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## Heartworm in Canines: Trends in Rhode Island Shelter Populations

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# Heartworm in Canines

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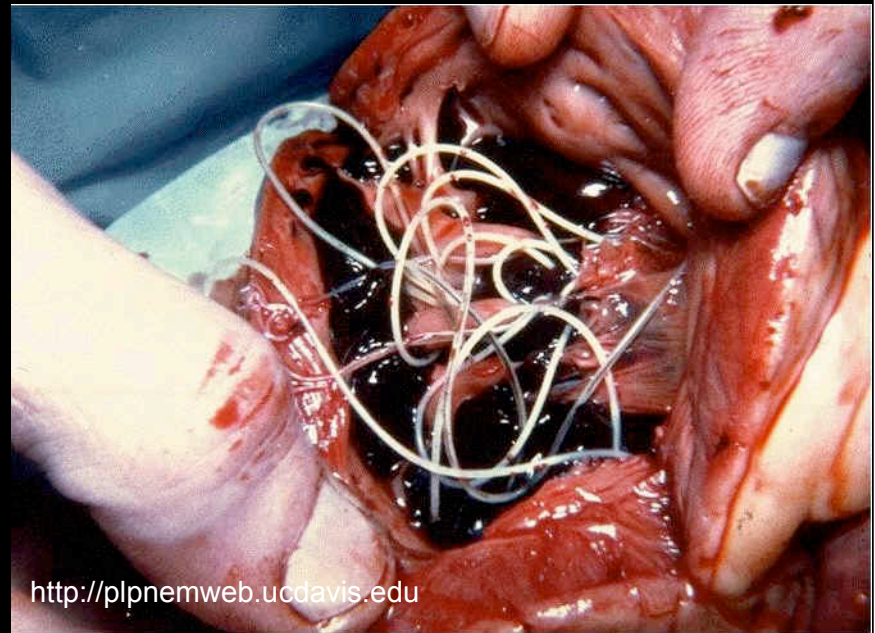
Trends in Rhode Island Shelter  
Populations

