Formation of a membraneless compartment regulates bacterial virulence

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Presenter: Yu-Hao Chen **Date/Time:** 2025/10/09, 16:10 -17:00
Commentator: Dr. Po-Lin Chen **Location:** Room 601, Med College Building

Background:

Attaching and effacing (A/E) pathogens are a group of foodborne pathogens that invade intestinal epithelial cells. The major virulence factor of these pathogens is the type III secretion system (T3SS), which forms a needle-like structure encoded by the *locus of enterocyte effacement (LEE)* genes. This needle-like structure penetrates the host cell and directly injects effectors—proteins that remodel the host cytoskeleton—into the host cell.

Since T3SS is a powerful but energy-consuming system, its regulation is especially important and involves both transcriptional and post-transcriptional mechanisms. Carbon storage regulator A (CsrA), an RNA-binding protein, is one of the known regulators. CsrA can either promote or inhibit translation depending on its targets. In the case of T3SS, CsrA promotes the expression of the master regulator Ler, which in turn enhances the expression of the needle-like T3SS. After the bacteria attach to host cells and inject effectors, an effector-binding chaperone, CesT, is released from the effectors and binds to CsrA, acting as an inhibitor that turns off T3SS expression. However, the inhibition of CsrA through CesT only happens when these pathogens attach host cell, sending effectors and releasing CesT. This paper will discuss what happens if pathogens fail to contact host cells and whether CsrA still plays a role in the regulation of T3SS.

Objective:

In the present study, the authors aimed to discover the regulatory mechanism orchestrated by the assembly of a membraneless compartment via CsrA-RNA interaction in enteropathogenic *Escherichia coli* when they fail to contact host cells.

Results:

The authors first asked whether CsrA is also expressed in bacteria that have not contacted host cells. Unexpectedly, they found a single large focus located at the bacterial periphery. Assuming that the foci might increase over time, they discovered that its intensity actually increases as the bacterial growth phase progresses. The team then examined the content of the foci. Using RNA-seq and LC-MS/MS, they identified the degradosome complex, T3SS mRNAs, and the known CsrA target sRNAs, CsrB and CsrC. Finally, the authors showed that CsrA indeed plays a role in regulating T3SS, switching from supporting to repressing T3SS expression, thereby ultimately reducing pathogenicity to epithelial cells.

Conclusion:

This study provides a new insight into how CsrA regulates T3SS. In addition to stabilizing mRNAs, this RNA-binding protein cooperates with degradosomes, which are anchored to the inner membrane, and ultimately decreases T3SS expression levels.