Microbiology

By

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Microbiology

- From Greek μῑκρος, *mīkros*, "small"
- βίος, *bios*, "life"
- -λογία, *--logia* , study
- **Microbiology** is the study of microscopic is the study of microscopic organisms, either
  - unicellular (single cell),
  - multicellular (cell colony), or
  - acellular (lacking cells)
- Microbiology encompasses numerous sub-disciplines including : virologyMicrobiology encompasses numerous sub-disciplines including : virology, mycologyMicrobiology encompasses numerous sub-disciplines including :

Taxonomic arrangement

- Bacteriology: The study of bacteria.
- Mycology: The study of fungi.
- Protozoology: The study of protozoa.
- Phycology (or algology): The study of algae.

Taxonomic arrangement

- Parasitology: The study of parasites.
- Immunology: The study of the immune system.
- Virology: The study of viruses.
- Nematology:The study of the nematodes
- Microbiology:The study of microbes.

Integrative arrangement

- Microbial cytology: The study of microscopic and submicroscopic details of microorganisms.
- Microbial physiologyMicrobial physiology: The study of how the microbial cell functions biochemically. Includes the study of microbial growth, microbial metabolismMicrobial physiology: The study of how the microbial cell functions biochemically. Includes the study of microbial growth, microbial metabolism and microbial cell structure.
- Microbial ecology: The relationship between microorganisms and their environment.
- Microbial geneticsMicrobial genetics: The study of how genesMicrobial genetics: The study of how genes are organized and regulated in microbes in relation to their

Integrative arrangement

- Cellular microbiologyCellular microbiology: A discipline bridging microbiology and cell biology.

- Evolutionary microbiology: The study of the evolution of microbes. This field can be subdivided into:
  - Microbial taxonomy: The naming and classification of microorganisms.
  - Microbial systematics: The study of the diversity and genetic relationship of microorganisms.

Integrative arrangement

- Generation microbiology: The study of those microorganisms that have the same characters as their parents.

- Systems microbiologySystems microbiology: A discipline bridging systems biology and microbiology.

- Molecular microbiology: The study of the molecular principles of the physiological processes in microorganisms.

Other

- Nano microbiology: The study of those organisms on nano level.
- Exo microbiologyExo microbiology (or Astro microbiology): The study of microorganisms in outer space
- Biological agent: The study of those microorganisms which are being used in weapon industries.

Applied microbiology

- Medical microbiologyMedical microbiology: The study of the pathogenic microbes and the role of microbes in human illness. Includes the study of :
  - microbial pathogenesis
  - Epidemiology
- Related to the study of disease pathologyRelated to the study of disease pathology and immunology.

- Pharmaceutical microbiology: The study of microorganisms that are related to the production of antibiotics, enzymes, vitamins, vaccines, and other pharmaceutical products and that cause pharmaceutical contamination and spoil.

- Industrial microbiology: The exploitation of microbes for use in industrial processes.
  - industrial fermentation
  - wastewater treatment.

- Closely linked to the biotechnologyClosely linked to the

Applied microbiology

- Microbial biotechnology: The manipulation of microorganisms at the genetic and molecular level to generate useful products.

- Food microbiology: The study of microorganisms causing food spoilage and foodborne illness. Using microorganisms to produce foods, for example by fermentation.

- Agricultural microbiology: The study of agriculturally relevant microorganisms. This field can be further classified into the following:
  - Plant microbiologyPlant microbiology and Plant pathology: The study of the interactions between microorganisms and plants and plant pathogens.
  - Soil microbiology: The study of those microorganisms that are found in soil.

Applied microbiology

- Veterinary microbiologyVeterinary microbiology: The study of the role of microbes in veterinary medicineVeterinary microbiology: The study of the role of microbes in veterinary medicine or animal taxonomy.

- Water microbiology (or Aquatic microbiology): The study of those microorganisms that are found in water.

