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Bacteriophages Benefits and Drawbacks in the Treatment of Bacterial Infections

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Introduction

Bacteriophage is a type of virus that infects bacteria. It is also known as phage or bacterial virus. Frederick W. Twort in the United Kingdom (1915) and Félix d'Hérelle in France discovered bacteriophages independently (1917). To describe the agent's bacteriocidal ability, D'Hérelle developed the term bacteriophage, which means "bacteria eater." Bacteriophages can also infect archaea, which are single-celled prokaryotic organisms.

There are thousands of different forms of phages, each of which can only infect one or a few types of bacteria or archaea. Inoviridae, Microviridae, Rudiviridae, and Tectiviridae are only a few of the virus families that phages belong to. Phages, like all viruses, are basic organisms with a genetic material (nucleic acid) core wrapped by a protein capsid. The nucleic acid can be double-stranded or single-stranded, and it can be DNA or RNA. An icosahedral (20-sided) head with a tail, an icosahedral head without a tail, and a filamentous form are the three fundamental structural types of phage.

A phage adheres to a bacterium and inserts its genetic material into the cell during infection. Following that, phages normally go through one of two life cycles: lytic (virulent) or lysogenic (lysogenic) (temperate). Lytic phages use the cell's machinery to produce phage components. They then lyse the cell, releasing additional phage particles in the process. Pseudolysogeny occurs when a bacteriophage enters a cell but neither co-opts cell-replication machinery nor integrates stably into the host genome [1]. Lysogenic phages insert their nucleic acid into the chromosome of the host cell and multiply with it as a unit without destroying the cell. When a host cell experiences unfavourable growth conditions, seudolysogeny appears to play a key role in phage survival by allowing the phage genome to be preserved until the host growth conditions improve. New phage particles are created continually over lengthy periods of time in chronic infection, although there is no visible cell death.

In laboratory research, phages have played an essential role. Type 1 (T1) to type 7 phages were the first to be examined (T7). T2, T4, and T6 phages from the T-even family were employed as model systems for studying virus growth. In the year 1952, In a renowned experiment in 1952, Alfred Day Hershey and Martha Chase employed the T2 bacteriophage to show that only the nucleic acids of phages can cause disease.

The experiment's findings backed with the hypothesis that DNA is the genetic substance. Bacteriophages (BPs) are bacteria-infecting viruses that kill bacteria without harming human or animal cells. As a result, it is thought that they can be used to treat bacterial infections alone or in combination with antibiotics.

There are no bacteria that can't be lysed by at least one BP, in theory. In this aspect, BPs are far more effective than antibiotics, because, while some antimicrobial medications have a wide spectrum of activity, no antibiotic exists that can kill all bacterial species. The most appealing feature of BPs, however, is their specificity of action, or their ability to destroy only the pathogens that they recognise [2]. They have a very restricted spectrum of activity, avoiding the most serious issue directly associated to antibiotic administration, namely, the impact on the entire microbiome due to the eradication of potentially beneficial bacteria, as well as the overgrowth of potentially harmful bacteria. BPs have been used without changing the microbiota in both animals and people, according to various research. Oral treatment of four T4-like BPs that are effective against diarrhea-associated E. coli did not cause any damage to non-pathogenic bacteria of the same species in mice.

References

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