The Confounding Debate Over Lyme Disease in the South

The debilitating tick-borne disease is well-documented north of the Mason–Dixon line, but does it exist beyond that?

By Wendy Orent  |  Friday, November 01, 2013

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Kerry Clark never wanted to show that Lyme disease exists in the Southern United States by catching it himself.

Clark is a medical entomologist at the University of North Florida in Jacksonville. A wiry man with graying brown hair, he is most at home in a kayak on the ponds behind the wooded Jacksonville campus. He jogs and lifts weights, when he is well enough to do so.

Clark has spent years all over the South crawling through underbrush and kicking up leaf litter to collect ticks that transmit infections. Despite innumerable tick bites, Clark never had a medical
problem until the day he dragged for ticks in the town of Fayetteville, a suburb south of Atlanta.

Clark was giving a talk on Lyme disease at a gathering of the Dougherty County Medical Society in Albany, Ga., where he met Fayetteville resident Liz Schmitz, president of the Georgia Lyme Disease Association. When he heard how many people from Schmitz’s town had been sickened after tick bites, he agreed to come up and investigate.

As Clark dragged for ticks with a white flannel cloth on a pole, hungry, aggressive lone star females with their distinctive white spots seemed to burst out. In less than an hour, he had collected hundreds of adults and younger nymphs. He remembers one practically leaping from the cloth onto his finger. And that, Clark guesses, is when a lone star tick nestled in his hair. When Clark found it several days later, it had already deposited its bacterial load into his body.

Since that day almost three years ago, Clark has been suffering from what he describes as intermittent pounding headaches, fatigue, odd twitches and “fuzziness.” He reports that weeks-long courses of antibiotics make him feel better, but when he goes off the drugs, the symptoms return.

Clark is not alone. Other people from suburban communities around Georgia — and many other areas of the Southeast — report getting sick from what seems like tick-borne illness, too.

A man in his 50s from Fayette County who prefers not to use his name developed severe neurological symptoms after a tick bite. Initially his right foot dragged, and he couldn’t use his right arm at all. He was diagnosed with the lethal neurodegenerative disease ALS (for amyotrophic lateral sclerosis, also known as Lou Gehrig’s disease.) ALS gradually kills off motor neurons, causing progressive paralysis. It initially leaves patients weakened, then in a wheelchair, and then, within a few years, unable to eat or breathe.

The last specialist sent him home to die. But after talking with Schmitz, the man sent Clark samples of his blood. Using polymerase chain reaction (PCR) testing to analyze fragments of foreign DNA in the man’s blood, Clark found evidence of Borrelia burgdorferi, the pathogen that causes Lyme disease. Now on antibiotics, the Fayette County man says he feels better than he has in years, and the rapid downward trajectory common to almost all ALS patients seems to have stalled.

Clark also tested his own blood, where he found traces of B. burgdorferi along with another distinct genospecies (a bacterial species separated by divergence of genes), Borrelia andersonii, usually found in rabbits.

There is just one problem with this story: Many Lyme researchers, including some from the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC), won’t believe a word of it. There is little or no true Lyme disease anywhere in the South, say these experts.
They cite plenty of evidence: In the Northeast, where Lyme is endemic, the disease is spread by nymphs (the tick’s juvenile form) of *Ixodes scapularis*, commonly known as blacklegged ticks. Blacklegged nymphs rarely bite humans down South, though researchers don’t agree as to why not. Adult blacklegged ticks do bite people, but because of their large size, they’re often noticed and picked off before they spread disease.

So if there is Lyme — or Lyme-like illness — in the South, what could be spreading it? The aggressive lone star tick, *Amblyomma americanum*, which frequently bites people as well as other animals, is a prime suspect. In the early 1990s, researchers realized its bite could cause a roundish, gradually spreading mottled red rash that was a virtual ringer for the erythema migrans (EM) rash, the classic signature of Lyme disease in the Northeast.

But since few Lyme experts believe that the lone star can harbor and transmit Lyme *Borrelia*, the rash the tick leaves upon biting is never attributed to Lyme disease. Instead, in the South, the illness is called STARI, for Southern Tick-Associated Rash Illness. According to microbiologist Barbara Johnson, one of the top Lyme disease experts at the CDC’s Division of Vector-Borne Diseases in Fort Collins, Colo., STARI is relatively benign, presenting only with the rash and flulike symptoms of early Lyme. Its cause remains unknown.

