Ratna Sagar

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Revised and Updated

LIVING SCIENCE BIOLOGY

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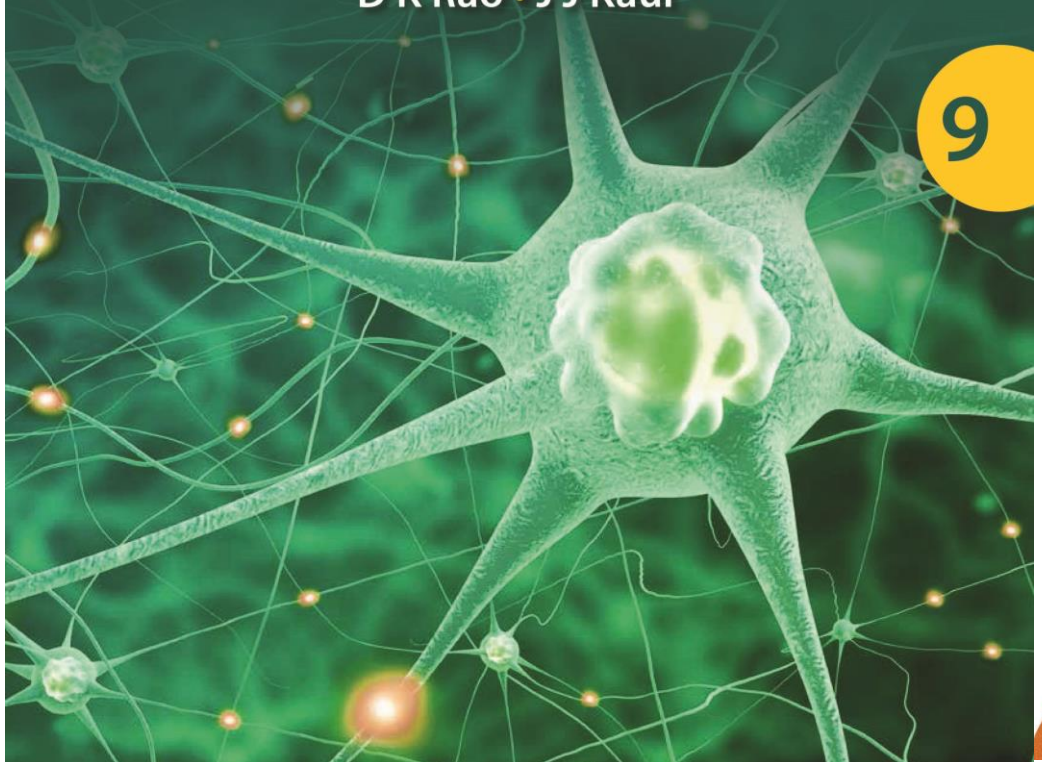


ICSE
Living Science
Biology

Class 9

Chapter 8 Bacteria and Fungi – Their Economic Importance

LEARNING OBJECTIVES

Bacteria

- ❖ Economic importance of bacteria
- ❖ Harmful effects of bacteria

Fungi

- ❖ Characteristics of fungi

Moulds

- ❖ Economic importance of fungi
- ❖ Harmful fungi

What are bacteria?

Bacteria are the simplest, most primitive and unicellular organisms without a true nucleus (prokaryotes). They are placed under kingdom Monera. They are found everywhere in air, water, soil, food, inside our body, etc. They lack true nucleus and other cell organelles of complex cells. Like plants, they possess a cell wall. Each bacterial cell has its nuclear material in the form of a **nucleoid**, which consists of circular, double stranded DNA.

