Turning Over a New Phage: A Novel Approach to Phage Therapy

Kang, Emily (School: Canyon Crest Academy)

The increasing incidence of antibiotic resistance in bacteria necessitates the development of a new approach to target such infections without the constant abuse of antibiotics. This project tests alternatives to phage cocktails, the current standard for bacteriophage therapy, in order to develop a sustainable treatment option. To test a sequential approach to phage therapy, E. coli was cultured with T1 phage, with a single addition of T4 phage after varying periods of time. To model a phage cocktail, both T1 and T4 phage were cultured with E. coli; kinetic growth curves were created for both methods. Based on the results from the sequential method, a computational model was created using Matlab to map growth dynamics for phage and bacteria based on the acquisition of resistance. Both the phage cocktail and sequential approach effectively eradicated the bacterial population without the emergence of resistance. The phage cocktail was initially faster in killing bacteria than the sequential method, but both methods displayed a similar end result. However, bacteria grown with only one phage eventually gained resistance to the single phage. Sequential phage treatment successfully eliminated a population of bacteria, whereas bacteria grown with only one phage developed resistance. With the method of applying phage sequentially, only the phage necessary to control an infection are used, minimizing exposure. In contrast, current phage cocktails risk exposing bacteria to all of the phage in stock, allowing the potential for multiphage resistance. Future studies could develop the computational model by determine the optimal interval between phage additions based on the infection mechanisms of the phage and the specific growth rates of the bacteria and phage in question.

Awards Won:

Second Award of $1,500