# Common Diseases of Wild Mammals

ERICA A. MILLER, DVM

ERICA@JFRINK.COM

# Disease

“a specific state of malfunctioning of an animal body”

Dorland’s Medical Dictionary

Infectious disease = bacteria, virus, fungus, parasite, prion, etc.

Noninfectious disease = toxin, trauma, shock, exertion, nutritional, genetic, etc.

# For purposes of this lecture...

## Focus on *Infectious* Diseases:

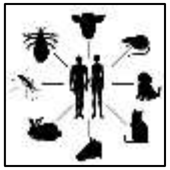
### Microbes

- Viral, Bacterial, Fungal

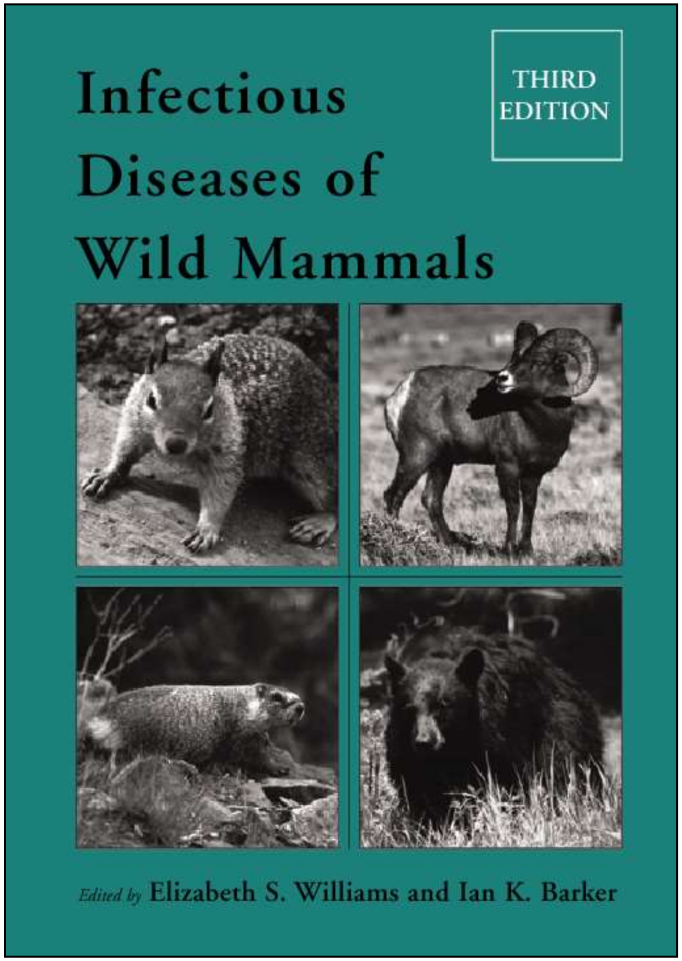
and

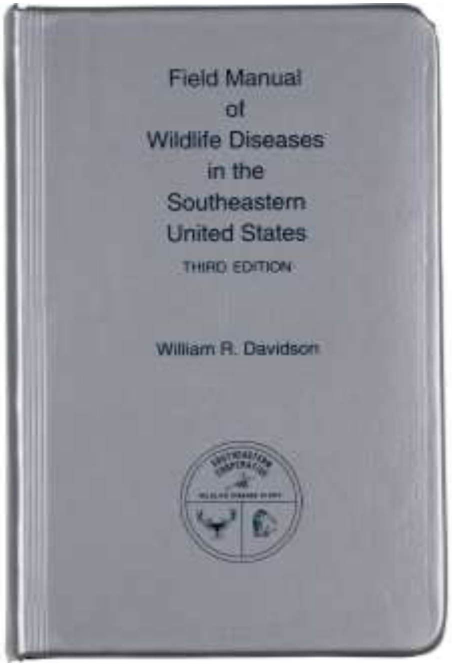
### Parasites:

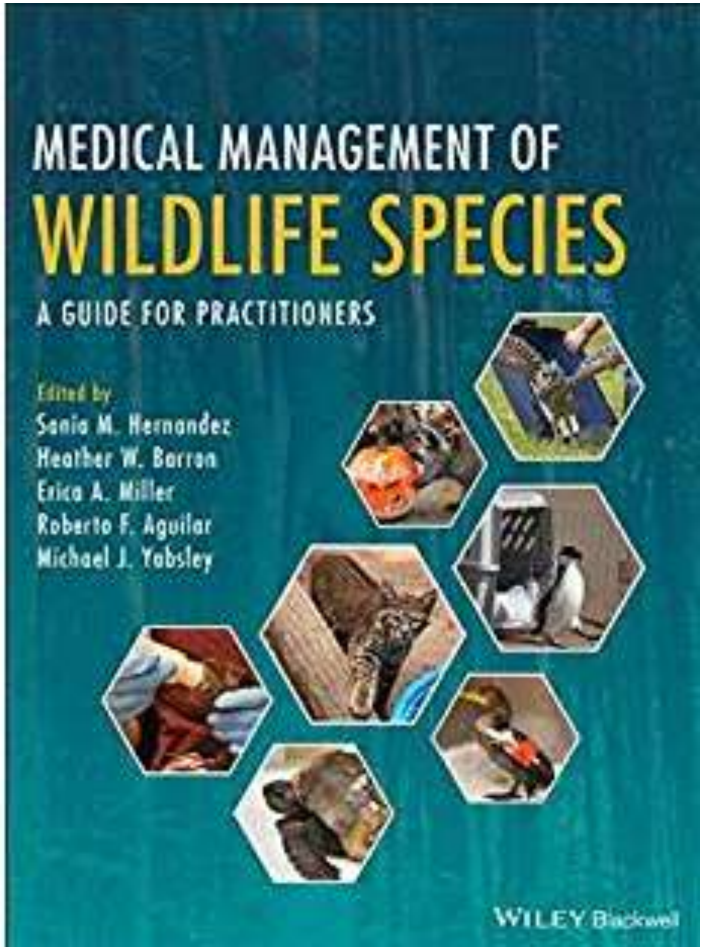
- External & Internal

 = zoonotic

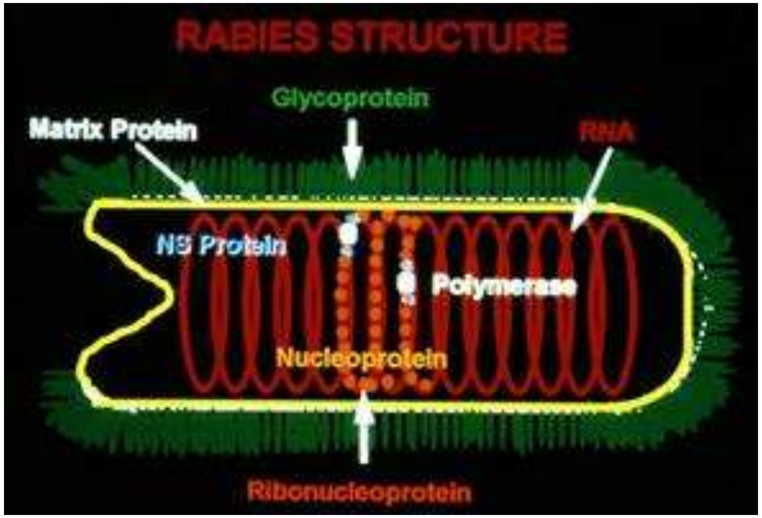
# Common and small mammals



# Viral Diseases





RECENT RABIES REPORTS HAS EVERYBODY ON EDGE...

# Raccoon

Presented for surgery of fractured tibia

Had been in rehab 3 days

Appeared BAR

# Raccoon

Surgical repair

Splint placed post op

# Raccoon

Noted abscess above L eye

Cleaned

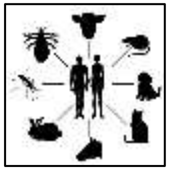
On antibiotics and analgesics post op

Recovered well

Hardware removed 3 weeks later

Seizured when moving to outdoor pen 5 days later

# Rabies virus




**Etiology** Lyssavirus; Rhabdovirus

**Epidemiology**
- Reservoir species: varies by region
- Transmitted in saliva and aerosol
- Bats: independent (sylvatic) cycle

**Clinical signs**
- No species-specific signs
- Behavior, neurologic signs

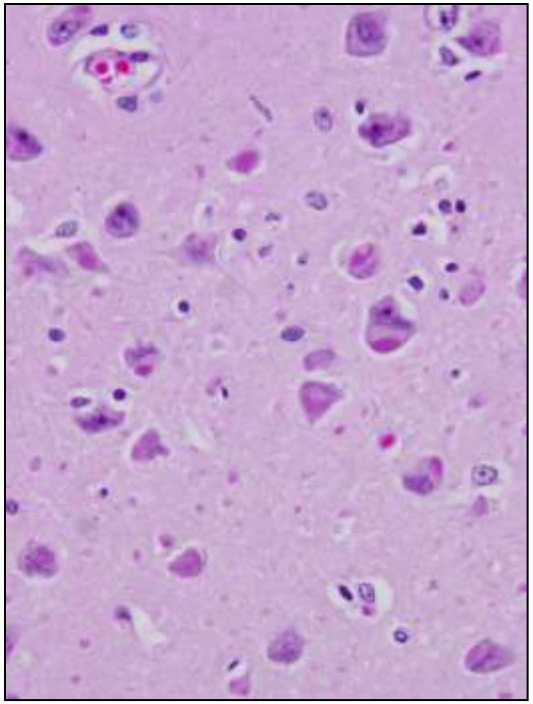
**Gross examination**
- Poor body condition; trauma

**Sampling**
- Head (let someone else remove brain!)

Get contact information

Every mammal is a rabies suspect!

Reportable Disease



Images: CDC

# Raccoon

Clinical signs
- Unkempt fur
- Hyper-reflective tapedae
- Conjunctivitis/Rhinitis
- Distinct odor
- CNS signs

# Canine Distemper Virus




Etiology Paramyxovirus

Epidemiology

- All canids*, wild felids, mustelids, mephitids, procyonids
- 4-7-year cycle, breeding & dispersal season
- Spread by body fluids
- Highly contagious

# Canine Distemper Virus

Changes to epithelium

- of paws (foot pad hyperkeratosis)
- and nasal planum (thinning)

# Canine Distemper Virus

## Gross examination
- Pneumonia
- GI inflammation

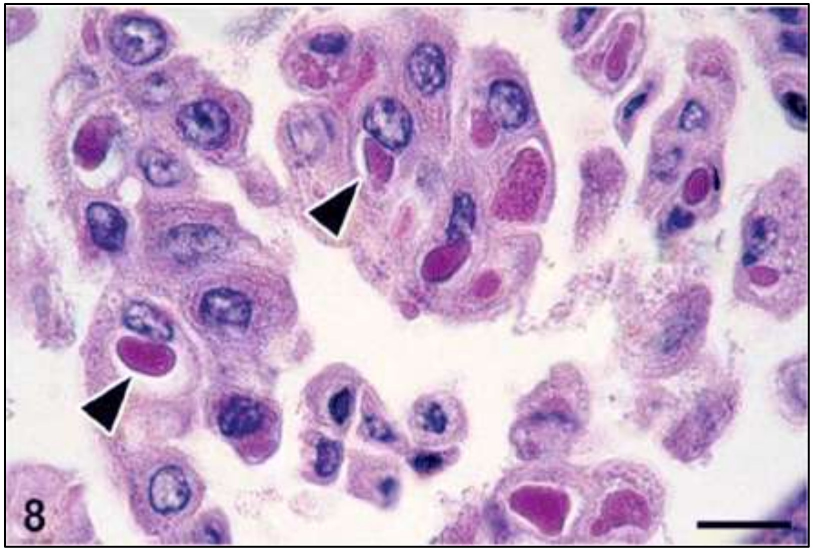
## Sampling
- Inclusion bodies on histopath
  - Brain, lung, stomach, urinary bladder, spleen or lymph nodes (conjunctival smears)
- Ab test or PCR on blood

## Prevention
- Do **NOT** use ***modified live virus vaccines***; use Purevax® Ferret, or Recombitek® Distemper vaccines

Slow recovery

Carrier status unknown??

