

## GENERAL SCIENCE

### BIOLOGY

#### **MICROORGANISMS:**

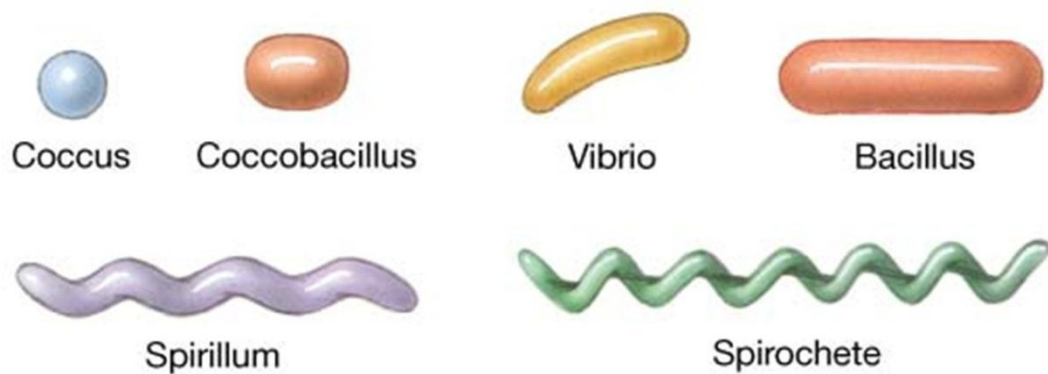
- Microorganisms are those organisms that cannot be seen with the naked eye and require the help of a microscope to see them. This is because the human eye cannot detect any substance smaller than a certain size.
- These are single-celled organisms, or uni-cellular organisms which may either live singly, or live in colonies. They may be either prokaryotic or eukaryotic
- Microorganisms are ubiquitous organisms, they are present everywhere, in the soil, air, water and on most of the surfaces.
- The presence of microorganisms was first postulated by Sushruta in 600 B. C, where he termed that 'kitanu' are responsible for some of the diseases observed in humans.
- However, microorganisms are both harmful, since they cause many diseases, and useful, since they have applications in different industries. They play an important role in supporting and maintaining nature and life.

	<b>Prokaryotes</b>	<b>Eukaryotes</b>
<b>Nucleus (karyon)</b>	Primitive nucleus, not enclosed by a nuclear membrane.	True nucleus surrounded by a nuclear membrane and enclosing the genetic material
<b>Genetic material</b>	Dispersed in the cytoplasm in an area known as <b>nucleoid</b> , which doesn't have definite membrane	Present inside the nucleus
<b>Membrane bound organelles such as mitochondria, chloroplasts ect</b>	Absent	Present
<b>Ribosomes</b>	70s	80s
<b>Number of cells</b>	Unicellular	Unicellular or multicellular

- Based upon various parameters, microorganisms are divided into five different types:
  - Bacteria
  - Algae
  - Protozoa
  - Fungi
  - Viruses.

## Bacteria:

- Bacteria are **prokaryotic organisms** that are included under the kingdom Monera and show diverse nutritional habits. While some are capable of synthesizing their own food (autotrophs), others depend upon other organisms for their nutrition (heterotrophs).
- These may exist either singly, or in colonies. Locomotion is either by simple flagella, or gliding, or they may be non-motile
- They are of various shapes:
  - Spherical – coccus
  - Rod shaped – bacillus
  - Comma shaped – vibrio
  - Curved forms – spirochete/spirillum.



- Based upon the arrangements of their cells, bacteria may also be classified as:
  - Diplococcus
  - Strepto (arranged in a chain)
  - Staphylo (arranged in a grape cluster)
  - Tetrads (arranged in fours)
  - Sarcinae (arranged to form cubes)

## Useful bacteria:

- Populations of bacteria are **present on human skin and in the digestive tract** where they help in **breakdown of certain substances** that humans can otherwise not digest.
- ***Escherichia coli*** (E.Coli) is found living in the large intestine and helps in the **synthesis of vitamin B12**, which cannot otherwise be synthesized by humans.
- Bacteria found living in the gut of cattle, horses and other herbivores secrete cellulase, an enzyme that helps in the digestion of the cellulose contents of plant cell walls.
- Bacteria play an important role as **detritivores** where they **decompose dead and decaying organic matter** thus helping release various nutrients such as nitrogen, phosphorous etc to the soil.
- Several **soil bacteria help in nitrogen fixation**, where they convert atmospheric nitrogen into a form usable by the plants, thus enriching the soil fertility. These are referred to as

biofertilizers. Eg. **Rhizobium** which lives on the **root nodules of leguminous plants** such as groundnut.

- Lactic acid bacteria, **Lacto bacillus**, is responsible for the **curdling of milk**, and has been used for thousands of years in the production of cheese, bread, pickles.
- **Acetobacter acetii** is used in the **production of acetic acid (vinegar)**.
- Some bacteria are also used in the **production of antibiotics**.
- Bacteria are used as **vectors** or molecular carriers in **genetic engineering**.
- They are used in **fibre retting**, a process of separating fibres of jute, hemp, flax, etc. The separated fibres are used to make rope, sacks etc.
- Bacteria were also used in **bioremediation**, a treatment where naturally occurring organisms are used to breakdown hazardous substances into less toxic or non-toxic forms.

#### **Harmful bacteria:**

- Some bacteria also denitrify the soil by converting soil nitrates to atmospheric nitrogen.
- Bacteria such as staphylococcus & clostridium are responsible for the spoiling of food and may also lead to food poisoning.
- Bacteria are responsible for many plant diseases such as bacterial blight disease, citrus canker, crown gall etc.
- They are responsible for various diseases in humans such as typhoid, leprosy, tuberculosis, pneumonia, diphtheria, tetanus, cholera, syphilis etc.

#### **VIRUSES:**

- Viruses are **small infectious agents** that infect all types of life forms, and **can replicate only inside a host cell**. **Outside** a host cell, they **exist as a protein coat and are metabolically inert**.
- Viruses are **acellular** (not made of cells) and merely **contain the genetic material** (either DNA or RNA, never both) **surrounded by a protein coat** (called as capsid).
- Viruses are often regarded as the **connecting link between living and non-living organisms** as they are acellular, crystallize outside a host cell and have absolute dependence on the host for reproduction. They are **obligate parasites** and are incapable of multiplying themselves without a host.
- During an infection, the virus injects its genetic material into the target cell. This genetic material takes control of the target cell and directs it to synthesize those proteins that are subsequently assembled into virus particles that fill the host cell. Ultimately the cells bursts open releasing these virus particles which go on to infect other target cells.