

Overall Research Question:

Do viruses act as reservoirs for antibiotic resistance genes?

Experimental Hypothesis:

Since past studies have shown that antibiotic resistance genes are present in viral DNA taken from environmental samples in low quantities (Balcazar, 2014), if viruses act as a large reservoir for antibiotic resistance genes in the Han River, then it will be possible to identify antibiotic resistance genes from a viral metagenome taken from the Han River.

Experiment 1: Experimental Test

Research Question:

Are there antibiotic resistance genes present in the viral metagenome sampled from the Han River?

Experimental Hypothesis:

Since past studies have identified conserved sites in the sequences of antibiotic resistance genes (Stogios et al., 2014), if antibiotic resistance genes are present in the viral metagenome sampled from the Han River, then the genes identified will contain these conserved sequences.

Experiment 2: Experimental Test

Research Question:

Are there antibiotic resistance genes present in the assembled viral contigs from the metagenome sampled from the Han River?

Experimental Hypothesis:

Since viruses are able to integrate bacterial DNA into their genomes using specialized transduction, if viruses are acting as a reservoir for antibiotic resistance genes by carrying them in their genomes, then the antibiotic resistance genes will be present in the predicted viral contigs.

Experiment 3: Experimental Test
Research Question:

Are the antibiotic resistance genes encoded in viral contigs functional?

Experimental Hypothesis:

Since antibiotic resistance genes protect their host from antibiotics, if the antibiotic resistance genes being carried in viruses are functional, then bacteria transformed with the antibiotic resistance genes will have a higher minimum inhibitory concentration than bacteria without the antibiotic resistance genes.

Balcazar, J. L. (2014). Bacteriophages as Vehicles for Antibiotic Resistance Genes in the Environment. *PLoS Pathogens*, 10(7), e1004219.

<https://doi.org/10.1371/journal.ppat.1004219>

Stogios, P. J., Kuhn, M. L., Evdokimova, E., Courvalin, P., Anderson, W. F., & Savchenko, A. (2014).

Potential for Reduction of Streptogramin A Resistance Revealed by Structural Analysis of Acetyltransferase VatA. *Antimicrobial Agents and Chemotherapy*, 58(12), 7083–7092.

<https://doi.org/10.1128/AAC.03743-14>