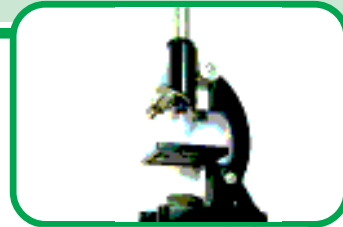


STORY OF MICRO ORGANISMS



Part - I

Why do we add some drops of butter milk to lukewarm milk to make curd?

Why does even 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.

400 years back several people wondered over such questions and tried to find out answers.

One such person was Antonie van Leeuwenhoek.

Story of Microscope invention and discovery of micro organisms



Fig.1: Antonie van Leeuwenhoek

Microbiology as a science was born in 1674 when Antonie van Leeuwenhoek observed at a drop of lake water through a glass lens that he had carefully found. Anton van Leeuwenhoek was a fabric

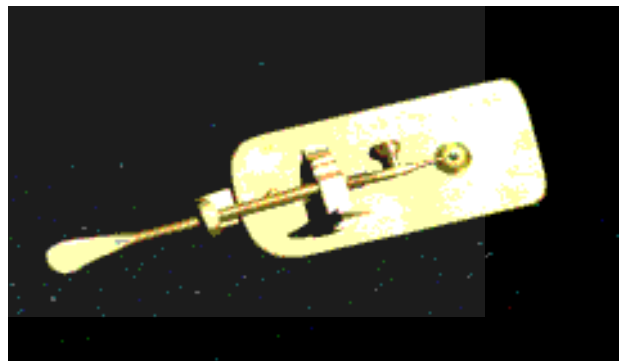


Fig.2: Single lens powerful microscope

merchant. Leeuwenhoek built a single lens powerful microscope, which could magnify the object 300 times. His curiosity and skill of making powerful lenses were the secrets of this invention of powerful microscope.

His keen observation of different things under his microscope helped him to discover small moving organisms in 1678. He called them “animalcules.” Later these were named bacteria. Along with the animalcules, he also observed many other microorganisms under his microscope which got their respective names later on. This helped further discoveries of other microorganisms.

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

Microorganisms

We can see several organisms in our surroundings but we can not see many of them with our unaided eyes. They can be seen only with the help of a microscope. They are called microorganisms. Some of the microorganisms are shown in Fig-2-6.

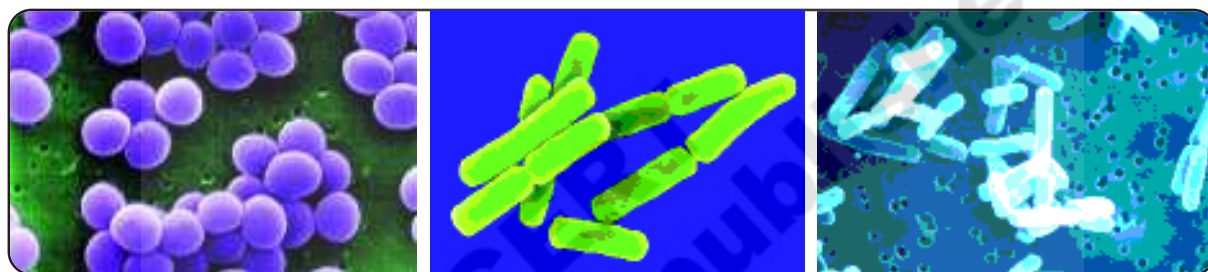


Fig-2 Bacteria of different shapes

Lactobacillus

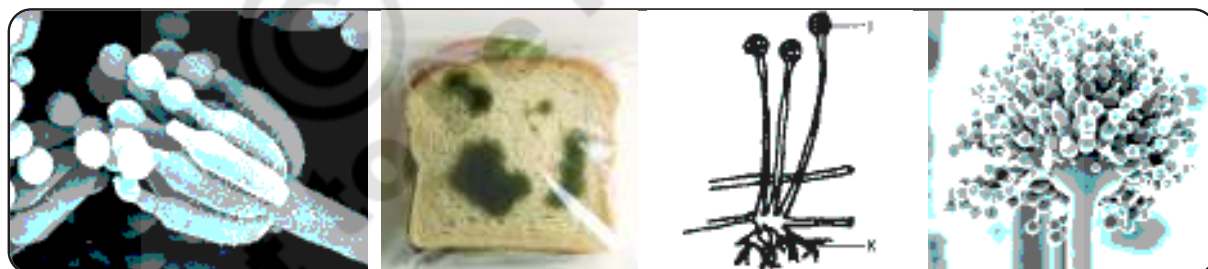


Fig-3 Penicillium

Bread mould Rhizopus

Asperigillus



Fig-4 Amoeba (500 Microns)

