

New tool emerging in fight against Lyme disease

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Host-seeking blacklegged tick. Credit: Centers for Disease Control and Prevention (CDC), CC0

As black-legged ticks crawl their way across Michigan, scientists hope a new vaccine in development could make their presence less menacing.

The [vaccine](#) would rob the ticks of a trait that makes them exceptional vectors for Lyme [disease](#): the ability to bite and suck blood without notice, latching on long enough to pass bacteria to their host human.

"Have you ever heard of anybody swatting at a tick bite?" said Dr. Erol Fikrig, an infectious disease researcher and professor at the Yale School of Medicine who is working on the vaccine development. "No. A tick is silent. It feeds on you for a long period of time."

Fikrig hopes the vaccine will cause a person to develop a physical reaction to bites from a black-legged tick, also known as a deer tick, the species that carries Lyme disease bacteria.

In a vaccinated person, the skin around a black-legged tick bite would become itchy, visible and inflamed, similar to what happens around a mosquito bite. The reaction would give someone a chance to remove a tick before it has time to transmit Lyme.

"There are very few people who are going to look at a tick bite, find a tick on them and let it remain," Fikrig said. "They'll pull it off quite quickly."

The vaccine was inspired by a natural phenomenon called acquired tick resistance. Some animals develop a natural resistance to tick spit over time; those animals develop sores around tick bites and ticks that bite them don't eat well, which can cause them to detach early. The vaccine under development is designed to induce a similar response.

A vaccine that targets tick bites has a benefit over a vaccine that targets Lyme disease, since black-legged ticks can carry more bacterium than the one that causes Lyme disease, said Jean Tsao, a Michigan State University associate professor and tick expert.

There is also anaplasmosis, another tick-bite-induced disease whose symptoms include fever, headache, chills and muscle aches but which is difficult to diagnose because it doesn't leave a rash. This disease only becomes worrisome if it isn't treated early with doxycycline, medical experts said.

"We've been talking about Lyme because it's the most important vector-born disease ... but you also have anaplasmosis," Tsao said. "It's a little bit of a distant number two, but still, way more people get anaplasmosis than they do West Nile or Zika or Dengue. And then there are like five other pathogens that this Lyme disease tick transmits. So developing a vaccine against the tick is, I think, in many ways more useful."

Fikrig and a group of university researchers from the East Coast tested the vaccine in guinea pigs and reported their findings in a November issue of *Science Translational Medicine*, which publishes original, peer-reviewed scientific articles.

Guinea pigs that were vaccinated in the study developed redness and irritation as early as 18 hours after they had been bit. Ticks also fed poorly and for less time on the guinea pigs that had been vaccinated, sometimes dying or detaching on their own after 48 hours.

"So far I'm cautiously optimistic" about the vaccine someday being available for humans, Fikrig said. "From what we've seen in the [guinea pigs](#), the results are quite promising."

A Lyme disease vaccine is under development by Valneva and Pfizer. It is in human clinical trials.

As the researchers continue their experiments, the ticks are marching on.

Approximately 35,000 Lyme disease cases are reported annually in the

United States, according to the federal Centers for Disease Control and Prevention. But the CDC said that figure is likely an undercount, since it relies on doctors actively reporting cases. The CDC estimates 476,000 Americans are treated for Lyme every year, a figure that may be inflated by patients who are treated for Lyme without actually being infected.

In 2020, 305 cases of Lyme were reported to the Michigan Department of Health and Human Services, mostly in the state's western counties. That is up from 66 cases reported in 2011.

Black-legged ticks are increasingly widespread through Michigan, MSU's Tsao said. There was very little risk of encountering a Lyme-carrying tick when she moved to the state in 2003. Now, the potential to catch Lyme exists in almost every county. Where the ticks spread, the disease usually is not far behind.

"By 2010, 2015, they were starting to come across the southern counties of the Lower Peninsula," she said. "If you talk to people in Ann Arbor and Ypsilanti, they would say that probably about three to four years ago they started seeing more ticks."

Michigan doctors increasingly encounter Lyme disease in their patients, said Dr. Leonard Johnson, chief of infectious disease at Ascension St. John Hospital in Detroit.

"It used to be rare that we would see it, and it was just in people who had traveled to those areas" where Lyme is common, such as the East Coast or the western Upper Peninsula, Johnson said. "But now we see it fairly frequently during the warm weather months."

It usually takes about 36 hours for a tick to transmit Lyme disease, he said.

People who contract the disease usually develop a bull's-eye-shaped rash around a [tick bite](#). If it isn't treated with antibiotics within a few weeks, Johnson said Lyme can lead to long-term complications including chronic joint inflammation, cardiac disease and neurologic disorders. Those complications require more intensive treatment.

Johnson suggested people check their skin for ticks after spending time outdoors, particularly in wooded areas, and to look for the bull's-eye-shaped rashes.

Most of the patients Johnson treats for Lyme disease didn't know they had been bit by a tick. That's something the vaccine could change.

"It would allow you to get the [tick](#) off before the infection actually occurs," he said. "I think it could be a valuable tool."

The vaccine is still in the early stages of development. Fikrig estimated researchers are in the first year of [vaccine development](#), typically a five- to 10-year process. Although the rapid development of COVID-19 vaccines show the possibilities for a shorter time frame, he said.

"COVID has shown us something different," Fikrig said. "COVID vaccines came in about (a year), but perhaps that was an exception to the rule. It's hard to say yet. But perhaps the experience from COVID may make the development process faster in the future."

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