TickSense™




Lyme Disease Curriculum

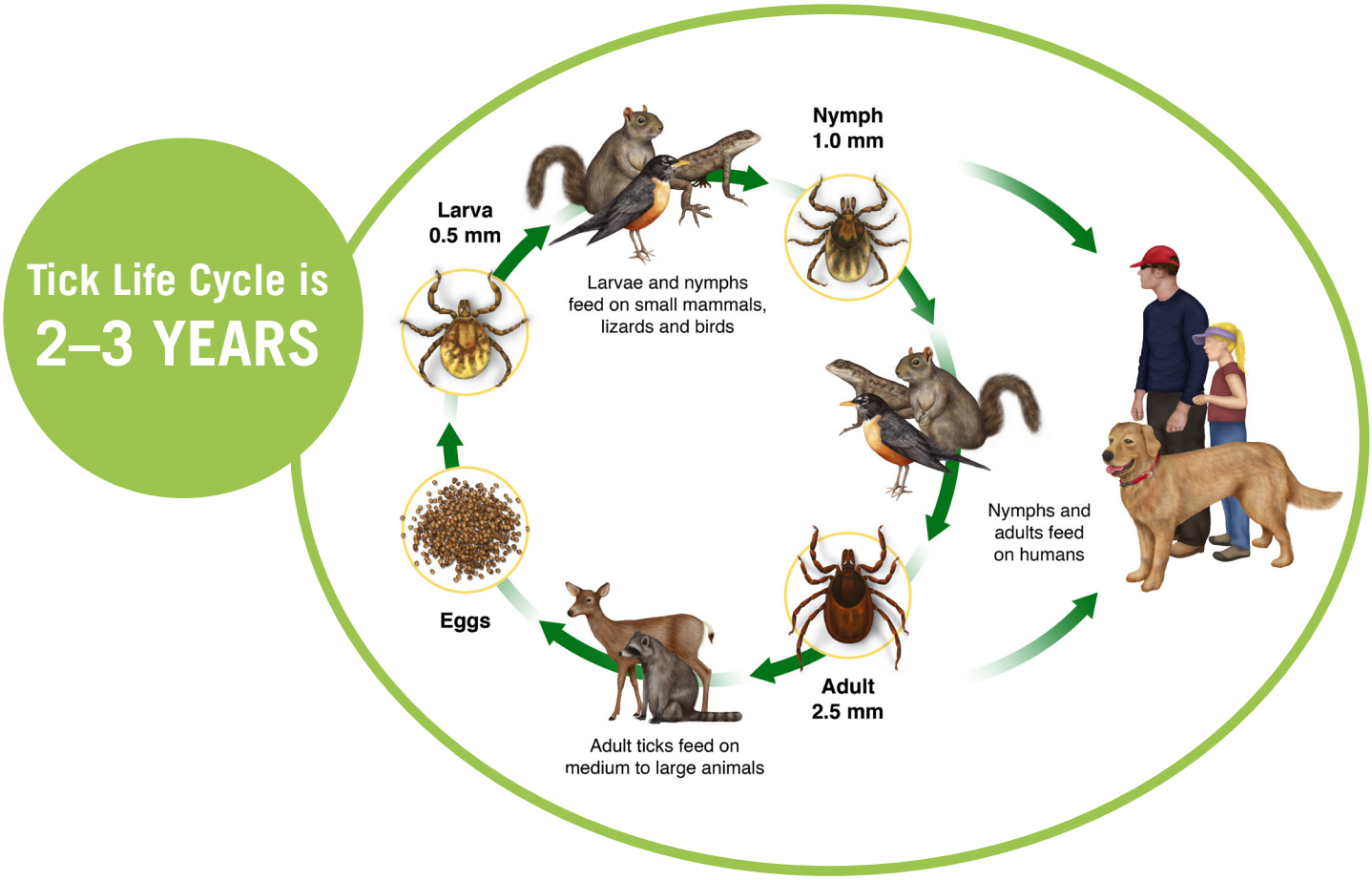
STUDENT MATERIALS

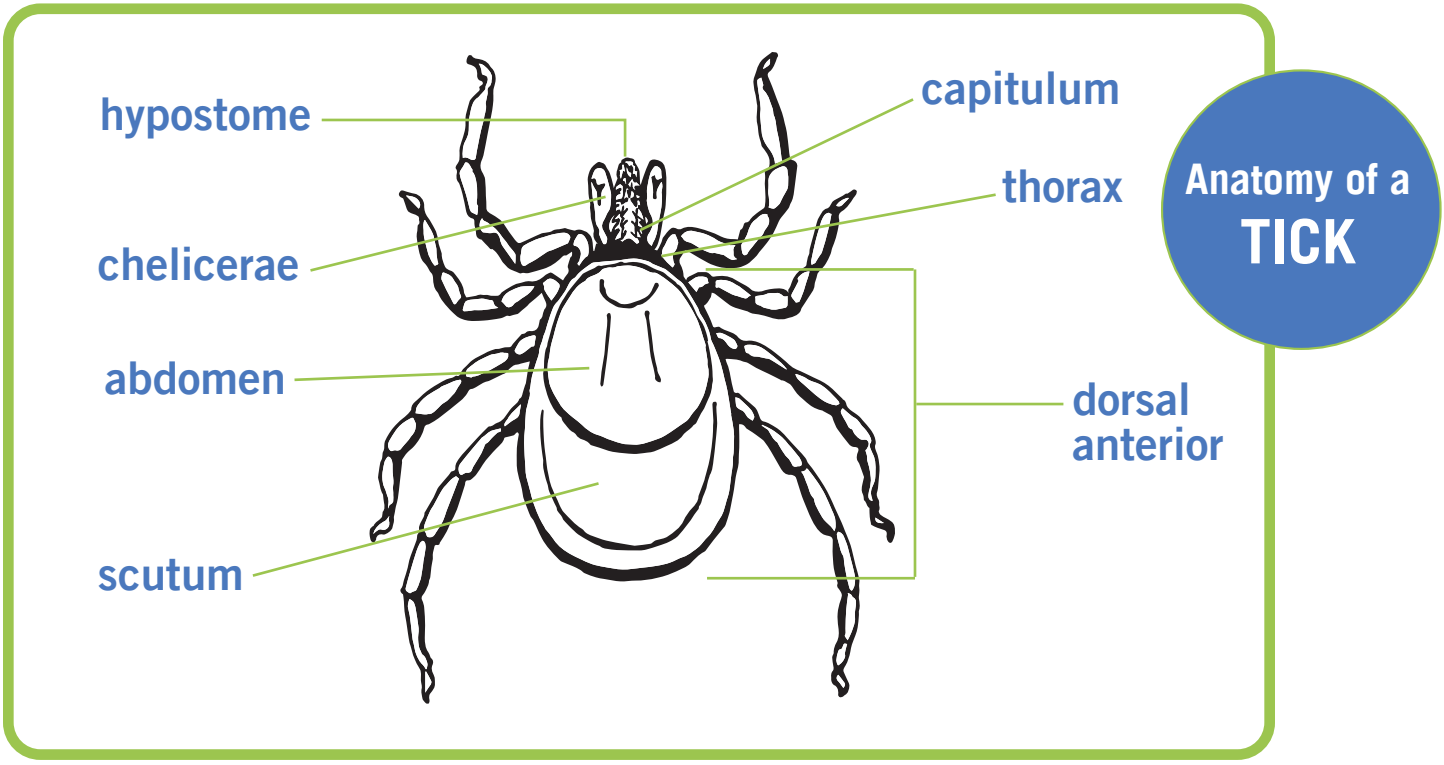
Bay Area Lyme
FOUNDATION

TICKS

Ticks are arthropods. **Arthropods** are **invertebrates** with an **exoskeleton** and jointed appendages. Arthropods include: insects (e.g. aphids), arachnids (e.g. spiders and mites), crustaceans (e.g. crabs) and myriapods (e.g. millipedes). Like spiders, ticks are **arachnids**, not insects. Ticks are **external parasites** that live off of the blood of other animals—such as mammals, birds, and reptiles. There are many different kinds of ticks, but for this lesson we will focus on the Blacklegged tick and the Western Blacklegged which can transmit Lyme disease.

Ticks have four stages of life: **egg, larva, nymph and adult**. Ticks undergo **metamorphosis** from one stage of life to another in a process known as **molting** (similar to caterpillars). Ticks must have a blood meal to molt from larva to nymph, and from nymph to adult. The adult female tick takes a final meal and then lays several thousand eggs. A tick completes its life cycle from egg to adult in **2-3 years**.



