Phage Foundry: A High-Throughput Platform for Rapid Design and Development of Countermeasures to Combat Emerging Drug- Resistant Pathogens

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At its current rate, the rise of antimicrobial-resistant (AMR) infections is predicted to paralyze industries and healthcare facilities while becoming the leading global cause of loss of human life. With limited new antibiotics on the horizon, society is ill-equipped to respond to the inevitable AMR pandemic. As noted in American Pandemic Preparedness Plan and DOE's Biopreparedness report, to be prepared for any natural or human-made infectious disease outbreaks countries urgently need to invest in foundational knowledge necessary to develop alternative therapies that can be scaled rapidly as new infections emerge. Bacteriophages (phages)—viruses targeting bacteria—offer a powerful alternative approach to combat AMR bacterial infections. Despite recent advances in using phages to treat recalcitrant AMR infections, the field lacks broad-scale mechanistic understanding of phage-host interactions in clinically and agriculturally relevant bacteria. The ability to rationally design therapeutic phage formulations to overcome AMR pathogens quickly and with seamless adaptability to new pathogens, can revolutionize the approach to combat AMR. With this goal, this team has brought together multidisciplinary and multi-institutional expertise to develop a foundational Phage Foundry platform that integrates in-depth multiscale characterization of phage-host molecular interactions with high-throughput isolation, phage-host coevolution, machine-learning, and engineering design principles to enable rapid development of targeted phage-based therapeutics against AMR pathogens. The team envisions this Phage Foundry platform to serve as an open and integrative knowledgebase available to researchers, clinicians, and industries in a fair and equitable manner, and serves to power biobased economy by developing other phage-based biotechnologies including diagnostics and vaccination strategies to treat emerging viral threats in future.