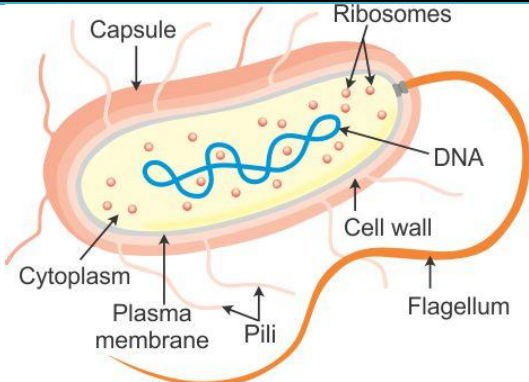


# Economic Importance of Bacteria and Fungi

- **Bacteria** are the most primitive unicellular prokaryotic organisms which do not have a well-defined nucleus and are not enclosed within a nuclear membrane.

CHARACTERISTICS	DESCRIPTION												
Discovery	Anton von Leeuwenhoek, a Dutch scientist, first observed bacteria in 1675. He named them animalcules.												
Occurrence	Ubiquitous in nature, commonly found in air, soil, water, deserts, plants, animals and in man.												
Size	Ranges from 0.2 to 1.5 $\mu\text{m}$ in diameter and 3 to 5 $\mu\text{m}$ in length.												
Shape	<table border="1" style="width: 100%; text-align: center;"> <tr> <td colspan="4">Coccus: Spherical</td> </tr> <tr> <td>Micrococcus: Solitary cell of coccus.</td> <td>Diplococcus: Occur in pairs.</td> <td>Streptococcus: Occur in chains</td> <td>Staphylococcus: Occur in clusters.</td> </tr> <tr> <td colspan="2">Bacilli: Rod-shaped</td> <td>Spirilla: Spiral or twisted</td> <td>Vibrio: Comma-shaped</td> </tr> </table>	Coccus: Spherical				Micrococcus: Solitary cell of coccus.	Diplococcus: Occur in pairs.	Streptococcus: Occur in chains	Staphylococcus: Occur in clusters.	Bacilli: Rod-shaped		Spirilla: Spiral or twisted	Vibrio: Comma-shaped
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Structure	 <p style="text-align: center;"><b>Structure of bacteria</b></p>												
Movement	<ul style="list-style-type: none"> <li>• Possess whip-like flagella, which pierce through the cell wall and capsule.</li> </ul>												
Nutrition	<ul style="list-style-type: none"> <li>• Photoautotrophs: Contain chlorophyll and use light energy for the synthesis of food.</li> <li>• Chemoautotrophs: Obtain energy by oxidising inorganic compounds.</li> <li>• Saprophytes: Grow on dead and decaying organic matter.</li> <li>• Parasites: Obtain their food from a living host on which they grow.</li> </ul>												
Respiration	<ul style="list-style-type: none"> <li>• Aerobic respiration: Absorb atmospheric oxygen.</li> <li>• Anaerobic respiration: Do not require free oxygen.</li> </ul>												
Reproduction	<ul style="list-style-type: none"> <li>• Asexual reproduction: Binary fission/cell division</li> <li>• Sexual reproduction: Conjugation</li> </ul>												

Spore formation	<ul style="list-style-type: none"> <li>Under adverse conditions, several bacteria survive by the formation of spores.</li> </ul>
Examples	<i>Penicillium notatum</i> , <i>Streptomyces griseus</i> , <i>Penicillium chrysogenum</i> etc.

## Useful Role of Bacteria

### 1. Production of antibiotics

- The chemical substances produced by a living organism that kill or stop the growth of disease-causing microorganisms such as fungi and bacteria are called **antibiotics**.
- Antibiotics are used to cure several life-threatening infections in humans, plants and animals.

#### • Some Important Antibiotics

ANTIBIOTIC	SOURCE ORGANISM	DISEASE TREATED
Streptomycin	<i>Streptomyces griseus</i>	Tuberculosis
Chloromycetin	<i>Streptomyces venezuelae</i>	Fever, skin rash, typhoid, meningitis
Chlorotetracycline	<i>Streptomyces aureofaciens</i>	Typhoid
Bacitracin	<i>Bacillus subtilis</i>	Localised eye and skin infections, wound infections
Erythromycin	<i>Streptomyces erythraeus</i>	Rickettsial fever
Penicillin	<i>Penicillium chrysogenum</i>	Tetanus, diphtheria

### 2. Production of serums

- Serum** is blood plasma from which fibrinogen has been removed.
- It is used as a means of prevention against bacterial invasion.

