

Microorganisms and Diseases

Microorganisms

- Organisms that cannot be seen with the unaided eyes are called microorganisms or microbes.
- These microorganisms are as small as 10^{-6} nm in size. Some of these such as fungus on bread can be seen with magnifying glass while others need a microscope for their observation.
- The study of microorganisms is called Microbiology and Anton van Leeuwenhoek is regarded as the **Father of Microbiology**.

Major Groups of Microorganisms

Microorganisms may be unicellular (single-celled) or multicellular (many-celled). These are classified into major groups as described below.

Bacteria

- These are simplest unicellular organisms having rigid cell wall like plant cells.
- Based on their shapes, bacteria are of four types, i.e. bacillus (rod-shaped), coccus (spherical shaped), spirillum (spiral-shaped) and vibrio (comma-shaped), e.g. *Lactobacillus*, *Rhizobium*.

Fungi

- It is a large group of organisms which do not have chlorophyll and do not perform photosynthesis, thus there are heterotrophs, e.g. yeast, *Penicillium*, *Aspergillus* and *Rhizopus* (bread mould).
- Fungi may be unicellular or multicellular.

Protozoa

- It is a group of single-celled microorganisms that have animal-like characteristics.
- They can move from place to place, e.g. *Amoeba* and *Paramecium*.

Algae

- It is a large group of simple, plant-like organisms. But they have no roots, stems or leaves.
- They can be unicellular or multicellular.
- They are photoautotrophs, e.g. *Chlamydomonas* and *Spirogyra*.

Viruses

These are also microscopic organisms which reproduce only inside the cells of the host organisms.

Microbes in Household Product

Some of the household products obtained from microbial activities are

- (i) **Curd** The bacterium, *Lactobacillus* multiplies in milk and converts it into curd.
- (ii) **Dough** (for making foods) Yeast is used in the baking industry for making breads, pastries and cakes. It reproduces rapidly and produces carbon dioxide (CO_2) during respiration.
- (iii) **Cheese** The production of cheese starts by curdling of milk. The quality and characteristics of cheese are determined by activities of specific microorganisms.

Commercial Use of Microorganisms

- Microorganisms are used for the large scale production of alcohols, wine and acetic acid.
- The process of conversion of sugar into alcohol is called **fermentation**. It was discovered by **Louis Pasteur** in 1857.
- Yeast is also used for commercial production of alcohol and wine.
- The sugar for making alcohol comes from grains like barley, wheat, rice, crushed fruit juices, etc.

Medicinal Use of Microorganisms

The sources of antibiotic medicines and vaccines are microorganisms. The details of antibiotic medicines and vaccines are given below

Antibiotics

- The medicines, which are used to kill or stop the growth of the disease causing microorganisms are known as antibiotics, e.g. penicillin, streptomycin, tetracycline, erythromycin.
- These are manufactured by growing specific microorganisms and are used to cure a variety of disease. Antibiotics are even mixed with the feed of livestock and poultry to check microbial

infection in animals. They are also used to control many plant diseases.

- **Penicillin** is the first antibiotic which was discovered by Alexander Fleming in 1929.

Vaccine

- A vaccine consists of dead or weakened microbes which when introduced in a healthy body, produce suitable antibodies to fight and kill themselves.
- These antibodies remain in the body to protect from disease causing microbes, thus develop immunity.

Vaccine	Disease	Age group
DPT-Hib	Diphtheria, Tetanus, Pertussis	To all infants of $1\frac{1}{2}$, $2\frac{1}{2}$ and $3\frac{1}{2}$ months age.
Hepatitis-B	Hepatitis (Serum hepatitis)	All infants, children and even adults.
Polio	Poliomyelitis	All infants up to 5 years of age, minimum of three doses at one month intervals
BCG	Tuberculosis	All children between 10-14 years.

- **Edward Jenner** discovered the smallpox vaccine in 1798. A worldwide campaign against smallpox has finally led to its eradication from most parts of the world.
- Pulse Polio Immunisation Programme was launched in India in 1995 for eradication of polio. Children in the age group of 1 month to 5 years are administered polio drops (actually vaccine) every year.

Disease Causing Microorganisms in Humans

Some of the microorganisms cause diseases in human beings. Such disease causing microorganisms are called **pathogens**.

There are various ways given below through which they can enter our body.

