

# How to control and prevent pesky parasites: basics on worms, coccidia and other internal parasites

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Where are you currently located?





# Zoonosis

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- Pl. Zoonoses
- A disease such as rabies that can be transmitted from animals to people
- Zoo- from Gk zoio- living being, animal
- indicates animals or animal forms
- Nosos- illness (Gk)
- Adj- zoonotic



# Overview- what will cover

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- Hookworms
- Roundworms
- Coccidia (*Isospora* particularly-  
dogs/cats)
- *Giardia*
- *Tritrichomonas*
  - *Parasitic diseases that are zoonotic*




Do you see hookworms at your shelter/clinic?

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Yes

No



## How often do you diagnose hookworms?

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- All the time (daily to weekly)
- Sometimes (weekly to monthly)
- Only in the summertime
- Occasionally (monthly)
- Rarely (a couple times a year)
- Never

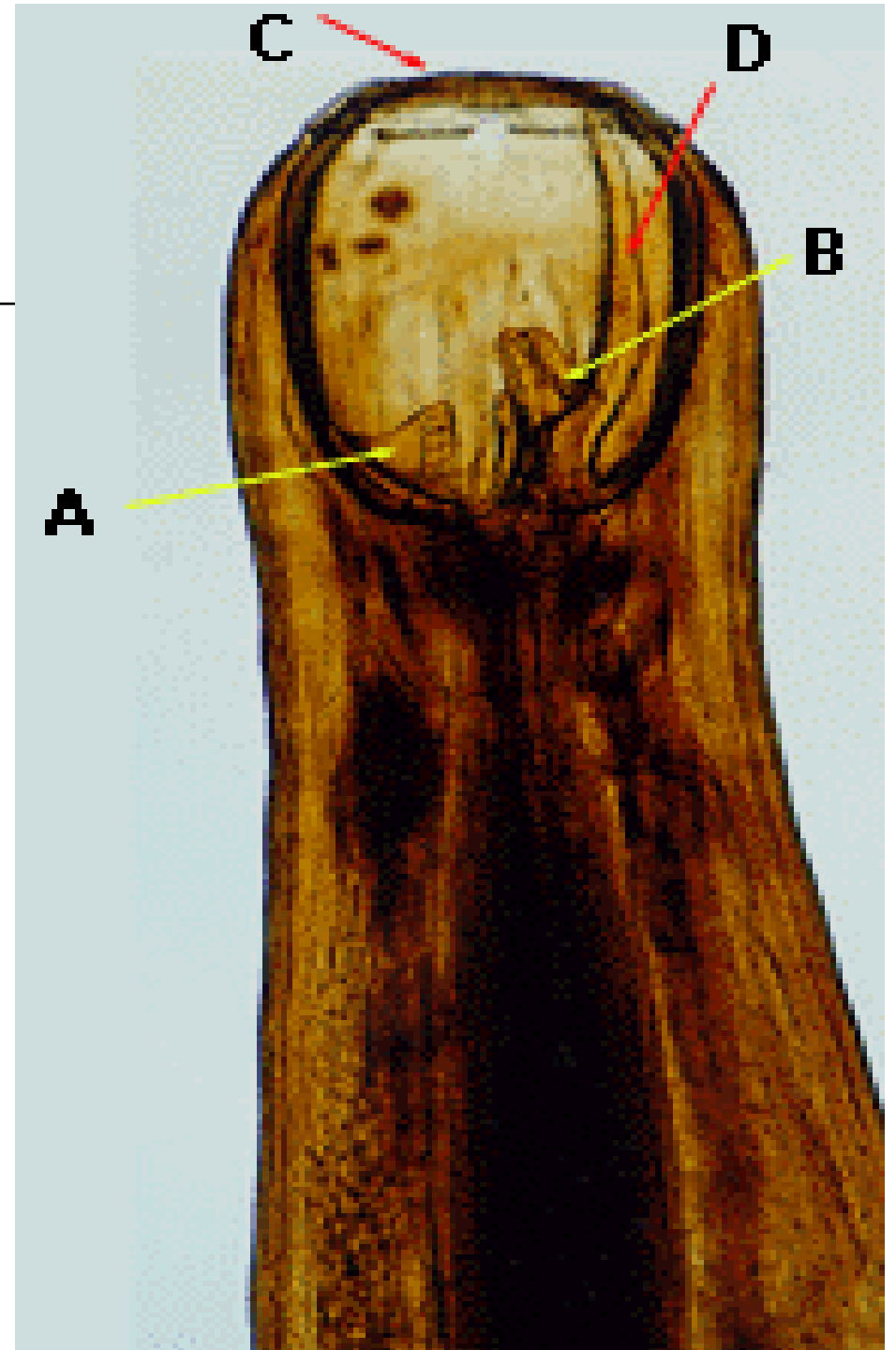
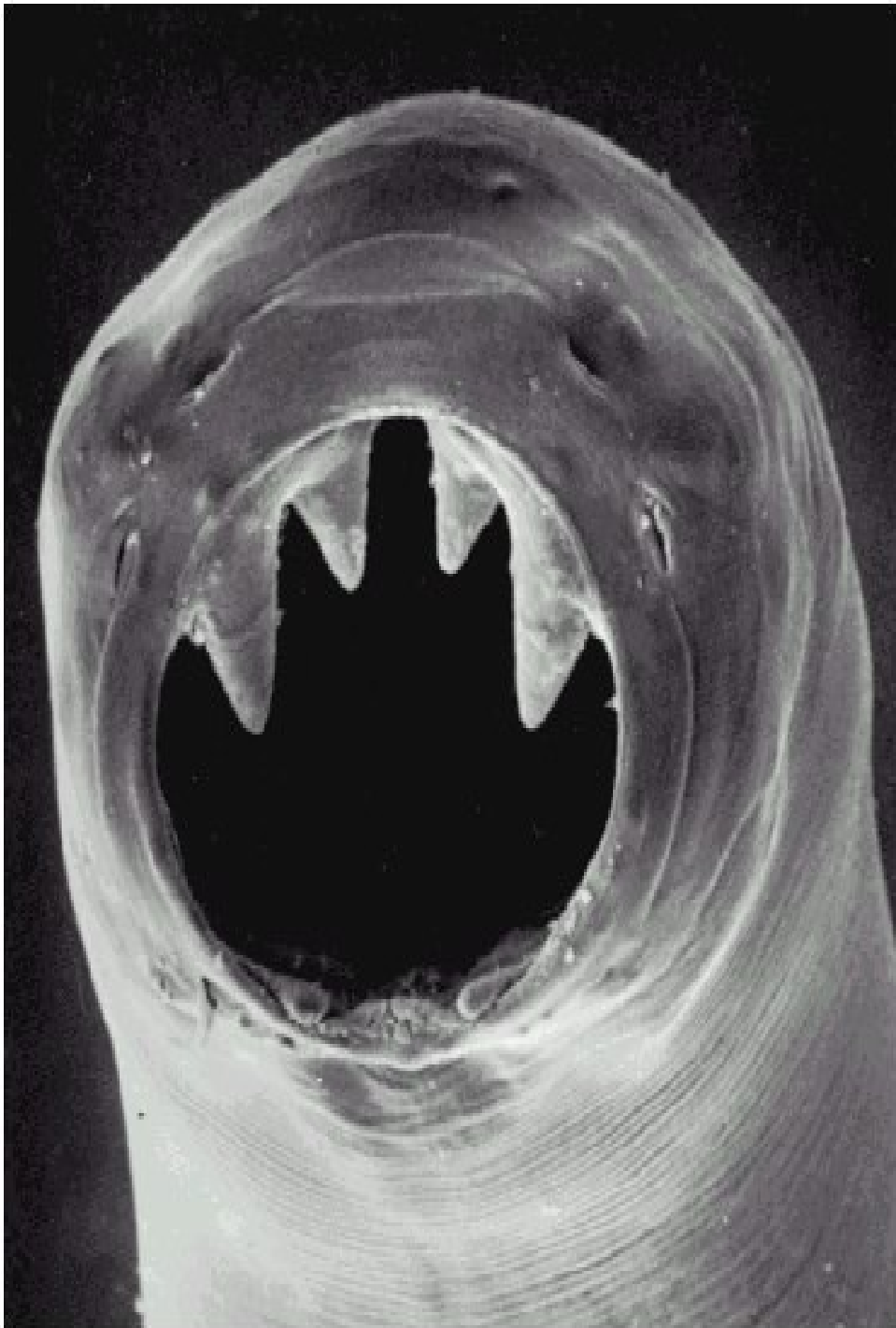


