

Public Health

Department of Entomology

LYME DISEASE

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Lyme disease is a tick-borne disease. In Indiana, the risk of contracting Lyme disease begins in late spring and continues into summer. Because of the potential health effects of Lyme disease, you are encouraged to learn more about this disease and how to take precautions that can reduce the risk of transmission to you, your family, and your pets.

What Is Lyme Disease and Where Does It Occur?

Lyme disease is a new name for a disease that has been recognized in Europe and Asia since the early 1900s. In the

U.S., Lyme disease was first recognized as a new form of inflammatory arthritis in the area of Lyme and Old Lyme, Connecticut in the mid-1970s. It now occurs throughout much of the country, but is most common in two regions where over 90% of all diagnosed cases occur: southern New England, New York, and the Mid-Atlantic states; and Minnesota and Wisconsin. In 2004, approximately 20,000 cases of Lyme disease were reported in the U. S. making it the most common vector-borne disease in the country. Lyme disease cases have been documented from more than 70 counties in Indiana.

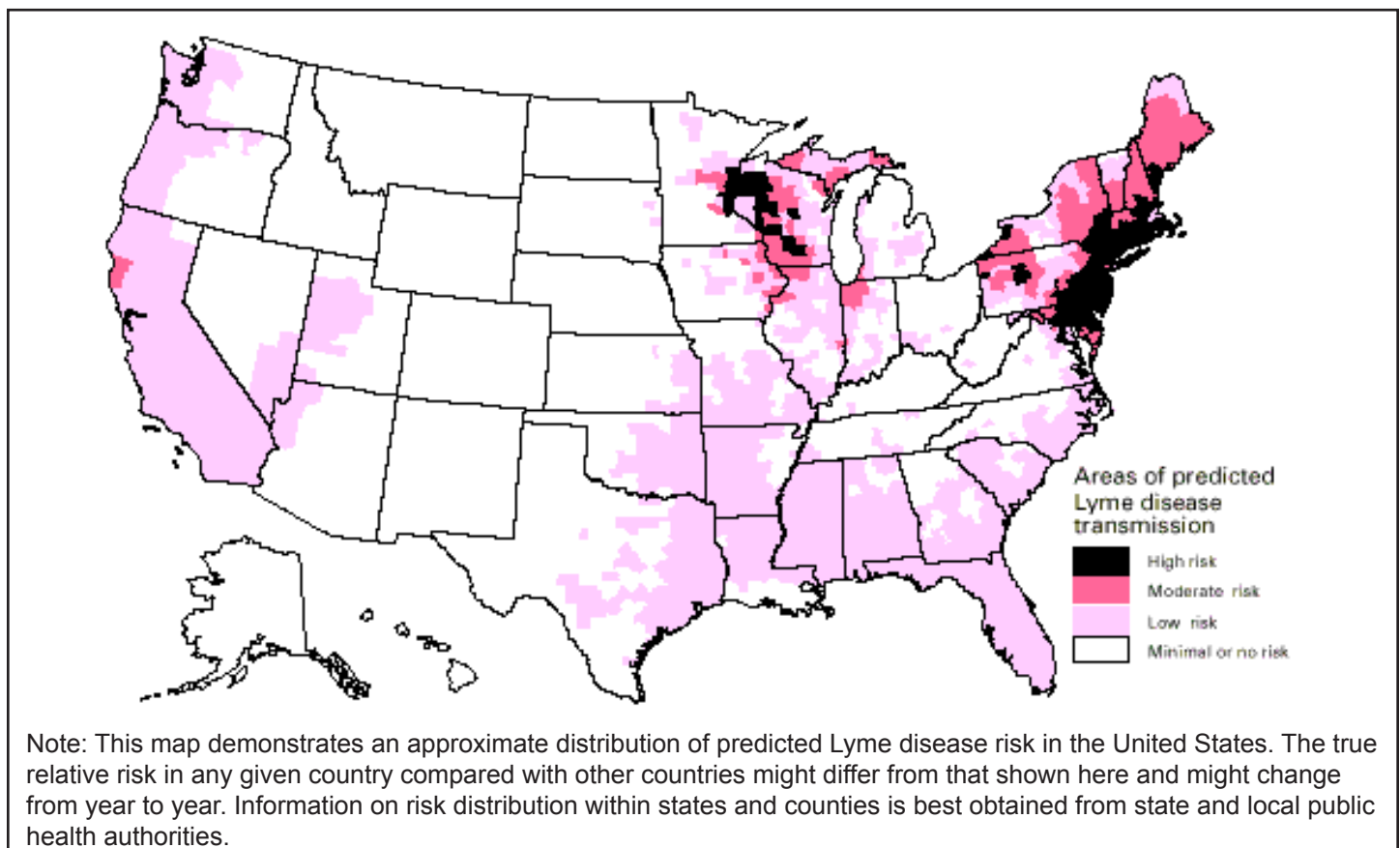


Figure 1. Map showing the relative risk of acquiring Lyme Disease in the U.S. as of April 2004.
(Graphic credit: Centers for Disease Control and Prevention)

Did You Know?

Ixodes scapularis, the black-legged tick, also is known as the "Lyme disease tick" and the "deer tick." Some scientists have used the name *Ixodes dammini* for the black-legged tick, but this name no longer is considered valid.

