**Name : Arshad Khan**

**F/Name : Sher Nawaz Khan**

**ID: 16928**

**Mam: ` Pashmina**

**Microbiology:**

**Microbiology** (from [Greek](https://en.wikipedia.org/wiki/Ancient_Greeks) μῑκρος, *mīkros*, "small"; βίος, *bios*, "[life](https://en.wikipedia.org/wiki/Life)"; and -λογία, [*-logia*](https://en.wikipedia.org/wiki/-logy)) is the study of [microorganisms](https://en.wikipedia.org/wiki/Microorganism), those being [unicellular](https://en.wikipedia.org/wiki/Unicellular) (single cell), [multicellular](https://en.wikipedia.org/wiki/Multicellular) (cell colony), or [acellular](https://en.wikipedia.org/wiki/Acellular) (lacking cells).[[1]](https://en.wikipedia.org/wiki/Microbiology#cite_note-1)[[2]](https://en.wikipedia.org/wiki/Microbiology#cite_note-Brock-2) Microbiology encompasses numerous sub-disciplines including [virology](https://en.wikipedia.org/wiki/Virology), [bacteriology](https://en.wikipedia.org/wiki/Bacteriology), [protistology](https://en.wikipedia.org/wiki/Protistology), [mycology](https://en.wikipedia.org/wiki/Mycology), immunology and [parasitology](https://en.wikipedia.org/wiki/Parasitology).

[Eukaryotic](https://en.wikipedia.org/wiki/Eukaryote) microorganisms possess membrane-bound [organelles](https://en.wikipedia.org/wiki/Organelles) and include [fungi](https://en.wikipedia.org/wiki/Fungi) and [protists](https://en.wikipedia.org/wiki/Protists), whereas [prokaryotic](https://en.wikipedia.org/wiki/Prokaryote) organisms—all of which are microorganisms—are conventionally classified as lacking membrane-bound organelles and include [Bacteria](https://en.wikipedia.org/wiki/Bacteria) and [Archaea](https://en.wikipedia.org/wiki/Archaea).[[3]](https://en.wikipedia.org/wiki/Microbiology#cite_note-3)[[4]](https://en.wikipedia.org/wiki/Microbiology#cite_note-4) Microbiologists traditionally relied on culture, staining, and microscopy. However, less than 1% of the microorganisms present in common environments can be cultured in isolation using current means.[[5]](https://en.wikipedia.org/wiki/Microbiology#cite_note-Amann1995-5) Microbiologists often rely on [molecular biology](https://en.wikipedia.org/wiki/Molecular_biology) tools such as DNA sequence based identification, for example 16s rRNA gene sequence used for bacteria identification.

[Viruses](https://en.wikipedia.org/wiki/Virus) have been variably classified as organisms,[[6]](https://en.wikipedia.org/wiki/Microbiology%22%20%5Cl%20%22cite_note-6) as they have been considered either as very simple microorganisms or very complex molecules. [Prions](https://en.wikipedia.org/wiki/Prions), never considered as microorganisms, have been investigated by virologists, however, as the clinical effects traced to them were originally presumed due to chronic viral infections, and virologists took search—discovering "infectious proteins".

The existence of microorganisms was predicted many centuries before they were first observed, for example by the Jains in India and by [Marcus Terentius Varro](https://en.wikipedia.org/wiki/Marcus_Terentius_Varro) in ancient Rome. The first recorded microscope observation was of the fruiting bodies of moulds, by [Robert Hooke](https://en.wikipedia.org/wiki/Robert_Hooke) in 1666, but the Jesuit priest [Athanasius Kircher](https://en.wikipedia.org/wiki/Athanasius_Kircher) was likely the first to see microbes, which he mentioned observing in milk and putrid material in 1658. [Antonie van Leeuwenhoek](https://en.wikipedia.org/wiki/Antonie_van_Leeuwenhoek) is considered a [father of microbiology](https://en.wikipedia.org/wiki/List_of_people_considered_father_or_mother_of_a_scientific_field) as he observed and experimented with [microscopic organisms](https://en.wikipedia.org/wiki/Microscopic_organisms) in 1676, using simple [microscopes](https://en.wikipedia.org/wiki/Microscope) of his own design. Scientific microbiology developed in the 19th century through the work of [Louis Pasteur](https://en.wikipedia.org/wiki/Louis_Pasteur) and in medical microbiology [Robert Koch](https://en.wikipedia.org/wiki/Robert_Koch).



