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2.1 Introduction

Microorganisms are those organisms which we cannot see with our naked eyes. A microscope is needed to see them. Microorganisms are studied under a branch of science called **microbiology**.

Around us, besides different kinds of plants, a large number of big and small organisms are found. The number of these organisms is very huge or uncountable. Some organisms are seen only sometimes. Some organisms are in soil, forests and seas, and cannot be seen with naked eyes. Some look like branches of trees while some are colourful. These organisms are called **microorganisms**.

These microorganisms were first seen by Antonie van Leeuwenhoek by a self-made microscope. The shapes of these organisms were different. The length of such organisms is in microns, which can be seen easily with the help of a simple microscope.

Microorganisms are also found in dead and decaying carbonic substances. Besides, a large

number of microorganisms are also found in our bodies.

2.2 Dwellings of Microorganisms

On the basis of where they live, microorganisms are of three types—free living, parasitic and symbiotic.

(i) Free living microorganisms : The microorganisms which are found living freely in nature are called **free living microorganisms**. These are found in air, soil and water.

Interesting Fact

In 1677, Antonie van Leeuwenhoek saw microorganisms for the first time, by a self-made microscope.

(ii) Parasitic microorganisms : The microorganisms which live in other organisms and plants are called **parasitic microorganisms**. They are also called **heterotrophs**. For their food and shelter, they are dependent upon other organisms.

(iii) Symbiotic microorganisms : The microorganisms which live together and provide mutual benefit to each other are called **symbiotic microorganisms**. Such organisms always live in a group. For example, rhizobium bacteria lives in the root nodules of leguminous plants.



Root nodules

Around us, the air, water and soil are stuffed with innumerable organisms, some of which we can see

and some which we cannot see but sense their presence.

Microorganisms can grow in any environment and any surroundings. These can easily handle the conditions of temperature, salt and dryness due to their hard, outer covering called **cyst**. In suitable conditions, these microorganisms come out of their cyst and continue their life cycle.

2.3 Groups of Microorganisms

Microorganisms have been divided into five groups : bacteria, fungi, algae, protozoa and virus.

2.4 Virus

Viruses are the smallest microorganisms. In Latin language, the meaning of 'virus' is 'liquid poison'.

Viruses cannot be even seen by powerful microscope which works on light. They can only be seen by an electron microscope. Viruses are unicellular organisms who live inside parasitic organisms and while multiplying, live in plants also.

The structures of viruses are different. The structures may be rod-like, poly-limbed or cubical. They are called **parasitic** or named after the disease they cause. Viruses are studied under a branch of science called **virology**. Viruses are complete parasites.

Structure and Shape of Virus : Normally, viruses are microorganisms with a simple structure. In a virus, the DNA or RNA genetic material is kept safe in a protein covering. Virus does not have a unicellular structure. It is also smaller than a bacteria. Its size is nearly 0.015 microns to 0.2 microns.

Interesting Fact

Virus was discovered by a Russian botanist Ivanovsky.

Kinds of Virus : Viruses are divided into three divisions :

1. Plant Virus : In these, RNA is the genetic material. These viruses infect animals and plants.

2. Animal Virus : It may have both RNA and DNA. These infect animals and insects.

3. Bacteria Virus : These have DNA, hence are called bacteria destroyers. They eat bacteria.

Reproduction : Since a virus does not have cells, hence it cannot perform biological works of cells. Besides, it also cannot reproduce. It needs the help of other organisms for reproduction.

This is the reason some believe virus to be an abnormal condition of life whereas some scientists do not agree with it and do not classify virus to be among living organisms. Virus remain alive in a living cell and once they come out of it, they become like dead. On an attack on a cell, its DNA comes out of the protein shell and increases its numbers inside the cell. This increase in numbers leads to the death of the cell.

This way, due to cells dying, the man becomes diseased. Viruses are considered to be the link between the living and the non-living.

Table of Diseases Caused in Humans by Virus

S.No.	Virus	Diseases Caused in Humans
1.	Measles virus	Measles
2.	Influenza virus	Viral fever
3.	Poliomyelitis virus	Polio in children
4.	Dysentery virus	Dysentery
5.	Chicken pox virus	Chicken pox
6.	Cold virus	Cold
7.	Foot & Mouth disease	Foot & mouth disease
8.	Herpes virus	Herpes
9.	Papaya leaf curl virus	Papaya leaf curl
10.	Tomato leaf curl virus	Tomato leaf curl
11.	Tobacco mosaic virus	Mosaic disease
12.	Potato leaf roll virus	Potato leaf roll
13.	German measles	Rubella
14.	Rabies	Rabies
15.	Pneumonia	Pneumonia

Characteristics of Virus :

