Evaluating *Plestiodon* spp. skinks as potential reservoir hosts for the Lyme disease bacterium *Borrelia burgdorferi*

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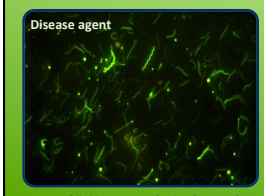
Outline

- Background and Justification
- Research Objectives
- Methods
  - Research Questions
  - Lizard Husbandry
  - Field Components
- Future Directions

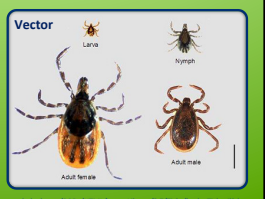
Background and Justification

What is Lyme disease?

- Most common vectorborne disease in US (www.cdc.gov/lyme)
- Spirochetal bacteria
- Vector transmitted; by *Ixodes spp.* ticks through bites

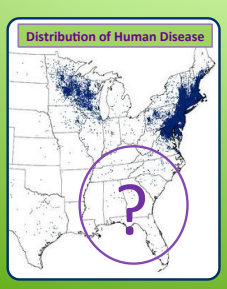


www.fullerlaboratories.com/products/veterinary/international/iv-borrelia/

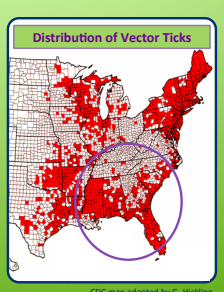


www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/S-Z/Ticks/body_Ticks_ill.htm

Human Lyme Cases in the United States



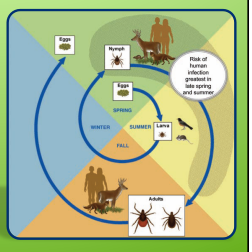
www.cdc.gov/lyme/stats/maps/map2011.html



CDC map adapted by G. Hickling

How are Lyme bacteria maintained in nature?

- Requires a reservoir host
- In the North: small mammals and birds
- In the Southeast: lizards
  - Does southern ticks' preference for lizards explain why Lyme disease is uncommon in the South?



www.cdc.gov/lyme/resources/brochure/508_LD_Brochure.pdf

Lizards and Ticks

- In the Southeast, lizards are often more abundant than rodents (Apperson et al. 1993)
- Lizards are suitable hosts for *Ixodes scapularis*
  - 3-88% of skinks infested with ticks (Apperson et al. 1993, Swanson and Norris 2007, Levine et al. 1997)
  - 0-20% rodents infested with ticks (Apperson et al. 1993)

Lizards and Bacteria

- Many lizard species are not thought to be reservoirs for the Lyme disease bacterium
  - Western fence lizard (Lane and Loye, 1989; Lane, 1990; Manweiler et al., 1992; Lane et al., 2006)
  - European sand lizard (Matuschka et al., 1992)
- However, *Borrelia*-positive skinks have been found in three eastern U.S. studies (11-36% prevalence; Levin et al. 1996; Swanson and Norris 2007; Clark et al. 2005)
- The potential for *Borrelia* transmission from skinks to other hosts, including humans, remains unknown

Research Objectives

Research Objectives

Q1. Are some skinks reservoirs for naturally-occurring *B. burgdorferi*?

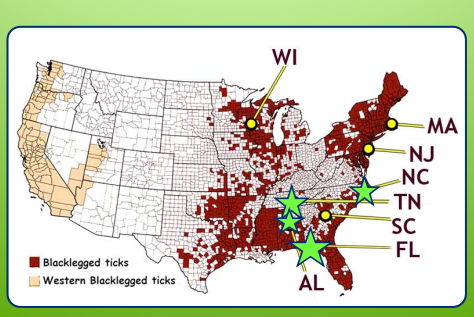
Q2. Are uninfected skinks capable of becoming reservoirs for *B. burgdorferi* originating from infected ticks?

Q3. If skinks can act as reservoirs of *B. burgdorferi*, can *I. scapularis* transmit these strains i) to other reptiles and ii) to rodents?

Methods

Methods: "Go catch skinks!", they said!

