Enrichment of Bacterial Virulence Factors in Bacteriophages

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Outline

Virulence

Virulence Defined

The capacity of a microorganism to proliferate despite the bodies defenses

Influences on Virulence

- Number of microorganisms
- Composition of the mobile genetic reservoir
- Location of niche
- Host immune capabilities

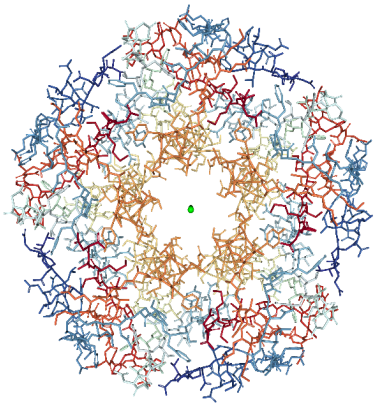
Bacterial Virulence Factors Increases Pathogenesis

Examples of Virulence Factors

- Increased fitness for nutrients
- Host immunity resistance
- Toxin secretion

Pathology from Virulence Factors

Cholera toxin, dysentery, botulism, and food poisoning



PDB Structure of Cholera Toxin

Bacteriophages as a Genetic Reservoir of Virulence Factors

Bacteriophages (Phages)

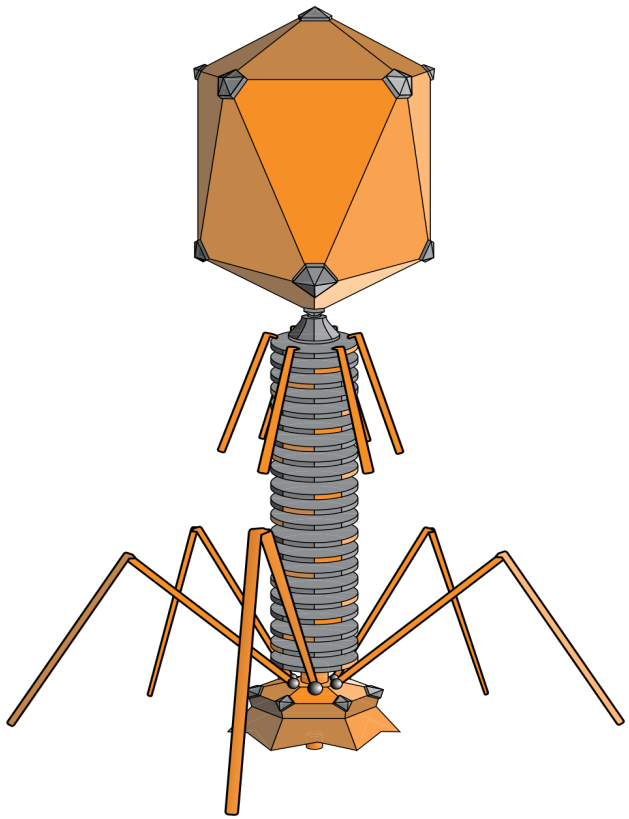
DNA viruses that infect bacteria

Bacteriophages and Pathology

Toxins that cause cholera, dysentery, botulism, and food poisoning all derive from bacteriophage elements.

Prior Studies

Prior studies focus on bacteriophage relationship to disease causing bacteria



Novick, Richard, Plasmid (2003)

Virulence Factor Data Acquisition

Virulence Protein Databases

- VFDB
  Chen, Lihong, et al. Nucleic Acids Research (2005)
- PatricVF
  Wattam, AR, et al. Nucleic Acids Research (2017)

Virulence HMMs

- pFam
  Bateman, Alex, et al. Nucleic Acids Research (2004)
- pVOG
  Grazziotin, AL, et al. Nucleic Acids Research (2016)

