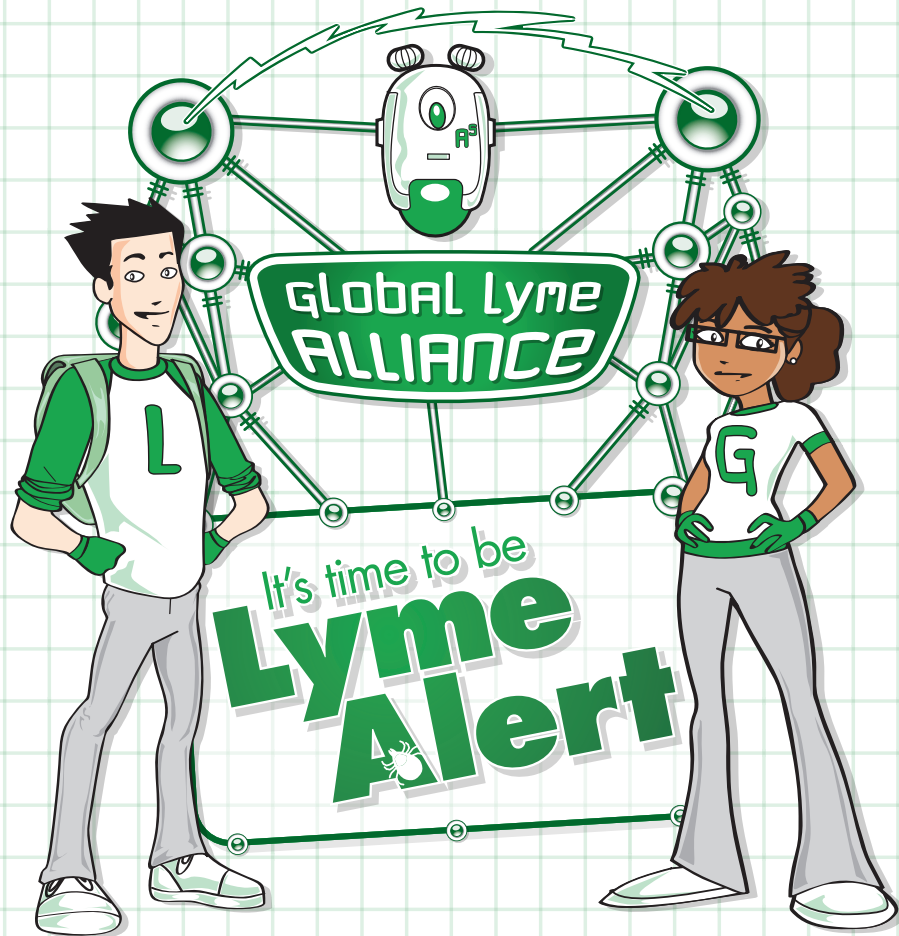


6th GRADE WORKBOOK



name: \_\_\_\_\_ date: \_\_\_\_\_



GLOBAL LYME ALLIANCE  
Conquering Tick-borne Disease through Research & Education

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

# LYME DISEASE CURRICULUM

Teacher's Guide – 6th Grade

Dear Teacher,

This program is flexibly designed to cater to your class schedule. As a supplement, either print the student workbook or utilize the interactive version to accompany the curriculum. Peer guides, Gaby and Lenny, along with their robot A5, help students digest the material in a fun and interactive way.

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

### OBJECTIVES:

1. Identify the cause, signs and symptoms, and treatments.
2. Identify measures to prevent Lyme disease including steps to take if a tick is found on their body.



# Topics of Discussion and Teacher's Key to Workbook Activities

## OBJECTIVE 1

Identify the cause, signs and symptoms, and treatments.

### 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 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).
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 are essential to avoid late-stage problems.
8. You cannot catch Lyme disease through casual interaction with 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. In the absence of an erythema migrans rash, early Lyme disease can be confused with the flu because it often has 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. Lyme disease is often called the ‘great imitator’ because its symptoms mimic many other diseases.
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.

