

# LYME DISEASE CURRICULUM

Teacher's Guide – 9th grade

Dear Teacher,

This program is flexibly designed to cater to your class schedule and is suitable for grades nine and above. As a supplement, either print the student workbook or utilize the interactive version to accompany the curriculum.

Goal: To promote student knowledge and skills regarding transmission, course of illness, and prevention of Lyme disease.

### OBJECTIVES:

1. List the signs and symptoms of Lyme disease and explain the course of Lyme disease from its onset to treatment.
2. Describe the actions to take to prevent Lyme disease and identify steps to take if a tick is found on one's body.
3. Describe the social, emotional, and educational ramifications of Lyme disease.



# Topics of Discussion

## OBJECTIVE 1

List the signs and symptoms of Lyme disease and explain the course of Lyme disease from its onset to treatment.

### Lyme Disease

1. Lyme disease is an infectious disease caused by *Borrelia burgdorferi*, a corkscrew-shaped bacterium called a spirochete.
2. In the U.S., Lyme disease can be transmitted through the bite of a Blacklegged (deer) tick [*Ixodes scapularis* (northeastern, mid-Atlantic, and north-central)] or the Western Blacklegged tick [*Ixodes pacificus* (Pacific Coast)]. The tick relies on other organisms for food. Since it carries and transmits a bacterium from one animal to another, it is also called a vector (a carrier).
3. Lyme disease was first discovered in the U.S., in Lyme, Connecticut.
4. Lyme disease has been reported throughout the United States, but is most prevalent in the Northeast, Upper Midwest, and from Northern California into Oregon and Washington. However, it continues to spread through migratory birds (over 50 species carry ticks), deer overpopulation, and the reforestation of the suburbs.
5. Over 100 strains of the bacteria have been identified in the U.S. (300 strains worldwide). Some strains are more virulent and may cause varying severity of illness.
6. A single tick bite may simultaneously transmit Lyme disease and other diseases, referred to as co-infections, such as babesiosis, anaplasmosis (ehrlichiosis), bartonella, tularemia, and *Borrelia miyamotoi* infection. Future research may uncover other co-infections.
7. Early diagnosis and adequate treatment, including antibiotics, reduce the risk of long-term illness.
8. You cannot catch Lyme disease from other people.

## Signs & Symptoms

1. Symptoms may appear days, weeks, months, or even years after an infected tick bite. Symptoms may vary over time.
2. An erythema migrans (expanding red rash) is a definitive symptom of Lyme disease.
3. A rash may appear in many forms (the expanding red rash is the most widely recognized) and may vary in size and shape. NOT everyone with Lyme disease develops a rash. The rash is not always a classic “bull’s-eye” rash (round, red, circular rash with a clear center) and is often mistaken for a spider bite. Consider the season and the region — if it’s June or July in the northeast, it is very likely Lyme disease.
4. Common early symptoms may include rash, flu-like symptoms such as fever, stiff neck, stomachache, headache, swollen lymph nodes, migratory pains in joints and muscles, and fatigue.
5. Physical symptoms (at any stage of the disease) may mimic Bell’s palsy (facial paralysis) and may include motor or sensory problems, meningitis, encephalitis, various heart problems, conjunctivitis and other eye problems, speech difficulty, dizziness, motor tics, stabbing and shooting pains, numbness, tingling and swollen joints. Severe fatigue may occur, requiring vast amounts of sleep.
6. Psychiatric and cognitive symptoms may include trouble with attention and concentration, planning and organization, memory problems, and changes in sleep patterns (often dramatic) and/or behaviors (violent outbursts, irritability).

Psychiatric problems could also include OCD (Obsessive Compulsive Disorder), anxiety, depression, panic attacks, eating disorders, and psychosis.

