

# 6

## MICRO-ORGANISMS AND DISEASES

### What we have learned earlier

- Micro organisms cause contagious diseases.
- Tooth decay is caused by the lactic acid produced by bacteria living on the food remnants.
- Some micro-organisms, toxic substances, alcohol etc cause diseases which affect the liver.
- Certain diseases affect the respiratory system. They can be controlled and cured.
- The infection of micro-organism is a cause for diseases in joints.

There are several diseases which affect man. Some of them are transmissible and others are not. The transmissible diseases are called contagious diseases. Louis Pasteur discovered that the contagious diseases are caused by the entry of micro-organisms from the surrounding into the body. This discovery helped a lot in the understanding of diseases, to improve methods of treatment and to control the diseases effectively. The discovery of antibiotics also led to a greater advancement in the modalities of treatment.

Do you know how pathogens enter the body and how the body reacts to them? It will be quite useful to know about some of the disease causing organisms or pathogens, the disease caused by them and the preventive measures against them.

### Bacteria

The bacteria are of different types. Observe table 6a. Understand the shape of different types of bacteria and the diseases caused by them.

- How does each type differ in its shape?
- Have you seen diversity in the shape of similar types?

You know that we cannot see bacteria with our naked eye. Let us examine their other characteristics. Some bacteria can



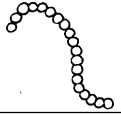


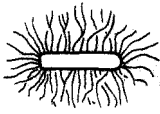
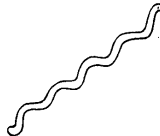

Type of bacteria	Shape	Diseases
Coccus		pneumonia
		eye cysts
		throat infection
Bacillus		tuberculosis
		tetanus
		typhoid
Spirillum		siphilis
		cholera

Table 6.a  
Certain types of bacteria and the diseases caused by them

move through liquid medium using certain hairy appendages. Others have slimy outer covering which gives them protection.

Don't you know that the bacteria reproduce by binary fission.

During favourable conditions it takes only about twenty minutes for a bacterium to divide once.

If so, how many bacteria will be formed from a single one in one day? What will happen if conditions are unfavourable? Observe the figure given below. (6.1.a,6.1.b)

How do bacteria overcome the unfavourable situations? How does their mode of reproduction differ with respect to the situations? Record the conclusions in your science diary.

**Bacteria which have better surviving ability**

Some halophilic bacteria can live in concentrated salt solution. Some other bacteria can live at a temperature of 110°C. They prepare ATP molecules by directly absorbing sunlight but they have no ability for photosynthesis. Thermoacidophilic bacteria can live at 80°C and can survive upto acidic pH2. They can be seen in hot springs.

**Unfavourable situation**

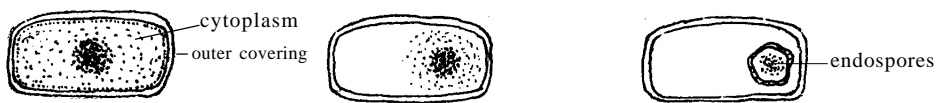


Figure 6.1.a  
**Endospores are formed from the cytoplasm**

**Favourable situation**

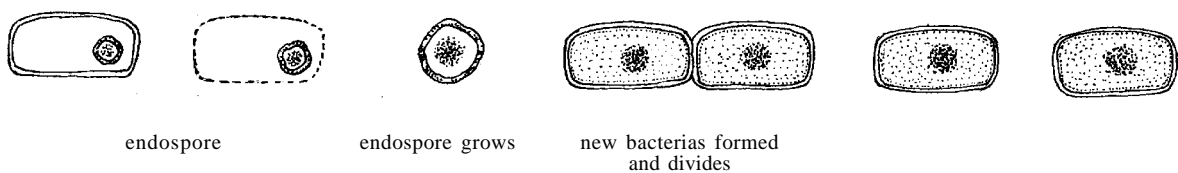


Figure 6.1.b  
**Division of endospores**

Temperature is the major factor which affects the multiplication of bacteria. What would be the nature of their multiplication at different temperatures? Analyse the figure 6.2.

- How far does our body temperature help the multiplication of bacteria?
- What happens to the bacteria and endospores on heating?