## Diagnostic Testing

1. Current widely used blood tests, ELISA and Western Blot, are not always reliable to make a definitive diagnosis of Lyme disease. False-negative and false-positive tests are common.
2. Most tests look for antibodies (the immune system's response to the disease), not the bacteria.
3. The diagnosis should be a clinical one based upon symptoms, tick exposure and evaluation of test results.
4. Currently, no tests can rule out Lyme disease.
5. An erythema migrans rash is a definitive diagnosis of Lyme disease and requires immediate medical treatment.
6. A neuropsychological/neurocognitive evaluation to determine decline in cognitive and emotional functioning should be considered as part of the medical evaluation.

## Treatment

1. Treatment protocols vary due to duration of undetected infection, presence of co-infections, and individual's immune system response and genetic predisposition.
2. Oral and intravenous medications may be used in the treatment of tick-borne illnesses.
3. No one specific treatment protocol addresses every patient, and each individual circumstance should be discussed with a physician.

## OBJECTIVE 2

Identify measures to prevent Lyme disease including steps to take if a tick is found on their body.

### Blacklegged (Deer) Tick Life Cycle

1. The female Blacklegged tick has a 2-year life cycle, consisting of 4 stages. The last stage ends in the laying of up to 3,000 eggs in the spring.
2. The eggs hatch into larvae which feed on small mammals (rats, chipmunks, mice) and birds. If the host mammal is infected, the larvae become infected.
3. After spending the winter in the ground, the larvae molt to the nymphal stage the following spring. The nymph needs a blood meal before it can molt into an adult. Nymphs' preferred hosts are small mammals and birds, but pets and humans are fine, too. The adult ticks prefer a large mammal, such as a deer or human, for their 3rd and last feeding.
4. By the time a tick reaches the adult stage, it has had two feedings and thus is more likely to be infected than at earlier stages.
5. Most humans are infected by nymphs; they are tiny (less than 2 mm) and difficult to see. They feed during the spring and summer months. Adult ticks are larger – about the size of a sesame seed. They can transmit Lyme disease bacteria and are most active during the cooler months of the year. Ticks may be active any day of the year when the temperature is above 36 degrees Fahrenheit. (cdc.gov)

### Prevention Tips

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, under adult supervision.
5. Perform frequent tick checks on both yourself and your pet after exposure to possible tick environments.

### Prevention Tips (continued)

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 poppy seed 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, get adult help. Have an adult remove the tick **properly** and **promptly** by using fine-point tweezers or special tick-removal tweezers as close to the skin as possible, and gently pulling 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.)
9. Once you're bitten and already diagnosed with Lyme disease, you can be re-infected a second time; this can make you more ill, even if you're still on medication.

## MATERIALS:

**Teacher Resources:** Lyme Disease Curriculum Teacher's Guide — 6th Grade

**Handouts:** 6th Grade Curriculum

## SUGGESTED ACTIVITIES:

### Objective 1:

A. Emphasize that *preventing* a disease is much easier and less painful than *treating* a disease.

**Ask students:**

- 1) Can you prevent Lyme disease?
- 2) What can you tell me about Lyme disease?

### Objective 2:

A. During spring and summer months (depending on where you live) when nymphal ticks are most active, have the students make posters about the prevention of Lyme disease to display around the school. These posters will create an awareness and educate the school staff, students, and parents about Lyme disease. The most important thing to remember is that Lyme disease is preventable through education.

B. Enter the school's science fair by doing a Lyme project.

C. Review workbook activities.

## Symptom List

Some of the many signs and symptoms of Lyme disease are:

### **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

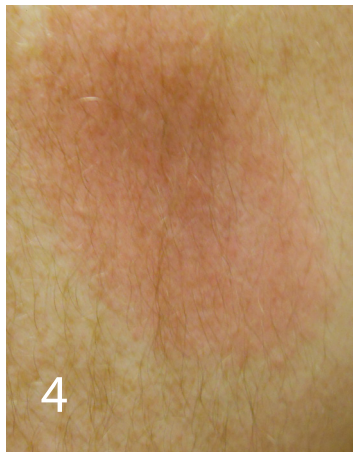
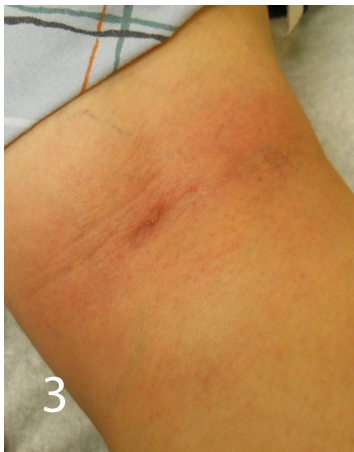
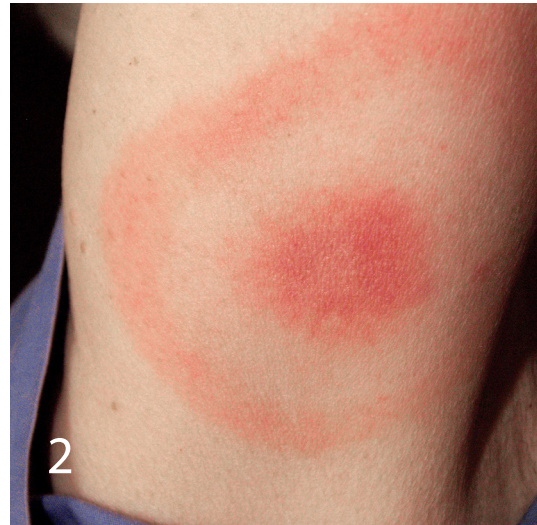
### **Neurologic System:**

Numbness in body, tingling, pinpricks  
Burning/stabbing sensations in the body  
Burning in feet

### **General Well-being:**

Extreme fatigue, exhaustion

## 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.

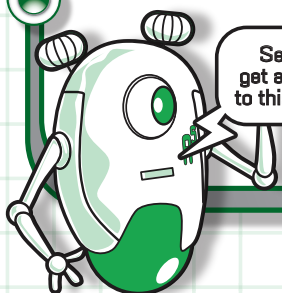
## WORKBOOK ANSWER KEY

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 corkscrew 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 to 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 distractibility.
15. Lyme disease is a major public health threat that is grossly Under-reported.

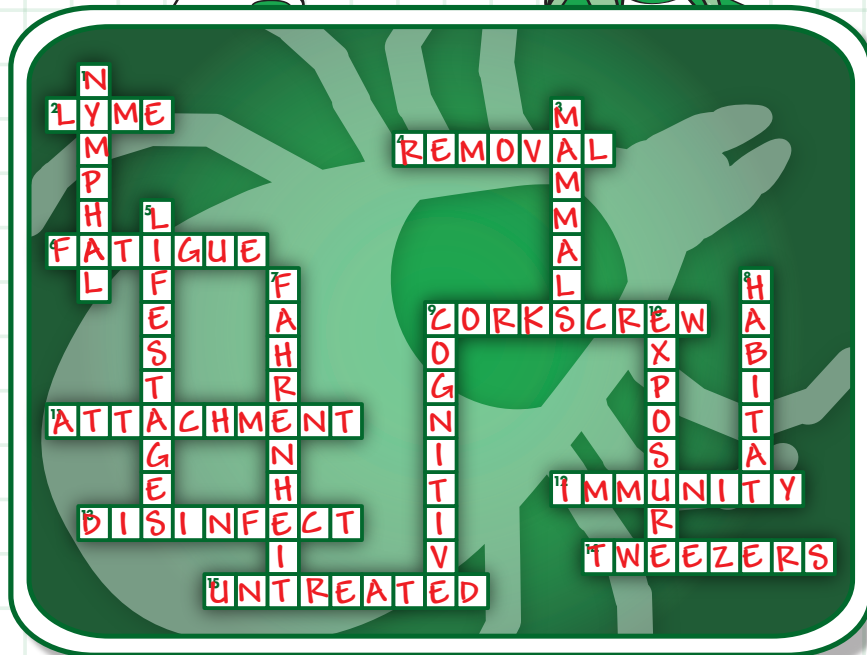
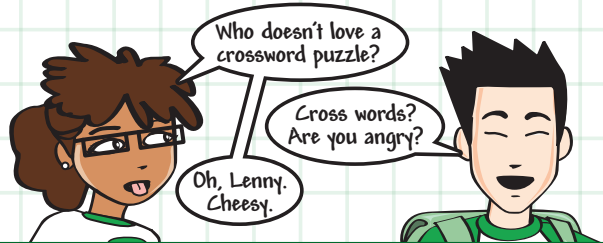
### Word key