## Testing

1. Current widely used blood tests, ELISA and Western Blot, are not always reliable to make a definitive diagnosis of Lyme disease.
2. The accuracy of testing to support the Lyme diagnosis depends on a number of variables; false negatives and false positives are common.
3. Most tests currently available are indirect detection tests (the immune system's response to the disease), and look for antibodies to Lyme disease spirochetes, not the bacteria.
4. The diagnosis should be a clinical one based upon symptoms (particularly the rash), tick exposure and evaluation of test results.
5. Currently, no tests can rule out Lyme disease. A person can test negative, but still have Lyme disease.

## Treatment

1. Treatment protocols vary due to duration of undetected infection, presence of co-infections, and individual's immune system response and genetic predisposition. No one specific treatment protocol addresses every patient, and each individual circumstance should be discussed with a physician.
2. Oral, intravenous, and intramuscular medications may be used in the treatment of tick-borne illness.
3. Prophylactic (preventive) treatment should be considered when bitten by a tick in a Lyme endemic area because left untreated the bacteria can cause severe, multi-system manifestations including cardiac, arthritic, and neurologic abnormalities.

## OBJECTIVE 2

Describe the actions to take to prevent Lyme disease and identify steps to take if a tick is found on one's body.

### Prevention

1. Wear light-colored clothing, so ticks are more visible to you.
2. Wear long sleeves, tucked-in shirts and long pants tucked into your socks to prevent ticks from attaching to your skin.
3. Avoid tall grass and moist, wooded, leaf littered areas where ticks love to hide. Stone walls are frequented by rodents that can leave ticks behind, so it's important to be particularly careful in these areas.
4. Use an appropriate tick or insect repellent on clothing and on skin as directed.
5. Perform frequent tick checks on both yourself and your pet after exposure to possible tick environments.
6. Ticks love to hide in warm, moist places, such as the groin, back of the knees, armpits, the back of the neck, navel, and ears, but ticks will feed anywhere on the body, so look carefully.
7. The nymph is only the size of a pinhead and may be missed during your daily examination. Be sure to feel skin for any tiny bumps that might indicate a tick, especially on the scalp. If a bump is found, do not squeeze or press the bump.
8. If a tick is attached to your skin, try to get help from someone who is experienced at tick removal. It needs to be removed properly and promptly. Use fine-point tweezers or special tick removal tweezers as close to the skin as possible, and gently pull the tick straight out.

**DO NOT SQUEEZE THE BELLY OF THE TICK, AS IMPROPER REMOVAL INCREASES RISK OF INFECTION.**

- a. The longer the tick is attached, the greater likelihood of transmission of disease.
- b. Place tick in a zippered plastic bag with a blade of grass or a moist cotton ball, and bring it to your local health department or private lab for testing, if they provide this service. The blade of grass or dampened cotton ball provides moisture to keep the tick alive. Both dead and live ticks may be tested, but live ticks yield quicker test results. (Visit the Global Lyme Alliance website [[www.GlobalLymeAlliance.org](http://www.GlobalLymeAlliance.org)] for information on where ticks can be taken for testing.)

## OBJECTIVE 3

Describe the social, emotional, and educational ramifications of Lyme disease.

### Social & Emotional

Lyme disease is a serious, complex, multi-system illness that affects individuals differently. Many factors are involved, including the strain of the bacteria, presence of co-infections, duration of the illness (particularly prior to diagnosis), and the immune-response of the individual. It is therefore difficult to predict a pattern, particularly in adolescents, when hormonal factors can influence symptoms.

1. Many with Lyme disease do not look sick, particularly those for whom the neuropsychiatric symptoms are the primary indications.
2. Fluctuations in moods may occur, such as irritability, hostility, extreme sensitivity, anxiety, panic attacks, and even combativeness and oppositionality. Female adolescents often have extreme PMS symptoms.
3. Fatigue and depression are very common and stem from the illness itself, as well as the situation of the patient.
4. Cognitive problems, such as problems with attention, concentration, executive functioning (planning, organization, prioritizing and multitasking, concentration, and working memory), short-term memory, and word retrieval can occur with people who have been diagnosed with Lyme disease.
5. Eating disorder symptoms, though not common, can be seen in both male and female adolescents, as well as in adults, with Lyme disease.
6. Sound and light sensitivity can impact a student's ability to tolerate the noise and fluorescent lighting of most school settings.
7. Abilities to perform well and consistently, in the academic, athletic, and social arenas can be seriously impacted, and the student with Lyme disease often loses confidence in him/herself. Sound and light sensitivity can impede a student's involvement in social activities (sporting events, school dances, etc.).