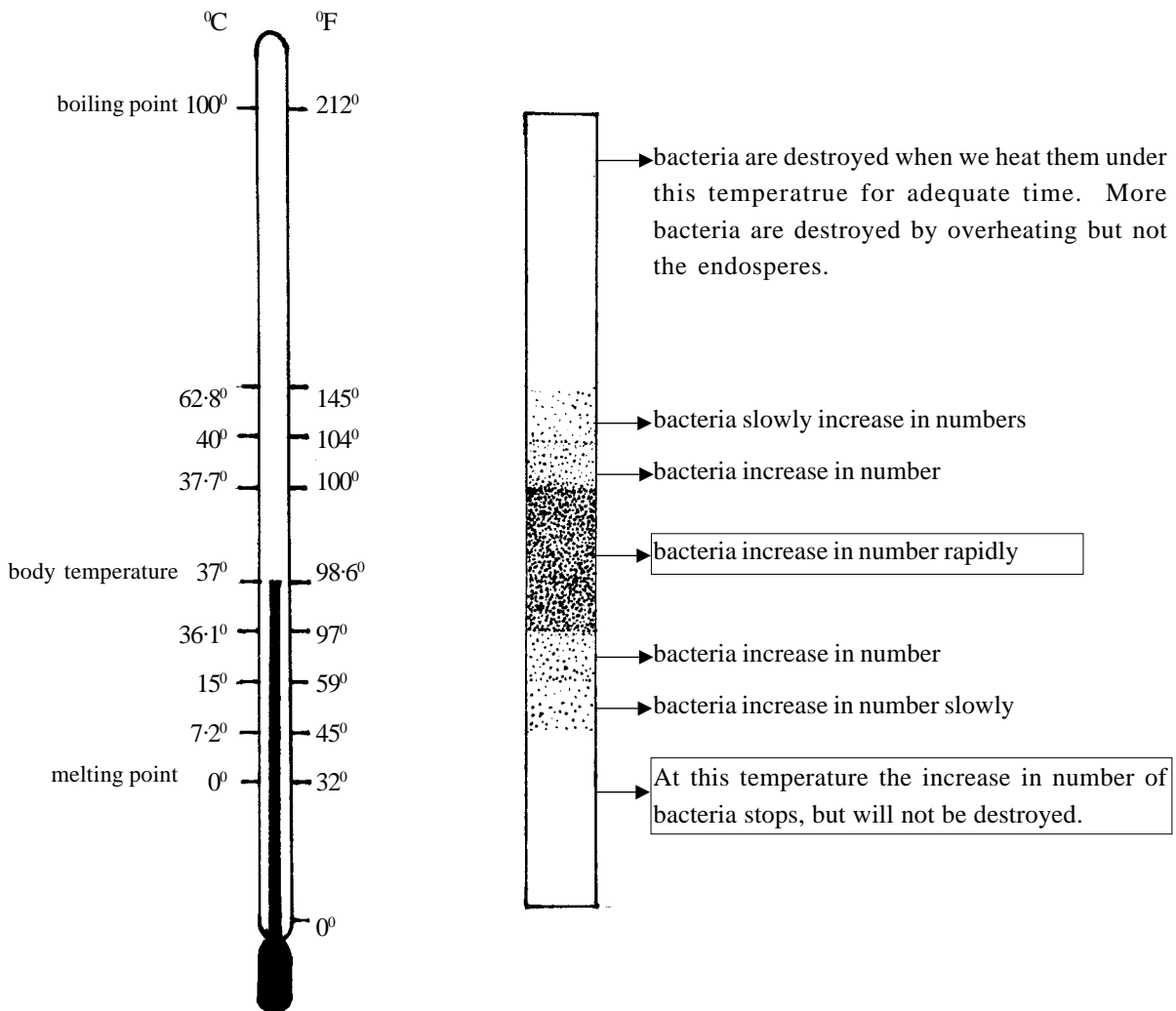


Figure 6.2

**Influence of temperature on the multiplication of bacteria**

- When substances are taken out of the refrigerator, what will happen to the bacteria in them?

Record the conclusions in the science diary.

Now you know that endospores can survive the temperature of even boiling water. In order to destroy the endospores they should be heated under high pressure and

temperature for about fifteen minutes. You can imagine why autoclaves are used in hospitals to make the surgical instruments germ free. We get the same result when we use the pressure cooker for cooking.

The micro-organisms like bacteria enter our body, after overcoming several unfavourable situations. What would happen, once they enter our body?

You have seen that our body temperature is very suitable for the multiplication of bacteria. A lot of waste materials are deposited in our body as a result of the life processes of these microbes. These are called toxins. Toxins upset the life processes in our body. Sometimes it may destroy the cells too. The temperature of our body raises to make them inactive or to check their multiplication. Rise in body temperature is the first symptom of typhoid. Now you can

understand why this occurs. This is a type of resistance activity . Our body resists against several diseases like this.

Bacteria cause several diseases besides typhoid. Haven't you understood about tuberculosis. This disease is caused by *Mycobacterium tuberculosis*. Does tuberculosis affect the lungs only? Observe the figure 6.3. Which are the other parts of the body affected by this disease? Prepare notes on that.

