TickSense

Lyme Disease 5th/6th Grade Curriculum

TEACHER MATERIALS

Bay Area Lyme FOUNDATION

Committed to making Lyme disease easy to diagnose and simple to cure
Lyme Disease

Lyme disease is a serious health concern in the United States. This curriculum has been designed to help teachers communicate the facts about Lyme disease to students as part of the science curriculum, or as an aspect of general health education.

This material has been organized with teacher notes and information first—including a PowerPoint presentation for teachers—followed by handouts, worksheets and activities for students. The student material may be used in any order or sequence.

Curriculum Goal:
To teach students about Lyme disease so that they will understand...
• How it is transmitted
• Symptoms
• Medical treatment
• Best methods of prevention

Note: The student portion of this material is designed to be used in two ways:
1. Before embarking on an extended field trip or outdoor education program where children may be in areas known to be tick habitats, or
2. As part of a general health education curriculum.

Objectives:
By the end of this unit, students will be able to:
1. Identify and understand the cause, signs and treatments of Lyme
2. Identify and understand how to execute measures to prevent Lyme disease, including correct steps to take if someone is bitten.

Sequence of Material:
• Teacher Overview and Key Facts
• Teacher PowerPoint
• Student Materials and Activities
Standards:
This material has been developed with the California Department of Education’s Next Generation Science Standards for Grade 5 and Grade 6, and Grade 5 Health Education Standards as references:

www.cde.ca.gov/pd/ca/sc/ngssstandards.asp
and
www.cde.ca.gov/be/st/ss/documents/healthstandmar08.pdf
(see Personal and Community Health, page 25)

TEACHER OVERVIEW
This section of material has been designed to provide teachers with information so you can present a lesson or sequence of lessons about Lyme disease to students. Students will have lots of questions about Lyme, ticks and the bacteria that causes Lyme disease. It is important that they are made aware of the facts about Lyme, but that the information is presented in a non-scary way, especially if you are preparing to go on a field trip where ticks are known to be present, or embarking on an outdoor education program.

We hope we have covered everything you need. If not, please contact us through our website at education@bayarealyme.org

Lyme Disease – KEY FACTS students should know
1. Lyme disease is the fast-growing vector-borne disease in the United States today.
2. In 2014, the Centers for Disease Control and Prevention (CDC) revised its estimate of the number of new cases from 30,000 to over 300,000 new cases every year.
3. Lyme disease has been reported in 49 of 50 states—it’s not just an East Coast problem.
4. In California, Lyme disease can be contracted year-round.
5. Lyme disease has been detected in 42 of 58 counties in California.
6. Children are more susceptible to contracting Lyme disease than adults as they are closer to the ground and typically play in grasses, woodlands, sit on logs and have physical contact with tick habitat.
What is Lyme?

1. Lyme disease is caused by a bacteria called *Borrelia burgdorferi*.
2. The bacteria has a distinctive corkscrew or spiral shape, so it is known as a *spirochete*.
3. It is transmitted to humans through a *tick bite*.
4. The tick that carries the disease in California is the *Ixodes pacificus*, or western blacklegged tick.
5. The tick is both a *parasite* (relies on other animals for food) and a *vector* (carrier of bacteria that it transmits from one animal to another).
6. Lyme disease was first *discovered in the US in Lyme, Connecticut* in the early 1970s.
7. Ticks carry other microorganisms which are responsible for a variety of diseases known as *co-infections*, such as *Anaplasmosis*, *Babesiosis*, *Bartonella*, *Colorado tick fever*, *Ehrlichiosis*, *Rocky Mountain spotted fever*, *Southern tick-associated rash illness (STARI)*, *Tick paralysis*, *Tick-borne relapsing fever*, *Tularemia*, and *Powassan virus*. Note: not all of these infections are caused by the same species of tick.
8. *Early diagnosis and adequate treatment are essential* to avoid long-term health problems. (Early diagnosis is what is termed the “acute” stage of the disease when symptoms are localized – usually days or weeks after infection.)
9. Over 100 strains of the *Borrelia burgdorferi* have been detected in the US; over 300 strains worldwide.
10. If a tick is removed from a person’s body **24 hours or less** after attaching to the skin, the chances of the bacteria being transmitted is small. After 24 hours has elapsed, the chances of the bacteria being passed into the person’s bloodstream increases dramatically.

Symptoms:

1. Symptoms may appear days, weeks, months or even years after an infected tick bite.
2. *Symptoms vary over time* so are hard to pinpoint.
3. *Erythema Migrans*—an expanding red rash known as an “EM” rash may be present.
4. Rash may appear in many forms and varies in size, shape and location.
5. The classic “bull’s-eye” rash is the most widely recognized form, but not everyone with Lyme gets the rash.
6. **Common Early Symptoms:** rash (see above), flu-like symptoms when no one else around you has had or has the flu – aches, fevers, stiff neck, stomach ache, headaches, joint, muscle pain, fatigue, swollen lymph nodes.