1. Viruses are found living in water, air, soil and living bodies.

2. They have the qualities of both living and non-living.

3. Virus can be stored in a crystalline form, just like a non-living thing.

4. Virus have genetic material.

5. They multiply and grow inside a living cell only.

6. They do not have any metabolic process.

7. Virus does not have any cell structure.

8. These are biologically infecting organisms which spread diseases.

9. The main diseases spread by them are rabies, polio, chicken pox, dysentery, rubella, etc.

10. Once outside a living cell, a virus can neither respire nor reproduce.

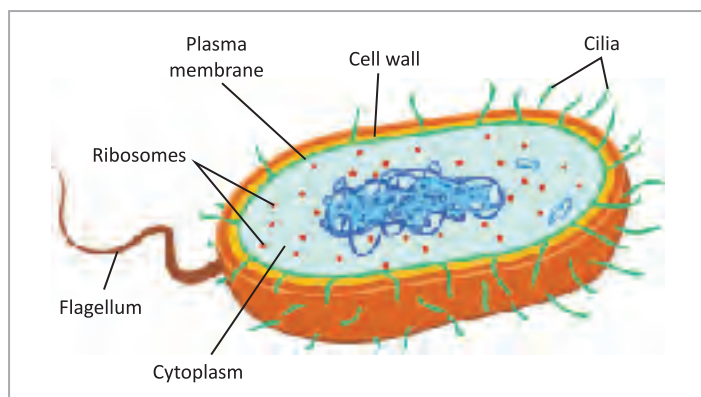
2.5 Bacteria

The study of bacteria comes under the branch of science called **bacteriology**. Bacteria are found in the upper layers of air, water and soil. In fact, bacteria are found at nearly all the places. They are found at such places also where no other living being can survive. All the bacteria die in excess water.

Interesting Fact

In 1829, German scientist Ehrenberg named micro-organisms as bacteria.

Structure : Bacteria are unicellular organisms and their size is from 0.2 to 100 microns. They can only be seen by a good quality microscope. They have a hard cell wall whose nucleus is undeveloped and the nuclear material is in the cytoplasm. Some bacteria can photosynthesise while some are parasitic. There may be millions of bacteria in a single drop of water. Many of these have **cilia** or **flagella** which help them to move about.



Structure of Bacteria

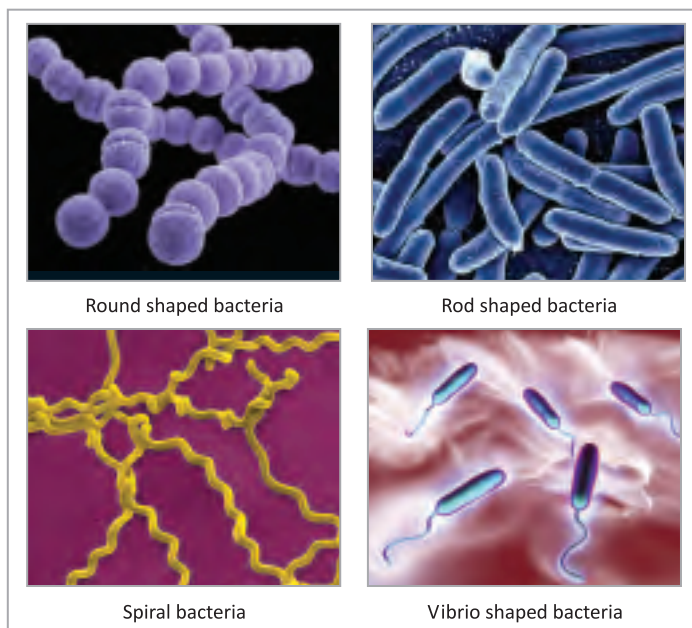
Kinds of Bacteria : On the basis of shape, bacteria are of four kinds :

1. Round shaped : Round bacteria are either found singly, in the group of two or in a bunch. Besides, they are also found in the form of a series.

2. Rod shaped : Rod shaped bacteria are found in the form of filaments.

3. Spiral shaped : They look shaped like spirals which have more than one fold. Most of these have flagella on both the ends.

4. Vibrio or comma shaped : The shape of these bacteria is like a comma.



Different bacteria

Motion : Some bacteria are mobile while some are immobile. Mobile bacteria have a structure called cilium. Structure of some mobile bacteria is like a whip. Cilia may be at one or both the ends of the bacteria. Cilia help a bacteria to swim.