## Social & Emotional (continued)

8. The effect of Lyme disease on the brain and body can even impact a gifted athlete's ability to perform:
  - a. Spatial perception may suffer; thus an athlete may lose the ability to judge distances.
  - b. He/she may lose the ability to recall and execute plays, as well as understand and follow directions.
  - c. Reduced speed of processing can inhibit the ability of an athlete to compete at his/her pre-Lyme disease potential.
  - d. Extreme sensitivity to light and sound might impact performance (even watching an athletic event can be difficult for a student who has late-stage Lyme disease).
  - e. Physical symptoms that impact performance include: intermittent fatigue, muscle and joint pain, dizziness, loss of balance, strength, coordination, and flexibility; even asthmatic symptoms may be worsened by Lyme disease.
9. Part of the pattern of this illness is that symptoms may come and go, or become more or less severe, from day to day, both due to the illness itself, and to the response to treatment. Because of this, Lyme disease patients often are met with doubt from those around them who have difficulty accepting that they are suffering from a serious, debilitating illness. Lyme disease is often an invisible disease because the patient may not always appear to be ill.
10. Students who are ill with Lyme disease may respond in different ways, partially due to their gender. Female students may be more likely to display emotion, some having tearful "meltdowns" when they feel overwhelmed. Male students are more likely to withdraw—exhibiting the bravado common to adolescent males, perhaps denying the illness—and appear angry and belligerent. Adolescence, a time of change and pressure on several fronts, is far more difficult for students struggling with Lyme disease.
11. Some students with Lyme disease are truly isolated, missing school for long periods of time, not being able to predict when they will be well enough to return to school and remain there.
12. Non-acceptance by peers and the isolation that comes from long periods of time out of school can lead to feelings of alienation and loneliness. This can result in a tendency to further withdraw and isolate. Some feel embarrassed about an illness they cannot control.
13. Returning to school after absences may be a problem, as the student struggles to catch up, and returning to the social arena can be particularly difficult.



## Educational

### 1. Loss of school time:

- a. Too sick to attend school at all
- b. Too sick to attend full day
- c. Frequent absences
- d. Late mornings/start of school

### 2. Interrupted school day:

- a. Falling asleep in class
- b. Frequent visits to nurse

### 3. Cognitive impairments (often dramatic):

- a. Word-finding deficits
- b. Impaired memory, short- and long-term
- c. Forgetfulness
- d. Reduced processing speed
- e. Impaired auditory and visual processing
- f. Impaired visuospatial ability
- g. Inability to multi-task
- h. Impaired attention and concentration (ADD-like symptoms)
- i. Difficulty planning and organizing school work
- j. Reduction in IQ, sometimes dramatic
- k. Inconsistent performance across all aptitude, achievement and functional tests
- l. Poor concentration
- m. Distractibility
- n. Difficulty organizing schoolwork

### 4. Other impairments that impact learning:

- a. "Brain fog," described as the inability to think, remember or articulate clearly
- b. Profound fatigue, as well as other physical symptoms (see symptom checklist)
- c. Vision problems (floaters, blurred vision, etc.)
- d. Sensitivity to light and sound

## Educational (continued)

5. Despite the student's best efforts, the effects of Lyme disease can impact academic performance in all areas, resulting in:
  - a. Low or inconsistent test scores
  - b. Poor or inconsistent class participation
  - c. Poor or incomplete homework assignments
6. Standardized tests:
  - a. A dramatic lowering of IQ can be seen on tests
  - b. Other standardized tests can give a false (negative) impression of the student's potential (including college entrance exams)

