

The Disease Unchecked

When Lyme disease is undiagnosed and untreated, it can progress through different stages, often with remissions between them.

Three Stages of Lyme

After infection in late spring or summer, a slowly expanding red rash (*erythema migrans*) may appear at site of the tick bite. **Possible associated symptoms:** fever, headache, neck stiffness, joint or muscle pain, fatigue.



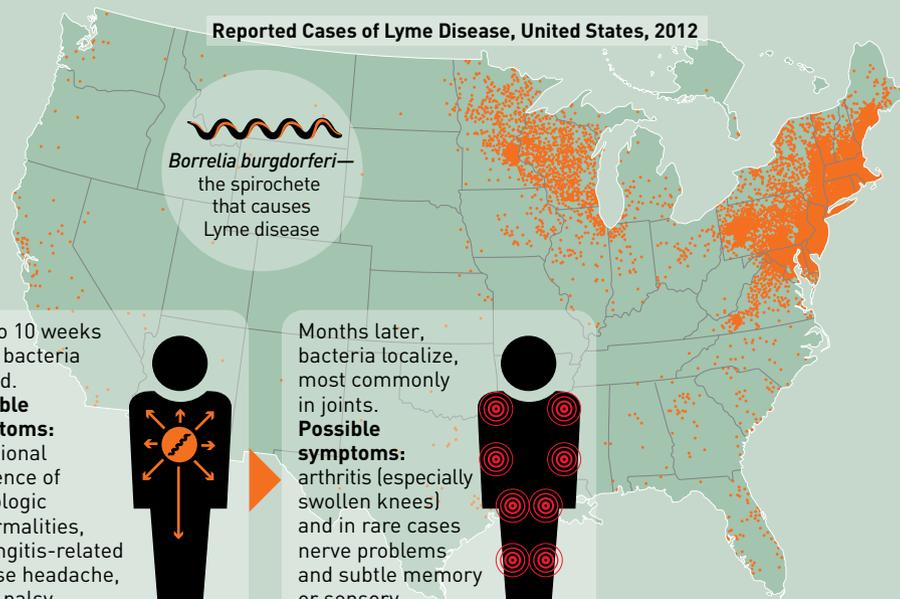
Two to 10 weeks later, bacteria spread. **Possible symptoms:** occasional incidence of neurologic abnormalities, meningitis-related intense headache, facial palsy, heart block.



Months later, bacteria localize, most commonly in joints. **Possible symptoms:** arthritis (especially swollen knees) and in rare cases nerve problems and subtle memory or sensory changes.



Reported Cases of Lyme Disease, United States, 2012



Not every patient experiences all stages of the disease. If the disease progresses, the symptoms of each stage improve and often resolve before the next stage begins.

more, sometimes without any sign of *Borrelia* infection past or present. That approach and the phrase “chronic Lyme” itself are extremely controversial, with many physicians and public health officials asserting that such treatment is irresponsible and even dangerous. “The chronic Lyme ideology,” Steere says, “has been very seductive for someone who has gone to doctors who can’t explain what’s wrong and then finds one who says, ‘You have Lyme, and I will make you well.’”

To untie the Gordian knot that is Lyme, begin with diagnosis. The most common test is often negative during the first several weeks of infection. That’s because it’s designed to detect the antibodies the body generates to battle the bacteria, and those antibodies don’t initially show up in sufficient quantities to produce a positive test result, says Ben Beard, coordinator of the CDC’s national programs on Lyme disease, plague and tularemia. A patient who notices a bull’s-eye rash might test negative, even if she does have Lyme.

Next, factor in the possibility of co-infection. Scientists have identified at least four other disease-causing pathogens in the ticks that carry Lyme. It’s possible that these bacteria behave differently in combination and may cause more severe early infections. Add to that the vast array of possible

hosts—people who are young or old, who are healthy or have compromised immune systems—and the resulting symptoms are quite variable and can range from mild to severe.

The bacterium at the root of Lyme disease, *Borrelia burgdorferi*, is an organism with a remarkable ability to mask its presence so that it won’t be attacked by the human immune system, says Monica Embers, an assistant professor in the Division of Bacteriology and Parasitology at the Tulane University Health Sciences Center. The bacterium may, for example, bind with human proteins on its surface, thus appearing to be made up of human cells. The bacterium also can mask itself when presented with an immune response; as soon as the host starts to attack, it changes its expression—its genetic appearance—to thwart the assault. “It keeps doing this throughout the infection,” Embers says, “so the immune system can’t keep up.”

Embers, using a monkey model, recently led an intriguing study into Lyme bacteria in which uninfected ticks were fed on an infected monkey, then analyzed to determine whether they had become infected. The research was a follow-up to work at University of California, Davis showing that the DNA of the *Borrelia* spirochetes sometimes persisted in mice after antibiotic treatment. In the study by Embers’ team, published