## Hookworms- scientific name

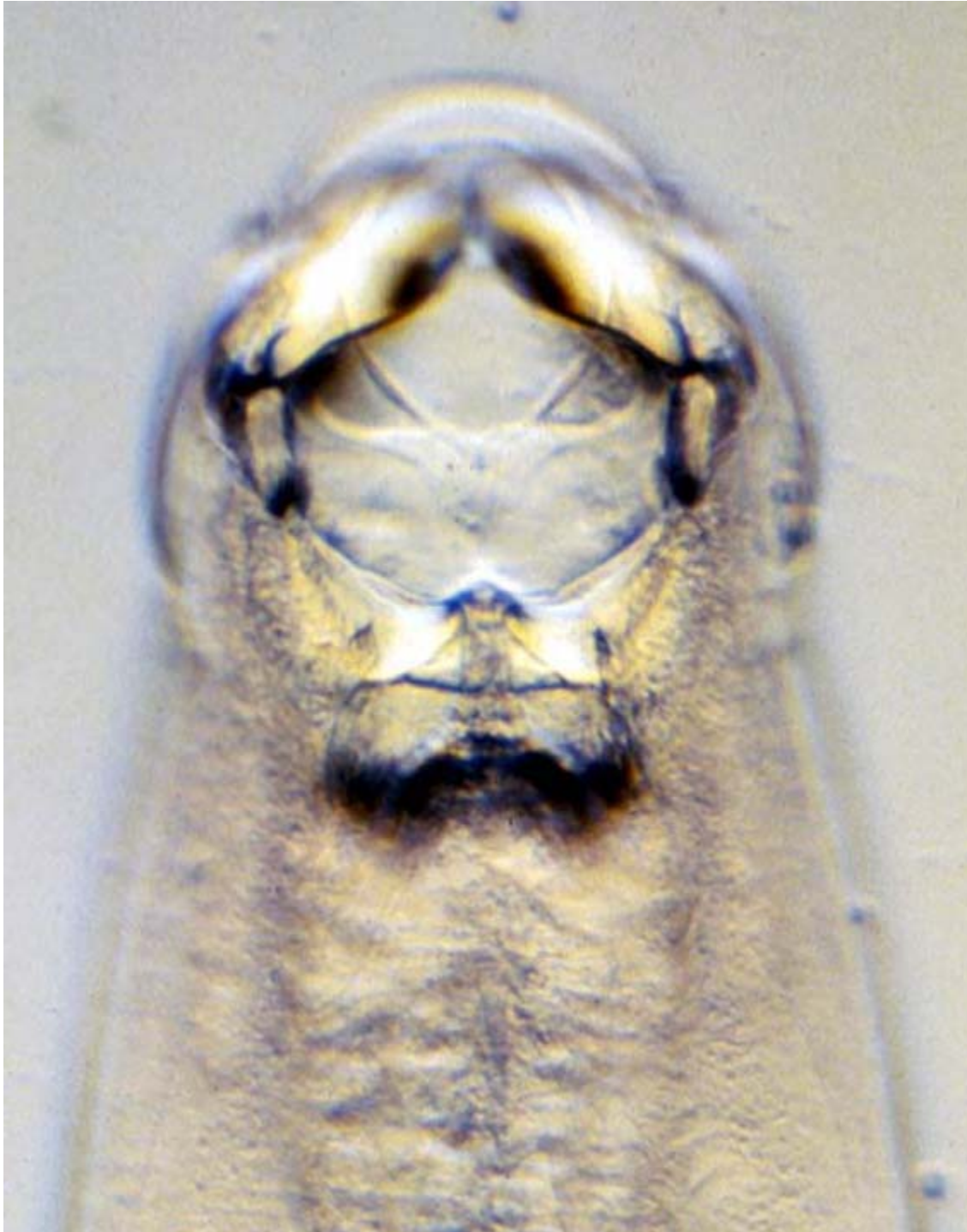
### *Ancylostomatoidea*

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- Anterior end is bent (hooked)
- Have highly cuticularized buccal capsule
  - Used to pierce GI wall and obtain blood
- Adults occur in small intestine of dog/cat
  - Attach to host intestinal GI wall & suck blood







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Buccal cavity  
of *Uncinaria*  
showing  
cutting plates

# Hookworms of dogs and cats

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## *Ancylostoma caninum*

- common hookworm of dogs
- very rare in cats
- most pathogenic hookworm in dogs/cats



## *A. tubaeforme*

- common hookworm of felids
- rare in dogs



# Hookworms of dogs and cats

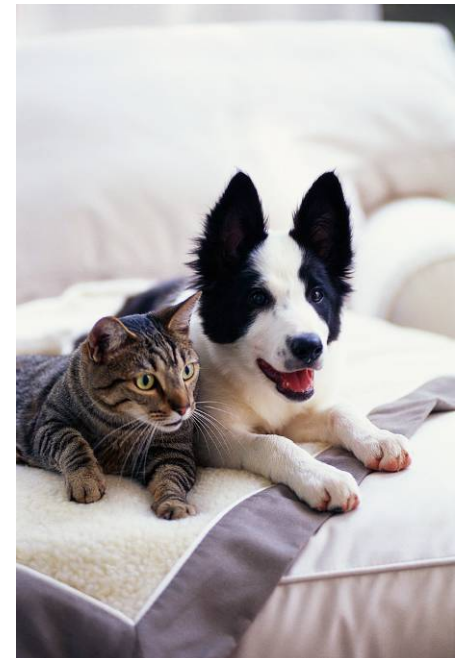
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## *A. braziliense*

