



## Screening for vector-borne disease

SNAP® 4Dx® Plus Test clinical reference guide



# Every dog, every year

The Companion Animal Parasite Council (CAPC) Guidelines recommend annual comprehensive screening for pathogens transmitted by ticks and mosquitoes. Adding an annual cycle of comprehensive testing and year-round prevention to your practice benefits your patients, clients, and practice in 3 important ways:

## 1. React to changing prevalence

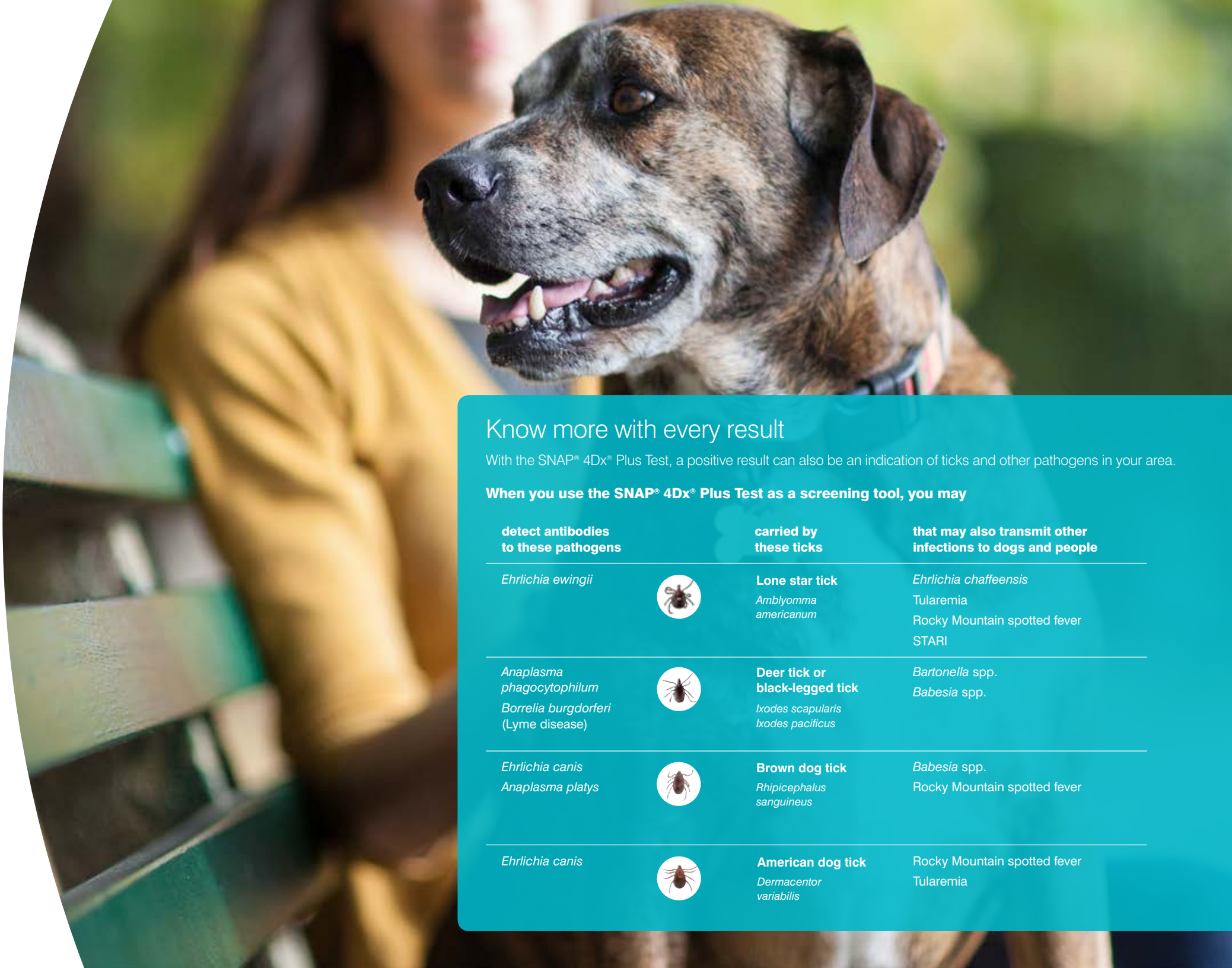
Mosquitoes and ticks are constantly on the move, and annual testing is the most reliable way to determine if new infections are threatening pets in your area. Pets move too, of course; without comprehensive testing, you sacrifice the ability to detect and treat mosquito and tick-borne infections acquired in other locations.

