

# **Lecture-5**

## History of microbiology (Part-2)

# History of microbiology

## Content

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- **History of microbiology (part-1)**
  - **Microbiology in the Islamic era (Arabic content).**
  - **Pathways of discovery in microbiology**
    - The historical roots of microbiology
    - Pasteur and the defeat of spontaneous generation
    - Koch, infectious disease, and pure culture microbiology.
- **History of microbiology (part-2)**
  - The rise of microbial diversity
  - The modern era of microbiology

# The rise of microbial diversity

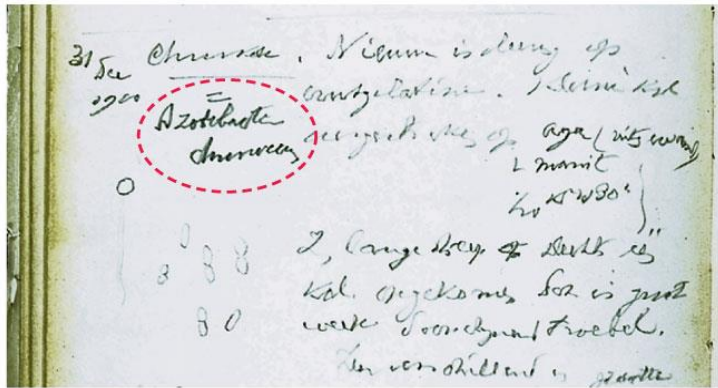
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## **Microbial Diversity**

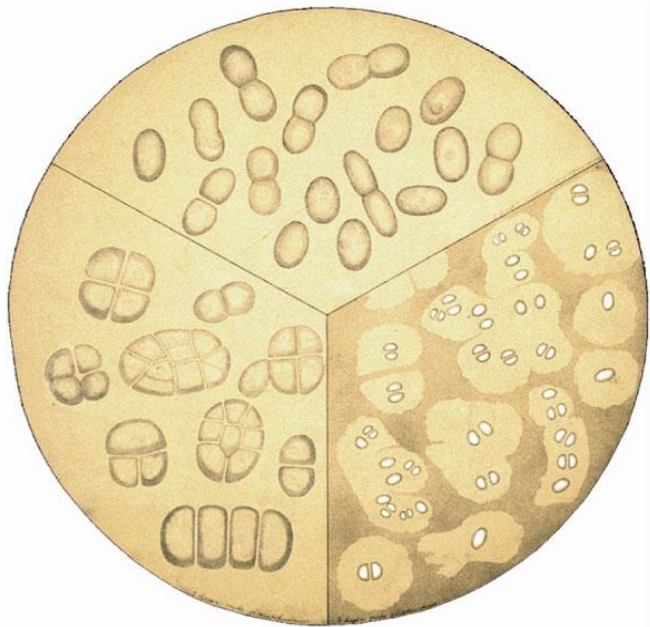
- Field that focuses on nonmedical aspects of microbiology (soil , water)

## **Martinus Beijerinck (1851–1931)**

- Developed enrichment culture technique
  - Microbes isolated from natural samples in a highly selective techniques by adjusting nutrient and incubation conditions to favor a particular metabolic group of organisms.
    - Example: nitrogen-fixing bacteria, sulfate –reducing bacteria , sulfur- oxidizing bacteria, aerobic nitrogen –fixing bacteria.



(a)



(b)

- a) A page from the laboratory notebook of M.Beijerinck in 1900 describing the aerobic nitrogen-fixing bacterium *Azotobacter chroococcum* ( shown in red)
- b) A painting by M.Beijerinck's sister showing cells of the same bacteria .

# The rise of microbial diversity

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## Sergei Winogradsky (1856–1953)

### The Concept of **Chemolithotrophy**

- Demonstrated that specific bacteria are linked to specific biogeochemical transformations (e.g., S & N cycles)
- Proposed concept of chemolithotrophy
  - Oxidation of inorganic compounds linked to energy conservation

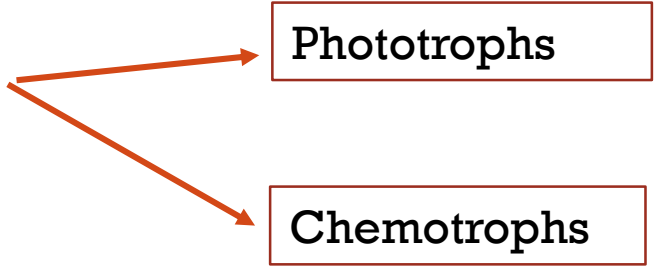
**Carbon source**



CO<sub>2</sub>

Reduced organic molecule from other organisms

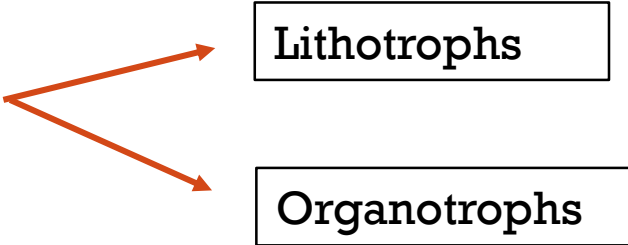
**Energy source**



Light

Oxidation of organic and nonorganic molecule

**Electron source**



Reduce nonorganic molecule

From organic molecule

**Not required**

# The Modern Era of Microbiology

## The major subdisciplines of microbiology

subdiscipline	Focus
<b>1- Basic emphases</b>	
Microbial physiology	Study of the nutrients that microbes require for metabolism and growth and the products that they generate
Microbial genetics	Study of Genes , heredity and genetic variation
Microbial biochemistry	Study of microbial enzymes and chemical reactions
Microbial systematics	The science of grouping and classification and nomenclature
Molecular biology	Study Nucleic acids and protein
Microbial ecology	Study microbial diversity and activity in natural habitats
Virology	Study viruses and subviral particles

# The Modern Era of Microbiology

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The major subdisciplines of microbiology	
subdisciplines	Focus
<b>2- Applied emphases</b>	
Medical Microbiology	Infectious disease
Immunology	Immune systems
Agricultural /soil microbiology	Microbial diversity and processes in soil
industrial microbiology	Large-scale production of antibiotics ,alcohol and other chemicals
Biotechnology **	Production of human proteins by genetically engineered microorganisms
Aquatic Microbiology	Microbial processes in waters and wastewaters, drinking water safety.



# The Modern Era of Microbiology

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## Molecular Microbiology

- \*\* Biotechnology
  - Manipulation of cellular genomes
  - DNA from one organism can be inserted into a bacterium and the proteins encoded by that DNA harvested
- Genomics: study of all of the genetic material (DNA) in living cells
  - Transcriptomics: study of RNA patterns.
  - Proteomics: study of all the proteins produced by cells.
  - Metabolomics: study of metabolic expression in cells.

ANY  
QUESTIONS  
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**REMEMBER**

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