

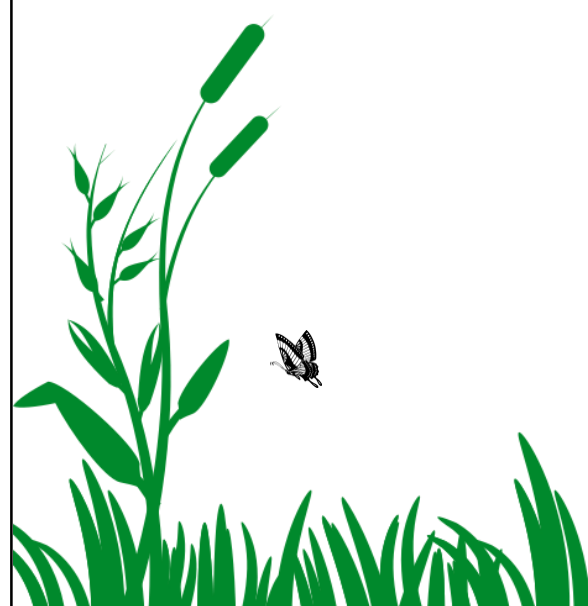
# The Bugs That Bug You

---

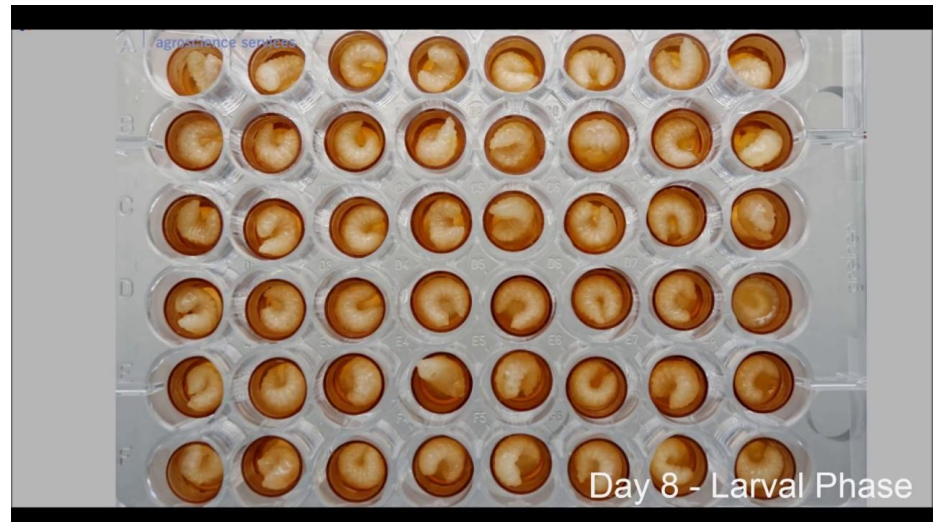
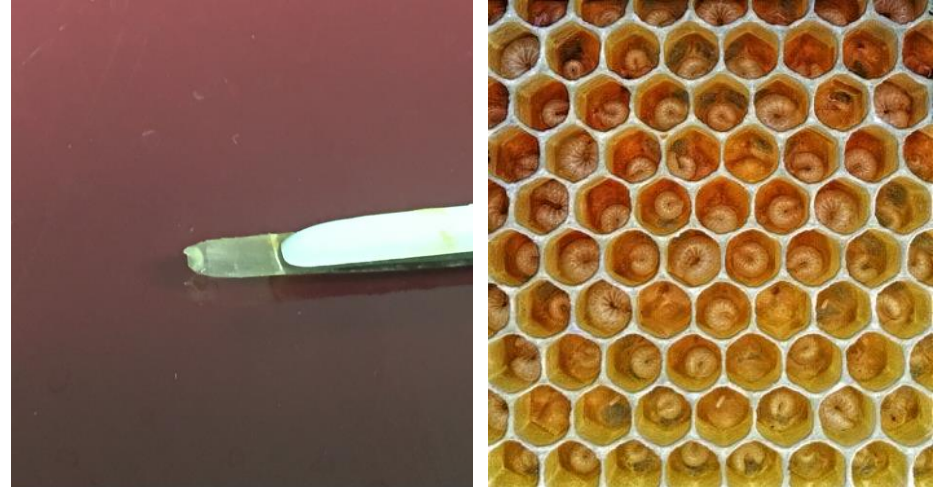
Plymouth County Extension



Blake Dinius  
Entomologist Educator  
[bdinius@plymouthcountyma.gov](mailto:bdinius@plymouthcountyma.gov)  
774-773-3404



# Introduction





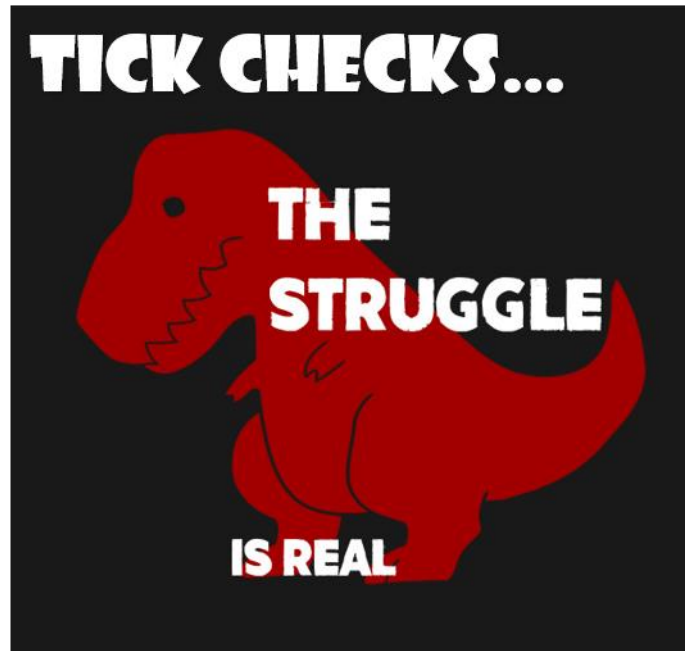
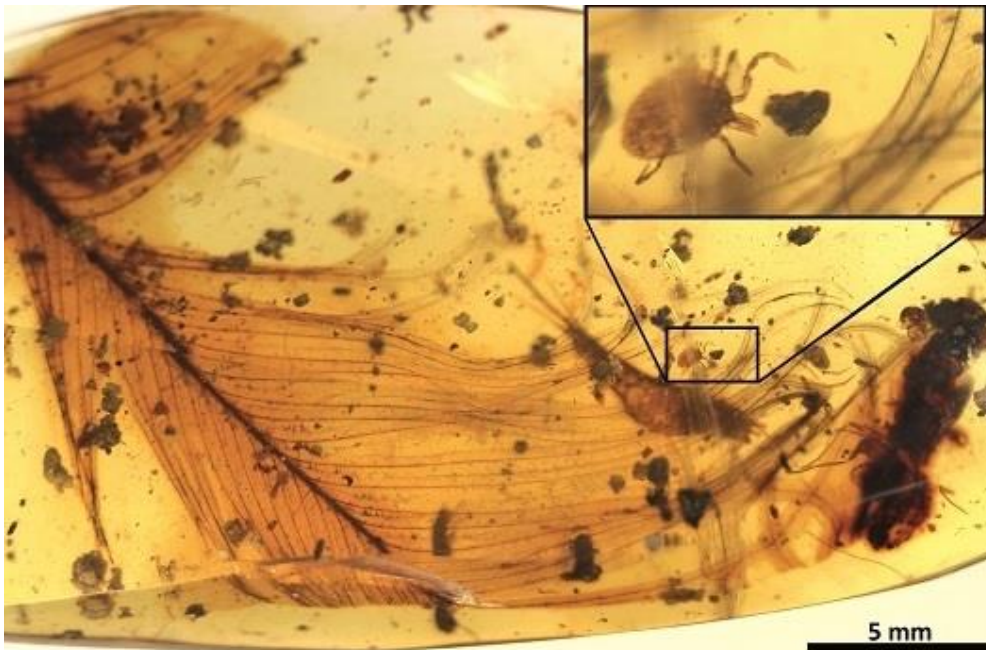
# Introduction