## 2. Detect and treat coinfection

Comprehensive testing lets you assess a dog's risk of having more than one infection.<sup>1</sup>

## 3. Measure the effectiveness of prevention protocols

Only comprehensive testing helps you know if your prevention protocols are working. Even a negative result is valuable; it's an opportunity to celebrate the pet owner's role in successfully preventing these infections and keeping their pet healthy.



## Know more with every result

With the SNAP® 4Dx® Plus Test, a positive result can also be an indication of ticks and other pathogens in your area.

### When you use the SNAP® 4Dx® Plus Test as a screening tool, you may

#### detect antibodies to these pathogens

*Ehrlichia ewingii*



*Anaplasma phagocytophilum*  
*Borrelia burgdorferi*  
(Lyme disease)



*Ehrlichia canis*  
*Anaplasma platys*



*Ehrlichia canis*



#### carried by these ticks

**Lone star tick**  
*Amblyomma americanum*

**Deer tick or black-legged tick**  
*Ixodes scapularis*  
*Ixodes pacificus*

**Brown dog tick**  
*Rhipicephalus sanguineus*

**American dog tick**  
*Dermacentor variabilis*

#### that may also transmit other infections to dogs and people

*Ehrlichia chaffeensis*  
Tularemia  
Rocky Mountain spotted fever  
STARI

*Bartonella* spp.  
*Babesia* spp.

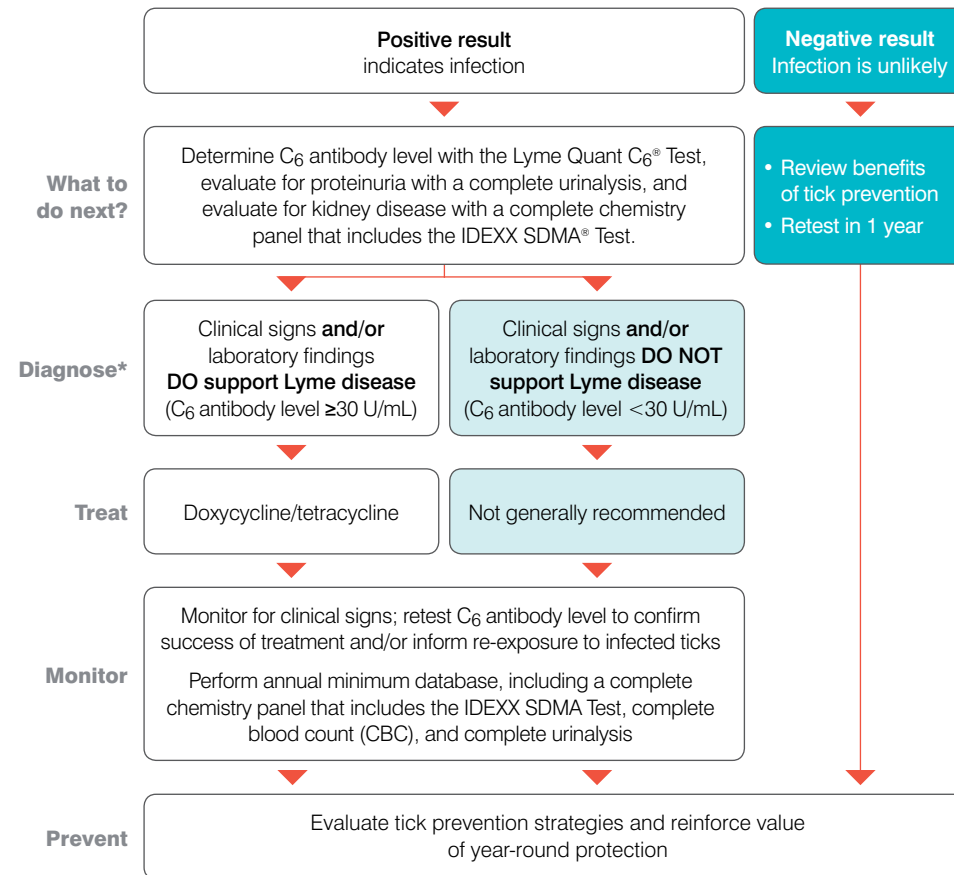
*Babesia* spp.  
Rocky Mountain spotted fever

Rocky Mountain spotted fever  
Tularemia

# Lyme disease

Transmitted by the deer tick or black-legged tick, Lyme disease is caused by the bacterium *Borrelia burgdorferi*. Clinical signs may not appear until several months after infection. Lyme disease has been found throughout North America with cases ranging from mild to severe.