Paramecium (0.25m.m)

Plasmodium sp

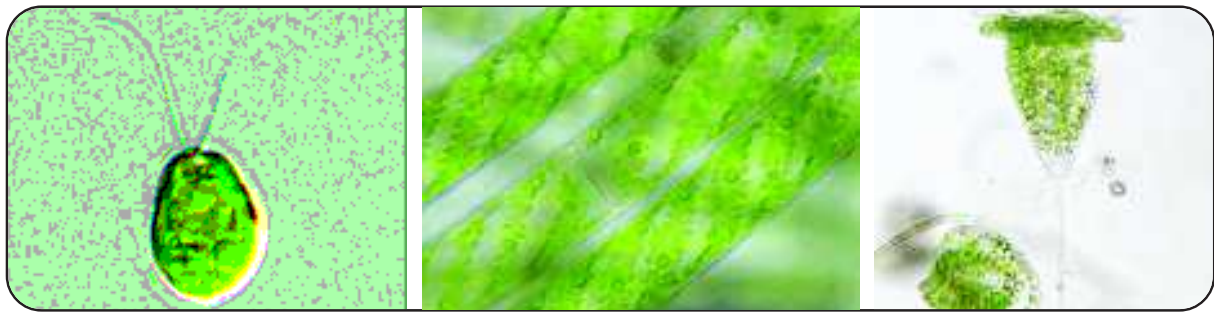


Fig-5(a) Chlamydomonas

Spirogyra

Vorticella

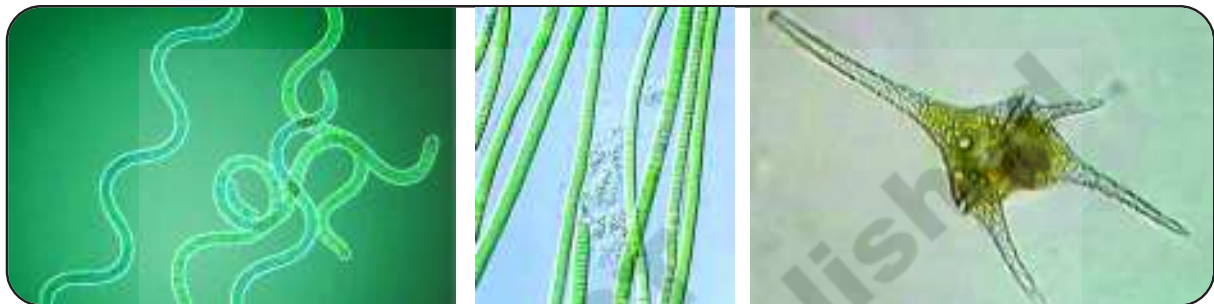


Fig-5(b) Spirulina

Oedogonium

Ceratium



Fig-6 Cyclops

Daphnia

Scabies mite

Eyelash mite

Groups of microorganisms

Let us study some micro organisms that belong to the groups like bacteria, fungi, protozoa, algae and certain micro arthropods with the help of some activities.

For this we will need a Microscope. You already know how to use it. You could also refer to “Chapter Cell- Basic unit of life”.

Activity-1

Collect some pond water / or water from any tank in your surroundings. Ensure to 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 through Microscope. Draw rough sketches in your note book of what you observed. Compare it with the

figures given above for observation and identification (You may also hold discussion with your friends). Take the help of your teacher as well.

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 may have observed white patches on the bark of trees. On these areas you can find some 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 on a slide. Put a drop of water, place a cover slip on it and observe it under the microscope.



Fig-7(a) Photographs of curd in bowl

Draw rough sketches in your note book of what you observed. Take the help of the figures given in fig-3 bread mould - rhizopus and compare.