And this is where the CDC and researchers like Clark and his colleagues part ways: Clark recognizes that Lyme disease transmitted by blacklegged ticks is relatively infrequent in the South. But he believes that lone star ticks can transmit a similar spiral-shaped bacterium or spirochete to the one that causes Lyme disease.

Other scientists disagree. While strains of *Borrelia burgdorferi* can be found in the South, says Jean Tsao, a Lyme researcher from Michigan State University, there is no bridge between the natural and the human world. Instead, the disease cycles are “cryptic,” meaning the spirochetes cycle quietly among ticks and animal hosts but have virtually no effect on human health.
Getting to the truth here is critical — especially to the thousands of patients who believe they suffer from some form of Lyme disease acquired in the South. The confusion starts with the numbers. No one has any clear idea how many STARI cases exist because, unlike Lyme in the North, they are not reportable to state departments of health.

Gary Wormser, an infectious diseases physician at New York Medical College and a recognized Lyme researcher, says STARI is “pretty widespread in the Southeast and south central part of the country.” Yet, Adriana Marques, chief of clinical infectious diseases at NIH, launched a study of STARI in 2002, and enrolled only three suspected patients over 10 years.

But Marcia Herman-Giddens, scientific adviser for the Tick-Borne Infections Council of North Carolina, a research and advocacy organization, says she can’t believe anyone actively looking for STARI patients would come up with just three of them in a decade. Patients with Lyme or Lyme-like illness in the South likely number in the thousands, she says.

The dispute leaves Southern patients who insist they have Lyme disease — or something much like it — angry and adrift. Because few doctors recognize their illness, they say, they are treated too late or not at all, and are allowed to slide into chronic illness as debilitating as untreated Lyme disease in the North.

**Play the Name Game**

*Lean how to distinguish lone stars from blacklegged ticks, and how to identify them during every life stage. Rollover the tick to learn whether it is a female, male, nymph or larva, then click to learn more about its size and bite.*

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**Amblyomma americanum**

(*lone star tick, commonly called the wood tick*)

**Habitat:** Found in the southeastern and eastern United States. According to the CDC, their distribution has grown over the last 20 to 30 years.
Legends of the North

*Ixodes scapularis* (blacklegged tick, commonly known as the deer tick)

**Habitat:** Widely distributed in the northeastern and upper midwestern United States. Also found in the South -- in Texas and farther east.
That Lyme disease was first thought confined to the northeastern United States may be historical accident. Almost 50 years ago Polly Murray, an artist and mother from Lyme, Conn., noticed a strange increase of juvenile arthritis, a rare and sometimes disabling condition, among children living within a few blocks of her house. By 1975, she had launched a campaign to force doctors and scientists to figure out why so many in her town had swollen knees and elbows, persistent fatigue, difficulty concentrating, headaches and rashes, among a host of other symptoms.

Although Lyme disease, under other names, had already been described in Europe for a century, many public health experts initially thought the condition in Connecticut was unique. The CDC dispatched a rheumatologist to investigate the mysterious outbreak. That investigator, Allen Steere of Yale, initially described a largely rheumatologic syndrome notable for swollen knees and rash. While Steere later included meticulous descriptions of neurologic and cardiac manifestations of Lyme in his reports, the view of American Lyme disease — unlike European Lyme disease — as essentially rheumatologic persisted for years.

Another line of research dovetailed with Steere's work, locking Lyme disease into place as a phenomenon of the Northeast. That work was conducted by Harvard entomologist Andrew Spielman, who had spent years studying the malaria-like parasite, Babesia, on Nantucket island off Cape Cod. By 1979, Spielman had identified Babesia's tick vector, Ixodes dammini, as a creature new to science. I. dammini lived only in the North, and only I. dammini could be Babesia's vector, Spielman said. When NIH entomologist Willy Burgdorfer discovered the Lyme spirochete inside what he identified as I. scapularis ticks from Fire Island, N.Y., in 1981, Spielman immediately claimed that those infected ticks weren't scapularis, but dammini as well. The ticks' limited range — the Northeast and the Midwest — restricted Lyme's range too, and the casebook on Southern Lyme slammed shut.