- in both dogs and cats in tropics & subtropics

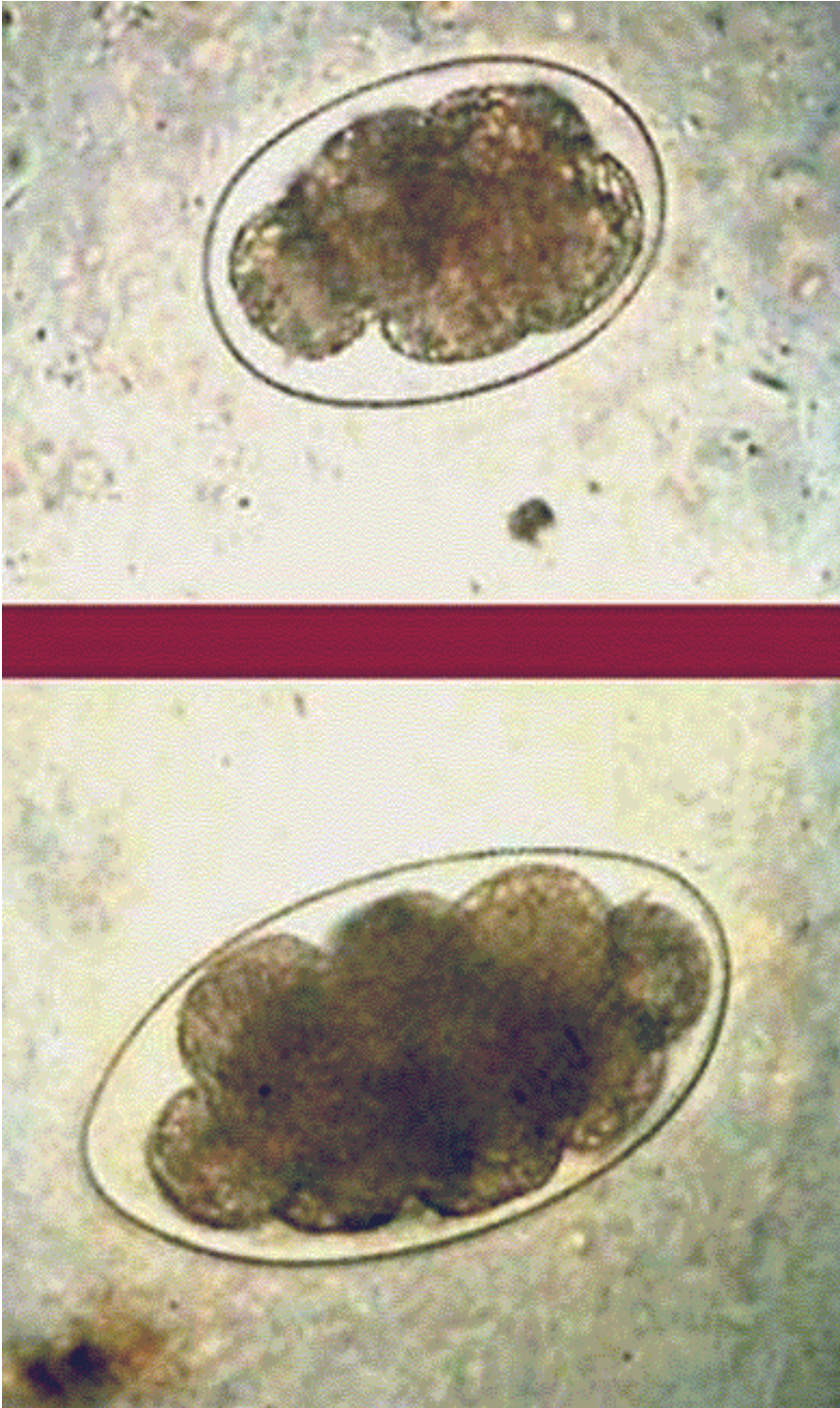
## *Uncinaria stenocephala*

- northern hookworm
- found mainly in dogs
- not common in cats





## Eggs of *Ancylostoma* (top) & *Uncinaria* (bottom)



- thin shell, oval to oblong, pale
- non-embryonated in fresh feces (2-8 cell stage)

### Diagnosis:

Signalment, age and clinical signs  
this is the *only* basis for ante-mortem  
diagnosis in per-acute neonatal  
ancylostomiasis

Detection of eggs in feces and/or worms  
at necropsy

Fecal flotation to detect eggs  
Worms grossly visible



## *Ancylostoma caninum*

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- Very common in dogs of all ages in midwest
  - More significant problem in south & central US
- Infectious larval stage (L3) survive best in moist, sandy-loam soils at moderate temperatures
  - do not survive freezing
  - do not survive at temps  $>37^{\circ}\text{C}$
- Clinical cases more common during warm weather

# *Uncinaria stenocephala*

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- More prevalent in northern US
  - less common & less pathogenic than *A. caninum* because it sucks less blood
- Structure
  - eggs slightly larger than *A. caninum*
- **Lactogenic transmission** important
- No prenatal transmission



# Hookworm transmission

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L3 (infective larvae) can be acquired by:

1. Skin penetration
2. Ingestion
  - In food or water
  - Lactogenic transmission: major source of infection of puppies
  - Ingestion of arrested larvae in paratenic hosts
3. Transplacental route ~unimportant



## Tracheal vs. somatic migration

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- **Tracheal**- Penetrate capillary and alveolar walls
  - Enter lumen of alveoli and migrate up airway to trachea
  - Get coughed up and swallowed
  - Develop to adults in small intestine
- **Somatic**- Remain in alveolar capillaries
  - Blood flow carries L3 to *muscles*
  - Exit muscle capillaries and become hypobiotic or arrested larvae





## L3 acquired by ingestion

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### **Undergo** *mucosal migration*

- Enter gastric glands or SI mucosa
- Most emerge in a few days & develop to adults
  - pre-patent period = 2-3 weeks
- Some enter bloodstream from SI mucosa and undergo either *tracheal* or *somatic migration*
  - in older or infected dogs, most undergo a somatic migration to become arrested larvae in muscles

# Fate of hypobiotic larvae in pregnant dog

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- Larvae are “activated”
  - L3 occur in milk up to 20 days post-whelping
  - These larvae develop directly to adults in puppy small intestine
    - blood-lung migration already completed in dam
  - Undergo **lactogenic transmission** to nursing pups
- Possible transplacental transmission to fetal lung





# Persistent hookworm infection

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Source of infection: hypobiotic larvae in SI mucosa or muscles

1. Larvae “leak” out of these sites
  - ~continuously and reach the SI lumen
    - if animal already has adults in SI: probably shed into lumen and expelled
    - if no hookworms present: develop to adults
2. If adult hookworms killed by an anthelmintic, arrested larvae can be activated and quickly repopulate the SI



# Pathogenesis

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- Blood sucking & plug-feeding activities
  - attach to mucosa and pull a plug of intestinal mucosa into the buccal capsule
  - use teeth to lacerate mucosa
  - secrete proteolytic enzymes & anticoagulant
  - change sites frequently so old sites continue to bleed
  - Leads to blood loss- anemia

# Clinical signs

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- Vary from asymptomatic to rapidly fatal-not enough red blood cells (anemia)
- Severity depends upon:
  - dosage of infecting L3
  - age resistance and acquired immunity
  - iron reserves (low in puppies)
  - nutritional status





## Clinical signs

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- ↓ stamina with weakness
- pale mucous membranes
- melena or possible bloody feces
- unthrifty appearance (thin, rough hair coat)