Euthanasia recommended



Kuiken et al, 2006

# Raccoon Parvovirus

- Juveniles outdoors
- Sudden onset
- Profuse diarrhea
- Some with ocular discharge
- Acute deaths with no signs

# Raccoon Parvovirus

## Etiology

- Raccoon Parvovirus
- Canine Parvovirus
- Mink Enteritis Virus
- Feline Panleukopenia

## Epidemiology

- CPV affects canids & wild felids
- MVE affects mustelids
- FPV affects wild felids
- All 4 may affect young raccoons
- Spreads by direct contact with body fluids, insect vectors, fomites
- Viremia within 24 hrs, destroys bone marrow and intestinal villi

# Raccoon Parvovirus

## Clinical signs

- Diarrhea
- Sudden death

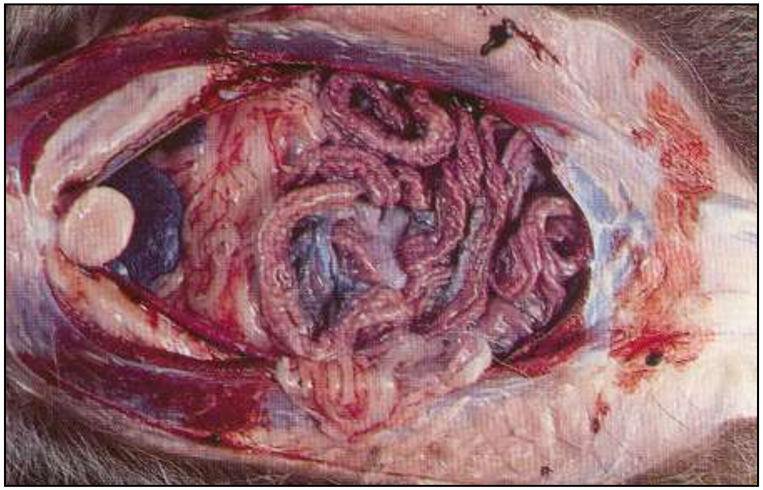
## Gross examination

- Contracted intestines (hypermotility)

## Sampling

- GI for histopathology or PCR
- Blood for CPV or FPV ELISA

Profuse diarrhea in raccoon with parvovirus enteritis.



Photos: Southeastern Wildlife Disease Cooperative

# Raccoon Parvovirus

Prevention

- Killed vaccine: Biovac® for MEV; Fel-O-Vax® for FPV

May shed virus in feces for 90 days after recovery

Euthanasia is recommended

# Fox Squirrel

Juvenile

All 4 feet swollen

Fur appears “ruffled”

Thin

Lethargic

# Squirrel Fibromatosis

Etiology

- Squirrel fibroma virus (squirrel pox)
- Related to Shope Fibroma Virus in rabbits

Epidemiology

- Most common in E. fox squirrels
- Also gray squirrels and woodchucks

Spread by contact or ectoparasites (mosquitoes, lice)

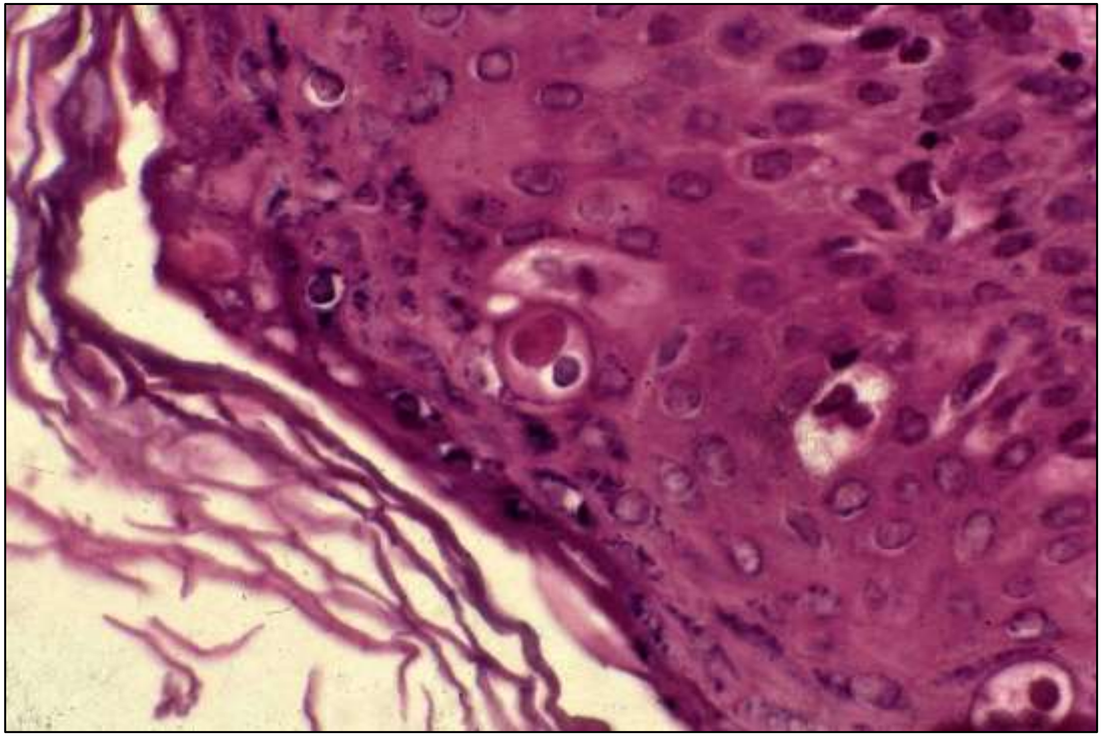
Clinical signs

- Skin lesions

# Fibromatosis

## Diagnosis

- Clinical signs
- Histopath of lesions
- Scraping of lesions
  - IC inclusions



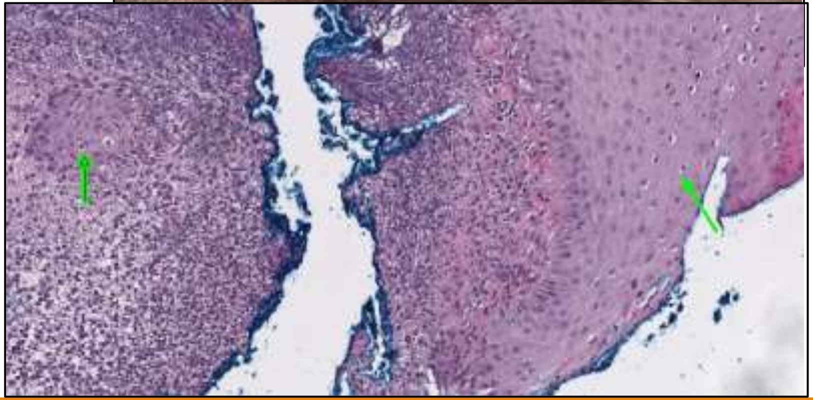
## Treatment

- Treat ext. parasites
- Supportive care
- Vitamin A
- Antibiotics

# Squirrel Fibromatosis



# Raccoon Papillomatosis



## Etiology
- Papilloma virus

## Epidemiology
- Direct contact
- Lesions are self-limiting in young animals and typically regress

## Clinical signs
- Nodular skin masses

## Sampling
- Biopsy for histopathology (koilocytes)

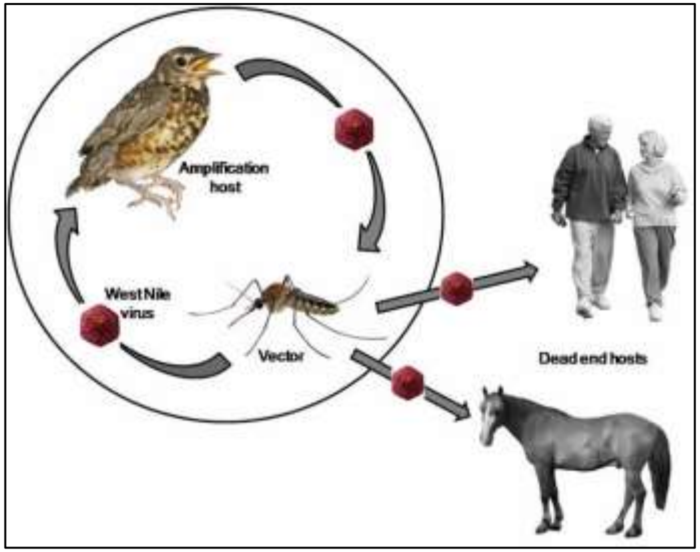
Hamir AN, Moser G, Jenson AB, Sundberg JP, Hanlon C, Rupprecht CE. 1995. Papillomavirus infection in raccoons. *J Vet Diagnostic Invest*;7(4): 549-51

# West Nile Virus (WNV)

## Etiology
- Arbovirus (*Flavivirus*)

## Epidemiology
- Avian Reservoir
- Mosquitoes; direct contact, fecal ingestion
- Bats, Squirrels, Skunks, Rabbits, Chipmunks, Raccoons, others?

## Clinical signs
- Paralysis, CNS signs, diarrhea, sudden death



# West Nile Virus

## Gross necropsy
- Meningitis
- Pallor in myocardium

## Sampling
- Brain, Kidney, GI, Heart for histopath
- Blood for Ab or Ag testing

## Treatment
- Supportive care; anti-inflammatory drugs
- May remain carriers?
- Meningitis in humans and horses

Reportable Disease

# RHDV-2

Family Caliciviridae, Genus Lagovirus

PERSISTANT

- Temperature: Survives heat of 50°C for 1 hour, and freeze–thaw cycles.
- pH: Stable at pH 4.5–10.5. Survives pH 3.0 but inactivated at pH >12.
- Persists in frozen rabbit meat and carcasses in environment for months.
- Can survive >7 months in organ suspensions at 39°C, at least 3 months dried on cloth at room temp., up to 20 days at 71°F in carcasses, and at least 2 days at 140°C in an organ suspension.