period of time, in some cases months to years, and typically is not harmed by the agent.) Lyme disease spirochetes ingested in a blood meal taken from an infected white-footed mouse multiply in the gut of a larval tick and are maintained by the tick during its molt into the nymphal stage. During feeding, spirochetes move to the salivary glands of a nymph and can be transmitted via saliva into a bird or mammal. It is the nymphal stage of the black-legged tick that is the primary vector of Lyme disease spirochetes to humans.

Are There Additional Modes of Transmission and Reservoirs of Lyme Disease?

Ticks other than the black-legged tick transmit Lyme disease spirochetes among wild animals, but none are considered to be important vectors to humans in Indiana, at this time. These include the two most common ticks in the state, the American dog tick *Dermacentor variabilis* and the lone star tick *Amblyomma americanum* (see Purdue Extension publication E-243-W "The Biology of Indiana Ticks"). The lone star tick has been implicated as an inefficient vector of Lyme disease spirochetes in some areas of the Atlantic Coast, but its role as a vector elsewhere is doubtful. Laboratory studies have failed to demonstrate that the Lyme disease spirochetes can survive and multiply in lone star ticks and American dog ticks. Bloodsucking insects such as mosquitoes and fleas have been studied extensively in regard to Lyme disease transmission, but none have been implicated as vectors.