# Blood-feeding

Blood-feeding is very old

Ticks: 400 million years





# Tick and Mosquito Diseases

Why do mosquitoes and ticks suck?

Blood is nutritious!

Maybe evolved from plant-feeding?



# Mosquito Feeding

- Cannulate blood vessels
- Quick feeders



- Only females feed on blood
- Egg production



Guillaume Lacour

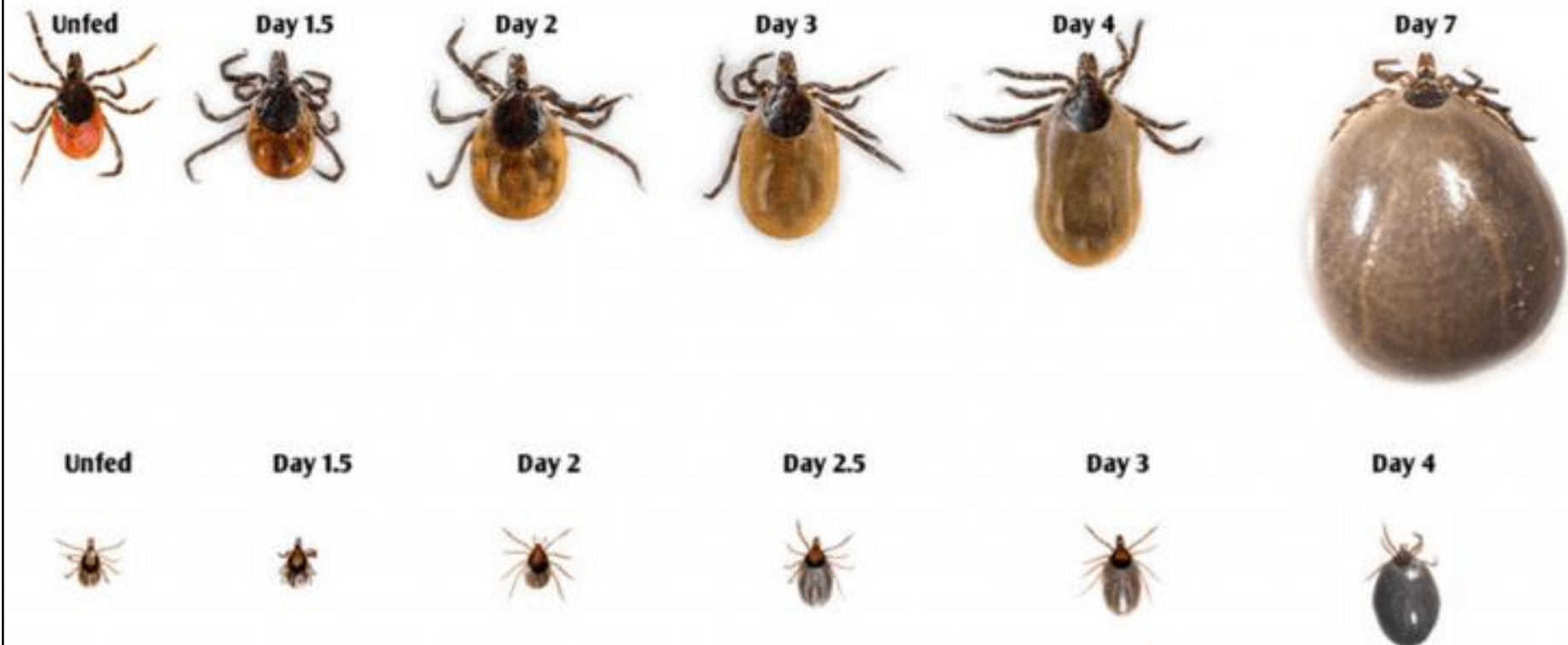
# Tick Feeding

- Create feeding lesions
- Long-term feeders



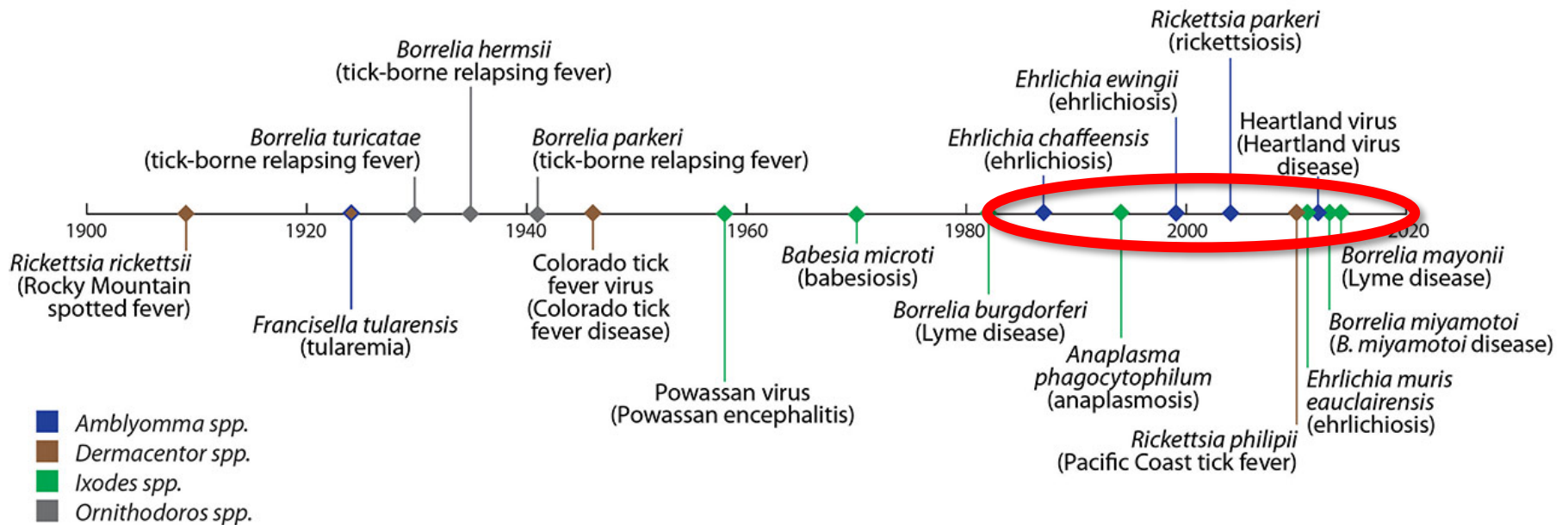