### 3. Production of vaccines

- A **vaccine** is any germ or germ substance introduced into the body to develop resistance to a particular disease.
- Vaccines confer immunity against specific diseases. They act as antigens and stimulate the body to produce antibodies.

#### Some Important Vaccines

VACCINE	DISEASE TREATED
TAB vaccine (killed bacteria)	Typhoid
BCG vaccine (living, weakened bacteria)	Tuberculosis
Triple vaccine	Diphtheria, whooping cough, tetanus
Polio vaccine	Poliomyelitis virus

#### 4. Production of Toxoids

- **Toxoids** are the inactivated toxins of particular bacteria which can stimulate the production of respective antibodies.
- Toxoids are mostly useful in providing immunity against diphtheria and tetanus.

#### 5. Nitrogen fixation

- The process of circulation of nitrogen between the atmosphere, soil, plants and animals is called the **nitrogen cycle**.
- The process of conversion of free nitrogen from the atmosphere into soluble nitrates by microorganisms is known as **biological nitrogen fixation**.
- The microbes which carry out biological nitrogen fixation are commonly called **biological nitrogen fixers**. Examples: *Rhizobium* and *Azotobacter*.

#### 6. Biogas production

- **Gobar gas, biogas** or **methane** production is carried out with the help of bacteria using animal faeces. Examples: Cowdung and urine.
- Biogas is used as a fuel and for street lighting.

## Harmful Role of Bacteria

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### 1. Spoilage of food

- Bacteria carry out the process of decay or fermentation, resulting in the spoilage of food materials, such as milk, fruits, vegetables etc., especially during summer. This spoilage can be so severe that it can also lead to **food poisoning**.

### 2. Diseases in Living Beings

#### Plant Diseases

DISEASE	PLANT AFFECTED	CAUSATIVE BACTERIAL AGENT
Angular leaf spot	Cotton	<i>Xanthomonas malvacearum</i>
Blight canker	Paddy	<i>Xanthomonas oryzae</i>

#### Animal Diseases

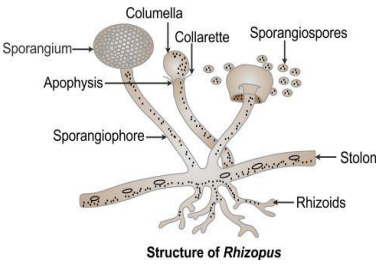
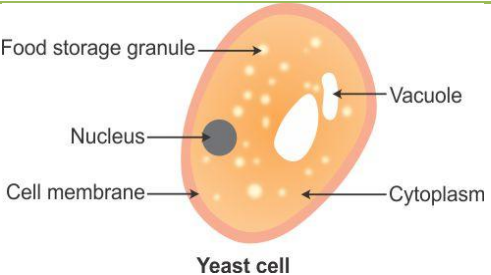
DISEASE	ANIMAL AFFECTED	CAUSATIVE BACTERIAL AGENT
Anthrax	Cattle, sheep, elephant	<i>Bacillus anthracis</i>
Diphtheria	Guinea pigs, kittens, rabbits	<i>Corynebacterium diphtheriae</i>

#### Human Diseases

DISEASE	CAUSATIVE BACTERIAL AGENT
Bronchitis	<i>Staphylococcus sp.</i> , <i>Haemophilus influenzae</i>
Cholera	<i>Vibrio cholerae</i>

### 3. Bioweapons

- When pathogenic microorganisms such as bacteria, viruses, fungi or biological toxins are used deliberately as means to kill or disable plants, animals and humans, they are known as **bioweapons**. Examples: *Bacillus anthracis*, *Clostridium botulinum*, *Clostridium perfringens* etc.
- Fungi** are eukaryotic and have a true nucleus enclosed within the nuclear envelope.

