Chapter

3

The World of Microorganisms : Part-I

Why do we add small amount of curd to lukewarm milk to make curd?

Why does cooked food get spoiled after some days? Why do we get bad smell from our mouth after we wake up in the morning?

In this chapter we will try to find out what may be involved in causing such changes.

Microscope invention-discovery of microorganisms

Fig-1(a): Antonie van Leeuwenhoek

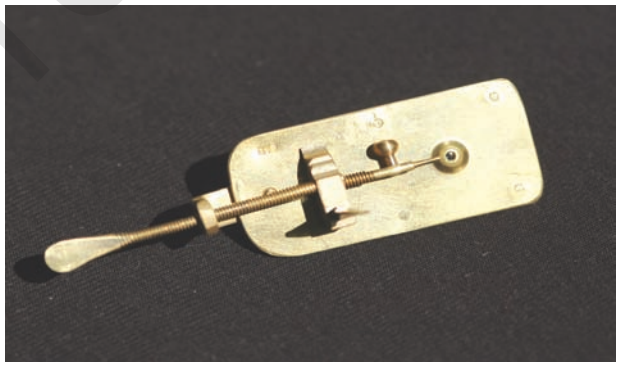


Fig-1(b): Microscope prepared by Leeuwenhoek

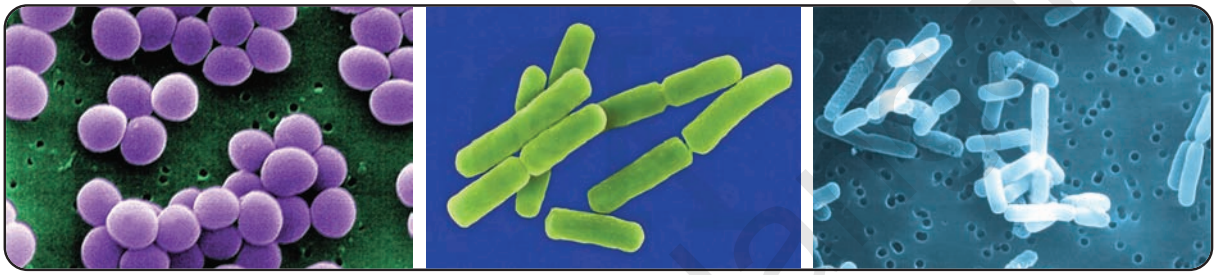
Antonie van Leeuwenhoek was a cloth merchant from Netherlands. Leeuwenhoek built a single lens microscope, which could magnify the object 300 times. His curiosity and skill of making powerful lenses was the secret of this invention of powerful microscope. At around 1674, with the help of his microscope, Leeuwenhoek discovered many small moving organisms in a drop of lake water. He called them "animalcules". Later these were named bacteria. Along with the animalcules, he also observed many other microorganisms under his microscope which were named later on. The invention of powerful microscope helped in further discovery of other microorganisms.

Now let us see what are microorganisms and where we can find them.

Microorganisms

There are different organisms present around us, which can be observed through microscope. Photographs of some microorganisms are shown in Fig-2 to Fig-6.