- All life stages feed



# More discoveries past 40 years?

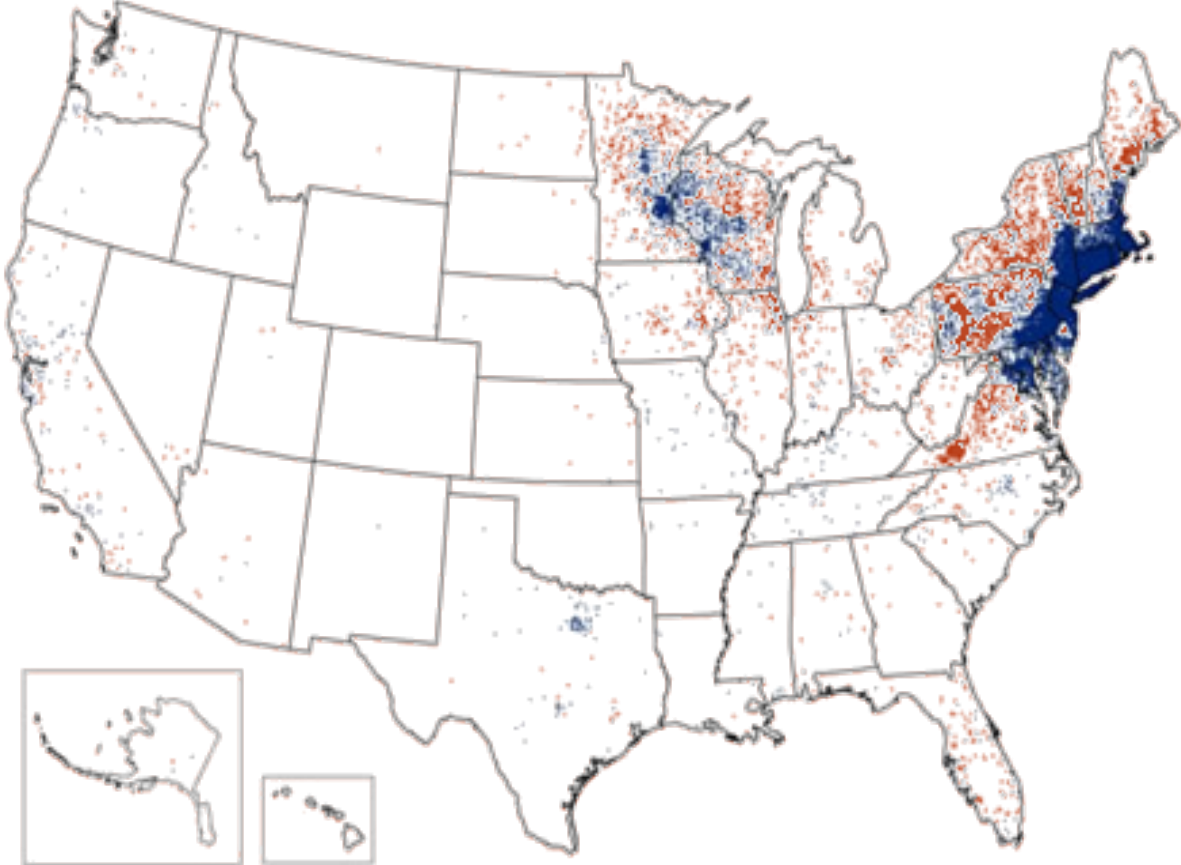
## Discovery of Tickborne Pathogens as Causes of Human Disease in the United States, 1900–Present



Note: This timeline shows when tickborne pathogens were recognized as causes of human disease. In some cases, organisms were identified in ticks before they were associated with human disease. In other cases, the disease was recognized before the etiological agent was found to be tickborne.

