Tick-borne Disease Testing in Shelters

What Does that Blue Dot Really Mean?

Your Presenter

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Tick-borne Disease Testing

Special thanks to Dr. Stephen Barr

Tick-borne Disease Testing

When do you test dogs at your shelter for tick-borne diseases?

- A – We do not perform testing on any dogs
- B – Testing limited to suspected cases
- C – Screening of some dogs
- D – Screening of all dogs

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Tick-borne Disease Testing

What do you do with positive results?

- A – Try to ignore them
- B – Assume they are correct
- C – Perform additional testing
- D – Provide treatment
- E – Some combination of the above

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Our Goal for Today

- Provide a brief overview of:
  - Factors influencing test interpretation
  - Each disease included in common point-of-care assays for tick-borne disease
  - What to do with positive results
- Give you tools to assess your shelter's protocols

Tick-borne Disease Testing

- Lyme Disease (*Borrelia burgdorferi*)
- *Anaplasma* spp.
- *Ehrlichia* spp.

- *Babesia* spp.
- *Hepatazoon canis*
- Rocky Mountain Spotted Fever (*Ricketsia rickestii*)

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What does that result really mean?

- You get a test result back. Does that mean it's correct?
- How useful, or credible, is that test at telling you what you're looking to know?

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Inherent Limitations

	Antigen tests	Antibody tests
False negatives	• Early/late or low-level infections • Antigen-antibody complexes • Antigen not in sample tested	• Compromised immune function • Early/late infections
False positives	• Contamination • Cross-reactivity	• Vaccination or maternal antibody interference • Cross-reactivity

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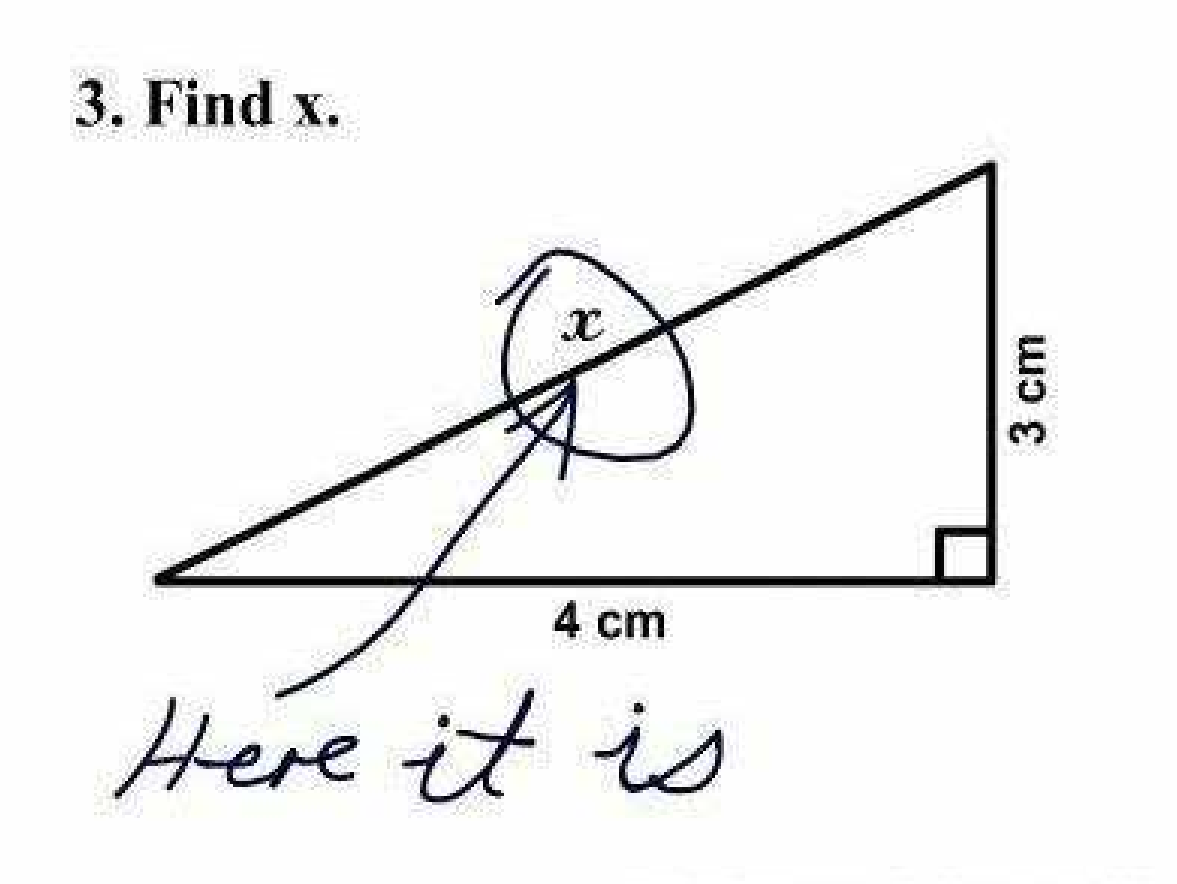
Testing Limitations

One of the biggest limitations?