Observing Bacteria

We can see these 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, 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.

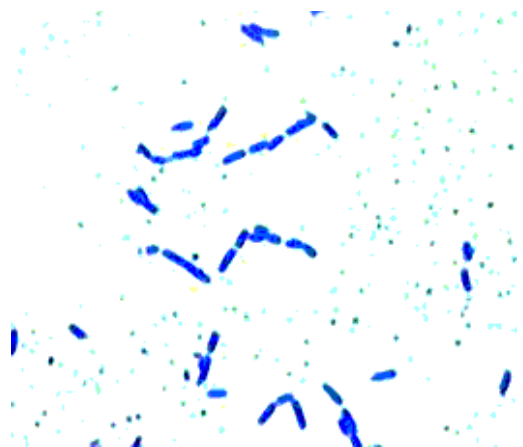


Fig-7(b) Stained lactobacillus bacterium



Do you know?

There are several Bacteria growing on our skin. Many of the disease causing ones live in some symbiotic relations with other bacteria. There are different kinds of bacteria in our intestine which are useful in digestion. Bacteria are found everywhere and there are over thousand types of them in soil, water etc. Recently two types of bacteria in 1997 Heide N. Schulz discovered a biggest bacteria *Thiomargarita namibiensis* found in coastal waters of Namibia (0.75mm), which can be seen with unaided eye.

Observing Algae

Very often to 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.

They can be observed only through a microscope. Let us collect pond water or water from the tanks with a bit of greenish scrapings. To observe some of the micro algae growing in water, let us do the following activity.

Activity-4

Select a few strands (green string like bodies). Or some part of the scrapings that have small string like bodies. Take one or two drops of collected greenish pond water (in a bottle) on a slide. Cover it with a cover

slip and observe through microscope. Draw rough sketches in your note book of what you have observed. Compare with fig-6.

Observing Protozoa

The other group of microorganisms is protozoa. They are yet another group of microorganisms present in water and soil. Let us do the following activity to observe them.

To grow protozoa, soak hay in pond water to prepare a decoction of hay. After 3- 4 days take a drop of water and observe it under the compound microscope.

Activity-5

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. Take the help of the figures given in the chapter for observation.



Do you know?

Micro arthropods

Some micro arthropods are very important for the soil. They help in increasing soil fertility by decomposing the biomass through digestion which converts the bigger compounds into smaller compounds. These are to be found on our skin, eyelids, beddings, rugs etc.

Some micro arthropods cause diseases like scabies e.g.: scabies mites. Actually these are not micro organisms like bacteria these are minute size orthopods means 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. Excessive use of pesticides kills these bacteria. We can see them through a microscope or by growing them in different media.

Let us do the following activity to observe some soil microbes.

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.

Take the help of the figures given in the chapter for observation.

From the above activities you would be able to understand how diversified are the microorganisms. You can also appreciate the fact that this is another amazing world of living organisms.

Let us try to find out where else we can find them.

Microorganisms are present everywhere around us. They are present in air, water and in the soil too.

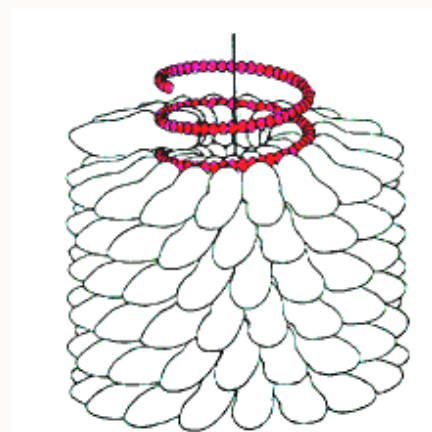
Do you know?

Viruses are an interesting type of microorganisms. They behave like non-living things when they are outside of a living cell. But they behave like living organisms when they are inside host living cells and reproduce just like bacteria, plants or animals.



HIV

(Fig.2.5 Electron Microscopic view of some Viruses)



Tobacco Mosaic virus

They can only be seen through very powerful electron microscope.

Diseases like polio, swine flu, conjunctivitis, smallpox, chickenpox and AIDS are caused by viruses.

They 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.

