

Researchers unravel how ticks protect themselves from Lyme bacteria and other microbes

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Everyone agrees that ticks are exceedingly nasty creatures. For hundreds of millions of years, they have survived on Earth by sucking blood from their victims for days, often leaving behind terrible diseases as a thank-you note. In humans, these diseases include many unpleasant and dangerous illnesses, such as Lyme disease, Rocky Mountain Spotted Fever, babesiosis, Tick-Borne Relapsing Fever, and tularemia, to name a few.

No one has ever looked at why ticks, themselves, are able to survive while harboring bacteria, viruses and parasites. Now, for the first time, scientists at the University of Maryland School of Medicine have decoded how the ingenious tick immune system fights a myriad of microbes. The study appeared today in *Nature Communications*.

"This basic science discovery is fascinating, and may pave the ground for new translational approaches that reduce the negative impact of [tick-borne diseases](#) in people," said Joao Pedra, PhD, the senior author on this study and an Associate Professor in the Department of Microbiology and Immunology at the University of Maryland School of Medicine.

Scientists had long assumed that the tick immune system works similarly to that of flies and mosquitoes. But ticks, which have existed on the planet for between 120 million and 443 million years, have taken an entirely different path. Dr. Pedra points out that in evolutionary terms,

ticks are as far removed from insects, as humans are from fish.

"Although the two bugs are seemingly alike, it turns out that the immune system of ticks is quite distinct from insects. Our discovery clarifies the ins-and-outs of how the tick immune system fights bacteria," Dr. Pedra says.

Dana Shaw, PhD, the lead author on the study and a Research Fellow in Dr. Pedra's laboratory, first noticed that ticks were missing crucial genes for a proper [immune response](#). This observation led to the discovery of an entirely new pathway that recognizes three distinct bacteria: the Lyme disease agent, *Borrelia burgdorferi*, and two others that cause rickettsial illnesses, *Anaplasma phagocytophilum* and *Anaplasma marginale*. After identifying components of the immune system, Dr. Shaw was able to block the tick immune response with a molecular technique named RNA interference. She also over-activated the ticks' immune system to get rid of bacteria even more efficiently. "It's really amazing what one can do in science these days. I am very fortunate to lead such talented and driven scientists in my laboratory and to work with great colleagues at Maryland and elsewhere" says Prof. Pedra.

The discovery has several exciting implications. By targeting key molecules - essentially manipulating the tick [immune system](#) - scientists may now try to make ticks less vulnerable to infection by these microbes. If [ticks](#) do not acquire these bacteria in the wild, then they won't be able to transmit the microbes to humans. Dr. Pedra and his colleagues are now pursuing work along these lines to further understand the tick immune response. "This area of research is understudied and we are only beginning to scratch the surface. That is the beauty of it." says Dr. Pedra.

Of tick-borne diseases, Lyme disease is perhaps the most well-known. It exists all over the United States, although it is more concentrated in the Northeast, Midwest and, to a lesser extent, along the Pacific coast.

Researchers estimate that between 296,000 and 376,000 people per year are infected in this country. Lyme disease symptoms can include fatigue, muscle pain, joint aches, memory loss, confusion, headaches and neurological problems.

Provided by University of Maryland School of Medicine

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