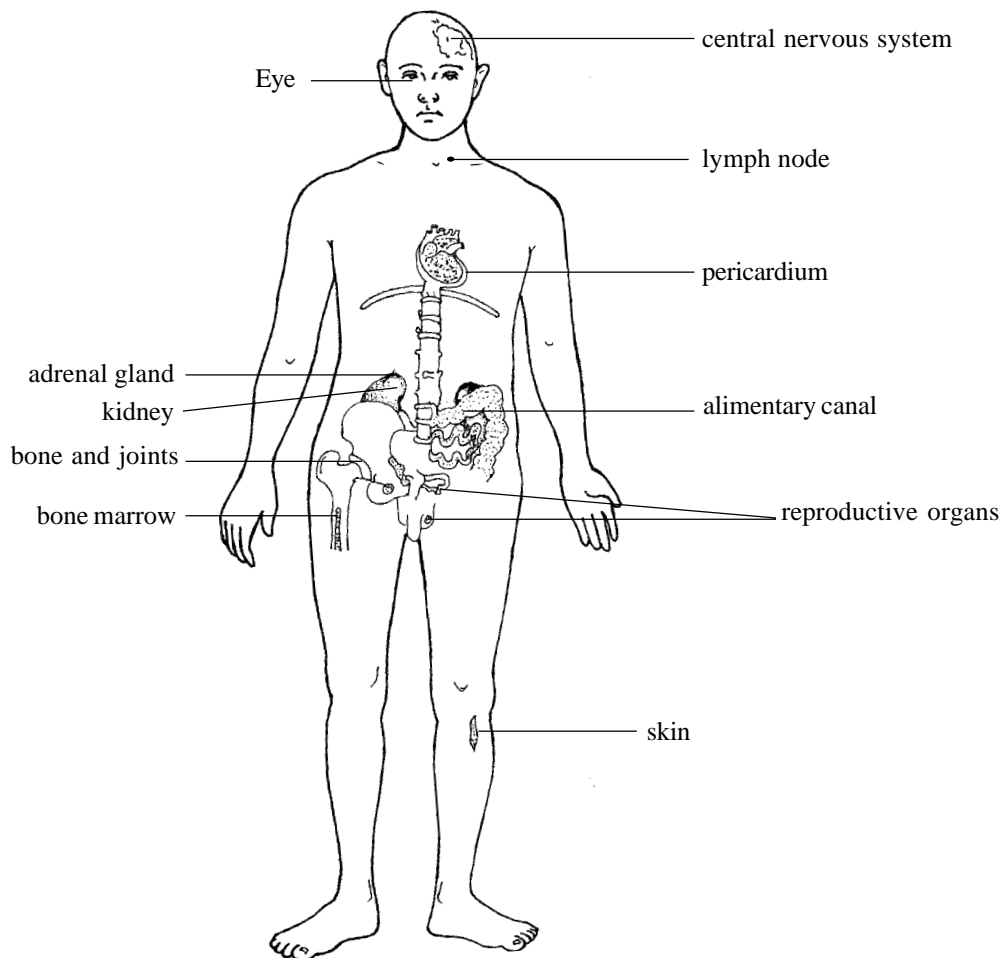


Figure 6.3  
Sites of affection of tuberculosis other than lungs

Disease	Pathogen	Mode of infection	Symptoms/Other characteristics	Things to be taken care of
Cholera	<i>Vibrio cholerae</i>	Through contaminated food and water, insects like housefly and untidy surroundings	Continuous diarrhoea, vomiting, over tiredness, muscle cramps, dehydration and loss of minerals. If this continues death may occur.	Dilute rice soup with salt to be given at intervals. Provide medical help at once.
Leptospirosis (Rat fever)	<i>Leptospira ictero-haemorrhagiae</i>	The germs seen in the urine of rat or water may enter into the human body through cuts or wounds on the skin. Through domestic animals, squirrel, rabbit etc.	Headache, fever, shivering, body pain, redness of eyes, difficulty to look on sunlight, jaundice. It may affect the organs such as liver, kidney, lungs etc and lead to a severe condition.	Eradication of rats. Take medical help in time.
Leprosy	<i>Mycobacterium leprae</i>	Through continuous contact with the patient	The symptoms may not be seen from 3 to 5 years. Sensation of skin diminishes – rashes will appear, wounds in the fingers and loss of wounded part, swellings appear on the face, saddle nose etc.	Seek medical help at the initial stages. By delaying treatment, though the disease can be cured, the bodily deformities still persist.
Tetanus	<i>Clostridium tetani</i>	From soil, animal excreta, dirty objects, unsterilised instruments. Through wounds	The body will curve like a bow due to spasm and rigidity of muscle. The disease is known as lock jaw because of the difficulty to open mouth. Death may occur due to the constant damage to the central nervous system.	Vaccination should be given

Table 6.b  
Some diseases caused by bacteria

Do you know the other diseases caused by bacteria? Observe the table 6.b.

Find out more diseases caused by bacteria and make a list of them in the science diary. Bacteria also cause food poisoning.

### Bacteria and Food poisoning

Bacteria such as Salmonella, Staphylococcus, Clostridium botulinum etc poison the food materials.

### Useful Bacteria

There are thousands of different strains of bacteria all around the air, in water and in soil. Most of the bacteria are useful. They decompose the organic wastes, produce certain vitamins in the body of animals, help in digestion, change milk to curd, ferment grapes to wine, and are used in the preparation of antibiotics and hormones. Only a small group of bacteria is harmful.

Vomiting, diarrhoea abdominal pain and headache are the common symptoms of food poisoning.

Bacteria such as salmonella, staphylococcus etc are destroyed at 55°C. They are infected mainly through meat & other non-vegetarian food items. What are the precautions to be taken against infection from these?

*Clostridium botulinum* is a type of bacteria that grow in tinned meat (tinned food). It produces a poison, botulin which causes the deadly food poisoning called botulism. This bacteria grow at about 43°- 47°C. It is an anaerobic bacteria. The endospores of this cannot be destroyed even by boiling.

**Viruses**

You have realised how the multiplication of bacteria causes diseases. The viruses are another type of micro-organisms and like bacteria they also cause diseases. At present they are a real threat to the life of man. Viruses cause a variety of diseases from common cold to AIDS. You have learnt that the viruses show characteristics of life only when they are inside living cells but shows non-living attributes when they are outside.

What is their structure? Observe the figure 6.4.

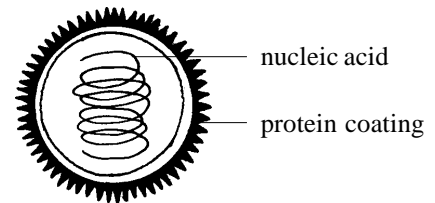


Figure 6.4  
A typical virus

Observe the figure 6.5 and understand the diversity among viruses.