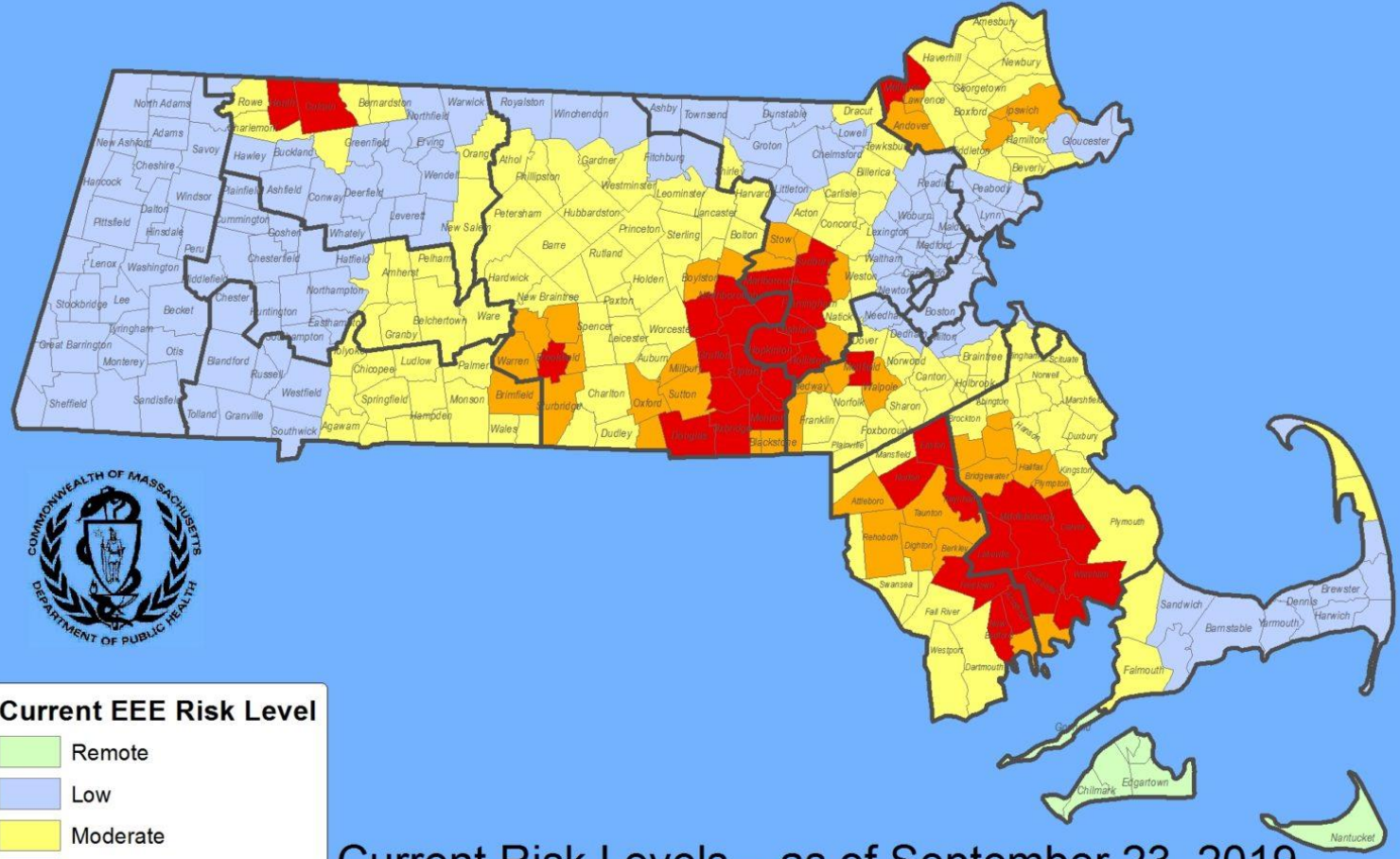
# Lyme Disease

Reported Cases of Lyme Disease -- United States, 2001- 2015





# Massachusetts EEE Risk Categories



**Current EEE Risk Level**

- Remote
- Low
- Moderate
- High
- Critical

Current Risk Levels – as of September 23, 2019

Massachusetts State Public Health Laboratory  
Arbovirus Surveillance Program

# Are Things Getting Worse?



U.S. World Opinion Politics Entertainment Business Lifestyle TV Radio More

Hot Topics New York AG scandal | ObamaCare price hikes | Horrifying Hawaii footage

Zika, Ly

b  
M



more than triple, since 2004, in the US

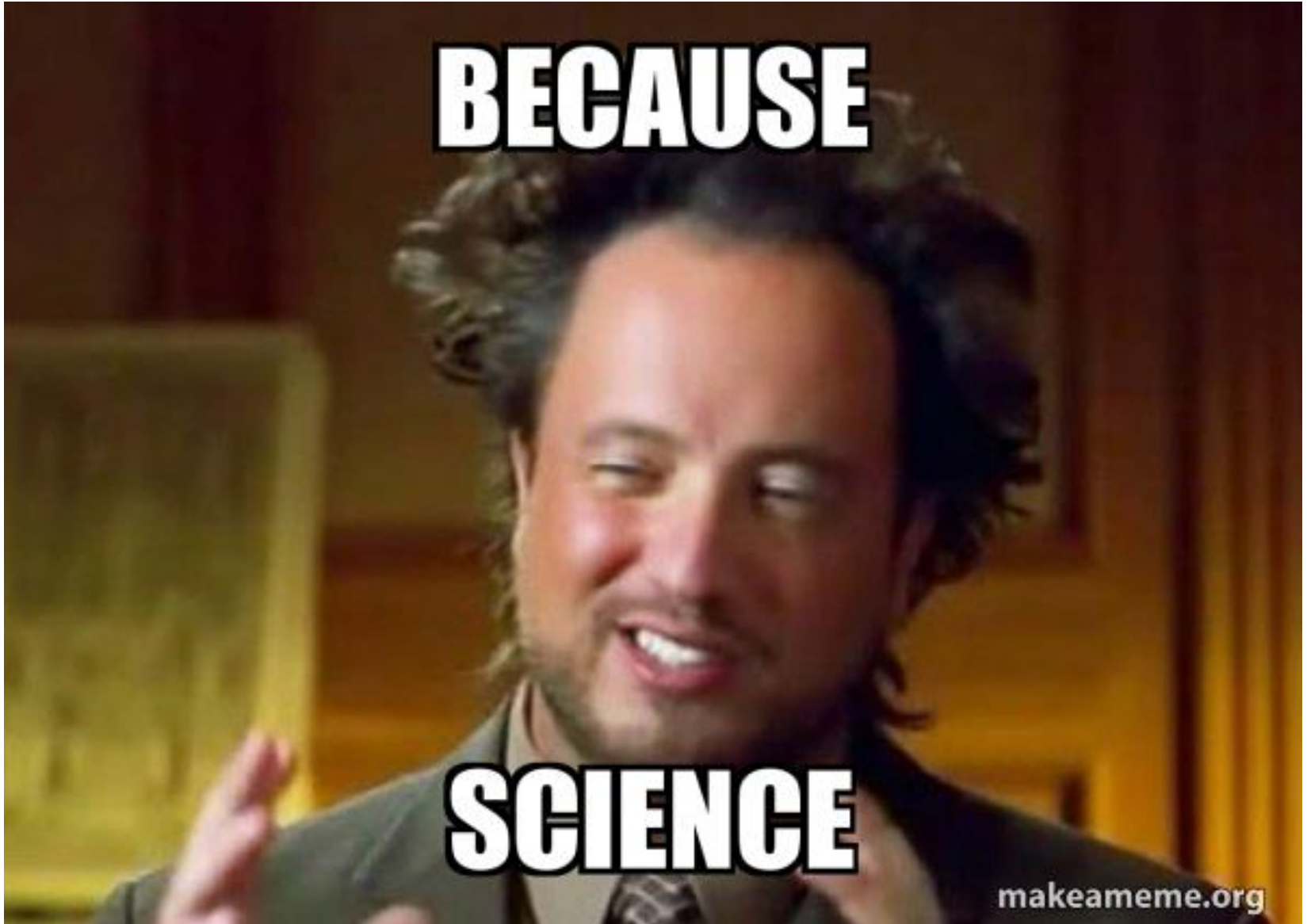


Why?

**BECAUSE**

**SCIENCE**

makeameme.org





# How Did They Become the Bad Guys?

It wasn't always this way

Looking back through history...

Hunter-gatherers: Fewer pathogens?

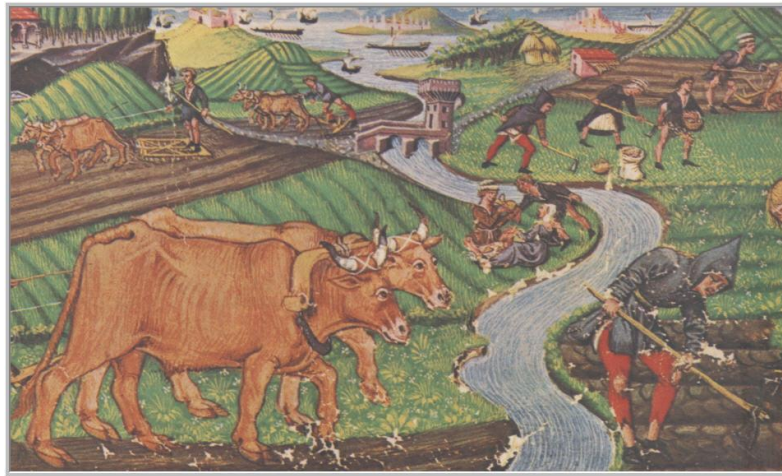


# How Did We Get to This Point?

Onset of agrarian/agricultural (~40k years ago) (Edman, 1988):

- Destruction of wild hosts
- Destruction of wild habitat
- Community living
- Domesticated animals (14k years ago)

- Vectors adapted to new food
- ...Diseases!