Spielman’s triumphant discovery was short-lived: Ixodes dammini was torpedoed at the hands of Spielman’s close friend, the Georgia entomologist and tick expert James H. Oliver. Ensnconced at Georgia Southern University in Statesboro, Oliver was thinking hard about Spielman’s dammini tick, its identification and its distribution. Today a tall, courtly Southern gentleman with high cheekbones and a delicate frame, Oliver is known for building the National Tick Museum, perhaps the most extensive tick collection and library in the world.

“When I started working in this area, I was told, point blank, Lyme disease was not in the South, and human Lyme disease could not occur — there were no ticks and no germs,” he recalls. But he was not convinced that the blacklegged ticks in the North and South differed much — or that Spielman’s discovery represented a separate species at all.

In a series of experiments from 1989-1990, Oliver demonstrated that so-called Northern deer ticks (dammini) and the blacklegged ticks (scapularis) found up and down the East Coast bit exactly the
same animals in the lab. In 1992, he showed that even ticks from widely separated areas like Georgia and Massachusetts were genetically too similar to be different species. And breeding ticks from the North and South in the lab, Oliver demonstrated that a series of matings produced reliably fertile offspring — a crucial test of species boundaries.

Oliver’s definitive experiments blew up the idea that dammini was a new or separate species. The name dammini was dropped from the scientific literature. But Spielman’s framework — restricting Lyme to the Northern ticks — remained intact.

The notion that the ticks in the North and the South were fundamentally different still lies at the heart of the controversy over Southern Lyme. Oliver attributed most of those differences to Southern heat: To avoid it, scapularis nymphs hide out under leaf litter, biting lizards and small mammals instead of questing for larger prey on tall grass or brush.

Lymeresearcher Gary Wormser saw the difference as more basic: “There’s no doubt that something somewhat like the deer tick exists in the South; it’s called the same name — Ixodes scapularis. But it has some differences in biological behavior and has a low infection rate with Borrelia burgdorferi.” What did it matter if the tick species were the same, if scapularis nymphs didn’t bite people in the South?

Exceptions to Spielman’s geographic rule ultimately emerged. By 1985, medical entomologist Robert Lane of the University of California in Berkeley demonstrated that B. burgdorferi was also carried by a West Coast tick named Ixodes pacificus.

And in 1998, Mercer University entomologist Alan Smith learned for himself that while reclusive blacklegged nymphs might not often infect humans in the South, adults did. Bitten by an adult tick in the Piedmont National Wildlife Refuge, a forested area south of Atlanta, Smith developed an EM rash, which he regarded with aplomb despite a low-grade fever and flulike symptoms. His physician initially wanted to treat him with antibiotics. “Oh, no, that’s not necessary,” Smith told his doctor. “The CDC says there’s no Lyme in Georgia.”

Within months, he was nearly crippled. His wife dragged him back to the doctor, and he went on antibiotics. He improved immediately. “There’s definitely Lyme in Georgia,” he says now with a laugh. “It’s a lot of crap that blacklegged ticks don’t ever bite people in the South.”

Unlike heat-fleeing nymphs, scapularis adults do bite, but they’re easy to see and remove. If there really are thousands of cases of Lyme in the South, both Clark and Oliver say something else must be transmitting it: Amblyomma americanum, the lone star tick. And it is on the back of this fierce, ubiquitous, rapidly spreading tick that much of the mystery of Southern Lyme-like illness rests.
Borrelia burgdorferi, the agent of Lyme disease, through a scanning electron microscope.

CDC/Janice Haney Carr

**Quest for Evidence**

Edwin Masters, a country doctor from Cape Giradeau, Mo., had no reason to doubt the conventional wisdom that the South was Lyme-free until 1988, when he was asked to give a talk on Lyme disease to a group of foresters. Masters flung himself into the topic, spending a year collecting pictures of ticks and rashes to prepare. Suddenly he began to see signs of Lyme in his patients. He saw EM rashes on their skin; he saw swollen joints; and he documented confusion and fatigue.

Hoping to get to the bottom of things, Masters contacted Oliver in 1993. Oliver sent his postdoctoral student Tom Kollars to trap animals, including wild rabbits, at a farm where two of Masters’ patients
had developed EM rashes along with arthritis, muscle aches and other Lyme-like symptoms after lone star tick bites.

