

Bacteriophage therapy

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Bacteriophages (or just phages) are naturally-occurring viruses that infect and kill bacteria. They are remarkably numerous, diverse and easily found, for example in sewage and dog faeces. Each phage typically has a narrow host range, infecting only certain strains of a particular bacterial species. Yet a large majority of bacterial species studied to date play host to bacteriophages, explaining the remarkable diversity. Phages were discovered just over 100 years ago and were first used to treat bacterial infections in domestic animals and people in the 1920s. Phages grown in simple broth cultures of host bacteria were used successfully to treat salmonellosis in chickens, bacillary dysentery in children and cutaneous furuncles and carbuncles in adult humans. Phages have been safely administered orally, topically, intravenously, directly into infected lesions and via inhaled aerosol. In many parts of the world, interest in bacteriophage therapy waned after penicillin became available. Interest continued in France and parts of Eastern Europe. In Georgia, phages continue to be used to treat human bacterial infections, for example diabetic foot ulcers. During the 1980s, veterinarian H. Williams Smith and colleagues investigated phage therapy in the UK. They sought to prevent and treat severe *Escherichia coli* diarrhoea in calves, piglets and lambs. In 1987 they showed that severe, experimental *E. coli* diarrhoea in calves could be cured by a single dose of 100,000 phage particles and could be prevented by doses as low as 100 particles. They obtained their phages from ordinary sewage. The worsening antimicrobial resistance crisis has recently led to resurgent interest in bacteriophage therapy. Importantly, phages can kill their host bacteria regardless of whether or not the host is antimicrobial drug-resistant. This is because drug resistance usually has nothing to do with phage resistance. There has recently been a marked increase in the number and quality of research publications dealing with phage therapy, mostly for use in human medicine but including some veterinary papers. A few promising publications have described successful, topical phage therapy of *Pseudomonas aeruginosa* otitis externa in dogs. Consequently, a veterinary phage product for treatment of *Pseudomonas* otitis externa in dogs (containing six different bacteriophage strains) was licensed and became commercially available in Europe. There have been some proof-of-concept studies. A New Zealand-based research group showed that bacteriophages readily found in sewage could kill a large proportion of different uropathogenic canine and feline *E. coli* strains. A very recent publication described the isolation and characterisation of phages with preferential activity against methicillin-resistant *Staphylococcus pseudintermedius* strains, mainly from Europe and North America. The anti-staphylococcal phages were isolated from canine faeces. Despite the fact that bacteriophages have been used to treat bacterial infections for nearly 100 years, surprisingly little has been published about their use in companion animals. What has been published looks promising. Bacterial skin diseases of dogs (including otitis externa) have been studied the most, although only

to a small extent at this stage. Phage therapy represents a promising and potentially fruitful area of study for companion animal researchers in the future.

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