Human disease	Causative microorganism	Mode of transmission	Preventive measure (General)
Tuberculosis	Bacteria	Air	Keep the patient in complete isolation.
Measles	Virus	Air	Keep the personal belonging of the patient away from those of the healthy persons.
Chickenpox	Virus	Air/contact	Vaccination to be given at suitable age.
Polio	Virus	Air/Water	Vaccination
Cholera	Bacteria	Water/Food	Consume properly cooked food and boiled drinking water.
Typhoid	Bacteria	Water	Maintain personal hygiene and good sanitary habits.
Hepatitis-B	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 of the examples animal diseases are given in table below.

Animal disease	Microorganisms	Animal affected
Anthrax	Bacteria (<i>Bacillus anthracis</i>) discovered by Robert Koch (1876)	Cattle
Foot and mouth disease	Virus	Cattle
Swine flue	Virus	Pigs
Bird flue	Virus	Birds

Disease Causing Microorganisms in Plants

Several microorganisms cause diseases in plants like wheat, rice, potato, sugarcane, etc. These diseases reduce the yield of crops. These can be controlled by the use of certain chemicals which kill the microbes. Some of the examples are tabulated below

Plant disease	Microorganism	Mode of transmission
Citrus canker	Bacteria	Rain water splashes
Rust of wheat	Fungi	Air, seeds
Yellow vein mosaic of bhindi (okra)	Virus	Insect, mechanical injury

Food Poisoning

- It occurs due to the consumption of food spoilt by some microorganisms.
- Microorganisms that grow on our food may produce toxic substances. These substance make the food poisonous causing serious illness and even death.
- The food starts giving foul smell, bad taste and colour may also change. This spoiling of food is a chemical change.
- Such a food if eaten, can lead to food poisoning.
- Its symptoms include vomiting, diarrhoea, headache, fever, etc. It is caused by bacteria (like *Salmonella*, *Clostridium*), fungus (like *Aspergillus*) etc.

Practice Exercise

1. Microorganisms are found in
(a) soil (b) air
(c) water (d) All of these
2. Vaccine contains
(a) dead microbes (b) weakened microbes
(c) live microbes (d) Both (a) and (b)
3. Penicillin was discovered by
(a) Pasteur (b) Fleming
(c) Darwin (d) Mendel
4. A disease in human beings caused by virus is
(a) typhoid (b) influenza
(c) dysentery (d) cholera
5. The study of microorganisms is called
(a) Virology (b) Bacteriology
(c) Microbiology (d) Botany
6. The father of Microbiology is
(a) Robert Hooke
(b) Louis Pasteur
(c) Anton van Leeuwenhoek
(d) Khurana
7. Cocci are shaped bacteria.
(a) rod (b) round
(c) spiral (d) comma
8. Typhoid is caused by
(a) bacteria (b) virus
(c) protozoa (d) fungus
9. Which of the following is a viral disease?
(a) Typhoid (b) Polio
(c) TB (d) Leprosy
10. Ringworm is a/an
(a) air borne disease
(b) infectious disease
(c) non-infectious disease
(d) None of the above
11. Foot and mouth disease of cattle is caused by
(a) virus (b) bacteria
(c) protozoan (d) fungi
12. The spoiling of food is a
(a) physical change (b) chemical change
(c) Both (a) and (b)
(d) None of these
13. Food poisoning is caused by
(a) *Salmonella* (b) *Clostridium*
(c) *Aspergillus* (d) All of these
14. Citrus canker is caused by
(a) bacteria (b) fungi
(c) virus (d) protozoan
15. The disease that can be prevented by vaccination is
(a) polio (b) cholera
(c) TB (d) All of these
16. Pasteurisation was discovered by
(a) Louis Pasteur (b) Darwin
(c) Khurana (d) Hooke
17. Pasteurisation is done at
(a) 100°C
(b) 30°C
(c) 70°C
(d) 45°C
18. Oral rehydration solution is the solution of sugar and salt in a particular ratio in the clean water. When person passes out watery stools frequently, the disease is called.....
(a) stomachach
(b) dysentery
(c) diarrhoea
(d) cholera

Answers

1	(d)	2	(d)	3	(b)	4	(b)	5	(c)	6	(c)	7	(b)	8	(a)	9	(b)	10	(b)
11	(a)	12	(b)	13	(d)	14	(a)	15	(d)	16	(a)	17	(c)	18	(c)				