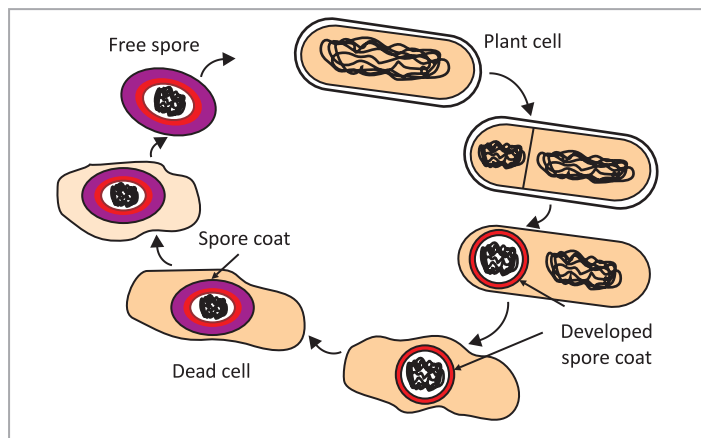
Nutrition : Some bacteria have bacterial chlorophyll for photosynthesis. Most bacteria are heterotrophs. They may also be saprophytic. They get their food from the tissues of other organisms.

Growth and Respiration : Some bacteria need free oxygen from environment for their growth. These are called **aerobic**. On the other hand, the bacteria which can survive without oxygen are called **anaerobic**.

Reproduction : Bacteria reproduce by binary fission, for which favourable conditions are needed. In it, the nucleus of the bacterial cell becomes large and a horizontal wall divides the nucleus into two parts, both the offspring cells separate and once they mature, division takes place again. They grow very fast, such as pseudomonas reproduce at every 9.5 minutes. Some bacteria grow very slow, such as bacteria which cause leprosy.

Formation of Spores : Despite adverse conditions, some bacteria form spores. Such spores are generally formed in rod shaped bacteria. Cytoplasm contracts to become round and a hard protective shield is formed around it. Spore structure is stronger than the structure of bacteria. These are metabolic and can

survive temperature up to 80°C to 100°C. This process is called breeding without reproduction.



Spore formation in bacteria

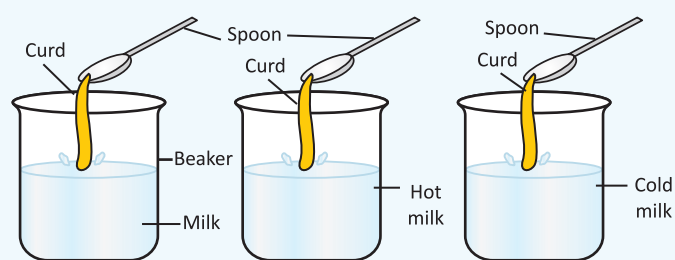
Formation of Curd : Curd is made from milk. When some curd is mixed with warm milk (37°C), then the bacteria begin to use the fatless constituent and grow and multiply slowly. Curd begins to form due to acidic substance.

Activity

Making of curd from milk at home

Take some milk and pour it equally in three beakers. Mark the beakers 1, 2 and 3. Now, heat the milk in beaker 1 at 37°C and boil the milk in beaker 2. Leave the milk in beaker 3 cold. Then, put a spoonful of curd into each beaker and mix well. Cover each beaker with a vessel and leave them for 3–4 hours. The milk in beaker 1 solidifies as curd and no change happens in milk in beaker 2 and 3.

To change milk into curd, it has to be boiled at 37°C.



Forming curd

Curd has anaerobic bacteria called ***Lactobacillum***. After the curd is formed, it is kept at a cold place, which stops the growth of bacteria. Extra acid makes the curd sour. Hot milk kills the microorganisms and in cold milk, the microorganisms do not grow.

Uses of Bacteria :

1. Making of milk products such as curd and cheese (paneer).

2. Preparing vinegar by anaerobic reaction on fruit juice, sugarcane juice and plum juice.

3. Making of wine by aerobic reaction.

4. The bacteria present in the intestines of ruminants such as cow digest plant cellulose. That is why these animals eat grass as main food.

5. Some bacteria increase the process of the purification of leather.

6. Some bacteria break down the carbonic substances to prepare nutrients and release huge amounts of carbon dioxide for the green plants to use.

Medicinal Uses of Bacteria :

1. Some secondary bacteria are used to fight against harmful bacteria. Such bacteria also help to make bacteria destroying medicines.

2. The DNA of some bacteria also changes with them. After that, the bacteria produce important substances like insulin in large quantity. Insulin helps to control the quantity of sugar in the human body.

Harmful Actions of Bacteria :

1. Some bacteria rot the meat, sour the milk and make the butter stale whereas they gain food energy for their purposes.

2. The diseases in humans caused by bacteria are pneumonia, roughness in neck, diphtheria and tuberculosis.

3. Some diseases in plants caused by bacteria are shriveling of apples and pears and rotting and decay of vegetables.

4. Some diseases in animals caused by bacteria are an infectious disease in sheep, horse and other domestic animals, called anthrax and fadil cholera disease in hens and cocks.