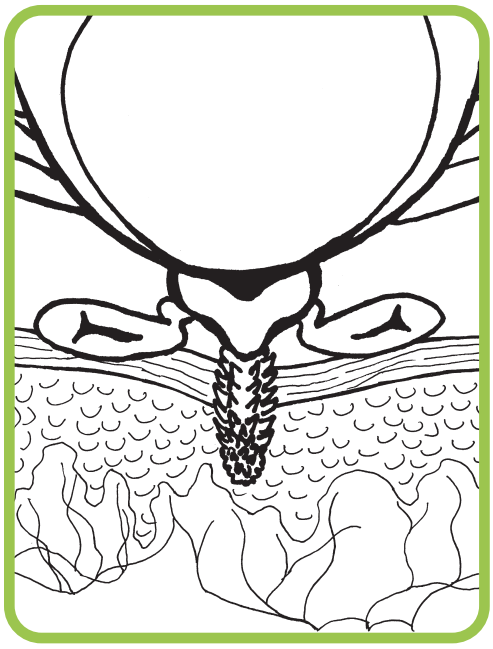


The body of a tick includes a false head called the **capitulum**, a **thorax** and **abdomen** fused into a single, flattened, oval body. A larval tick has six legs; nymphs and adults have eight legs, like spiders. The **scutum** on the larva, nymph, and female tick covers almost 1/3–1/2 of the **dorsal** anterior surface. The female tick has a reddish-brown scutum and black body. The male tick is all black, and its scutum covers almost the entire dorsal area.

How Do Ticks Feed?

Ticks feed on hosts, some examples of which could be a squirrel, a mouse, a lizard, a bird, a deer, or a human. Ticks use their barbed mouthpart (**hypostome**) to pierce their hosts' **epidermis** (skin) until it reaches a **capillary** (small blood vessel) and blood flow is detected.

The tick's salivary gland secretes **anticoagulants** (chemicals that stop the blood from clotting) and a kind of cement to glue itself to the skin, as well as a kind of anesthetic to numb the skin so the host may not feel the bite. Young nymphal ticks may feed for up to 4 days but adult ticks may feed for up to 10 days before they drop off to lay their eggs, often in leaf litter.



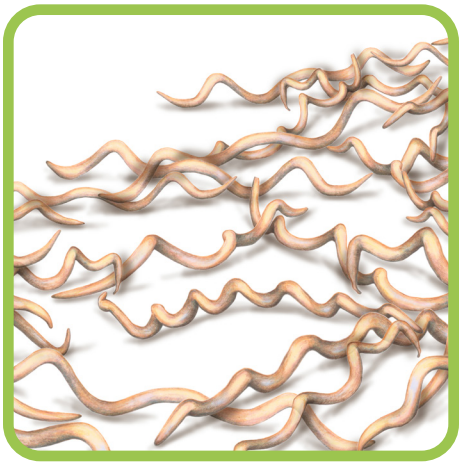
Ticks use their mouthparts to pierce their hosts' skin and extract blood.

Range and Habitat

Ticks are found in many parts of the world and most of the USA. Young nymphal ticks can primarily be found under and around leaf litter and at the bottom of trees while adult ticks will often climb up tall grass and vegetation and wait on the edges in the hope of catching a ride and a meal from an animal host. This behavior is called "questing."

Ticks and Lyme Disease

Ticks can carry different types of microorganisms in their bodies. One of those is a bacteria that causes Lyme disease in humans and pets. Ticks can get the bacteria by ingesting infected blood during one of their blood meals. Infected blood comes from a "reservoir" where the bacteria lives. Reservoirs are often small mammals like squirrels and mice who have the bacteria (or other microorganisms) in their blood, but it doesn't make the animal feel sick.



The bacteria that causes Lyme disease is called *Borrelia burgdorferi*. This particular bacteria has a spiral or corkscrew shape and is therefore called a spirochete.

Ticks are **opportunistic** feeders. They simply wait until a mammal, bird or lizard comes close to them, and then climb onto that creature's body to feed. Humans who find ticks on their bodies have often been outdoors on trails, gardening or walking in woods and meadows. People may brush against grasses, shrubs, leaf litter, trees, logs or other places where ticks are waiting. Ticks may hitch a ride on shoes or pants. They can **crawl up** between layers of clothing and then embed themselves into the skin using their barbed mouthparts.

SYMPTOMS of Lyme Disease

Lyme has many different symptoms. If you think you have been bitten by a tick, or you have been in a place where ticks are present, it's important to be aware of these symptoms if you start to feel unwell. You should see a healthcare provider who knows about tick-borne diseases.

Symptoms may include:

- Flu-like symptoms
- Fever and chills
- Skin rash (often red and oval)
- Headaches and stiff neck
- Muscle and joint pain
- Fatigue
- Bump or redness at bite site
- Swollen lymph nodes
- Dizziness or heart racing/pounding
- Facial paralysis

The most common rash is a solid red oval, not the well-known "bullseye" rash. Examples of some types of rashes are shown below:

Disseminated lesions

"Bullseye" rash

Prevention

> Check for ticks every day—especially during showering.

> Ticks can be very small—so feel for bumps, especially on the scalp.

> Be sure to tick-check your entire body, and don't forget to check your hair, behind your ears, groin, armpits, backs of your knees, belly button, and back of your neck.