Sensitivity & Specificity

- Sensitivity = how good the test is at identifying affected animals
  - Highly sensitive tests correctly identify all or nearly all affected animals, with few false negatives
- Specificity = how good the test is at not misidentifying healthy animals as affected
  - Highly specific tests correctly identify only those animals actually affected, with few false positives

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Predictive Values

- Predictive value = usefulness of the test in classifying animals with and without the disease
- How trustworthy are your results?
- Remember – no test is perfect!

Small changes can have a big impact on your results – especially if you are testing many animals

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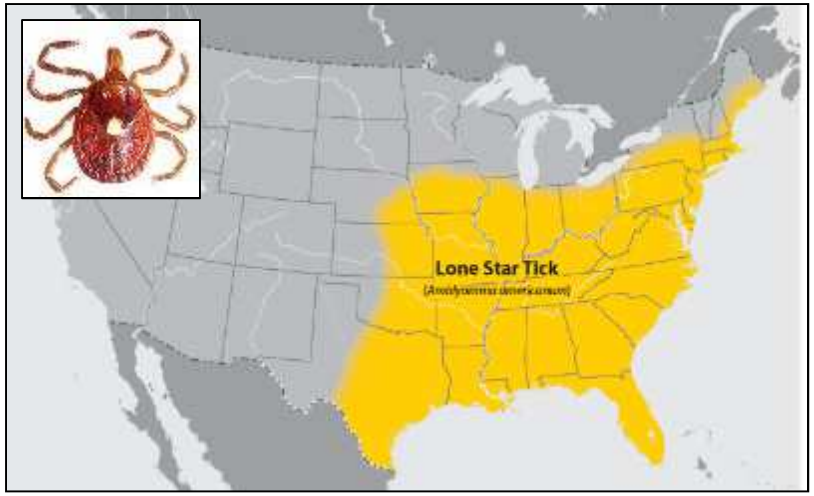
Ehrlichia spp.

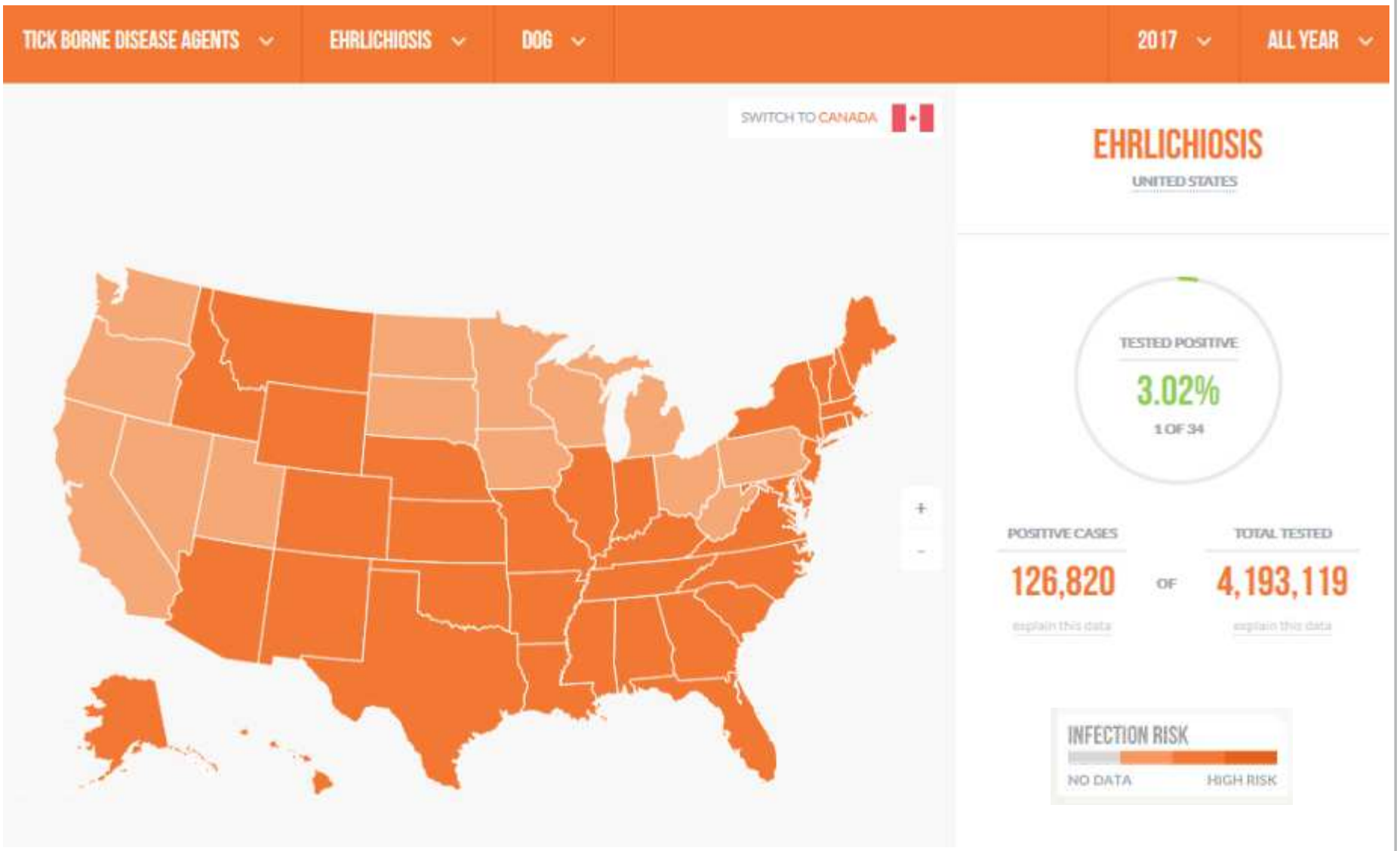
Gram negative obligate intracellular bacteria

