

## Sleuthing Mysterious Tickborne Disease a Chilling Endeavor

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Hidden away in Todd Damrow's freezer are the cold, dead bodies of Eunice, Filbert, and Harold. As spring approaches, Damrow looks forward to watching the body count rise.

While Damrow may sound like the villain in a sordid murder mystery, he's actually one of the good guys in a public health mystery that may result in the discovery of a new disease in humans.

Damrow is the Montana state epidemiologist, and--along with his colleagues at the Montana Department of Public Health and Human Services, the U.S. Centers for Disease Control and Prevention, and the NIH, Rocky Mountain Laboratories--he has spent the past few years investigating reports of a tickborne rash similar to that found in Lyme disease.

Eunice, Filbert and Harold are Rocky Mountain wood ticks, and they are among the prime suspects in the group's investigation.

Damrow first thought something strange was going on a few years ago, when he began getting reports from patients and physicians of what appeared to be Lyme disease. The patients complained of fever and severe fatigue, as well as odd circular rashes at the site of a previous tick bite. The symptoms were similar to those of Lyme disease, but only deer ticks carry Lyme disease, and deer ticks are not indigenous to Montana. In addition, Montana is the only state, according to Damrow, that has never had a documented case of Lyme disease that was acquired in-state.

The rash also was not characteristic of Rocky Mountain spotted fever or other tickborne diseases in Montana.

"We'd do tests for Lyme disease, and they'd always come up negative," Damrow said. "So we could tell them what they didn't have, but not what they did have."

Then one spring, a public health worker mailed Damrow a photo of the distinctive rash. It was unlike anything he had seen before, and it prompted him to launch a more formal investigation. He knew the Centers for Disease Control and Prevention (CDC) were looking into Lyme-like symptoms caused by unidentified infectious agents in Lone Star ticks in Texas and dog ticks in Missouri. Could the same thing be happening with wood ticks in Montana?

Lyme disease is not caused directly by ticks but by a spiral-shaped bacterium called *Borrelia burgdorferi* that invades the salivary glands of deer ticks. When an infected deer tick inserts its mouth into a human host to feast on his or her blood, it transfers the bacteria to the human. The tick must be attached to the person's skin for at least two days to spread the infection.

In the United States, Lyme disease occurs primarily in the northeastern, mid-Atlantic, and upper north-central regions, and along the Pacific coast. It usually features a telltale circular or oval-shaped red rash that starts at the site of a tick bite and enlarges during the next several days or weeks. The rash is accompanied by nonspecific symptoms such as fever, malaise, fatigue, headache, muscle aches, and joint aches. The disease is rarely fatal, though it can be severe, chronic and disabling. In its early stages, it usually responds well to antibiotics.

In 2002, 23,763 cases of Lyme disease were reported to the CDC. The number of cases has been escalating, possibly because of an increase in the number of housing developments being built in rural areas, where deer ticks usually live.

In the Montana cases, Damrow hypothesized, perhaps some previously unknown *Borrelia* species had adapted to the wood tick. He worried that the unusual rash might not be the only impact of this potentially new disease.

The only way to solve the mystery was to collect the offending ticks, extract DNA from their salivary glands, and study it with molecular probes to find out whether some new bacterium or other pathogen had infected the ticks.

"So last spring we launched a 'save the tick' campaign," Damrow said.

Through news releases and public service announcements on radio and TV, the state Department of Public Health and Human Services (DPHHS) asked Montanans who found ticks embedded in their skin to carefully remove the tick, drop it alive into a plastic bag, and take it immediately to their county health department.

DPHHS staff also notified physicians and county health workers about the study, and they became integral partners in the research effort. They collected the ticks, documented patients' symptoms, and mailed the ticks to DPHHS.

Damrow was hoping to collect around 100 tick samples.

"We thought it would be pretty hard to get people to hang onto ticks after removing them," he said. "Usually you just want to throw the nasty little buggers in the trash."

But the public information campaign was more effective than he had dared to hope. He soon had a collection of about 350 ticks, "and that was after excluding the ones that didn't actually bite someone."

As the bugs accumulated in his office, Damrow dropped them into individual test tubes and stored them in the office freezer to preserve their DNA.

"When the first ticks started coming in we were real excited, and we were pleasantly surprised that people were so cooperative," he said. "Some people even gave their ticks names and were really attached to them--no pun intended."

This month, as the snow melts and famished wood ticks become active, Damrow will again launch a public information campaign and will again begin collecting tick samples. His colleague, CDC epidemiologist Kammy Johnson, plans to start tracking bite victims to find out whether the mysterious disease has any late-developing or long-term effects.

DPHHS enlisted researchers at the NIH, Rocky Mountain Laboratories in Hamilton to search for antibodies in the blood of bite victims that might help to identify the pathogen and confirm its role in the disease. The partnership with the labs seemed especially appropriate, Damrow noted, since they were the first to identify Rocky Mountain spotted fever almost a century ago. And in 1982, a scientist at the lab identified the causative agent in Lyme disease.

While Damrow is mindful of the serious potential of any new disease, he can't help but get excited about the chance to play Sherlock Holmes.

"We're really excited about this, because it isn't often that you get a chance to discover a new disease," he said. "This may be our chance--and that's why public health exists."

Damrow and his partners in deduction hope to solve their public health mystery and reveal the culprit sometime in the next couple of years.

#### Sidebar:

For the second year in a row, the Montana Dept. of Public Health and Human Services is asking Montanans to help with researching a potentially new disease transmitted by ticks.

Anyone who finds a tick embedded in his or her skin is asked to remove it carefully, drop it alive into a plastic bag, and promptly take it to the county health department. County health workers will collect information about the geographic location where the tick was picked up, the location of the tick bite, and the date the tick was removed.

If an individual develops a rash at the site of a tick bite within 7 to 21 days after removing the tick, he or she is encouraged to visit a health-care provider. A doctor or nurse will collect a blood sample, which will be examined for signs of a germ that may have caused the rash. The identities of those who participate in this study will be kept confidential as required by law.

For more information, call your county health department.

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