CHARACTERISTICS	MOULD	YEAST
Occurrence	Commonly found on paper, wood, cloth, animal dung etc.	Grow profusely in sugar-rich organic substances such as palm juice, sugarcane juice etc.
Size	Ranges from 2-10 $\mu\text{m}$ to about a few cm.	Vary in size from 5 to 10 $\mu\text{m}$ .
Shape	Match stick-shaped.	Usually oval or spherical in shape.
Structure	 <p>Structure of <i>Rhizopus</i></p>	 <p>Yeast cell</p>
Nutrition	The hyphae derive their nourishment from the bread piece by the secretion of various enzymes which digest the complex materials into simple molecules through the process of extracellular digestion.	Has a saprophytic mode of nutrition and is dependent on various sugars such as sucrose, fructose, glucose etc.
Respiration	Aerobic respiration: Presence of oxygen Anaerobic respiration: Absence of oxygen	
Reproduction	Asexual reproduction: By means of sporangiophores. Sexual reproduction: By means of conjugation.	Asexual reproduction: By means of budding. Sexual reproduction: By means of conjugation.
Examples	<i>Mucor</i> , <i>Rhizopus</i>	<i>Saccharomyces cerevisiae</i>

# Useful Role of Fungi

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## 1. Preparation of fermented foods and bakery products

- **Yeast** is useful in the preparation of fermented foods such as *idli*, *dosa* and bakery products such as breads and cakes.

## 2. Preparation of alcoholic beverages

- Alcoholic beverages such as beer and wine are prepared using yeast.

## 3. Preparation of organic acids

- Fungi are used in the production of organic acids such as citric acid and gluconic acid.

## 4. Production of enzymes

- Some fungi are commercially very important because they produce several useful enzymes such as proteases, amylases and cellulases.

## 5. Production of antibiotics

- The first antibiotic was produced using fungus *Penicillium notatum* as discovered by **Alexander Fleming**.
- Other fungal antibiotics include cephalosporin, fumagillin etc. which are used to cure wounds, infections of the throat, brain, eyes etc.

## 6. Decomposition and recycling

- Some fungi grow on dead and decaying materials of plants and animals and help in the decomposition and recycling of nutrients to the soil, which in turn are used by plants and animals.

## 7. Production of alcohol

- On a commercial basis, yeast is grown on natural sugars present in grains such as barley, wheat, rice, molasses, corn starch, *toddy* and crushed fruit juices to produce alcohol.
- Several industries use alcohol as a solvent and in the manufacture of some drugs.
- The alcohol can be converted into vinegar with the help of acetic acid bacteria.

## 8. Cheese making

- Cheese is a milk product and is considered as a valuable food.

- **Steps in Cheese Production**

- a. Curdling of milk
- b. Processing of curd
- c. Salting of curd
- d. Ripening or curing of cheese
- e. Packing and distribution of cheese

## 9. Mushroom cultivation

- Mushroom cultivation can be carried out indoors, in a small space. Mushrooms are able to grow on any particular substrate or simply compost of a variety of agricultural wastes.
- They are very rich in vitamins and minerals, which are retained even after cooking, canning and dehydration. They also have sufficient amounts of niacin, pantothenic acid and biotin.

# Harmful Role of Fungi

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## 1. Destruction of goods

- Fungi are responsible for the destruction of textiles, wooden articles and leather goods.

## 2. Spoilage of food

- Fungi such as *Penicillium* and *Aspergillus* cause spoilage of food materials such as fruits, vegetables, meat, bread, dairy products etc.

## 3. Diseases in living beings

### Plant Diseases

DISEASE	PLANT AFFECTED	CAUSATIVE FUNGAL AGENT
Rust	Wheat	Wheat rust
Smut	Barley, wheat, oats, sugarcane, forage grasses	Smut
Ergot	Corn, rye, wheat, bajra, barley	<i>Claviceps purpurea</i>

### Animal Diseases

DISEASE	CAUSATIVE FUNGAL AGENT
Lung necrosis	<i>Aspergillus spp.</i>

### Human Diseases

DISEASE	CAUSATIVE FUNGAL AGENT	SYMPTOMS
Athlete's foot	<i>Trichophyton rubrum</i> , <i>Trichophyton mentagrophytes</i> and <i>Epidermophyton floccosum</i>	Itchy, peeling skin on the feet
Ringworm	<i>Trichophyton</i> and <i>Microsporum</i>	Scalp, nails and feet get affected
Candidiasis	<i>Candida albicans</i>	Superficial infections of skin and mucosal membranes