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Hidden Amun defensive proteins within defense islands broaden protectivity against phage families

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The ongoing arms race between phages and bacteria is a biological struggle for survival where bacteria develop defense mechanisms to resist phage infections. Vibrio cholerae interacts with numerous different lytic and lysogenic phages and strains from the current cholera pandemic acquired over 30 different antiviral defense systems. This project aims to investigate the presence of new single-component defense factors in well-known defense islands.
Using differential RNA-seq and ribosome profiling, we identified a previously unrecognized short open reading frame (sORF) within the 5′ UTR of the CBASS defense system in V. cholerae, encoding an 82-amino-acid protein. We therefore named the sORF for the Egyptian deity Amun. Both systems, Amun and CBASS, are transcribed from the same promoter and confer resistance to different phage families, increasing the protective potential of this genomic region. Amun homologs are widespread across more than 2,000 bacterial genomes and are often linked to operons with known or predicted antiviral roles, making Amun a valuable tool for identifying previously uncharacterized antiviral defense systems. While phage genome replication and viral transcription are only moderately impaired by Amun, host cell lysis and the release of progeny phages are markedly suppressed. Transcriptomic data indicated an altered cAMP response upon viral entry in cells expression Amun. By manipulating the host cAMP production, we showed that Amun-mediated protection required cAMP. Taken together, our data suggest that a small, single-component antiviral effector expands the protective capacity of a defense island.

Reference #1

Reference #2

Reference #3

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