61364P



Coccus *Bacillus* *Lactobacillus*

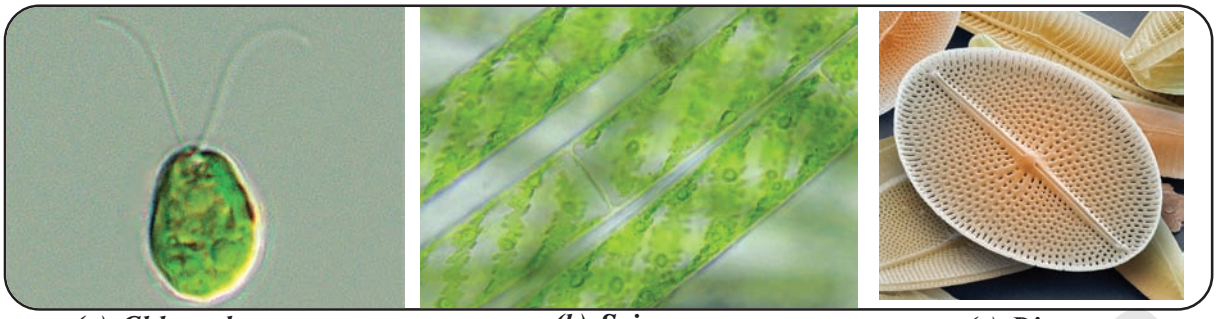
Fig-2 : Different types of bacteria

Penicillium *Rhizopus (Bread mould)* *Asperigillus*

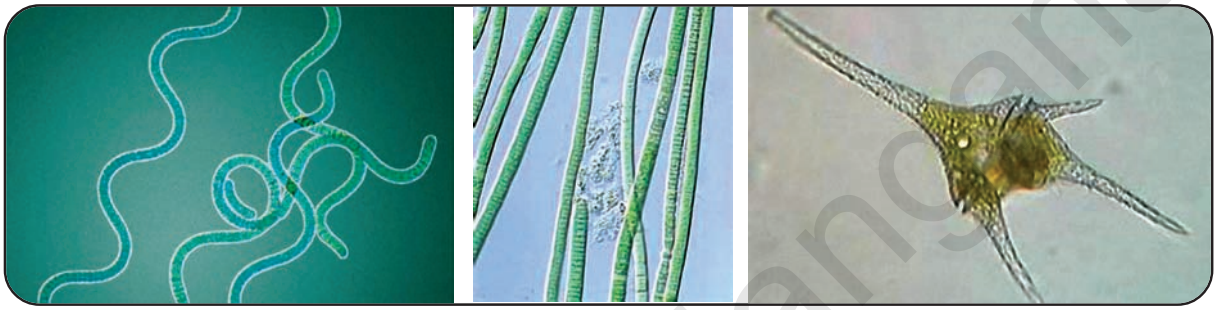
Fig-3 : Fungi

Amoeba *Paramoecium* *Vorticella*

Fig-4 : Protozoa



(a) Chlamydomonas *(b) Spirogyra* *(c) Diatom*



(d) Spirulina *(e) Oedogonium* *(f) Ceratium*

Fig-5 : Algae

(a) Cyclops *(b) Daphnia* *(c) Scabies mite* *(d) Eyelash mite*

Fig-6 : Micro Arthropods

Groups of microorganisms

Let us study some microorganisms that belong to the groups like Bacteria, Fungi, Protozoa, Algae and certain micro arthropods with the help of some activities.

For this we need a Microscope. You already know how to use it. You could also refer to Chapter "Cell-The basic unit of life".

Activity-1

Microorganisms in water

Collect some pond water / water from any tank in your surroundings. Take some of the greenish scrapings from the side of the tank. Take 1-2 drops of water (from the sample you have collected) on a slide and observe it under the Microscope. Draw rough sketches in your note book of what you have observed. Compare it with the

figures given above for observation and identification. You may also hold discussion about their shape, size and other characteristics with your friends. Take the help of your teacher also.

Can you name the organisms which you have observed through the microscope?

We will try to know more about the microscopic world by doing the following activities.

Observing Fungi

Usually after the rainy season you might have seen some small umbrella like growths over rotten materials of dumped waste, between the grasses in a field and edges of wet rotten wooden planks. Often you might have observed white patches on the bark of trees. These patches are formed due to Fungi. Now let us look at them more closely by the following activity.

Activity-2

Take some rotten part of vegetable or black spoiled part of bread or coconut with the help of a needle, place it on a slide. Put a drop of water, place a cover slip on it and observe it under the microscope.

Fig-7(a) : Photograph of curd in bowl

Draw rough sketches in your note book of what you observed. Take the help of Fig-3. This is the common bread mold *Rhizopus*.

Observing Bacteria

There is bacteria in butter milk or curd or early morning scraping of tongue (before washing the mouth). We can also find them in the soil, over bark of trees, over our skin, in our arm pits and many other places. But they are not visible to the unaided eye. Now let us look at them more closely by the following activity.

Activity-3

Take one or two drops of butter milk on a slide and spread it. Heat the slide slightly on a lamp (3-4 seconds). Add a few drops of crystal violet stain, leave it for 30 to 60 seconds and wash the slide gently with water. Observe the slide under the compound Microscope. Draw rough sketches in your note book of what you have observed. Compare it with Fig-7.

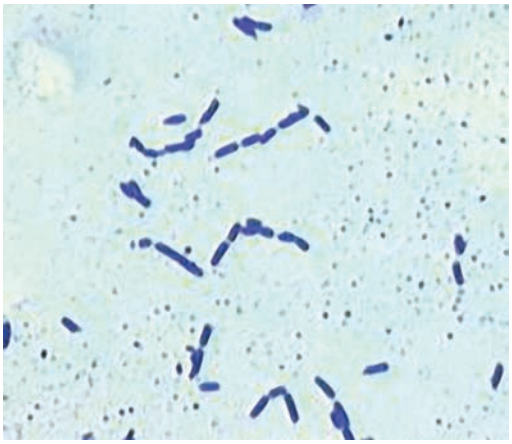


Fig-7 : Stained Lactobacillus bacterium

Do you know?

There are several bacteria that grow on our skin. Some of them cause diseases. Some shows symbiotic relation with other Bacteria. There are different kinds of bacteria in our body. Bacteria present in our digestive tract are useful in digestion. Bacteria are found everywhere and there are over thousand types of them in soil, air, water etc. They can live in low and high temperatures also. One of the biggest bacteria *Thiomargarita namibiensis* was discovered (0.75mm) by Heide N. Schulz in coastal waters of Namibia, which can be seen with unaided eye.

Observing Algae

Very often we observe greenish pond water in our surroundings. It is greenish because of growth of Algae and other plants which grow in water. We can see some of Algae like *Chara, Spirogyra* etc. with unaided eye, but most of the algae present in water are microscopic.

Let us collect pond water or water from the tanks with a bit of greenish scraping. To observe some of the microalgae growing in water, let us do the following activity.

Activity-4

Select a few strands (green string like bodies) from water sample collected and put them on a slide. Cover it with a cover slip and observe it under the microscope. Draw rough sketches of what you have observed in your note book. Compare it with Fig-5.

Do you know?

Photosynthesis in microalgae is very useful to organisms which lives on earth. Nearly half of the oxygen in the atmosphere is produced by the microorganisms.

Observing Protozoa

These are present in water and soil. Let us do the following activity to observe them.

Activity-5

To grow Protozoa, soak hay in pond water to prepare a decoction of hay. After 3- 4 days. Take one or two drops of hay decoction on a slide and observe it under the microscope. Draw rough sketches in your note book of what you have observed. Compare your figures with figure 4.