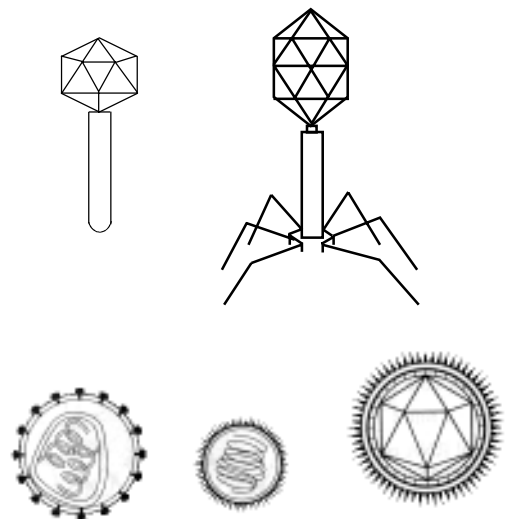


Figure 6.5  
Different types of viruses

Try to understand how the viruses multiply after getting entry into a host cell. (Fig 6.6).

**Rickettsia**

Rickettsia are micro-organisms smaller than bacteria and larger than viruses. They have close resemblance with bacteria in structure. Rickettsia cause diseases such as Rocky mountain spotted fever, typhus, Q-fever. Rickettsia are spread through wounds, fleas, lice, bugs, food and air.

When the virus particles are formed in the host cell, the membrane system of the cell gets damaged. Membrane damage causes rupture of lysosomes and release of lysosomal enzymes. Life processes get disrupted and the cell disintegrates. The viruses continue multiplying and cause damage to more and more cells. This leads to a state of disease.

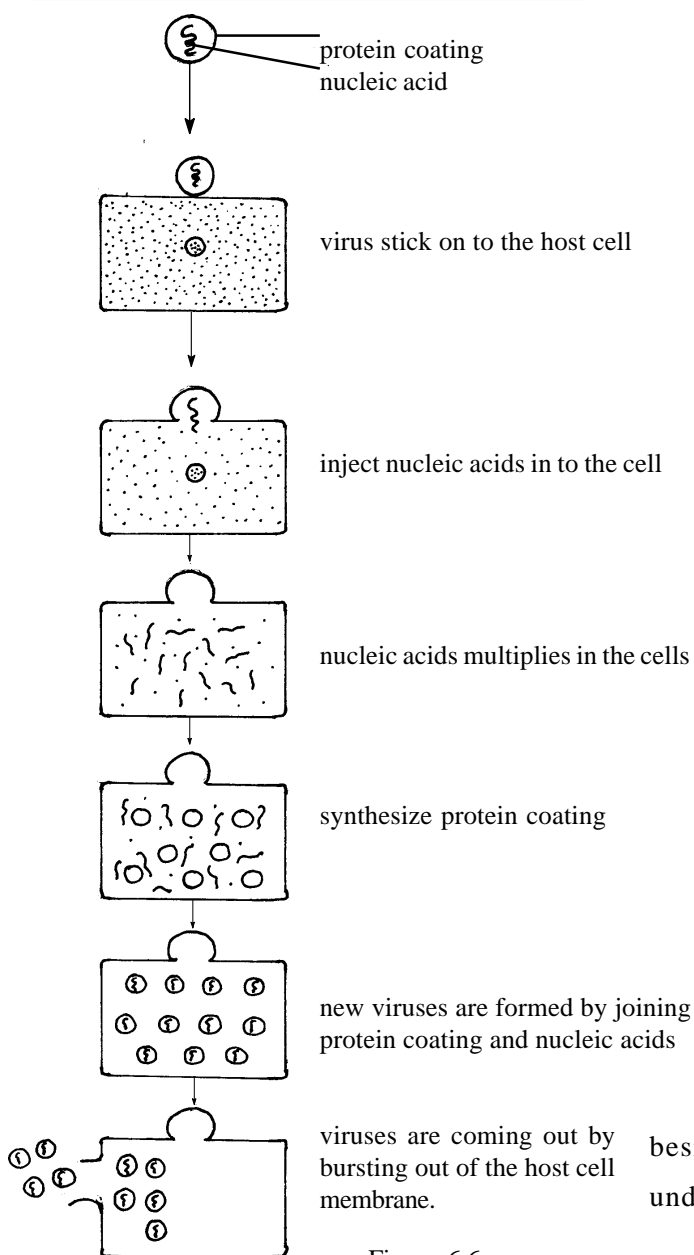


Figure 6.6  
**Reproduction of viruses**

**SARS -A New Threat**

SARS (Severe Acute Respiratory Syndrome) is a severe respiratory disease. It was first reported from the south east region mainly from China. The causative organism is considered to be a virus. The disease starts like a flu, then changes to pneumonia and severe respiratory problems which may lead to death. Acute fever, dry cough, respiratory trouble etc are the common symptoms. But sometimes headache, sprain, diarrhoea etc may be found. Infection of this disease is through close contact with the patient.

Which are the other viral diseases besides AIDS? Check the table 6.c and understand more facts about some of them.

Disease	Causative organism	Mode of infection	Symptoms/Other characteristics	Things to be taken care of
Dengue fever	Dengue viruses	A type of mosquito by the name <i>Aedes aegypti</i>	Sudden and severe fever, severe headache, pain behind the eye balls, loss of appetite, red rashes on the face and chest, nausea. At severe stages there may be sudden fall in the number of blood platelets.	Treatment should start at the initial stages. Severity may cause death. Control of mosquitoes essential
Polio myelitis	Polio virus	Infection through food, water etc.	Fever, headache and weakness of hands and legs. Permanently handicapped due to damage of nerve cells to muscles	Polio drops (oral) should be given in time
Japanese encephalitis	Virus	Through culex mosquito	Severe fever, headache, nausea, vomiting. Difficulty in bending the neck, hallucination, muscle cramps, fainting.	Treatment should be given at the initial stages. Eradication of mosquitoes.

