

Antibiotic-resistant bacteria are one of the greatest threats to global health today. One such dangerous bacterium is *Pseudomonas aeruginosa*, which causes serious infections, especially in people with weakened immune systems or chronic lung diseases. As this bacterium becomes more resistant to available antibiotics, scientists are urgently searching for new ways to fight it.

One promising solution is the use of bacteriophages - viruses that infect and kill bacteria. These so-called “phages” are natural enemies of bacteria and could become an alternative to traditional antibiotics. But while they are very effective at destroying bacteria, we still don’t fully understand how phages affect the inner workings of bacteria like *Pseudomonas aeruginosa*. Do they only kill them, or do they also change how the bacteria behave, evolve, or cause disease?

In this project, we aim to explore how phages interact with *Pseudomonas aeruginosa* on a deeper level. Our goal is to learn how phage infection influences bacterial behavior - such as how the bacteria produce pigments, how they regulate genes responsible for causing disease, and how they develop resistance to phages. We’ll also investigate how phages themselves change in response to bacteria that try to escape them, like an ongoing biological arms race.

To answer these questions, we will use modern scientific tools that allow us to look at which bacterial genes are turned on or off after phage infection, and how the bacterial metabolism changes. We will also grow bacteria and phages together over time to observe how they evolve in response to each other. In addition, we plan to genetically modify some phages to better understand how specific parts of their DNA affect their ability to infect bacteria.

This research is important because it could lead to smarter and more reliable use of phages in medicine. By learning how phages and bacteria influence each other beyond just killing and surviving, we can better predict and manage resistance, improve treatment outcomes, and make sure phage therapy is safe and effective in the long term.

In short, our project will help unlock the secrets of phage-bacteria interactions, which could be crucial in the fight against antibiotic-resistant infections - one of the most pressing medical challenges of our time.