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## DIFFERENCES BETWEEN VIRUSES AND BACTERIA, THEIR CAUSE OF DISEASES.

**Xamraev Rashid Ravshan o'g'li**

Lecturer at Termez University of Economics and Service

E-mail: [khamrayevrashid@gmail.com](mailto:khamrayevrashid@gmail.com)

**Ismatullayeva Mehriniso To'lagan qizi**

Termez University of Economics and Service

Student of the Faculty of Medicine, Department of Dentistry

E-mail: [ismatullayevamehriniso21@gmail.com](mailto:ismatullayevamehriniso21@gmail.com)

**ANNOTATION.** This article describes in detail the structure of viruses and bacteria, the main biological, morphological and functional differences between them, the mechanisms of their influence on the body, methods of reproduction, the level of pathogenicity, diagnostic methods and approaches to treatment. Differentiation between viral and bacterial infections is an important diagnostic criterion in medical practice, and an incorrect diagnosis or approach can lead to aggravation of the infection. Also, the study of viruses and bacteria, their prevention are highlighted as a topical issue in modern biology.

**KEYWORDS:** virus, bacteria, infection, diagnosis, antibiotic, antiviral drugs, immune response, pathogenicity, differential diagnosis, microscopy, prevention.

**INTRODUCTION.** Nowadays, one of the main factors threatening human health is microorganisms. In particular, viruses and bacteria, which are studied in the field of Microbiology, are of particular importance as the main causes of various infectious diseases. They are widespread in the external environment and can enter the human body in various ways and cause disease. In recent years, especially during the COVID-19 pandemic, the danger of viruses to human life has become even more obvious. At the same time, bacteria also continue to cause many serious infectious diseases. Studying viruses and bacteria, identifying their differences, and understanding the mechanisms of disease are one of the important tasks of medical and biological sciences.

Viruses and bacteria are fundamentally different in their biological nature, mechanisms of reproduction, the way they affect body systems, the way they provoke an immune response, as well as their approaches to diagnosis and treatment. A correct understanding of these differences is crucial in determining treatment strategies, especially in clinical medicine. Viruses are ultra-microscopic pathogens consisting of genetic material (DNA or RNA) and protein that are unable to reproduce outside the cell and reproduce only inside living cells. They make copies of themselves using the genetic system of their host cell. In other words, viruses are genetic agents that live a non-cellular, parasitic lifestyle. They have the ability to hide from the immune system and change the structure of the cell. Bacteria, on the other hand, are single-celled, living organisms with independent metabolism, many species of which live in symbiosis with the human body. At the same time, pathogenic bacteria can attack various systems and cause





acute or chronic diseases. They have complex structures such as cell walls, cytoplasm, DNA, and ribosomes, and are usually killed by antibiotics. In hospitals and medical practice, it is vital to be able to correctly distinguish between viral and bacterial infections.

Viruses are widespread in nature, causing various serious diseases in humans, animals and plants. They are spread by special means of transmission or mechanical means. Most viruses do not lose their viability for years, but begin to cause disease when they fall into favorable conditions (into a living cell). Some viruses (for example, influenza viruses) lose their properties in the external environment. Often, only one virus particle can cause a disease caused by viruses. For example, billions of viruses can be formed from one polio virus particle (molecule) in a few hours. The reproduction of viruses is associated with amino acids in the cytoplasm. The aggregate of millions of virus molecules is visible under a microscope in the form of crystals or X-bodies. The property of causing a disease is that they are very small compared to other disease-causing agents and do not develop in a typical artificial nutrient medium. With the exception of some bacteriophages, it has been proven that they can be grown in the laboratory. All viruses that can be studied in the laboratory have been "measured" with some accuracy by various physical methods. Their diameter is 10-300  $\mu\text{m}$ . They are rod-shaped, spherical, or filamentous. Most viruses that cause diseases in plants and animals are round. Wheat and alfalfa mosaic viruses resemble bacterial rods or arrows in appearance. By studying the structure of viruses with an electron microscope and X-rays, some of their delicate components have been identified. They all have an internal substance, mainly nucleic acid, surrounded by a protein shell. The chemical composition of only a few types of viruses has been studied.

Vaccines The structure of viruses is also complex, probably like that of ordinary bacteria. It contains nucleoproteins, carbohydrates and lipids. Nucleic acid is found in the form of deoxyribose, and the lipid group is found in the form of cholesterol, phospholipids and neutral oils. Phytopathogenic viruses contain ribonucleic acid (RNA), and viruses that cause diseases in animals and humans contain RNA or DNA (Ribonucleic acid) (deoxyribonucleic acid). Some viruses are obtained in the form of purified preparations, some of which form pure true crystals (e.g., tobacco necrosis viruses), while others form liquid crystals (e.g., tobacco mosaic viruses) or formless precipitates. Ultracentrifugation is used to isolate and purify viruses, and various physicochemical methods are used. The classification (classification) of viruses and the signs that characterize them have not yet been accepted. They are also given the same species and genus names as animals and plants, folk expressions, various abbreviations are used, the genus name of the infecting organism is called, followed by a number, or Viruses are grouped into genera and families based on their morphological, chemical, and reproductive properties. The Latin name of the genus of viruses is written with the word virus (e.g., Enterovirus), and the family name is written with the word viridae (e.g., Poxviridae).