Figure 6.c  
Some diseases caused by the viruses

### Protozoa

Don't you know about the unicellular organisms called protozoa? Protozoa includes organisms such as amoeba. They differ from the bacteria in having a specific nucleus. Observe picture 6.7 and study the characteristics of protozoa. Prepare notes in the science diary.

Pseudopodia, flagella, cilia etc help protozoa in locomotion. You know how amoeba reproduces. The protozoa also multiplies through binary fission. How do they overcome the unfavourable situations?

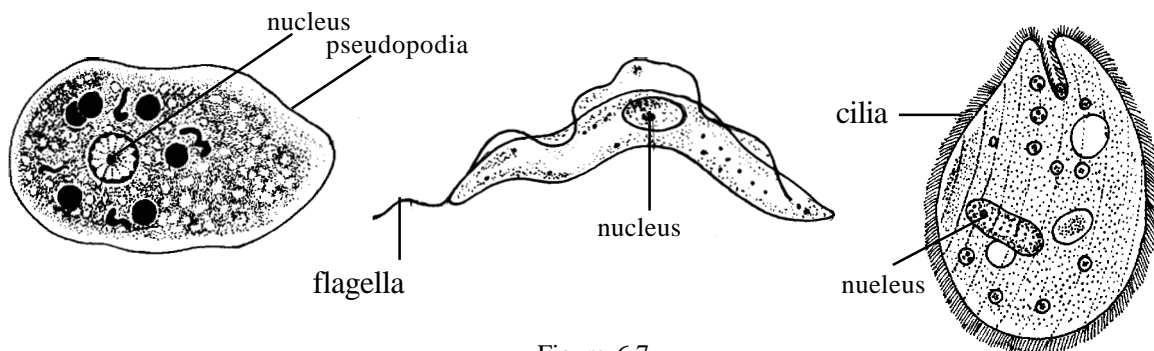


Figure 6.7  
Different types of Protozoa

## Pathogenic Protozoa (Disease causing protozoa)

Some protozoa cause diseases just like bacteria and virus. Dysentery, malarial fever etc are such diseases caused by protozoa.

### Dysentery

Dysentery is a disease caused by infection of small intestine. What are its symptoms?

- Stomach ache
- Frequent bowel movement
- Blood and mucous in stool

The causative organism is *Entamoeba histolytica*. How do the infective form of the germs that come out along with the faeces of the patient infect others?

Dysentery causes dehydration and loss of minerals. If no treatment is given in time it may affect the functioning of kidneys and sometimes it may lead to death. Do not stop the treatment even if the symptoms disappear. Complete eradication of the cysts of pathogens can be made possible only through long term treatment. Bacteria also cause dysentery.

### Malaria

Malaria spreads through the bite of Anopheles mosquitoes. The causative organism is the protozoan, Plasmodium. What are the symptoms of Malaria?

- Severe fever
- Chilling and shivering
- Severe headache
- Feeling of intense heat in the body
- Symptoms repeat intermittently

Disease may gradually affect organs such as the brain and the kidneys, and become fatal. Therefore if fever with shivering develops, blood testing should be conducted to confirm whether it is malaria or not. The treatment should be taken for the period as per the doctor's advice.

### *Black water fever*

Four different types of plasmodium such as Plasmodium vivax, Plasmodium malariae, Plasmodium falciparum and Plasmodium ovale cause malaria. Among these the malaria affected by P.falciparum is the most dangerous. The pathogens grow and divide in our red blood cells and destroy them. The haemoglobin and bile pigments formed due to the destruction of red blood cells are excreted through urine. This makes the urine appear dark in colour. This acute stage called black water fever is associated with P.falciparum malaria.

## Fungi

Have you noticed black spots on the wet clothes. It is due to a type of fungus. Mould on the bread is also due to fungus. Observe the fungus affected portion of the bread through a microscope. Compare your

observations with the figure given below.  
 (6.8) Make notes on it and record it in the science diary.

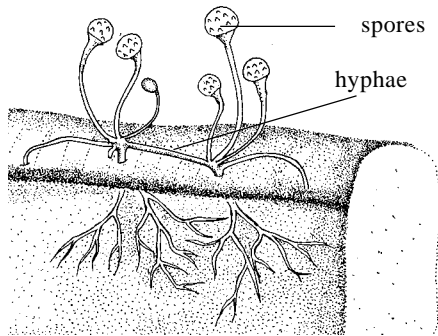


Figure 6.8  
**mould on bread**

The body of the fungi called mycelium is made up of long thread like structures called hyphae. You have learnt that the fungus reproduces by spores.

***Aflatoxin is dangerous***

Aflatoxin produced by the fungus *Aspergillus flavus* is dangerous. If a high dose of it reaches the body it may cause lung cancer. Sometimes this fungus grows on food grains.

**Are fungi pathogenic?**

Fungi cause several diseases. Have you noticed white patches in between the fingers of *dhobies*. This is caused by a fungus. Fungi cause patches on skin, athlete's foot, ringworm disease, corn disease etc. Some fungi cause food poisoning. The toxin produced by them sometimes lead to death.

**Infection through body fluids**

Diseases may develop even when the body fluids of patient or carriers happen to mix with that of normal ones.

Do you know how the body fluids mix?

- through blood transfusions
- using unsterilised needles and syringes
- through sexual contacts

Sexual diseases are transmitted only through sexual contacts with the infected person. Gonorrhoea, syphilis etc are examples of sexually transmitted diseases.

