Bacterial Supramolecular RADAR Against Phage

By YAN Fusheng (Staff Reporter)

Bacteria are constantly under threat from viruses called phages, which can hijack their machinery and replicate within their hosts. To defend themselves, bacteria have developed a variety of sophisticated mechanisms, including the well-known CRISPR-Cas system and the recently discovered RADAR defense system.

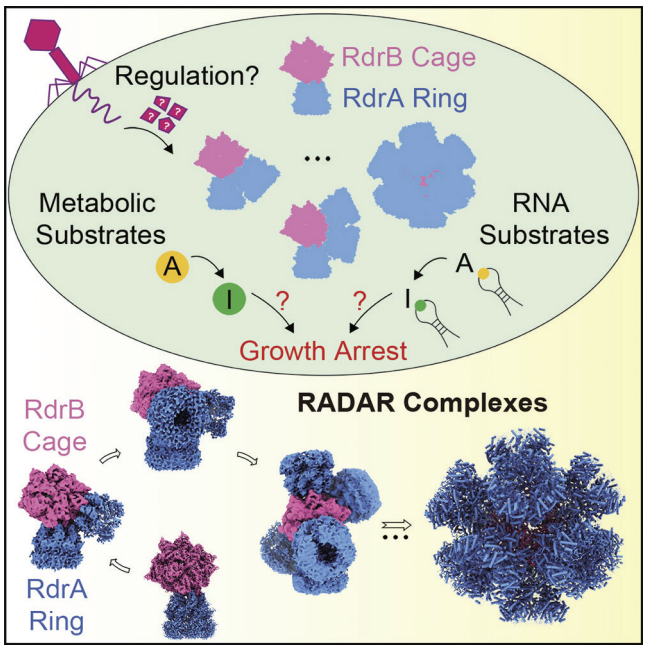
The RADAR defense system involves adenosine-to-inosine RNA editing, a process in which RNA molecules are modified to recognize and destroy viral DNA.

In a recent study, published in *Cell* on February 9, a research team led by Dr. GAO Pu at the CAS Institute of Biophysics (IBP) made a groundbreaking discovery about how bacteria protect themselves from phages through RADAR.

A Supramolecular Machinery of Bacteria's Arsenal

Using cutting-edge cryo-EM imaging techniques, the scientists visualized the structures of two key components of the system, RdrA and RdrB, and their complexes with RNA and ATP. Their findings revealed that RdrA can take on both autoinhibited tetradecameric and activation-competent heptameric rings, while RdrB forms a dodecameric cage. Moreover, up to twelve RdrA rings can dock one RdrB cage, creating a sophisticated supramolecular assembly.

The researchers also discovered the fascinating mechanism by which the system functions. They found that RNA is loaded through the bottom section of the RdrA ring and translocated along its inner channel, likely coupled with ATP-binding status. This results in the precise alignment of deaminase catalytic pockets and RNA-translocation channels, indicating the coupling of RNA translocation and deamination.



Molecular basis of RADAR anti-phage supramolecular assemblies. (Image by IBP)

These findings shed light on the remarkable ability of bacteria to defend themselves against phage attacks through these sophisticated supramolecular assemblies. These new discoveries expand our understanding of bacteria's unique ability to defend themselves against viruses.

A Chance to Go Beyond Bacteria's Arsenal

These findings shed light on the remarkable ability of bacteria to defend themselves against phage attacks

through this sophisticated supramolecular assembly. It can help researchers identify new targets for developing antimicrobial agents and better comprehend bacterial biology.

For example, by understanding how bacteria defend themselves against phages, researchers may be able to engineer phages that are more efficient at infecting and killing bacteria. The development of phage therapies that bypass or overcome this defense mechanism offers new treatments for antibiotic-resistant bacterial infections.

The discovery of the RADAR defense system and its unique supramolecular assemblies may also inspire the development of new biotechnological applications, such as nanomachines or synthetic biology approaches for manipulating RNA or destroying viral DNA.

In any case, it will be exciting to see how the future unfolds for this unique supramolecular machinery.

Reference

Gao, Y., Luo, X., Li, P., Li, Z., Ye, F., Liu, S., & Gao, P. (2023). Molecular basis of RADAR anti-phage supramolecular assemblies. *Cell, 186*(5), 999-1012 e1020. doi:10.1016/j.cell.2023.01.026