# RHDV-2

- Incubates 3-5d
- Necrotizing hepatitis, DIC, death
- 90% mortality rate
- Can shed for 1-2 months

- Vaccine available for domestic rabbits


# Bacterial Diseases

May culture—treat with appropriate antibiotics

# Salmonellosis

## Etiology *Salmonella spp.*

## Epidemiology
- Normal flora
- Gram negative
- Fecal transmission

## Clinical signs
- Diarrhea / enteritis dehydration, depression, death

## Gross examination
- Intestinal inflammation
- Large mesenteric LNs

## Prevent with good hygiene
- Avoid stress/overcrowding

Photo courtesy of Stuart Porter, VMD

# Cottontail rabbits

Right at weaning age

Bloating

Diarrhea

Sudden death

# Pseudomembranous Colitis

## Etiology *Clostridium difficile*

## Epidemiology
- Normal GI flora
- Stress, diet or GI flora change (weaning, meds)
- Inadequate fat in diet

## Clinical signs
- Bloating, diarrhea, sudden death

## Gross examination
- Colitis

## Treatment/prevention
- Antibiotics, probiotics, lower stress

# *Grey squirrels*

Several 3-4 week old squirrels

- Fever
- Nasal discharge
- Raspy congestion in lungs
- Lethargic before death

# *Bordetella bronchiseptica*

Epidemiology
- Squirrels & rabbits
- Aerosol transmission
- May be carriers?

Clinical signs
- Fever
- URI to LRI
- PU/PD

Gross examination
- Consolidation/congestion in lungs
- Confirm via culture

Treatment
- Oxytetracycline and enrofloxacin combo

# White tailed deer fawn

- Crusty lesions on ears and muzzle
- Normal to thin body condition

Photo: *Field Manual of Wildlife Diseases in the Southeastern United States*

# Dermatophilosis

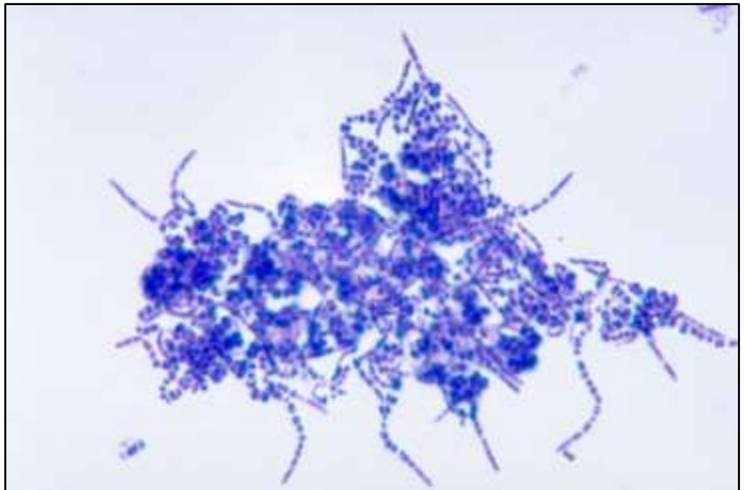
## Etiology *Dermatophilus congolensis*

## Epidemiology
- Contact & arthropods
- Gram +ive
- Worse in fawns

## Clinical signs
- Scaly scabs / hair loss

## Sampling
- Impression smears of scabs

## Treatment
- LA Oxytetracycline



*Public Health Image Library*, No 2986


European J Dermatology 26(6):621-2


# Tularemia

Etiology *Francisella tularensis*

Epidemiology
- Rabbits & Rodents
- Inhalation, contact with blood, ticks, deerflies

Clinical signs
- Abnormal behavior
  - Slow; tame; rub noses on ground; muscle spasms
- Fever, oral ulcers, swollen glands, death

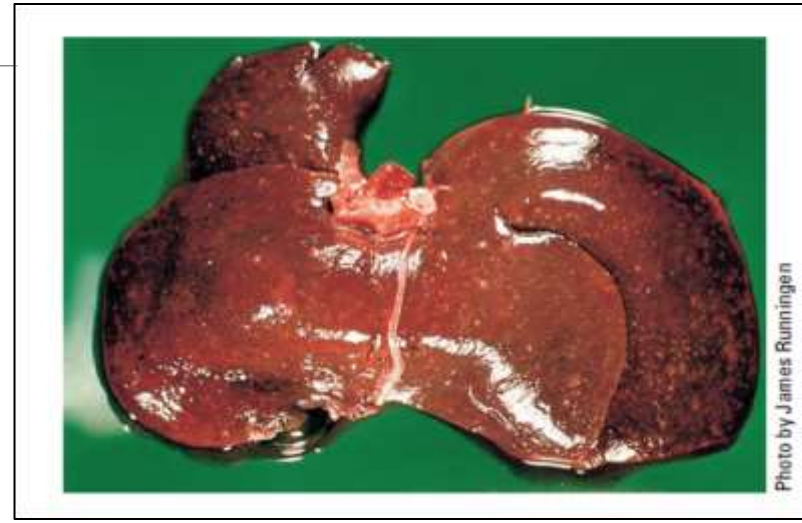
# Tularemia

## Gross examination

- White foci in liver and spleen
- Necrotic lymph nodes
- SQ hemorrhages
- Pneumonia

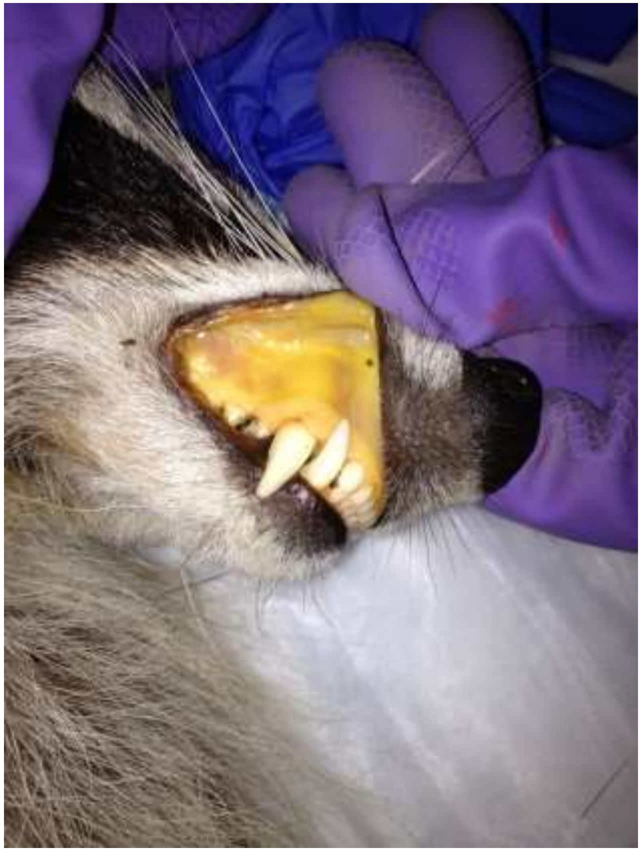
## In humans

- Several forms
- Skin, pneumonic, etc.




www.cdc.gov

# Raccoon



Photos: Woodlands Wildlife Sanctuary

# Leptospirosis

## Etiology *L. interrogans*

## Epidemiology

- Rodents & Raccoons reservoir
- Contact with urine

## Clinical signs

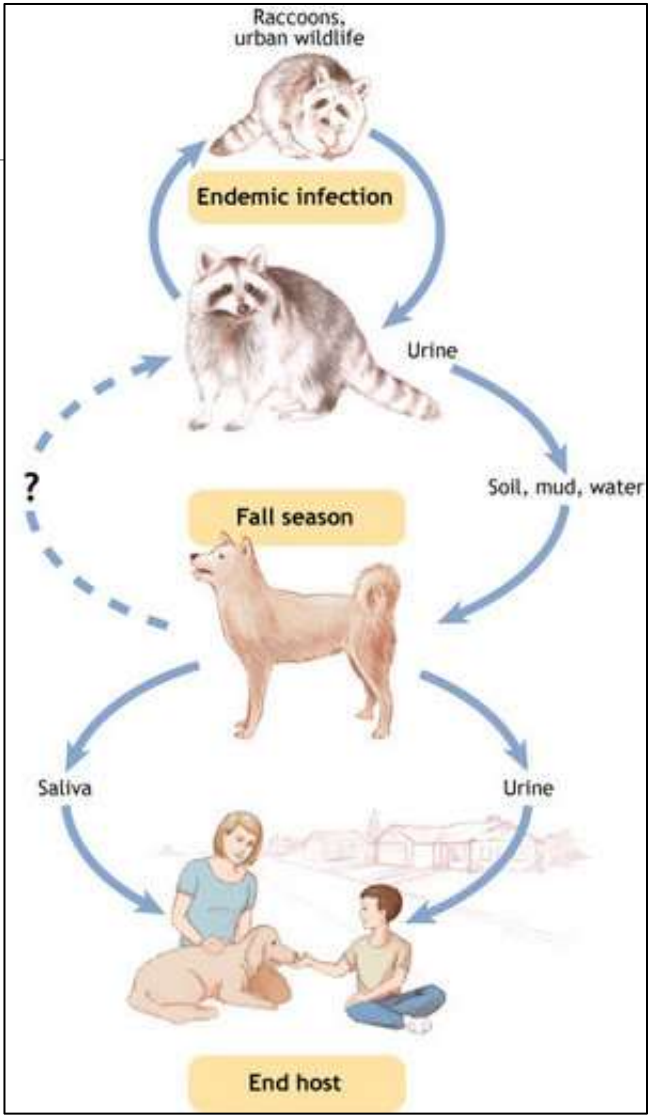
- Fever, Vomiting, Diarrhea, Dehydration, Weakness, Jaundice

## Gross examination

- Hepatitis, Renal disease, Pneumonia

## Treatment

- Antibiotics and fluids




http://www.higginsanimalclinic.com/site/epage/100532_332.htm

# Fungal Diseases

Often associated with stress and poor immunity

Filamentous or yeast forms

# Grey Squirrel

## Clinical signs

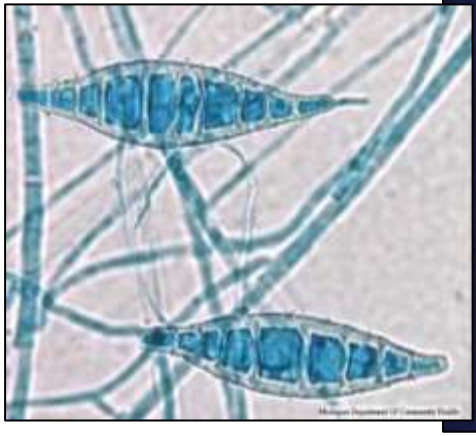
- Scaly skin +/- itching
- Area of fur loss expands daily

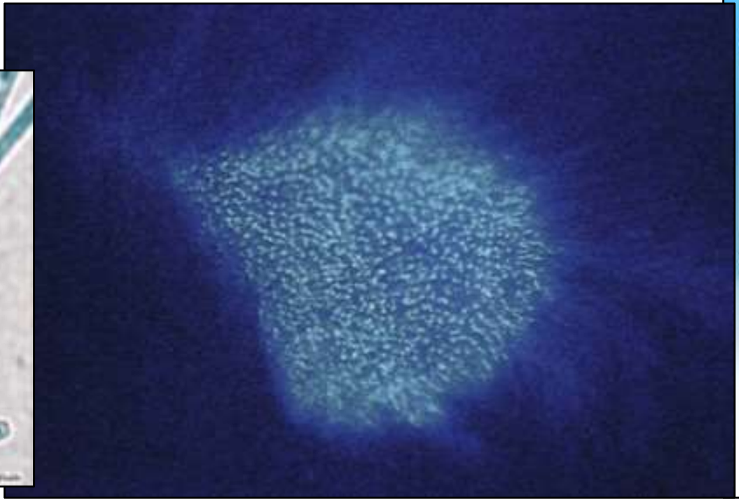
# Dermatophytosis (Ringworm)

