

Short Communication

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## **Bacteriophage Therapy: A Short Commentary**

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## SHORT COMMUNICATION

The therapy of using bacteriophages may sound new, but actually it's not. These were first discovered twice at the beginning of the 20<sup>th</sup> century and were often used against infections in some places of Russia and Eastern Europe. These were first isolated in 1917 by d'Herelle, from the feces of convalescing dysentery patients at the Pasteur Institute in Paris. The viral nature of bacteriophages was recognized in 1940 for the first time after the advent of the electron microscope [1]. But as early as in 1945, Sir Alexander Fleming discovered Penicillin as an antibiotic and further rise of antibiotics abandoned most of the phages, particularly in the west, making antibiotics as one of the greatest achievements in the history of medicine as antibiotics showed the true definition of what a treatment should be and how it should work [2].

Antibiotics are medicines that fight bacterial infections and can save a number of lives if used properly. Whenever an antibiotic is taken, several sensitive bacteria get killed, leaving resistant germs to grow and multiply leading to infections that are not cured by certain antibiotics. This is one of the reasons why today, just 50 years after the discovery of antibiotics, more and more bacteria have developed resistance to antibiotics making antibiotic resistance one of the greatest current threat to global well-being. The worldwide decrease in the effectiveness of antibiotics has contributed to a renewed interest in the use of bacteriophage therapy an alternative approach to target bacterial infections mainly caused by drug-resistant strains. Phage therapy around the globe has been hailed as an answer to the overlying problems associated with antibiotics.

Bacteriophages also known as 'Intelligent drugs', frequently called phages, like other viruses are obligate parasites using a host microorganism to multiply and spread. Phages are lifeless outside of cells, so to start the process of killing the bacteria, they first recognize and land on a specific host bacterium on the basis of unique surface proteins and receptors. The phage at this point injects its DNA into the bacteria. The DNA copies itself, which means the phage multiplies within its host and the newly packaged phages escape from the cell by producing toxic chemicals that rupture the bacterial host from back to front, thus infecting even more bacteria. This is one of the promising methods where the virus infects and kills bacteria showing how bacteriophages acts as natural enemies of bacteria [3].

A well-developed phage could have numerous advantages over antibiotics. First, phages are very specific about their target bacteria and thus do not cause selection of resistances in the useful bacteria that reside in and on the body [4]. Second, phages have demonstrated the ability to clear biofilms, which is a thick viscous layer that bacteria develop to protect themselves from antibiotics [5]. Third, phages are inherently non-toxic as they consist mainly of nucleic acids and proteins [6]. They multiply at the site of infection until there are no more bacteria. Fourth, phages are versatile in terms of formulation development and can be applied in the form of liquids, creams, or impregnated into solids. These formulations are even suitable for administrating via different routes [7].

Despite of all these pros, there are few concerns about using phages as antibacterial agents. First, to prepare phages cleanly that is to isolate live phages from dead bacterial growth, as this dead bacterial cell mass if given as medication to the patient could trigger a deadly immune response. Second, to obtain the right concentration of phages, otherwise, the final product would not be capable of treating infectious diseases. Third, phage selection takes time as it has to be done with care because of the specific nature of phage to infect bacteria. In addition to this, there are few concerns about its safety and efficacy. However, with improving technology and continuous research on phage therapy, it is clear that phages can also be used efficaciously without exhibiting any major safety concerns.

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The usage of phages is broadly considered feasible for topical and localized use, for instance in Staphylococcus aureus bacterial sinusitis [8], Clostridium difficile bowel infection [9], burns [10] and wounds [11]. Currently, phages are being used as a therapeutic agent mainly in Russia and Georgia. Even, a whole phage therapy unit has been established in Wroclaw, Poland, being the first phage therapy center in the European Union [12].

Maybe the time has arrived to consider coming back to where we were numerous decades ago and moving phage from our last resort to our first line of defense against antibiotic-resistant microorganisms.

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