Interesting Fact

Bacteria were on the earth before humans. These are hardy organisms and can survive in tough conditions. They are also found alive in boiling water along with cold freezing water. They have also been found in caustic soda lakes and ponds of sulphuric acid. They can also live in space and in depth of many kilometers. It was observed on camera that a bacteria survived on the moon for two years, i.e. there is no environment where bacteria cannot survive.

Interesting Fact

Robert Koch postulated that *tuberculous bacillum* bacteria causes the disease tuberculosis.

2.6 Fungi

A cell which does not have chlorophyll is called **fungus**. A very large group of plants such as mildew mushroom and death-cup in which chlorophyll is not found is called fungi.

They develop as blue-green smudge or stain on rotting and decaying fruits, stain on unpolished shoes and tree trunks. For example, yeast, penicillium, rhizopus and mushroom. The branch under which the fungi are studied is called **mycology**.

Base and Structure of Fungi : Fungi are both unicellular and multicellular. Multicellular fungi are in the shape of filaments. That's why they are also called **fungus filaments**. A group of fungal filaments is called **funginet**. A fungi has a pin-sized **sporangium** which have **spores**. Fungi do not make their own food. They are also called parasites and saprophytes.

Kinds of Fungi : Fungi are mainly of two kinds, yeast and mildew.

Generally, **yeast** are unicellular whereas **mildew** are multicellular and look like filaments. Mushroom is also a kind of fungi. Yeast can survive in both **aerobic** and **anaerobic** conditions.



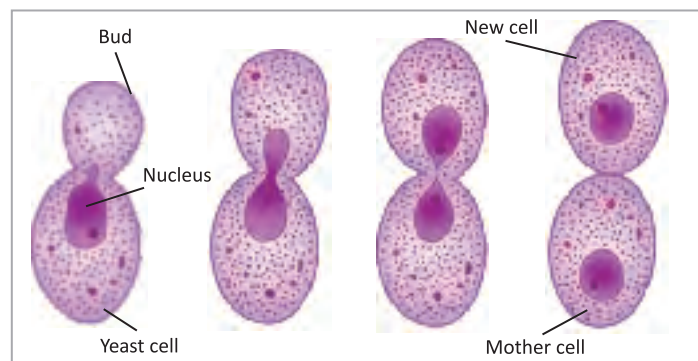
Different fungi

The size of a yeast is from 5 to 10 microns while the size of mildew is from 2 to 10 microns. Mushroom like some mildews can be many centimetres long.

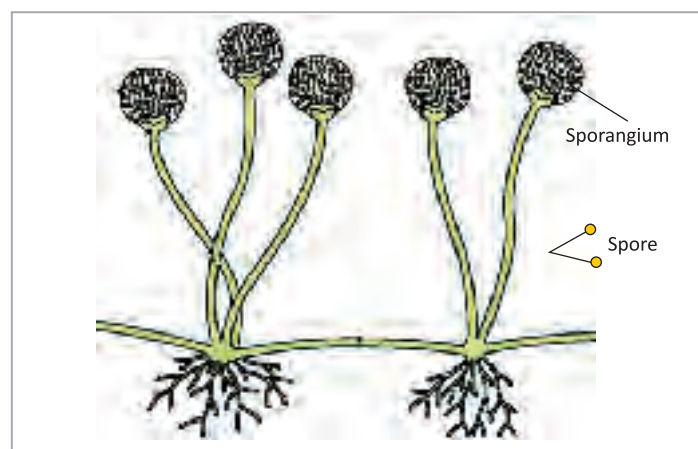
Nutrition in Fungi : Fungi cannot make their own food. For food, they depend on others. They lead saprophytic and parasitic life. They grow on dead, decaying matters and on other living organisms. Just like plant cells, they too have a cell wall but they do not photosynthesize. Thus, they are **heterotrophs**.

Respiration in Fungi : Mildew is aerobic but yeast is both aerobic and anaerobic. During aerobic respiration, yeast makes alcohol and CO_2 .

Reproduction in Fungi : During adverse conditions, fungi reproduce asexually by binary fission, budding, regeneration and sporogenesis. Reproduction in fungi, mildews and mushroom takes place by sporogenesis. Fungi produce spores in innumerable numbers which are spread far and wide by air.



Budding in Yeast



Spore formation in rhizopus

Useful Activities of Fungi :

1. Bread, biscuit and cake are made from wheat flour.
2. Wine, fruit juices, beer from hops, and idli and dosa are made from a mixture of rice and pulse paste.
3. Some fungi such as mushroom are eaten directly as food.
4. Important medicines such as penicillin are made from fungi.
5. Some fungi are used to make acid, fats and organic manure.

Harmful Activities of Fungi :

1. Fungi spoil the food. They destroy potato and plants of other crops (wheat and maize).
2. They rot clothes, shoes and things made of wood.

3. Some fungi lead to diseases such as roundworm.

Interesting Fact

Fermentation was discovered by Louis Pasteur in 1857.