## Sampling

- DTM growth and color change
  - Tape prep
  - Exam growth
  - Hyphae

## Black light





# Dermatophytosis (Ringworm)

## Etiology

- *Microsporum canis, M. nanum, Trichophyton mentagrophytes*

## Epidemiology

- Most mammals
- Contact transmission

## Clinical signs

- Scaly skin +/- itching

## Sampling

- Remove hairs from edge of lesion

## Treatment

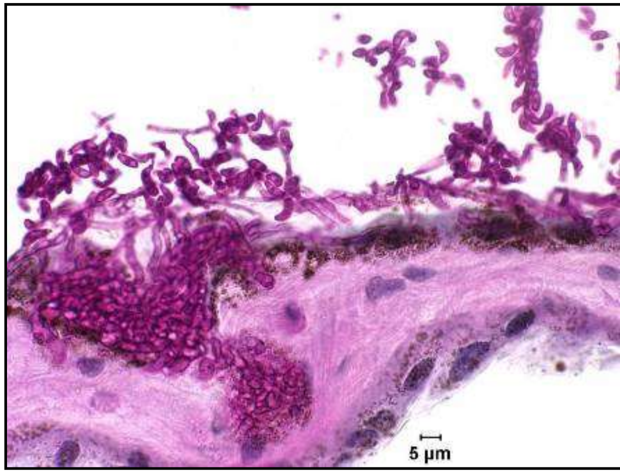
- Topical or oral anti-fungals
- Clotrimazole, Terbinafine

# White-Nose Syndrome

Etiology *Pseudogymnoascus destructans*

Epidemiology

- Optimal growth at 5-15°C (<60°F)
- Persists in environment
- 12 bat species known affected, to date
- Up to 98% mortality at some hibernacula

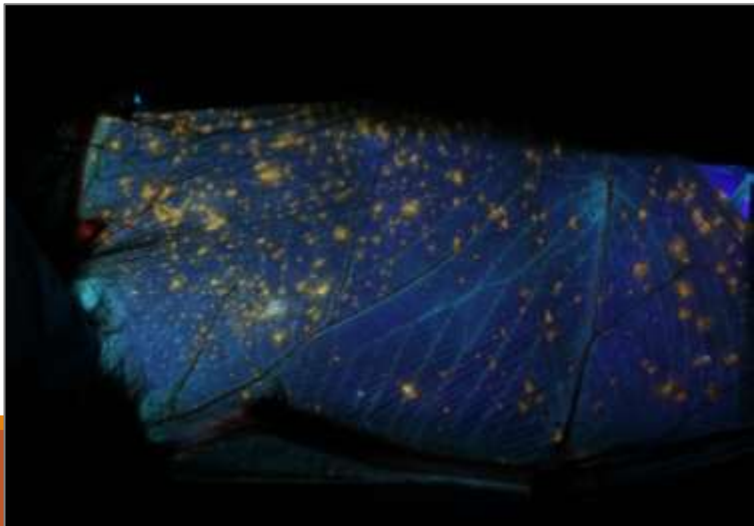



Clinical signs

- White fungal growth in hibernation
- Abnormal behavior
- High mortality

Gross examination

- Skin lesions
- Emaciation common

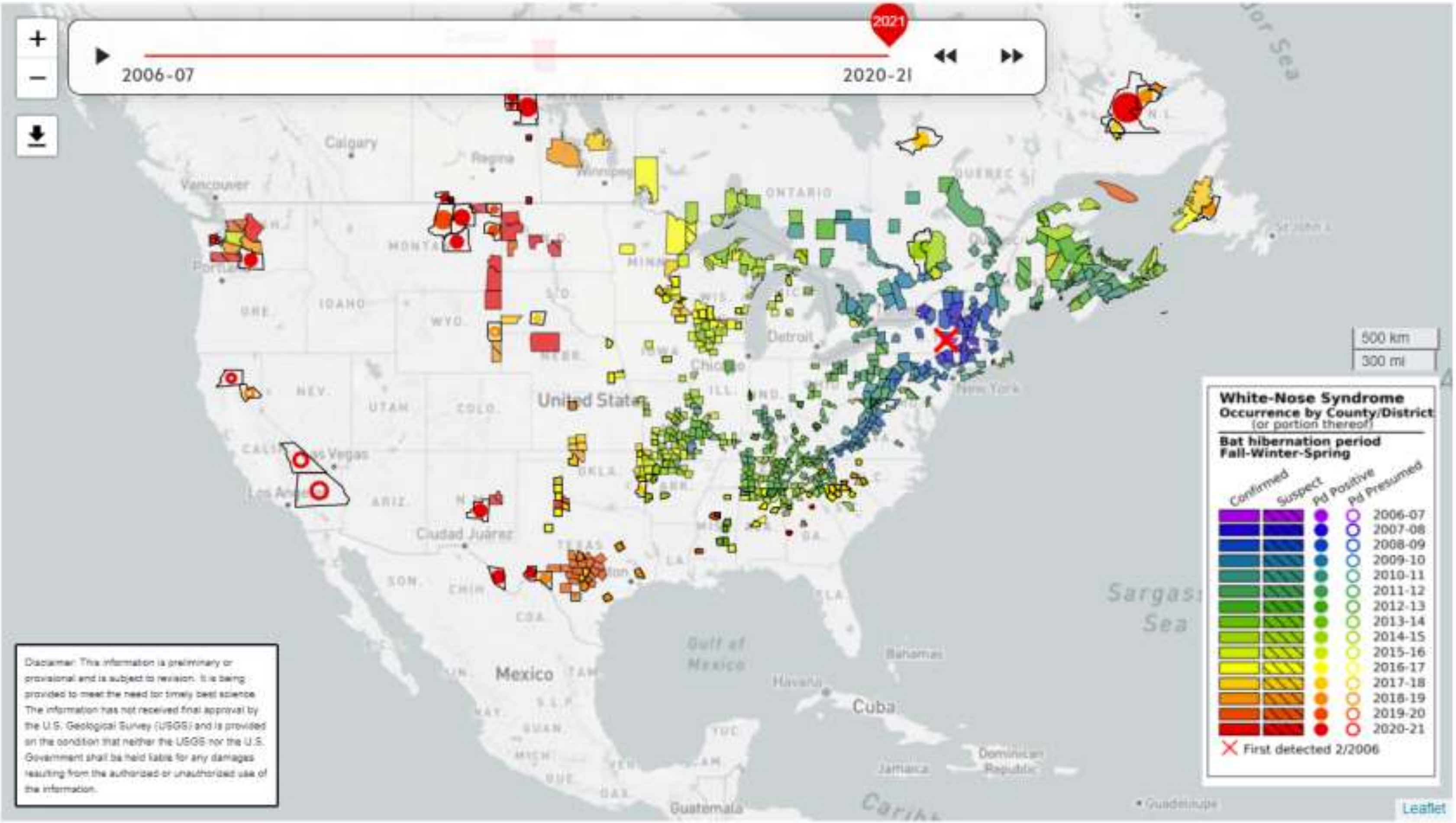


Sampling

- Whole carcass, wing punch biopsy, fungal swabs

# White-Nose Syndrome

## Where is WNS Now?




https://www.whitenosesyndrome.org/where-is-wns

# Common Diseases

Microbes

- Viral, Bacterial, Fungal

Parasites

- External & Internal

# Fleas

Etiology order Siphonaptera

Epidemiology

- May transmit tapeworms, bubonic plague, and poxvirus
- Most not host specific

Treatment

- Kitten/puppy products safe for most mammals
- Imidacloprid/Selamectin

# Ticks

## Etiology

- *Dermacenter, Ixodes, Rhipacephalus, Amblyoma, Haemaphysalis longicornis*

## Clinical Concerns

- Anemias
- Transmit diseases
  - Borreliosis
  - Ehrlichiosis
  - RMSF
- Tick paralysis

## Treatment

- Ivermectin, Fluralaner, etc.
- Manual removal

# Lice

## Etiology

- Order Mallophaga in mammals
- Species specific

## Epidemiology

- Fur loss or matting
- Scratching
- Anemia
- Lice or nits on the skin or fur

## Treatment

- Pyrethrine spray/dust
- Phosmet dip

# Ear Mites

## Etiology

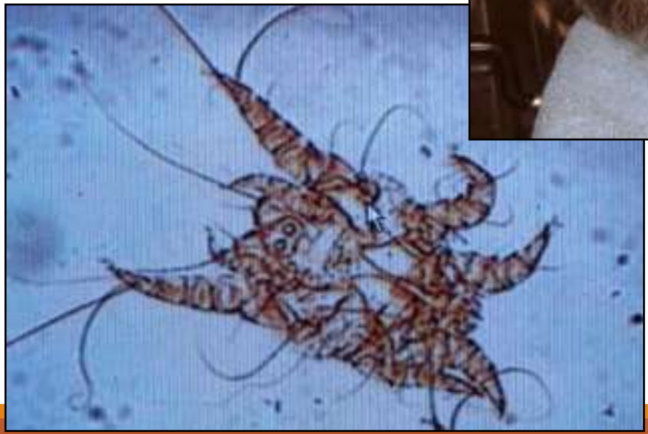
- *Psoroptes* spp., *Otodectes* spp.

## Epidemiology

- Scratching ears; head tilt; ataxia

## Diagnosis

- Swab



## Treatment

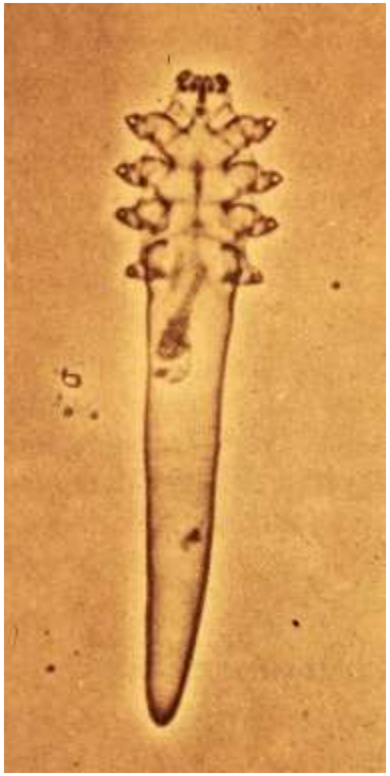
- Avermectins

# Coyote

Photo courtesy Sandy Woltman

# Diagnosis

Skin scraping



*Demodex* spp.

*Sarcoptes* spp.

# Mange

## Etiology

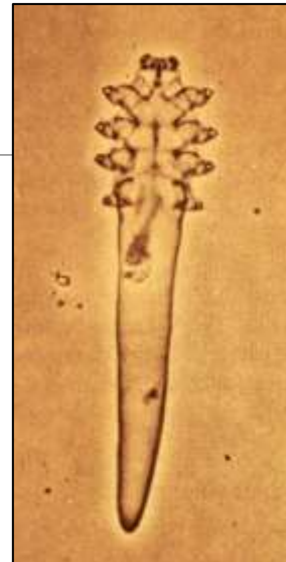
- *Sarcoptes scabiei*
- *Demodex spp.*

## Epidemiology

- All mammals
- Direct contact
- Environment

## Diagnosis

- Skin scraping
- Microscopic exam



d

S

Photo courtesy Sandy Woltman

# *Sarcoptes scabiei*

# Treatment

#1 is supportive care!

Isolate

Heartworm test!

