Miss Manasi M. Borkar
Department of Microbiology
Shri Shivaji Science College
Congress Nagar, Nagpur

IMPORTANT DATES AND HISTORY OF MICROBIOLOGY

What is Microbiology?

A. Definition

Microbiology: Study of organisms and agents that are too small to be seen clearly with the naked eye.

Organisms Included: Viruses, bacteria, algae, fungi, and protozoa.

B. Types of Microbiology

- **Applied Microbiology:** Focuses on practical applications and uses of microorganisms.
- **Basic Microbiology:** Aims to understand fundamental aspects of microorganisms.

C. Interdisciplinary Connections

- **Related Disciplines:**
  - **Biochemistry:** Study of chemical processes in living organisms.
  - **Cell Biology:** Study of cell structure and function.
  - **Evolution:** Study of the origins and changes in species over time.
  - **Ecology:** Study of interactions between organisms and their environments.

D. Subdisciplines of Microbiology

1. **General Microbiology:**
   - Broad range of microbiological questions and studies.
2. **Medical Microbiology:**
   - Study of microbes that cause human diseases.
3. **Public Health and Epidemiology:**

- Studies and controls transmission, frequency, and distribution of diseases.

4. **Immunology:**
    - Study of the immune system and its responses to pathogens.
5. **Agricultural Microbiology:**
    - Impact of microbes on agriculture, including soil health and crop growth.
6. **Microbial Ecology:**
    - Relationships between microbes and their environments or habitats.
7. **Food Microbiology:**
    - Prevention of foodborne diseases and use of microbes in food and drink production.
8. **Industrial Microbiology:**
    - Commercial use of microbes to produce products such as antibiotics and enzymes.
9. **Biotechnology:**
    - Manipulation of organisms to develop useful products, including genetic engineering and synthetic biology.

Important Dates and Discoveries in Microbiology

History of Microbiology

A. Discovering the "Organisms"

1. 1676: Anton van Leeuwenhoek
    - ➢ First to observe and describe microbes accurately using a microscope.
2. 1884: Charles Chamberland
    - ➢ Constructed a bacterial filter that allowed the identification of viruses.
3. 1898: Loeffler and Frosch

- Identified the filterable infectious agent causing foot-and-mouth disease in cattle.

4. 1898-1900: Martinus Beijerinck
    - Identified the tobacco mosaic virus.
5. 1982: Stanley Prusiner
    - Described prions, infectious proteins that induce normal proteins to misfold.

B. Disproving Spontaneous Generation

1. 1688: Francesco Redi
    - Challenged spontaneous generation by showing maggots do not form in meat protected from flies.
2. 1748: John Needham
    - Supported spontaneous generation by demonstrating microbial growth in boiled and sealed mutton broth.
3. 1776: Lazzaro Spallanzani
    - Refuted spontaneous generation by showing no microbial growth in sealed, boiled containers.
4. 1861: Louis Pasteur
    - Rigorously disproved spontaneous generation with experiments using swan-neck flasks, demonstrating that microbes in the air caused contamination.

C. The Germ Theory of Disease

1. Early Beliefs:
    - Diseases thought to be caused by punishment, poisonous vapors, or imbalances of the "four humors."
2. Lucretius (Ancient Greece) and Girolamo Fracastoro (1546):
    - Early proponents of the idea that invisible organisms cause disease.
3. 1835: Agostino Bassi
    - Demonstrated that a fungus causes silkworm disease.

4. 1867: Joseph Lister
    - Introduced antiseptic techniques in surgery, reducing wound infections.
5. 1876/1884: Robert Koch
    - Proved that *Bacillus anthracis* causes anthrax and *Mycobacterium tuberculosis* causes tuberculosis using Koch's postulates.

D. Preventing Disease by Vaccination

1. 1796: Edward Jenner
    - Inoculated individuals with cowpox to protect against smallpox.
2. 1885: Louis Pasteur
    - Developed the rabies vaccine.
3. 1890: Emil von Behring and Shibasaburo Kitasato
    - Produced antitoxins to protect against diphtheria and tetanus.
4. 1884: Elie Metchnikoff
    - Described phagocytosis, the process by which cells ingest and destroy pathogens.

E. Discovering the Effect of Microbes on Organic and Inorganic Matter

1. 1856: Louis Pasteur
    - Described lactic acid fermentation, contributing to the wine industry.
2. 1887-1900: Sergei Winogradsky and Martinus Beijerinck
    - Studied soil microbes and their roles in sulfur, carbon, and nitrogen biochemical cycles.

Recent History of Microbiology – The 20th Century

A. Infectious Diseases

- Identified etiological agents for most infectious diseases; current research focuses on molecular mechanisms of disease.

B. Chemotherapy

- Discovery of antibiotics and development of treatments; ongoing research on antibiotic resistance.

C. Immunology

- Development of immunology as a science.

D. Physiology and Biochemistry

- Use of microbes as models to elucidate physiological and biochemical processes.

E. Genetics

1. 1941: Beadle and Tatum
   - Proposed that one gene codes for one enzyme.
2. 1943: Luria and Delbruck
   - Demonstrated that mutations are spontaneous.
3. 1944: Avery, MacLeod, and McCarty
   - Identified DNA as the genetic material.
4. 1961: Jacob and Monod
   - Discovered the operon model and gene regulation mechanisms.

F. Molecular Biology

1. 1970: Discovery of Restriction Enzymes
   - Enzymes that cut DNA at specific sequences.
2. 1979: Synthesis of Insulin
   - Produced using recombinant DNA techniques.
3. 1990: Gene Therapy Trials
   - Initiated trials for therapeutic gene editing.
4. 1995: Sequencing of Haemophilus influenzae
   - Published the first complete nucleotide sequence of a free-living organism