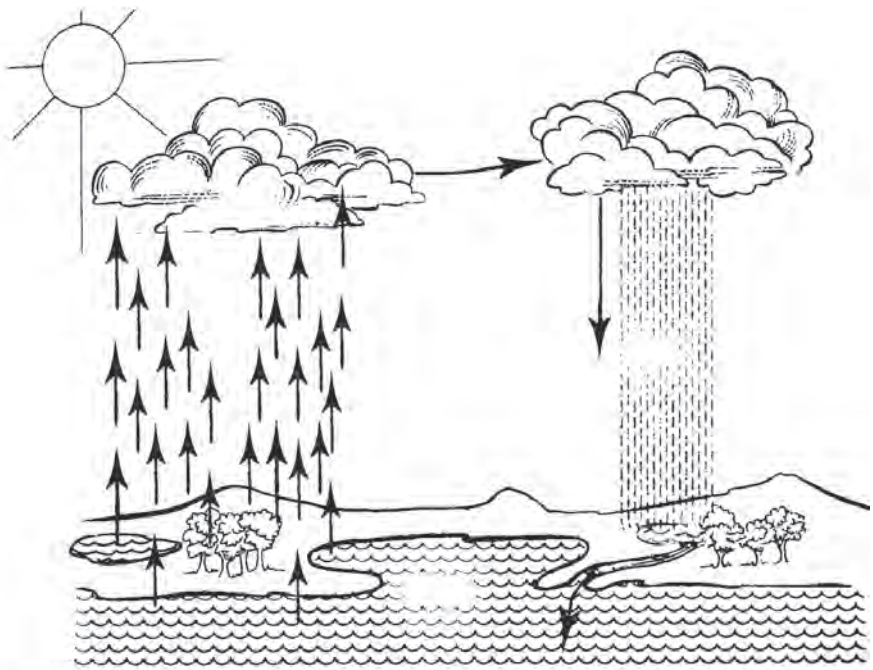
c. ---------- is the gaseous form of water. (Rain / Water vapour)

d. Desalination is an artificial process by which ---------- is converted to fresh water. (Sea water / River water)

2. Given below are some sources of water. Arrange the jumbled words and fill in

INAR	OWNS	RRVIE	ASE
RAIN.....	.....	.....	.....
AKEL	NOPD		
.....	.....	.....	.....

3. Diagram of a water cycle is given. Place the following words in the correct place. Sea, cloud, evaporation, rain.



4. Advice class leaders on water conservation in your school.

a) Close the water tap after use.

b) ……

c) ……

d) ……

e) ……

f) ……

g) ……

h) ……

5. All of us use water every day. Fill in the tables according to your observation:-

S.No.		IN SCHOOL	IN HOME
1.	Source of water	_____	_____
2.	Number of taps	_____	_____
3.	Taps that leak	_____	_____
4.	Water wasted by leakage every day in litres	_____	_____

6. The State Government of Tamil Nadu has taken up a venture to convert sea water into potable water. Name the two desalination plant.

a) _____

b) _____

FURTHER REFERENCE

Books

1. **Frame Work of Science** - Paddy Gannon, Oxford University Press, New Delhi
2. **Environmental Science** - Tata McGraw Hill, New Delhi.

Websites

www.rainwaterharvesting.org

http;//www.worldwaterday.org

Places of scientific importance for visit:

1. The desalination plant, Minjur, Thiruvallur District
2. The desalination plant, Nemmeli, Kanchipuram District.
3. Sathanur Dam, Thiruvannamalai District.