Antibiotics	Anxiety	Clinical
Concentration	Diagnosis	Diagnostic tests
Distractibility	Erythema migrans	Fluctuations
Flu-like	Headaches	Medical
Sensitivity	Spirochete	Spreads
Treatment	Under-reported	

See if you can  
get all the answers  
to this assessment.



## WORKBOOK ANSWER KEY



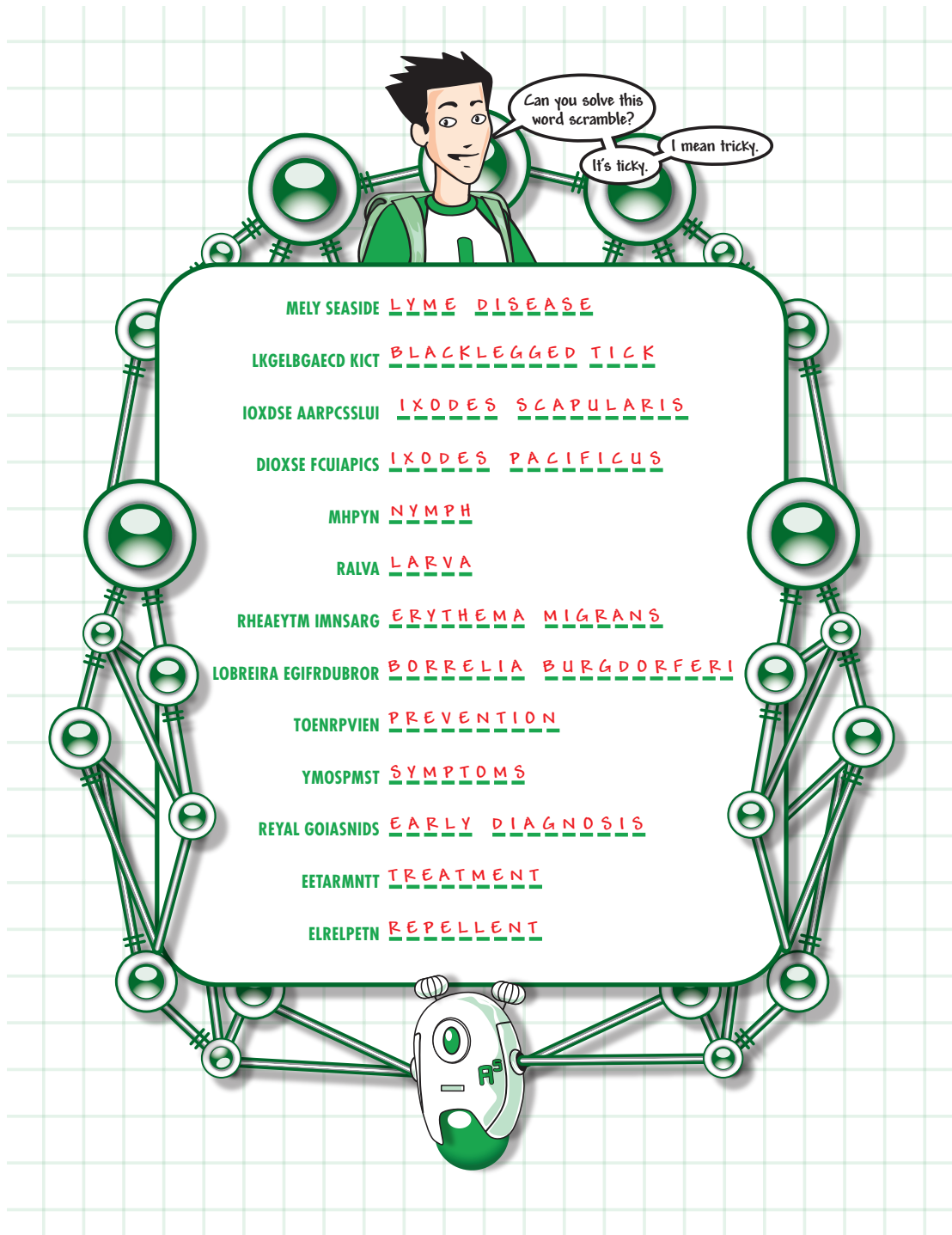
### ACROSS:

2. \_\_\_\_ disease was first recognized in 1975.
4. Improper \_\_\_\_ increases risk of infection.
6. \_\_\_\_ is a symptom of Lyme disease.
9. Lyme disease is an infectious disease caused by a \_\_\_\_ shaped bacterium called a spirochete.
11. If tick removal occurs within several hours after \_\_\_\_, the risk of infection is greatly reduced, although not entirely eliminated.
12. The body does not develop an \_\_\_\_ to Lyme disease.
13. After removing a tick, thoroughly \_\_\_\_ the bite site and wash hands.
14. To remove an attached tick, grasp with fine-tipped \_\_\_\_ as close as possible and pull upward and out.
15. If Lyme disease is left \_\_\_\_, complications such as heart abnormalities and problems with attention and memory may occur.

### DOWN:

1. Most Lyme disease cases are associated with the bite of a \_\_\_\_ stage of the blacklegged tick.
3. The eggs of a tick hatch into larvae, which feed on small \_\_\_\_ (rats, chipmunks and mice) and birds.
5. Ticks have four \_\_\_\_.
7. Ticks may be active any day of the year when the temperature is above 36 degrees \_\_\_\_.
8. People who spend time outside in a tick-infested \_\_\_\_ are at increased risk for Lyme disease.
9. \_\_\_\_ problems, such as problems with attention, concentration, executive functioning, short-term memory and word retrieval can occur with people who have been diagnosed with Lyme disease.
10. Symptoms may appear days, weeks, months or even years after \_\_\_\_.

## WORKBOOK ANSWER KEY



## WORKBOOK ANSWER KEY

### OPTIONAL WORD SEARCH

K O S Y M E L L P K J E T C C S E D D O S H C Y F  
G J O G T Y G V I S O W G B W D W I Z M W S D F I  
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M B I S C J F D U B F O R B M C I D R O W M H I U  
K K T S D N A K I V I V U R A O B T H E S S N A K  
R H I R M E D I C T R E C I L Z O S I E E P U P R  
R F V R H C I L A Y R T R X Y P O D I V I J W E Y  
O B I R E T F R W N O V L H X A P W I T I J I L V  
Y W T V Y A T L D P W Z X H X L Q X B N S T K C A  
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Q H H I E R B I P B L S U O Y M Z R R N O S L U E  
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E U N U D D A Z W L D Z E A C B X Y D W E N P G B  
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C S L W Y Z Y V Z L A F F B N V C E A J X A F V M  
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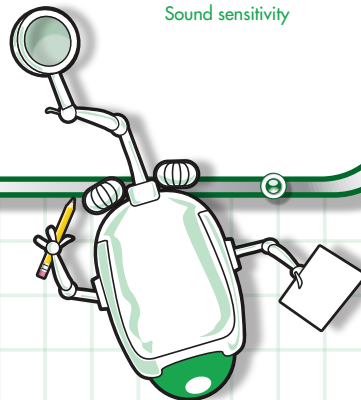
Blurry vision  
Fatigue  
Headaches  
Irritability

Joint pain  
Moodiness  
Rash

Heart palpitations  
Concentration problems  
Distractibility

Light sensitivity  
Muscle pain  
Numbness  
Sound sensitivity

Complete this  
word search with these  
Lyme disease-related  
symptoms.



Check out our website for more information and activities!

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