- *E. canis* vectored by *Rhipicephalus*
- *E. ewingii* and *E. chaffeensis* mainly by *Amblyoma*

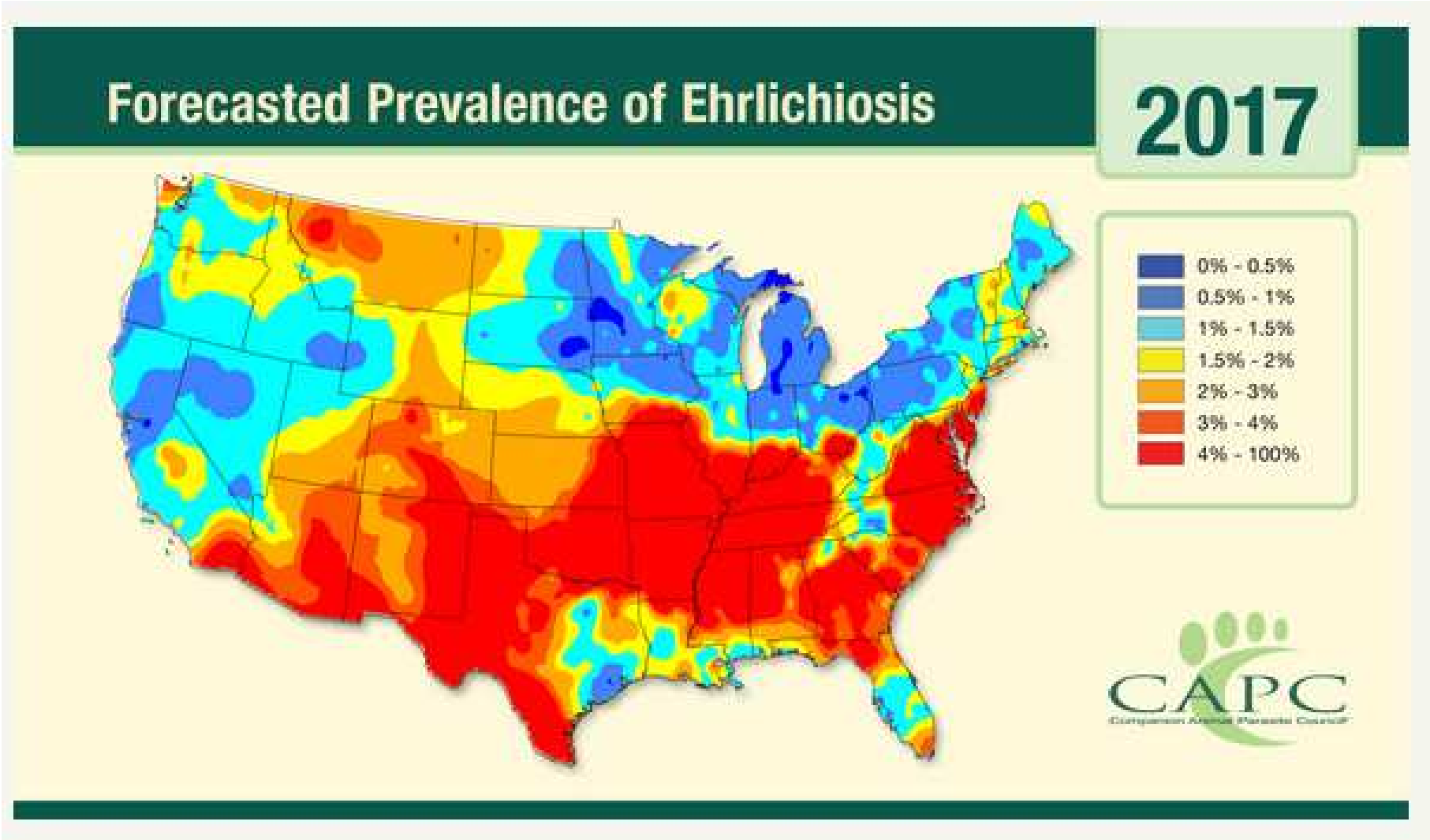
Acute, subclinical and chronic disease may occur

Cases year-round, peak in summer





https://www.capcvet.org/maps/#2017/all/ehrlichiosis/dog/united-states/



https://www.capcvet.org/articles/2017-ehrlichia-forecast/

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Ehrlichia spp.