> Walk in the middle of the trail to avoid questing ticks on grasses.

> Avoid bushes, grasses, leaf piles, logs, and tree trunks.

> Wear light-colored clothing so you can more easily spot ticks.

> Ticks crawl UP, so tuck pants into socks.

> Use repellent like oil of lemon eucalyptus, DEET, permethrin or picaridin

> When you get home after being outdoors, put your clothes in the dryer on high for 10 minutes to kill ticks.

> Shower as soon as you can and tick check everywhere from the top of your scalp to in between your toes.

Ticks can be tiny, especially when they are nymphs (see life cycle). They are easy to miss, so always check your body and be sure to feel for bumps.

Removing Ticks

> If you find a tick on you, stay calm and find an adult. Remove the tick as soon as possible.

> Use fine-point tweezers as close to the skin as possible and gently but firmly pull the tick straight out.

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

> Don't use any other method to remove a tick like pulling with your fingers, putting Vaseline on it, applying heat, or anything other than carefully pulling it out while trying not to squeeze the tick's body.

> Clean bite area with antiseptic or soap and water.

> Write down where you were and what time you found the tick.

> SAVE THE TICK in a Ziploc bag with a moist piece of tissue.

> Ask an adult to send the tick for tick identification and testing as soon as possible. The tick testing laboratories should be able to tell you what kind of tick it is and what kinds of infections you may need to watch out for.

> Monitor for symptoms (for at least 30 days). If you feel sick, tell your healthcare provider you were bitten by a tick.

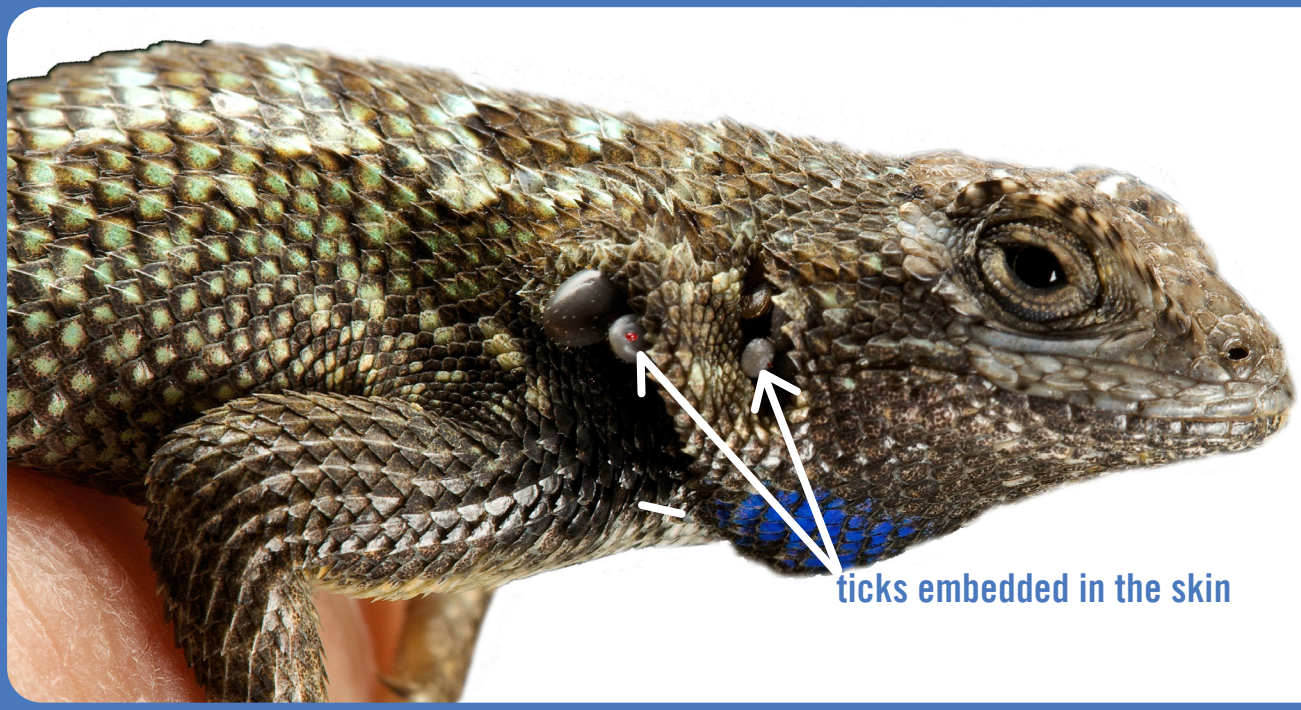
For more information about tick testing, visit our website:
www.bayarealyme.org/lyme-disease-prevention/tick-testing

Use fine-point tweezers as close to the skin as possible and gently but firmly pull the tick straight out.

