

## 01-Microbiology: Introduction and overview (Instructor: Şeref Tağı)

Since the 19th century, there has been an explosion of great microbiological research, leading to many different branches of microbiology, all of which are both basic and applied in nature.

**The science of microbiology mainly involves knowledge of**

- Biochemistry
- Cell biology
- Molecular biology
- Environmental science

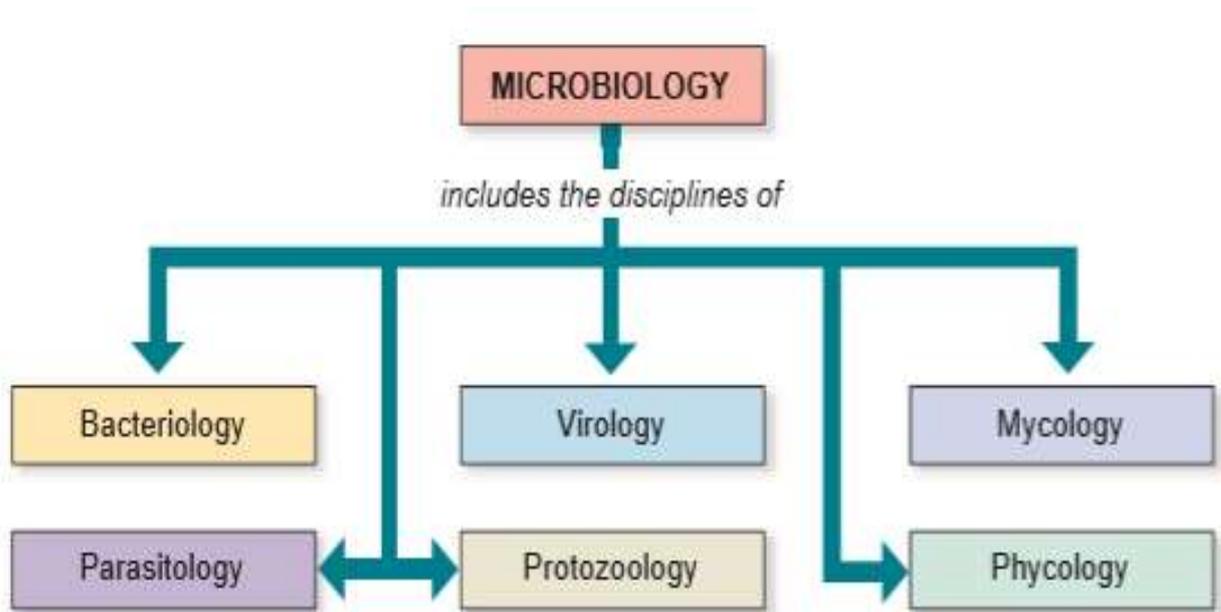
**Different fields of microbiology that have developed since the discovery of microorganisms:**

- **Aquatic, soil, and agricultural microbiology;** study the microorganisms associated with aquatic (including wastewater treatment systems), soil, and agricultural environments, respectively.
- **Immunology;** is the study of the body's response to infection by microorganisms. Included within this field is the area of vaccine research, which aims to develop more and better ways of immunizing people from microorganisms that cause lifethreatening infections.
- **Industrial microbiology;** applies the large-scale use of microorganisms to make things like antibiotics or alcohol.
- **Medical and pharmaceutical microbiology;** is the study of pathogenic microorganisms that cause infectious disease in humans and animals and ways to prevent and treat infections, disease treatment.
- **Microbial biochemistry;** aims to understand the enzymes and chemical reactions inside microbial cells.
- **Microbial biotechnology;** is genetically engineering microorganisms to produce a foreign gene or pathway so that it may either make a product for human use (for

example, human insulin) or perform a function that we need (for example, degradation of environmental contaminants).

- **Food Microbiology;** deals with the microorganisms responsible for the desirable transformation (cheese, pickles, sauerkraut, green olives, yogurt, soy sauce, vinegar, bread, beer, wine, alcohol etc.) and undesirable changes (food spoilage microorganisms and foodborne disease causing microorganisms).
- **Microbial ecology;** is the study of microbial diversity in nature, as well as microbial populations and microbial communities and their effects on their environments. This includes nutrient cycling and biogeochemistry (biological, chemical, and physical processes that control the composition of the natural environment).
- **Microbial genetics;** is the study of the genomes of microorganisms, including how the genetic code varies between microbes and how genes are passed on
- **Microbial systematics;** is the study of how microorganisms diversified through time. It includes the naming and organizing of microbial groups with respect to one another.
- **Geomicrobiology;** concerns the role of microbe and microbial processes in geological and geochemical processes (e.g. recovery of minerals from low grade ores). Another area is the study of extremophile organisms, hot (hot springs or mid-ocean ridge black smoker) environments, extremely saline environments, or even space environments such as Martian soil or comets (exomicrobiology).
- And more emerging fields to add, think about it....

Based on the on the taxonomical classification microbiology can be classified as follows:



Microbiology Disciplines by Organism or Agent Studied. This simple concept map shows the relationship between microbiology and the organisms or agents that make up the various disciplines (Alcama's Fundamentals of Microbiology, 2011).

- Bacteriology is the study and cultivation of bacteria and with their applications in medicine, agriculture, industry.
- Mycology is the study of fungi, both in terms of their natural habitats and genetics, and in terms of their ability to cause disease in humans, other animals, and plants.
- Parasitology\* is the study of parasites of animals and humans. These are all eukaryotic (not bacterial or archaeal) and include protists and worms.
- Virology is the study of viruses and simple nonviral entities, such as viroids (RNA molecules that behave like infectious agents) and prions (proteins that behave like infectious agents).
- Phycology is the study alga

\* Some of these parasites cause disease in humans, which is why parasitology is included with the other disciplines of microbiology

#### References:

- 1- Alcamo's Fundamentals of Microbiology, 2011, Ninth Edition (9 ed.) by Jeffrey C. Pommerville, Jones & Bartlett Publishers, Canada
- 2- <https://www.onlinebiologynotes.com/fields-scope-microbiology/>
- 3- <https://www.onlinebiologynotes.com/category/bacteriology/>