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2024 SEA Faculty Meeting Abstract

Hope College

Holland MI

Corresponding Faculty Member: Joseph Stukey (stukey@hope.edu)

A tale of two immunity repressors: studies from K1 and F2 mycobacteriophages

Davi Zola de Araujo, Dulcinea Licavoli, Jairus Meer, Joseph Stukey

Phage immunity repressors are DNA-binding proteins that repress gene transcription. They play a critical role in maintaining phage lysogeny, and as a prophage, provide the lysogen an effective defense mechanism against repeat phage infections. Twitch and Peel are two nearly identical K1 mycobacteriophages isolated at Hope College in 2013 and 2014, respectively. Their genomes are 59,711 bp in length and differ at just three base positions, one of which is in their immunity repressor genes that alters an amino acid in an alpha helix predicted to interface with DNA. We hypothesized that this difference could impact the actions of the immunity repressors. To test this hypothesis we are comparatively examining lysogeny frequency and switch rates in both phages. Lysogeny frequency was different and always higher in Peel. Further, Twitch lysogen colonies tended to be smaller in size, perhaps reflecting decreased lysogen stability. A lysogen switch rate analysis is underway; we predict a higher switch rate for Twitch. Our second immunity repressor story involves Soul22, a temperate F2 phage with two immunity repressor genes. Although both are most similar to gene products of Cluster F mycobacteriophages, one (Soul22\_49) is exclusively associated with Cluster F mycobacteriophages, while the second (Soul22\_44) also shows strong similarity to immunity repressors found in mycobacteriophages of clusters A, C, J, K, and Rhodococcus phages of cluster CA. Further, Soul22\_44 may actually be a functional cross cluster immunity repressor as an F2 Soul22 lysogen shows strong resistance to infection by several A1 mycobacteriophages. Work to delete Soul22\_44 and test its predicted and essential role in providing that resistance to A1 mycobacteriophages is underway.