Microorganisms

- **Definition:** Tiny organisms, invisible to the naked eye, that exist everywhere (water, soil, air, inside bodies).
- **Types:** Bacteria, fungi, protozoa, algae.
- **Viruses:** Different from other microorganisms; reproduce only inside a host's cells; cause diseases like the common cold, flu, polio, chickenpox.
- **Diseases:**
    - Protozoa: Dysentery, malaria
    - Bacteria: Typhoid, tuberculosis

Friendly Microorganisms

- **Food production:**
    - Curd formation (Lactobacillus bacteria)
    - Cheese, pickles
    - Bread and cake (Yeast for fermentation)
- **Environmental cleanup:** Decomposition of organic waste.
- **Medicine:** Production of antibiotics and other medicines.
- **Agriculture:** Nitrogen fixation for soil fertility.

Commercial Use

- **Fermentation:** Yeast converts sugar into alcohol, used in the production of alcohol, wine, and acetic acid (vinegar).
- **Large-scale Production:** Microorganisms are used for industrial-level production of these substances.

Medicinal Use of Microorganisms

- **Antibiotics:**
    - Kill or stop the growth of disease-causing microorganisms.
    - Sources: Bacteria and fungi (e.g., penicillin, streptomycin, tetracycline).
    - Uses: Treat bacterial diseases, mixed with animal feed, control plant diseases.
    - Important Note: Use only on doctor's advice; complete the prescribed course; overuse can make them less effective and harm beneficial bacteria. Not effective against viruses (cold and flu).
- **Vaccines:**
    - Provide immunity against diseases.
    - How they work: Dead or weakened microbes trigger antibody production, providing future protection.
    - Preventable diseases: Cholera, tuberculosis, smallpox, hepatitis, polio.
    - Importance: Protect children through vaccination programs (e.g., Pulse Polio).
    - Success story: Smallpox eradication through vaccination campaigns.

Harmful Microorganisms

- **Disease-causing Microorganisms (Pathogens):**
    - Enter the body through air, water, food, or contact.
    - Cause communicable diseases (cholera, cold, chickenpox, tuberculosis).
    - Spread through:
        - Air (e.g., sneezing)
        - Water (contaminated)
        - Food (contaminated)
        - Contact (with infected person)
        - Carriers (insects, animals - housefly, Anopheles mosquito for malaria, Aedes mosquito for dengue)
- **Controlling Disease Spread:**
    - Keep food covered.
    - Maintain personal hygiene.
    - Control mosquito population (using repellents, nets, etc.).

Table 2.1: Some Common Human Diseases caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis	Bacteria	Air	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.
Measles	Virus	Air	
Chicken Pox	Virus	Air/Contact	
Polio	Virus	Air/Water	
Cholera	Bacteria	Water/Food	Maintain personal hygiene and good sanitary habits. Consume properly cooked food and boiled drinking water. Vaccination.
Typhoid	Bacteria	Water	
Hepatitis A	Virus	Water	Drink boiled drinking 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.

Food Preservation

- **Need for Preservation:**
    - Prevents spoilage by microorganisms.

- Spoiled food has bad smell, taste, and changed color.
- Microorganisms can cause food poisoning.

- **Methods of Preservation:**
  - **Chemical Methods:**
    - Salts and edible oils act as preservatives.
    - Sodium benzoate and sodium metabisulphite are used in jams and squashes.
  - **Preservation by Common Salt:**
    - Used to preserve meat, fish, amla, raw mangoes, tamarind.
  - **Preservation by Sugar:**
    - Jams, jellies, and squashes are preserved by sugar.
    - Sugar reduces moisture content, inhibiting bacterial growth.
  - **Preservation by Oil and Vinegar:**
    - Prevents spoilage of pickles.
    - Creates an environment where bacteria cannot survive.
  - **Heat and Cold Treatments:**
    - Boiling kills many microorganisms.
    - Refrigeration inhibits microbial growth.
    - Pasteurization: Milk is heated to 70°C for 15-30 seconds and then chilled to kill microbes.
  - **Storage and Packing:**
    - Dry fruits and vegetables are sold in sealed airtight packets.

Nitrogen Fixation

- **Rhizobium Bacteria:**
  - Lives in root nodules of leguminous plants (beans, peas).
  - Fixes atmospheric nitrogen, increasing soil fertility.
- **Nitrogen Cycle:**
  - Nitrogen in the atmosphere remains constant.
  - Nitrogen fixation is balanced by denitrification (conversion of nitrates back to nitrogen gas).

Nitrogen Cycle

- **Importance of Nitrogen:**
  - Makes up 78% of the atmosphere.
  - Essential for all living organisms (proteins, chlorophyll, nucleic acids, vitamins).
- **Nitrogen Fixation:**
  - Atmospheric nitrogen is unusable by plants and animals.

- Bacteria and blue-green algae convert it into usable compounds.

- **Nitrogen in the Food Chain:**
  - Plants absorb nitrogen compounds from the soil.
  - Animals obtain nitrogen by consuming plants.
- **Decomposition and Denitrification:**
  - Bacteria and fungi decompose dead organisms, converting nitrogenous waste into usable compounds for plants.
  - Some bacteria convert nitrogen compounds back into nitrogen gas, returning it to the atmosphere.
- **Balance:**
  - The nitrogen cycle maintains a relatively constant level of nitrogen in the atmosphere.