STUDY OF INTERACTIONS BETWEEN SHORT PROKARYOTIC ARGONAUTE AND HFQ PROTEIN

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In recent years, bacterial antiviral defense systems have attracted significant global attention due to their role in uncovering prokaryotic biology and their potential applications in antibacterial therapies and genome editing. The diversity and complexity of these systems necessitate detailed investigation into their distinct mechanisms. Among them, some Argonaute proteins possibly exhibit interactive properties with a bacterial chaperone that modulates their activity.

This study aims to investigate the interaction between the widely conserved bacterial RNA chaperone Hfq and short prokaryotic Argonautes (pAgos). Hfq, an Sm-like RNA-binding protein, promotes base pairing between small RNAs (sRNAs) and their target mRNAs [1]. Because sRNAs are closely associated with stress response pathways, Hfq plays a critical role in bacterial adaptation to fluctuating environmental conditions. Although Hfq is primarily known for its role in translational regulation, evidence suggests functional interplay between Hfq and pAgo systems.

Short pAgos, together with toll/interleukin-1 receptor/resistance protein (TIR), form the heterodimeric abortive anti-infective defense system SPARTA. While the monomeric SPARTA complex detects phage infections through sensing foreign nucleic acid duplexes, the formation of an active tetrameric complex triggers nicotine adenine dinucleotide (NAD) depletion [2]. By analyzing interactions between Hfq and multiple SPARTA homologs, and assessing the influence of Hfq on SPARTA's NADase activity, this study seeks to clarify SPARTA's functional mechanisms and its dependence on auxiliary factors.

Investigating antiviral defense systems and their molecular interactions not only deepens our understanding of bacteria–phage dynamics but also opens new avenues for biotechnological applications and genetic engineering research.

[1] S. Park et al., "Dynamic interactions between the RNA chaperone Hfq, small regulatory RNAs, and mRNAs in live bacterial cells," eLife, vol. 10, Feb. 2021, doi: 10.7554/elife.64207.

[2] B. Koopal et al., "Short prokaryotic Argonaute systems trigger cell death upon detection of invading DNA," Cell, vol. 185, no. 9, pp. 1471-1486.e19, Apr. 2022, doi: 10.1016/j.cell.2022.03.012.