## Hookworm infection in neonatal pups

- Results from massive milk-based transmission
- Signs develop as early as 4 days of age
  - worms start to suck blood after molting from L4 to L5 (immature adult stage)
  - Can be fatal by 10-24 days of age even with treatment



## Hookworm infection in neonatal pups

- Pups: extremely pale with bloody feces, diarrhea
- NO eggs in feces (yet):
  - Adults begin egg-laying at 16 DPI
  - Clinical signs usually occur ~7-14-days of age
- Necropsy findings:
  - blood & immature worms in intestinal tract



# Hookworm in older pups

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- Results from acquisition of large numbers of infectious larvae over short period of time
  - usually seen in older pups
  - general pallor due to severe anemia
  - Black feces- digested blood
  - often die unless treated promptly
  - eggs in feces
  - adults worms and blood in SI





# Hookworm in older dogs

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## Compensated form:

- dogs asymptomatic unless stressed
- feces normal and contain low to moderate numbers of eggs
- common in adult dogs with low number of worms

## De-compensated form:

- in mature dogs, usually malnourished
- moderate number of worms + many eggs
- thin, rough hair coat, lethargic
- pale: anemia
- melena: may develop bloody diarrhea
- can be fatal



Small intestine showing hemorrhagic lesions caused by hookworms



# Treatment

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- Peracute neonatal ancylostomiasis
  - Anthelmintic
  - Supportive care including blood transfusion
  - Poor prognosis
- Acute and chronic compensated form
  - Anthelmintic
- Chronic decompensated form
  - Anthelmintic plus nutritional support



# Treatment

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- Anthelmintics effective against adult worms

- butamisol                      dichlorvos
- disophenol                      febantel
- fenbendazole\*                  mebendazole
- milbemycin\*                      pyrantel pamoate  
(Strongid)
- ivermectin\* - effective dose is extra-label!
- \*also effective against larvae



# Prevention and control

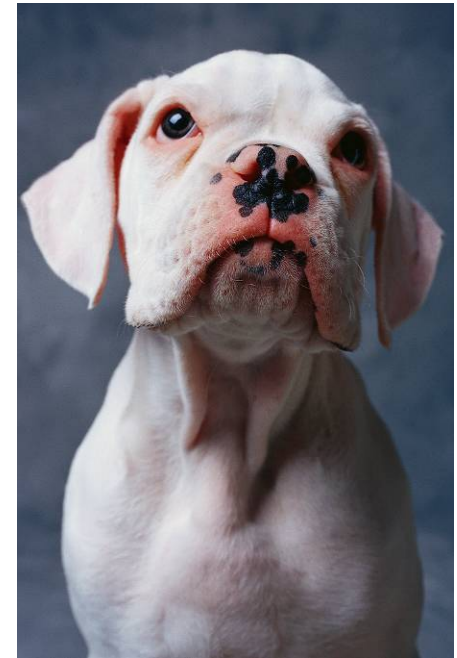
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- Identify and treat infected dogs
- Sanitation: remove feces daily + cleaning
- Good flooring with no cracks
  - Coated concrete
  - avoid gravel, sand, dirt, grass, damp shady areas
  - Spray with 1% bleach (3c/gal)
- Apply sodium borate (10 lbs/100 ft<sup>2</sup>) and rake in
- L3 killed by hard frost

# Prevention and control

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- Worm bitches before breeding, during 3<sup>rd</sup> trimester of pregnancy and 2 weeks after whelping
  - Objective: kill migrating larvae and activated hypobiotic larvae
  - Fenbendazole
- Treat pups at 2, 4, 6, and 8 weeks of age
  - In area with high parasite burden weekly Tx for 3 months
  - Pyrantel suggested





# Anthelmintics for prevention

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- Heartworm/hookworm preventatives:
  - ivermectin + pyrantel
  - milbemycin
  - styrid/caracide
  - oxibendazole + diethylcarbamazine





## Hookworms: Public health importance

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Cause cutaneous larval migrans (CLM)

- linear, tortuous, erythematous and intensely pruritic eruptions caused by migration of nematode larvae in humans
- Most commonly caused by *A. braziliense*
  - *A. caninum*, *U. stenocephala*, *Bunostomum spp* & *Strongyloides spp.* can also cause CLM
  - Known as “barnyard itch”, “creeping eruption” or “ground itch”

# Cutaneous Larval Migrants

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- Hookworms (Ancylostoma and Uncinaria) can produce cutaneous larval migrants
  - Eggs are passed
  - Larva develop and penetrate human skin- cases of walking barefoot in yard- Australia
  - Ingestion of worms leads to intestinal problems



**Cutaneous Larva Migrants (CLM)**



# Cutaneous larval migrans

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- Migration tunnels of larvae appear as ridges on skin surface
  - larvae want into bloodstream!!!
  - cause intense itching that can persist for weeks to months
  - secondary bacterial infection common
  - More severe and persistent in persons hypersensitized by prior exposure
- Rare cases of intestinal infection of humans with adult *A. caninum*



DOI

U.S. Department of the Interior  
Bureau of Land Management  
1615 North Lincoln Street  
Denver, Colorado 80202