## What to do with your SNAP® test result



## Did you know?

- Dogs testing positive for antibodies to the C<sub>6</sub> peptide had 43% increased risk of having chronic kidney disease compared to seronegative dogs.<sup>3</sup>
- The C<sub>6</sub> peptide used in the SNAP® 4Dx® Plus Test and Lyme Quant C<sub>6</sub>® Test does not cross-react with the antibody response to commercially available Lyme vaccines.<sup>4</sup>
- Dogs with seroreactivity to both *B. burgdorferi* and *Anaplasma phagocytophilum* may have two times the risk of developing clinical illness than singularly infected dogs.<sup>1</sup>

## *Borrelia burgdorferi*

### Primary vectors

*Ixodes scapularis* or *Ixodes pacificus* (deer tick and black-legged tick)

### Pathology

- Localizes in tissues of infected dogs
- Synovitis (may be subclinical)
- Lyme nephritis

### Clinical presentation

Chronic infection with clinical signs that may present acutely:

- Fever, anorexia
- Polyarthritits, lameness
- Rapidly progressive renal failure
- Neurologic syndromes

### Laboratory abnormalities

- Elevated C<sub>6</sub> antibody level ≥30 U/mL
- Proteinuria
- IDEXX SDMA Test > 14 µg/dL

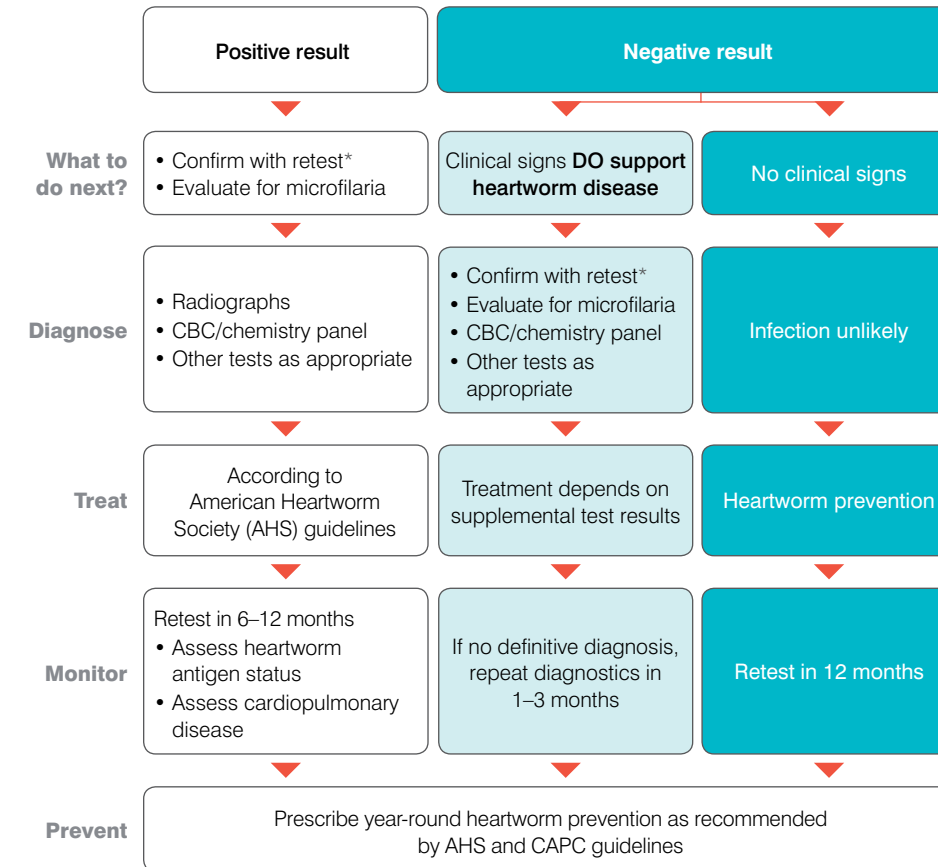


\*Serology is typically used to diagnose Lyme disease. *B. burgdorferi* localizes to the tissues and is therefore rarely detectable in the blood by PCR.<sup>5</sup>

# Heartworm disease

*Dirofilaria immitis*, the causative agent of heartworm disease, is transmitted by infected mosquitoes when *D. immitis* larvae are transferred to a healthy dog. Heartworm disease has no obvious clinical signs in the early stages, making preventive measures so much more important—especially as advanced infection may result in death.