Haven't you heard about the disease called AIDS (Acquired Immuno Deficiency Syndrome). The causative organism for this is the HIV (Human Immuno Deficiency Viruses) which attacks lymphocytes that play a significant role in immunity. This disease is transmitted through body fluids. This can be transmitted from mother to foetus.

**December 1 - World AIDS Day**

Every year December 1 is observed as World AIDS day with a view to making the people aware of the dreadful disease, AIDS.

What happens when human immuno viruses attack lymphocytes? Body

becomes susceptible to any disease. You can imagine the consequences. What are the precautions that are to be taken to prevent such diseases?

Now we have understood about some infectious diseases. You know that there are other infectious diseases also. What are the important infectious diseases common in your locality? Make a study and prepare a project report.

### **Disinfectants and Antiseptics**

You might have noticed that cleaning lotions such as phenols are used to clean the floor, table and other equipments in hospitals, hotels, homes etc. What is its purpose?

Disinfectants are strong chemicals that can destroy microorganisms. Phenol, bleaching powder, lysol, formalin etc are examples. Antiseptics are the chemicals used to destroy microorganisms in the body surface. It includes ethyl alcohol, boric acid, potassium permanganate. Dettol, savlon etc which can be used as disinfectants and antiseptics in dilute form. Care should be taken to avoid mixing of disinfectants with food and wounds.

### **Antibiotics**

Antibiotics are antimicrobial substances which can be used internally as well as externally. Some of them are

extracted from micro-organisms. Some others are produced through chemical processes. They destroy or make the microbes inactive. The examples for some antibiotics are given below.

- Penicillin
- Ampicillin
- Streptomycin
- Oriomycin

The discovery of antibiotics helped in the treatment and cure of contagious diseases such as typhoid, tuberculosis etc. There are many antibiotics in the market which are useful against many contagious diseases.

Though antibiotics are useful, some of them have side effects also. Observe the table 6 d.

Figure 6.d  
**Antibiotics and their side effects**

**An incidental discovery**

In 1928, a Scottish bacteriologist by name Alexander Flemming was working in St. Mary's Hospital in London. He cultured bacteria in an agar medium. Once he came to notice that some of the bacteria got destroyed due to some reaction. By careful observation it was found that a chemical produced by a fungus *Penicillium notatum* was responsible for the destruction of bacteria. That chemical was penicillin—the first antibiotic. It has the ability to destroy many bacteria. It was first used in 1940. In 1945 Nobel prize for medicine was awarded to Alexander Flemming, H.W Flory and E.B Chain. Don't you know that the indiscriminate use of antibiotics is dangerous? Emergence of antibiotic - resistant bacteria is a new problem in the field of treatment.

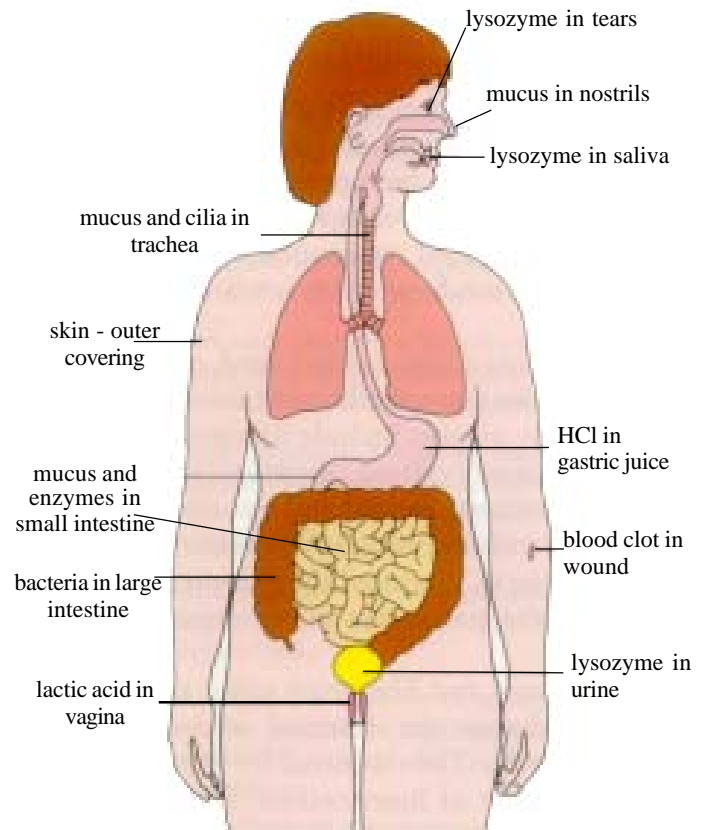


Figure 6.9  
**Safety measures in the body**

Do you understand the antibiotics are harmful to us. Production of bacteria which can resist antibiotics is a new problem in the field of medical science.

**Safety Measures in the Body**

You know that diseases occur while pathogens get entry into our body. Though there are millions of pathogens around us, we do not often get an attack of diseases. Why?

Observe the figure 6.9. Find out the answers to the questions and record it in the science diary.

- Which is the major safety device to check the entry of pathogens into the body?
- How does the body check the pathogens from entering through inspiring air?
- Where do you see lysozymes which have bacteriocidal property?

Make note on different parts of our body which protect us from the attack of pathogens and give a presentation.

**Immune System**

You have now understood the safety measures adopted by the body to prevent the attack of pathogens? What would be

the result if this measures fail? The body resists against the disease germs in accordance with their mode of attack. Have you noticed the appearance of swellings during trauma? Do you know that this also is a method of resistance. Observe the figure 6.10.