# Hookworms

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- Prevention in humans involves
  - Treatment of infected animals
  - Routine de-worming (CDC)
  - Daily fenbendazole treatment of pregnant dogs from 40th day of gestation through 14<sup>th</sup> day of lactation shown to inhibit *T. canis* larvae in tissues- prevents or greatly reduces incidence of infection in puppies
  - Cleaning the environment (pick up yard!!)
  - Keeping pets from defecating in child play areas
- Treatment in humans
- Handouts available from CDC for lobby area use, fast facts from CFSPH website



**Guidelines for Veterinarians:**

PREVENTION OF ZOONOTIC TRANSMISSION OF  
**ASCARIDS AND HOOKWORMS**  
of Dogs and Cats

## FAST FACTS

### Hookworms

#### What are hookworms and what diseases do they cause?

Hookworms are parasites that cause mild diarrhea in both people and animals. As their name suggests, they have hooks on their mouth that help them attach better to the intestines of their host. Humans affected can also develop a skin condition called **cutaneous larva migrans**. The young worms or larvae (lar-vay) migrate in the skin. Hookworms are widespread and can be found in many parts of the world.

#### What animals get hookworms?

Hookworms are primarily found in carnivores (meat eating animals) such as, cats and dogs. Up to 96% of the dogs and 80% of the cats in some countries may be infested. Cattle and rodents may also be infested with hookworms.

#### How can my animal get hookworms?

In dogs, larval hookworms can be transmitted from the mother to puppies during pregnancy or through nursing (**oral**). Dogs, cats and other animals can get hookworms from the environment. Hookworm eggs are shed in the feces of infected animals and then hatch into larvae in the soil. Animals may ingest the worms from the soil. Hookworm larvae can also directly penetrate the skin if there is **direct contact** with contaminated soil. This requires at least 5 to 10 minutes contact.

#### How do hookworms affect my animal?

The signs and severity of disease from hookworms depends on the number of parasites (worm-load) infesting the animal. In dogs and cats, hookworms can cause diarrhea (that may have blood), pale pink gums (sign of anemia or blood loss), and weight loss. Large numbers of hookworms can be fatal in kittens and puppies. Hookworms that penetrate the skin will leave reddened, raised "tracts" or lines where they migrate.

#### Can I get disease from hookworms?

Yes. Humans can be infested with hookworms by ingestion (**oral**) of the larvae from soil contaminated with fecal material. This can occur when people don't wash their hands after working or playing in dirt. People can also get the worms from **direct contact** with contaminated soil. When this happens, it is called cutaneous (skin) larva migrans (movement), because the worms tunnel in the skin leaving reddened lines.

#### Who should I contact, if I suspect hookworm disease?

##### In Animals –

Contact your veterinarian.

##### In Humans –

Contact your physician.

#### How can I protect my animal from hookworms?

Prompt removal of animal feces is the best prevention method. House animals in a way that minimizes exposure to contaminated soil. Routinely take your animals to your veterinarian for testing and deworming.

#### How can I protect myself from hookworms?

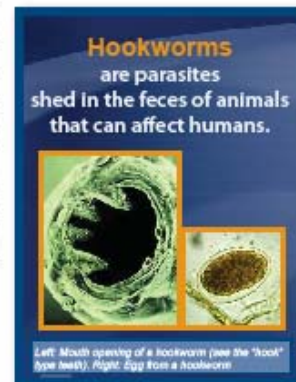
Good hygiene is important. Always wash your hands after touching animals or playing in soil. Treatment (deworming) of infected animals will reduce contamination in the environment and your chance of exposure. Avoid bare skin contact with potentially contaminated soil.

#### For More Information

CFSPH Technical Fact Sheets. Hookworm at <http://www.cfsph.iastate.edu/DiseaseInfo/>

CDC website. Human hookworms at [http://www.cdc.gov/ncidod/dpd/parasites/hookworms/factsht\\_hookworm.htm](http://www.cdc.gov/ncidod/dpd/parasites/hookworms/factsht_hookworm.htm)

CDC website. Guidelines for Veterinarians: Prevention of Zoonotic Transmission of Ascarids and Hookworms of Dogs and Cats at <http://www.cdc.gov/ncidod/dpd/parasites/ascaris/prevention.htm>





# Questions?

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# Roundworms

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- Dogs, cats
  - *Toxocara sp., Toxascaris*
- Horses
  - *Parascaris equorum*
- Swine
  - *Ascaris suum*
- Cattle
  - *Neoascaris (Toxocara) vitulorum*



## Ascarids of dogs and cats

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- *Toxocara canis*, *T. cati*
- *Toxascaris leonina*
- Very common & important roundworms
  - virtually all puppies & kittens are infected early in life
  - **zoonotic**: cause **visceral & ocular larval migrans** in humans

# *Toxocara canis*

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- Common dog roundworm
- Hosts
  - wild & domestic canids
  - rarely in felids
- Many animals can be paratenic hosts
  - rodents, rabbits, cattle, sheep, goats, birds, earthworms, etc





Do you see roundworms at your shelter/clinic?

