

**COLLEGE NAME & CODE** : Periyar Arts College, Cuddalore-01 & 105  
**COURSE NAME & CODE** : I B.Sc., Microbiology & U26  
**SEMESTER** : I  
**SUBJECT TITLE & CODE** : **FUNDAMENTALS OF MICROBIOLOGY & CMB11**

#### **UNIT-I**

- Definition & Scope of Microbiology
- History of Microbiology
- The origin of Microbial life
  - Theory of spontaneous generation
- Pasteurs's Tyndall experiments
  - Fermentation studies
- Contributions of
  - Leewenhoek,
  - Lister,
  - Robert Koch,
  - Thomas J.Burrill,
  - Sergei N.
  - Winogradsky,
  - Willen Beijerinck,
  - Emil Christian Hansen,
  - S.A. Wakmann,
  - Alexander flaming,
  - Stanely
  - Dimitri Ivanovsky
- Impact of Microbiology and the future.

## **DEFINITION OF MICROBIOLOGY**

**Microbiology** is the study of microscopic organisms, those being unicellular (single cell), multicellular (cell colony), or acellular (lacking cells). Microbiology encompasses numerous sub-disciplines including bacteriology, virology, mycology and parasitology.

## **SCOPE, IMPACT & FUTURE OF MICROBIOLOGY**

Microbes are living organisms that are so tiny and invisible to the naked eye. This branch deals with group of particular life and it comes under the broad domain of biology which includes the study of all aspects of living beings.

They play a major role in both harmful and beneficial way. It is also used as food.

### **Microorganisms used as Food:**

The biomass of an organism is converted into food and food material for human and animal. The edible mushroom is used as food material and yeast cells are used as single cell protein.

e.g., *Agaricus campestris* - Edible mushroom  
*Saccharomyces cerevisiae* - Single cell protein

### **Microorganisms involved in Fermentation:**

Microbes act as food materials by fermentation process. It yields fermented food material like bread, idly, etc. the microbes ferments sugar to yield alcohol and alcohol beverages. It is also employed in dairy production for preparation of cheese, curd, etc.

e.g., *Streptococcus lactis*  
*Lactobacillus acidophilus*

### **Microbes used as Vaccines:**

The vaccines are produced by growing viruses in animal cell culture and used against Small pox and Polio virus.

### **Microorganisms used as Antibiotics:**

Some of the microbes produces antibiotics which kills the pathogenic organisms. Antibiotics are chemical substances produced by microorganisms at smaller level which kills other organisms.

e.g.,  
*Penicillium chrysogenum* - Produces Penicillin  
*Streptomyces griseus* - Produces Streptomycin

### **Microbes involved in Biogas & Biofuels production:**

Microbes produce Biogas from cow dung and agriculture waste materials by anaerobic fermentation which is used as fuel.

e.g., *Methanobacterium*  
*Methanomicrobium*

### **Microbes used in Industry:**

Microorganisms are industrially employed for the production of Organic acids, enzymes, vitamins, amino acid and growth regulators. They are widely used in paper, chemical, food and fibre industry.

e.g., Enzyme producing organisms are:  
Bacteria - *Bacillus evagulans* - Amylase  
Actinomycetes- *Actinoplanes* sp. - Glucose isomers  
Fungi - *Trichoderma viridi* - Cellulase

### **Microbes used in Genetic Engineering:**

It is a technology of constructing genes and transferring them into a cell in which viruses, plasmids are used as 'vectors' or 'vehicles'.

### **Microbes used as Pesticides:**

There is a vast majority of microorganisms such as viruses, bacteria, fungi, protozoan and mycoplasmas known to kill the insect pests. So they are called as bioinsecticides or biopesticides.

e.g., Virus - *Baculovirus*  
Bacteria - *Bacillus thuringiensis*  
*Bacillus papillae*  
Fungi - *Aspergillus* sp  
*Entomophthora*, *Beauveria bassiana* and *Fusarium*

### **Harmful effects of Microorganisms:**

Microorganisms cause human diseases like Small pox, Cholera, Tuberculosis, Leprosy and AIDS. They also cause diseases to plants like leafspot, stem, root and root rot. It also causes disease to animals like foot and mouth disease. It also causes spoilage of foods, fruits and vegetables.