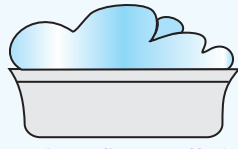
Activity

Making Bread

Some yeast, sugar and warm water is mixed with wheat flour (maida). The mixture soon begins to rise up. Because of sugar and heat, the yeast cells begin to grow rapidly. During respiration and reproduction, yeast cells produce CO₂ whose bubbles make the flour rise up. Baking it gives us spongy bread. Hence, soft and spongy bread is made by the action of yeast.



Wheat flour with yeast powder



Wheat flour puffed up by yeast

2.7 Algae

Algae generally live in aquatic environment such as seas, ponds and lakes. Most algae are multicellular and big enough so that they can be seen with naked eyes. Unicellular algae may be **round** and **rod shaped**. But the structure of multicellular algae is more complex. They may be of blue, red, green or brown in colour. This colour is due to a special dye present in their bodies. Some algae are found in ice, moist soil, barks of plants and rocks. Some algae live in symbiosis with fungi in lichens. They grow in the bodies of watery organisms such as hydra.

Structure and Size of Algae : Algae are unicellular and multicellular as well. The expansion of their size is from microscopic form with a length of 1 micron to those large marine weeds whose length may be in metres.



Chlamydomonas



Spirogyra



Kelp

Different algae

Kinds of Algae : Algae are mainly of two kinds:

1. Unicellular Algae : **Chlamydomonas** and **diatom** are examples of unicellular algae. These may be round and rod shaped. Some unicellular algae are immobile while some are mobile. Their motion is made possible by flagella.

2. Multicellular Algae

Colonial Algae : These mobile algae make colonies, which have specific number of same kind of cells such as volvox. Some multicellular algae may have the shape of filaments and may be branched or unbranched such as spirogyra.

Nutrition in Algae : Chlorophyll is found in algae. These make their food by photosynthesis and they tend to grow on wet and moist surfaces. Besides this, some algae are parasitic and symbiotic.

Dyes in Algae : On the basis of dyes, algae may be of following kinds :

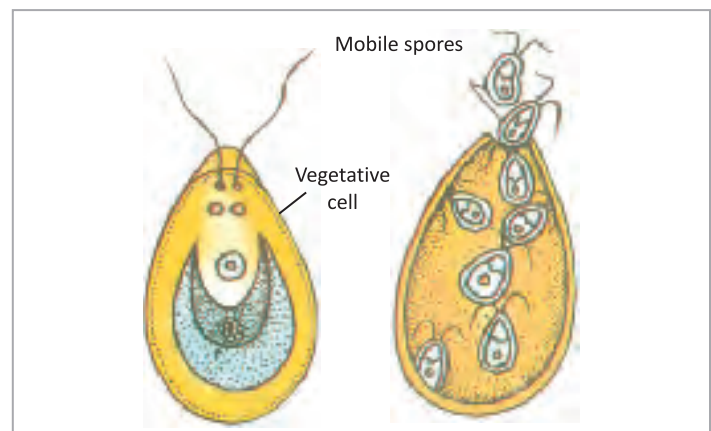
(i) Red Algae : Besides chlorophyll, they have photosynthesizing red dye also. The red colour of Red sea is due to the red algae floating at its floor, such as Porphyra.

(ii) Blue-green Algae : These are unicellular autotrophs in the form of colonies, such as anavina, nostoc, etc.

(iii) Brown Algae : These are multicellular such as laminaria, fern, etc.

(iv) Green Algae : Such as spirogyra, volvox, chlamydomonas, etc.

Reproduction in Algae : In algae, reproduction is mostly carried out by fission (vegetative reproduction). Algae reproduce asexually by sporogenesis. Zygotes are formed in sexual reproduction. Thus, algae reproduce by vegetative, sexual and asexual methods.



Spore formation in chlamydomonas

Uses of Algae :

1. Brown coloured algae called 'kelp' is an excellent source of iodine and potassium.
2. Ice creams, medicines and cosmetics are made from the algae juices. Important algae juice are **agar** and **alginic acid**.
3. **Diatom** cells are important and natural source of fine silica. That is why large deposits of diatom rocks are used to make filters, special glasses and porcelain.
4. Carbonic materials produced by algae are eaten as food by aquatic animals.
5. Some products such as wool, synthetic fibres, boot-polish, etc. are made from algae.
6. Some algae also help in nitrogen fixation.