Diseases like typhoid, tuberculosis (T.B) and septicemia (blood poisoning) are caused by bacteria. Some of the skin diseases are caused by fungi while others by micro arthropods and bacteria. Diseases like Malaria, Amoebiasis are caused by Protozoans.

Do you know?

Bacterial Staining?

Bacteria are very small/ tiny microorganisms. 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, Microbiology, Bacteria, Fungi, Protozoa, Algae, micro orthropods, Virus, discovery, invention



What we have learnt

- Microorganisms are very minute living things. We cannot see them with our naked eye.
- We can see microorganisms with the help of Microscope.
- Antonie van Leuwenhoek invented a powerful single lens microscope.
- Microbes are present everywhere in our surroundings.
- 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

1. Observe some permanent slides of microorganisms in your school lab with the help of microscope. Draw its picture. (AS 5)
2. Which organisms are interlinked between living and non-living organisms? Why do you think so? (AS1)
3. Prepare a model of any microorganism. And write a note on them. (AS 5)
4. Visit any bakery or milk chilling center near to your school with the help of your teacher or parents. Learn about some techniques to culture and usage of some Microorganisms and prepare a note on them.(AS 4)
5. What are micro-organisms? Where we can find them? (AS 1)
6. What type of micro organisms we can observe in pond water? (AS1)
7. How can we observe Lactobacillus bacterium? (AS 3)
8. Whether microorganisms are useful and harmful. How explain.(AS1)
9. How human actions causing death of useful bacteria and fungi. What happens it continue. (AS 7)
10. Why cooked food spoils within less time but not uncooked food. Give your reasons.(AS1)
11. Why should we clean our hands with soap before eating?(AS 7)

STORY OF MICRO ORGANISMS



Part-II

Microorganisms - Our friends or foes?

Microorganisms are present everywhere. They are to be found in air, water, soil; within the bodies of animals and plants and over the surfaces as well. 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 (Friendly) Organisms

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 in preparation of medicines required to cure different diseases. Some of them are farmer friendly as they increase soil fertility. Let us do some activities. How microbes are useful to 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*. *Lactobacillus* 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 water and knead it to make dough. Keep the dough in a warm place. Observe the dough after 3-4 hours.

- What changes do 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 idly and dosa. What will be the reason for preparing Idli and Dosa dough one day before?



Fig. 1: Cups containing Myda dough.

- In the above figure yeast was added to maida dough placed in one of the two cups identify it.

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 fill the dough, increase its volume and make it spongy in nature.

Activity-3

Commercial use of microorganisms

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



Fig-2(a) Antibiotic capsules

- What differences did you observe between the two bowls?
- What will 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 and acetic acid. Yeast is grown in natural sugars present in grains like barley, wheat, rice and crushed fruit juices like grapes.

Molasses produced in sugar industry is used in the preparation of ethyl alcohol by adding yeast for Fermentation process.

Medicinal use of Microorganisms

Sometimes when we fall ill, get injured or need to undergo an operation doctors prescribe some medicines that kill the bacteria involved. Such medicines are called as antibiotics. These antibiotics are produced by growing specific microorganisms. Nowadays a number of antibiotics like penicillin, tetracycline, streptomycin and erythromycin are being produced. Antibiotics help in curing many



Fig-2(b) Antibiotic injections

bacterial diseases like typhoid, gonorrhoea and prevent infections like Septicaemia.

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

? Do you know?

We must use antibiotics prescribed by qualified doctor. If you use antibiotics without consulting a qualified doctor it may harm you. Unnecessary use of antibiotics, affects blood cells which fight infections. Sometimes they may kill useful bacteria too in our intestine and this increases the resistance towards anti biotics. Excess use of antibiotics weakens the body.

The story of discovery of the antibiotic Penicillin



Fig-3(a) Dr. Alexander Fleming in his lab

Fig-3(b) *Penicillium sp* inhibiting bacterial growth in Petridis

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

He was working on antibiotics in his lab. One day he keenly observed that some fungi (mould) 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 many other disease causing bacteria. The mould or fungus separated was identified as *Penicillium notatum*. The

substance which was produced by the fungus *Penicillium* is named as Penicillin. Substances that killed bacteria were generally named as antibiotics by Dr. Fleming.