Oliver found five genetically distinct strains of *Borrelia* in the rabbit blood. But he could not find any evidence of *Borrelia* in either Missouri lone star ticks or in Masters’ patients. So he could not prove that the lone star tick transmitted a Lyme-like illness or, indeed, any spirochetal infection at all.

But Clark and Oliver have never given up. With his scientific partner, Czech biologist Natasha Rudenko, Oliver has found 300 Southern genetic strains of *Borrelia*, 57 of them so similar to the Northern Lyme spirochete that they’re classifiable as *B. burgdorferi* sensu stricto, meaning “in the strict sense.” Rudenko has also managed to culture new strains by growing them on a medium developed in Slovenia.

Rudenko and Oliver send DNA from the cultured spirochetes for gene sequencing at a lab at the University of Washington in Seattle. They compare those sequences to other known strains. If the new sequences fall too far from earlier isolates, they classify the spirochete as a new genospecies. In 2009 and 2011, Oliver and Rudenko published reports on two new genospecies: *Borrelia carolinensis* and *Borrelia americana*. Based on PCR analysis of patient samples, Clark thinks these may cause human disease.

The new spirochetes, Oliver and Rudenko have shown, reinforce the sense of ecological complexity characterizing Southern *Borrelia* cycles involving lizards, songbirds, small mammals (cotton mice; cotton, wood and rice rats; chipmunks; squirrels; rabbits; and raccoons) and a welter of ticks — lone stars and blacklegged ticks and three *Ixodes* species that seldom bite people: *dentatus, affinis* and *minor*. These convoluted cycles mean that the neat Northern picture has, in the South, been blown apart into hundreds of fractured images.

Using a new testing technique to capture tiny DNA fragments from several hundred Southern patients, Kerry Clark hopes he can identify the *Borrelia* strains infecting both patients and ticks. Clark’s new test, if validated and confirmed by others, could represent an advance over the standard PCR test for Lyme, which often fails to detect *Borrelia* infection.

As Clark explains, *B. burgdorferi* DNA in the blood tends to deteriorate quickly after collection. It occurred to Clark that “targeting a smaller fragment of DNA might work better” than looking for larger pieces. He has created primers, or sensitive strips of DNA, that target those shorter pieces. His primers seek out bits of DNA coding for part of the spirochete’s flagella — tiny, whiplike structures that help propel it through the bloodstream. In particular, he has focused on targeting the gene coding for flagellin protein b, or flaB, which has proved to be quite distinct from one genospecies to the next.
The strategy has proved successful, yielding Clark far more hits than he had ever found before. This June, Clark published, in the *International Journal of Medical Science*, evidence of Lyme *Borrelia* from lone star ticks, and from 10 patients from Florida and Georgia.

Among the finds: evidence of *B. andersonii* in three of the patients, *B. burgdorferi sensu stricto* (classic Lyme) in seven of them, and *B. americana* in two more. Especially compelling are reports of two patients who managed to salvage the lone star ticks that bit them. Both ticks and patients had evidence of infection with *andersonii* and *burgdorferi*. Clark’s study represents the first published indication that *Amblyomma americanum*, the lone star tick, may transmit some form of Lyme *Borrelia*.

A thousand miles away from the green vines and wet red clay of Statesboro, Ga., and the tranquil creeks outside Jacksonville, Fla., the town of College Station, Texas, lies baking in the sun. But in this hot, dry ecosystem, *Borrelia* strains also find a home. Maria Esteve-Gassent, a Spanish-born microbiologist at the Texas A&M School of Veterinary Science, has been studying Lyme disease since 2004.

Using PCR with a different set of short primers from Clark’s, her findings seem to corroborate Clark’s and Oliver’s works: She has identified *B. andersonii*, *B. americana* and classic *B. burgdorferi* in lone star ticks and their close relatives *Amblyomma cajennense*, found from the U.S./Mexican border down through South America. She’s found *B. burgdorferi* in Texas dogs as well.

On the day I visit Esteve-Gassent, a Mexican physician and researcher, Guadalupe Gordillo-Perez, is also present. Gordillo-Perez has studied blood samples from people living across Mexico as part of a Mexican government-sponsored public health study.

Based on her analysis of 1,000 samples, Gordillo-Perez estimates that 1.1 percent of Mexican citizens test positive for different forms of *Borrelia burgdorferi*. She reports PCR evidence of *Borrelia* in *scapularis* and *cajennense* from Mexico. And some of Gordillo-Perez’s patients have also manifested strange lesions resembling skin cancer in patients, similar to the lesions seen in European Lyme patients.