## MATERIALS:

Teacher Resources: Lyme Disease Curriculum Teacher's Guide — 9th Grade

Video: Living the Lyme Life

Handouts: 9th Grade Workbook

## SUGGESTED ACTIVITIES:

### Objective 1:

List the signs and symptoms of Lyme disease and explain the course of Lyme disease from its onset to treatment

- a. Symptom List
- b. What EM Rashes Could Look Like
- c. Video: Living the Lyme Life (9th grade curriculum video)

### Objective 2:

Describe the actions to take to prevent Lyme disease

- a. Different Life Stages of the Blacklegged Tick
- b. Tick Checklist
- c. Video: "Living the Lyme Life"

### Objective 3:

Describe the social, emotional, and education ramifications of Lyme disease

- a. Video: Learn About Lyme for Teens

## Symptom List

There are many signs and symptoms of Lyme disease, and a hallmark of the disease is the fluctuation of symptoms.

### Head, Face and Neck:

Headache

Facial paralysis (Bell's palsy)

Tingling of nose, cheek, or face

Twitching of facial/other muscles

### Respiratory/Circulatory Systems:

Heart palpitations

Heart block, murmur

### Psychiatric Symptoms:

Mood swings, irritability, agitation

Anxiety

Personality changes

Feeling as though you are losing your mind

### Cognitive Symptoms:

Poor school or work performance

Attention deficit problems, distractibility

Difficulty with concentration,  
reading, spelling

Difficulty in multitasking

### Skin Problems:

Erythema migrans (rash)

### Ocular:

Double or blurry vision, vision changes

Light sensitivity

### Auditory:

Sound sensitivity/pain in ears

### Musculoskeletal System:

Joint pain, swelling, or stiffness

Migratory joint pains

Muscle pain or cramps

### Neurologic System:

Numbness in body, tingling, pinpricks

Burning/stabbing sensations in the body

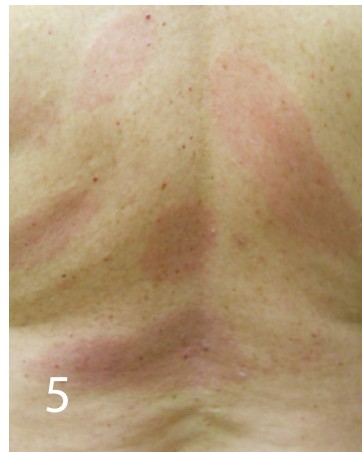
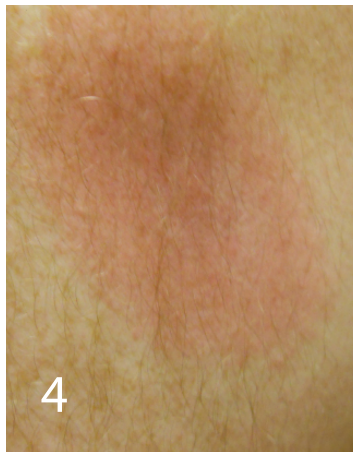
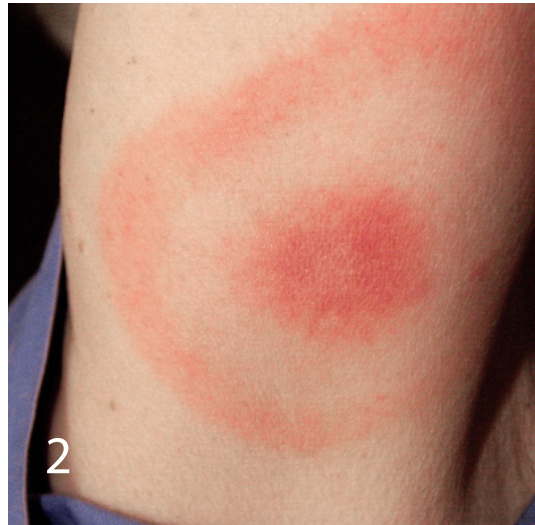
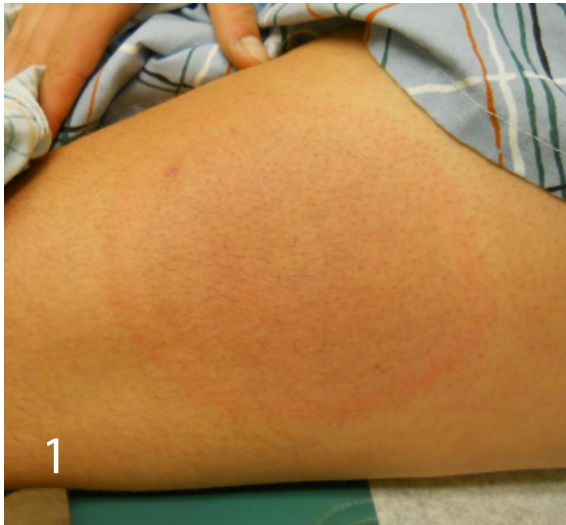
Burning in feet