Names of Algae and Their Uses

S.No.	Algae	Uses
1.	Laminaria	In the form of food; source of iodine
2.	Galadium	Agar-agar
3.	Caranaders	Cosmetics, boot-polish, shampoo
4.	Chlorella	Chlorelinae
5.	Sargasum	Food for aquatic and domestic animals

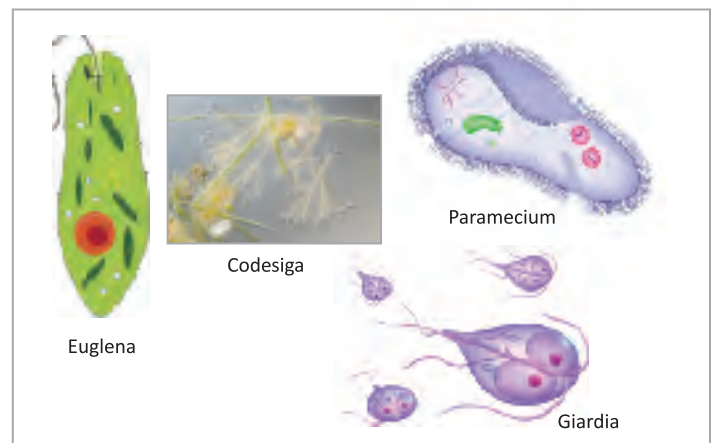
Harmful Activities of Algae : Algae such as **anavina** and **osiletosia** give rise to foul smell and stink, thus making the water of water sources unfit for the consumption by other organisms. This leads to the death of fish due to deficiency of water.

Interesting Fact

Agar is a gelatin-like substance. It is obtained from red algae and is used in laboratories for the growth of microorganisms. These are used in medicines and to solidify jellies and jams. China grass is also obtained from algae.

2.8 Protozoa

The meaning of the 'protozoan' is 'first organisms' (Proto = first, zoom = organisms). Protozoa are the kinds of organisms such as algae and plants. Protozoa is a unicellular organism which lives alone or in groups. Their size is from 2 to 20 microns. They may be very simple or complex types. They lives in moist places like seas and oceans, soil, freshwater, ditches, ponds, rivers and bodies of organisms. Some free living protozoa are also found in polar regions and very high mountains.



Different protozoa

Size and Structure : Amoeba does not have a fixed shape and it can change its shape. On the other hand, paramecium is slipper- shaped and has mouth, cilia and other structures. Some paramecium can be seen with naked eyes also.

Motion : Motion in them is done through the mediums of pseudopodia, cilia and flagella.

1. Pseudopodia : Some organisms such as amoeba move with the help of finger-like **shape** of **cytoplasm**. Such shapes are called **pseudopodia**. They also help the amoeba to catch its food.

2. Cilia : Protozoa like paramecium have hair-like structures called cilia. They swim in water with the help of the cilia and catch food with it.

3. Flagella : Protozoa such as euglena have a long, whip-like structure called flagella. It helps to move in wave like movements.

Activity

Observing amoeba and paramecium in a laboratory

Put dry grass, wheat or rice chaff, grass, dry leaves and some grain in half a litre of water and boil it. Filter the water. Now keep this filtered fodder like liquid for 2-3 days in an open place. Divide this filtered water into two parts.

In the liquid of the first beaker, put a rotted leaf from a pond after washing it. After a week, you will see a lot of amoeba on its bottom.

In the second beaker, put some water, with paramecium, from the pond. After a week, you will see a lot of paramecium in the filtered liquid of the beaker.

Interesting Fact

Amoeba was discovered in 1755 by Roesel Von Rosenhof and paramecium was discovered by Hill in 1752.

Nutrition : Nutrition in Protozoa is in many ways. Chlorophyll is found in euglena and it can make its own food. Rest of the protozoa are dependent on living and dead organisms. The **respiration** and **ejection** in protozoa is from the surface of the cells.

Reproduction : Reproduction in protozoa takes place by binary fission, multiple fission, budding, sporogenesis and sexual methods.

Useful Activities of Protozoa :

1. Protozoa feeds on algae and bacteria which are responsible for the breakdown of carbonic substances. This way, they play an important role in the breakdown of waste materials.

2. Some protozoa are used in different researches as study material, to study various biological processes such as cell division and reproduction.

3. Some protozoa live in symbiosis with other organisms and help to use the dwelling place, without which they cannot use it.

Harmful Effects of Protozoa :

1. Many protozoa are parasites. They live in human bodies and of other organisms where they give rise to various diseases.

2. Antomeba and giardia give rise to dysentery.

3. Plasmodium gives rise to malaria.

4. Trypanosoma gives rise to drowsy disease.

2.9 Microorganisms and Diseases

The microorganisms which spread diseases are called disease **causing microorganisms**. Some microorganisms affect our digestion process. Microorganisms produce some poisonous substances which affect the working process of our bodies. Some microorganisms destroy the tissues of our bodies. Diseases such as, cholera, small pox, etc. are called infectious diseases.