Clinical findings vary by species:

- *E. canis* – lethargy, fever, anorexia, weight loss, bleeding tendencies, enlarged lymph nodes and/or spleen
- *E. chaffeensis* – bloody nose, enlarged lymph nodes, ocular signs, vomiting
- *E. ewingii* – fever, anorexia, stiffness/joint swelling, neurologic signs

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Ehrlichia - Diagnostics

Positive results indicate <u>exposure</u>

- Treatment of asymptomatic dogs solely on basis of positive screening NOT recommended
- Additional testing to determine active infection

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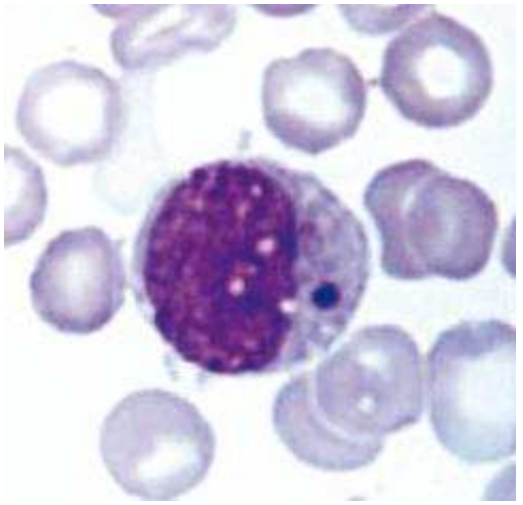
Ehrlichia + Result: Next Steps



Identify any co-infections

Look for evidence of active infection:

- Consistent history and clinical signs
- Low white blood cell counts, especially low platelets; high protein levels, elevated liver enzymes, prolonged bleeding times, blood or protein in the urine
- Morulae in buffy coat blood smears or aspirates
- Real-time PCR: blood vs. splenic aspirates

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Treatment of Ehrlichiosis

Antibacterial agents and supportive care

- Doxycycline for 4 weeks
- Response in 24-48 hours, platelets normal w/in 14 days
- Chronically infected dogs may be poorly responsive

- May not clear infection

- Reinfection possible

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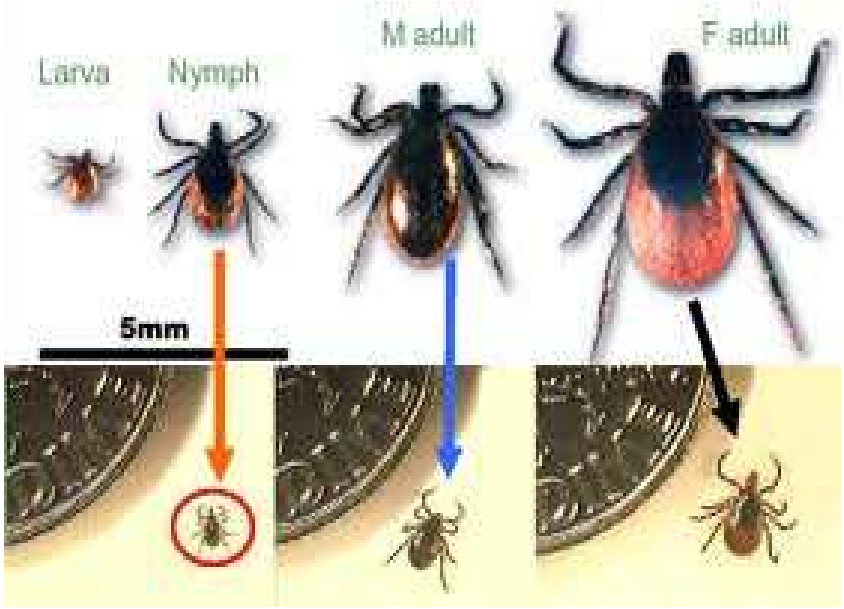
Lyme Disease

- Disease caused by a bacterium called *Borrelia burgdorferi*
- First human case → Lyme, Connecticut (1975)
- Increasingly problematic for humans and dogs

How do dogs get infected?