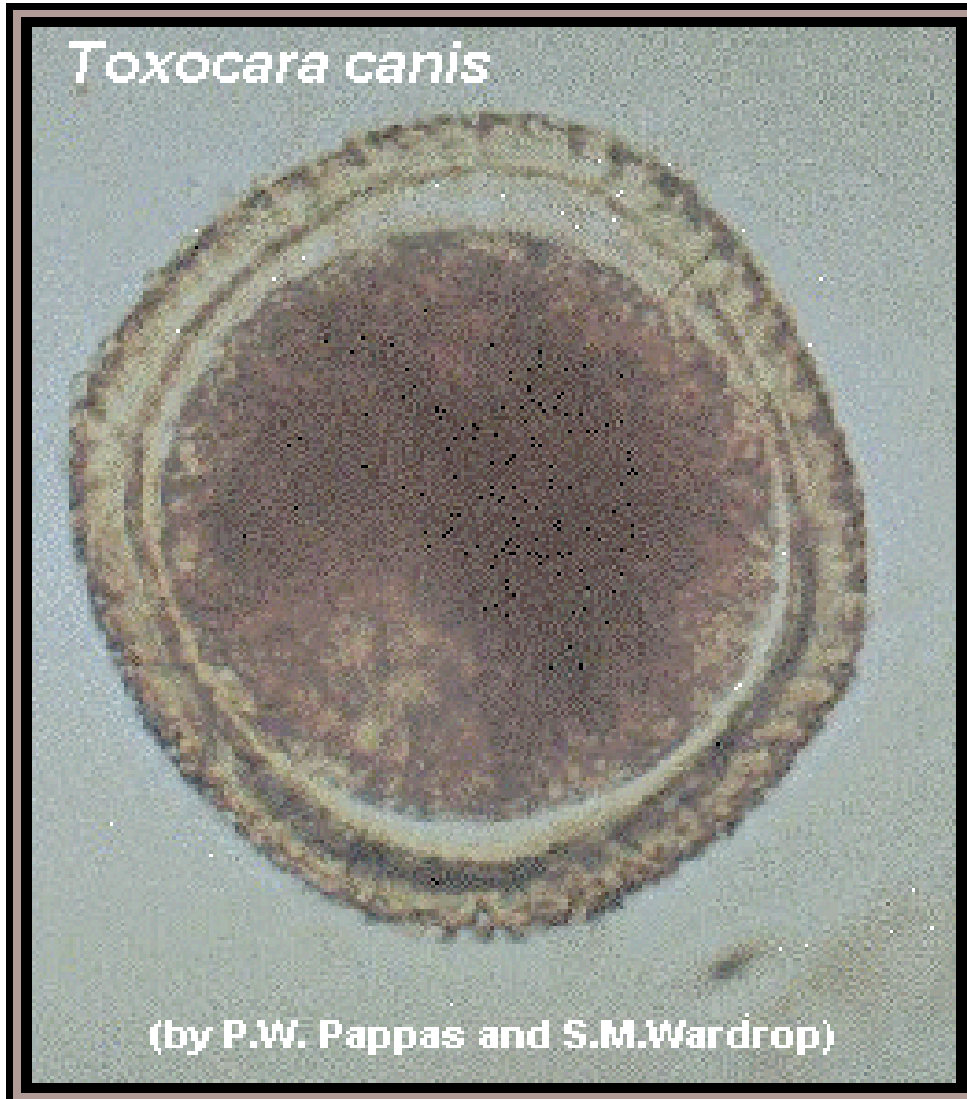
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Yes