Observing Microarthropods

Some micro arthropods are very important for the soil. They help in increasing soil fertility. They may also be found on our skin, eyelids, beddings, rugs etc.

Some microarthropods cause diseases like scabies e.g. scabies mites. Actually these are not as small as bacteria, but they are of minute size and are joint- legged organisms.

Do you know?

Soil is highly rich in microorganisms such as bacteria, fungi, protozoa, microarthropods. The top eight inches of soil of one acre area may contain as much as five and half tons of fungi and bacteria. This is very much useful for growing crops. But excess use of pesticides kills these microorganisms. We can see them through a microscope.

Activity-6

Observing soil microorganisms

Collect some soil from the field in a beaker or in a glass. Add some water to it and stir it. Wait for some time to allow the soil particles to settle down. Take a drop of water on a slide and observe it under the microscope. Draw rough sketches in your note book of what you observed. Compare them with Fig-4, 5, 6.

From all the above activities you will be able to understand how diversified the microorganisms are. You can also appreciate the fact that this is another amazing world of living organisms. We will discuss some more in next lesson.

Viruses are an interesting type of microorganisms. They behave like non living things when they are outside a living cell. But they behave like living organisms when they are inside the host living cells such as bacteria, plants and animal cells and multiply.

Fig-8(a) : Electron Microscopic view of a virus

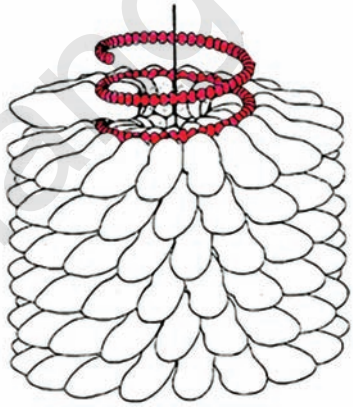


Fig-8(b) : Tobacco Mosaic virus

They can only be seen through very powerful electron microscope.

Diseases like Polio, Swine flu, Conjunctivitis, Smallpox, Chickenpox, Common Cold and AIDS are caused by viruses.

Viruses are also present inside the bodies of animals and plants. They can survive in all types of environments ranging from ice cold climate to hot springs, deserts to marshy lands. Some microorganisms grow on other organisms as parasites and some may exist independently.

Do you know?

Bacterial Staining

Bacteria are very small/ tiny micro-organisms. We must stain before seeing Bacteria under Microscope. Smear bacteria on a slide and slightly heat the slide. Then put drops of crystal violet on the slide. After 30 to 60 seconds gently wash the slide. Dry the slide and now watch the slide under the microscope in **25 X or 40 X.**

Key words

Microorganism, Microscope, Algae, Bacteria, Fungi, Protozoa, Micro-arthropods, Virus, Staining.

What we have learnt

- Microorganisms are very minute living things. We cannot see them with our unaided eye.
- We can see microorganisms with the help of Microscope.
- Antonie van Leeuwenhoek invented a powerful single lens microscope.
- Microbes are present everywhere in our surroundings. They live in water, air, soil and even in ice cold climate to hot springs.
- Bacteria, Fungi, Protozoa, and Algae are major groups of microorganisms.
- Viruses are special type of microorganisms, which lie between living and non living organisms. They can reproduce only in host living cells.

Improve your learning

8JPI9C

1. Which organisms act as an interlink between living and non-living organisms? Why do you think so? (AS1)
2. Write the diseases caused by micro organisums? (AS 1)
3. What type of micro organisams we can observe in pond water? (AS1)

4. Whether micro-organisms are useful or harmful. Explain.(AS1)

5. Why the cooked food spoil soon but not uncooked food. Give your reasons.(AS1)

6. What questions would you like to ask your teacher to know about different shapes of Bacteria? (AS2)

7. What would happen if you add buttermilk to a) chilled milk? b) hot milk c) luke warm milk (AS2)

8. How are the human actions causing the death of useful bacteria and fungi? What will happen if this continues? (AS 1)

9. What procedure did you follow to observe lactobacillus bacterium in the Lab? (AS 3)

10. Visit any bakery near your school with the help of your teacher or parents. Know about preparation of bread and cake and prepare a note on them. (AS 4)

11. Observe some permanent slides of microorganisms in your school lab with the help of microscope. Draw this pictures. (AS 5)

12. Prepare a model of any microorganism with clay and write the characteristics of the microbe. (AS 5)

13. Do you clean your hands with soap before eating? Why? (AS 6)

Chapter

3

The World of Microorganisms : Part-II

Microorganisms - Our friends or foes?

Microorganisms are present in air, water, soil and within the bodies of animals and plants. Some microorganisms are very useful and help us in many ways while some of them are harmful.

In this section we will study about how microorganisms help us and how they harm us.

Useful Microorganisms

Some microorganisms are very useful to our everyday life. For example in making of curd and in preparation of idly, dosa, bread and cake. Some microorganisms are also useful in the preparation of medicines required to cure different diseases. Some of them are farmer friendly as they increase soil fertility. Let us do some activities to grow microbes and produce products used by us.

Activity-1

Take some lukewarm milk in two small bowls. Add a few drops of butter milk or little curd in one of the bowls. In the second bowl do not add anything. Keep the two bowls in a warm place and observe the milk in the bowls after 5 to 6 hours.

- What changes did you observe?
- What is the reason for this?

Curd or buttermilk contains bacterium named *Lactobacillus* which converts the milk into curd.