[Avicenna](https://en.wikipedia.org/wiki/Avicenna) hypothesized the existence of microorganisms.

The existence of microorganisms was hypothesized for many centuries before their actual discovery. The existence of unseen microbiological life was postulated by [Jainism](https://en.wikipedia.org/wiki/Jainism) which is based on [Mahavira](https://en.wikipedia.org/wiki/Mahavira)’s teachings as early as 6th century BCE.[[7]](https://en.wikipedia.org/wiki/Microbiology#cite_note-7) Paul Dundas notes that Mahavira asserted the existence of unseen microbiological creatures living in earth, water, air and fire.[[8]](https://en.wikipedia.org/wiki/Microbiology#cite_note-8) [Jain scriptures](https://en.wikipedia.org/wiki/Jain_scriptures) describe [nigodas](https://en.wikipedia.org/wiki/Nigoda) which are sub-microscopic creatures living in large clusters and having a very short life, said to pervade every part of the universe, even in tissues of plants and flesh of animals.[[9]](https://en.wikipedia.org/wiki/Microbiology#cite_note-9) The [Roman](https://en.wikipedia.org/wiki/Ancient_Rome) [Marcus Terentius Varro](https://en.wikipedia.org/wiki/Marcus_Terentius_Varro) made references to microbes when he warned against locating a homestead in the vicinity of swamps "because there are bred certain minute creatures which cannot be seen by the eyes, which float in the air and enter the body through the mouth and nose and thereby cause serious diseases."[[10]](https://en.wikipedia.org/wiki/Microbiology#cite_note-10)

In the golden age of Islamic civilization, Iranian scientists hypothesized the existence of microorganisms, such as [Avicenna](https://en.wikipedia.org/wiki/Avicenna) in his book [*The Canon of Medicine*](https://en.wikipedia.org/wiki/The_Canon_of_Medicine), [Ibn Zuhr](https://en.wikipedia.org/wiki/Ibn_Zuhr) (also known as Avenzoar) who discovered [scabies](https://en.wikipedia.org/wiki/Scabies) mites, and [Al-Razi](https://en.wikipedia.org/wiki/Muhammad_ibn_Zakariya_al-Razi) who gave the earliest known description of [smallpox](https://en.wikipedia.org/wiki/Smallpox) in his book *The Virtuous Life* (al-Hawi).[[11]](https://en.wikipedia.org/wiki/Microbiology#cite_note-11)

In 1546, [Girolamo Fracastoro](https://en.wikipedia.org/wiki/Girolamo_Fracastoro) proposed that [epidemic](https://en.wikipedia.org/wiki/Epidemic) [diseases](https://en.wikipedia.org/wiki/Diseases) were caused by transferable seedlike entities that could transmit infection by direct or indirect contact, or vehicle transmission.[[12]](https://en.wikipedia.org/wiki/Microbiology#cite_note-12)

[Antonie van Leeuwenhoek](https://en.wikipedia.org/wiki/Antonie_van_Leeuwenhoek), often cited as the first to experiment with [microorganisms](https://en.wikipedia.org/wiki/Microorganism).[[13]](https://en.wikipedia.org/wiki/Microbiology#cite_note-13)[[14]](https://en.wikipedia.org/wiki/Microbiology#cite_note-14)[[15]](https://en.wikipedia.org/wiki/Microbiology#cite_note-BrianJFord_1992-15)[[16]](https://en.wikipedia.org/wiki/Microbiology#cite_note-16)