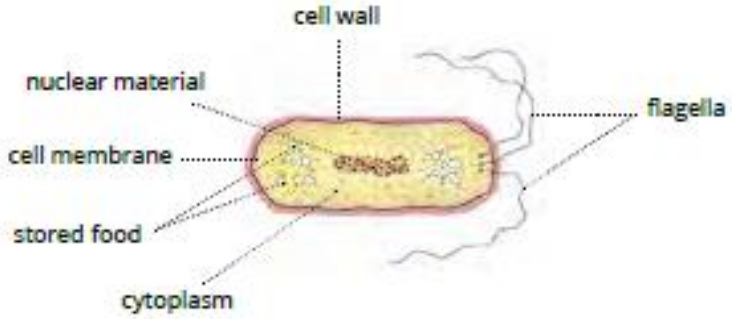
Bacteria: Size, Shape and Structure

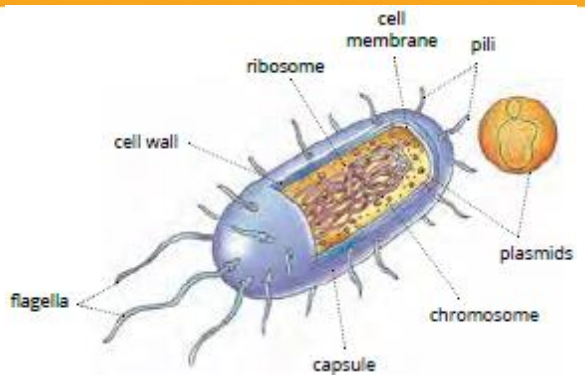
Bacteria are the smallest living organisms on earth. Their size varies between 0.5 to 5.0 micrometres. Because of such a minute size, they are not visible without a microscope.

According to the shape, bacteria are of four types:

- **Coccus** or **spherical-shaped bacteria**: These may be present in clusters like a bunch of grapes.
- **Bacillus** or **rod-shaped bacteria**: These may be present as single rod.
- **Spirillum** (plural: spirilla) or **spiral / curvedshaped bacteria**: These bacteria may have one or more flagella at the ends of their bodies.
- **Vibrio** or **comma-shaped bacteria**: The body is curved with only one flagellum as in *Vibrio cholera.*

Each bacteria is a simple cell. It contains a **protoplast** (living substance) surrounded by a non-living **cell wall**. The cell wall of a bacterial cell is made of peptidoglycan (and not cellulose). Beneath the cell wall is a thin **cell membrane** which surrounds the cytoplasm.





The **chromatin material** is in the form of a **single molecule of circular DNA** attached to the cell membrane and is not enclosed in a **nuclear membrane**. Golgi complex and plastids are absent. Smaller rings of DNA, known as **plasmids** and **ribosome granules**, are also present in the cytoplasm. **Ribosomes help in protein synthesis.**

Movement, Nutrition and Respiration in Bacteria

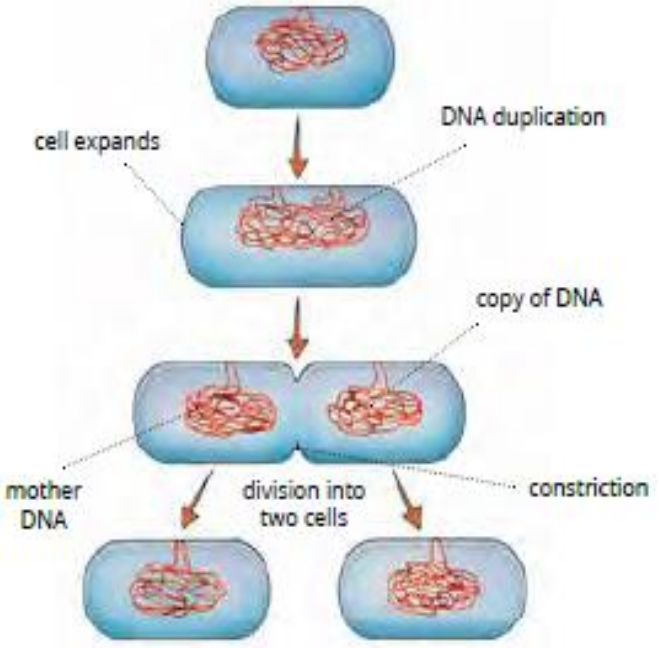
Most bacteria are **immotile**, i.e. cannot move on their own. However, some bacteria such as bacilli and spirilla can move on their own with the help of **whip-like flagellum** (plural: flagella). Bacterium like *Salmonella* has flagella all over the body to move about in water.

Most bacteria do not have chlorophyll. They have heterotrophic mode of nutrition. Some bacteria draw nutrition from dead, decaying organic matter and hence are **saprophytic**. Some bacteria draw nutrition from the body of other organisms and are **parasitic**.

Respiration in bacteria can be **aerobic** by absorbing oxygen present in the atmosphere or **anaerobic**, i.e. in the absence of atmospheric oxygen.