The discovery of the antibiotic, penicillin was announced in 1929. In 1945 Dr. Alexander Fleming was awarded the Nobel prize along with other scientists (Dr. Howard flory, and Dr. Ernst.B.chain).

The discovery of penicillin paved the way to the discovery of many antibiotics like streptomycin, erythromycins etc. Can our body prevents the diseases without using antibiotics?

Do you know?

Inventor of Aureomycin

This is the picture of **Dr. Yellapreggada Subba Rao**. He was born in west Godavari district of Andhra Pradesh state, India. He discovered Aureomycin i.e tetracycline which cures number of bacterial diseases like Typhoid, plague, Tuberculosis etc.



Vaccine

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

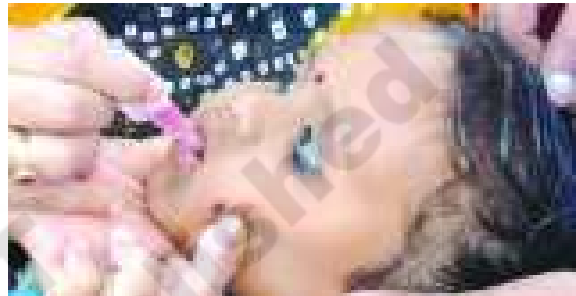


Fig-4 Children consuming polio drops.

This protects us from getting the diseases over a long period of time (often throughout our life). You may have heard that children below five years must take polio drops. Why are polio drops given to children? What is the purpose of polio drops?

dangerous deasease what could be done to make the polio free society? Discuss in you class room about polio contamination and its methods of prevention. Write your findings in the following lines.

Have you given polio drops, when you were a child? Do you know about puls polio programm?

.....
.....
.....

Our national objective is to make Polio free society. What do they do in this programme? You know that polio is a

- collect a pamphlet or broucher on pluse polio programme and discuss the points which are mentioned in them.
- What diseases control by vaccination?

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



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

When a vaccine is given which contains weak micro organisms our body learn to fight them by producing anti bodies whenever danger comes. When the disease causing micro organisms enter in our body, the already present antibodies fight and eliminate them. And the disease is controlled. The weakened disease causing micro organisms which are injected into our bodies are called as **vaccines**. Polio vaccine is given in the form of oral drops which prevents polio in children. While many other vaccines are injected to prevent diseases like smallpox, chickenpox, hepatitis, tuberculosis etc.

Now, we know of several vaccines and are protected against several diseases 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 got them. The most remarkable of such experiments were that conducted by Dr. Edward Jenner in 1796 that give us the first vaccine against a disease caused in human.

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

Activity-4

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

Do you know? Vaccine for Rabies was discovered by Louis Pasture. Rabies causing virus enters in to our body through dog bite, only if the dog also has the same infection.

Story of discovery of Smallpox vaccine



Fig-5 Baby with small pox



Dr.Edward jenner inoculating vaccine

The decision of Dr. Edward Jenner to setup his medical practice in country yard i.e. in a village, which helped mankind save from extinction from diseases with discovery of vaccines. 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 took the fluid from a cowpox pustule on a dairymaid's hand and inoculated a 8 years 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. This



Fig-6(a) *Nostoc*

invention of smallpox vaccine saved millions people from deadly disease. This showed the way for the discovery of number of vaccines which prevent us from harmful diseases. The word vaccine comes from 'vaca' which means cow.

Soil Micro organisms in soil fertility:

About 78% of air around us is nitrogen gas. Plants need it mainly for synthesizing proteins. But they can not make it from the atmosphere directly. Micro organisms like Rhizobium, nostoc, anebena, azotobacter, etc., help to provide this essential element to the plants by fixing them from atmosphere to form certain compounds. That they release into the soil that can be taken up by plants.

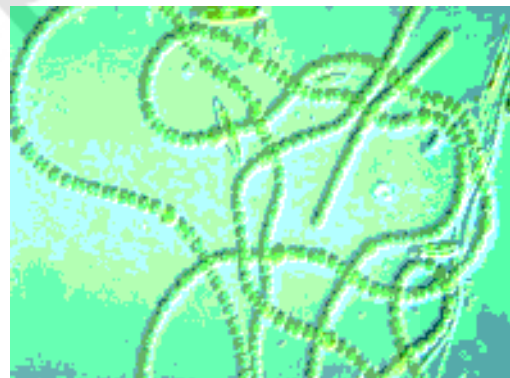


Fig-6(b) *Anabina*

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

? Do you know?

