



মণিপুরৰ শিক্ষা বিভাগ (সংসদ)

DEPARTMENT OF EDUCATION (S)
Government of Manipur

CHAPTER - 2.

MICROORGANISMS: FRIEND AND FOE

NOTES

Microorganisms

Microorganisms are very small organisms that cannot be seen with the naked eye. They can be seen with the help of a microscope. They are also known as **microbes**.

Major groups of microorganism

There are five major groups of microorganism. They are:-

1. Bacteria
Examples: *Rhizobium*, *Lactobacillus*, etc.
2. Fungi
Examples: Bread mould, *Penicillium*, yeast, etc.
3. Protozoa
Examples: *Amoeba*, *Paramecium*, etc.
4. Algae
Examples: *Chlamydomonas*, *Spirogyra*, etc.
5. Viruses
Examples: HIV, Coronavirus, Polio virus, etc.

Viruses are different from other microorganisms

Reasons:

- They reproduce only when they are inside the cells of other organism, which may be a bacterium, plant or animal.
- They are like non living things when they are outside the host cell.

Where do microorganisms live?

Microorganisms live in all types of environment, ranging from ice cold climate to hot springs, deserts to marshy lands; inside or on other organisms and some exist freely.

Microorganisms and us

Microorganisms can be grouped into two based on their role in our lives.

1. Friendly Microorganisms
2. Harmful Microorganisms

Friendly microorganisms

- Yeast is used in baking industry for making bread, cake, pastries, etc.
- Bacterium, *Lactobacillus* is used to make curd from milk.
- Bacteria and yeast are also used for fermentation of rice *idlis*, *dosa* batter and many other fermented foods.
- Yeast is used for commercial production of alcohol and wine.
- Bacteria are also used for production of acetic acid.
- Many antibiotics are produced from bacteria and fungi and help in curing a variety of human, animal and plant diseases.
- Many vaccines are also made on large scale from microorganisms to protect humans and other animals from several diseases.
- Bacteria like *Rhizobium* and blue green algae can fix atmospheric nitrogen in the soil and increase fertility of soil.
- Microorganisms decompose dead organic waste of plants and animals converting them into manures.
- Microorganisms can decompose the harmful and smelly dead organic wastes of plants and animals into simple substances and thereby clean the environment.

Action of yeast in bread making

When yeast is added to the mixture of flour and water, it reproduces rapidly and produces carbon dioxide during respiration. Bubbles of this gas fill the dough and make it to rise. Once baked, the yeast dies and a soft and spongy bread is formed.

Fermentation

The process of conversion of sugar into alcohol by the action of yeast is known as fermentation. This is the basis for the commercial production of alcohol, wine, acetic acid, etc.

Antibiotics

Antibiotics are medicines that kill or stop the growth of the disease causing microorganisms. Examples: Streptomycin, Penicillin, etc.

Precautions that must be taken while taking antibiotics

- Antibiotics should be taken only on the advice of a qualified doctor.
- The prescribed course must be completed.
- Antibiotics must be taken in right doses when needed. A wrong dose may make the drug less effective.
- Antibiotics taken unnecessarily may kill the beneficial bacteria in the body.

- Antibiotics are not effective against cold and flu as these are caused by viruses.

Vaccine

Vaccines are dead or weakened microbes. When vaccines are introduced into a healthy body, the body fights and kills the invading microbes by producing suitable antibodies. The antibodies remain in the body and we are protected from the disease causing microbes forever.

Some examples of vaccine

Vaccine	Disease
OPV	Polio
TT	Tetanus
DTaP	Diphtheria, tetanus and pertussis
MMR	Mumps, measles and rubella

Harmful microorganisms

Microorganisms are harmful in many ways:

- Some microorganisms cause diseases in human beings, plants and animals
- Some microorganisms spoil food, clothing and leather.

Pathogens

Disease causing microorganisms are called pathogens.

Communicable diseases

Microbial diseases that can spread from an infected person to a healthy person through air, water, food or physical contact are called communicable diseases. Examples: cholera, common cold, tuberculosis, etc.

Carriers

Carriers are insects, animals or humans which spread disease from infected persons to healthy persons. They carry pathogens in or on their bodies.

Examples:

- Housefly
- Female *Anopheles* mosquito is a carrier of malarial parasite, *Plasmodium*.
- Female *Aedes* mosquito is a carrier of dengue virus.

Prevention of communicable diseases

- Keeping a handkerchief on the nose and mouth while sneezing and coughing.
- Keeping distance from infected persons.

- Maintaining personal cleanliness by taking bath, washing hands, cutting nails, washing clothes, etc.
- Keeping our food covered.
- Stagnation of water should be avoided.
- Keeping our environment clean.

Some common human diseases caused by microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis Measles Chicken pox Polio	Bacteria Virus Virus Virus	Air Air Air/ contact Air/water	Keep the patient in complete isolation. Keep the personal belongings of the patient away from those of the others. Vaccination to be given at suitable age.
Cholera Typhoid	Bacteria Bacteria	Water/ food Water	Maintain personal hygiene and good sanitary habits. Consume properly cooked food and boiled drinking water. Vaccination.
Hepatitis A	Virus	Water	Drink boiled water. Vaccination.
Malaria	Protozoa	Mosquito	Use mosquito net and repellents. Spray insecticides and control breeding of mosquitoes by not allowing water to collect in the surroundings.