Viruses enter the body in various ways, viruses can enter plant cells from the outside only when they are damaged. Influenza viruses and others have enzymes that have the property of destroying the cell membrane. After viruses enter the body, a latent or hidden period of infection begins. Many viruses accumulate in cells and form specific components inside the cell (see Viral granulosis). Plants infected with viruses usually remain foci of infection throughout their lives. Viruses have strong variability that occurs under the influence of environmental, biological and other factors. Viruses are widespread in nature and have a wide range of hosts. They are mainly spread by sucking insects, mites and nematodes. Some viruses are spread by seeds, and almost all viruses are transmitted to offspring when a diseased plant reproduces asexually. The pathological effects of viruses are diverse, and are mainly determined by the disruption of protein and nucleic acid metabolism in the host organism during their reproduction (see Viral diseases). Viruses are studied by the science of virology.

Understand how bacteria and viruses differ in infection. Bacterial infections differ from other infections, for obvious reasons, depending on the microbe that causes them. Bacteria are single-celled organisms that live in abundance in humans, animals, plants, and all parts of our planet. There can be "good" bacteria that help systems function properly (from digestion to fermentation) and "bad" bacteria that cause infections. It is known that less than one percent of bacteria can cause disease in humans.

Differences between bacteria and viruses. Bacteria and viruses can both cause infections, but there are many differences between them. Viruses are very small organisms (10 to 100 times smaller than bacteria) and require a living host to reproduce and survive. Viruses do not have a cellular structure; bacteria do. Bacteria are living organisms; viruses are considered non-living.

In treatment, antibiotics can kill bacteria (except most gram-negative bacteria), but not viruses. Antivirals are used to kill viruses; bacteria are not affected.

In addition to bacteria and viruses, other types of organisms can infect the body, such as protozoa, fungi, worms, and prions. Types of Bacterial Infections The severity of bacterial infections is largely based on the type of bacteria, the overall health of the person affected, and other factors that can help to improve or reduce the infection.

Bacterial infections range from minor illnesses like strep throat and ear infections to life-threatening conditions like meningitis and encephalitis.

**The most common bacterial infections include:**

Salmonella is a type of foodborne infection caused by non-typhoidal salmonella bacteria found in the intestinal tracts of humans and other animals.

Escherichia coli (E. coli) is a type of bacteria that is commonly found in patients with gastrointestinal illnesses.





Tuberculosis is a highly contagious disease caused by a bacterium called *Mycobacterium tuberculosis* that can seriously affect the lungs and other organ systems.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a bacteria that is resistant to antibiotics and can be fatal, especially in people with compromised immune systems.

*Clostridium difficile* (C. diff) is a bacteria that can cause gastrointestinal illnesses (for example, when antibiotics kill other intestinal bacteria).

Bacterial pneumonia is a type of bacterial infection that can be caused by a variety of bacteria.

Bacterial vaginosis is a vaginal infection that can cause itching, discharge, and painful urination.

*Vibrio vulnificus* is a rare, "flesh-eating" bacteria found in warm seawater.

*Helicobacter pylori* (H. pylori) is a type of bacteria associated with stomach ulcers and chronic gastritis.

Bacterial meningitis is a non-viral form of the disease caused by various types of bacteria that cause inflammation of the brain and spinal cord.

Gonorrhea is a sexually transmitted infection caused by the bacteria *Neisseria gonorrhoeae*.

### **Treating bacterial infections.**

Most bacterial infections need to be treated with antibiotics. The choice is based on the type of bacteria. Diagnosis can be made by testing blood or urine samples, but is sometimes made presumptively (based on a study of the symptoms and circumstances leading up to the infection).

If you get a bacterial infection and need antibiotics, you should take your prescribed medication and finish the full course of treatment to prevent the development of antibiotic resistance.

**In summary**, viruses and bacteria, which are studied within the framework of Microbiology, are the main microorganisms that affect human health. Although they may seem similar in appearance, they are fundamentally different in terms of their biological structure, life activity, and reproduction mechanisms. Viruses have a non-cellular structure and can only function inside the cells of a living organism. Therefore, the diseases they cause, such as COVID-19, are often closely related to the immune system and are not effective in treating them with antibiotics. Bacteria, on the other hand, are living cellular organisms that can live independently, and some species cause various infectious diseases in the human body and are often treated with antibiotics. The mechanism of disease is also different: viruses cause damage by invading a cell and multiplying inside it, while bacteria cause disease by producing toxins and inducing inflammatory processes. A deep understanding of these differences is important not only for the correct diagnosis of diseases, but also for the selection of effective treatment measures.

Today, the prevention of viral and bacterial infections remains one of the most pressing issues in the global health system. Therefore, by observing hygiene





rules, using vaccines, and strengthening immunity, the risk of diseases caused by these microorganisms can be significantly reduced.

In general, knowing the differences between viruses and bacteria serves as an important scientific and practical basis for improving medical knowledge, forming a healthy lifestyle for the population, and combating infectious diseases.

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