What is Bt?

Bt means *Bacillus thuringiensis* is name of a bacterium. It produces a toxin which kills pests on plants or crops. The bacterium is used as bio pesticides. 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.

Activity-4

Take two pots or dig two pits in the corner of the garden at home or ground at your school. 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 or pots 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 you have observe? Note them down.

Think and discuss with your friends. Is there any harm with non-decomposed material? Discuss.



Fig-7 Compost pit

You may have observed the same thing happening in your own surroundings as well. Microorganisms present in the soil, air and water act upon wastes around us and decomposes them. They are converted into

simple substances. Thus microorganisms help us in cleaning the environment.

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

Do you know that micro organisms like several bacteria help in the process of sewage treatment.

Harmful microorganisms:

Now let us learn about some of the micro organisms that are harmful to us. 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-5

Meet a doctor of your locality and ask him about the different types of diseases, caused by different micro organisms. 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, that times some of your family members or friends get cold and cough with the sudden change of weather. When the infected person

sneezes or coughs, the pathogens enters into air from such infected persons. When this air containing pathogens enter into the body of healthy person and may cause cold! (we commonly use these terms). This type of diseases which spread from infected people to healthy ones are known as “communicable diseases”. These get spread through air, water, food or through physical



Fig-8 Anopheles female mosquito biting

contact of infected person (or his used towels, kerchiefs) or through insects like houseflies and mosquitoes. Common cold, conjunctivitis, typhoid, smallpox, chickenpox, swine flu, tuberculosis are some of the communicable diseases.

Some insects and animals carry diseases causing microorganisms. They are called

as ‘vectors’. 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. We should be careful not

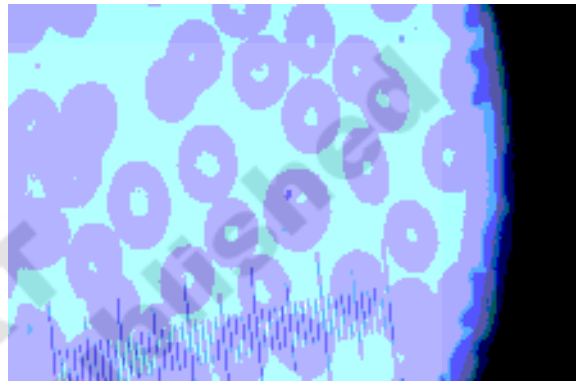


Fig-9 Plasmodium in RBC.

to let water collect anywhere in our surroundings, including left over waste pots, waste flower pots, tyres, bowls etc.

- Why should we take care for our surroundings 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 Secendrabad. For full story of discovery of Ross. Refer annexure for more details.





Fig-10 House fly on food

House flies also carry disease causing microorganisms and spread the diseases like typhoid, cholera, etc. When they sit on garbage, excreta of infected persons or animals, pathogens stick to their bodies.

When these flies sit again on a uncovered food, they transfer the disease causing bacteria into the food. Whoever eats this food may have chances to get these diseases. So we must avoid taking uncovered food. We must always cover the food. Houseflies breeds on garbage. We can control houseflies by keeping our surroundings clean.

- Where do you find more number of houseflies? Why?

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

TABLE-1: SOME COMMON DISEASES CAUSED BY MICROORGANISMS IN HUMAN

Name of the disease	Causative Microorganism	Mode of transmission\	Preventive measures
Tuberculosis	Bacteria	Air	* Vaccination (BCG) * Avoid using infected persons towels, Hand kerchiefs, Glasses etc
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	Parasite	(vector) Mosquitoes	* Use mosquito nets, repellents. * Control breeding of mosquitoes by not allowing water stagnation in our surroundings
Dengue	virus	Mosquitoes	„
Chikungunya	virus	Mosquitoes	„
Japanese Encephalitis	Virus	Mosquitoes	„

Study above table and answer following questions.

