# **TickSense** Lyme Disease Curriculum

STUDENT MATERIALS



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



**Ticks are arthropods. Arthropods** are **invertebrates** with an **exoskeleton** and jointed appendages. Arthropods include: insects, arachnids (ex. spiders), crustaceans (ex. crabs) and myriapods (ex. millipedes).

Ticks are **arachnids**, not insects (spiders and mites are also arachnids). Ticks are **external parasites** that live off of the blood of other animals – mostly small mammals, birds, reptiles and amphibians. They undergo **metamorphosis** moving from one stage of life to another in a process known as **molting** (similar to caterpillars).

Ticks have four stages of life: **egg**, **larva**, **nymph and adult**. 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 so it can mate (the male adult tick does not feed). The female tick then lays eggs. This is three meals in total. It takes a tick **two years** to complete its life cycle from egg to adult!





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 and mites. Hard ticks get their name from a tough **dorsal** shield called the **scutum** which is present on all stages of the tick. The scutum on the larva, nymph, and female tick covers almost 1/3-1/2 of the dorsal anterior surface. Female ticks are reddish brown. The scutum on a male tick covers almost the entire dorsal area and is black/dark brown in color.

The tick's digestive system includes the mouth parts: the **hypostome** and **chelicerae**, the foregut, midgut and salivary glands. The tick inserts its hypostome into the **epidermis** (skin) of a **host** mammal until it reaches a **capillary** and blood flow is detected. The salivary gland secrets **anticoagulants** (chemicals that stop the blood from clotting) and digestive enzymes into the host's skin. The tick secretes a cement, bonding its hypostome to the skin to ensure attachment. The host could be a squirrel, a mouse, a lizard, a deer, or a human.



The tick inserts its hypostome into the epidermis (skin) of a host mammal until it reaches a capillary and blood flow is detected.



The bacteria that causes Lyme disease is called *Borrelia burgdorferi*. It is named after the man who discovered it: William Burgdorfer.

This particular bacteria has a spiral or corkscrew shape and is therefore called a spirochete

## **Range and Habitat**

Ticks are found all over the world but do best in countries with warm, humid climates. They need moisture in the air to complete their metamorphosis. Cold temperatures make it harder for ticks to hatch from eggs into larvae.

## **TICKS and Lyme Disease**

Ticks carry different types of microorganisms in their bodies. They 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 in their blood, but they are not affected by it. Not all small mammals have the bacteria, therefore not every tick carries it after they have had a blood meal. However, those that do pose a risk to humans if they get bitten by an infected tick.

Ticks are **opportunistic** feeders. They simply wait until a mammal, bird, or lizard comes close to them, then they will climb onto that creature's body to feed. **Ticks live in grass-es, leaf litter, on tree bark and other outdoor areas**. Humans who find ticks on their bodies have often been outdoors on trails, or walking in woods and meadows. They brush against grasses where ticks are waiting.

**Ticks crawl up** having landed on shoes or pants. They will crawl between layers of clothing and then embed themselves into the skin using their barbed mouthparts.



This picture shows a closeup of the mouthpiece of the tick and how the hypostome is barbed to make the tick secure in the skin.

This shows why it can be difficult to pull the tick out of the skin.

#### **HOW Do They Feed?**

When the tick latches on to the skin, it inserts the **hypostome** through the top layer of the human skin, or **epidermis**.

Once the tick is attached, it will start feeding. If this tick is on your body (feeding) for more than a day, the bacteria that causes Lyme disease may be passed to you during its feeding cycle.



This picture shows how the mouthpiece of the tick punctures a hole in the skin. The hypostome is barbed making the tick secure in the skin. The tick also excretes a cement to glue itself to the skin, plus a numbing gel so you won't feel the bite.

#### **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 doctor and let him/her know you have been around ticks.



#### Picture shows the classic "bull's-eye" rash

#### Symptoms may include:

- Flu-like symptoms
- Fever and chills
- Skin rash that expands
- Headaches and stiff neck
- Muscle and joint pain

- Exhaustion no energy
- Bump or redness at bite site
- Swollen lymph nodes
- Dizziness
- Facial paralysis



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



## Prevention

- > Check for ticks every day especially during showering
- > Ticks can be very small-- so feel for bumps, especially on the scalp
- > Ticks like certain parts of the body: groin, armpits, around the waistband, backs of knees, naval, neck and ears (be sure to check those areas)
- > Walk in the middle of the trail
- > Avoid bushes, grasses, leaf piles, logs and tree trunks
- > Wear light-colored clothing covering ankles and wrists
- > Ticks crawl UP, so tuck pants into socks
- > Consider treating clothing with insect repellents
- > If you find a tick on you, stay calm and find an adult

# **Removing Ticks**

- > Find an adult to help you remove the tick
- > Using pointy-nose tweezers, grasp the tick as close to the skin as possible
- Lift the tick STRAIGHT UP and pull firmly. Do not twist or yank it out.
- > Remember where you were and what time you found the tick

Try and get the whole tick out of your body, including the mouthparts.