## What to do with your SNAP® test result



## Did you know?

- Despite availability of monthly preventives, prevalence rates of canine heartworm have remained consistent in North America.<sup>6</sup>
- The American Heartworm Society (AHS) and the Companion Animal Parasite Council (CAPC) recommend testing all dogs for both antigen and microfilariae at least annually.
- For more information and current recommendations on treating canine heartworm disease, go to [heartwormsociety.org](http://heartwormsociety.org) or [capcvet.org](http://capcvet.org).

## *Dirofilaria immitis*

### Primary vector

Mosquito

### Pathology

Infective larvae (L3) mature to adult worms in the heart and pulmonary arteries

### Clinical presentation

Asymptomatic at first, later developing:

- Mild, persistent cough
- Lethargy
- Exercise intolerance
- Reduced appetite
- Weight loss

### Laboratory abnormalities

- Eosinophilia
- Azotemia
- Increased liver enzymes
- Proteinuria



\*A heartworm antigen test by ELISA at a reference laboratory is recommended as the confirmatory test.

# Canine anaplasmosis

Canine granulocytic anaplasmosis is caused by the bacterium *Anaplasma phagocytophilum* (transmitted by the deer tick or black-legged tick). *Anaplasma platys* (transmitted by the brown dog tick) is the cause of infectious cyclic thrombocytopenia.

## Did you know?

- Many mammalian species, including humans, are susceptible to *A. phagocytophilum* infection.
- Dogs coinfecting with *Anaplasma* and other bacterial pathogens may have more complex disease presentations and respond more slowly to therapy.
- *A. platys* infects canine platelets and is frequently seen as a coinfection with *Ehrlichia canis*.

### *Anaplasma phagocytophilum*



### Primary vectors

*Ixodes scapularis*  
*Ixodes pacificus*  
(deer tick or black-legged tick)

### *Anaplasma platys*



Most likely *Rhipicephalus sanguineus* (brown dog tick)

### Pathology

Infects neutrophils      Infects platelets

### Clinical presentation

Can present acutely:

- Fever
- Anorexia
- Lethargy
- Polyarthritis, lameness
- Neurologic signs

Usually minimal clinical signs, but some dogs may have:

- Fever
- Uveitis
- Petechia and ecchymoses
- Epistaxis

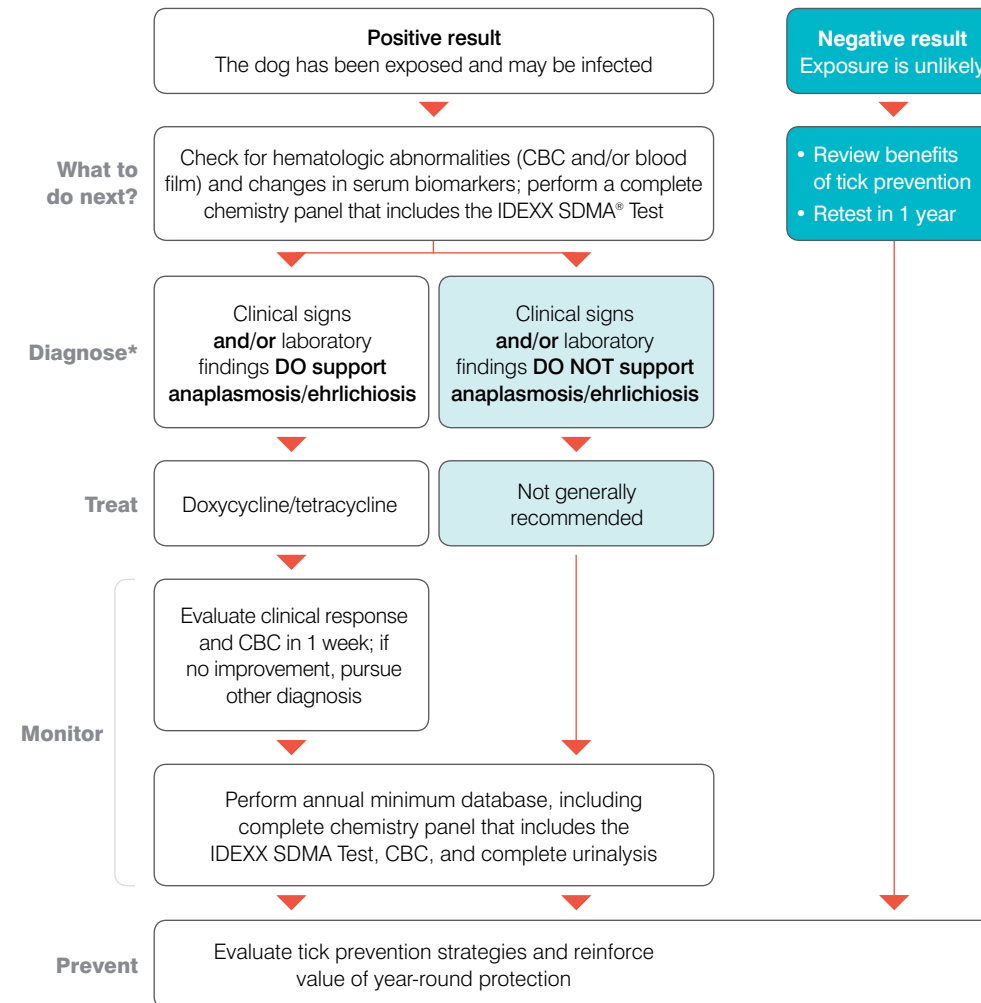
### Laboratory abnormalities

- Thrombocytopenia
- Lymphopenia
- Increased liver enzymes
- Thrombocytopenia

### Note

Previous infection may not prevent reinfection and persistent infections are possible.<sup>7,8</sup>

## What to do with your SNAP® Anaplasma and Ehrlichia test results



\*Additional diagnostics may be beneficial. See the "Serology and PCR for sick patients" section of this guide for more information.

# Canine ehrlichiosis

Canine ehrlichiosis is caused by the bacteria *Ehrlichia canis* (transmitted by the brown dog tick) and *Ehrlichia ewingii* (transmitted by the lone star tick). Canine *Ehrlichia* infections may progress to the subclinical phase, lasting days, months, or years.

## Did you know?

- Dogs coinfecting with *E. canis* and *A. platys* were found to have more severe anemia and thrombocytopenia than dogs with either single infection.<sup>9</sup>
- In a study of healthy dogs with antibodies to *E. canis*, 39% were thrombocytopenic.<sup>10</sup>
- Chronic *E. canis* infections, if left untreated, can lead to bone marrow dysfunction or kidney disease.
- Dogs with *Ehrlichia* antibodies in *E. canis* endemic areas had a 300% increased risk of developing chronic kidney disease (CKD).<sup>3</sup>

### *Ehrlichia canis*



### Primary vector

*Rhipicephalus sanguineus*  
(brown dog tick)

### *Ehrlichia ewingii*



### Primary vector

*Amblyomma americanum*  
(lone star tick)

### Pathology

Infects monocytes

Infects granulocytes

### Clinical presentation

- Fever, anorexia, lethargy
- Bleeding disorders
- Polyarthritis, lameness
- Lymphadenomegaly
- Neurological signs

- Fever, anorexia, lethargy
- Polyarthritis, lameness
- Neurological signs

### Laboratory abnormalities

- Anemia
- Thrombocytopenia
- Hyperglobulinemia
- Proteinuria
- IDEXX SDMA Test > 14 µg/dL

- Thrombocytopenia

### Note

Previous infection may not prevent reinfection, and persistent infections are possible.<sup>10,11</sup>





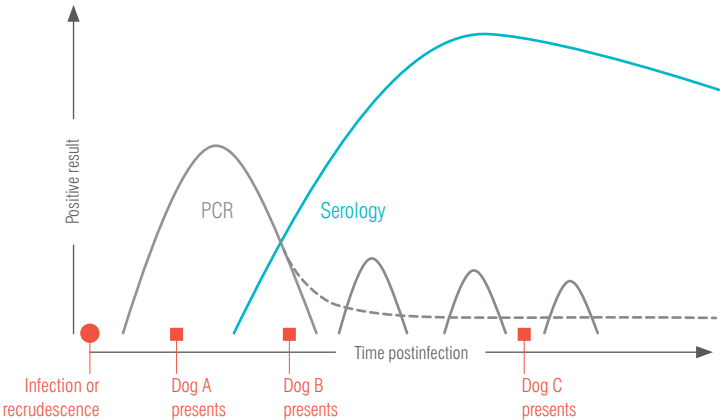
# Serology and PCR for sick patients

For sick dogs presenting with clinical signs consistent with a vector-borne disease, using serology and PCR together improves your ability to make a complete and accurate diagnosis.