# And, for the Disease?

## Animal diseases

- Lyme, babesiosis = mice and small rodents
- EEE, WNV = birds (robins, cardinals)





# What's Causing this?

## Changing land-use patterns

- Changing ecology
- Close contact with animals
- Expansion of hosts



# What's Causing this?

- Degraded habitats



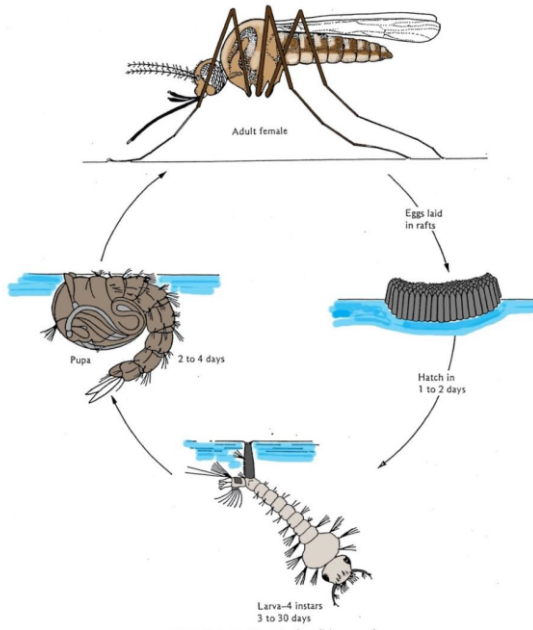
Socio-Ecological Mechanisms Supporting High Densities of *Aedes albopictus* (Diptera: Culicidae) in Baltimore, MD  
E. Little, D. Biehler, P. T. Leisnham, R. Jordan, S. Wilson, and S. L. LaDeau



# What's Causing this?

Increased temperatures:

- Reproduction cycles (7-14 days vs months)
- Faster extrinsic incubation period (EIP)
- Warm-weather species moving north



***Culex tarsalis***  
**14 days at 70° F**  
**10 days at 80° F**

<b><i>Culex pipiens</i></b>	<b>20 °C (68°F)</b>	<b>30 °C (86°F)</b>
<b>West Nile EIP</b>	<b>15 days</b>	<b>5 days</b>





# Where Do We Go From Here?

## Different Strategies

### Pathogen-vector

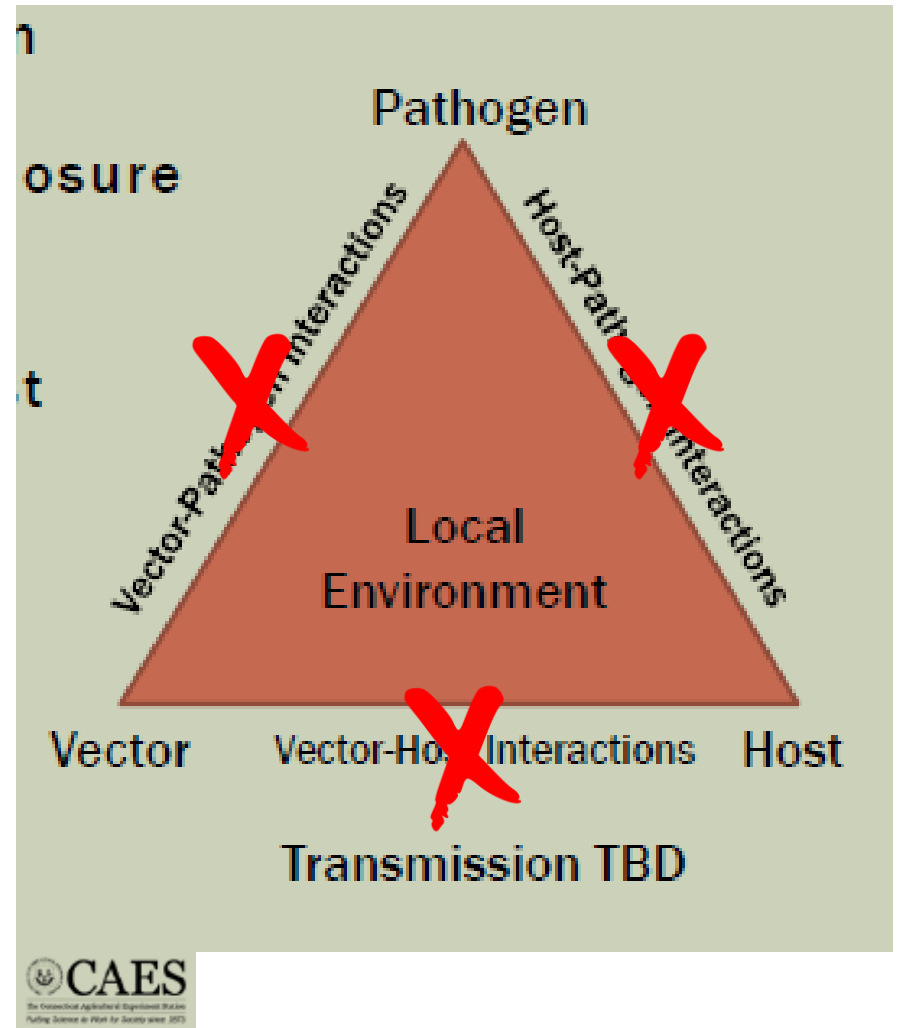
- Control animal populations
- Aerial sprays

### Human-pathogen

- Vaccines

### Vector-human

- Repellents
- Sprays (yard/aerial)
- Sterile insect technique



# Staying Safe

There are tools that already exist that we can rely on!