Activity-2

Take 100 grams of maida in a bowl, add one or two spoons of yeast powder, add some hot water and knead it to make dough. Keep the dough in a warm place. Observe the dough after 3-4 hours.

- What changes did you observe in the dough?
- What might be the reason? Discuss with your friends and write about it.

You might have observed your mother preparing fermented foods like Idli and Dosa. What could be the reason for prepearing Idli and Dosa dough a day before cooking it?

Fig. 1: Cups containing Maida dough.

- *In which of the two cups yeast was added to maida dough?*

In bakery when yeast is added to the dough for preparing bread, the dough rises. This is due to the production of carbon dioxide gas during the process of fermentation. Bubbles of the gas makes the dough spongy in nature.

Activity-3

Commercial use of microorganisms

Take two bowls, half filled with water. Add 5 to 10 spoons of sugar to each beaker, then add 2 to 3 spoons of yeast to any one of the two bowls. Close both the bowls with lids and keep them in a warm place. After 3 to 4 hours remove the lids and smell the contents.

- *What differences did you observe between the two bowls?*
- *What may be the reason for the odour in yeast mixed bowl?*

This is the characteristic smell of alcohol. Sugars are converted into alcohol by yeast. This process of conversion of sugars into alcohol is known as **fermentation.** This process is used on a large scale in the production of alcohol, wine, beer etc. Yeast is grown in natural sugars present in grains like barley, wheat, rice and crushed fruit juices like grapes.

Medicinal use of Microorganisms

Sometimes when we fall ill or get injured doctors prescribe some medicines that kill the microorganisms (bacteria) which causes diseases. Such medicines are called as **antibiotics**. These antibiotics are produced by growing specific microorganisms such as fungi. Nowadays, a number of antibiotics like Penicillin, Tetracycline, Streptomycin and Erythromycin are being produced. Antibiotics help in curing many bacterial diseases like Typhoid, Gonorrhoea Diarrhoea, Tuberculosis and prevent infections like Septicaemia.

Antibiotics are also used to control the bacterial diseases in plants and animals.

Fig-2(a) : Antibiotic injections

Fig-2(b) : Antibiotic capsules

Do you know?

We must use antibiotics prescribed by a qualified doctor. If we use antibiotics without consulting a qualified doctor it may harm us. Unnecessary use of antibiotics, affects blood cells which fight infections and also cause resistance towards antibiotics. Sometimes they may kill useful bacteria in our body too.

The discovery of Penicillin - The Antibiotic

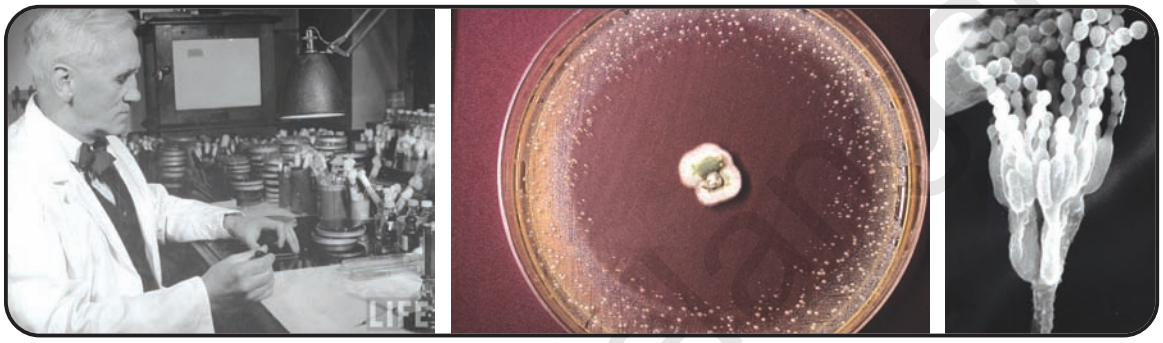


Fig-3(a) : Dr. Alexander Flemming

Fig-3(b) : Pencillium species inhibiting bacterial growth in petridish

Dr. Alexander Flemming was an army doctor during First World War. He observed that many injured soldiers died because of bacterial infection of wounds.

He was working on antibiotics in his lab. Accidently one day he observed that some fungi (mold) were preventing the growth of bacteria in the petridish, in which he was growing bacterial colonies.

He separated the substances released by the fungus and tested it on some other disease causing bacteria. This substance also killed those disease causing bacteria.

The fungus was identified as *Penicillium notatum.* The substance which was produced by the fungus *Penicillium* was named as **Penicillin**.

The discovery of the antibiotic, Penicillin was announced in 1929. In 1945 Dr. Alexander Flemming was awarded the Nobel Prize along with other scientists namely Dr. Howard Florey and Dr. Ernst. Chain.

The discovery of Penicillin paved the way to the discovery of many antibiotics like Streptomycin, Erythromycin etc.

Do you know?

Inventor of Aureomycin

Dr. Yellapreggada Subba Rao was born in West Godavari district of Andhra Pradesh state, India. He discovered some antibiotics like Tetracycline which cure number of bacterial diseases like Typhiod, Plague, Tuberculosis etc.

Vaccine

6EJGYF

Doctors prescribe medicines in the form of tablets, syrups, injections etc, to gain control ever diseases. We are often protected against certain other diseases by vaccination.

Whenever a disease causing micro organism enter our body, the body produces some defenders to fight against them, these are called as antibodies.

The weak/dead disease causing microorganisms which are administered in our bodies are called as **vaccines**. When vaccine is administered in our bodies antibodies are produced and information about the same is stored. The process of administration of weak/dead organisms into our body is called **vaccination**.