Reproduction in Bacteria

Most bacteria reproduce asexually, however a few reproduce sexually also. Asexual reproduction in bacteria is by **binary fission** which takes place in favourable conditions or by endospore formation. During fission, bacteria divide into two. Cell division is preceded by duplication of the DNA. The bacterium grows and its nucleus enlarges due to DNA duplication. The two DNA are pulled apart to two sides. Then there is a constriction in the cell wall to divide cytoplasm. This wall grows separating a single bacterium into two daughter cells.



Economic importance of bacteria

Bacteria have both useful as well as harmful role.

Useful role of bacteria in agriculture

In agriculture, bacteria are helpful in nitrification and nitrogen fixation. Plants get nitrogen from soil for synthesizing proteins.

They absorb it in the form of nitrates. **The process of conversion of ammonia into nitrites and nitrates is called nitrification.** Nitrification is brought about by nitrifying bacteria in the soil.

The process of conversion of free atmospheric nitrogen into nitrogen compounds is called **nitrogen fixation**. Free-living nitrogen fixing bacteria like *Azotobacter*, *Clostridium*, which live in the root nodules of leguminous plants (*Rhizobium*) can fix free atmospheric nitrogen into nitrates. The degradation of nitrate and nitrite salts to elemental nitrogen is called denitrification. It is carried out in the soil by free-living bacteria called *Pseudomonas*.

In industry, bacteria are used in curdling of milk, retting of fibres, jute and hemp, tanning of leather, production of vinegar, cheese making, processing of coffee, tobacco, etc. Many bacteria are used for production of vitamins, medicines, serum, antibiotics and vaccines.

Harmful effects of bacteria

1. Bacteria cause many harmful diseases in plants, animals and humans: Some common diseases caused by bacteria in humans are **diphtheria, typhoid, tuberculosis, leprosy, cholera, tetanus, dysentery, gonorrhoea, botulism,** etc.

In **animals,** bacteria cause **anthrax** and **tuberculosis**.Some diseases caused by bacteria in **plants** include **leaf spot disease** in cotton, bacterial **wilt of potato**, and **gall formation** in plants .

2. Spoilage of food by bacteria. They spoil milk, meat, vegetables and other food items. Some bacteria release toxins into spoiled food and cause food poisoning.

Fungi

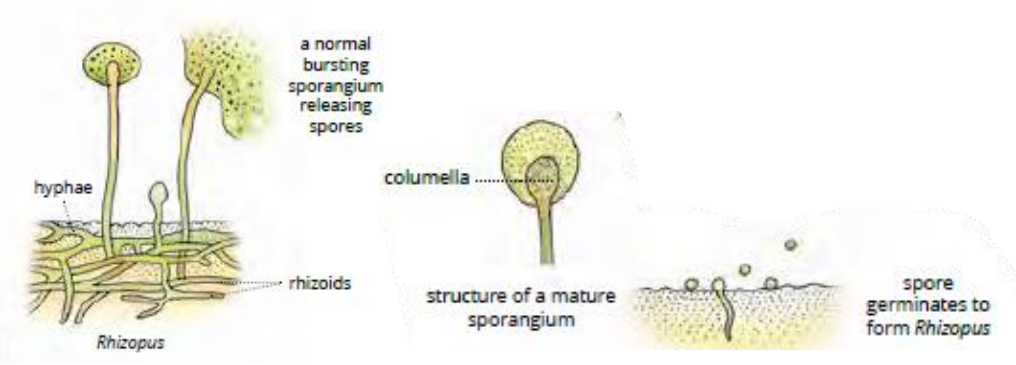
The fungi are non-green, heterotrophic multicellular organisms belonging to the kingdom Fungi. They do not have chlorophyll. They grow in dark and moist places and the substratum containing dead organic matter. Mushrooms, moulds and yeast are common examples of fungi.

Characteristics of fungi

- ❖ Fungi are eukaryotic organisms with nuclei and mitochondria.
- ❖ They have a definite cell wall made-up of chitin.
- ❖ They do not contain chlorophyll, hence they are heterotrophic.
- ❖ They are non-motile (i.e. cannot move freely).
- ❖ They reproduce mostly by spore formation. However, sexual reproduction may also take place

Moulds

Mucor and *Rhizopus* are the two common bread moulds which grow on breads and other organic matter such as fruits, vegetables, warm and humid places.