Like Clark and Oliver, Esteve-Gassent and Gordillo-Perez are at home with complexity — the convoluted cycles among the rabbits, birds and lizards; the unusual strains of *Borrelia*; the many flavors of *B. burgdorferi* that make the South such a heated mess. “Why do Americans insist that there’s only one kind of Lyme *Borrelia* that causes disease in the U.S. while there are so many in Europe?” Esteve-Gassent asks, saying at least five are known to cause human disease. “It’s a big country!”
Lyme disease is shown in black. Region inhabited by the lone star tick, suspected by some of carrying Lyme-like disease, is in yellow.

Reframing the Debate

The biggest weakness in the case for Southern Lyme transmission via lone star ticks is that, despite Clark’s PCR hits, no one has cultured any disease-causing spirochetes from them. Since STARI is by definition associated with the bite of a lone star tick, the inability to grow a spirochete from either ticks or patients suggests to many that there is nothing to find.

“The evidence so far is that we can’t find any pathogen — and we’ve looked,” says Wormser. “Every study has come up empty.”
Barbara Johnson, who has been conducting a still unpublished study on STARI, agrees. She feels it is “not likely” to be caused by a spirochete, and suspects positive Lyme antibodies from STARI patients are false positives, cross-reactions to other spirochetes, or souvenirs of travel to the North.

Herman-Giddens sees Johnson’s logic as circular. Southern states aren’t generally considered endemic for Lyme because Lyme and STARI are not usually reported; Lyme disease isn’t usually reported because the states aren’t considered endemic.

Still, no one has proven that lone star ticks transmit \textit{B. burgdorferi} or any other \textit{Borrelia} strains, and, as infectious disease expert Paul Lantos of Duke University has argued, some STARI cases recover without treatment. But nothing is simple here. “Rash-only” Lyme disease is common throughout the Northeast as well. According to infectious disease doctor and Lyme expert Benjamin Luft of Stony Brook University in New York, only certain strains of Northern \textit{Borrelia burgdorferi} cause invasive Lyme disease, though it’s accepted protocol to treat all Northern patients with antibiotics.

Johnson, Lantos and Wormser also argue that most Lyme spirochetes are killed by lone star tick saliva. But as Rudenko points out, strains that have adapted to lone star ticks wouldn’t be killed by lone star saliva. It’s an intense adaptive struggle among ticks, hosts and spirochetes; that process forces germs in different vectors to evolve in very different ways.

In 2007, two years before he died of diabetes at age 63, Ed Masters spoke at a conference on Lyme in the South held at Duke. He acknowledged that no one had cultured the infectious agent from his patient samples, but he never abandoned the belief that his patients were sick from either Lyme or a Lyme-like illness that demanded antibiotic treatment. “Absence of proof is not proof of absence,” Masters insisted to the end of his life.

Laboring without that proof, Schmitz, the Georgia patient advocate, and Herman-Giddens, the community health liaison, field call after call from desperate patients whom almost no one else believes. That disbelief compounds the patients’ isolation and misery, not to mention the difficulty of finding doctors who will care for them.

At the patient group I attended, one young woman insisted she’d rather have cancer: “At least then, I’d be recognized as having a real disease,” she said.

The resolution can only come from more science. If Rudenko confirms Clark’s PCR tests using additional gene targets, and if Clark or Rudenko manage to grow \textit{Borrelia} cultures out of human and lone star tick samples, then even the fiercest skeptics will have to recognize that Southern Lyme strains threaten human health, and that Lyme-like illness deserves Lyme-like treatment.
In the Northeast, Lyme-transmitting ticks spiral through a simple two-year life cycle, taking blood meals from rodents, deer — and us.

Until then, patients diagnosed with STARI, and even those positive for Lyme infection, will have little recourse to that treatment, as the bitter controversy over Southern Lyme rages on.

Hothouse Complexity

After the Lyme pathogen was identified, scientists in the Northeast traced the relatively simple two-year life cycle of the disease in nature, as depicted below. In the first year, adult blacklegged ticks feed and mate on the ears and hide of deer, laying eggs that drop to the forest floor in late spring.