Collection sites



http://wildlifehealth.tennessee.edu/lyme_gradient/sites.htm

Sample sizes

- 10 Broadheads
- 14 Five-lined
- 6 Southeastern Five-lined
- = 3 groups of 10 lizards for trials

Lizard housing

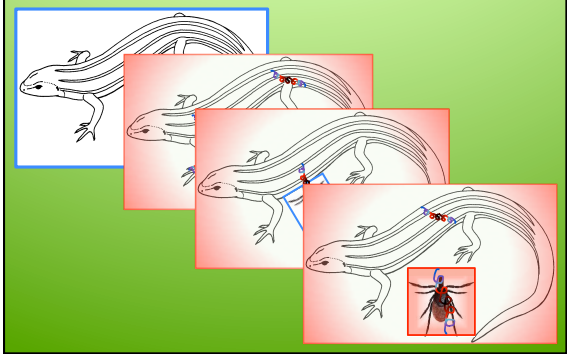
Methods for Q1: Are some skinks reservoirs for naturally-occurring *B. burgdorferi*?

Test naturally attached ticks

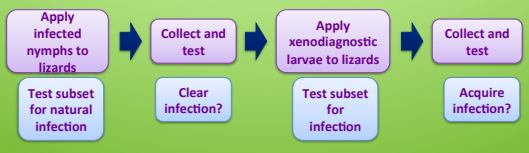
Apply Xenodiagnostic Larvae and test

Prevalence?

Xenodiagnosis – high sensitivity test

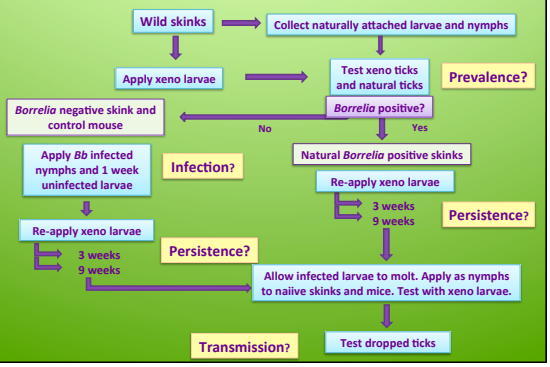


Methods for Q2: Are uninfected skinks capable of becoming reservoirs for *B. burgdorferi* originating from infected ticks?

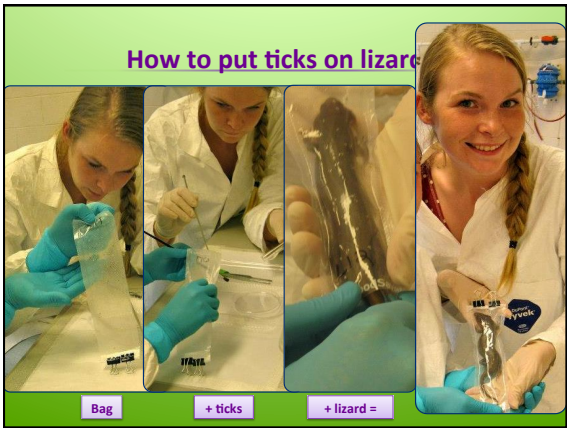


Infection?

Methods for Q3 : Persistence and Transmission



How to put ticks on lizard



Tick collection and *Borrelia* testing

- Lizards held over water for up to 2 weeks to collect engorged ticks
- Preserve ticks in 70% EtOH
- Extract total DNA
- Run PCR tests for *Borrelia*
- Sequencing to determine *Borrelia* species

Analysis

- Estimate prevalence of *Borrelia* in natural and experimental lizard samples

$$\text{Prevalence} = \frac{\text{Number of infected lizards}}{\text{Total number of lizards in trial}}$$

- Estimate persistence of infection in lizards
- Incorporate these parameter estimates into the Lyme Gradient Project's simulation models

Future Directions

Future Directions

- Continue with flow chart through three total groups, to have ample sample size for the lab-infection trial
- Sample additional lizards from coastal NC, SC and FL in spring/summer 2013, to improve the natural infection prevalence estimate

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The Center for Wildlife Health

The Lyme Gradient Project

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Questions?