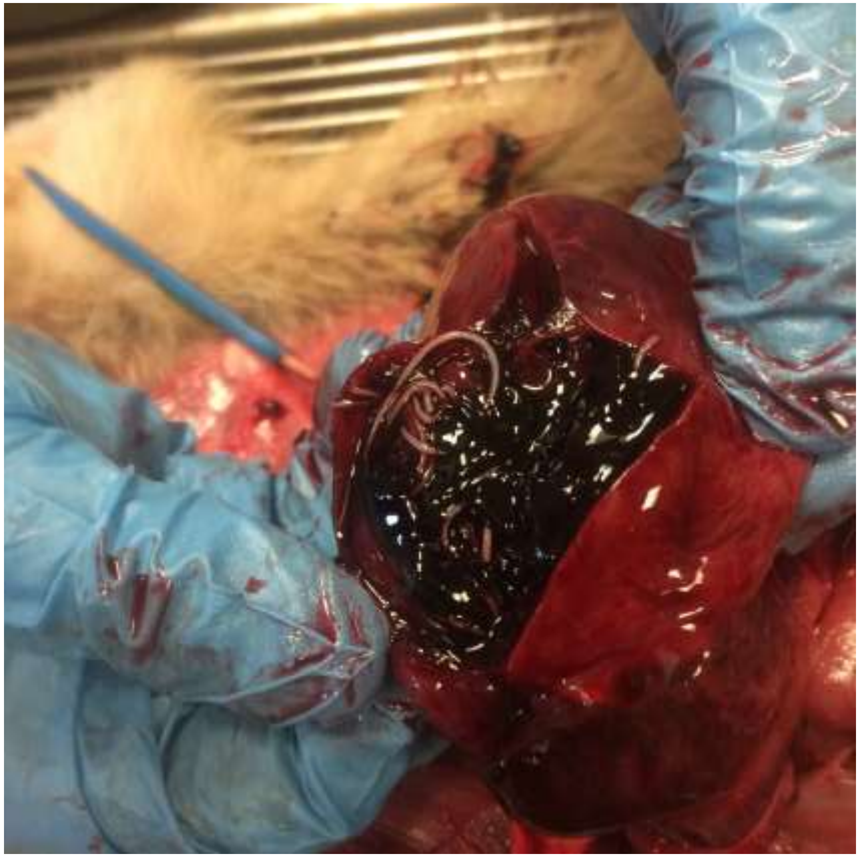
Miticide when stronger

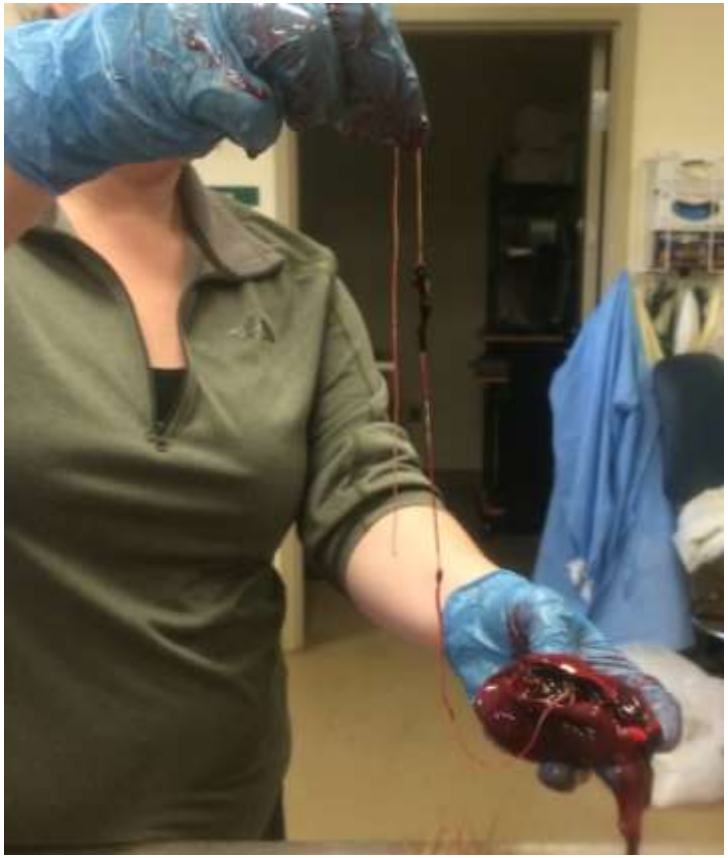
- Ivermectin (injection)
- Selamectin (Revolution™) topical
- Fluralaner (Bravecto™) oral
- Amitraz dip (for demodex)

# Pre-Release

Photo courtesy Sandy Woltman

# Coyote Heartworm





# Heartworm

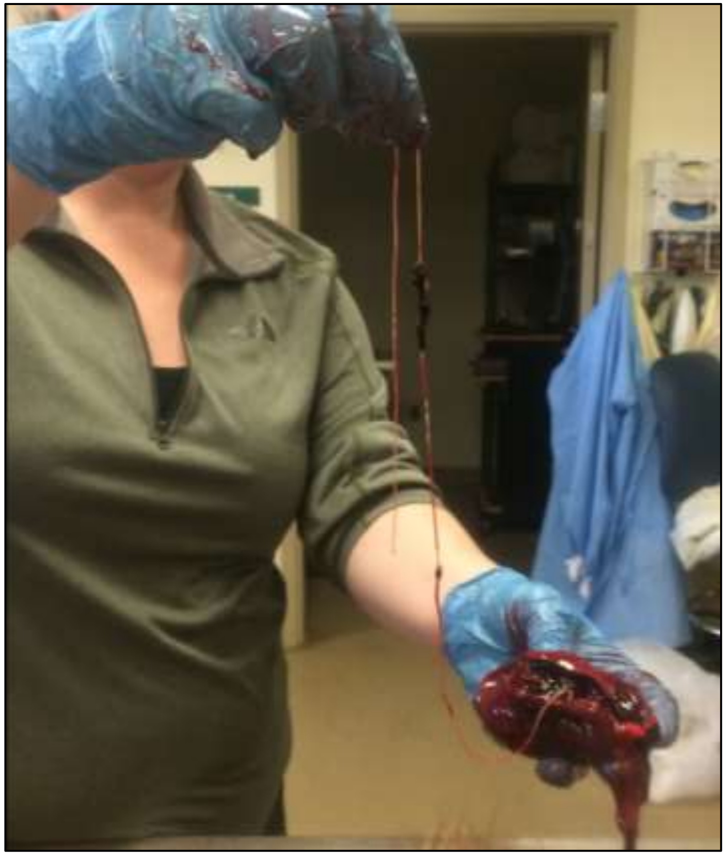
Etiology *Dirofilaria immitis*

Epidemiology

- Transmitted by mosquitoes to canids
- Esp. Gray Fox and Coyote

Treatment

- Melarsomine (Immiticide®)
- Doxycycline for *Wolbachia*
- Imidacloprid and moxidectin (Advantage® Multi for Dogs)



# Red Fox

- ~4-month kit
- Caught in live trap
- No outdoor enclosure or other rehabilitator available
- No injuries, thin
- Good body condition

- Skin scraping shows sarcoptes mites
- Treatment options?

# Treatment

Oral Fluralaner (Bravecto™)

# Fox Squirrel

# Cutaneous Warbles

Squirrel photos courtesy of Frank Slansky

## Etiology  Bot fly larva (*Cuterebra spp.*)

## Epidemiology

- All mammals
- Penetrate mucous membranes and migrate to skin

## Treatment

- Ivermectin or nitenpyram
- Remove carefully to avoid anaphylaxis
- Local lidocaine

# Common Myiasis

**Etiology** Blow fly larvae

## Epidemiology

- Flies deposit eggs on moist areas
- Larvae hatch in 8 to 20h
- Feed on dead tissue/fluids

## Treatment

- Ivermectin
- Nitenpyram (Capstar™)
- Flea combs

More info : http://australianmuseum.net.au/Decomposition-fly-life-cycles

# Endoparasites

Diagnose via fecal smear or flotation

General classes of hooks, rounds, whips, tapes, flukes, coccidia

Treat accordingly if symptomatic

# What is this?

"Rice-like" segments seen in feces

www.cdc.gov

"Egg packet" seen on microscopy

# Tapeworms

## Etiology

- Cestodes—*Dipylidium, Taenia, Mesocestoides, or Diphyllobothrium*

## Epidemiology

- Require intermediate host; varies

## Clinical Signs

- Often none
- Impactions or weight loss in large #s


- Treatment
  - Praziquantel (Droncit®)

# Tapeworm Larvae

*e.g. Taenia pisiformis*

Cysticerci in abdominal cavity or on organ surfaces of IM host

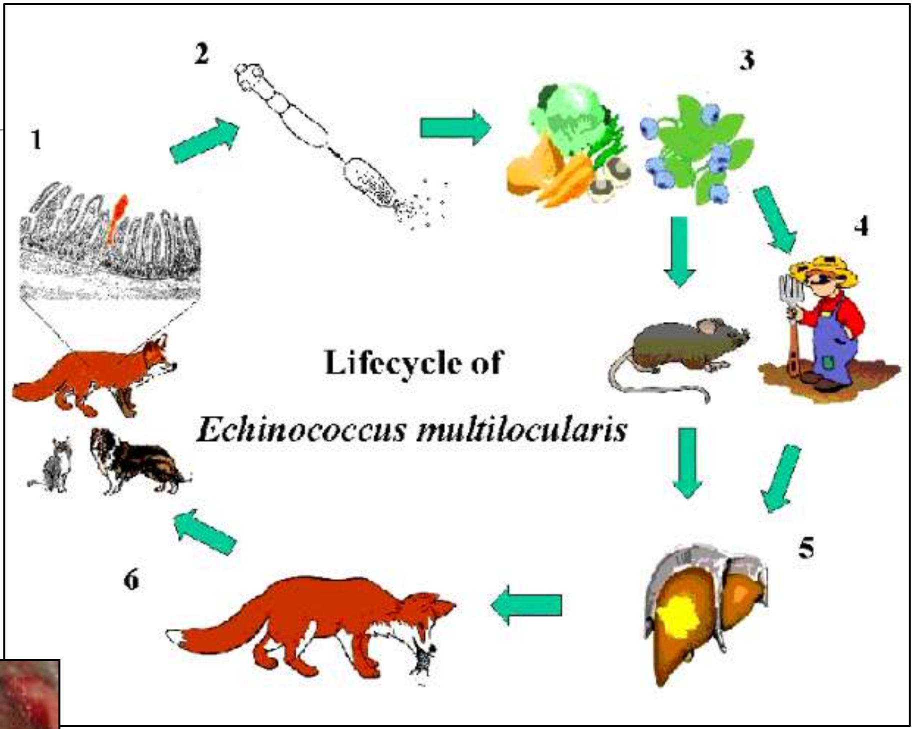
Carnivores are definitive hosts

Usually not pathogenic

# Tapeworms

Diphyllobothrium and Taenia spp.