7. **Physical Signs and Symptoms:** facial paralysis or Bell’s Palsy, meningitis, encephalitis, heart problems, conjunctivitis, speech difficulties, dizziness, motor tics, stabbing and shooting pains, numbness, tingling, swollen joints, severe fatigue.

8. **Psychiatric and Cognitive Symptoms:** attention difficulties, “brain-fog” problems concentrating, planning and organization, memory problems, changes in sleep patterns, behaviors – outbursts and irritability. Psychiatric problems could include obsessive/compulsive disorder (OCD), anxiety, depression, panic attacks, eating disorders and psychosis.

**Diagnostics, Testing and Treatment**

1. Current blood tests administered to diagnose Lyme disease can miss up to 60% of cases.

2. A negative result on a Lyme test does not definitively rule out infection.

3. Someone who has had exposure to ticks or a tick bite and is experiencing symptoms should be seen by a medical professional to be evaluated for Lyme and other tick-borne infections.

4. Ticks that are found embedded in the body and removed may be tested for the *Borrelia burgdorferi* bacteria and tick-borne infections. These tests are 100% accurate in detecting whether or not the bacteria is present in the body of the tick. However, even if the tick is carrying the bacteria, it does not mean that the bacteria was transmitted (see: What is Lyme? Point 10).

5. Different stages of the disease may require different treatments.

6. If diagnosed within days or weeks of infection, antibiotics (doxycycline) or amoxycillin may be an effective measure against the *Borrelia burgdorferi* bacteria.

**Bacteria and Ticks**

1. The bacteria that causes Lyme is called *Borrelia burgdorferi*.

2. Bacteria are single-celled microorganisms.

3. Bacteria are able to survive in many types of environments in and on the human body.

4. Most bacteria cause no harm to people, but some are the causes of infection as they move from one environment to another.
5. Bacteria that causes infection leaves an existing “reservoir” — either within the current host or in another host—and cause infection in another place—like an animal or human.

6. When a bacteria is living in its reservoir host organism, it causes NO HARM to that organism.

7. The reservoirs for the *Borrelia burgdorferi* bacteria are specific types of small mammals and birds; the grey squirrel and white-footed mouse are known to be the most “effective” reservoirs in California.

8. The *Borrelia burgdorferi* bacteria that causes Lyme disease in humans is distinctive: it is a corkscrew or spiral shape and is therefore known as a spirochete.

**The Tick Life Cycle**

9. The western blacklegged tick (*Ixodes pacificus*) has a multi-year life cycle and many animals play a role in its journey from larva to adult.

10. Adult ticks lay eggs in leaf litter, grasses and other habitats.

11. The tick eggs hatch into larvae. Larvae are NOT infected with the bacteria—but the larvae have to have a blood meal to grow to the next phase of their lifecycle.

12. Tick larvae feed on the blood of small mammals, birds, and lizards. That’s when the bacteria passes from the reservoir host (if the host is infected) into the tick. The tick is thus now infected with the *Borrelia burgdorferi* bacteria. It spends the winter in the ground, then in spring it molts and becomes a nymph.

13. The nymph—which can be the size of a tiny poppy seed—waits for its next blood meal in grasses, leaf litter, tree trunks and other outdoor habitats. When a mammal, bird, or lizard presents itself as the opportunity for its next meal, the nymph latches on to that creature and takes a blood meal. This is one of the stages of the tick’s life cycle when humans can be bitten, although nymphs will also feed off of dogs and/or small woodland mammals, too—and again, if the small mammal it feeds on is infected, it will ingest the bacteria. If the tick that bites the human at this point is already infected with the *Borrelia burgdorferi* bacteria, it may transmit the bacteria into the bloodstream of the person.

14. The nymph then molts into an adult tick. The adult tick needs one more blood meal from a large to medium-sized mammal. This may be a deer, raccoon, or a dog or a human! Once again, if the adult tick is infected with the spirochete, it will transmit the *Borrelia burgdorferi* bacteria to the animal if it is left to feed undetected.
15. After its final blood meal, the adult tick will reproduce and the female tick will lay eggs.

16. In California, when the western black-legged tick larvae or nymph feeds on a California western fence lizard or alligator lizard, the immune system of these lizards kills the *Borrelia* bacteria in the lizard and in the tick. In effect, our California lizards de-infect the ticks of *Borrelia burgdorferi*. Lizards in other parts of the United States and around the world do not share this capability and can be a reservoir.

Tick Life Cycle Illustration—Life Cycle is Two Years

The cycle lasts two years; the tick feeds three times over that two-year cycle.
Challenges

1. Ticks are hard to detect. The nymphs are particularly challenging as they can be the size of a pin head.

2. Ticks excrete a numbing substance from their jaws and saliva when they bite. People rarely feel the tick when it latches on to their skin.

