

CRISPR system can promote antibiotic resistance

July 14 2014

CRISPR, a system of genes that bacteria use to fend off viruses, is involved in promoting antibiotic resistance in *Francisella novicida*, a close relative of the bacterium that causes tularemia. The finding contrasts with previous observations in other bacteria that the CRISPR system hinders the spread of antibiotic resistance genes.

The results are scheduled for publication in *PNAS Early Edition*.

The CRISPR system has attracted considerable attention for its potential uses in genetic engineering and biotechnology, but its roles in bacterial gene regulation are still surprising scientists. It was discovered by dairy industry researchers seeking to prevent phages, viruses that infect [bacteria](#), from ruining the cultures used to make cheese and yogurt.

Bacteria incorporate small bits of DNA from phages into their CRISPR region and use that information to fight off the phages by chewing up their DNA. Cas9, an essential part of the CRISPR system, is a DNA-chewing enzyme that has been customized for use in biotechnology.

F. novicida infects rodents and only rarely infects humans, but it is a model for studying the more dangerous *F. tularensis*, a potential biological weapon. The bacteria infect and replicate inside macrophages, a type of immune cell.

Researchers at the Division of Infectious Diseases of the Emory University School of Medicine and the Emory Vaccine Center were

surprised to find that when the gene encoding Cas9 is mutated in *F. novicida* bacteria, they become more vulnerable to polymyxin B as well as standard antibiotic treatments such as streptomycin and kanamycin. They were able to trace the effects of the mutation back to a defect in "envelope integrity." Cas9 regulates production of a lipoprotein, which appears to alter membrane permeability.

"The mutant bacteria are more permeable to certain chemicals from the outside," says David Weiss, PhD, assistant professor of medicine (infectious diseases) at Emory University School of Medicine and Yerkes National Primate Research Center. "That increased permeability also seems to make them more likely to set off alarms when they are infecting mammalian cells."

Graduate student Timothy Sampson, working with Weiss, found that Cas9 mutant bacteria may be more likely to leak bits of their DNA, a trigger for immune cells to get excited. This is a large reason why Cas9 is necessary for *F. novicida* to evade the mammalian immune system, a finding published in a 2013 *Nature* paper.

The regulatory role for Cas9 does not appear to be restricted to *F. novicida*; Weiss's team found that a Cas9 mutant in *Campylobacter jejuni*, a bacterium that is a common cause of human gastroenteritis, also has increased permeability and impaired [antibiotic resistance](#).

The findings add to recent discoveries where Cas9 has been found to be involved in virulence – the ability to cause disease in a living animal or human—in various pathogenic bacteria such as *Campylobacter* and *Neisseria meningitidis*.

More information: A CRISPR-Cas system enhances envelope integrity mediating antibiotic resistance and inflammasome evasion, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1323025111

2013 *Nature* paper - www.ncbi.nlm.nih.gov/pmc/articles/PMC3651764/

Provided by Emory University

Citation: CRISPR system can promote antibiotic resistance (2014, July 14) retrieved 19 April 2024 from <https://phys.org/news/2014-07-crispr-antibiotic-resistance.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.