# Hydatid Disease




Etiology *Echinococcus spp.*

Epidemiology

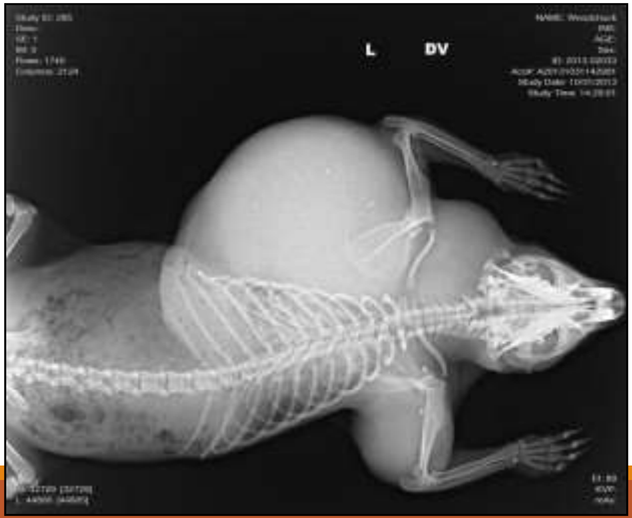
- Fox is normal definitive host
- Fecal / oral transmission
- Encysts in liver, lung, etc.

# Woodchuck/Groundhog

Presents with large mass around left front leg

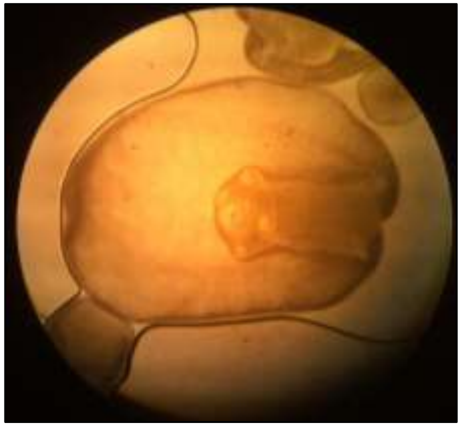
Very thin body condition

Difficulty walking and respiration is shallow

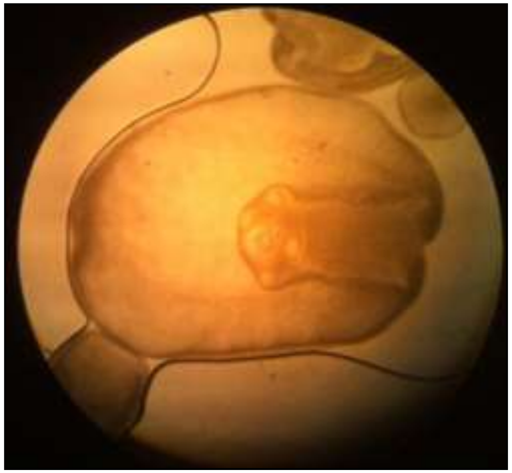



# *Taenia crassiceps* (cysticerci)

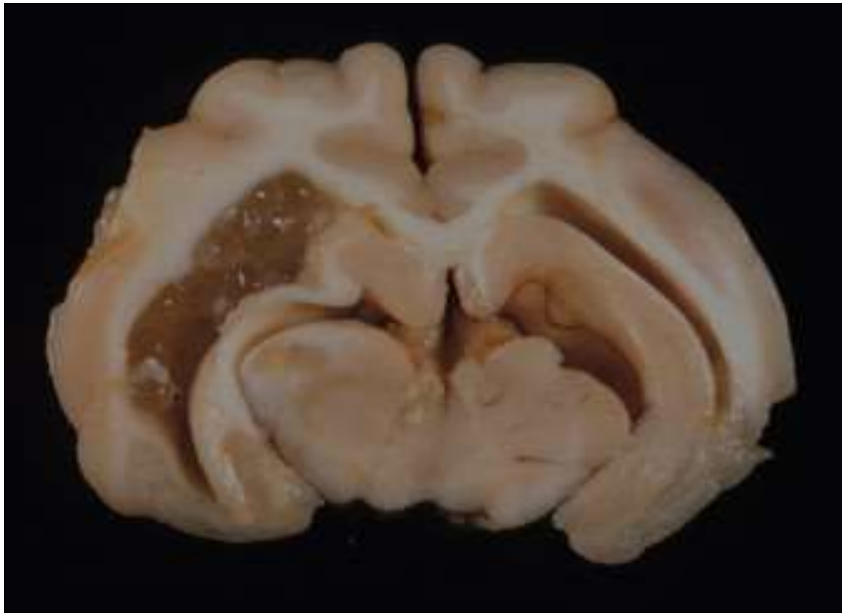

From Heldwein et al., 2006, Am. J. Tropical Medicine & Hygiene



# *Taenia crassiceps* cysticerci

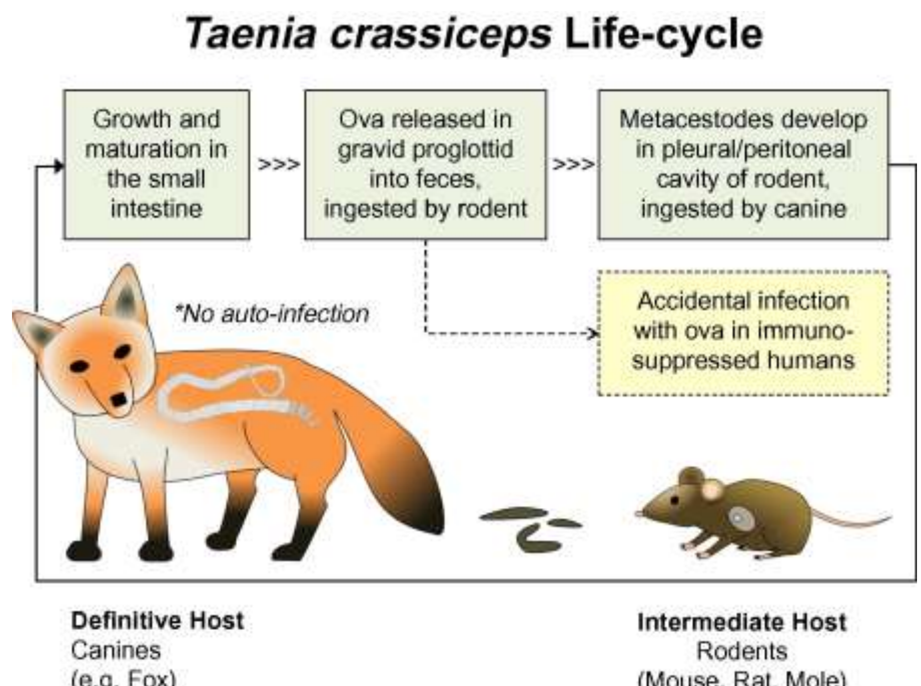


# *Taenia crassiceps* cysticerci

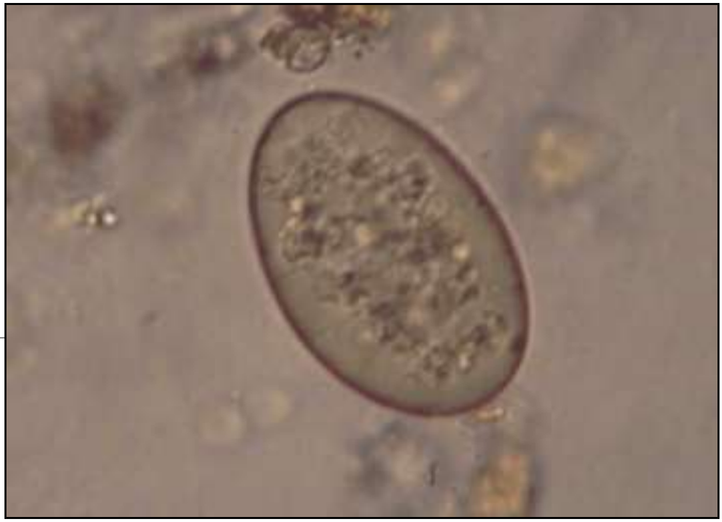


Domestic cat brain with intraventricular *T. crassiceps* cysticerci.
(From Wunschmann et al., 2003, *J. of Vet. Diagnostic Investigation*)

Life cycle from:
International J for Parasitology. 2013. 43(3–4): 233-243



# Trematodes (Flukes)



## Etiology

- *Fasciola* spp. & others

## Epidemiology

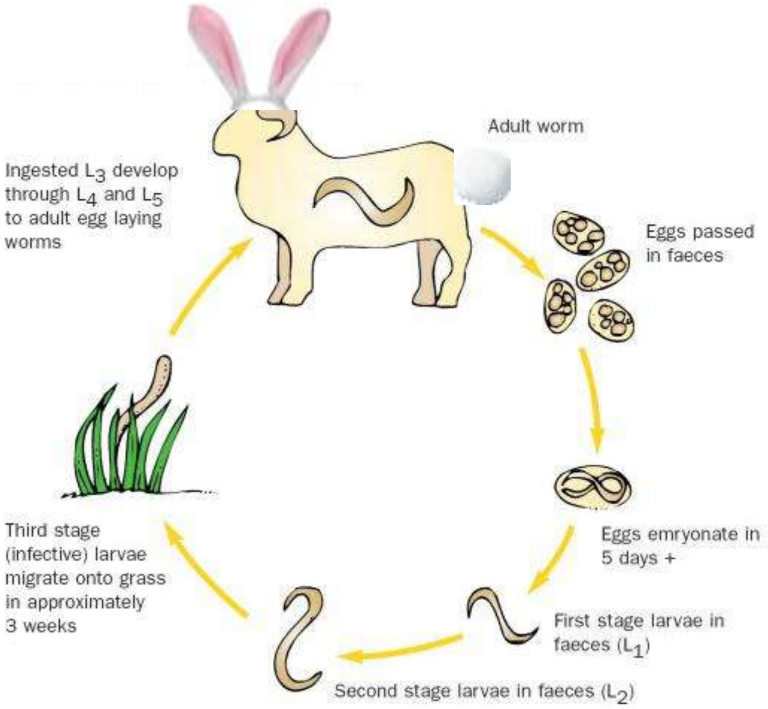
- Often in herbivores
- Multi-stage life-cycles

## Diagnosis

- Large, oval, operculated ova

## Treatment

- Triclobendazole
- Albendazole



# Cerebral nematodiasis (VLM)

## Epidemiology

- *Baylisascaris procyonis*
- Rodents, lagomorphs, birds
- Exposure from eggs in feces

## Clinical signs

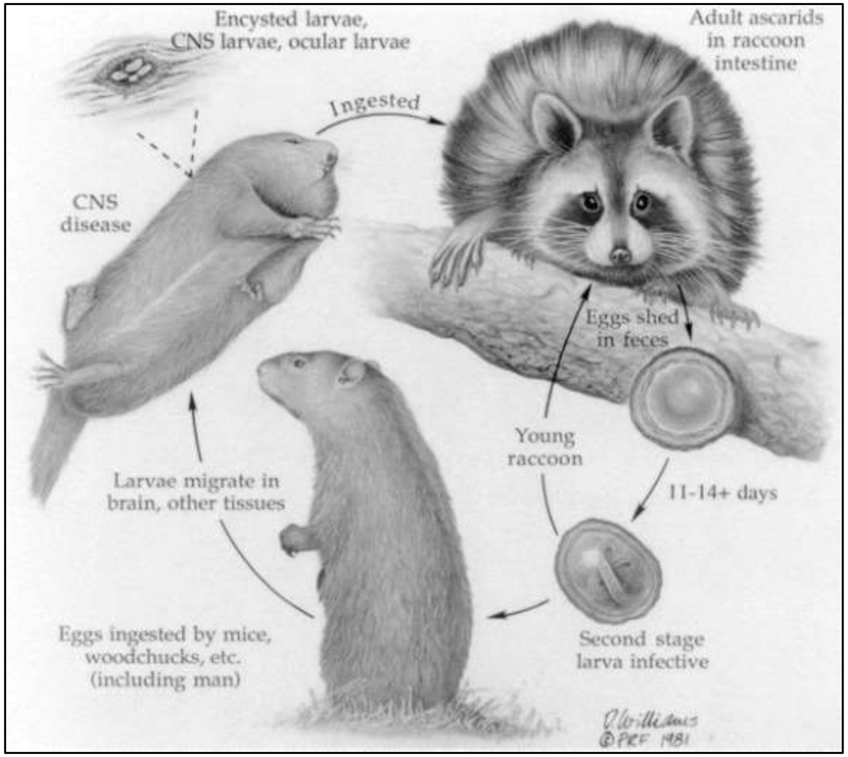
- Weight loss, lethargy
- Neurologic, ocular

