Bacteriophage Resistance in E. coli Impacts Sensitivity to Antibiotics

Zheng, Maya (School: Massachusetts Academy of Math and Science at WPI)

Antibiotic resistance in bacteria is a growing medical problem that has resulted in significant increases in the severity of bacterial infections and the cost of healthcare. These consequences have motivated research into alternative antimicrobial treatments such as phage therapy, which uses lytic bacteriophages (or phages) to infect and destroy bacterial pathogens. Bacteriophages have also been shown to impact antibiotic sensitivity in their host bacteria by trading-off antibiotic resistance for bacteriophage resistance, thereby making the bacterial pathogen more sensitive to antibiotics. To observe this trade-off, E. coli was exposed to phage T4 and phage-resistant mutants were selected to examine their sensitivity to the antibiotics colistin, vancomycin, and ampicillin in comparison to the ancestral strain. The minimum inhibitory concentration (MIC) of vancomycin was lower in E. coli strains that were resistant to phage T4, likely due to modifications to OmpC. The MIC for colistin also decreased, likely due to modifications to LPS, while the MIC for ampicillin remained the same. These results show that the development of bacteriophage resistance impacts E. coli's sensitivity to different antibiotics, demonstrating the efficacy of phage steering. Using E. coli as a model organism, it is reasonable to believe that similar phage-bacteria relationships occur in other multidrug-resistant (MDR) bacteria. The discovery of bacteriophages that can steer the evolution of problematic MDR bacteria, such as MRSA and P. aeruginosa, could open new paths to treat patients with these infections.

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