Some common animal diseases caused by microorganisms

- Anthrax is a dangerous disease of cattle caused by a bacterium, *Bacillus anthracis*.
- Foot and mouth disease of cattle is caused by a virus.



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Some common plant diseases caused by microorganisms

Plant Diseases	Micro-organism	Mode of Transmission	Figures
Citrus canker	Bacteria	Air	
Rust of wheat	Fungi	Air, seeds	
Yellow vein mosaic of <i>bhindi</i> (Okra)	Virus	Insect	

- Diseases reduce the yield of crop.
- Diseases of plants can be controlled by use of certain chemicals which kill the microbes. These chemicals are called **pesticides**.

Food poisoning

Microorganisms that grow on our food sometimes produce toxic substances. These make the food poisonous causing serious illness and even death when consumed.

Food preservation

Foods are preserved using various methods to save it from the attack of microorganisms. Some of the methods are:

- **Chemical method.** Sodium benzoate and sodium metabisulphite are common preservatives used to preserve pickles, jams and squash. **Preservatives** are chemicals which check the growth of microorganisms.
- **Preservation by common salt.** Common salt is used to preserve meat, fish, *amla*, raw mangoes, tamarind, etc. It removes water and kills microorganisms.
- **Preservation by sugar.** Jams, jellies and squashes are preserved by sugar. Sugar reduces the moisture content which inhibits the growth of microorganisms.
- **Heat and cold treatment.** Boiling of milk before storing kills many microorganisms. Refrigeration inhibits the growth of microbes on them.
- **Pasteurisation.** It is the process of heating milk at about 70°C for 15 to 30 seconds and then sudden chilling before storing. It kills all harmful microbes.
- **Storage and packing.** Dry fruits and vegetables are sealed in air tight packets. This prevents the attack of microbes due to absence of air.

Nitrogen fixation

- Bacterium, *Rhizobium* lives in the root nodules of leguminous plants like pea and bean and fixes nitrogen in the plant.
- Atmospheric nitrogen also gets fixed through the action of lightning.

Nitrogen cycle



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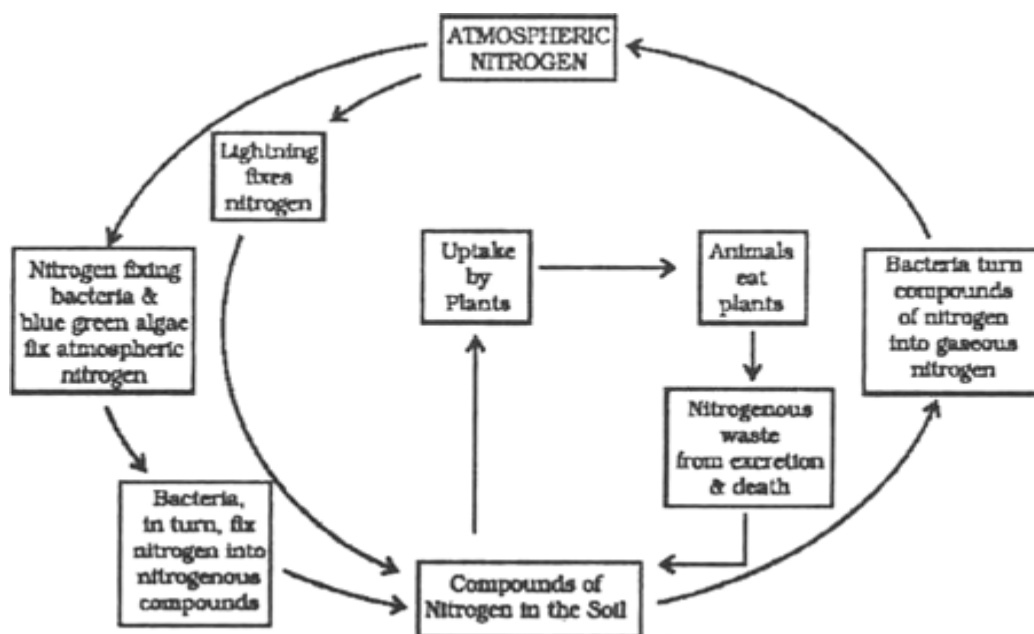


Fig. Nitrogen cycle

Nitrogen cycle is the process of circulation of nitrogen between atmosphere, soil and living organisms. It involves the following processes.

- Atmosphere has approximately 78 % nitrogen gas.
- Certain bacteria like *Rhizobium* and blue green algae fix atmospheric nitrogen into nitrogenous compounds in the soil.
- Plants absorb these nitrogenous compounds by their roots to synthesise its proteins and other compound.
- Animals feeding on plants get these nitrogenous compounds.
- When plants and animals die, bacteria and fungi present in the soil convert the nitrogenous wastes into nitrogenous compounds to be used by plants again.
- Certain other bacteria convert some part of these nitrogenous compounds to nitrogen gas which goes back into the atmosphere.

Scientists

1. Louis Pasteur discovered fermentation in 1857
2. Alexander Fleming discovered antibiotic penicillin in 1929
3. Edward Jenner discovered the vaccine for small pox in 1798.
4. Robert Koch in 1876 discovered the bacterium (*Bacillus anthracis*) which caused anthrax disease.