

# Lyme Disease Handout

## By Zoe and Maddy

### What is Lyme Disease

1. Transmitted by the Blacklegged Tick (*Ixodes scapularis*)
2. The tick must remain attached to the person for at least 24 hours to transmit the disease
3. Caused by a bacterium called *Borrelia burgdorferi*
4. Mainly affects blood vessels and induces an inflammatory response
5. Found in North America, Europe, and some parts of Asia

### Discovery and Background

1. The children of Lyme, Connecticut, were suffering from rheumatoid arthritis, which caught the attention of Willy Burgdorfer and his team of scientists.
2. Willy Burgdorfer is credited with the discovery of the bacteria causing Lyme Disease
3. Lyme Disease is classified as a tick-borne zoonosis

### Causes

1. *Ixodes Scapularis* ticks are the insect vector for Lyme. More commonly known as the Blacklegged Deer Tick
2. Nymphal ticks an effective vector for the disease because of their small size (less than a poppy seed)
3. A nymphal tick has to stay attached for 24H for a host to be prone to infection



### Characteristics

1. The bacteria that causes Lyme Disease is *Borrelia burgdorferi*
2. *Borrelia burgdorferi* is
  - a. Gram Negative
  - b. Sprochetie
  - c. Highly Motile
  - d. Non-endospore-forming - But can form a biofilm!
    - i. Biofilm makes the sprochete more resistant to antibiotics and more infectious
3. Lyme Disease can persist in the body for months or years as Post-Treatment Lyme Disease (PTLD)



### Tick Life Cycle

#### 4 Stages

- 1st Stage: Egg
- 2nd Stage: Larva
- 3rd Stage: Nymph
  - Can be infected with/ and transmit Lyme Disease
- 4th Stage: Adult
  - Can be infected with/ and transmit Lyme Disease
  - Females cannot pass it to their offspring

### Modes of Transmission

- Reservoir Hosts: Small wild mammals like rats
- Deer commonly transport ticks, but are immune to the disease

- Can only be transmitted to pets or people by a blacklegged tick bite (24+hours attached)
- No human-to-human transmission (Slight risk if untreated for a prolonged period in pregnancy)

## Progression of Disease

1. Bacteria alter gene expression to survive a new environment
2. Bacteria enter the skin
3. Replicate in the skin
4. Move into the blood vessels
5. Travel and replicate in different tissues

## *Borrelia burgdorferi* Surface Proteins

Surface Protein	Function
CRASP Family Proteins	Evades immune response by binding to Factor H  Factor H acts as a camouflage for Bacteria to blend in with host cells
Lipoprotein OspC	Antiphagocytic properties that prevent macrophages from ingesting it.  Bacteria can survive the second line of defense in Human Hosts.
VisE	Allow the Bacteria to perform antigenic variation.  Immune Response has to “catch up” with the always-changing epitopes, delaying immune response.

## Signs and Symptoms

1. Early Stage (~7-30 days)
  - a. Fever
  - b. Chills
  - c. Headache
  - d. Fatigue
  - e. Swollen lymph nodes
  - f. Aching muscles and or joints
  - g. Erythema Migrans Rash (EM Rash), also called the “Bull’s Eye” Rash
2. Late Stage (30 + days)
  - a. Progression of EM rash and can have more than one
  - b. Severe headache and stiffness in the neck
  - c. Facial Palsy
  - d. Arthritis and severe swelling in large joint regions
  - e. Nerve Pain
  - f. Shooting pains and or numbness

## Treatments

1. Treated with a course of antibiotics
2. In severe cases, other treatments are implemented to target symptoms (Steroids for arthritis)