Polio is given in the form of oral drops which prevents polio in children. There are many other vaccines available to prevent diseases like Smallpox, Chickenpox, Hepatitis, Tuberculosis, Mumps, Diphtheria, Wooping Cough, Measles.

Vaccination protects us from getting the diseases over a long period of time (often throughout our life). You may have heard

Fig-4 : Child consuming polio drops.

that children below five years must take polio drops.

- *Why are polio drops given to children?*
- *Were you given polio drops, when you were a child?*
- *Do you know about pulse polio programme?*

Our national objective is to achieve a Polio free society. What do they do in this programme? You know that polio is a dangerous disease. What could be done to make the polio free society? Discuss in your classroom about polio contamination and its methods of prevention. Write your findings in year notebook.

- Collect a pamphlet or broucher on Pulse Polio Programme and discuss the points which are mentioned in them.

Do you know?

Dr. Jonas Salk discovered vaccine for Polio in 1952. He wanted to distribute it freely to everyone. So he never patented his polio vaccine. Dr. Albert Sabin discovered oral polio vaccine in 1957.

Dr. Jonas Salk

Now, we know about several vaccines which protect us against many disease causing microorganisms. But vaccines were not known even 300 years ago. It was only after many experiments conducted by several scientists in 18th century helped us to get them.

Nowadays, vaccines are made on a large scale from microorganisms to protect humans and other animals from several diseases.

Activity-4

Visit nearby PHC and collect information about vaccination given to 0-15 year old children. Meet a doctor or a health worker and ask what types of vaccines are there? Which disease can be prevented through vaccination? When it should be taken? List them out.

Rabies was discovered by Louis Pasteur. Rabies causing virus enters our body through dog bite, only if the dog has the same infection.

Discovery of Smallpox vaccine

Fig-5 : Baby with small pox

Dr.Edward jenner inoculating vaccine

Dr. Edward Jenner setup his medical practice in a village which saved mankind by eradicating some diseases. He keenly observed that the milkmaids who developed cowpox, a less serious disease, did not develop the deadly smallpox. He thought they are developing immunity which is preventing small pox, a very dangerous disease wiping out millions of people in those days. In 1796, Jenner

6ETD13

took the fluid from a cowpox pustule on a dairymaid's hand and inoculated a 8 year old boy with his parents permission. Six weeks later, he exposed the boy to smallpox, and the boy did not develop any symptoms of smallpox. The fluid collected from Cowpox pustule acted as a vaccine to prevent smallpox. This invention of smallpox vaccine saved millions of people from the deadly disease.

This paved the way for the discovery of number of vaccines which prevent us from harmful diseases. The word vaccine comes from word 'vacca' which means cow.

Soil Microorganisms - Soil fertility

About 78% of air around us is Nitrogen gas. Plants need it mainly for growth. But they can not make it from the atmosphere directly. Microorganisms like *Rhizobium, Nostoc* - Fig 6(a), *Anabaena* - Fig 6(b), *Azotobacter*, etc., help to provide this essential element to the plants by absorbing them from atmosphere to form certain compounds and then fixing them into the soil that can be taken up by plants.

Fig-6(a) : Nostoc

Fig-6(b) : Anabaena

Nitrogen Fixation

Rhizobium bacteria present in root nodules of pea family or *Leguminaceae* plants such as pea gram, groundnuts fix nitrogen.

Activity-5

Collect root nodules from ground nuts, beans and pea gram crush. Put them on a glass slide. Press it with coversslip. Observe it under compound microscope. Draw and discuss about it with your friends.

Rhizobium converts atmospheric nitrogen into nitrates and stores in roots. Plants use this stored nitrates. Plants gives shelter to *Rhizobium*. They co-operate one another. Such a cooperation is called "symbiosis". Soil fertility increase in growing legume crops in the fields. Farmers plough crop field along with legumes on the onset of monsoons.

Fig-7 : Root Nodules

6F392Q

The micro organisms like fungi and bacteria present in the soil degrade biological wastes, some of which are essential for plants.

Do you know?

What is Bt?

Bt stands for *Bacillus thuringiensis* which is the name of a bacterium. It produces a toxin which kills pests on plants or crops. The bacterium is used as bio pesticide. In transgenic crop plants this toxin producing gene was separated from the bacterium and transferred into the crop plants. So this can protect it from pests. For example B.t. cotton. It shows severe impact on plants and animals. Discuss, about effect of Bt in your class.

Activity-6

Take two pots or dig two pits in the corner of the garden at home or at your school ground. Fill them up to half with loose soil. Put some biological wastes like fallen leaves, vegetable wastes, waste papers etc., in one of them. Fill the second one with plastic wastes, polythene bags and with some empty glass bottles.

Now cover the pits with some loose soil. Sprinkle some water on the pots /pits. Do this every day. After three to four weeks remove the upper soil from the pits and observe the changes. What changes did you observe?

In which pit did the materials decompose? Why? Is there any harm with non-decomposing material? Discuss.

Fig-8 : Compost pit

You might have observed the same thing happening in your own surroundings as well. Microorganisms present in our surroundings act upon wastes around us and decompose them. They are converted into simple substances. Thus microorganisms help us in cleaning the environment.

Think and discuss

- What would happen if microorganisms were absent, in our surroundings?