**Benefits and limitations of each diagnostic method:**

	Serology	Polymerase chain reaction (PCR)
<b>Measures</b>	Antibody response of host	Nucleic acid (DNA) from pathogen
<b>Benefits</b>	Useful for screening as well as diagnosis of infection	Specifically identifies pathogens indicating active infection
<b>Limitations</b>	Clinical signs may precede a measurable antibody response	A negative PCR result does not necessarily rule out infection

**Dogs with ehrlichiosis and anaplasmosis may present with clinical signs at different times after infection. Which sick dog are you dealing with?**



**When to use the IDEXX vector-borne disease RealPCR™ panels:**

- Sick patients with clinical signs and/or laboratory abnormalities consistent with a vector-borne illness
- Patients with subclinical infections based on history, physical examination, serology, and clinical laboratory findings
- Monitoring response to therapy—a negative PCR result indicates a reduction in pathogen load

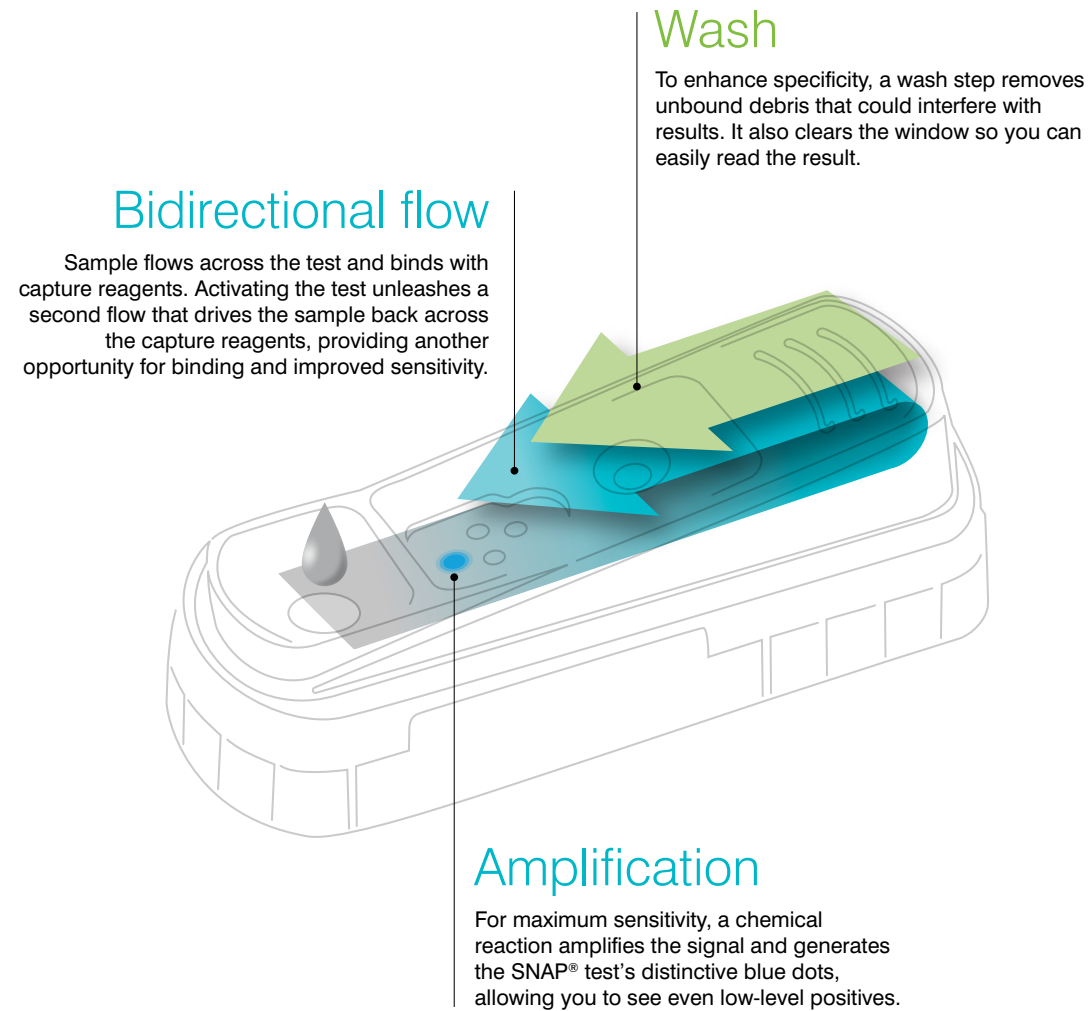
“No single test is sufficient for diagnosing an infectious disease in a sick patient.”