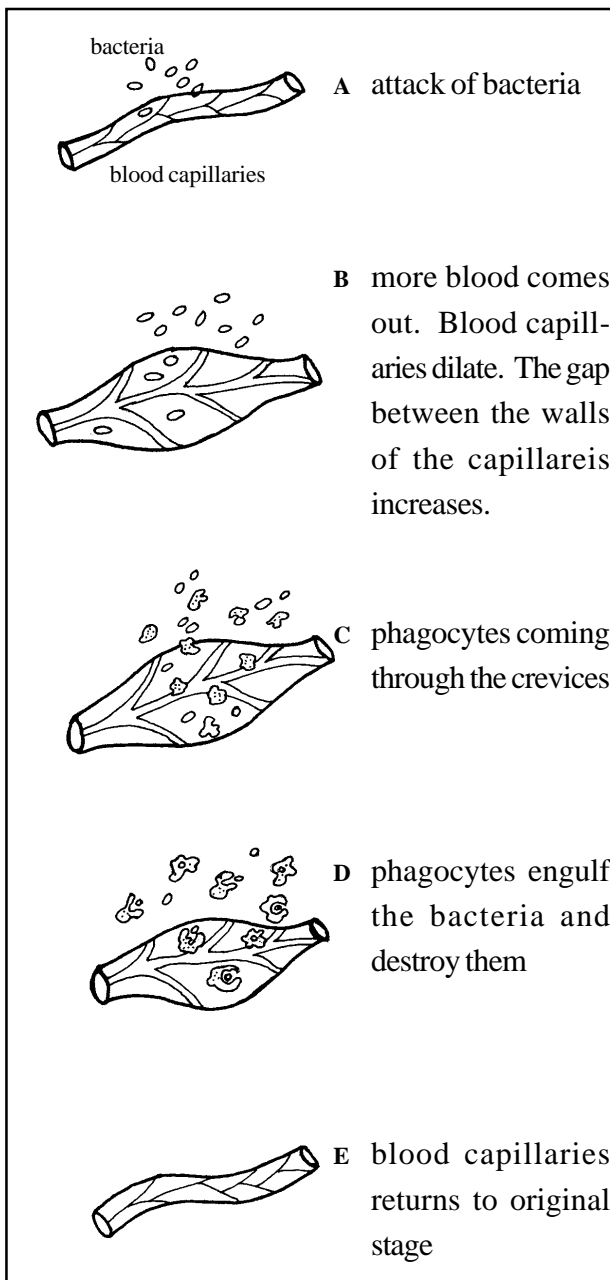


Figure 6.10

Swelling responses in the affected area

Notice the changes in affected part of blood vessels.

- What is the use of expansion of gaps on the blood capillaries?
- Why do the affected parts swell and red coloured?

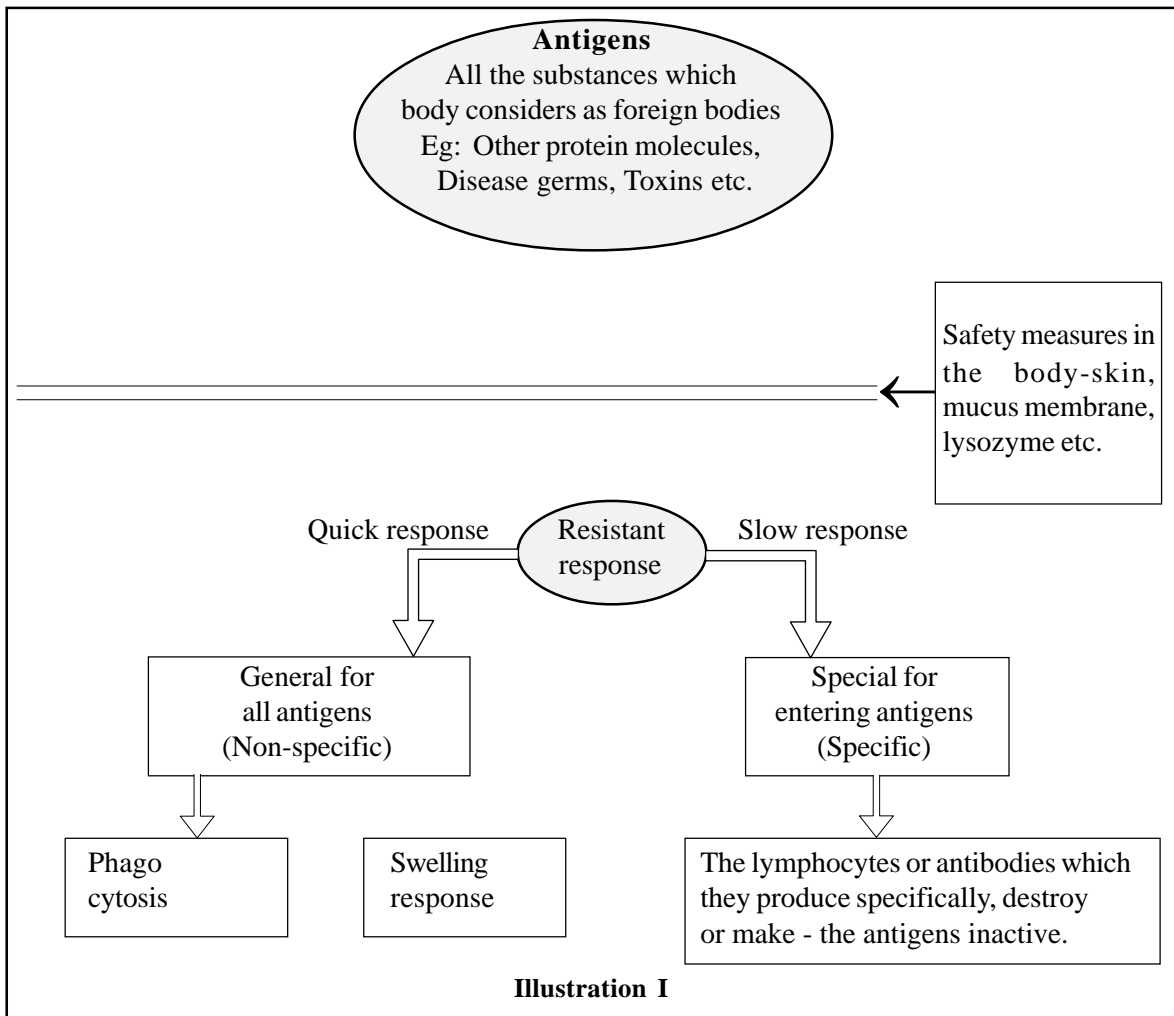
Swelling response in the affected area is local and provides immediate resistant activity. You know that a type of white blood corpuscles called lymphocytes produce antibodies to resist the disease germs. When more lymphocytes are needed, the lymph glands in the affected area do extra work to produce more lymphocytes. Such lymph glands also show swelling. That is why wounds are often associated with inflammation of lymph glands.