Basically, soil organisms

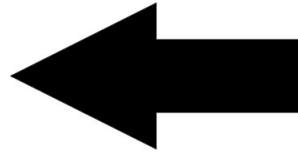
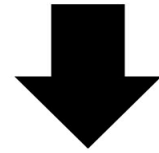
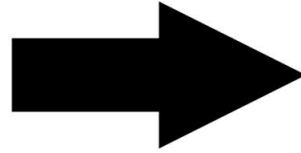
Require high humidity (82%+)

6.3% of the total population is active at a time





# Basically, aquatic organisms



# Yard Management





# Clean Up

- Rake leaves 75-77% reduction in nymphs

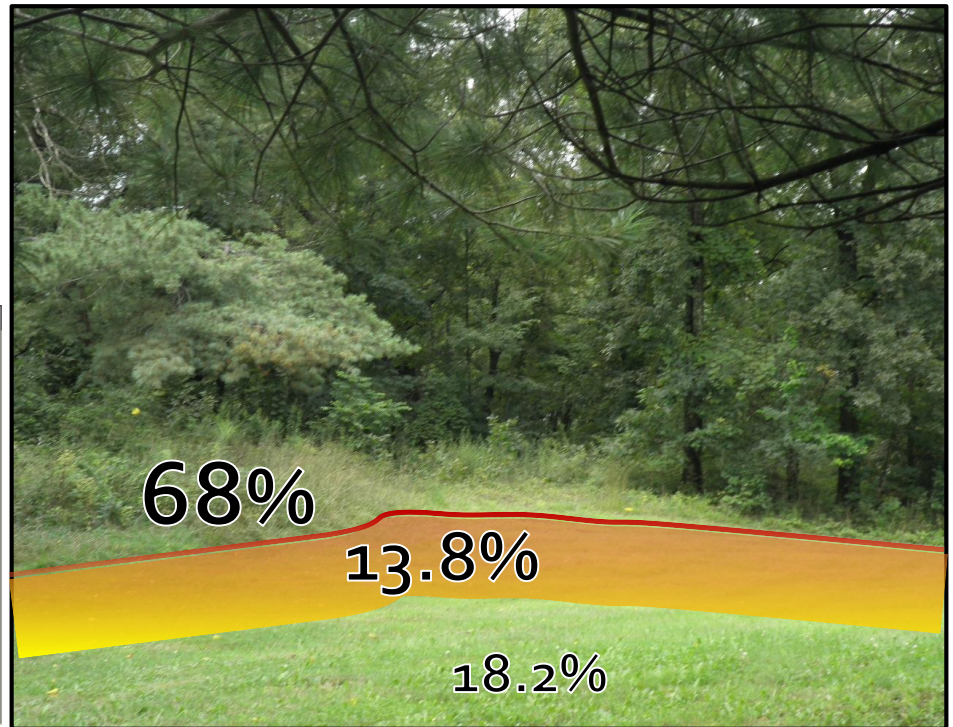
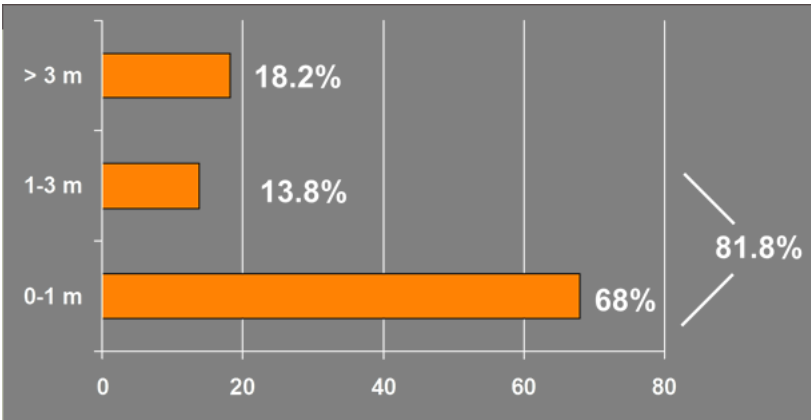


**GET OFF MY LAWN**



# Yard Sprays

- Can reduce ticks
- Can be long lasting
- Use a pyrethroid
- Timing
- Repeat yearly
- Hire someone
- DIY



# DIY

- EPA-registered
- Made for use on lawns and gardens
- Lists that it will control deer ticks (or ticks, in general)
- Listed as “ready to use” or “ready to spray”
- **FOLLOW THE LABEL**





# Yard Management

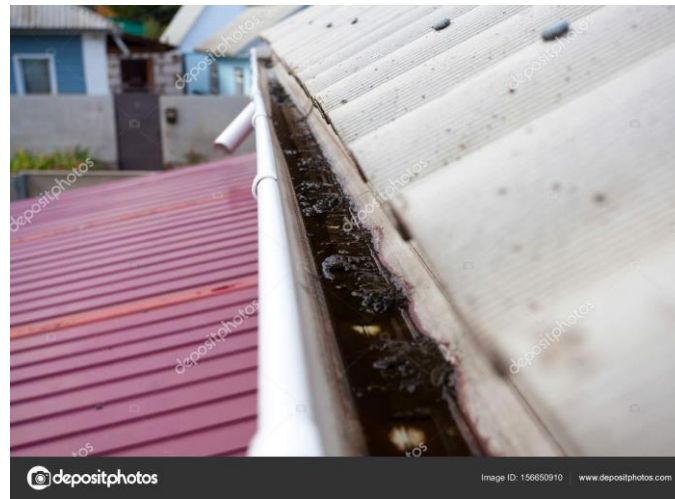
Most fly 2 km or less





# Mosquito Management

Weekly, remove/replace water



# Source Reduction

Keep water moving





# Mosquito Yard Sprays

Variable and TEMPORARY

Local mosquito control project.... FREE by trained professionals





# Protection for Outside?

What about going into tick habitat?

Step 1: Cover up!