Micro organisms like several bacteria help in the process of sewage treatment. Bacteria are useful in cleaning sewage water. Oil sleeks formed due to leakage of oil from oil tankers (ships) in oceans. This kills marine animals because of shortage of oxygen and light.

Introducing oil eating bacteria can safeguard aquatic marine animals from oil sleek.

Harmful microorganisms

Microorganisms can cause diseases in crop plants, livestock and in human beings. They also spoil food, clothes and many other things.

Diseases causing microorganisms in human beings

Activity-7

Meet a doctor of your locality and ask him about the different types of diseases caused by different microorganisms. Note them down and discuss with your friends.

Recall that microorganisms are present everywhere in our surroundings. Microorganisms which cause diseases are called as “pathogens”.

Pathogens enter into our body through air we breathe, water we drink and food we eat. They can also be transmitted by direct contact with infected person or carried through animals or insects.

You might have observed, some of your family members or friends getting cold and cough with the sudden change of weather. When the infected person sneezes or

coughs, the pathogens enter into air from such infected persons. When this air containing pathogens enters into the body of a healthy person, it may cause cold. These type of diseases which spread from

Fig-9 : Anopheles female mosquito

infected people to healthy ones are known as "communicable diseases". They spread through air, water, food or through physical contact with infected person (or his/her used towels, kerchiefs) or through insects like houseflies and mosquitoes. Such insects or other animals are called **vectors**. Common cold, Conjunctivitis, Typhoid, Smallpox, Chickenpox, Swine Flu, Tuberculosis, Chikungunya are some of the communicable diseases.

The microorganism *'plasmodium'* causes malaria. The female *Anopheles* mosquito carries plasmodium and thus it is the vector. Mosquitoes are vectors for other diseases as well. By controlling mosquitoes, we can prevent diseases caused by them. Mosquitoes breed in stagnant water as in ponds, tanks, waste pots, waste flower pots.

- *Why should we keep our sorroundings clean?*
- *What precautions should we take to prevent mosquito bite?*
- *What are the other diseases caused by mosquitoes?*

Do You Know?

Dr. Ronald Ross discovered that female Anopheles mosquitoes are carrier of the causative Microorganism (parasite) for Malaria. For this discovery Dr.Ronald Ross got **Nobel prize** in 1902. He discovered it in Secunderabad. For full story of discovery of Ross. refer annexure.

House flies also carry disease causing microorganisms and can spread diseases like Typhoid, Cholera, Diarrhoea etc. When they sit on garbage, excreta of infected persons or animals, pathogens stick to their bodies. When these flies sit

Fig-11 : House fly on food

again on uncovered food, they may transfer the disease causing microbes. Whoever eats this food becomes infected. So we must avoid taking uncovered food. That is why we should always cover the food. Houseflies breed on garbage. We can control houseflies by keeping our surroundings clean.

- *Where do you find more number of houseflies? Why?*
- *What are the measures to be taken for preventing houseflies?*

One day sameer went to hospital with his mother. There he saw the following chart on a wall.

TABLE-1: SOME COMMON DISEASES CAUSED BY MICRO ORGANISMS IN HUMAN

Name of the disease	Causative Microorganism	Mode of transmission	Preventive measures
Tuberculosis	Bacteria	Air	* Vaccination (BCG) * Avoid using infected persons materials.
Chicken pox	Virus	Air	* Vaccination (Varisella)
Measles, mumps	Virus	Air	* Vaccination (MMR)
Polio	Virus	Air, Water	* Vaccination (Polio drops)
Swine flu	Virus	Air	* Vaccination
Cholera, Typhoid	Bacteria	Contaminated Water, Food Housefly (vector)	* Personal hygiene and good sanitary habits * Consume boiled drinking water
Malaria	Plasmodium	Female anopheles Mosquitoes (vector)	*Use mosquito nets, repellents. avoid stagnaton of water
Dengue	virus	Mosquitoes aedes	,,
Chikungunya	virus	Mosquitoes aedes	,,
Japanese Encephalitis	Virus	Mosquitoes culux	,,
Diphtheria, Whooping Cough, Tetanus, Hepatitis B, Haemo-philus, Influenza 'B'	Bacteria virus	Contaminated water, food, Direct contact	Pentavalent.
Diphtheria, Whooping cough, Tetanus	Bacteria	Contaminated water, food, Direct contact	DPT, Triple antigen.

Study above table and answer following questions.

1. *Which diseases can be prevented if we control mosquitoes?*
2. *Which diseases can we prevented by vaccination?*
3. *Name the diseases which are spread through by contaminated water?*

4. *Can you name few diseases which are spread through by Air?*
5. *Can we protect ourselves from bacteria and protozoan diseases through vaccination? Discuss in your class?*
6. *Discuss in your class about Indradhanussu.*

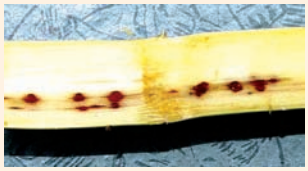
The Diseases caused by microorganisms in animals

Anthrax mainly show effect on cattle, sheep, goat and also effects humans, foot & mouth disease, viral diseases in prawns, and fishes, fowl fox septicimia disease, bird flue in poultry, Rabies in dogs.

Disease causing microorganisms in plants:

Microorganisms also cause diseases in plants. Diseases in our crop plants are studied to save our crops. The following table shows some diseases caused by microorganisms in crop plants.

TABLE-2: Shows some of plant diseases, causative microorganisms and mode of transmission.