3. Ticks love to hide in warm, moist places like the groin, armpits, backs of knees, waistband, navel, in the hair, folds of skin in the neck and ears.

Prevention

1. Wear light-colored clothing so ticks are more visible.

2. Wear long sleeves, tuck in shirts and long pants.

3. Consider using effective repellents such as lemon eucalyptus oil and Deet on the skin and Permethrin on clothing (easily obtainable from hardware stores and outdoor suppliers) to repel ticks.

4. Avoid tall grasses and moist, wooded, leaf-littered areas. Do not sit on the ground or lean up against tree trunks.

5. Check for ticks every day, especially if you have been in areas known to be tick habitats.

6. Feel for bumps on the skin, especially on the scalp.

7. Pets can bring ticks into the house on their coats. Check animals for ticks too.

Removal and Actions If You Find a Tick

8. If a tick is attached to your skin, get help; children should tell an adult.

9. Remove tick promptly following these directions: Use fine-point tweezers as close to the skin as possible and gently but firmly pull the tick straight out.

10. Do not squeeze the belly of the tick to avoid squeezing the contents of its gut into your bloodstream.

11. Note: the longer the tick is attached, the greater the likelihood of disease transmission.

12. Place tick in a zippered plastic bag with a moist cotton ball to keep it alive.

13. Take it to your local health department or send it to a specialized laboratory for testing.

14. Both live and dead ticks may be tested, but live ticks yield results more quickly.
15. Watch yourself for symptoms of the disease.
16. See your doctor if you suspect you may have contracted the bacteria.
17. It is possible to be re-infected with Lyme with multiple exposures.

**TALKING POINTS TO USE WITH STUDENTS**

Here are some suggested talking points for teachers to use with class (or classes):

1. Lyme disease is a serious health issue, but it is preventable
2. Stay on trails and avoid grasses, leaf litter and bushes
3. Consider using Permethrin on clothing, Deet on skin
4. Tick check DAILY—especially when showering—particularly key parts of body
5. Do not panic if you find a tick! Ask an adult for help
6. Simple steps will minimize a person’s risk for contracting Lyme and other tick-borne infections
7. If you get a tick, remove it immediately using fine-point tweezers
8. Be vigilant about checking for symptoms
9. Go to the doctor if you think you have been exposed to Lyme
10. It is possible to cure Lyme disease if people are aware and treatment is given soon after a bite
11. Antibiotics may cure Lyme
12. You need to be your own advocate if your doctor is skeptical
13. Right now, diagnostic tools for Lyme are only 40–80% reliable
14. Even if you get a negative result if you still don’t feel well, go back to your doctor—trust your instincts
15. Lyme is the fastest-growing vector-borne disease in the United States today
16. Estimated 300,000 new cases annually
17. Because it’s hard to detect and diagnose people may have Lyme and not even know
18. Scientists are working hard to develop new ways to diagnose Lyme disease and find a cure
SUGGESTED LESSON PLAN/MINI-UNIT ON TICKS AND LYME

We recommend that teachers use this material as a two-day mini-unit to teach students about ticks, tick-borne diseases and Lyme disease prevention. The ideal unit would be two 45–55-minute lessons with a take-home/homework assignment between the two lessons. However, teachers may adapt and change the timing and assignments as required.

This unit is designed to be of particular use in advance of a field trip where a class is headed into the outdoors for the day, or an extended one-week residential outdoor education program when students may be exposed to ticks, but it is just as relevant as a general health education unit.

LESSON 1: (60 minute time slot)

> Introduction (3 mins)
  • Explain to students that they will be doing a mini-unit about ticks and Lyme disease.
  • Be sure to help them understand why they are learning about this and its importance (ex: they are about to go to outdoor education, it’s part of a health unit etc).

> Ask questions—what do students know about ticks, tick-borne diseases and Lyme? What are things that they want to learn? (5 mins)
  • Create and fill out a chart with what they currently know and what they want to learn during the unit. This way, you can check things off the list as they learn them and they will be able to actually see their progress.

> Show PPT (20 mins)
  • Take your time with the powerpoint presentation. Allow students to ask questions as you go through it—they will most likely have questions.

> In-class assignment: Design mini-brochure (20 mins). See optional template p. 15.
  • Explain to the students that they will be creating an information brochure/pamphlet that they will use to educate someone at home about ticks and Lyme disease. The brochure should include:
    1. a cover with a picture and title.
    2. information that will help someone avoid getting bitten by a tick.
    3. information that will help them know what to do if they get bitten by a tick.
    4. information that will help them identify the symptoms of Lyme disease.
    5. important- for the graphing assignment on day two: students need to ask four adults (two males, two females) if they have ever been bitten by a tick. They will record the answers on the back of the brochure with the signature of the person they showed it to.