1. What diseases can be prevented if we can control Mosquitoes?

2. Which diseases we can prevented by vaccination?

3. What are the diseases which are transmited by contaminated water?

4. Can you name some diseases which are transmited by Air?

5. Can we protect from bacteria and protozoan diseases through vaccination? Discuss in your class.

Disease causing microorganisms in animals

Some examples are like Anthrax mainly in cattle (also affects humans), foot & mouth disease, viral disease in prawns etc.








Fig-11 Anthrax disease in sheep

Disease causing micro organisms 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	
Smurt disease of Rice	Fungus	Air	

Food poisoning:

Sometimes you might have listened 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. Cooked food spoiled in less time than raw food.

? 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 emits bad smell and tastes bad. Water or moisture present in food items helps the microorganisms to grow. How can we preserve our food? We knew the cause of food spoilage i.e. growing

of microorganisms. 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? Think, 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.

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 or cold conditions.

Pasteurisation

Another method of preservation is pasteurisation. You may have read this word written on some milk packets. In this process milk is heated up to 70 degrees C for 15 to 30 seconds and then suddenly chilled and stored. This prevents growth of most microorganisms. This process was discovered by **Louis Pasteur**. So this method is known as **pasteurisation**.

Invention of Pasteurisation

Louis Pasteur was born in a village of France in 1822. He was a painter. He wanted to become a teacher. He was interested in mathematics, physics, and chemistry, and he became a researcher. He was doing his research on crystals. In those days the wine industry of France was in trouble with spoilage of preserved wine. They approached Pasteur. Pasteur studied the problem and hypothesised that



microorganisms may be the cause of wine spoilage. He thought that these microorganisms can be controlled by heat. This led to the invention of Pasteurisation. He proposed germ theory of diseases i.e. microorganisms causes diseases. He also invented vaccine for Rabies. He studied and conquered Anthrax, by inventing the Anthrax vaccine. He studied several other conditions of diseases in humans and animals and showed how to control them. He had saved the silk industry of Germany and France by controlling microbial diseases caused to the silk moth.

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

Storage and packing

Nowadays, dry fruits and even 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, at any seasons.
- 5) Can you name different fruits import from outside of the state?

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 infected.

Nitrogen fixation

Activity-6

Take root nodules of any pulse or leguminous plants crush on a slide, put a drop of water or any oil on it and observe under microscope. Draw rough sketches of what you observe. Discuss with your friends.

You have learnt about rhizobium bacterium previously. Rhizobium is



Fig-12 Root nodules of legume plant

present in the root nodules of many leguminous (pulses) plants, such as beans and peas. The bacterium rhizobium takes nitrogen from atmosphere and fixes on the roots of plants. Plant gives shelter to the bacterium. Thus both help each other. This relationship is known as **symbiosis**. Growing pulse crops thus helps in increasing soil fertility.



Key words

Lactobacillus, penicillum, fermentation, stirilisation, vaccination, bacillus thuringiensis, pathogens vectors, pasteurisation, symbiosis.



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

1. 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)
2. Make an Album of scientists and their discoveries related to Microorganisms.(AS 4)
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. What are antibodies? When do they develop? How they help us? (AS1)
5. How vaccines works in our body? (AS1)
6. If there are no micro organisms on the earth what will happen? (AS 6)
7. What are the precautions to eradicate malaria? (AS 7)
8. How you appreciate Edward Jenner's experiments? (AS 6)
9. Visit a nearby milk chilling centre. 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. What are the differences between Antibiotic and Vaccine? (AS1)
13. Jeevan said that "If there are no micro organisms earth will remain with wastes" will you agree this statement, why? (AS 6)
14. Invention of pencilline protect the world from deaths during first world war, explain.
15. One medical store owner is giving antibiotics to his customer who is suffering with fever without a doctor's prescription? But the customer's daughter Malathi is telling her father not to take antibiotics without doctor's prescription. Whom do you support and why? (AS 7)
16. Pranavi is suffering from serious illness. Doctor prscribed antibiotics for five days. After three days of usage she stopped taking antibiotics. Is it right or not, discuss. (AS 6)

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 talked 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 expresses 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 Uttarakhand 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 carrier. 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 with 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. This 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 become 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 carries 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 transport 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 can 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 on 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 a 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.