Name of the plant disease	Causative Microorganism	Mode of Transmission	Figure
Citrus canker	Bacteria	Air	
Red rot of sugarcane	fungi	Air, seedlings	
Tikka disease of groundnut	Fungi	Air, seeds	
Tobacco mosaic	Virus	Insects	
Smut disease of Rice	Fungus	Air	

Discuss with your friends about plant diseases and in what way they spread in your area. For this read agriculture magzines.

Food poisoning

Sometimes you might have heard or read in news papers that some people were hospitalised due to food poisoning. Food poisoning could be due to the consumption of spoiled food. Some microorganisms produce toxic substances in spoiled food. These toxic substances make the food poisonous. Taking stale food may lead to vomiting, motions, even to death.

Do you know?

Clostridium botulinum a bacterium which is widely responsible for causing food poisoning. The disease is known as botulism.

Food Preservation

If microbes grow on our food, they spoil it. Spoiled food smells and tastes bad. Water or moisture present in food items helps the microorganisms to grow. How can we preserve our food? Think how can we prevent the growth of microbes on food?

You have learnt in class-VI that different methods are adopted to preserve food at home. For example while making pickles, salt and oil are added. Fishes are preserved by adding salt or smoking them. Jams and Jellies are preserved by adding sugar after boiling fruits or fruit extracts. Vegetable slices and fishes are preserved by adding salt and drying in sun light. What happens in all these methods? Water or moisture is removed from the food items. Thus microbes cannot grow in these conditions.

Let us study some other methods of food preservation.

Food Preservation - Heat and cold method

You might have observed your mother boiling the milk before using or storing it. Boiling helps in killing several types of microorganisms present in milk. After lunch or dinner we preserve our remaining food items in refrigerator. We preserve fruits and vegetables and some other food items in the refrigerator. Refrigeration helps to inhibit the growth of microorganisms. Micro organisms do not grow in cold and hot conditions.

Pasteurisation

Another method of preservation is pasteurisation. You might have read this word written on some milk packets. In this process milk is heated up to 72°C for 15 to 30 minutes and then suddenly chilled and stored. This prevents the growth of most micro organisms. This process was discovered by **Louis Pasteur**. So this method is known as **pasteurisation.** High temperature short time pasteurisation-HTST. (see page - 145).

Think what would have happend if pasterurisation had not been invented.

Lazzaro Spallanzani is the first person to prove experimentally that microorganisms could be killed by boiling (1768).

Invention of pasteurisation led to the invention of sterilisation process. In this process microbes are killed. The materials are kept in a sterilisation chamber and are heated up to very high temperature for upto 30 minutes. During operations surgeons use only sterilised instruments and other sterilised materials, which avoid getting infection.

Storage and packing

Nowadays dry fruits, milk, cool drinks, food items and vegetables are sold in sealed and air tight packets, which prevents the entry of microbes from outside.

Thus proper preservation of food helps us, in the following ways:

1) This prevents spoilage of food.
2) Food can be preserved for longer period.
3) Quality of food is ensured for a long time.
4) Variety of food items may be available in far away places, in any season.

Key words

Lactobacillus, penicillum, fermentation, sterilisation, vaccination, pathogens, vectors, pasteurisation, symbiosis, Vaccine, Small Pox

What we have learnt

- Some microorganisms are useful and some microorganisms are harmful.
- Microbes are useful in home, industry cleaning the environment.
- Soil microbes degrade organic wastes into useful nutrients. This helps plants in their growth and development.
- Some microorganisms cause diseases in humans, plants, and other animals.
- Some insects and animals act as vectors of microbes.
- Some microbes release toxins in improperly preserved food, which causes food poisoning.
- Pasteurisation helps in milk preservation.
- The bacterium 'rhizobium' present in root nodules of leguminous plants fixes atmospheric Nitrogen.

Improve your learning

8JYEAZ

1. How do vaccines works in our body? (AS1)
2. What are the differences between Antibiotic and Vaccine? (AS1)
3. Take three bowls and mark as A, B, C. Pour lukewarm milk in bowl A, hot milk in bowl B, cold milk in bowl C. Add one tea spoon of curd or butter milk in three bowls and stir them slightly. Cover the bowls with lids. Keep the bowls undisturbed for five to six hours. In which bowl milk turned into curd? Give your reasons. (AS 3)
4. Collect more information about scientists who invented and discovered other facts related to Microorganisms. How these discoveries helped mankind? Make a chart presentation and paste it on your classroom wall Magazine.(AS 4)
5. Make an Album of scientists and their discoveries related to Microorganisms.(AS 4)
6. Visit the veterinary hospital and prepare a list of cattle, Goat, Sheep diseases by asking questions to the doctor? (AS4)
7. What is pasteurisation ? How is it useful? (AS 6)
8. Edward Jenner's collects fluid from cow pox pustule and injects to a eight year old boy. Then he exposed the boy to smallpox and the boy did not get smallpox. How do you appreciate the daring action of Edward Jenner? (AS 6)
9. Visit a nearby milk chilling centre/a librarey . Observe the process and make a report on it. (40)
10. "Prevention is better than cure" comment. (AS 6)
11. Raheem tells to his neighbours, "stagnation of sewage in our surroundings is harmful to our health." Do you support this? Why?(AS 6)
12. Jeevan said that "If there are no micro organisms earth will remain with wastes" will you agree with this statement, why? (AS 6)

13. kavita is suffering from serious illness. Doctor priscribed antibiotics for five days. After three days of usage she stopped taking antibiotics. Is it correct or not, discuss. (AS 6)

14. What are the precautions taken to eradicate malaria? (AS 7)

15. One medical store owner is giving antibiotics to his customer who is suffering from fever without a doctor's prescription? But the customer's daughter Malathi is telling her father not to take antibiotics without doctor's prsecription. Whom do you support and why? (AS7)

Story of Discovery of Malaria Parasite in Female Anopheles

by Dr. Ronald Ross

Dr. Ronald Ross

Nobel Prize

Dr. Ronald Ross was a military doctor, who did his research extensively on malaria for 16 years (1881-1897) in India. He finally discovered malaria causative microbes in female anopheles mosquito which fed on malaria infected patient. He found the route map of malaria disease. For that he got Noble Prize in 1902.