Methods of transmission of diseases : Infectious diseases are transmitted by the following methods :

(i) By Air : When we breathe in, the microorganisms enter our bodies along with the inhaled air. A person affected by cold, releases thousands of small droplets in the air, by one sneeze. These droplets have thousands of virus. When these droplets change into vapour, these virus stick to the minute dust particles present in the air. When someone inhales air, these microorganisms enter his body. This may lead to diseases such as cold, chain cough, etc.

(ii) By Food and Air : Microorganisms are also found in infected food and air. These transmit diseases through infected food and hands, such as cholera, dysentery, polio, typhoid, etc.

(iii) By Contact : Diseases are also caused by skin contact. Microorganisms are transmitted by using the same towel, handkerchief, comb, blanket and clothes. Shingles and eczema are also spread by contact.

(iv) By Carriers : Some insects and animals too are carriers of microorganisms. A fly is a general carrier.

The microorganisms present on animals waste (faeces) and on waste materials, stick to hair on the body and are transferred to food and other materials. **Anopheles mosquito** is the carrier of **plasmodium** microbe which causes malaria.

Precautions for the Prevention of Diseases :

1. We should keep our surroundings clean.

2. We should stay away from an infected person.

3. The things used by an infected person should not be used by others.

4. Water and milk should be boiled before using.

5. Never have uncovered food as it may be infected by dust, flies or cockroaches, etc.

6. We must get inoculated by vaccines for specific diseases.

Interesting Fact

Penicillin was discovered in 1929 by Dr. Alexander Fleming.

2.10 Commercial Uses of Microorganisms

Microorganisms prepare specific kinds of substances. Some substances are so useful that microorganisms are used to prepare them on a commercial level, which are as follows:

1. Production of Antibiotics and Vaccines : Antibiotics and vaccines are produced by the help of fungi and bacteria.

2. Alcohol and Wine : Fungi and yeast disintegrate the particles of carbohydrates into alcohol and carbon dioxide. This mixture is called wine whereas alcohol can be obtained by distillation of wine.

3. Vinegar and Acetic Acid : Fermentation of sugarcane juice gives us vinegar. Acetic acid is the distilled form of vinegar. Acetic acid is also obtained by action of **acetobacter aceti** bacteria on alcohol.

4. Bakery and Dairy Products : Bread is made with the help of yeast. Curd and cheese (paneer) are made

Some Diseases Caused by Microorganisms

Diseases	Microorganism	Transmitted through	Precautions
Humans			
Cholera	Bacteria	Food/water	Do not let dirt, dust and water collect in the surroundings. Human faeces and other excreta should be collected and covered, away from air and water sources.
Typhoid	Bacteria	Water	
Tuberculosis	Bacteria	Air	Human faeces and other excreta should be collected and covered, away from air and water sources.
Measles	Virus	Air	Clothes of infected persons should not be used and washed separately.
Polio	Virus	Air/water	Children should be given polio drops.
Malaria	Protozoa	Mosquito	Protection from mosquitoes.
Animals			
Foot and mouth disease	Bacteria	Air/scratch on skin	Infected animal should be kept separate.
Plants			
Rust of wheat	Fungi	Insects and seeds	Spray insecticides and fungicides on plants.
Mosaic disease	Bacteria	Air	Plant should be burned.

from ***Lactobacillus bacteria***.

5. Genetic Engineering : The study of the making of cell is done under genetic engineering. Scientists have been successful in making such bacteria which perform specific tasks. For example, the bacteria which feed on petroleum oil are used to clean oil tankers.

2.11 Other Uses of Microorganisms

Microorganisms are used to treat the flowing faeces. For this, breeds such as ***Bacillus***, ***Pseudomonas*** and ***Proteus*** are used. These bacteria are circulated around the big drains in large tanks by which the air is pumped. In enough presence of oxygen, the bacteria perform fast disintegration of the flowing faeces in a few hours only. The residual flowing faeces is sent to anaerobic digestion tank while the aerobic bacteria are left behind. Anaerobic bacteria make methane gas and the mixture of this gas is called ***Biogas***. Biogas is used as a fuel.

The waste which remains behind in the tank is nitrogenous. It is dried and used as manure.

2.12 Storage and Conservation

Following are the two methods of storage and conservation :

1. Chemical Methods
2. Hot and Cold Treatment

1. Chemical Methods :

(i) Treatment by insecticides and fungicides : To prevent the increase of microorganisms in wood,

leather, clothes, paper and grains, they are treated with chemicals. That's why naphthalene balls are put with woollen clothes.

(ii) Use of Preservatives : To keep meat, fish, pickles, vegetables, jams and jellies safe, they are treated with smoke, salt and vinegar are mixed in pickles and sugar is mixed in jam. This way, preservative method is used.

2. Hot and Cold Treatment :

(i) Boiling : It is used to keep safe liquids such as water and milk. By boiling, the microorganisms present in the liquids are killed.