Phage Protein Database

Methods

BLAST Filters

- evalue < 10e-5
- pident >= 75

BLAST Results

Initial: 1484868 Hits
Post-filtering: 5022 Hits

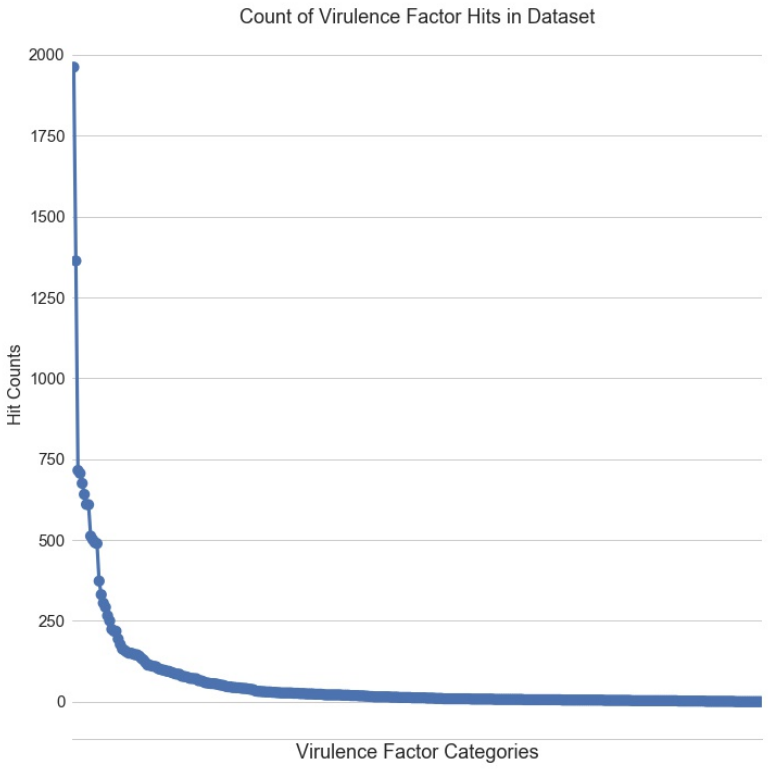
HMM Filters

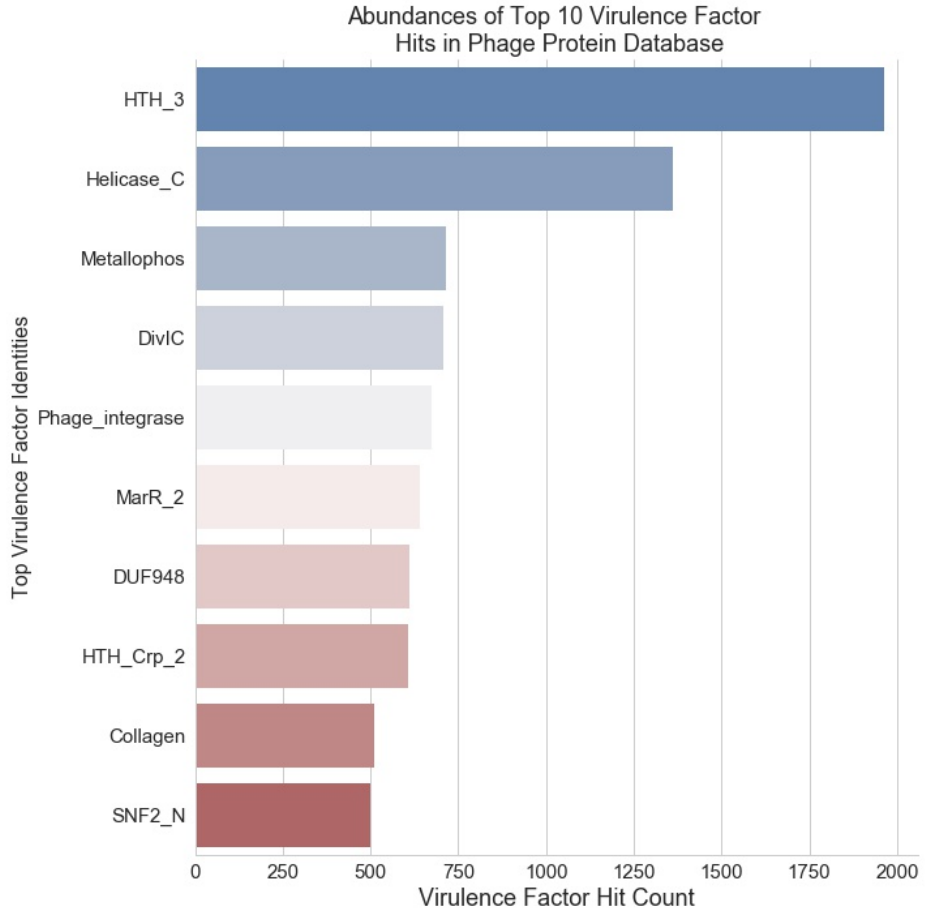
- MSV filter
- bias filter
- Vit filter
- Fwd filter