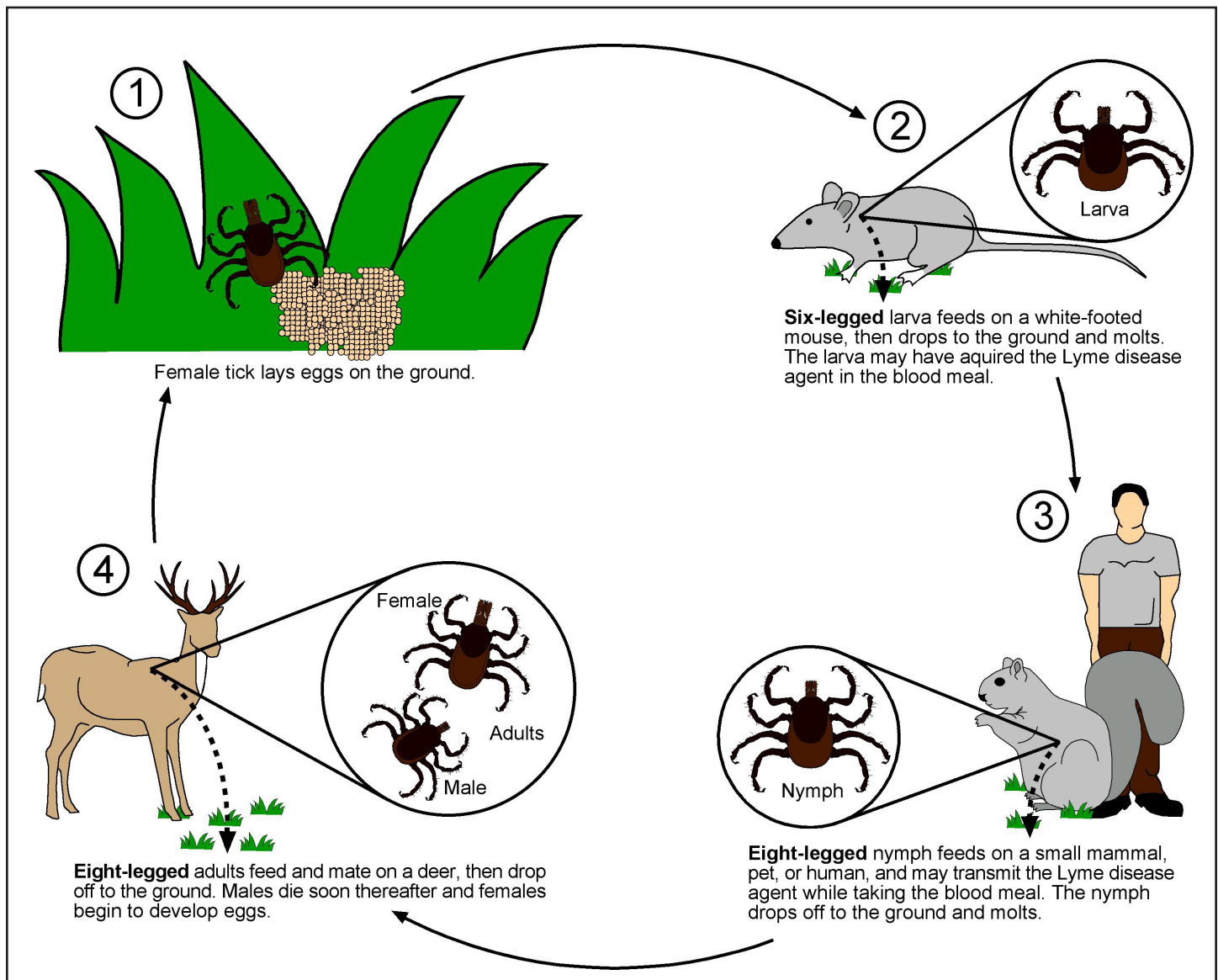


Figure 4. Transmission cycle of Lyme disease including *Ixodes scapularis* (black-legged tick).
(Drawing credit: Scott Charlesworth, Purdue University)

Several species of rodents other than white-footed mice can serve as secondary reservoirs of Lyme disease spirochetes in regions of the U. S. outside of Indiana. These rodents include tree squirrels, the dusky-footed wood rat, the California kangaroo rat, and the Norway rat. Numerous species of birds also are known to be reservoirs of Lyme disease spirochetes.

White-tailed deer are not reservoirs of Lyme disease because they do not support Lyme disease spirochetes in their blood at levels high enough to infect black-legged ticks and other animals. For this reason, deer hunters who dress deer are not at risk of contracting Lyme disease through contact with deer blood. However, hunters and taxidermists are at risk for coming in contact with infected black-legged ticks that infest deer. These people should examine themselves daily and remove any attached ticks following the procedure outlined below. Although deer are not reservoirs of Lyme disease spirochetes, they are very important to the establishment and eventual transmission of Lyme disease in an area. This is because deer are the preferred hosts for adult black-legged ticks, which feed and mate on them. Deer are critically important to tick reproduction and thereby to increasing tick numbers in an area. Deer also spread ticks into adjacent new areas in which Lyme disease may become established.

Is It Possible to Get Lyme Disease from Another Person or a Pet?

No, humans, dogs, and cats are not reservoirs of Lyme disease spirochetes. In other words, although we may be infected with Lyme disease spirochetes, we do not pass the spirochetes to people or other animals. The same is true of dogs and cats. However, dogs and cats may bring infected black-legged ticks into contact with us. Pet owners should check their dogs and cats and remove any attached ticks following the procedure outlined below.

What Are the Symptoms of Lyme Disease?