Lizard Magic

Scientists have studied the blood of the western fence lizard. This lizard is very unique as it can be part of the tick life cycle and is one of the small creatures that ticks use for their blood meals.

The western fence lizard—or blue-belly lizard—which lives in the western USA, is a fascinating creature because there are proteins in its blood that can kill the *Borrelia burgdorferi* bacteria that can cause Lyme disease in humans. If a tick that is infected with the bacteria feeds on the blood of the western fence lizard, the tick is not likely to infect the next mammal upon which it feeds.



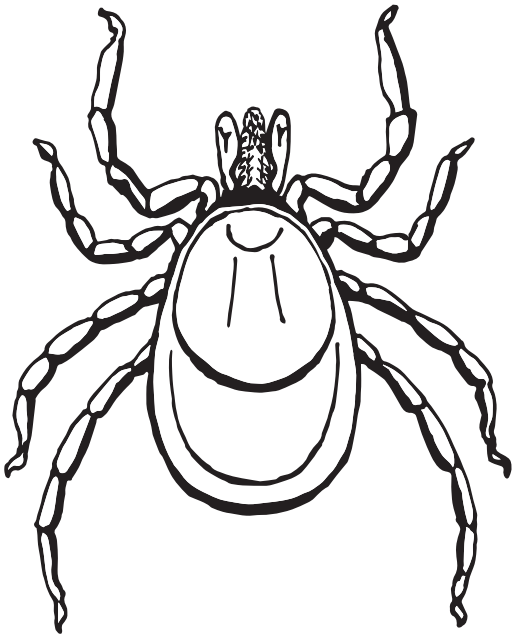
This picture shows a western fence lizard. If you look very closely, you can see the ticks embedded in the skin of the lizard to the left of its jaw.

Perhaps scientists will be able to unlock the secrets in the blood of the lizard and develop a cure for Lyme disease? We hope so!

Name: _____

WORKSHEET

LABEL THE PARTS OF THE TICK



FILL IN THE BLANKS (hint: the number of letters in the word is after each blank!)

Ticks are not insects, they are _____(8). They belong to the same family as mites and _____(7) and have _____(5) legs. They have a life cycle that lasts _____(3) years and undergo _____(13) to get to their adult stage. In order to change from one stage to another, ticks need a meal of _____(5). When ticks bite a mammal, they insert their mouthpart called the _____(9) into the top layer of the mammal's skin called the _____(9). They feed by tapping into tiny vessels in the skin called _____(11). If they are infected with the bacteria _____(8) _____(10) which is the bacteria that causes _____(4) disease, they may transmit the bacteria into the mammal. If the mammal is a human, that person may get very sick. There are ways to prevent tick bites to reduce the chances of getting bitten. These include: walking in the _____(6) of the trail; avoiding tall grasses, bushes, leaf_____(7) and logs; wearing clothing that is light-colored with _____(4) sleeves and pants; using tick repellents; and conducting _____(4) checks daily when showering.