- Tick bite → *Ixodes scapularis* (~24-48 hours)
- In endemic areas high proportions of ticks are infected



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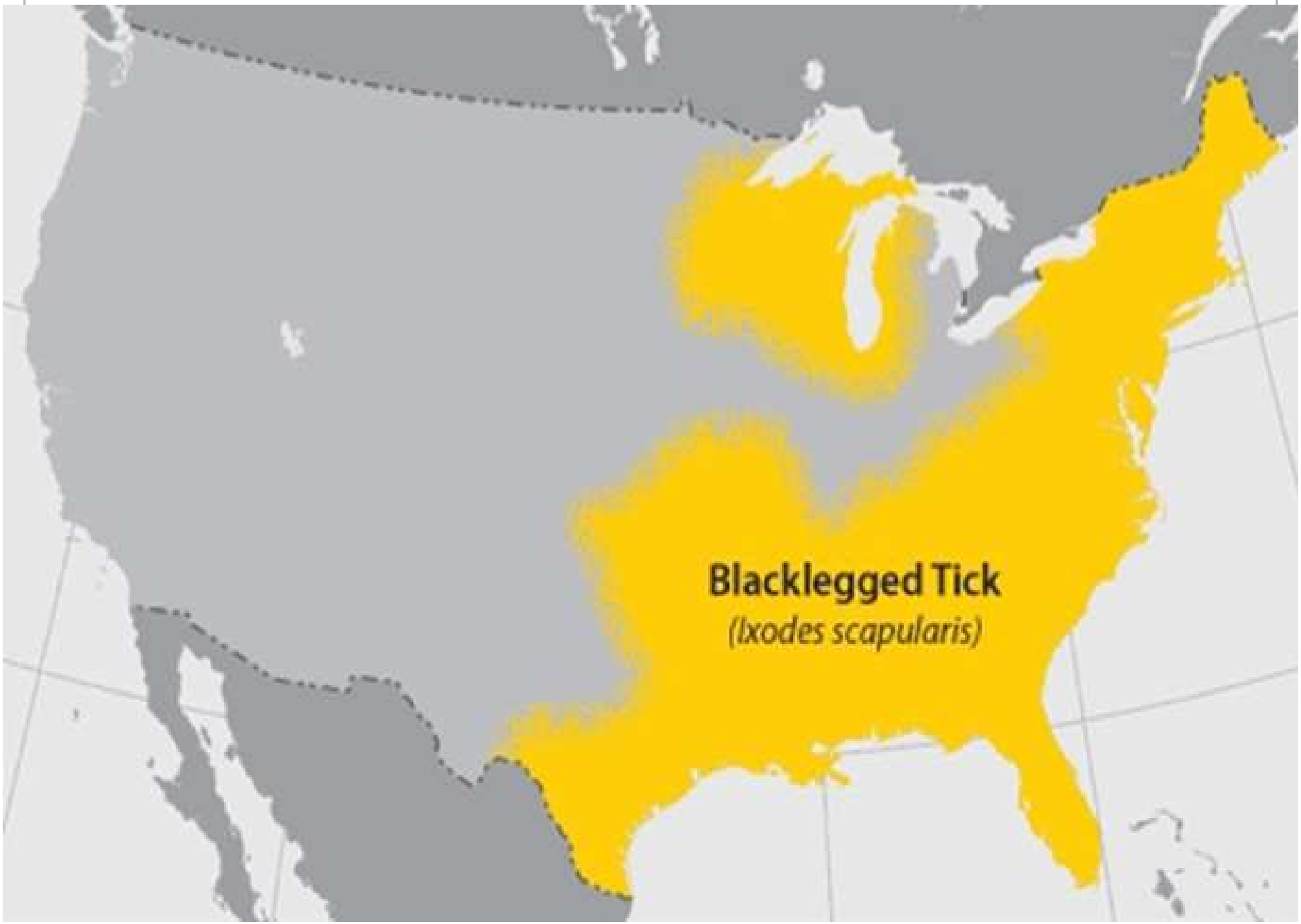
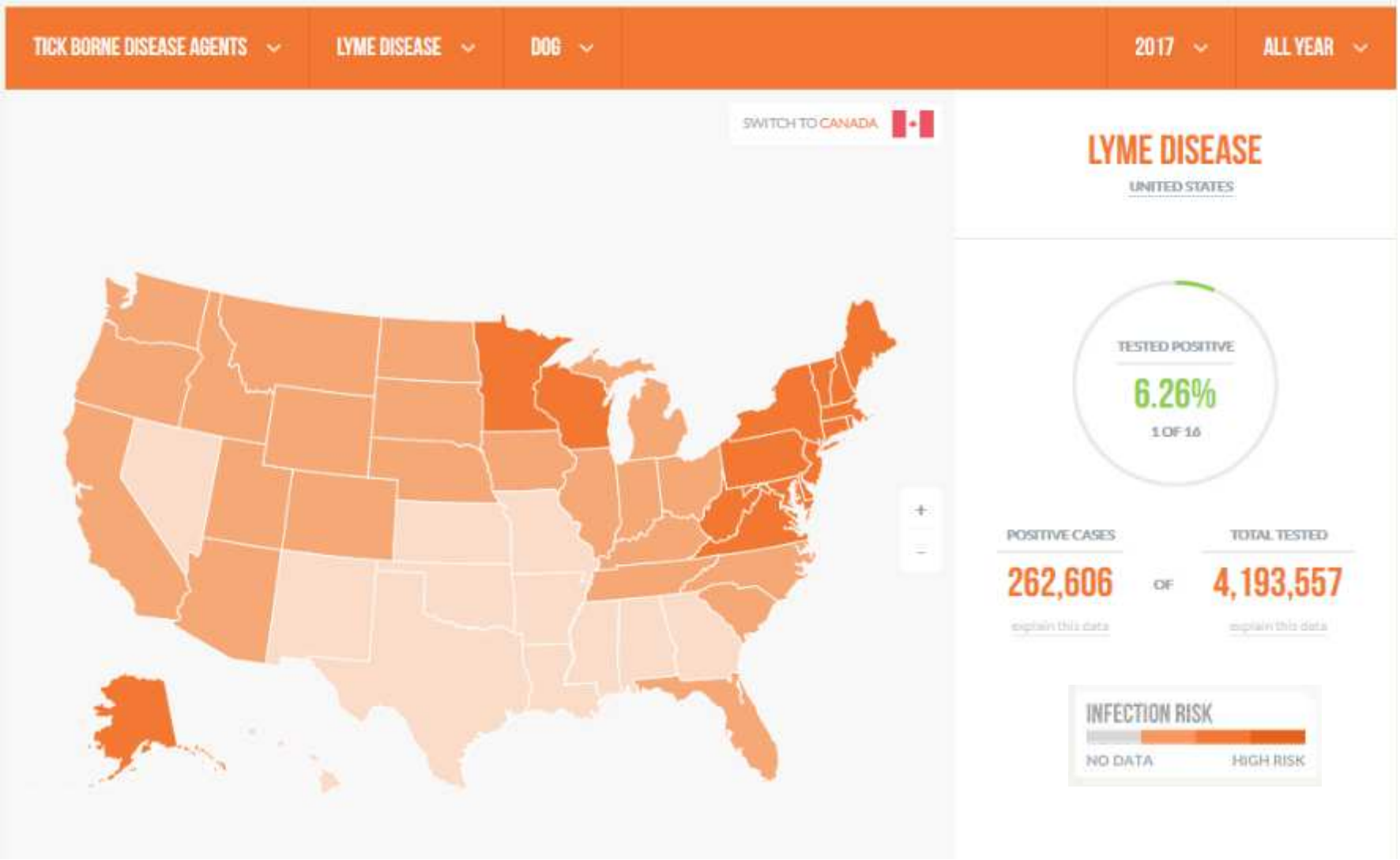

