

Testing ticks for *Borrelia burgdorferi*, the Agent of Lyme Disease Questions and Answers

The California Department of Public Health (CDPH) occasionally receives calls from members of the public who have recently been bitten by a tick. Often concerned about getting Lyme disease from the tick, these individuals wonder if they should have the tick tested by a laboratory. Below is information to help answer some commonly asked questions regarding tick testing.

1. Should a tick that has been attached to a person be tested for *Borrelia burgdorferi*?

CDPH does not recommend that ticks be tested for *B. burgdorferi* to determine if medical treatment is necessary because 1) the tick may not be a western black-legged tick (*Ixodes pacificus*) that transmits Lyme disease, 2) testing methods vary in accuracy, 3) the need for treatment should not be based on these test results, and 4) tick testing results do not necessarily predict if the person bitten will get Lyme disease. Even if an attached tick tests “negative,” other undetected ticks may have attached to a person and transmitted the agent of Lyme disease. However, there may be individuals who would like to have a tick tested and, therefore, CDPH is providing the following information.

2. What is “Lyme disease”?

Lyme disease is an infectious disease caused by a bacterium called *Borrelia burgdorferi*. People get Lyme disease when the western black-legged tick infected with *Borrelia burgdorferi* attaches and feeds on them; detailed information on Lyme disease in California is available at [CDPH’s Lyme disease website](https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/LymeDisease.aspx) (<https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/LymeDisease.aspx>).

3. Which ticks transmit *Borrelia burgdorferi* to people in California?

The western black-legged tick, *Ixodes pacificus*, transmits *B. burgdorferi* to humans. The life stages of the tick that can transmit the bacteria are the adult and nymph. Nymphs are an early or “sub-adult” stage of the tick. Nymphs may be more likely to transmit Lyme disease bacteria to humans than adult ticks because they are tiny and difficult to see and so may not be found or removed promptly. Also, nymphs are most active in spring and early summer, when people are more likely to be outdoors; adult ticks are most active from fall through early spring. Furthermore, in parts of California, a greater percentage of nymphal ticks than adult ticks are infected with *B. burgdorferi*.

4. Why is prompt removal of ticks important?

Laboratory animal studies have shown that it takes at least 24 to 48 hours for Lyme disease bacteria to pass from the tick to the animal it is biting. The sooner a tick is removed, the less likely it is for a person to get Lyme disease.

5. Which tick species are submitted for testing?

Four species of ticks that occur in California commonly bite humans: the western black-legged tick (*Ixodes pacificus*), the Pacific Coast tick (*Dermacentor occidentalis*), the American dog tick (*D. variabilis*), and the Rocky Mountain wood tick (*D. andersoni*). Only the western black-legged tick can transmit *B. burgdorferi*; the other tick species do not transmit Lyme disease bacteria to people or other animals. Since tick-identification takes some training, often ticks that are not *Ixodes pacificus* are submitted for testing. Most laboratories will identify the tick first and test only *Ixodes pacificus* ticks. Knowing the species of the tick may provide your physician with useful information on risk of exposure to Lyme disease.

6. How should I store the tick until it can be tested?

Ticks must be kept alive for direct fluorescent antibody (DFA) or (indirect fluorescent antibody (IFA) tests (see description of lab tests in Question 7). Therefore, after the tick has been removed, it is best to put it in a tightly sealed plastic bag with a slightly moist cotton ball or tissue. The tick ideally should be stored in a cool place (such as the refrigerator) until it can be sent or delivered for testing. Dead ticks can be tested by the polymerase chain reaction (PCR). Dead ticks should ideally be stored in a small jar with alcohol.

7. Which tests are performed on ticks?

Borrelia burgdorferi is detected in ticks through tests performed on the content of the tick's digestive tract ("gut") or by testing the entire tick. Different laboratories perform different tests to determine tick infection with *Borrelia burgdorferi*. Each test described below differs in its ability to detect *Borrelia burgdorferi*.

Culture: *Borrelia burgdorferi* can be grown from infected tick gut in special liquid. This test may miss some ticks infected with *Borrelia burgdorferi*. It is sometimes difficult to grow these bacteria if small numbers of *Borrelia* or large numbers of other bacteria are present.

DFA = Direct Fluorescent Antibody: *Borrelia* bacteria are detected in the tick gut by putting on special protein antibodies that will attach to the *Borrelia*. If *Borrelia* bacteria are present, they will glow when viewed under a specially equipped microscope. While a positive result means that *Borrelia* are present, these *Borrelia* are not necessarily *Borrelia burgdorferi*.

IFA = Indirect Fluorescent Antibody: The IFA test is like the DFA test except that a sequence of two special protein antibodies are used to detect *Borrelia burgdorferi* in the tick gut. If *Borrelia* are present, they will glow when viewed under a specially equipped microscope. Like the DFA, this test can detect other kinds of *Borrelia* bacteria. However, with the IFA test, positive results are more likely to be *Borrelia burgdorferi*.

PCR = Polymerase Chain Reaction: PCR is used to detect genetic DNA of *Borrelia*

burgdorferi, usually from the whole tick. Very small numbers of *Borrelia* bacteria can be detected. This method is able to detect either *Borrelia burgdorferi*, and if desired, other *Borrelia* species. However, sometimes ticks that do not have any *Borrelia* can be “positive” due to contamination in the laboratory or because the test is not completely accurate.

8. How should test results be interpreted?

- If a tick tests “**positive**,” the patient may not have necessarily acquired Lyme disease.
 - In general, the shorter a tick is attached, the less likely it is to transmit *Borrelia burgdorferi*.
 - The test result could be a false positive. The fluorescent antibody and PCR tests are very good at detecting *Borrelia*-infection in a tick even when the tick has only a small number of *Borrelia*. However, sometimes a tick may test “positive” even when it has no *Borrelia* infection.
 - Not all infected ticks actually transmit the *Borrelia*.
- If a tick tests “**negative**,” this does not necessarily mean that the patient will not become ill from the tick bite.
 - The patient could have been bitten by another tick that was not detected and was infected.
 - The tick may carry other pathogens known to cause disease (e.g., *Anaplasma phagocytophilum*). Tick bites can also cause skin infections and localized allergic reactions.
 - The test may not detect *Borrelia* in the tick, even though they are present and, thus, could be a false-negative.

9. Where can a tick be tested?

Several local health departments and vector-control agencies test ticks for residents of their county or for others, often for a fee. For more information, contact your local county public health agency, the [Mosquito and Vector Control Association of California](http://www.mvcac.org/) (<http://www.mvcac.org/>), or the California Department of Public Health, Vector-Borne Disease Section: (916) 552-9730.