Chapter-2: Micro-organisms – Friends and Foe

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1 Introduction

- **Micro-organisms / Microbes**: very tiny living beings that cannot be seen with naked eyes; need a microscope.
- First observed in 1674 by **Anton van Leeuwenhoek** using a simple microscope.
- They are present **everywhere**: air, water, soil, food, inside plants, animals & humans.

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2 Types of Micro-organisms

2.1 Bacteria

- **Structure**: Single-celled, no true nucleus (prokaryotes).
- **Occurrence**: air, water, soil, inside our intestines, deep oceans, hot springs, polar ice.
- **Shapes**:

Shape	Name	Example
Spherical	Coccus	Streptococcus
Rod	Bacillus	*Lactobacillus* (in curd)
Comma	Vibrio	*Vibrio cholerae*
Spiral	Spirilla	*Spirillum volutans*

Uses: curd making, nitrogen fixation, sewage treatment, medicines.

2.2 Fungi

- Plant-like but **without chlorophyll**, so they cannot make food; feed on decaying matter.
- Grow on bread, fruits, leather, clothes.
- Examples: **Bread mould (Rhizopus)**, Penicillium, Aspergillus, Mushrooms, Yeast.
- Structure of *Rhizopus*:
    - Sporangiophore (stalk)
    - Sporangium (ball containing spores).

2.3 Protozoa

- Unicellular, animal-like, mostly in water or damp soil; some inside other organisms.
- Examples:
    - Amoeba (moves by pseudopodia).
    - Paramecium (uses cilia).
    - Euglena (has chlorophyll).
- Cause diseases: malaria (*Plasmodium*), amoebic dysentery (*Entamoeba*).

2.4 Algae

- Simple, green plant-like microbes → have **chlorophyll**, make their own food.
- Found in ponds, lakes, moist places.
- Examples: Spirogyra, Chlamydomonas, Fucus, Diatoms.
- Supply oxygen in water & act as food for aquatic animals.

2.5 Viruses

- Very tiny (0.15–0.2 micron); live only inside living cells → act like **link between living & non-living**.
- First discovered by **W.M. Stanley (1935)** while studying Tobacco Mosaic Virus (TMV).
- Examples: TMV, Influenza virus, Coronavirus, HIV, Polio virus.

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3 Micro-organisms in Our Life

3.1 As Friends

Field	Role	Examples
Food industry	Convert milk → curd & cheese, fermentation of sugar → alcohol, raise dough in breads/idli	*Lactobacillus*, Yeast
Medicines	Antibiotics: Penicillin (*Penicillium notatum*), Streptomycin, Tetracycline, Erythromycin	
Decomposers	Break down dead plants & animals, recycle nutrients (N, P, C)	Bacteria & fungi
Nitrogen fixation	*Rhizobium* in legume root nodules; blue-green algae (Anabaena)	
Sewage treatment	Bacteria decompose organic matter in sewage treatment plants	

Field	Role	Examples
Retting of fibres	Soften flax/jute stems for making linen & jute	
Tanning of leather	Bacteria soften hides to make leather	
Animal digestion	Bacteria in cow's alimentary canal help digest cellulose	

3.2 As Foe (Harmful)

(a) Diseases in Humans

Microbe	Disease	Transmission
Bacteria	TB, Typhoid, Cholera, Tetanus	Air, water, soil
Viruses	Common cold, Influenza, Polio, Mumps, AIDS, COVID-19, Rabies	Air, bite, contact
Protozoa	Malaria, Amoebic dysentery	Mosquito bite, contaminated water
Fungi	Ringworm, Athlete's foot	Skin contact, damp clothes

(b) Diseases in Animals

Animal	Disease	Microbe
Cattle	Anthrax	Bacteria
Dogs, Monkeys	Rabies	Virus
Poultry	Aspergillosis	Fungi
Cattle	Foot & Mouth disease	Virus

(c) Diseases in Plants

Plant	Disease	Microbe
Tobacco	Mosaic disease	Virus
Citrus	Canker	Bacteria
Wheat/Rice	Smut	Fungus

Plant	Disease	Microbe
Wheat	Rust	Fungus
Sugarcane	Red rot	Fungus

Loss: reduced yield, poor quality, sometimes complete crop failure.

(d) Food Spoilage

- Bread, pickles, cooked food may spoil due to bacteria/fungi → souring, foul smell, discoloration.
- **Food poisoning**: by *Clostridium botulinum*, *Staphylococcus*, *Aspergillus* (toxins).

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4 Food Preservation

Method	Principle	Examples
Drying	Removes water → stops microbial growth	Grains
Salting & sugaring	Draws water out of microbes by osmosis	Pickles, jam, fish
Vinegar (acetic acid)	Acidic medium prevents microbes	Pickles
Heat treatment	Kills microbes (boiling, pasteurization)	Milk (pasteurized)
Refrigeration / Freezing	Low temperature slows growth	Meat, fruits
Vacuum packing	No air → no oxygen for microbes	Nuts, coffee

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5 Prevention of Diseases

- **Vaccination**: inject weakened/killed microbes → body makes antibodies & remembers them.
    - Vaccines: Polio, Tetanus, Rabies, Smallpox, COVID-19.
- **Hygiene**: wash hands, keep surroundings clean, cover food.
- **Clean water & proper sewage disposal**.
- **Mosquito control**: nets, repellents, remove stagnant water.

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6 Key Points to Remember

- Microbes live in all environments.
- Not all are harmful → many are essential for food, soil, medicine.
- Viruses act living only inside hosts.

- Antibiotics cure bacterial diseases, **not** viral ones (cold/flu).
- Pasteurization keeps milk germ-free.
- Handle food safely → prevents poisoning.

🌟 Final Note

Micro-organisms are **indispensable**: they make food, medicines, recycle nutrients, purify water, and help in agriculture — yet some cause serious diseases or spoilage.
→ **Proper use, hygiene & preservation** let us enjoy their benefits and stay safe from harm.