Using pointy tweezers or tools designed to remove ticks are the best approach!

Don't use any other method to remove a tick like pulling with your fingers, putting Vaseline on it, or trying to set it on fire. You could burn yourself or make things worse.

If the tick's mouthparts stay in your skin, do not panic. This will not mean you will get infected. Your body will push the mouthparts out naturally over time and cause no harm.

#### What Stops the Bacteria?

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—is a fascinating creature! Why? Because there are proteins in the blood of this lizard that kill the *Borrelia burgdorferi* bacteria! If a tick that is infected with the bacteria that causes Lyme disease feeds on the blood of the western fence lizard, when that tick molts into an adult tick, it is no longer able to infect the next mammal that it feeds on. The proteins in the blood of the lizard are like a neutralizing agent and the bacteria is unable to survive.

This means that this little lizard helps stop the spread of Lyme disease!



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!

#### WORKSHEET



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 \_\_\_\_\_\_\_\_(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) sheeves and pants; using tick repellents; and conducting \_\_\_\_\_\_\_\_(4) checks daily when showering.

## WORKSHEET

It is important to check yourself for ticks every day if you have been out in the woods or outdoors anywhere where ticks are known to be present.

Ticks like certain parts of a human body more than others. We are not sure why these are more attractive to ticks, but we have some guesses! These body parts tend to be moist, a bit warmer than other areas, and there are folds of skin that make it easier for a tick to embed itself.

Using the outline below, label where you are most likely to find a tick on your body when you shower off after a day outdoors:

#### Remember—tick check every day!!!



# **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. Note three things in each category so you can talk about it in class the following lesson.

## WORKSHEET

#### Tick Survey & Graphing

You will be collecting data about tick bites and graphing that data.

In the table below, tally the total number of men, women, boys and girls who have (or have not) been bitten by a tick (example: if 1 of the 2 boys you interview have been bitten, there should be 1 tally mark in the "Yes" column and 1 tally mark in the "no" column). You could ask teachers at your school, family members, classmates and friends.

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.

	Yes, I have been bitten by a tick before	No, I have never been bitten by a tick before
2 Men		
2 Women		
2 Boys		
2 Girls		

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 (men, women, boys, girls) and a different shade for yes vs. no (example- women yes: red, women no: pink):

Name: \_

# What do you know about ticks?

Test your knowledge with this word search

Μ	А	R	Ι	Ν	U	Ν	F	А	т	Ι	G	U	Е	Х
I	D	Е	Е	Т	U	S	Y	М	Р	Т	0	Μ	С	Ε
D	U	А	Е	I	А	М	А	М	А	Ι	I	Μ	Е	S
I	L	Y	М	С	Ν	Ρ	В	R	Ρ	R	S	Т	Q	U
А	т	В	R	К	D	А	0	Ν	Е	К	Е	U	К	0
G	L	Y	М	Е	S	т	R	F	Е	н	I	Ρ	Н	М
Ν	х	D	D	R	т	Н	R	Е	С	S	В	С	В	S
0	т	L	Ι	Ν	R	0	Е	R	R	А	S	Н	А	Q
S	R	Ι	Ι	А	D	G	L	Е	Е	В	0	Е	Ν	U
Т	Q	0	С	G	F	Е	I	R	Ρ	V	Е	Z	Y	Ι
I	J	Y	R	К	Ρ	Ν	А	I	Ν	т	Е	Q	М	R
С	G	U	Е	С	G	J	Ν	0	А	А	Y	F	Ρ	R
L	В	А	Ν	т	Ι	В	I	0	т	Ι	С	S	Н	Ε
0	А	R	V	т	R	Е	А	т	М	Е	Ν	т	Ν	L
G	R	А	S	S	Е	S	Е	V	А	Е	L	V	W	Y

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



LYME	MOUSE	DIAGNOSTIC	FATIGUE
TICK	SQUIRREL	TREATMENT	JOINT
NYMPH	GRASSES	ANTIBIOTICS	FEVER
BORRELLIA	LEAVES	SYMPTOM	NUMBNESS
BURGDORFERI	PATHOGEN	RASH	DEET
		<b>C</b> 1	

Visit <u>www.bayarealyme.org</u> for clues.