### General Well-being:

Extreme fatigue, exhaustion

This is a partial list – there are many possible symptoms.

## Images of erythema migrans rashes



Photos of rashes 1, 3, 4 and 5 courtesy of Dr. John Aucott of Johns Hopkins University.  
Photo of rash 2 courtesy of James Gathany Content Providers(s): CDC/James Gathany.

## ASSESSMENT

1. The bacteria that causes Lyme disease enters the body through the bite of an infected blacklegged tick and then spreads to many parts of the body and can cause many different symptoms.
2. The corkcrew shaped bacterium that causes Lyme disease is known as a spirochete (*Borrelia burgdorferi*).
3. A large, red, expanding rash is a definitive symptom of Lyme disease and means that immediate medical care is needed.
4. Many people do not display the telltale erythema migrans rash. This rash may be the most classic but it is not the most common.
5. Early diagnosis and appropriate treatment prevent later stage complications that may be costly and debilitating.
6. Common early symptoms may include flu-like symptoms such as fever, stiff neck, stomachaches, headaches, swollen lymph nodes, migratory pains in joints and muscles, and fatigue.
7. The ELISA and Western blot are the most widely used diagnostic tests but are not always reliable to make a definitive diagnosis of Lyme disease. Currently no tests can rule out Lyme disease.
8. The diagnosis of Lyme disease should be a clinical one based on signs and symptoms, tick exposure, and evaluation of tests.
9. Mild to severe headaches are a sign that Lyme disease has spread to the nervous system.
10. The main treatment for Lyme disease is the use of antibiotics, both oral and intravenous.
11. Fluctuations in symptoms and the severity of these symptoms from day to day are the hallmark of Lyme disease, due to both the illness itself and the response of the treatment.
12. Psychiatric problems associated with Lyme disease may include anxiety.
13. Sound and light sensitivity can make it difficult for a student with Lyme disease to tolerate the lighting and noise in most school settings.
14. Some students with Lyme disease may experience problems with school performance, especially in the areas of concentration and distraction.
15. Lyme disease is a major public health threat that is grossly under-reported.