## Gross examination

- Foci of necrosis and hemorrhage in the CNS
- Visceral granulomas

## Sampling

- Brain and spinal cord
- Visceral granulomas

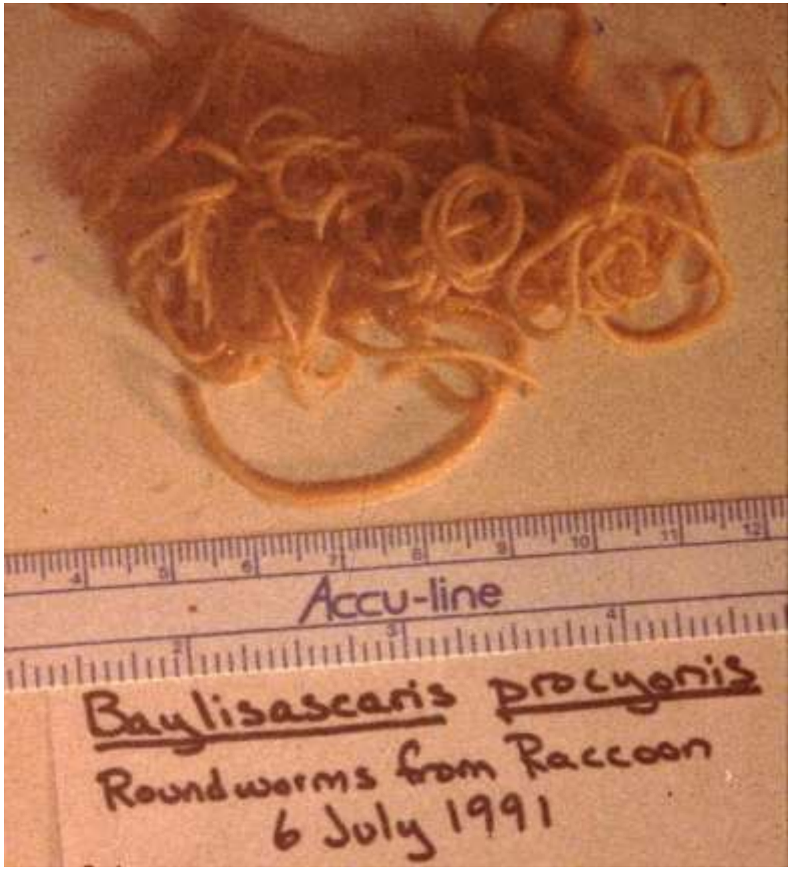


# Visceral Larval Migrans

Anorexia, ataxia, torticollis, depression, death in abherrent species

Diagnosis via fecal exam in raccoons

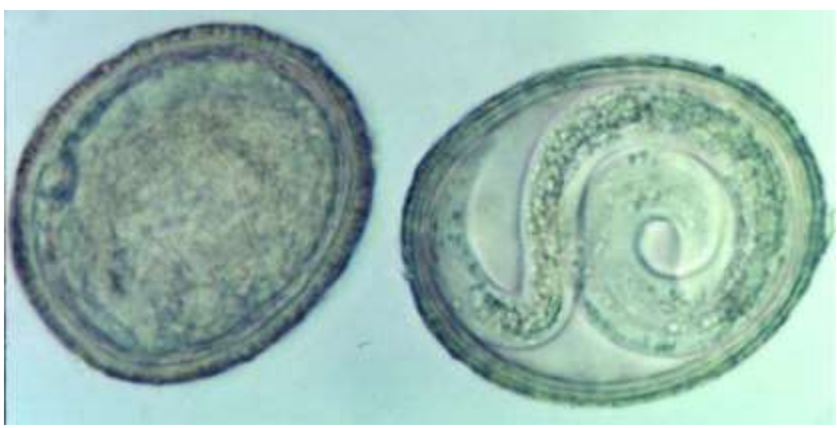
Clinical signs or post-mortem in other hosts



# Visceral Larval Migrans

Treatment

- Aberrant host -- none
- Routine deworming in raccoons with ivermectin or pyrantel pamoate



Ova photos: Clinical Microbiology Newsletter 2002;24:1–7

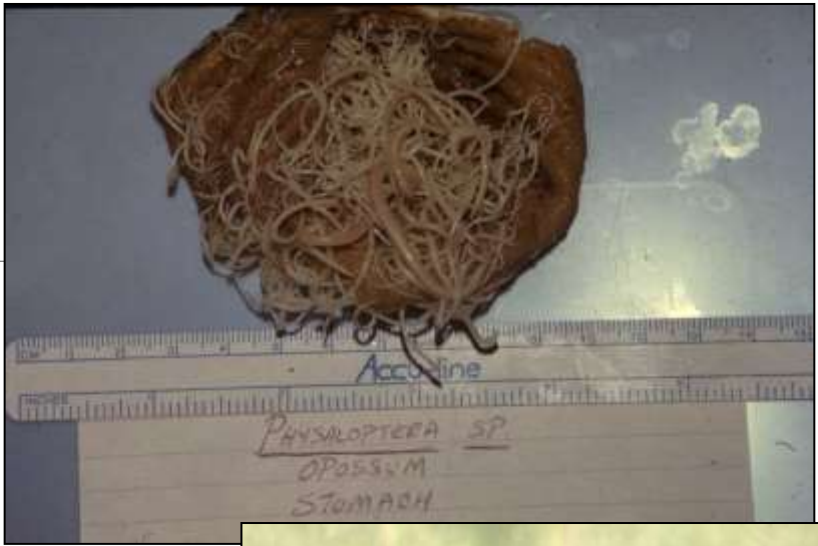
# Spirurids

Etiology *Physaloptera turgida*
 Opossum Stomach Worms

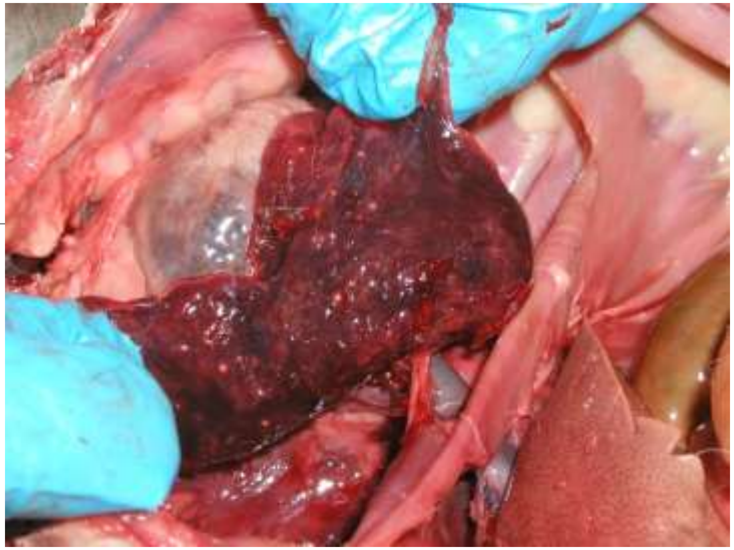
Epidemiology
- Beetles are inter-mediate hosts

Clinical signs
- Usually none
- Anemia/emaciation with heavy burdens; ulcers in mucosa

Treatment
- Levamasole




# Virginia Opossum



# Besnoitia

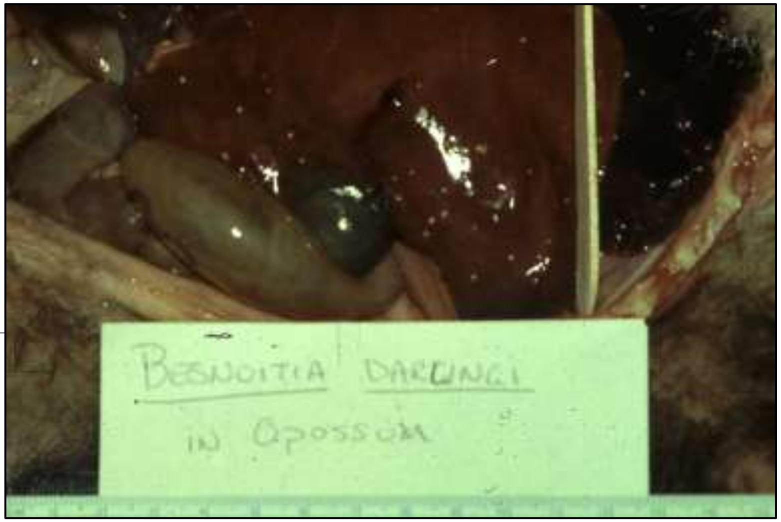
**Etiology** Protozoan *Besnoitia darlingi*

**Clinical signs**

- Pinpoint white foci in connective tissue
- Specific to Opossums
- Non-pathogenic?

