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Bacteriophages Marteena and Nubi: Distinct Clusters United by Shared Phams

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Bacteriophages are viruses that replicate within a bacterial host. Due to their size and mode of replication, phages are far more abundant than bacteria or any other organism. We isolated six bacteriophages of *Gordonia terrae* CAG3 in the fall of 2018. DNA extracted from one of these, Marteena, was submitted to the Pittsburgh Bacteriophage Institute for sequencing. Marteena was isolated from soil collected on the campus of North Carolina A&T State University. Marteena is in subcluster CY1. Its genome is 50531 base pairs in length with a 66.6% GC content. Through isolation, purification, and computational analysis, we were able to articulate the similarities and differences between Marteena and Nubi, a second bacteriophage of *Gordonia terrae* isolated at N. C. A&T in the fall of 2017. Nubi, a cluster DC phage, has a genome length of 58718 base pairs and a 67.9% GC content. Nubi and Marteena exhibit a temperate life cycle. Some host cells are lysed following infection, releasing newly replicated phage particles, while other host cells become lysogens. Our research involved two major activities, isolation of the phage and annotation of the genome. The initial process of isolation was accomplished through enriched isolation and amplification of the phage particles using serial dilutions. DNA Master, GeneMark, HHPred, NCBI BLAST, phagesdb, Phamerator, I-TASSER, SEA-PHAGES.org, and PECAAN were employed to annotate, compare, and hypothesize on the function of genes and origin of differences present in the two phages. Phylogenetic trees generated from single gene comparisons allowed us to evaluate the placement of Nubi and Marteena into clusters and sub-clusters. BLAST revealed that Nubi and Marteena contain genes similar to those found in a variety of different bacteria. Could this be due to the evolutionary advantage of producing these bacterial proteins, or is it a result of phages assimilating their DNA into the bacterial DNA to hijack replication and produce more phage particles? Even though phages might have a negative reputation, they can also be beneficial through manipulation and utilized to cure lethal bacterial infections. The research, in collaboration with the SEA-PHAGES Program, allows undergraduate students to articulate information through analysis and hypothesize new information.