The uninfected larvae acquire Borrelia only after taking a blood meal from infected white-footed mice previously bitten by other infected ticks. In the second year, infected larvae fall from the mice to the ground, growing into adolescent nymphs. The nymphs then quest, moving to the tips of long grass and brush to wait for their next blood meal to wander by: a dog, a deer, or that accidental human host.

Contrast the clear-cut disease path in the Northeast with the intricate complexity of the Southern ecosystem, as hypothesized by Southern researchers like Oliver and Clark. If their suspicions are borne out, *Ixodes scapularis* and *Amblyomma americanum* are the primary ways that Lyme can enter human populations in the South, with three other species — the Gulf Coast tick (*Amblyomma maculatum*), the American dog tick (*Dermacentor variabilis*) and the brown dog tick (*Rhipicephalus sanguineus*) — playing subsidiary roles.
Ixodes scapularis keeps Lyme Borrelia cycling in nature, says Clark, as do three other Ixodes species on the ground: Ixodes affinis moves among rodents; I. minor moves among rodents and probably birds; and I. dentatus moves among birds and rabbits. This last tick, Clark believes, sustains the Lyme-like genospecies, Borrelia andersonii, which may ultimately infect people via the ubiquitous lone star tick. — Wendy Orent

Lyme Disease's Cousin in the Northeast

Peter Krause has seen plenty of patients with Lyme disease. He has also seen his fair share of cases where classic symptoms suggest Lyme, but tests for the disease-causing bacterium, Borrelia burgdorferi, come back negative.

The Yale tick-borne diseases expert now says that in some instances, a related and recently discovered disease may be to blame. Borrelia miyamotoi elicits symptoms similar to its better-known bacterial cousin with two trademark exceptions: Patients do not get a bull’s-eye rash, and they come down with a fever in which the symptoms relapse and remit over the course of about a year.

To track down the disease, Krause tested blood from people living in Rhode Island and Massachusetts, areas endemic for tick-borne disease. His analyses confirmed the presence of B. miyamotoi in 1 percent of healthy patients. Three percent of patients with Lyme-like symptoms tested positive for the antibody against the bacteria as well.

Lyme is still far more prevalent, but one characteristic gives B. miyamotoi a leg up: While ticks cannot pass Lyme spirochetes to tick offspring, B. myamotoi is transmitted from female to larvae through eggs. Thus, the relapsing fever can be spread by the bite of larval ticks as well as the customary nymphs that cause Lyme.

When it comes to the new tick-borne disease, diagnosis remains a major hurdle. Existing methods, in which researchers detect the infection by looking at blood smears under a microscope, fall short. But a number of labs are developing tests that Krause thinks will be widely available soon.

“This will take a long, long time to fully understand, but a start has been made,” Krause says. — Breanna Draxler
New Chetes in California

On a chaparral-covered mountainside above Hopland, a pit-stop town of 750 on the northern outskirts of California’s wine country, Robert Lane drags a white flannel cloth over a patch of fallen oak leaves.

Lane is searching for nymphal western blacklegged ticks (species name *Ixodes pacificus*), the prime vector for spreading Lyme disease out West. A hundred miles south, in his Berkeley lab, Lane will examine these ticks to see whether they are carrying *Borrelia burgdorferi*, the agent of Lyme disease, or any one of several other spirochetes that might be making people sick.

In the early 1990s Lane and Humboldt State University ecologist Richard Brown began to suspect some of the spirochetes they saw in ticks were not causing classic Lyme disease but rather other related infections entirely. Then in 1998, French molecular biologist Danielle Postic confirmed their hunch. They had found at least one other species, *Borrelia bissettii*, known to cause Lyme disease in central and southern Europe.

Since then, Lane and team have continued to discover more *Borrelia* species in California’s coastal range, including *B. miyamotoi*, the cause of a relapsing fever; *B. californiensis*; and “*Borrelia* genomospecies II,” a placeholder name until the species is fully described. In 2010 Czech entomologist Natasha Rudenko isolated *Borrelia americana*, yet another spirochete that must be investigated as a cause of Lyme-like disease in the West from a Northern California tick.

Lane has also discovered “three or four genospecies in the last several years that we’re hoping to introduce as new to science, or at least new to North America. Every time we discover a new spirochete, we ask the question, ‘Does it infect people?’” he says. If so, does it cause Lyme-like symptoms, and what are the implications for diagnosing and treating people with these other forms of disease? — Laith Agha