Blacklegged Tick
(Ixodes scapularis)

Lyme Disease

- Up to 70% of dogs in certain places in the Northeast have been infected.
- Unfortunately, don't generally know how many dogs are infected in a specific area, but do know that it follows numbers in people.



https://www.capcvet.org/maps/#2017/all/lyme-disease/dog/united-states/

What does it do to dogs?

- 1. Nothing!! Only about 5% of infected dogs ever show signs!!!
- 2. Arthritis, fever, feeling "off," limb pain – 2 to 5 mo after infection
- 3. Kidney Disease → VERY RARE → mainly affects certain breeds of dogs

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Diagnosis

- Criteria:
  - 1. History of exposure to ticks in an endemic area
  - 2. Typical clinical signs for Lyme borreliosis
  - 3. Specific antibodies against *B. burgdorferi*
  - 4. Prompt response to appropriate antibiotic therapy

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Idexx 4DX™ Snap Test

- C6 antibody detection
  - Antibody made to infections, not vaccination
  - 2-3 wks post-infection
  - Drops 2-6 mo after treatment
  - No cross-reactivity with other diseases
- Asymptomatic dogs – titer magnitude doesn't correlate with clinical signs (over 20 months)

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To Treat or Not to Treat

- If Asymptomatic: Do NOT treat (ACVIM, CAPC)
  - Treating does decrease the titer quicker BUT there is no indication that it prevents future clinical signs or the development of kidney disease
- If Symptomatic (arthritis): TREAT
  - Quick response to disease – dogs feel better quicker
  - No indication that treatment will prevent future signs

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If you do treat…

- Standard treatment is doxycycline for 30 days, may need to be longer for some dogs
- All antibiotic regimes have failed to clear organisms from the tissues of some dogs
- Clinical signs (acute arthritis, fever) should improve within 1-2 days of starting therapy

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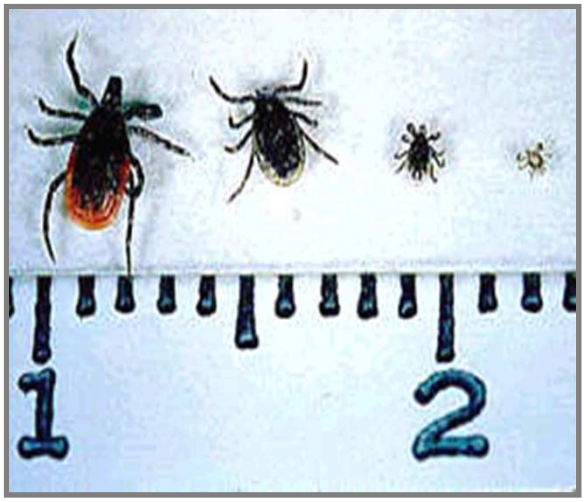
Anaplasmosis