Lyme disease has a wide range of symptoms. However, some patients do not experience any, and the reader should be aware that some of the symptoms described below have causes other than Lyme disease. This is a complex topic, and only certain aspects are covered here. If you develop any of the following symptoms, you should seek medical attention immediately, especially if you have been in areas infested with black-legged ticks.

The initial infection can involve flu-like symptoms, including fever, headache, swollen glands, fatigue, and stiffness or pain in muscles, joints, and neck. These symptoms may begin from several days to a month or so after a bite of an infected black-legged tick and are accompanied by a skin rash known as "erythema migrans," or EM, in an estimated 60-80% of patients. EM lesions begin as a small pimple-like welt that slowly expands into a reddish rash ranging in size from an inch to several inches in diameter. They usually are circular, with brighter red outer margins and a partially clear center, often resembling a "bull's-eye," but other shapes occur. Some EM lesions become raised near the middle and are rough in texture. Most patients develop a single EM lesion at the site of the tick bite, but 25% or more of untreated patients

may develop multiple EM lesions elsewhere. These secondary EM lesions represent an early dissemination of Lyme disease spirochetes. Unfortunately, some individuals do not develop these characteristic rashes, and so Lyme disease can go undiagnosed.



Figure 5. Erythema migrans (EM) rash on a human.
(Photo credit: Schwartzberg)

If an infected person is not treated, spirochetes can spread into various parts of the body including the nervous system and heart, usually within 1-12 weeks after the initial infection. It is during this stage that 10-20% of untreated patients develop symptoms ranging from headache and neck ache to encephalitis (inflammation of the brain) and meningitis (inflammation of the lining of the brain and the spinal cord), both potentially serious infections of the nervous system. Some patients suffer Bell's Palsy, a weakening of facial muscles usually affecting only one side of the face. Some patients with Lyme disease experience shooting pains, especially in large joints such as the knee, which interfere with sleep. Cardiac complications such as heart palpitations and dizziness associated with irregular heartbeat may occur in an estimated 4-10% of untreated patients. Cardiac symptoms eventually disappear, but a temporary pacemaker may be required in some individuals. Untreated patients may have no further symptoms and eventually recover, but others experience chronic disease.

Symptoms of chronic disease can begin months to years after infection in an estimated 60% of untreated patients and may persist for many years. The most common symptom is arthritis involving the swelling of large joints, especially the

knee. However, the nervous system also may be affected, with symptoms such as pain, loss of motor skill, memory loss, mood swings, sleep disorders, and debilitating chronic fatigue. Lyme disease rarely is fatal, but complications associated with chronic disease can be serious and costly, and cause degradation of "quality of life."

How Is Lyme Disease Diagnosed?

A diagnosis of Lyme disease by a physician is based on clinical findings such as an EM lesion or EM lesions in patients who recently have been in tick habitat or who have removed an attached black-legged tick nymph. Suspected cases may be confirmed in the laboratory by identifying Lyme disease spirochetes in culture or biopsy or with blood tests to detect antibodies against the bacterium. However, according to the Centers for Disease Control and Prevention (CDC), routine testing in the absence of clinical signs is not recommended because these tests are expensive and of limited usefulness.

How Is Lyme Disease Treated?

Consultation with a physician will determine the appropriate treatment on an individual basis. The reader should be aware that treatment of Lyme disease is not standardized in the U.S. However, early detection and action is very important because the initial infection typically can be treated successfully with an appropriate antibiotic taken over a 2-3 week period. Unfortunately, treatment of Lyme disease is less satisfactory after the spirochetes have spread and invaded other parts of the body. Application of antibiotics over several weeks may be necessary, and a patient might respond to treatment initially, but experience a relapse requiring subsequent antibiotic therapy. Some patients with chronic Lyme disease do not respond to treatment at all.

What Is My Risk of Becoming Ill With Lyme Disease in Indiana?

The risk of contracting Lyme disease varies by region, season, and habitat. Lyme disease transmission in Indiana requires infected white-footed mice, black-legged ticks, and white-tail deer. Moist woodlands with abundant leaf litter is the most common habitat in which Lyme disease is transmitted, but transmission also occurs in grassy vegetation between woodlands and suburban yards. In Indiana, the risk of contracting Lyme disease is quite low, but greatest during June and July, when nymphal black-legged ticks are active and most abundant. Indiana counties in which the risk of infection is greatest are in the northern third of the state, but Lyme disease transmission is becoming more widespread.