All of us know about Malarial fever. We frequently talk about this fever. The study of the mosquito causing malarial fever was done alone by the scientist Ronald Ross. A remarkable part of the study was carried out at Secundrabad. He expressed his experiences in his lecture at Noble prize presentation ceremony.

" I reached India in 1895 and found myself appointed as a medical officer of regiment of native soldiers at Secundrabad and many were suffering from malarial fever. A survey was immediately made of the malarial parasites existing among these men and I found myself able to confine for India. At the same time the mosquitoes which abounded in the barracks and hospital. Before leaving England I had made many attempts to obtain literature on mosquitoes especially the Indian ones, but without much success. Consequently I was forced to rely entirely on my own observations; and I noted that the various species of mosquitoes of the locality belonged to two different groups, separated by many traits, and called these groups for my convenience, *brindled mosquitoes* and *grey mosquitoes*. It was until 1897 that I clearly recognized a third group which called *spotted-winged mosquitoes*".....

Ronal Ross done siginificant discovery on malaria in this building at secundrabad in 1897

Ronald Ross was born on 13th May 1857 at Almora in present Uttarakand state in our India. His father was an Army Major. At age of 8 years young Ronald was sent to England for his education. He was interested in painting and mathematics. He wanted to settle down as a painter. But, on his father's insistence he selected medical carreer. After completing his medicine, he joined in Indian Military Academy in 1881. While he was studying medicine he faced a malaria patient. He treated many patients of malaria with quinine and cured it. But many people died of malaria because they failed to get treatment.

While he was working at Bangalore, he was allotted a bungalow. He was pleased to live in it but was irritated by the large number of mosquitoes. He noticed that there were more number of mosquitoes in his bungalow than in any other. He keenly observed that a barrel with water was full of mosquito larvae. Ross removed the water from the barrel and found that the number of mosquitoes got reduced. Then he started in thinking that if water was removed from the place it might be possible to eliminate them completely. Ross noted that malaria killed more than one million people in India. So he became interested in malaria, one of the important tropical diseases occurring in India.

After working 7 years in India he went back to England. He did his diploma in microscopic techniques. He met Dr. Patrick Manson who guided him throughout his research. He was with him through thick and thin. Patric Manson shared his proposed theory (hypothesis) that mosquitoes carry malaria as they carry filaria. This was to change Ross's life forever. He proposed that mosquitoes were carrying flagellated spores in their stomach. The mosquitoes died laying their eggs. The "flagellated spores" emerged into the water, ready to infect anyone who drank the water. Ronald Ross tried on this hypothesis. But he came to a conclusion that water would not cause malaria infection.

Ross was discouraged by the above reasons. But Patric Manson encouraged Ross not to give up his work and advised that malaria parasite germs would not go for no purpose, in a mosquito's body. Ross then hypothesised that the malaria disease is communicated by the bite of the mosquito which injects a small quantity. Parasites may enter in this manner into the human system.

To test this hypothesis Ross allowed mosquitoes that had fed on malaria patient to bite a healthy man. But the healthy man was not infected. Repeated the experiment again and again and failed. Unfortunately he was using Culex mosquitoes in his experiment, which do not transmit malaria. This fact came to light a little later.

One day his attention was drawn to a different mosquito that was sitting on a wall in a peculiar posture and he called it as "dappled-wing" mosquito. He was inspired again. He knew that only one species is capable of carrying Filariasis. Dr. Patric Manson also suggested him that a particular mosquito species might be the reason for the malaria plasmodium.

Ross suddenly realised that he had used the wrong species of mosquitoes in his experiment. He returned to Secunderabad in June 1897. He commenced work by making a careful survey of the various kinds of mosquitoes. He continued his study by examining the dissected mosquitoes under microscope, after feeding on malaria patients. Almost every cell was examined under the microscope.

On the 15th August, 1897 his assistant brought some larvae, many of which hatched out next day and among them he found several dappled-winged mosquitoes. Delighted with this capture, on August 16th , he fed them on his malaria patient Hussein Khan with crescents in his blood. On 17th he dissected two of these mosquitoes but found nothing unusual. On the 19th he killed another and found some peculiar vacuolated cells in the stomach about 10 microns in diameter.

Ross rough drawings and notes about what he observed

On August 20th 1897 he found a clear and circular outlines about 12 micron diameter cells, each cell containing a type of cell, black pigmented one. He made rough drawings in his note books. At last by this way Ross discovered the route map of malaria i.e., infected patients blood to mosquito stomach to salivary glands to infect into a healthy person. So we celebrate August 20th World Malaria day. He had done his experiments on malaria in birds also with his assistant named Mohammed Bux.