- *Anaplasma phagocytophilum*
  - Northeast, upper mid-west, California
  - Vectors:
    - *Ixodes scapularis* (Northeast)
    - *Ixodes pacificus* (California)



- *Anaplasma platys*
  - Texas, Oklahoma, Florida
  - Vector:
    - *Rhipicephalus sanguineus*

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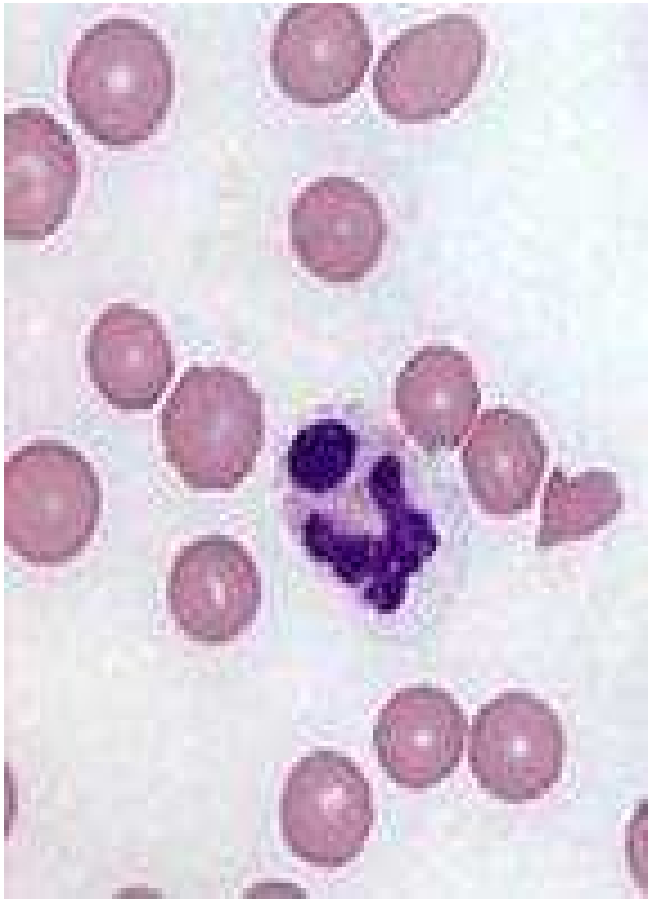
Anaplasmosis

- Infects certain white blood cells
- Not known how cause disease
- 10 days post-infection → strong immunity usually controls infection
- 1-3 week incubation period
- Acute disease only (if at all) – **no chronic disease**



Clinical Signs - *Anaplasma*

- **Middle aged dogs**
  - Spring, summer, early fall
- **Fever**, lethargy, anorexia
- Polyarthritis: pain/stiffness – lameness rare (10%)
- Low platelet counts, but bleeding does not occur
- Dogs infected with both Lyme and Anaplasma show **more severe signs (lame)**

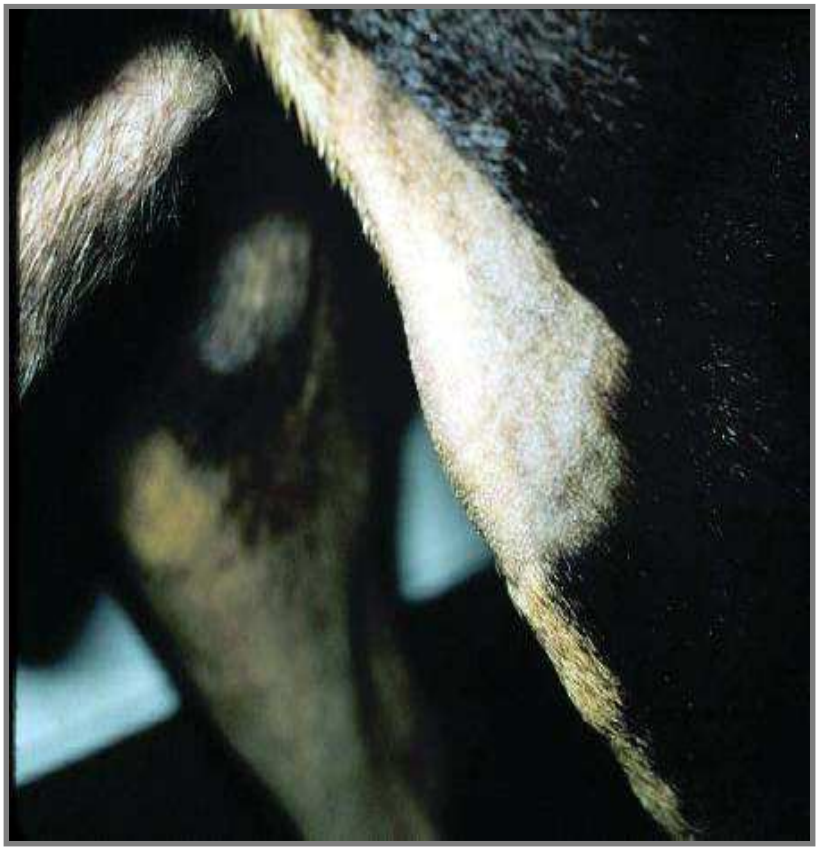


Photo courtesy of Stephen Barr

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4DX Anaplasma

- **Cross reaction**
  - *A. platys*
  - Slight with E. canis during acute infection (but less during convalescences)
  - None with Lyme or RMSP
- Positive result in west/northeast → *A. phagocytophilum*
- Positive result in southeast → *A. platys*

Treat a positive or not??