Research has shown that black-legged ticks infected with Lyme disease spirochetes become efficient vectors only after feeding on blood for at least 48 hours. Ticks feeding for between 24 and 48 hours are less efficient vectors, and transmission is rare by ticks feeding for less than 24 hours.

How Can I Protect Myself From Lyme Disease?

There is no Lyme disease vaccine for humans. (A vaccine was available until February 2002, but was taken off the market by the manufacturer.) Black-legged tick nymphs, the life cycle stage that is the primary vector to humans, rarely are noticed even when feeding on a human. This is because

they are very small, about the size of a sesame seed, and nearly translucent until they take a blood meal. Accordingly, the best protection is to avoid infested habitats during the height of the tick season. If this is not possible, the following practices are recommended:

- Walk on established trails and avoid contact with adjacent vegetation, such as grasses and low shrubs.
- Wear light-colored clothing consisting of a long-sleeved shirt, long pants, and also wear boots.
- Tuck the shirt into pants and the pants into socks.
- Apply repellent containing 15-30 % DEET (n, n-diethyl-toulamide) to clothes and exposed skin and/or apply permethrin to clothes; follow directions provided with both products.
- Conduct a thorough check of clothing and the body soon after returning from tick habitat.
- Wash clothing in hot, soapy water to kill any unseen immature ticks.
- Place unattached ticks in a container; label with date and location of the likely tick habitat.
- Properly remove and save attached ticks; label with date and site of attachment. (The tick might be sent for identification at a later date or, if you become ill, should be presented to the physician as evidence of possible involvement with a tick-borne disease.)
- See a doctor if you experience flu-like symptoms or an EM lesion at the site of tick attachment.

The reader should note that nearly all large ticks found on a person are either American dog ticks or lone star ticks, neither of which is a vector of Lyme disease spirochetes. Adult black-legged ticks rarely are found on humans, but they are known to feed on dogs and cats.

What Is the Best Way to Remove an Attached Tick?

The most effective and safest way is to grasp the tick with forceps or tweezers as close to the skin as possible and then pull gently and steadily until the tick releases its mouthparts. Do not jerk or twist the tick because this may tear the tick apart and expose the feeding wound to the tick's body fluids, which may contain Lyme disease spirochetes. Fingers protected by latex gloves can be used, but this method is less effective and less safe because the tick is more likely to be crushed in the process. Disinfect the feeding wound with warm, soapy water and rubbing alcohol. Place the tick in a sealable plastic bag and discard.

How Can I Control Ticks Around My Home?

Eliminate or at least cut back unwanted vegetation around yards, especially along the edge of woods and along paths in woods leading into the yard. Remove leaf litter at the edge of the woods, and consider using wood chips or gravel as a mulch in this area. If justified by the presence of large numbers of black-legged ticks, professional pest control applicators can apply a registered chemical to control them. Homeowners planning to attempt tick control on their property should read Purdue Extension publication E-71-W "*Ticks—Biology and Their Control*" and be sure to follow directions and precautions on the label of the product used for control.

Routinely monitor pets for ticks if they are kept outdoors or as they return from outings in tick habitat. Comb the pet over a white sheet, and kill displaced ticks by placing them in alcohol or by flushing them down a toilet. Remove attached ticks using the method described below, and disinfect the site of attachment. If necessary, check with a veterinarian for an effective dip or other tick control treatments for your pet. Tick collars are available and may provide partial protection, but they should not be relied on to prevent tick infestation.

Where Can I Find More Information on Lyme Disease?

Many Web sites provide additional information on Lyme disease, ticks, and associated public health issues. The following Web sites are recommended as accurate and current sources of information.