> Talking points to conclude (7 mins)
  • Ask students to think of three interesting new things they learned today.
  • Have students share with their elbow partner (person sitting next to them) what their three things are.
Once students have shared with their partner, have them share out as a class.

Then, address the chart you made at the beginning of class and check off any items that they learned today that they did not know before it began.

Hand out the packet for them to work on at home (you can have them do all of it, or part of it and finish the rest during day two).

**HOMEWORK**

Complete student packet (all or selected items): crossword, word search, fill in gaps, etc.

**LESSON 2: (60 minute time slot)**

> **Discussion about brochure presentation** (5 mins)

Have students raise their hands to share their experience with educating their families at home with their brochure.

- What did the adults know?
- What did the adults not know?
- Did anyone they educated have experience with ticks?

> **Packet** (15 minutes)

Whatever portion of the packet that students did not complete for homework may be completed at this point in class.

> **Math/graphing extension** (25 mins)

- Students will graph their data from the night before as well as collecting two more pieces of data from their classmates.
- Students might need to start this assignment as a class before finishing on their own.
- Once students are done, have them share their ‘results’ and discuss what they think it means.

  **EXAMPLE:** if they noticed that more adults than children have been bitten by ticks, ask them why they think that is (having more exposure over a longer lifetime, not being educated when they were kids, etc).

> **Take quiz** (10 mins)

- Give students the quiz
- Allow plenty of time to complete the quiz to ensure they are not rushed.
- Grade quiz together, as a class, so students immediately can rectify incorrect answers.

> **Closing conversation** (5 min)

- Now that students have learned so much about ticks, look over the chart from the day before and check off what they now know (do this as a class).
- Ask students to think about and share why they think it’s so important for people to learn about ticks and Lyme disease.
- Praise them for learning about Lyme disease and for being ambassadors to help educate others about the risks of ticks and Lyme disease.
Find the words in the puzzle above – be sure to look forwards, backwards, up, down and diagonal!

LYME
TICK
NYMPH
BORRELLIA
BURGDORFERI
MOUSE
SQUIRREL
GRASSES
LEAVES
PATHOGEN
DIAGNOSTIC
TREATMENT
ANTIBIOTICS
SYMPTOM
RASH
FATIGUE
JOINT
FEVER
NUMBNESS
DEET

Visit www.bayarealyme.org for clues.
1. What causes Lyme disease?
   a. A virus in the blood
   b. A bacterial infection from a tick bite
   c. A bacterial infection
   d. A tick bite

2. What animals carry the bacteria that causes Lyme disease?
   a. Ticks
   b. Mice
   c. Squirrels
   d. All of the above

3. What are the four stages of a tick’s life?
   a. Grub, cocoon, tick
   b. Egg, nymph, adult
   c. Egg, nymph, chrysalis, insect
   d. Egg, larva, nymph, adult

4. What should you do if you are bitten by a tick?
   a. Cover the tick with a band aid
   b. Pull the tick straight out of the skin using tweezers
   c. Squish the tick with your fingers

5. What are the symptoms of Lyme disease?
   a. Extreme fatigue with muscle and joint pain
   b. A rash that moves and spreads
   c. Headaches and flu-like symptoms
   d. All of the above

6. What is the best way to prevent getting Lyme disease?
   a. Stay in the middle of trails
   b. Avoid grasses, leaf litter, logs and tree trunks
   c. Wear light-colored clothing treated with tick repellent
   d. Tick-check every day
   e. All of the above

7. If you find a tick on your body you should
   a. Tell an adult
   b. Remove the tick safely
   c. Save the tick for testing
   d. Watch yourself for symptoms and see your doctor
   e. All of the above

8. When you check yourself for ticks, what parts of the body need close attention?
   a. Hair, scalp and neck
   b. Armpits and backs of knees
   c. Groin and waistband
   d. All of the above
Certificate of Completion

This certificate is awarded to:

This certifies that I am now armed with the knowledge to keep myself and others safe while outside through **Tick-bite prevention**!

I am now an ambassador and will go and enjoy the great outdoors!

Signature of Authorization ___________________________ Date Awarded ___________________________
About Bay Area Lyme Foundation

Bay Area Lyme was founded in 2011 by a group of concerned individuals determined to make Lyme disease easy to diagnose and simple to cure. Although primarily a medical research foundation that grants funding to scientists and researchers to progress the search for a cure, Bay Area Lyme is also committed to preventing new cases of the disease. Our education outreach program reaches over 200,000 children annually in California through our efforts to engage outdoor education programs, naturalists, environmental educators, scientists and classroom teachers in promoting safe behaviors when in tick habitats.

Please refer to our website www.bayarelymeorg/educators for more information.