# Heartworm

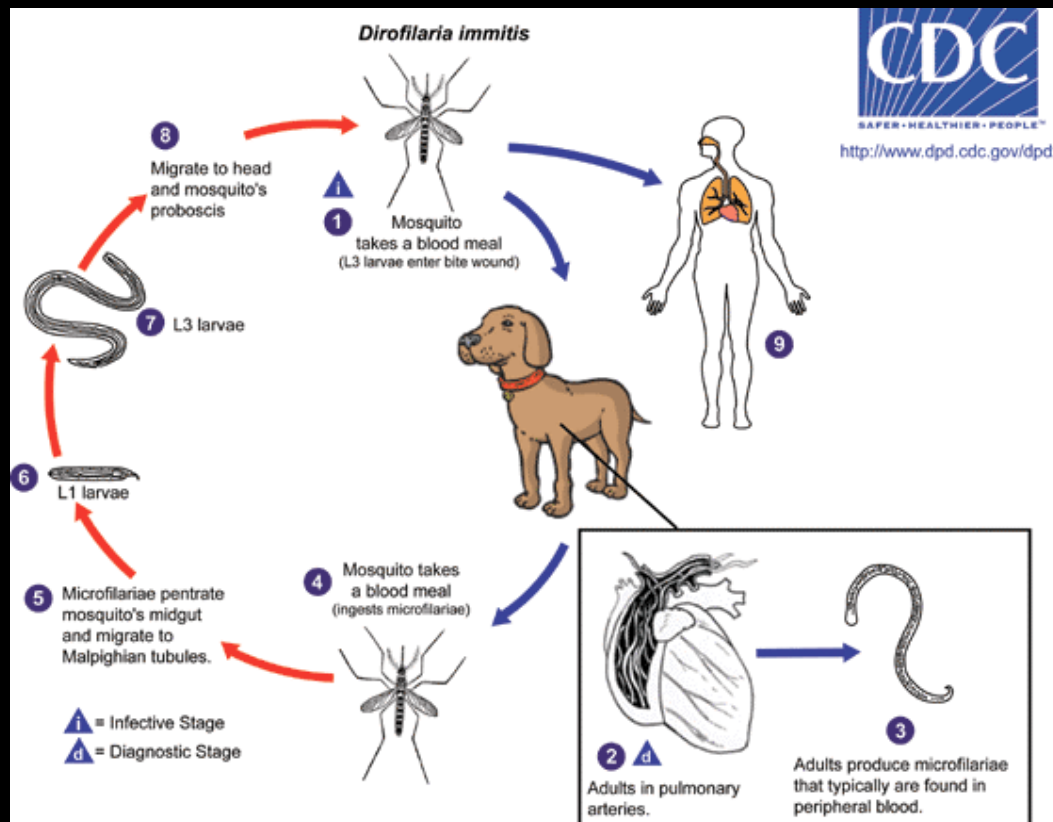
## *Dirofilaria immitis*

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- Parasitic roundworm spread from host to host via mosquito bite
- Long, slender worms measuring 20-30 cm
- Live in the pulmonary artery and the right ventricle of the heart
- Have life stages in both the mosquito and dog



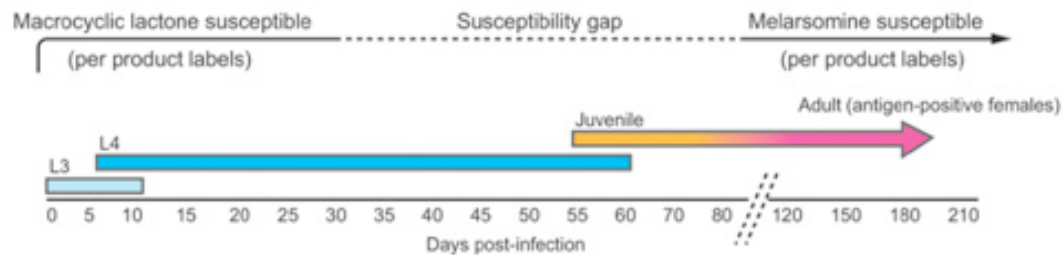
# Life cycle: *D. immitis*



- L3 infective stage
- Both larvae and adults are found in the body
- Humans can become dead-end-hosts

# Course of Infection: *D. immitis*

Timeline of *D. immitis* development, showing periods of susceptibility to macrocyclic lactones and melarsomine



The dotted line represents the "treatment gap", when *D. immitis* are not considered to be susceptible to either treatment.

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# Vector: *D. immitis*

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- Female mosquito transmits the disease if they are competent and infected
- Over 70 mosquito species have been identified as potential vectors
- Only 9 are prevalent Rhode Island
  - *Aedes albopictus*
  - *Aedes canadensis*
  - *Aedes cantator*
  - *Aedes excrucians*
  - *Aedes sollicitans*
  - *Aedes taeniorhynchus*
  - *Aedes vexans*
  - *Anopheles punctipennis*
  - *Anopheles quadrimaculatus*



# Testing

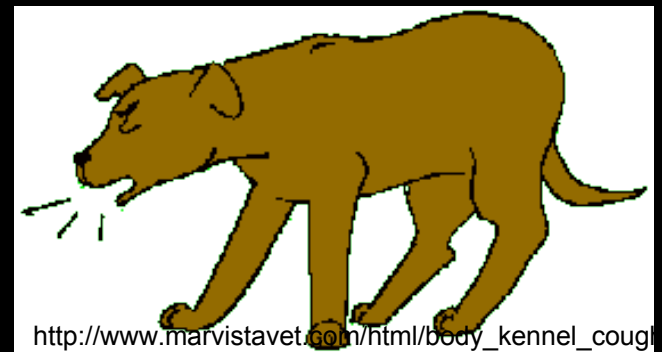
- Blood is drawn from cephalic vein
- Only need 3 drops
- Idexx 4Dx SNAP test
  - Heartworm
  - *Ehrlichia canis*
  - Lyme Disease
  - *Anaplasmosis phagocytophilum*
- Cost: from distributor \$16.17
  - Average Sharps disposal fee: \$5.00
  - Any employee wages



