Phage-antibiotic synergy inhibited by temperate and chronic virus competition

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The canonical bacteriophage is obligately lytic: the virus infects a bacterium and hijacks cell functions to produce large numbers of new viral particles which burst from the cell. Viruses of this type are well-studied, but there exist a wide range of coexisting virus lifestyles that are less well understood. Temperate viruses exhibit both a lytic cycle and a latent (lysogenic) cycle, in which viral genomes are integrated into the bacterial host. Meanwhile, chronic (persistent) viruses use cell functions to produce more viruses without killing the cell; chronic viruses may also exhibit a latent stage in addition to the productive stage. Here, we use a mathematical model and experimental data from *Pseudomonas aeruginosa* to study the ecology of these competing viral strategies. Understanding the ecology of *P. aeruginosa* and its phages is critical to controlling bacterial infections in humans, especially when bacteria are resistant to antibiotics. Our analysis reveals the conditions under which certain antibiotics can be effectively used in synergy with naturally occurring phages to treat *P. aeruginosa* infections in immunocompromised humans, as well as the conditions under which phages and antibiotics act antagonistically during infection control.