# Delay Bites

- Netting





# Delay Bites

- Tucking your pants into your socks
- Sometimes you find ticks... down there





# Time of Day Matters

## Day-biters

- EEE: 34/428 pools
- WNV: 1/87 pools

## Night and twilight biters

- EEE: 394/428 pools
- WNV: 86/87 pools



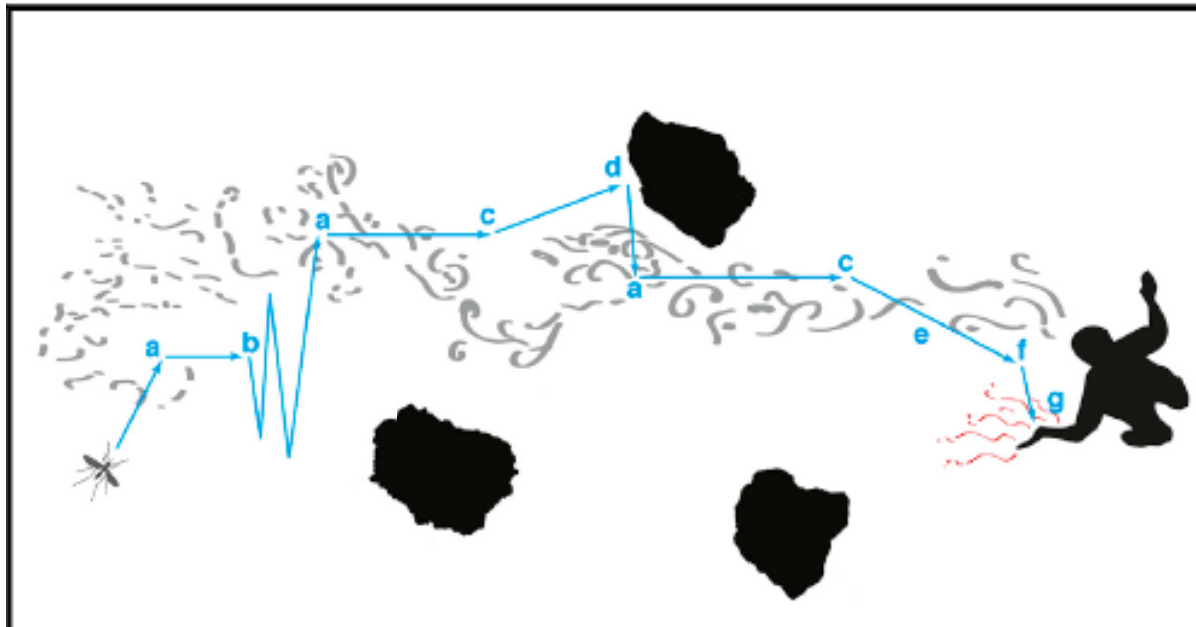
*Ae. vexans*



*Cq. perturbans*



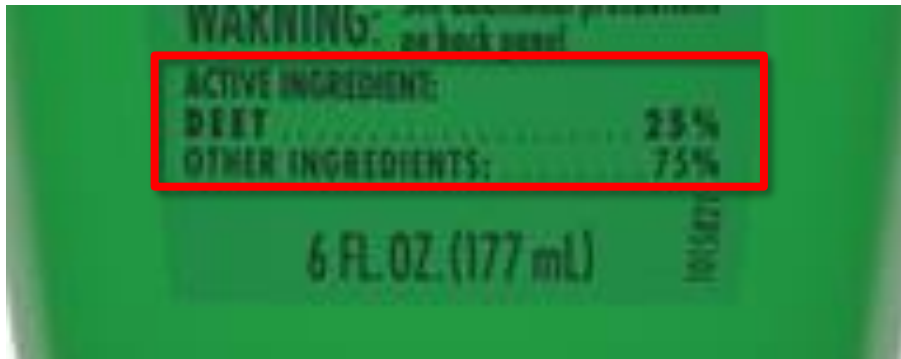
*Cx. pipiens*



van Breugel, F., Riffell, J., Fairhall, A., and Dickinson, M. (2015). Mosquitoes Use Vision to Associate Odor Plumes with Thermal Targets. *Current biology* : CB. 25. 10.1016/j.cub.2015.06.046.

# DEET, not DDT

- 60 years of use
- ~700 million people annually
- >8 billion human applications in 1998
- 4 deaths associated with DEET
- Never confirmed
- 1 million die people/year from mosquitoes
- 300,000 US cases of Lyme/year
- Falling coconuts kill 150 people/year





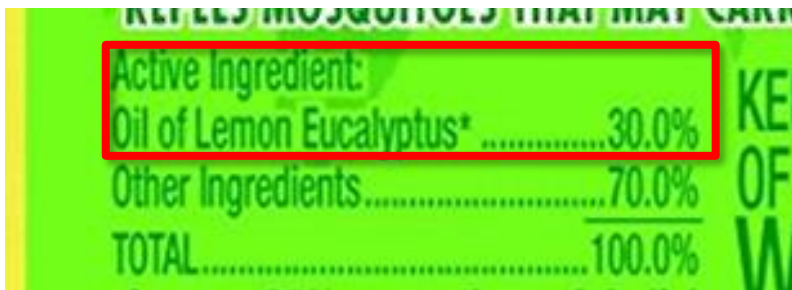
# Other Options

But, you have options...

- Picaridin or Icaridin
- IR3535

Jury still out?

- Oil of Lemon Eucalyptus or PMD (p-menthane-3,8-diol)
- Bio UD or 2-undecanone



Label for a repellent product showing ingredients. The active ingredient is Oil of Lemon Eucalyptus\* at 30.0%, and other ingredients make up 70.0%. The total is 100.0%.

Ingredient	Percentage
Active Ingredient: Oil of Lemon Eucalyptus*	30.0%
Other Ingredients	70.0%
TOTAL	100.0%



Label for a repellent product showing ingredients and caution. The active ingredient is 2-Undecanone (CAS# 112-12-9) at 7.75%, and other ingredients make up 92.25%. The total is 100%. A caution statement is present: "CAUTION See back panel for additional precautionary statements and directions for use." The EPA Reg No is 82669-2.

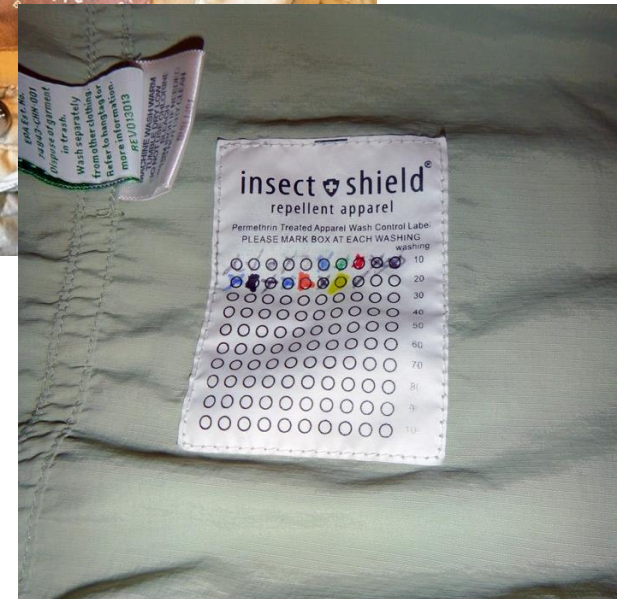
Ingredient	Percentage
ACTIVE INGREDIENT 2-Undecanone (CAS# 112-12-9)	7.75%
OTHER INGREDIENTS	92.25%
TOTAL	100%

CAUTION See back panel for additional precautionary statements and directions for use.

EPA Reg No 82669-2

# PERMETHRIN

- Garden centers, big box stores, Amazon
- Or through [InsectShield.com](https://www.insectshield.com)



- **Only** clothing and shoes
- Apply in advance and wait for it to dry
- Lasts for 6 washings or 1 month
- Keep cats away until it's dry





# Repellents

25(b) exempt (“all natural”)?

