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Modeling the interactions between pathogenic bacteria, bacteriophage and immune response CHUNG YIN (JOEY) LEUNG, JOSHUA S. WEITZ, School of Biology and School of Physics, Georgia Institute of Technology — The prevalence of antibiotic-resistant strains of pathogenic bacteria has led to renewed interest in the use of bacteriophage (phage), or virus that infects bacteria, as a therapeutic agent against bacterial infections [1]. However, little is known about the theoretical mechanism by which phage therapy may work. In particular, interactions between the bacteria, the phage and the host immune response crucially influences the outcome of the therapy. Few models of phage therapy have incorporated all these three components, and existing models [2] suffer from unrealistic assumptions such as unbounded growth of the immune response. We propose a model of phage therapy with an emphasis on nonlinear feedback arising from interactions with bacteria and the immune response. Our model shows a synergistic effect between the phage and the immune response which underlies a possible mechanism for phage to catalyze the elimination of bacteria even when neither the immune response nor phage could do so alone. We study the significance of this effect for different parameters of infection and immune response, and discuss its implications for phage therapy. References: [1] C. Potera, Environ. Health Perspect. 121, A48 (2013). [2] B. R. Levin and J. J. Bull, Nature Rev. Microbiol. 2, 166 (2004).

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