Structure, Nutrition and Respiration in Moulds

The bodies of both *Mucor* and *Rhizopus* consist of tiny filaments called **hyphae**. Hyphae are tiny filaments containing cytoplasm and nuclei. Their cell walls contain chitin.

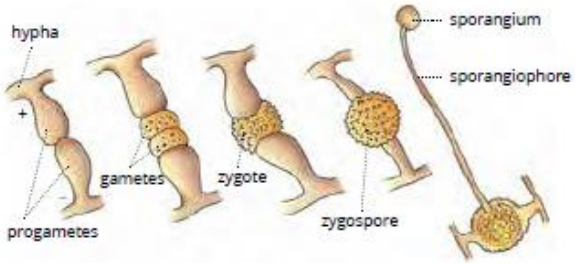
Bread moulds are heterotrophs, obtaining their **nutrition** from the substratum on which they grow. The hyphae secrete certain enzymes on the food that breakdown organic material (proteins, lipids and polysaccharides). This food is digested outside their bodies (extracellular digestion). Moulds then absorb this digested food through the cell walls of hyphae (specially tip region).

In moulds, **respiration** is brought about in the presence of oxygen, i.e. aerobic respiration.

Reproduction in Moulds

Reproduction is both asexual and sexual in both *Mucor* and *Rhizopus*.

Asexual reproduction takes place by formation of non-motile **spores** while sexual reproduction takes place by **conjugation** of similar gametes (**isogametes**)



Economic importance of fungi

Like bacteria, fungi are also very useful. They are used in industry, agriculture, and medicines.

Fungi are principal decomposers that reduce polysaccharides and proteins in dead bodies of plants and animals into simple organic compounds. Thus, they help in enriching the soil and in the biochemical cycling of materials.

1. Yeast, such as *Saccharomyces* is an important nutritional supplement because it contains vitamins, minerals and other nutrients.

2. Mushrooms are an important food.

Mushrooms are cultivated on a commercial scale for their nutritive value as they are rich in vitamins and proteins. *Agaricus*, pennybun, etc., are edible mushrooms.

However, there are certain field mushrooms such as fly agaric and death cap which are deadly poisonous and should not be eaten.

a. Fly agaric

b. Death cap

3. In wine industry (breweries), sugar is **fermented** by yeast to produce ethyl alcohol and carbon dioxide. The carbon dioxide is given off as a by-product which is solidified in the form of dry ice. The wine is prepared from grapes while beer is prepared from barley. The yeast *Saccharomyces cerevisiae* is used for fermentation process.

4. In the process of cheese production: *Penicillium* and *Aspergillus* are used for flavouring cheese.

5. In bread-making industry, yeast is added to produce sponginess in the bread.

6. Fungi are used to produce chemical compounds that are important to the food processing industry such as citric acid and gluconic acid. Citric acid is used in soft drinks and candies.

7. Some moulds are used as antibiotics to check the effects of disease-producing bacteria. For example, **Penicillin** is used to cure pneumonia, which is produced from moulds. Many enzymes such as pectinase, amylase and oxidases are synthesized by fungi, *Penicillium* and *Aspergillus*

a. Penicillium

b. Aspergillus

Harmful fungi

1. Fungi can attack tissues of plants and animals and cause diseases. Mould spores can cause **allergies** in some people leading to sneezing, sniffing and respiratory problems.

2. Fungi can infect and **poison** humans. For example, diseases like **Athlete's foot**, **ringworm**, vaginal yeast infection are caused by fungi.

3. Many fungi attack food grains and food products and spoil them. **Late blight in potatoes, rust in wheat, smut in corn** and **downy mildew in grapes** are some important fungal diseases of plants.

SUMMARY...

- Bacteria are single-celled and primitive organisms (prokaryotes) while fungi are multicellular organisms and much evolved.
- Bacteria help in nitrification, nitrogen fixation, decay and putrefaction, production of vitamins and certain medicines.
- Some bacteria spoil food, and cause harmful diseases in plants, animals and humans.
- Fungi are non-green plant-like multicellular organisms. Mushrooms, moulds and yeast are common fungi.
- Fungi are harmful as well as useful as they are used in industry, food and medicines.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