### Word key

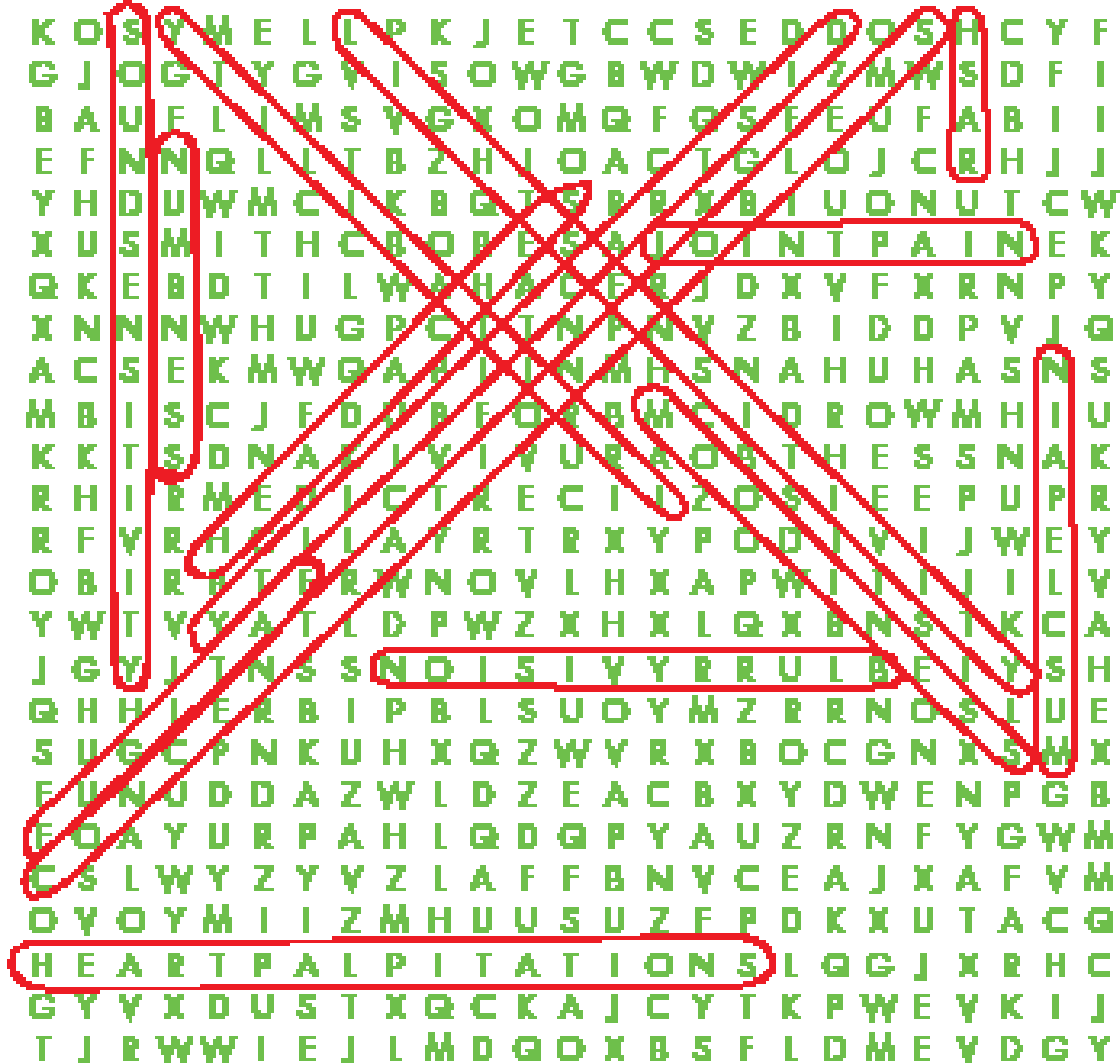
Antibiotics  
Concentration  
Distraction  
Flu-like  
Sensitivity  
Treatment

Anxiety  
Diagnosis  
Erythema migrans  
Headaches  
Spirochete  
Under-reported

Clinical  
Diagnostic tests  
Fluctuations  
Medical  
Speech

## OPTIONAL WORD SEARCH

### SYMPTOMS OF LYME DISEASE



Blurry vision  
Concentration problems  
Distractibility  
Fatigue

Headache  
Heart palpitations  
Irritability

Joint pain  
Light sensitivity  
Moodiness

Muscle pain  
Numbness  
Rash  
Sound sensitivity

Check out our website for more information and activities!

[www.GLA.org](http://www.GLA.org)

Sponsors for this educational curriculum: Mark and Deborah Blackman Charitable Trust, Newman's Own Foundation, The Allan B. and Frances G. Herzog Charitable Foundation, and The William H. Pitt Foundation