Boiling

(ii) Low Temperature : Low temperature makes the enzymes, present in microorganisms, inactive, so that they do not disintegrate food and spoil it. Low temperature also stops the growth of cells. That's why food is kept in the fridge to prevent it from spoiling.



Keeping things in fridge

(iii) Pasteurisation : A scientist named Louis Pasteur discovered that bacteria spoil and rot the food. He developed a method to conserve the food, which was named **Pasteurisation** after him. This method is used to conserve milk. In this method, the milk is heated at 70°C for 15 seconds. Then it is cooled to 5°C. On heating, most of the bacteria die while on cooling, rest of the bacteria cannot multiply.

(iv) Canning : This is the most important method of keeping the food safe. Practically, it can be used for

every kind of food. In canning, the food is heated and closed in airtight containers. On heating, every kind of microorganisms die and not much can enter because of canning.



Canned food

(v) Bottling method : It is used for fruits and vegetables. It is done just like canning but a bottle is used instead of a can. It is used at homes by many people.

Food Poisoning : Some microorganisms produce poisonous materials in food, eating which spoils the health. They break down the particles of food and make new products, and change its chemical composition, smell and taste. They are produced in such large numbers that they induce illness.

To prevent food poisoning, it is necessary to preserve food in a proper manner and to prevent attacks of microbes.

Highlights

- Microorganisms cannot be seen with naked eyes.
- Microorganisms are studied under microbiology.
- Microorganisms are also present in dead and decaying carbonic materials.
- Microorganisms are found on our bodies also.
- Microorganisms are of three kinds : free living, parasitic and saprophytic.
- In Latin, the meaning of virus is 'liquid poison'.
- Virus can be seen only by an electron microscope.
- The size of virus is from 0.15 microns to 0.2 microns.
- Viruses are of three kinds—plant virus, animal virus and bacteria virus.
- Viruses are the link between the living and non-living.
- Viruses have genetic material.
- Bacteria are studied under 'bacteriology'.
- Bacteria are unicellular organisms.
- Size of bacteria is 0.2 to 100 microns.
- Microorganisms are classified into five groups : virus, bacteria, fungi, algae and protozoa.
- Algae are green plants. They may be unicellular or multicellular.
- Protozoa are unicellular organisms.
- Microorganisms spread diseases by air, water, food, direct contact and carriers.
- Some fungi appear on wet clothes, shoes and things of wood.
- Viruses cause human diseases like cold, measles, polio and small pox, etc.
- Some red algae produce agar.
- The ways to keep the food safe are canning, bottling, low temperature, boiling, pasteurisation, etc.

Exercise



A. Tick (✓) the correct options :

- Protozoa are :
(a) multicellular (b) unicellular
(c) free of cells (d) All of these
- Saprophytic microorganisms live :
(a) together (b) alone
(c) in a free state (d) None of these
- Genetic material in plant virus is:
(a) DNA (b) DNA and RNA
(c) TMV (d) RNA
- Bacteria are :
(a) unicellular (b) multicellular
(c) cytoplasm (d) All of these
- Reproduction in yeast takes place by:
(a) budding (b) sporogenesis
(c) binary fission (d) multiple fission
- Disease spread by fungi is:
(a) small pox (b) tuberculosis
(c) roundworm (d) None of these
- Kelp algae is a source of:
(a) nitrogen (b) calcium
(c) iodine (d) All of these

B. Fill in the blanks :

- _____ lives in the root nodules of legumes.
- Bacteria _____ in more _____ of water.
- To make curd from milk, it is heated at _____.
- Examples of fungi are _____ and _____.
- Porphyra is a _____ coloured _____.
- Paramecium swims with the help of _____.
- In pasteurisation, milk is boiled at _____.

C. Very Short Answer Questions :

- What is the cause of cholera?
- Give two examples of algae.
- Name the diseases caused by fungi.

4. Write the name of any one disease caused by virus.
5. Algae reproduces in how many ways?
6. Which protozoan causes malaria?
7. Anthrax affects which animals?

D. Short Answer Questions :

1. Write three characteristics of virus.
2. Define a symbiotic microorganism.
3. How does growth and development take place in bacteria?
4. Which algae provides us iodine and potassium?
5. Write a brief note on fungi and virus.
6. Differentiate between yeast and mildew.
7. What is a microorganism? Classify them on the basis of their dwelling place.

E. Long Answer Questions :

1. Explain harms caused by bacteria, fungi and virus.
2. Make clear the differences between bacteria and virus.
3. Make clear storage and conservation.
4. Explain the structure, shape and kinds of fungi.
5. Write a brief comment on water.
6. Explain in detail the commercial uses of microorganisms.
7. Explain in detail the structure, shape, motion and reproduction in protozoa.



Project Work

- Draw a labelled diagram of paramecium and put it up in your class.