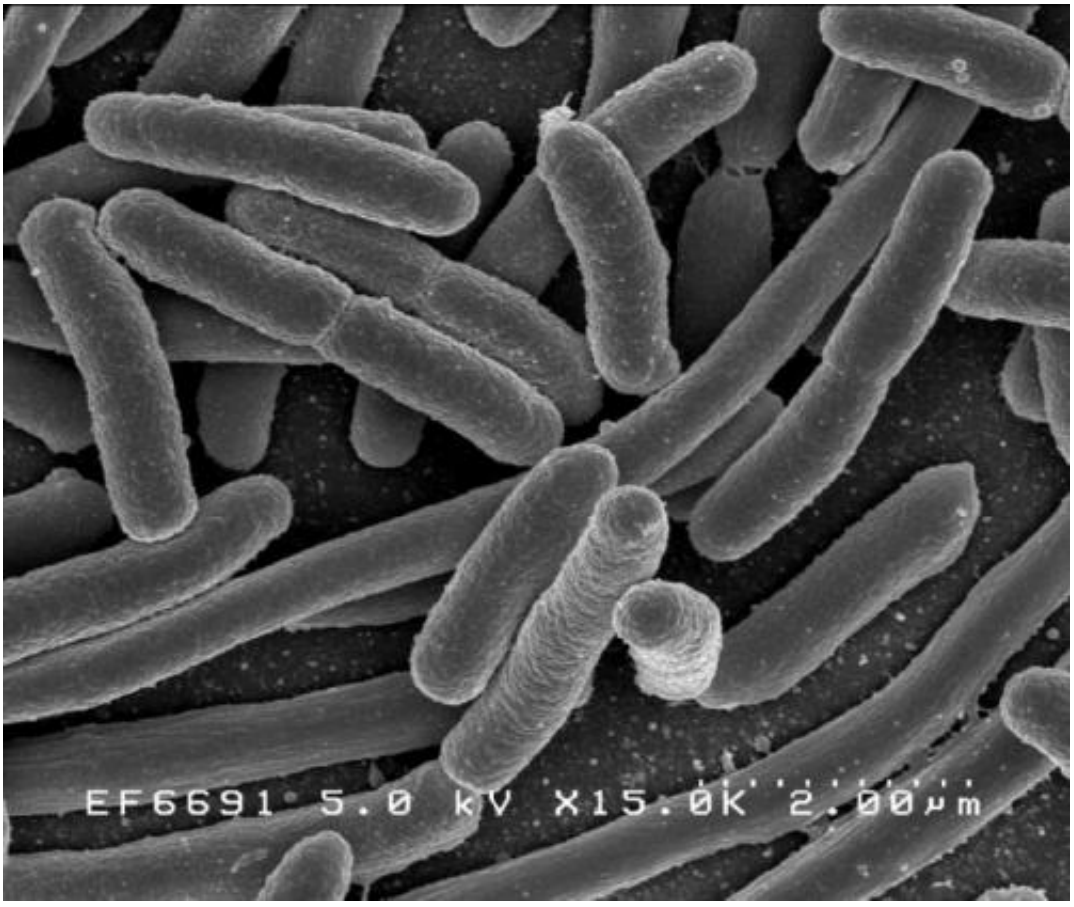
Research efforts yielding major advances in understanding immunological memory

February 19 2015, by Bob Yirka



Escherichia coli. Credit: Rocky Mountain Laboratories, NIAID, NIH

(Phys.org)—Two teams of researchers both working in the U.S. have announced new breakthroughs in better understanding how immunological memory works. Both teams have published their findings

in the journal *Nature*. The first team, made up of members from several academic institutions across the country, describe their study of part of the process by which bacteria fend off secondary viral attacks. The second team, with Rockefeller University, describes a system they devised for in vitro study of immunological memory at the bacterial level. Ido Yosef and Udi Qimron with Tel Aviv University offer a News and Views piece on the work done by the two teams in the same journal issue.

In humans and many other animals, part of the work of immunity involves storing information about previous viral or bacterial attacks so those of the same type can be more easily thwarted in the future. Until very recently, scientists believed this "memory" type of immunity was unique to vertebrates. Over the past few years, researchers have found this assumption to be false—they have found, as one example, that bacteria too have immunological memory that helps them fight off viral infections.

To remember viral infections, bacteria grab short snippets of its DNA during an attack—the snippets are called protospacers and make their way into bacterium DNA. Once entrenched they are called clustered regularly interspaced short pallindronic repeats (CRISPRs)—as a group they are referred to as spacers. The researchers with the first effort sought to uncover how it is that spacers are "chosen" by an individual bacterium in such a way as to prevent damage to its own sequences as pieces are cleaved to allow for retention. They found that a protein called Cas9 drives the selection process.

To learn more about how the immune system works, in all species, studies are done both in vitro and in vivo. Most work done to date at the bacterial level has been conducted in vivo. The team at RU has developed a system whereby future research using an in vitro approach can be used—it is based on *E. coli* memorizing proteins.

Learning more about how the immune system works in simple organisms allows researchers to uncover some of the basic properties involved, which hopefully can be applicable to those in larger organisms, such as human beings.

More information: Paper 1: Integrase-mediated spacer acquisition during CRISPR–Cas adaptive immunity, *Nature* (2015) DOI: 10.1038/nature14237

Paper 2: Cas9 specifies functional viral targets during CRISPR–Cas adaptation, *Nature* (2015) DOI: 10.1038/nature14245

News and Views: Microbiology: How bacteria get spacers from invaders, *Nature* (2015) DOI: 10.1038/nature14204