# Symptoms

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- Exercise Intolerance
- Lethargy
- Dry, non-productive cough
- Congestive Heart Failure
- Convulsions
- Vision disturbances
- Liver failure and icterus





# Veterinary Treatment

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- Melarsomine split-dosing three-dose protocol-adulticide
- Combined with Ivermectin- kills microfilaria to prevent repeated infection
- Often given with a NSAID drug to treat inflammation in the lungs
- Often given with pain medications- narcotic analgesics- which also calm and quiet the dog during treatment

# Shelter Treatment

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- On average, \$300/dog (Humane Society of Hamilton County)
- Often, there is a 4 step process to treatment
  - Find a foster home
  - Find a financial benefactor
  - Coordinate Treatment
  - Find a permanent home



# Shelter Treatment

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- Diagnostic, treatment, and prevention protocols for canine heartworm infection in animal sheltering agencies, Colby et al., 2011.
- Looked at the shelter protocols in four southern states: AL, FL, GA, MI
- Up to 90% of admitted dogs in shelters are euthanized in the south
- Five types of shelter
  - Open admissions with a central housing facility
  - Limited admissions with a central housing facility
  - Foster programs
  - Veterinary Clinics that participate in adoption programs
  - Sanctuaries

# Shelter Treatment

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- Of all shelters, only 72% tested all adult dogs, 16% tested some adult, 12% tested no dogs.
- Most common reason for NOT testing was expense
- Second most common reason for NOT testing was that treatment was not an option
- Antigen test was the most common testing type (SNAP)

# Shelter Treatment

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- Most common outcome for heartworm positive dogs
  - **Open admissions-** adopt/transfer with no treatment, euthanasia
  - **Limited admissions-** treat and adopt
  - **Foster-** treat and adopt
  - **Vet clinic-** treat and adopt
  - **Sanctuary-** treat and adopt
- Most common treatments for heartworm positive dogs
  - **Open admissions-** No treatment
  - **Limited admissions-** Melarsomine standard two dose protocol
  - **Foster-** Melarsomine split-dosing three-dose protocol
  - **Vet clinic-** Melarsomine split-dosing three-dose protocol
  - **Sanctuary-** Melarsomine standard two dose protocol

# Melarsomine Treatment- Immiticide® Merial

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- Only used to treat adult heartworms
- 1 mg/lb body weight
  - Given IM over the spine
- 3-4 month long process depending on severity of infection
- Dogs must be kept in strict confinement, as the dogs can die from a thromboembolism
- Up to 34% of dogs have some form of injection site reaction (Merial, 2011)

# Preventative Measures

- FDA approved heartworm preventatives

- Heartgard® (ivermectin/pyrantel)

- 6 mcg/kg
    - Chewable tablet
    - Give once every 30 days year round



- Interceptor® (milbemycin oxime)

- 0.5 mg/kg
    - Chewable tablet
    - Give once every 30 days year round



- 62% of agencies use a monthly preventative, 38% use a cheaper, livestock preparation of Ivermectin as a preventative (Colby, et al., 2011)