### Immunity

You have understood that the human body has an innate power of immunity. Do you know how the body resists the disease germs, once they enter the body. Observe the Illustration I given below.

You have understood why even after the attack of pathogens, we do not always get diseases.

Some lymphocytes retain the ability to produce antibodies even after the body has recovered from the disease. The antibodies once produced will remain



viable for a long period. You have heard that we develop permanent immunity against diseases such as chickenpox, mumps etc once we happened to be victims of such diseases. Now you may know the reason.

### Immunisation

Prevention is always better than cure. You have seen that the children are given preventive medicines. Do you know what are the preventive medicines?

**Health Organisations**

Have you heard about the World Health Organisation? It works with a view to provide health for all in the world. It functions with the guidance of United Nations. Organisations like UNICEF, International Red Cross, Indian Red Cross Society etc functions in health and social welfare fields. There are different organisations working in the national and international level. April 7 is celebrated as World Health Day in remembrance of that day in 1948, when all the member countries have signed when the constitution of World Health Organisation.

The killed or inactive disease germs, inactivated toxins etc are given as preventive medicines. These are called vaccines. They act as antigens which stimulate the immune system of the body

### ***The beginning of immunisation***

An English doctor Edward Jenner observed that small pox does not appear in persons who were once attacked by the disease. Jenner injected the pus of small pox with a needle into a girl from a girl having the disease. After that the injected person showed the symptoms of disease and then got cured. After about two months he injected the pus of the disease from another patient into the same girl. The girl did not show any symptoms of disease. This experiment in 1796 was the beginning of immunisation. The term vaccination is derived from a Latin word 'vacca' which means cow. The immunisation is also called vaccination in the remembrance of Jenner's small pox injection. The material used for this is called vaccine.

to produce antibodies against a specific disease. The antibodies once produced will protect the body from the further attack germs of that specific disease.

The body does not get adequate time to produce antibodies against certain diseases such as cholera. In such situations, antibodies are directly injected to attain immunity.

Immunisation is a method of giving vaccines in order to resist the diseases.

Visit a nearby Primary Health Centre and understand the different vaccines given for different diseases. Prepare an immunisation chart and exhibit.

## SUMMARY

- ❖ There is a suitable environment in our body for the growth and multiplication of the micro-organism.
- ❖ There are special adaptations for microorganisms to overcome the unfavourable situations.
- ❖ The microorganism which cause the contagious diseases have different shape and structure.
- ❖ Some micro-organisms cause food poisoning.
- ❖ Some diseases are transmitted through air, water, food and by some organisms.
- ❖ Some pathogens are transmitted through body fluids.
- ❖ Disinfectants, antiseptics, antibodies etc. help to destroy the microorganisms. Majority of antibiotics have side effects.
- ❖ Our body has a safety measure to prevent the entry of pathogens. When this measure fails, the disease manifests.
- ❖ White blood corpuscles play an important role in destroying the pathogens that enter our body.
- ❖ Through proper immunisation we can prevent many diseases. By taking adequate precautions, the diseases can be checked.

## FURTHER ACTIVITIES

- ⇒ Explain how the microorganisms cause diseases.
- ⇒ How can we avoid the fungal diseases affecting man?
- ⇒ Some of the diseases which are considered to be under control pose new threats. Eg. Tuberculosis. What explanation would you give for this.
- ⇒ “Carelessness may lead to death”- check how far this statement is true in the case of contagious diseases.
- ⇒ Explain the importance of immunisation.
- ⇒ Prepare posters on the importance of cleanliness in controlling contagious diseases.
- ⇒ The immediate treatment to diarrhoea is to control dehydration and loss of minerals. Which are the drinks that can be used for it? Which are the components in the ORS solution and at what proportions? Collect information.
- ⇒ What all things would be planned to observe the December 1 as World AIDS Day? Prepare notes on it.
- ⇒ Collect and Exhibit the pictures in the class of scientists who invented the different antibiotics.

