

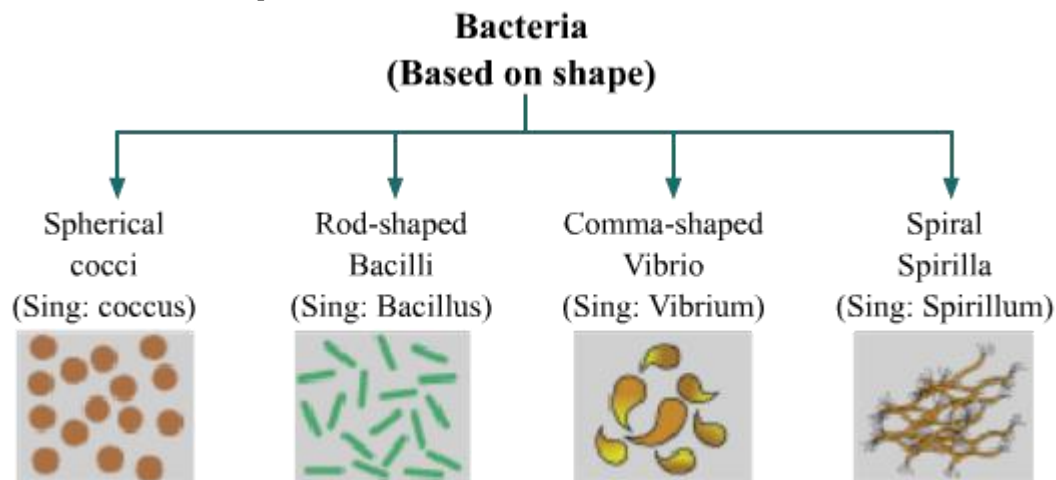
# Microorganisms : Friend and Foe

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- **Microorganism**

- The living organisms that cannot be seen with unaided eye are called microorganisms.
  - The study of microorganisms is called microbiology.
  - They are cosmopolitan in distribution and found everywhere around us.
  - All the tiny organisms around us like in air and soil do not fall into the category of microbes.
  - Antony Van Leewenhoek observed bacteria for the first time using his self built microscope.
- Microorganisms are classified into four major groups- bacteria, fungi, protozoa and some algae.

**Shapes of bacteria:** Bacteria are of different shapes. They can be classified in four groups based on their shape.



## Important Scientists

- Robert Koch ((1843-1910)
  - Robert Koch developed the germ theory of disease that established the microbial cause of disease.
  - He identified anthrax disease.
  - He developed agar growth medium.
- Louis Pasteur (1822-1895)
  - He disapproved the theory of spontaneous generation of life. He proved this by his famous experiment known as swan neck flask experiment.
  - He developed the method of pasteurization.

- He also contributed to the development of vaccines.
- **Classification of microorganisms**
  - There are five major groups of microorganisms.
- **Bacteria**
  - Single-celled organisms
  - Found in wide range of habitats ranging from glaciers to deserts and hot springs
  - For example – curd bacteria (*Lactobacillus*)
- **Fungi**
  - Multicellular, heterotrophic organisms
  - Lack chlorophyll and are generally found in colonies
  - For example – *Penicillium*, *Aspergillus*
- **Protozoa**
  - Unicellular or multicellular microorganisms
  - Usually found in water
  - For example – *Amoeba* and *Paramecium*
- **Algae**
  - Unicellular or multicellular autotrophic organisms
  - Contain chlorophyll pigment and carry out photosynthesis
  - For example – *Chlamydomonas* and *Spirogyra*
- **Viruses**
  - Ultramicroscopic organisms
  - Require host cells to reproduce and complete their life cycle.
  - For example – Influenza virus, polio virus
- **Favourable conditions for growth of microbes**
  - Temperature plays an important role in the growth of microorganisms.
  - Neutral pH is best suited for bacterial growth.
  - Microorganisms also require water as they absorb all the essential nutrients from their surrounding water.
  - Gases like carbon, hydrogen and oxygen are also needed for their development.
- **Importance of microorganisms**
- **In food industry**
  - *Lactobacillus* bacteria promote the conversion of milk into curd.
  - Yeast is used in preparation of breads, pastries and cakes.
- **In beverage industry**
  - Yeast is used for commercial production of alcohol, wine and vinegar (acetic acid).

