Diabologic: Bacteriophage

by Frank Dolinar

On April 4, 2008, I heard an interesting segment on NPR's Talk of the Nation Science Friday, titled "Using 'Phage' Viruses to help fight Infection". An old treatment for disease has acquired a new lease on life. (The NPR podcast is available at http://www.npr.org/templates/story/story.php?storyId=89380684)

Before modern antibiotics, some researchers saw a particular class of viruses, called bacteriophages (aka "phages"), that can seek out and destroy bacteria as candidates for fighting infections. Unfortunately, in the early part of the 20th century, we didn't know enough about these viruses, and how and why they worked. Therapies were too often a hit or miss proposition. Thus, when wide-spectrum antibiotics came along, most of the world dropped phage research.

Now, however, as organisms are developing resistance to antibiotics, as the cost of developing new antibiotic drugs rises to the realm of astronomy, and as our understanding of how phages work has grown, phage research is finding new favor.

The Wikipedia has a very nice article about phages, available at http://en.wikipedia.org/wiki/Bacteriophage I call your attention to the History section of that article where it describes the work of: French-Canadian microbiologist Félix d'Hérelle, working at the Pasteur Institute in Paris, announced on September 3, 1917 that he had discovered "an invisible, antagonistic microbe of the dysentery bacillus". For d'Hérelle, there was no question as to the nature of his discovery: "In a flash I had understood: what caused my clear spots was in fact an invisible microbe ... a virus parasitic on bacteria." D'Hérelle called the virus a bacteriophage or bacteria-eater (from the Greek phagein meaning to eat).

Phages are classified by the International Committee on Taxonomy of Viruses (ICTV) (http://www.ncbi.nlm.nih.gov/ICTVdb/Ictv/ICTVindex.htm) according to their morphology and the structure of the nucleic acid they contain, i.e. single strand DNA (aka ssDNA), dsDNA, ssRNA, dsRNA. Since bacteriophages are viruses, they are significantly smaller than the bacteria they destroy, with typical sizes between 20 and 200 nanometers (nm). For comparison, the human DNA molecule is about 2.5 nm in diameter and the typical human hair is about 100,000 nm in diameter.

According to the website of the Society for General Microbiology (http://www.sgm.ac.uk), researchers presented information at the society's 162nd meeting, held in Edinburgh at the beginning of April 2008, on incorporating bacteriophages into dressings for wounds and cleaning materials used in hospitals. The hope is that the phage-based approach will provide new weapons in the battle against dangerous bacteria.

When most of the rest of the world dropped phage research in the early 20th century, phages continued to be used and progressively better understood in the former Soviet Union and Eastern Europe. Today, they are seen as a possible therapy against multi drug resistant strains of many bacteria because we now know precisely how they work and which phages attack which bacteria – because each phage attacks and kills only the bacteria it is programmed for, and usually there is only one.

If you are interested in seeing how this process works, Encyclopedia Brittanica OnLine has a short animation available at http://www.britannica.com/eb/art-68574/The-cycle-of-infection-results-in-the-death-of-the?articleTypeId=1. It is informative and easy to understand.

As far as bacteria are concerned, phages are targeted, deadly, and don't bother anything else. From the human perspective, this means phages can be targeted to specific diseases without side-effects. Intralytix (http://www.intralytix.com/), a ten year old bacteriophage research and development company in Baltimore, is marketing a number of treatments / therapies using bacteriophates. According to its website, Intralytix is "using its core bacteriophage technology to develop novel natural products for use in food processing, environmental clean-up, sanitation, consumer products, and problems of antibiotic resistance in human therapy."

In 2008, phage research sounds very much like an idea whose time has come.

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