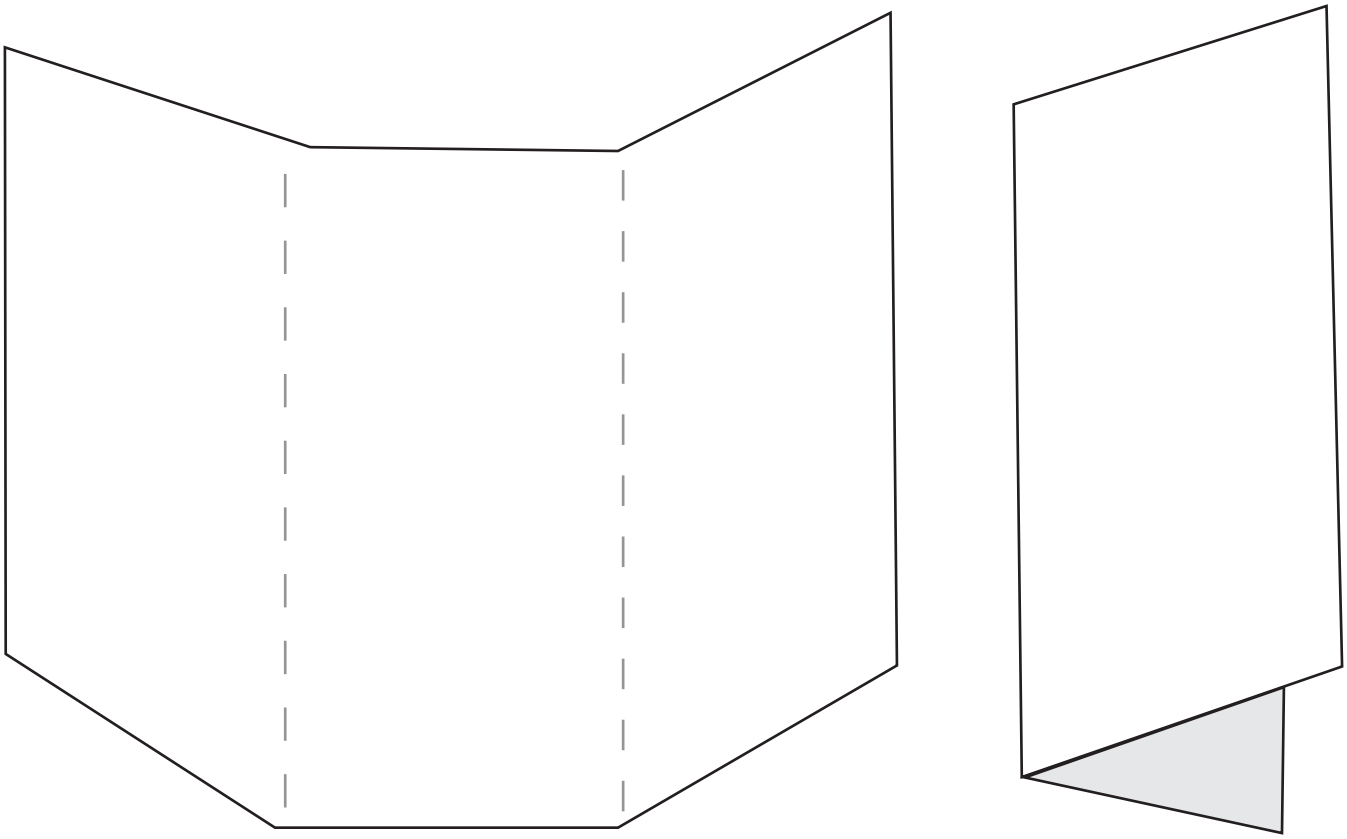
Name: _____

IN-CLASS ASSIGNMENT: DESIGN YOUR OWN BROCHURE

Design an informational brochure about ticks and Lyme

Using what you have learned, take a piece of letter-size paper and fold it into thirds like a booklet. Use both sides of the paper.

It's your job to educate people about ticks and Lyme disease! Use pictures, illustrations, and other sources to cover all the points:



Have your brochure "approved" by your teacher so you can take it home.

HOMEWORK ASSIGNMENT

Ask a parent or an adult you know: What do they know about ticks? What do they know about Lyme disease? Show them your informational brochure and teach them what you learned in class. Make sure you notice what things they already knew compared to things they didn't know. If possible, note three things they already knew and three things you taught them so you can talk about it in class the following lesson.

Name: _____

WORKSHEET

Tick Survey & Graphing

You will be collecting data about tick bites and graphing that data. Try to find 4 adults and 4 children (under 18) to survey. You could ask teachers at your school, family members, classmates, or friends.

In the table below, tally the total number of adults and children who have (or have not) been bitten by a tick. When surveying people, remember to be polite and inform them about your project. Here are some sample conversation starters:

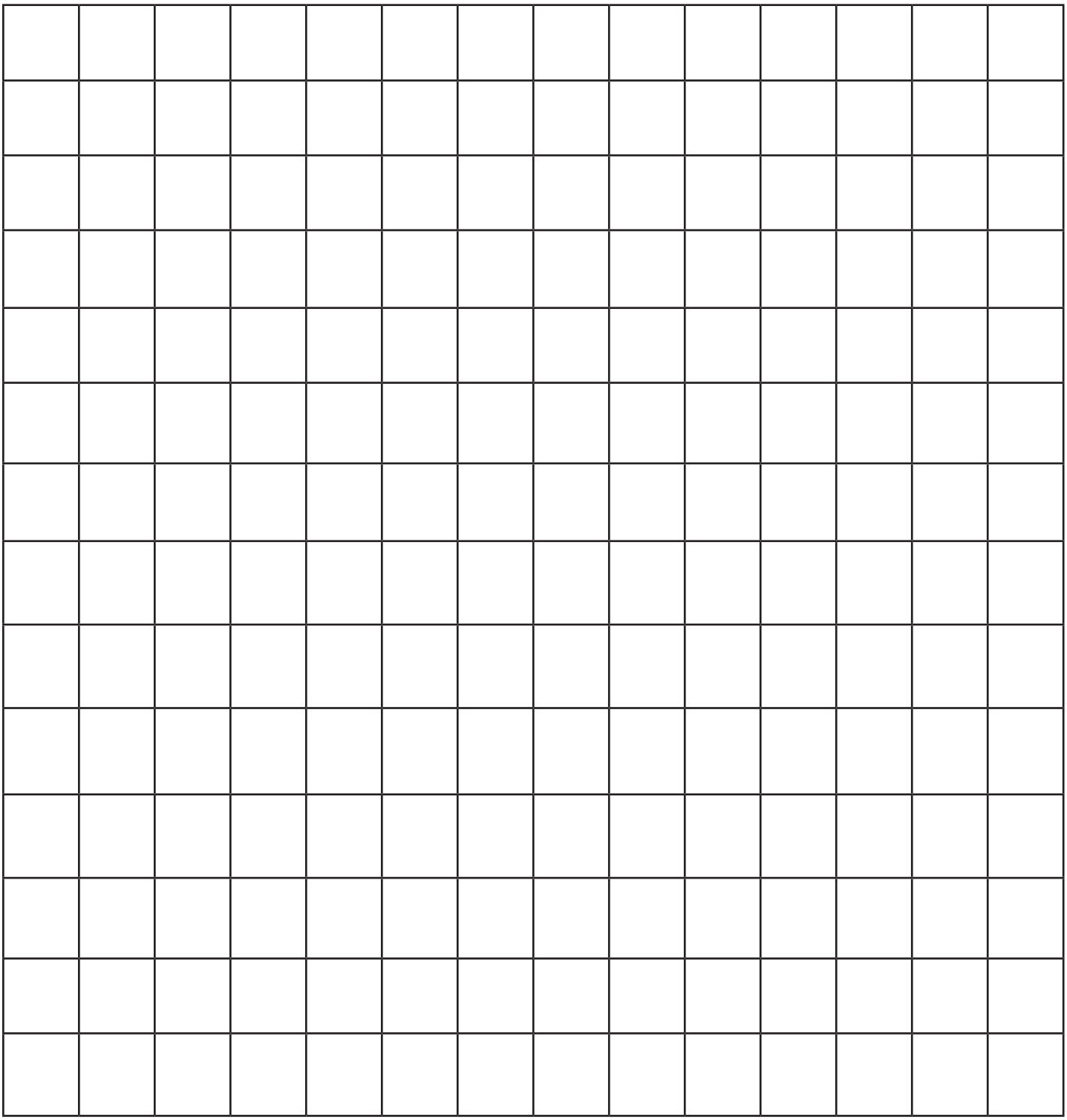
"Hi (use person's name). I am doing a survey for a project on ticks. Would you mind telling me if you have ever been bitten by a tick before?"

Make sure to thank them for their time, even if they did not answer your question.

Name	Yes, I have been bitten by a tick before	No, I have never been bitten by a tick before
Adult:		
Adult:		
Adult:		
Adult:		
Child:		
Child:		
Child:		
Child:		

Name: _____

Now that you have collected your data, you will graph it in the space below as a bar graph. Remember to choose a different color for each group (adults or children) and a different shade for yes vs. no.



Name: _____

What do you know about ticks?