HMM Results

Post-filtering: 15389 Hits

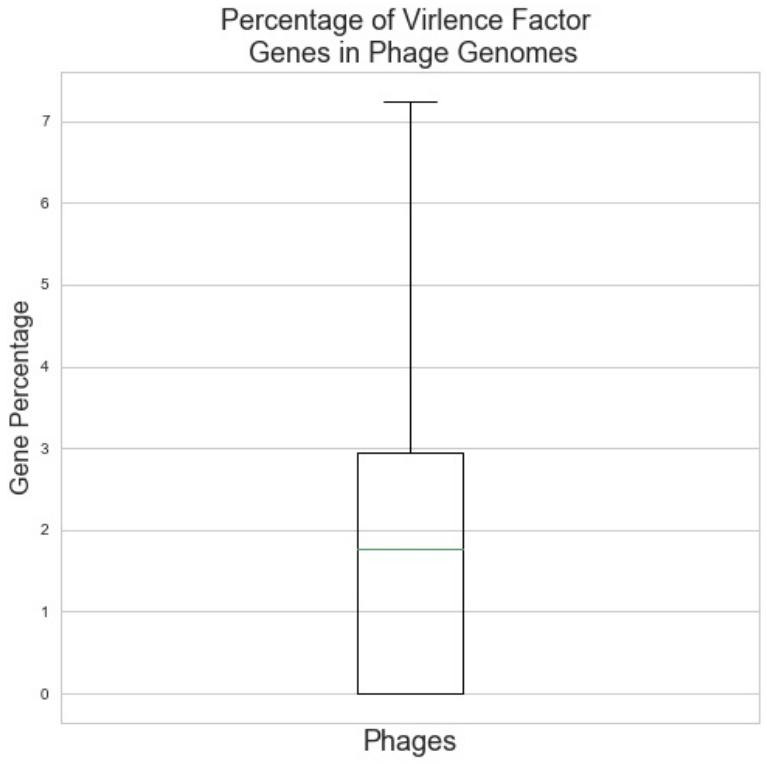
Hit Count Distribution



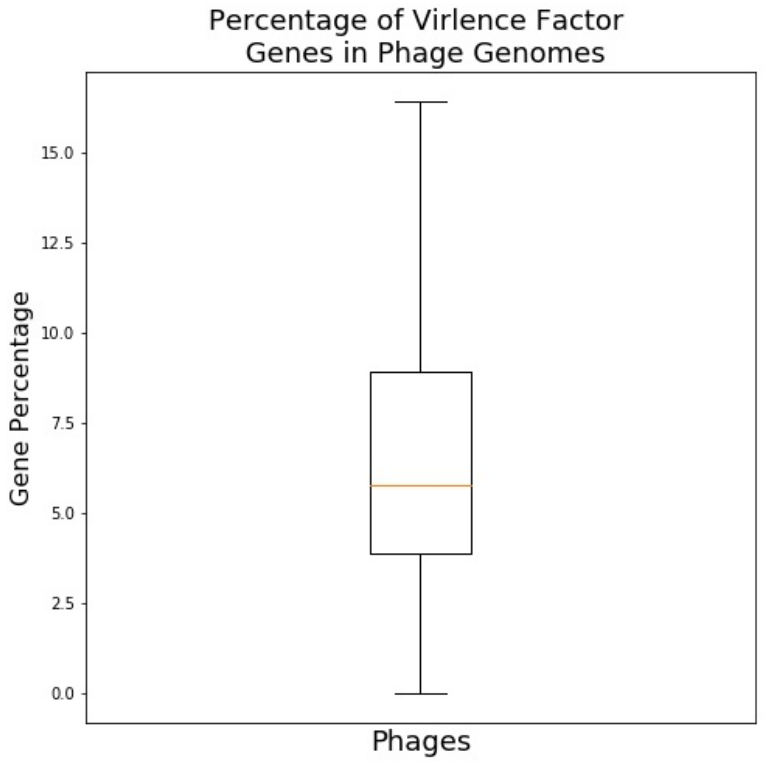


All Phages Distribution of VF Gene Percentages

BLAST

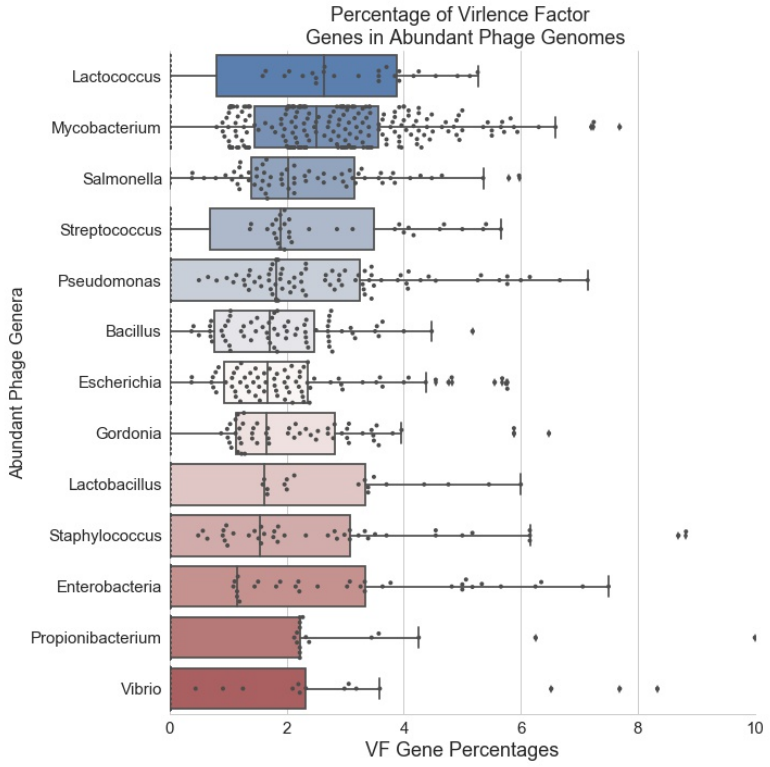


HMM

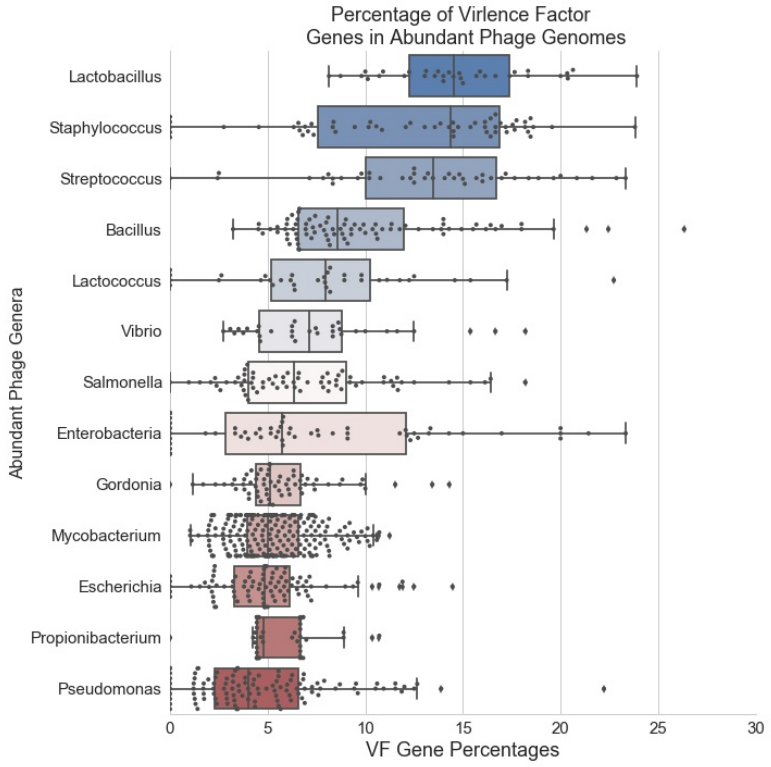


Top Phage Distributions

BLAST



HMM



Clinical Data and Methodology

Data Source

The data consists of 5 normal and 5 CF viromes

Concluding Remarks

Base line

Established Baseline

GRAB

Viral GRAB will contribute to a focus on phages specific to lung infections

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Questions?

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