- **If symptomatic (with typical CBC changes)**
  - Doxycycline for 4 weeks
  - *Anaplasma* spp are also susceptible to enrofloxacin

- **Remember** → this case is likely to also have a slightly positive *E. canis* dot

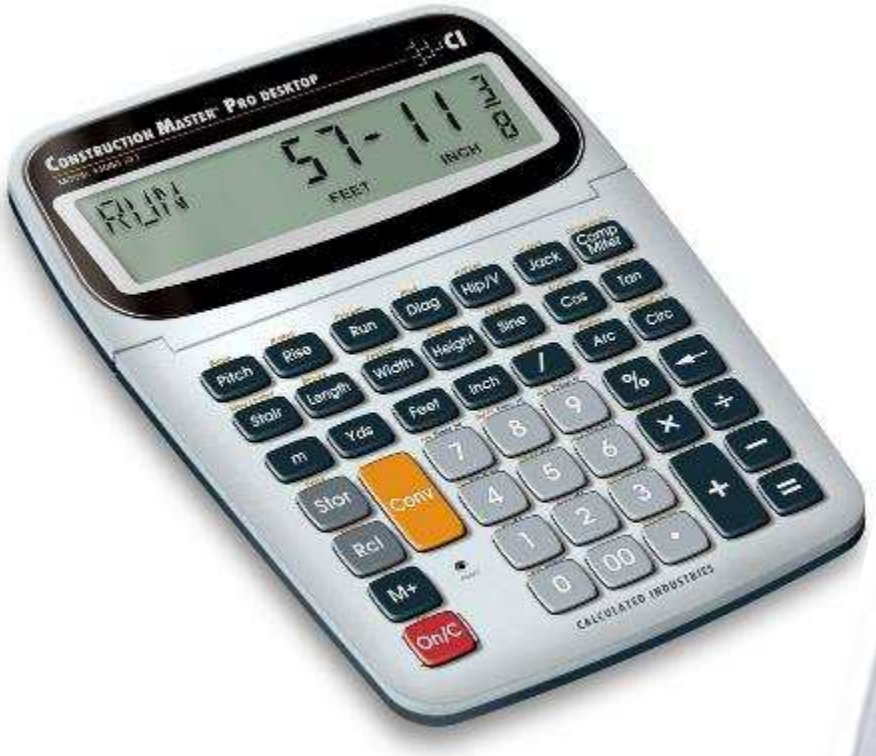
Treat a positive or not??

- **If <u>asymptomatic</u>**
  - No chronic disease = no point in treating
  - Consider treating if also Lyme positive, or wait until clinical signs develop

Pulling It All Together

- Positive results in healthy dogs:
  - Ehrlichia – additional testing, treat if confirmed
  - Lyme – probably nothing further
  - Anaplasma – probably nothing further

What does this mean for us?



Evaluating Your Protocols

- What is your testing protocol ?
- Estimated prevalence of disease?
- What test kit do you use?
- What is the reported sensitivity? Specificity?
- What do you do with positive results? Negative?
- Animals tested/year?
- Cost per test?
- What's the PPV and NPV?
- What is the 'cost' of the results?
- Other considerations

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Disease		Test kit	Sensitivity	Specificity
Heartworm	"Normal" burdens	VetScan Canine Heartworm	92.0%	100.0%
		Enhanced Witness HW	96.6%	96.6%
		SoloStep	95.0%	99.0%
		SNAP Heartworm RT	98.9%	99.3%
	Low worm burdens (1, 2, or 3 worms)*	SoloStep	62%, 85%, 88%	
		SNAP Heartworm RT	64%, 88%, 94%	
Lyme		VetScan Canine Lyme	100.0%	100.0%
		IDEXX 4DX Plus	96.7%	98.8%

Disease		Test kit	Sensitivity	Specificity
Ehrlichiosis	*E. canis*	VetScan Canine Ehrlichia	93.8%	96.3%
		IDEXX 4DX Plus	97.8%	92.3%
	E. ewingii	VetScan Canine Ehrlichia	93.8%	96.3%
		IDEXX 4DX Plus	96.5%	93.9%
Anaplasmosis	*A. phagocytophilum*	VetScan Canine Anaplasma	93.0%	96.0%
		IDEXX 4DX Plus	93.2%	99.2%
	A. platys	VetScan Canine Anaplasma	94.0%	96.0%
		IDEXX 4DX Plus	89.2%	99.2%

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