Test your knowledge with this word search

M A R I N U N F A T I G U E X

I D E E T U S Y M P T O M C E

D U A E I A M A M A I I M E S

I L Y M C N P B R P R S T Q U

A T B R K D A O N E K E U K O

G L Y M E S T R F E H I P H M

N X D D R T H R E C S B C B S

O T L I N R O E R R A S H A Q

S R I I A D G L E E B O E N U

T Q O C G F E I R P V E Z Y I

I J Y R K P N A I N T E Q M R

C G U E C G J N O A A Y F P R

L B A N T I B I O T I C S H E

O A R V T R E A T M E N T N L

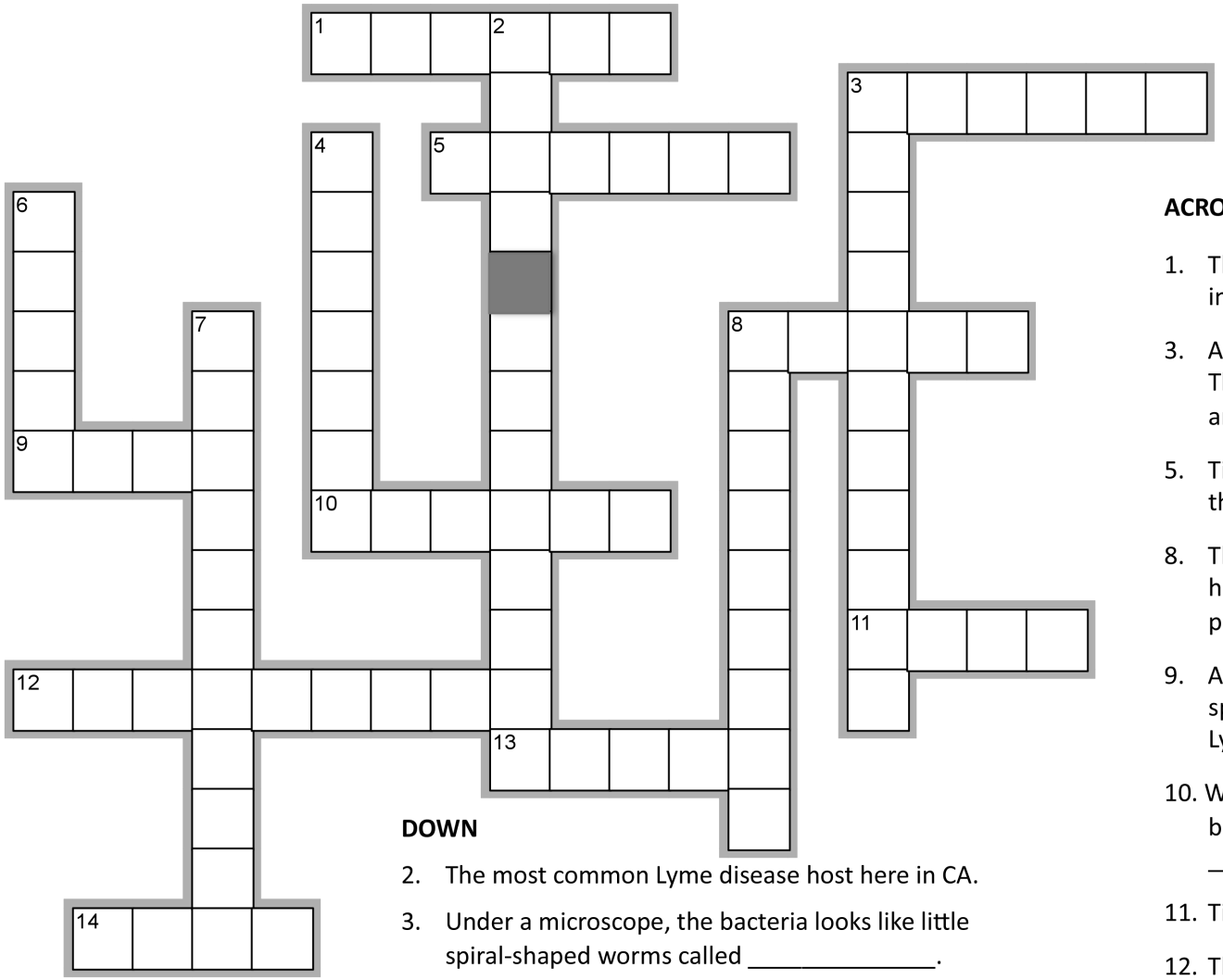
G R A S S E S E V A E L V W Y

Find the words in the puzzle above – be sure to look forwards, backwards, up, down and diagonal!

Bay Area Lyme FOUNDATION

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

Visit www.bayarealyme.org for clues.



EclipseCrossword.com

Name: _____

Bay Area Lyme FOUNDATION

DOWN

2. The most common Lyme disease host here in CA.
3. Under a microscope, the bacteria looks like little spiral-shaped worms called _____.
4. When you brush against these plants along a trail, ticks can jump on to you as you pass by.
6. A young, fully formed tick is called a _____.
7. The most common treatment for Lyme disease is this type of medicine.
8. Lyme disease is not a virus. It is a _____ infection.

ACROSS

1. The bacteria that causes Lyme disease lives in this part of the tick's body.
3. Another place that ticks like to hang out. These types of plants grow alongside trails and provide an additional tick habitat.
5. Ticks like to live in piles of _____ that gather under trees in the fall.
8. The infection replicates in this part of a human's body, eventually migrating to all parts of the body, including the brain.
9. Animals that ticks feed off of. Lyme disease spreads when the _____ is infected with Lyme disease.
10. When the tick is attached and feeding, the bacteria migrates into the tick's _____.
11. Ticks lay these to perpetuate their species.
12. The tick's mouth parts that pierce the skin to enable the tick to feed.
13. Ticks grow in stages; each stage has a specific name. This is the grub stage.
14. This CAN be an early symptom of Lyme, but not everyone develops this reaction to a tick bite.

Bay Area Lyme
FOUNDATION

About Bay Area Lyme Foundation

Bay Area Lyme was founded in 2012 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 provides tick and Lyme disease information for outdoor education programs, environmental educators, park rangers, first responders, medical professionals, scientists and classroom teachers. We have downloadable resources on our website: **www.bayarealyme.org/educators** for more information.