**Treatment**

- Ponazuril



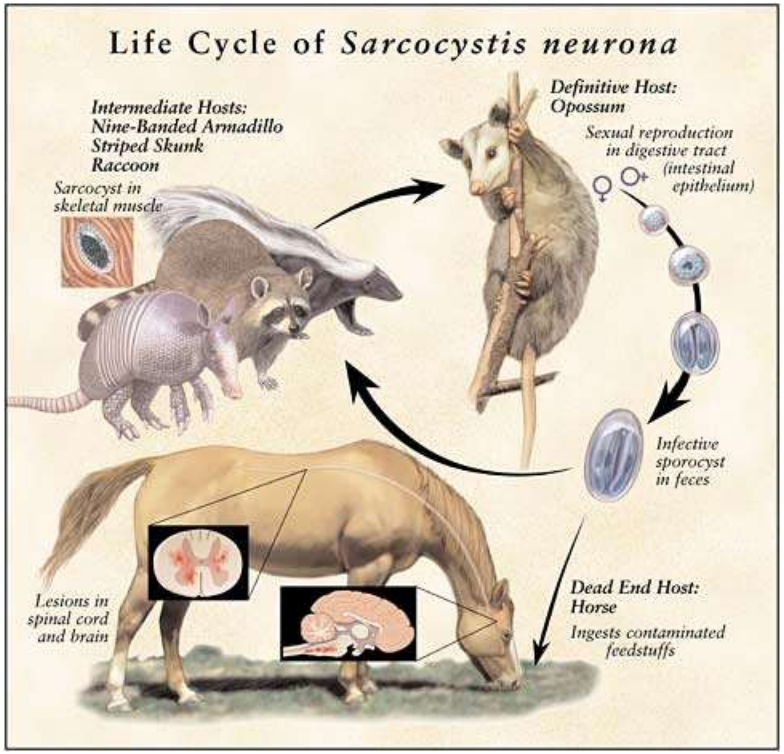

# EPM

## Etiology *Sarcocystis neurona*

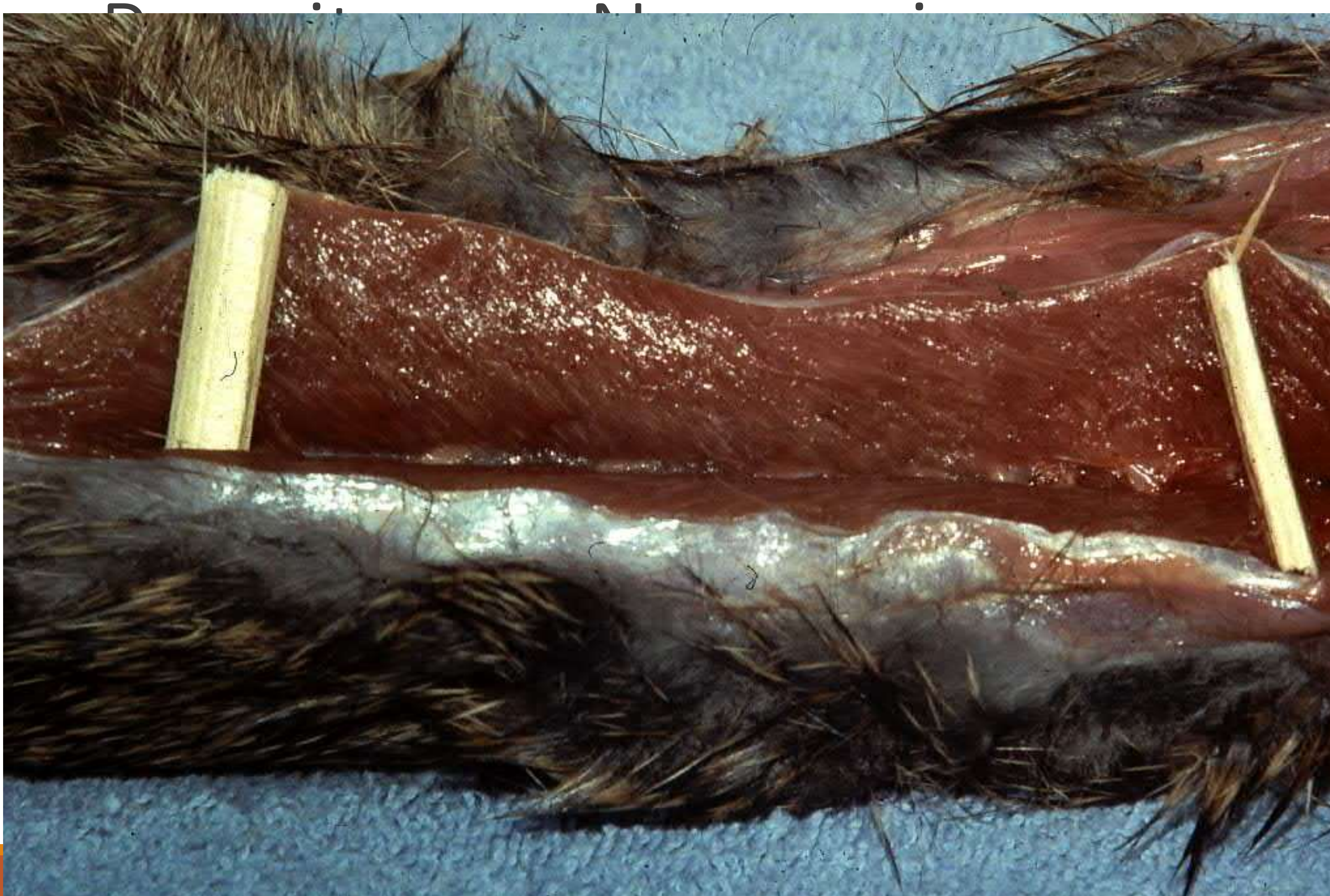
## Clinical signs

- None in opossums
- Neurologic disease in Gannets and others?

https://pathogenes.com/w/the-biology-of-sarcocystis/




http://atlantaequine.com/pages/vet_news.html



# *Sarcocystis speeri*

- Eastern bluebird in Landenberg, PA
- Found in opossums in S. America

# Fox Kit

Found in warehouse

Fed canned dog food by finder

Initially dehydrated, but now hydrated and eating well

Not gaining weight

Intermittent soft feces

# Fecal Exam

What is it?

How did the fox get it?

Should the fox be treated?

- If so, how?

Other concerns?

# Hookworms

Can be passed *in utero*

Anemias & wt loss

Fecal exam: ova in fresh feces; larvae in older samples

Treat could lead to emaciation, dehydration, & anemia
- Hydrate well
- Fenbendazole
- Ivermectin

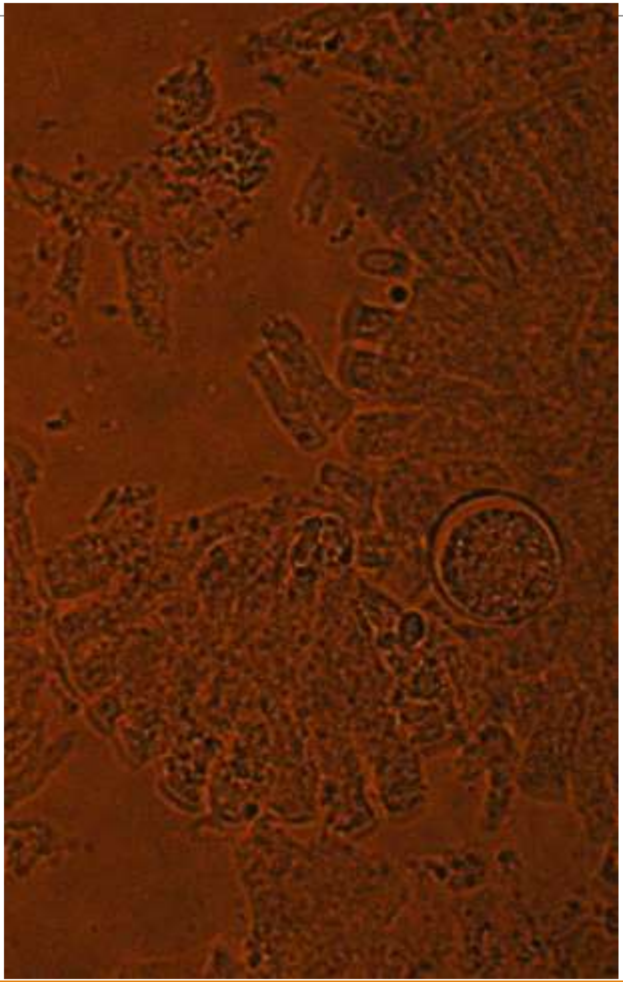
Contagious across species

# Grey Squirrel

2 week old

- Fed 2% milk by finder for 2 days
- Watery, light brown diarrhea

# Fecal



# Treatment

Sulfadimethoxine (Albon®)

Toltrazuril (Coccicure® or Baycox®)

Disinfect feeding implements and caging

Wear gloves/wash hands well

Isolate

# Toxoplasmosis

## Etiology *Toxoplasma gondii*

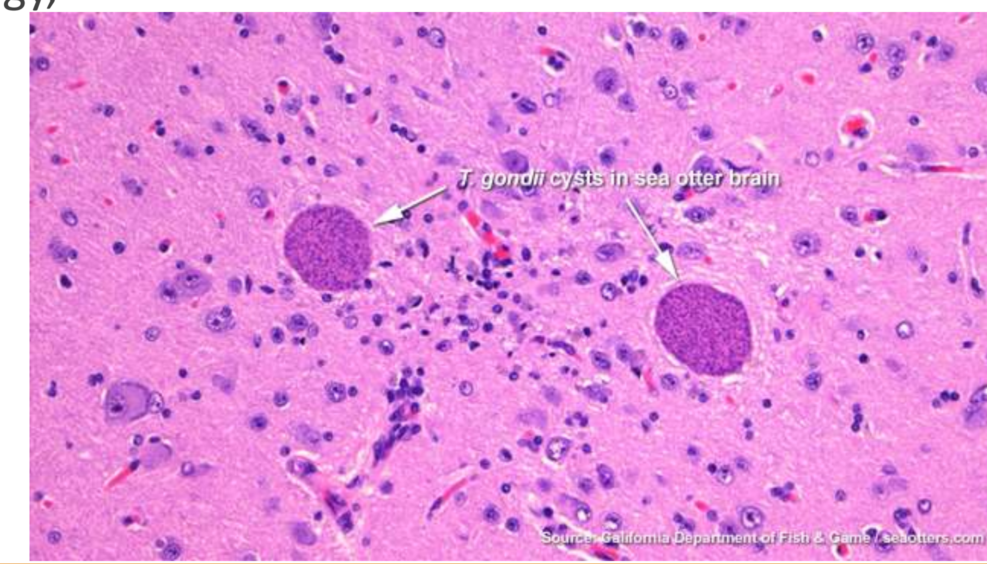
## Epidemiology
- Shedding: domestic and wild felids
- Subclinical: wild ruminants
- Subclinical & sporadic fatal cases: carnivores, rodents, lagomorphs

https://www.omicsonline.org/

## Clinical signs
- Red squirrels, rabbits, sea otters: lethargy, weight loss, CNS signs

## Gross examination
- Variable if any
- Pneumonia; Hepatic or myocardial discoloration (necrosis/inflammation)

## Sampling
- Brain, lung, liver, spleen, lymph nodes




https://www.seaotters.com

# Giardiasis

Etiology Protozoa *Giardia spp.*

Epidemiology

- Shed in feces
- Live well in water

Clinical signs

- Diarrhea
- Weight loss

Sampling

- Direct smear

Treatment

- Metronidazole

# Beaver Redemption

- Of two outbreaks of human *G. duodenalis* infection in Canadian communities during the 1990s, one ceased and the other diminished after, in each case, a beaver excreting *G. duodenalis* cysts was removed from the water source supplying the respective community.
- These observations suggested that the human cases of giardiasis had resulted from ingesting G. duodenalis cysts excreted by the beavers.
- The respective studies predated current knowledge of G. duodenalis assemblages.
- **Archival material (*Giardia* organisms) from these outbreaks was, however, available for study by modern molecular techniques some two decades later.**
  - Using such techniques, it was found that, in one of the outbreaks, the **beaver was infected with assemblage A** *G. duodenalis*, whereas the **water contained *G. duodenalis* of assemblage B**, and **assemblages A and B were isolated from the infected human** subjects.
  - In the other outbreak, the **beaver was found to be infected with assemblage B**, whereas the infected **human subjects included one with assemblage A** infection.
- Consequently, a straightforward causal relationship between the beavers and all the human cases was not found.
- Anthropocentric historical assumptions, that a relationship between *Giardia* infection in beavers and in human subjects merely involves beaver-to-human transmission of the parasite, have yielded to a more nuanced appreciation of environmental contamination by human-derived *G. duodenalis* cysts that may infect beavers.

Heyworth MF 2016 *Giardia duodenalis* genetic assemblages and hosts. Parasite 23 13

# Questions?


Sushi.
Still your best bet
for intestinal worms.
dribbleglass.com

Thank you!