- Aeromicrobiology (or Air microbiology): The study of airborne microorganisms.

Applied microbiology

- Environmental microbiology: The study of the function and diversity of microbes in their natural environments.

- This involves the characterization of key bacterial habitats such as the rhizosphereThis involves the characterization of key bacterial habitats such as
the rhizosphere and phyllosphereThis involves the characterization of key bacterial habitats such as
the rhizosphere and phyllosphere, soilThis involves the characterization of key bacterial habitats such as
the rhizosphere and phyllosphere, soil and groundwaterThis involves the characterization of key bacterial habitats such as the rhizosphere and phyllosphere, soil and groundwater ecosy s-temsThis involves the characterization of key bacterial habitats such as
the rhizosphere and phyllosphere, soil and groundwater ecosy s-tems, open oceansThis involves the characterization of key

Benefits

- We fear microbes due to the association of some microbes with various human illnesses,

- Microbes responsible for numerous beneficial processes such as
  - industrial fermentationindustrial fermentation (e.g. the production of alcoholindustrial fermentation (e.g. the production of alcohol, vinegarindustrial fermentation (e.g. the production of alcohol, vinegar and dairy products),
  - Antibiotic production
  - As vehicles for cloning in more complex organisms such as plants.

- Knowledge of microbes to produce biotechnologically important enzymesKnowledge of microbes to produce biotechnologically important enzymes such as Taq polymeraseKnowledge of microbes to produce biotechnologically important enzymes such as Taq polymerase, reporter genesKnowledge of microbes to produce biotechnologically important enzymes such as Taq polymerase, reporter genes for use in other genetic systems and novel molecular biology techniques

Benefits

The industrial production of amino acids

- *Corynebacterium glutamicum*: bacterial species with an annual production of more than two million tons of amino acids, mainly L-glutamate and L-lysine

- A variety of biopolymersA variety of biopolymers, such as polysaccharidesA variety of biopolymers, such as polysaccharides, polyestersA variety of biopolymers, such as polysaccharides, polyesters, and polyamides, are produced by microorganisms

- Biotechnological production of biopolymers with tailored properties suitable for high-value medical application such as tissue engineering and drug delivery.

- The biosynthesis of xanthanThe biosynthesis of xanthan, alginateThe biosynthesis of xanthan, alginate, cellulosеThe biosynthesis of xanthan, alginate, cellulose, cyanophycinThe biosynthesis of xanthan, alginate, cellulose, cyanophycin, poly(gamma-glutamic

Benefits

- Microorganisms beneficial for microbial biodegradationMicroorganisms beneficial for microbial biodegradation or bioremediationMicroorganisms beneficial for microbial biodegradation or bioremediation of domestic, agricultural and industrial wastes and subsurface pollution in soils, sediments and marine environments.

- The ability of each microorganism to degrade toxic wasteThe ability of each microorganism to degrade toxic waste depends on the nature of each contaminant.

- Since sites typically have multiple pollutant types, the most effective approach to microbial biodegradationSince sites typically have multiple pollutant types, the most effective approach to microbial biodegradation is to use a mixture of

Benefits

- Symbiotic microbial communities are known to confer various benefits to their human and animal hosts health including
  - aiding digestion,
  - production of beneficial vitamins and amino acids, and
  - suppression of pathogenic microbes.

- Some benefit may be conferred by consuming fermented foods, probioticsSome benefit may be conferred by consuming fermented foods, probiotics (bacteria potentially beneficial to the digestive system) and/or prebiotics (substances consumed to promote the growth of probiotic microorganisms).

- The ways the microbiome influences human and animal health, as well as methods to influence the microbiome are active areas of research.

Benefits

- Microorganisms could be useful in the treatment of cancer.
- Various strains of non-pathogenic clostridia can infiltrate and replicate within solid tumors.
- Clostridial vectors can be safely administered and their potential to deliver therapeutic proteins has been demonstrated in a variety of preclinical models.