Understanding a bacterial immune system one step at a time

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Researchers at the University of Alberta have taken an important step in understanding an immune system of bacteria, a finding that could have implications for medical care and both the pharmaceutical and dairy industries.

In research published in the high impact journal *Nature Structural & Molecular Biology*, Andrew MacMillan and co-workers in his lab have described the first step of the immune response of bacterial cells. Scientists had previously found that a bacterial virus, called a bacteriophage, attacks a bacterial cell by injecting its DNA in to the cell. MacMillan's lab discovered the mechanism by which bacterial RNA is cut into pieces by a specific protein; these pieces then target the invading virus' DNA.

"We are starting at the beginning because we want to understand how this works and how we can use this to basically control bacterial growth," said Matt Schellenberg, a post-doctoral fellow in the MacMillan lab in the department of biochemistry in the Faculty of Medicine & Dentistry. This system could be beneficial for bacteria to fight off invasion of viruses. Alternatively, medical professionals could use knowledge of this system to help fight a human bacterial infection.

According to MacMillan they used a technique called X-ray crystallography to produce high-resolution pictures of a key step in the bacteria's immune response — the production of the targeting RNAs.

"Bacteria have evolved this system to protect themselves against infection," said MacMillan.

As they unfold the mystery of the bacteria cells immune system, which is named the CRISPR system, there are implications for a variety of industrial practices involving fermentation. Everything from cheese and yogurt production to the synthesis of complex pharmaceuticals relies on large scale bacterial fermentation which is at risk of bacteriophage infection with expensive consequences – losing the batch. The labs ongoing work could help these industries boost the immune systems of the "good" bacteria.

The next step for the lab is to uncover the mechanism by which virus' DNA is destroyed.

"We want to use what we've learned so far to examine the actual targeting mechanism," says Macmillan. "This is a complex pathway and there's a lot of exciting biology to still uncover."

Provided by University of Alberta

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