## **CONTRIBUTIONS OF SCIENTISTS TO MICROBIOLOGY**

### **ANTONY VON LEUWENHOEK: (1632-1723)**

- He is predicted as a discoverer of Microbial world. As a hobby he used to grind glass and make lenses. He often used as magnifying glass, but since the lens was not so good, he himself grind and made more perfect lenses.
- He fixed his lenses placing them between two silver or brass plates diverted together. The opening between the plates was less than 1/16 inch. The specimen to be studied was mounted on metal print in front of the screw. During his lifetime he constructed more than 200 such microscopes. It magnifies the microbes to about 200-300 times.
- He observed variety of things mainly hair fibers, crystals, insect eyes, plants, variety of fluids such as pond water, blood and scrapings from his own teeth.
- He examined that and discovered some tiny microbes which are nothing but erythrocytes and also examined yeasts as sound particles.
- He examined pond water and described as ‘**animalcules**’. They were moving to and fro direction in field of microscope.
- All the main types of unicellular microorganisms like protozoa, algae, yeasts and bacteria were described by him.
- He made sketch as different forms of animalcules such as rods, spherical and spiral shaped which are nothing but morphological forms of bacteria.

### **ROBERT KOCH:**

He studied the direct demonstration of role of bacteria in cause of disease. Koch injected mice with material from diseased animal and mice become ill. The materials were identified as bacilli. It was isolated, reinoculated again into mice and it caused diseases.

From this he proved that the casual relation between the microorganisms and specific diseases this is known as ‘**Koch postulates**’.

- i. Microorganisms must be present in every cause of disease but absent in healthy organisms.
  - ii. The suspected microorganisms must be isolated and grown in a pure culture.
  - iii. Pure culture must produce that particular disease when inoculated into a susceptible animal.
  - iv. The organism can be recovered from the experimentally injected animals.
- Koch developed the **pure culture technique**. He cultured bacteria on sterile surfaces of cut boiled potatoes. He then tried to solidify the liquid media by adding gelatin. But it was digested by many

bacteria and melt at temperature above 28 °C. so the use of agar as a solidifying agent was suggested by Hesse, the wife of Walter Hesse, one of the Koch's assistant. Agar was not attacked by most bacteria and did not melt until reaching a temperature of 100 °C.

### **JOHN TYNDALL:**

**John Tyndall** developed a technique called **Tydallization**. By boiling a fluid or liquid intermittently, the resistant forms of bacteria are called **endospore** which destroyed. The spores germinate into vegetative cell in interval between heating and readily killed in the next heating.

### **JOSEPH LISTER:**

He was an English surgeon indirectly proved the role of microbes in contagious surgery. He developed a system of antiseptic surgery to prevent microorganism from entering wounds. He used sterilized instruments for surgery. He also used phenol or surgical dressing and at a time sprayed over the surgical area. Hence he is called as the **Father of Antiseptics**.

### **RICHARD PETRI**

- One of Koch's assistant developed the container for solid culture medium called Petriplate.

### **LOUIS PASTEUR:**

Louis Pasteur was a Chemist for the year (1822-95). He was from France who worked at the University of Lille. He disproved the Abiogenesis.

#### **Beverage Industry:**

- He found that holding the juices at a temperature of 62.8 °C (145 °F) for half an hour to destroy them. This process is called **Pasteurization**.

#### **Sericulture:**

- He also showed that silkworm farmers could eliminate the disease by using only healthy disease-free caterpillars for breeding.

#### **Anthrax:**

- Pastuer next tackled the problem of **Anthrax**, a disease of cattle, sheep and sometime human beings.
- He grew the microbes in laboratory flask after isolating from the blood of animals that had died of the disease.

#### **Chicken Cholera:**

- About 1880, he isolated the bacterium responsible for **Chicken Cholera** and grew it in pure culture. He arranged for a ‘Public demonstration’ where repeated an experiment that had been successful in many previous trials.

**Rabies:**

- He was asked to work on a disease affecting human beings. He set out to make a **vaccine** to **hydrophobia** or rabies, a disease transmitted by the bite of dogs, cats and other animals.
- **Joseph Meister** was bitten by a mad wolf. His family had taken him to Pastuer.

**LAZARO SPALLANZANI (1729-1799):**

- He disproved the spontaneous generation theory i.e., the abiogenesis.