# Resistance to Preventatives

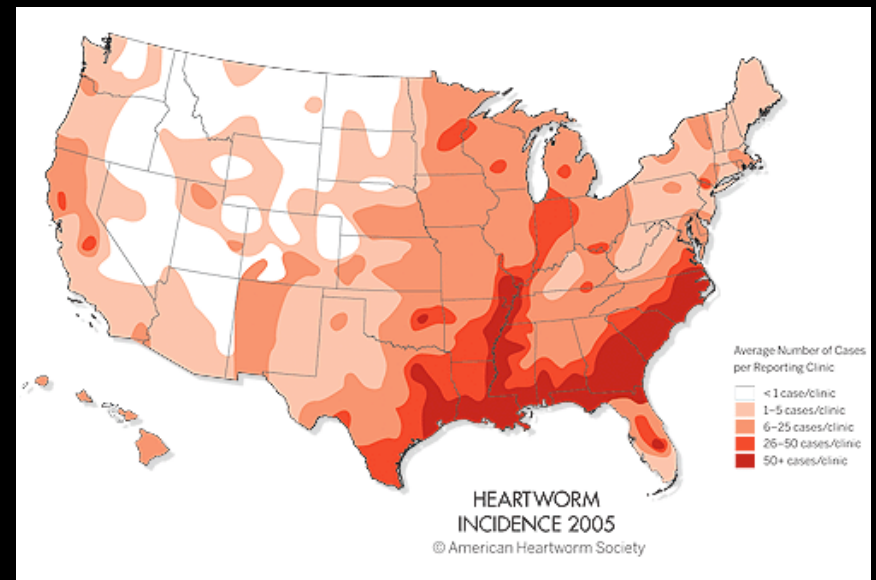
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- What is seen as resistance to preventatives by *D. immitis* is probably improper dosing of preventatives
- Is anthelmintic resistance a concern for heartworm control? What can we learn from the human filariasis control programs?, Prichard, R. K., 2005.
  - Unlikely that significant avermectin/milbemycin resistance will be selected in *D. immitis* with current treatment strategies
  - Evidence suggests several genes can contribute to avermectin/milbemycin resistance and the mechanisms of avermectin/milbemycin resistance are complex



# US Distribution

- More cases in southeast- more mosquitoes and competent species
- Some socio-economic differences
- Based on *reported* cases
  - Mail survey sent out to veterinary clinics- unsure of response rate



# Shelter Importation

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- Imported dogs account for a large portion of dogs that test positive.
  - 2006- 4/7 imported
    - 1 MA, 1 Puerto Rico, 2 MI
  - 2007- 1/4 imported
    - 1 NC
  - 2008- 0 imported\*
  - 2009- 1/2 imported
    - 1 GA
  - 2010- Data on origin of dog not available.