Van Leeuwenhoek's microscopes by [Henry Baker](https://en.wikipedia.org/wiki/Henry_Baker_%28naturalist%29)[[17]](https://en.wikipedia.org/wiki/Microbiology#cite_note-17)

[Martinus Beijerinck](https://en.wikipedia.org/wiki/Martinus_Beijerinck), the founding father of the Delft School of Microbiology, in his laboratory. Beijerinck is often considered as a [founder of virology](https://en.wikipedia.org/wiki/History_of_virology), [environmental microbiology](https://en.wikipedia.org/wiki/Environmental_microbiology), and [industrial microbiology](https://en.wikipedia.org/wiki/Industrial_microbiology).[[18]](https://en.wikipedia.org/wiki/Microbiology#cite_note-18)

In 1676, [Antonie van Leeuwenhoek](https://en.wikipedia.org/wiki/Antonie_van_Leeuwenhoek), who lived most of his life in [Delft](https://en.wikipedia.org/wiki/Delft), Holland, observed [bacteria](https://en.wikipedia.org/wiki/Bacteria) and other microorganisms using a single-lens microscope of his own design.[[19]](https://en.wikipedia.org/wiki/Microbiology#cite_note-NickLane_RS-19)[[2]](https://en.wikipedia.org/wiki/Microbiology#cite_note-Brock-2) He is considered a [father of microbiology](https://en.wikipedia.org/wiki/List_of_people_considered_father_or_mother_of_a_scientific_field) as he pioneered the use of simple single-lensed [microscopes](https://en.wikipedia.org/wiki/Microscope) of his own design.[[19]](https://en.wikipedia.org/wiki/Microbiology#cite_note-NickLane_RS-19) While Van Leeuwenhoek is often cited as the first to observe microbes, [Robert Hooke](https://en.wikipedia.org/wiki/Robert_Hooke) made his first recorded microscopic observation, of the fruiting bodies of [moulds](https://en.wikipedia.org/wiki/Mold_%28fungus%29), in 1665.[[20]](https://en.wikipedia.org/wiki/Microbiology#cite_note-20) It has, however, been suggested that a Jesuit priest called [Athanasius Kircher](https://en.wikipedia.org/wiki/Athanasius_Kircher) was the first to observe microorganisms.[[21]](https://en.wikipedia.org/wiki/Microbiology#cite_note-pmid12964250-21)

Kircher was among the first to design magic lanterns for projection purposes, so he must have been well acquainted with the properties of lenses.[[21]](https://en.wikipedia.org/wiki/Microbiology#cite_note-pmid12964250-21) He wrote "Concerning the wonderful structure of things in nature, investigated by Microscope" in 1646, stating "who would believe that vinegar and milk abound with an innumerable multitude of worms." He also noted that putrid material is full of innumerable creeping animalcules. He published his *Scrutinium Pestis* (Examination of the Plague) in 1658, stating correctly that the disease was caused by microbes, though what he saw was most likely red or white blood cells rather than the plague agent itself.[[21]](https://en.wikipedia.org/wiki/Microbiology#cite_note-pmid12964250-21)

# Fundamental:

[SEE SYNONYMS FOR fundamental ON THESAURUS.COM](https://www.thesaurus.com/browse/fundamental)

### adjective

serving as, or being an essential part of, a foundation or basis; basic; underlying: fundamental principles; the fundamental structure.

of, relating to, or affecting the foundation or basis: a fundamental revision.

being an original or primary source: a fundamental idea.

Music. (of a chord) having its root as its lowest note.

### noun

a basic principle, rule, law, or the like, that serves as the groundwork of a system; essential part: to master the fundamentals of a trade.

Also called fundamental note, fundamental tone. Music.

1. the root of a chord.
2. the generator of a series of harmonics.

Physics. the component of lowest frequency in a composite wave.