- Yeast acts on sugar and converts it into alcohol by the process of fermentation. Louis Pasteur discovered fermentation.
- **In medicine production**
  - Medicines produced by certain microorganisms to kill or stop the growth of other disease-causing microorganisms are called **antibiotics**.
  - Antibiotics are obtained from bacteria and fungi.
  - They are classified as narrow-spectrum and broad-spectrum antibiotics.
  - Commonly used antibiotics are streptomycin, tetracycline, and erythromycin.
  - First antibiotic penicillin was prepared by Alexander Fleming
- **In vaccine production**
  - Protection of the body from the attack of various disease-causing microorganisms through vaccines is known as **vaccination**.
  - Vaccine includes dead or weakened microbes that trigger the production of antibodies in the body.
  - These antibodies help in preventing the attack from disease-causing microorganisms.
  - Vaccination helps in controlling diseases such as cholera, polio, small pox, hepatitis etc.
  - Vaccine for small pox was discovered by Edward Jenner.
- **Serum**
  - Serum is a pale yellow coloured blood component which lacks any blood cell as well as clotting factors.
  - Due to presence of antitoxins/antibodies in serum, it can be used as a preventive measure against bacterial invasions.
  - Few serum compounds have been produced by genetically modified bacteria as well, for example, blood clotting factor VIII (for treatment of Haemophilia A), Factor IX (for treatment of Haemophilia B).
- **In increasing soil fertility**
  - Blue green algae and *Rhizobium* bacteria are called biological nitrogen fixers.
  - They fix free atmospheric nitrogen to enhance soil fertility.
- **In cleaning the environment**
  - Microorganisms (decomposers) help in converting dead waste of plants and animals into simpler substances by the process of **decomposition**.
- **Nitrogen cycle:** It involves circulation of nitrogen through living and non-living components of nature.
  - Nitrogen gas comprises 78% of the atmosphere.
  - First process of nitrogen cycle is **fixation of nitrogen** gas into nitrogenous compounds caused by bacterium *Rhizobium* and lightning.

- Nitrogen compounds in soil are taken up by the plants through roots and used up in synthesis of plant proteins. Animals obtain nitrogen by feeding on plants.
- Waste of plants and animals are converted to nitrogenous compounds by the action of bacteria and fungi in the soil.
- Some bacteria convert nitrogenous compounds back to nitrogen to maintain atmospheric levels of nitrogen.
- **Harmful microorganisms** – Disease-causing microorganisms are called **pathogens**.
- **Diseases in humans caused by microorganisms**
  - Diseases caused by microorganisms that spread from an infected person to a healthy person through air, water, or food are called **communicable diseases**.
  - The example includes cholera, chicken pox, and tuberculosis.
  - The organisms that transmit diseases from one place to the other are called **carriers**.  
Example of carriers:
    - Housefly spreads diseases such as cholera, dysentery, and typhoid.
    - Female *Anopheles* mosquito spreads malarial parasites.
    - Female *Aedes* mosquito spreads dengue virus.
- **Examples of human diseases caused by bacteria**
  - Tuberculosis
  - Cholera
  - Typhoid
- **Examples of human diseases caused by virus**
  - Measles
  - Chicken pox
  - Polio
  - Hepatitis-B
- **Examples of human diseases caused by protozoa**
  - Malaria
  - Sleeping Sickness
- **Diseases in animals caused by microorganisms**
  - Anthrax is caused by bacteria
  - Foot and mouth disease in cattle is caused by virus

- **Diseases in plants caused by microorganisms**

- Citrus canker disease is caused by bacteria
- Rust of wheat is caused by fungi
- Yellow vein mosaic of *Bhindi* (Okra) is caused by virus

### **Food Preservation**

- Microorganisms act on food items and spoil them.
- Process of preventing the spoilage of food items by the action of microbes is called food preservation.

### **Food Spoilage**

- Mishandling of foods led to the deterioration of food quality.
- Growth of microorganisms due to the undesirable changes in the environment.

### **Methods of food preservation**

- **Chemical methods**

- The chemicals that controls the growth of microorganisms on food are called preservatives. For example, sodium benzoate, sodium metabisulphite, salts and edible oil.
- Common salt is used as preservative in pickles, to preserve meat and fish.

- **Heat and cold treatments**

- Boiling the milk helps in killing microorganisms present in it.
- Pasteurization is a technique of preserving milk in which it is boiled to about 70°C for 15 to 30 seconds and then suddenly chilled and stored.
- Storage and packing: Dry fruits and vegetables are stored in sealed air tight packets to prevent microbial attack.

- **Methods of food preservation**

- Common salt is used as preservative in pickles. It is also used to preserve meat and fish.
- Sugar is used as preservative in jams and jellies.
- Oil and vinegar are used as preservatives in pickles and vegetables.

- **Heat and cold treatments**

1. Boiling the milk helps in killing microorganisms that are present in food.
2. Pasteurization is a technique of preserving milk in which it is boiled to about 70°C for 15 to 30 seconds and then suddenly chilled and stored.

- **Storage and packing**

Dry fruits and vegetables are sealed in air tight packets to prevent microbe attack.