Part 5.2 **Phage therapy in humans**

Slide number and description:

1) Phage therapy in human medicine
2) Phages as antibacterial agents have been employed already for more than 100 years to treat bacterial infections in humans. The process is called phage therapy.
   At the beginning of 20th century two scientists, Frederick Twort (1915) and Félix d'Herelle (1917) independently observed for the first time virus-associated cell lysis of *Staphylococcus aureus* and *Shigella sp.* This occurred about 20 years before penicillin, the first antibiotic.
   Unfortunately, due to antibiotic era most of the further studies and phage therapy were continued only in Georgia, Russia, Poland, USA and France. People thought it wasn't really necessary because of our successful antibiotics. Recently this "old-new" therapy is again intensively studied, due to the spread of antibiotic resistant bacteria.
3) In this movie you can see how efficiently and fast bacteriophages are killing pathogenic bacteria called *Pseudomonas aeruginosa*. Time is presented in hours.
4) Phages exhibit several advantages, such as: 1) high diversity and abundance; 2) bacteriolytic activity; 3) high specificity to a specific bacterial species; 4) they present low inherent toxicity; 5) phages have a minimal influence on natural bacterial flora; 6) they can work well together with other phages that have different lysis mechanisms and/or bacterial surface receptors in cocktail preparations. There are also examples where phages and antibiotics work well together; 5) it is self-dosing therapy; 6) and the costs of preparation are low. This makes phages very attractive alternative or complementary antibacterial therapy.
5) Felix d'Hérelle treated with phages several children suffering from severe dysentery in Paris. Further phages were used in the treatment of cholera or to cure a "hopeless" case of staphylococcal bacteremia. Phage therapy was also helpful in the treatment of patients with chronic orthopaedic resistant infections, such as those with hip prostheses infections or with infected diabetic ulcers. The mortality rate of people with conditions such as typhoid fever, acute colitis, peritonitis, prostate and urinary tract infections, furunculosis, sepsis significantly decreased after phage administration.
   Many years of phage therapy conducted on humans in Tbilisi (Georgia) and Wrocław (Poland) present high success rate in treatment of topical, internal and respiratory bacterial pathogens. Phage preparations, such as Georgian "Intestiphage", that targets about 20 different pathogenic gastrointestinal bacteria or "Pyophage", containing phages targeting *Staphylococcus, Streptococcus, Pseudomonas, Proteus* and *E. coli* are available to the public without prescription in Georgia and Russia. "Pyophage" also has been incorporated into a polymeric bandage called PhagoBioDermch, where phages act along with other active ingredients and can be applied on various wounds.

In Poland at Hirszfeld Institute phages are used to treat e.g. skin infections caused by *Pseudomonas, Staphylococcus, Klebsiella, Proteus*, and *E. coli*.
Till this day patients from around the world with incurable infections are travelling to the phage centres in Georgia, Poland and Russia with the hope of finding the cure.

6) Recently in Europe a large multi-center phase II clinical trial funded by the European Commission was lunched, called PhagoBurn project, that tests phage cocktails against *E. coli* or *P. aeruginosa* for the topical treatment of infected burn wounds. Importantly, also pharmaceutical companies start to be more and more interested in phage based products. On the picture you can see phage treatment of the wound infected with multidrug-resistant *S. aureus* with the use of PhagoBioDerm™ from Intralytix company.
7) Here I am presenting you important literature about phage therapy in medicine
8) Also many doctors and patients want to share their story and experience with phage therapy. Here you can find some links to movies that tell their story.