New test shows potential for detecting active cases of Lyme disease

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George Mason University researchers can find out if a tick bite means Lyme disease well before the bite victim begins to show symptoms.

"If you are bit by a tick, you can't be sure if you will get Lyme disease — that is the biggest problem right now," says Alessandra Luchini, research assistant professor for Mason's Center for Applied Proteomics and Molecular Medicine (CAPMM), who was named one of *Popular Science* magazine's "Brilliant 10" last year.

Luchini and other Mason researchers are evaluating a new type of diagnostic test they developed for humans and their canine pals to pinpoint tiny signs of the bacteria that lead to Lyme disease.

A study of the test is underway. (Call 800-615-0418 ext. 202 for more information about participating.) The test soon could be available commercially through privately held Ceres Nanosciences Inc., which partnered with Mason to develop the test and plans to market it to doctor's offices and veterinarian clinics.

The Lyme disease test is just in time for what promises to be a bumper crop of ticks this spring and summer.

The culprit is the blacklegged tick. It can carry the bacterium *Borrelia burgdorferi*, which leads to Lyme disease. To make matters worse, nymphs — about the size of the period at the end of this sentence — can bite unnoticed until the standard first sign of Lyme disease, a bull's-eye

rash, appears.

Joint and muscle aches, fatigue, fever, chills, headaches and swollen lymph nodes typically come next, according to the Centers for Disease Control and Prevention.

A dose of antibiotics usually kills the bacteria, but sometimes symptoms persist. Patients return to their doctors months and even years later, convinced they still have Lyme disease, says Lance Liotta, CAPMM co-director. Until now, there was no way of knowing definitively if the disease was still active or not, he says. Current blood tests only show if the body has created antibodies to fight the infection. Antibodies remain even after the infection is beaten.

But the active Lyme disease bacterium sheds a very small piece of itself called an antigen while it's doing damage. In the past, these nanoparticles were too small to test. But thanks to technology developed at CAPMM, researchers can now use a "nanotrap" to capture the antigen in urine.

The patented nanotrap works much like a lobster trap, Liotta says. It's an open meshwork with bait inside. The traps look like tiny white balls under the microscope. "The protein that we want goes in and gets stuck inside," Liotta says. "It binds to that bait in the trap."

The researcher plucks out the antigen, which is protected while in the trap. If the antigen shed by *Borrelia burgdorferi* is found, then the patient has an active case of Lyme disease, Luchini says.

"The antigen is a component of the toxic-causing agent itself," Luchini says. "Instead of looking at the host response or whatever the human body does to fight the infection, we look at a piece of the infection-causing agent. Everyone measures the antibodies because it's much easier."

And it's those antibodies that can cause problems, Liotta says. Antibodies fight infection and react to the proteins in the bacteria. But antibodies don't stop with the infection —they move to attack proteins in the nerves, joints and brain, Liotta says.

"The bacterium doesn't directly cause the damage," Liotta says. "It's the immune response that's doing the damage. The goal is to have a way to detect Lyme disease even before you make antibodies against it. Then you could treat the patient with antibiotics and they wouldn't get all those terrible symptoms. Or, if someone has joint problems and they're convinced they have Lyme disease — and there are thousands of people who feel that way — it gives us a way to definitively say they do or don't have Lyme disease."

Provided by George Mason University

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