- Purdue Extension Entomology <<http://extension.entm.purdue.edu/>>
- Centers for Disease Control and Prevention <<http://www.cdc.gov/>>
- Indiana State Department of Health <<http://www.in.gov/>>
- Minnesota Department of Health <<http://www.health.state.mn.us/>>
- Mayo Clinic <<http://www.mayoclinic.com>>

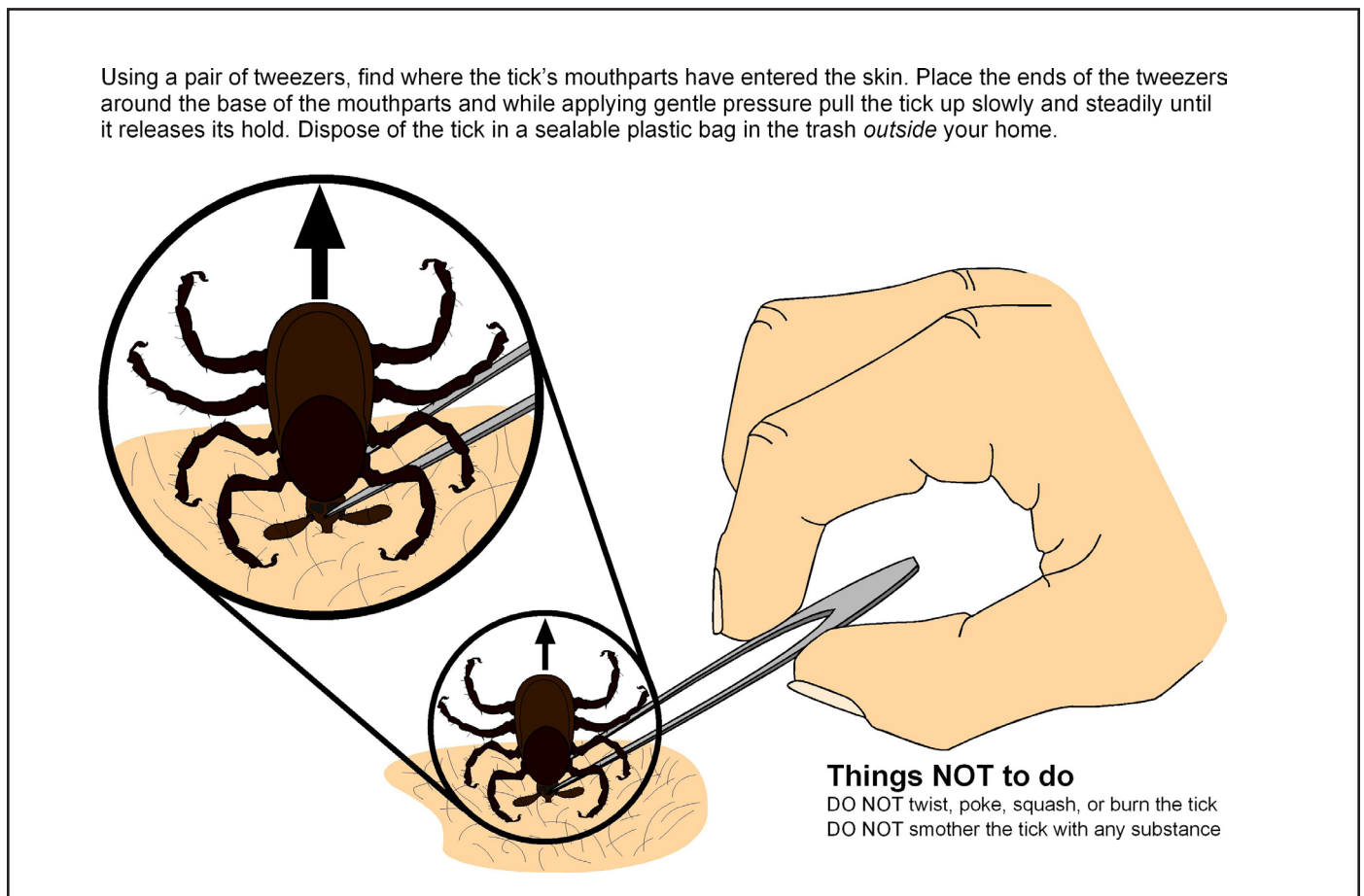


Figure 6. Diagram showing recommended procedure for removal of an attached tick.
(Drawing credit: Scott Charlesworth, Purdue University)

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