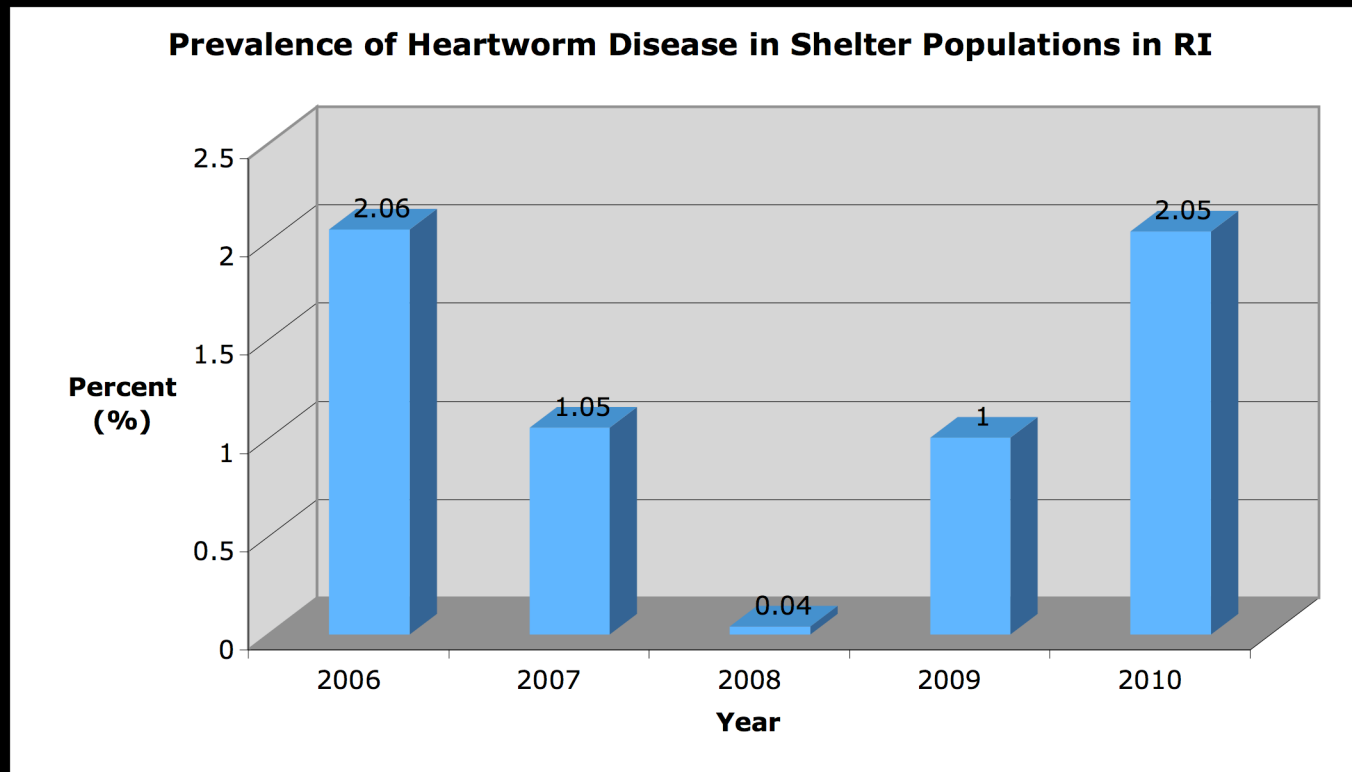
# Methods

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- Information was provided by three different shelters across the state of Rhode Island and the percent is a composite from all of the different shelters
- Some shelters imported strays from other states and if the dog originated from another state, that was indicated in the analysis
  - Creating a reservoir for mosquitoes
- Multiple tests for the same dog were not included

# *D. Immitis* Prevalence in RI Shelters (2006-2010)

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# Statistical Analyses: *D. immitis*

	2006	2007	2008	2009	2010
<b>DF</b>	1	1	1	1	1
<b>Pearson Chi-Square Statistics</b>	2.132	0.144	0.501	0.071	2.132
<b>P-Value</b>	0.144	0.704	0.479	0.790	0.144
<b>Significance</b>	Not significant with a 95% CI	Not significant with a 95% CI	Not significant with a 95% CI	Not significant with a 95% CI	Not significant with a 95% CI

# Comparison to Veterinary Populations

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- Prevalence and geographic distribution of *Dirofilaria immitis*, *Borrelia burgdorferi*, *Ehrlichia canis*, and *Anaplasma phagocytophilum* in dogs in the United States: Results of a national clinic-based serologic survey, Bowman et al., 2008.
- Materials and Methods
  - SNAP 3Dx and SNAP 4Dx
  - Data was arranged according to residence of the dog
- Results
  - 2,573 practices submitted samples from over 3 million dogs from all 48 continental states
  - Highest percentage positive samples obtained from the Southeast at 3.9% of all samples
  - **Percent of *D. immitis* infection in RI hospital dogs: 0.8%**
- Discussion
  - Results agreed with the map of reported cases by American Heartworm Society

# Conclusions

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- There is no statistical difference between prevalence of heartworm in shelter and veterinary populations
- **Preventative medications, such as Heartgard® and Interceptor® should be used on all dogs, year-round in Rhode Island**
- The different treatments for pet dogs v. shelter dogs illustrates the need for preventative medication, especially for open admission shelters where euthanasia for heartworm positive dogs is an option

# Coco

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# Acknowledgements

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# References

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# Questions?

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