- No evidence of safety or efficacy
- May be no better than water



Eisen and Dolan, 2016



# Myths

## “Tick tubes”

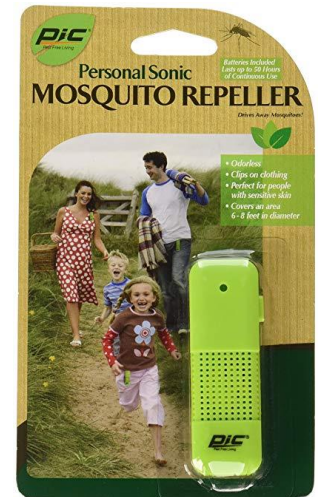
- Not reliable

## Citronella candles

- Not acceptable levels of repellency

## Mosquito bracelets

- Metafluthrin... worked
- Others... zero protection





# Treatments for Cats and Dogs

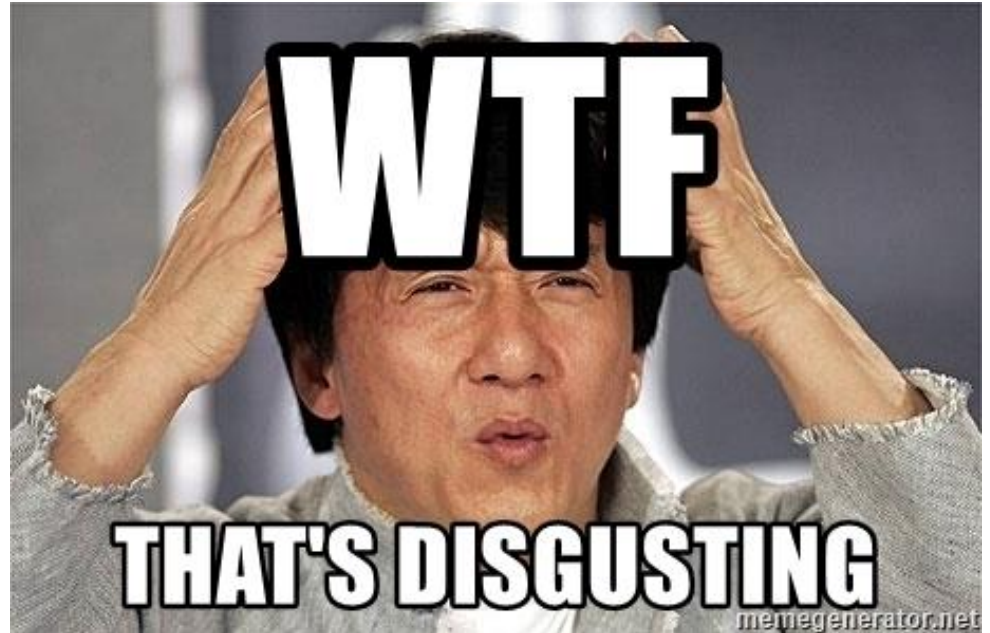
- Diseases specific to pets
- Proper treatment to protect





# Tick Checks

- 90% did not remove a nymph in  $\leq 1$  day
- >81% did not remember being bit



# How Do You Remove a Tick?

Don't over complicate things!

1. Use tweezers
2. Firmly grasp it
3. Pull straight up

life  
hacks



# Bitten?

- Symptoms: Generalized, non-descript for many cases
- Gather evidence... see a medical professional

\*experiences a minor stomach pain\*

\*Googles symptoms\*

Web MD: You already died.

Me:



Me



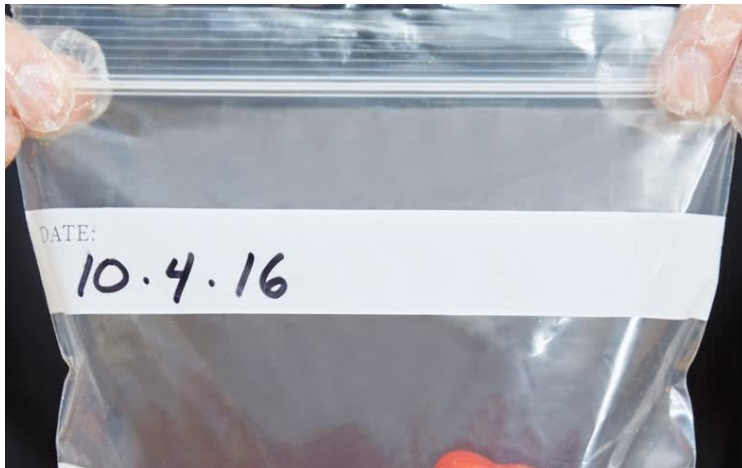
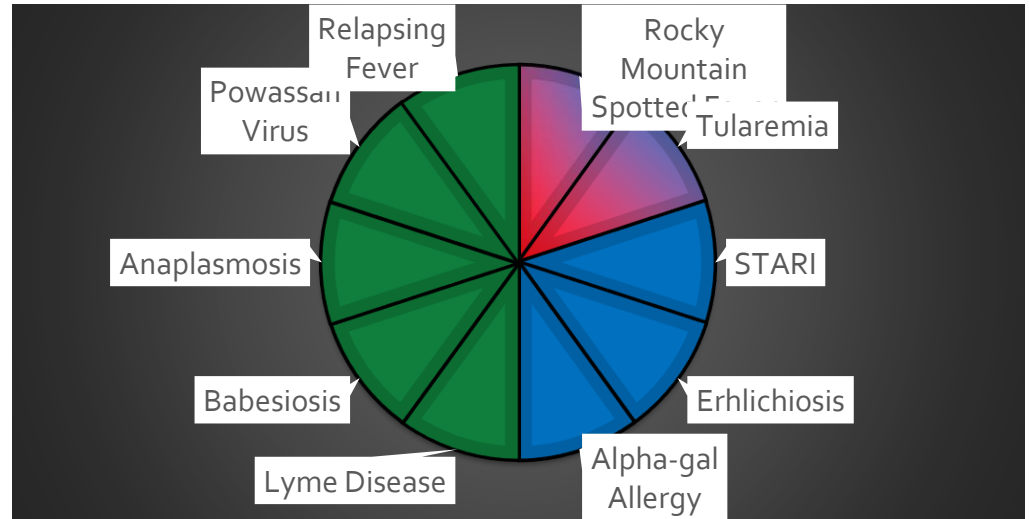
# Evidence

Bitten?

Ok... when?

What species?

What was in it?



Pathogen	Result Date	Result
<i>Borrelia general species</i> (Lyme or relapsing fever- generic)	11/30/2017 @ 3:22 PM EDT	POSITIVE
<i>Borrelia burgdorferi sensu lato</i> (Lyme borreliosis- specific)	11/30/2017 @ 3:23 PM EDT	POSITIVE
<i>Borrelia miyamotoi</i> (Hard tick relapsing fever)	11/30/2017 @ 3:22 PM EDT	NEGATIVE
<i>Borrelia mayonii</i> (Lyme borreliosis)	11/30/2017 @ 3:22 PM EDT	NEGATIVE
<i>Babesia microti</i> (Babesiosis often found in humans)	11/30/2017 @ 3:23 PM EDT	POSITIVE

# Photograph the Bite

Rashes?

Photograph them!

Show a doctor!



Centers for Disease Control and Prevention, <http://phil.cdc.gov/phil/>



© Alison Young, Dermatlas: <http://www.dermatlas.org>

# Bottom Line

With the right knowledge and awareness...

**Vector-borne diseases are preventable.**





Blake Dinius

Plymouth county extension

[bdinius@plymouthcountyma.gov](mailto:bdinius@plymouthcountyma.gov)

774-773-3404

# Questions?