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 College of Veterinary Medicine,  
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\*Dr. Breitschwerdt has a business relationship with IDEXX pursuant to which he receives compensation from IDEXX from time to time. The views expressed in this guide are solely those of Dr. Breitschwerdt.

# Depend on the most accurate and comprehensive screen

SNAP® technology uses a proprietary three-step process to deliver dependable sensitivity and specificity.



## References

1. Beall MJ, Chandrashekar R, Eberts MD, et al. Serological and molecular prevalence of *Borrelia burgdorferi*, *Anaplasma phagocytophilum*, and *Ehrlichia* species in dogs from Minnesota. *Vector-Borne Zoonotic Dis.* 2008;8(4):455-464.
2. Geographic distribution of ticks that bite humans [maps]. Centers for Disease Control and Prevention website. [www.cdc.gov/ticks/geographic\\_distribution.html](http://www.cdc.gov/ticks/geographic_distribution.html). Accessed November 19, 2015.
3. Data on file at IDEXX Laboratories, Inc. Westbrook, Maine USA.
4. O'Connor TP, Esty KJ, Hanscom JL, Shields P, Philipp MT. Dogs vaccinated with common Lyme disease vaccines do not respond to IR6, the conserved immunodominant region of the VlsE surface protein of *Borrelia burgdorferi*. *Clin Diagn Lab Immunol.* 2004;11(3):458-462.
5. Straubinger RK. PCR-based quantification of *Borrelia burgdorferi* organisms in canine tissues over a 500-day postinfection period. *J Clin Microbiol.* 2000;38(6):2191-2199.
6. CAPC recommendations: canine heartworm. Companion Animal Parasite Council website. [www.capvet.org/capc-recommendations/canine-heartworm](http://www.capvet.org/capc-recommendations/canine-heartworm). Accessed November 19, 2015.
7. Egenvall A, Lilliehöök I, Björnsdóttir A, Engvall EO, Karlstam E, Artursson K, Heldtander M, Gunnarsson A. Detection of granulocytic *Ehrlichia* species DNA by PCR in persistently infected dogs. *Vet Rec.* 2000;146(7):186-190.
8. Breitschwerdt EB, Hegarty BC, Qurollo BA, et al. Intravascular persistence of *Anaplasma platys*, *Ehrlichia chaffeensis*, and *Ehrlichia ewingii* DNA in the blood of a dog and two family members. *Parasit Vectors.* 2014;7:298.
9. Gaunt S, Beall M, Stillman B, et al. Experimental infection and co-infection of dogs with *Anaplasma platys* and *Ehrlichia canis*: hematologic, serologic and molecular findings. *Parasit Vectors.* 2010;3(1):33.
10. Hegarty BC, Diniz PPV, Bradley JM, Lorentzen L, Breitschwerdt EB. Clinical relevance of annual screening using a commercial enzyme-linked immunosorbent assay (SNAP 3Dx) for canine ehrlichiosis. *JAAHA.* 2009;45(3):118-124.
11. Starkey LA, Barrett AW, Beall MJ, et al. Persistent *Ehrlichia ewingii* infection in dogs after natural tick infestation. *J Vet Intern Med.* 2015;29(2):552-555.



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American dog tick (*Dermacentor variabilis*) photographer: Susan E. Ellis, USDA-APHIS-PPQ. Black-legged tick (*Ixodes scapularis*), lone star tick (*Amblyomma americanum*), and brown dog tick (*Rhipicephalus sanguineus*) photographer: James L. Occhi.

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