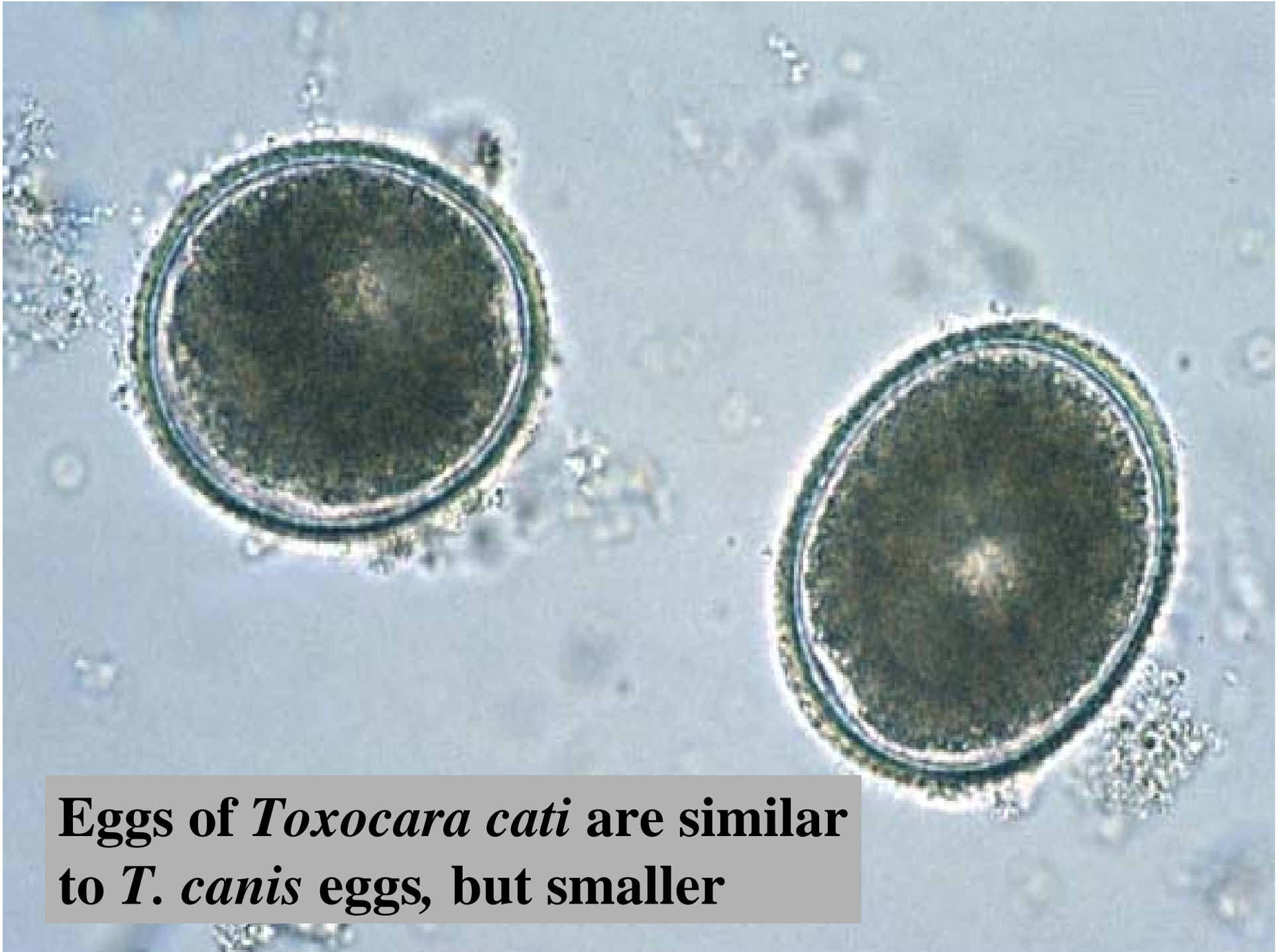
No



# *Toxocara* eggs



- Round or elliptical
- Shell thick, rough Shell contents
  - Single cell
  - Very dark
  - Almost fills shell



**Eggs of *Toxocara cati* are similar to *T. canis* eggs, but smaller**

# *Toxocara cati*

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- Common roundworm of wild and domestic felids
  - Very common in kittens
  - Rare in dogs
- Common in feral cats, wild felids as result of ingesting paratenic hosts
  - rodents, chickens, birds, earthworms, cockroaches, ruminants etc.
  - **Milk based transmission only**
  - **NO transplacental transmission!**







## *Toxascaris leonina*

- Occurs in both dogs and cats of all ages
  - More common in dogs than cats in the Midwest
- Not as prevalent as *Toxocara*
- Mixed infections with *Toxocara* occur



*Toxascaris*

Eggs of *Toxocara* and  
*Toxascaris*





## Life cycle of *T. canis*

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- Adults in small intestine → eggs (lots!) in feces
- **Infective larva develops within egg** in ~2-4 weeks
- Egg with larva ingested
- Larva hatches in duodenum
- Larval migration:
  - pathway & fate of larvae varies with host age and susceptibility
  - young hosts < 12 weeks: liver-lung-*tracheal* migration
  - older hosts > 12 weeks: liver-lung-*somatic* migration



## *T. canis* in pregnant dogs

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- **Worm can cross placenta before pups born**
  - Activation of hypobiotic larvae in last trimester
  - Enter uterine circulation, cross placenta → fetal liver  $\pm$  lungs
  - Larvae complete migration after birth
    - liver → lung → trachea → GI track



## *T. canis* in pregnant dogs

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### ○ **milk transmission to pups**

- Hypobiotic larvae activated in late gestation & early lactation
- Migrate to mammary glands
- Pups ingest larvae in colostrum & milk
- Ingested larvae mature in GI track

## Life cycle of *T. canis*

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- Males, non-pregnant or spayed females
  - Granulomas = dead end for hypobiotic larvae
- Small rodents, prey species (paratenic hosts)
  - larvae from ingested egg undergo somatic migration → hypobiotic in tissues
  - survive in granulomas for several years
  - develop directly to adults in ~3 weeks if dog ingests paratenic host





# Epidemiology

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- **Transplacental transmission is most common route of infection**
  - Very common in puppies & young dogs
- Patent infections more common in males than females
- Small rodents reservoir of infection
  - may be common source of infection for rural and feral dogs





# Epidemiology

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- Adult worms survive ~4 months
  - Pups expel most worms by 6 mos of age
    - irritation of intestine or “self-cure”??
- Eggs infective in  $\geq 2$  weeks in environment
  - **Very hardy** - resist environmental extremes
    - Persist in soil for years
  - Killed by direct sunlight and heat



## Summary: *T. canis* transmission

- **Transplacental transmission** to fetal liver via activated hypobiotic larvae in bitch
- Ingestion of:
  - Egg in environment with infective larva
  - Larvae from colostrum or milk of dam
  - Hypobiotic larvae in paratenic host tissues
  - Eggs, larvae or immature worms in puppy vomit or feces



## Clinical signs: *T. canis*

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- **Due to transplacental transmission**

- *In utero* (fetal pups)
  - migrating larvae can damage liver
  - cause fetal death or stillbirths
- Newborn puppies
  - Weak pups due to liver & *lung* damage by migrating larvae
  - Lung hemorrhages, pneumonia
  - May die at 2-3 days of age

# Typical clinical signs in pups

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- Pot-belly
- Ill thrift
- Dull dry hair coat
- Abdominal discomfort
- Vomiting
- Mucoid diarrhea
  - may alternate with constipation
- *Toxocara* in vomit/feces



# Clinical signs in pups

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## worst case scenarios

- Aspiration pneumonia (vomiting)
- Obstruction of bile or pancreatic ducts
- Obstruction of SI with possible rupture
- CNS signs can occur in heavy infections
  - Cause?
  - Recover with anthelmintic treatment
- Death ~2-3 wks of age



## Clinical signs older dogs

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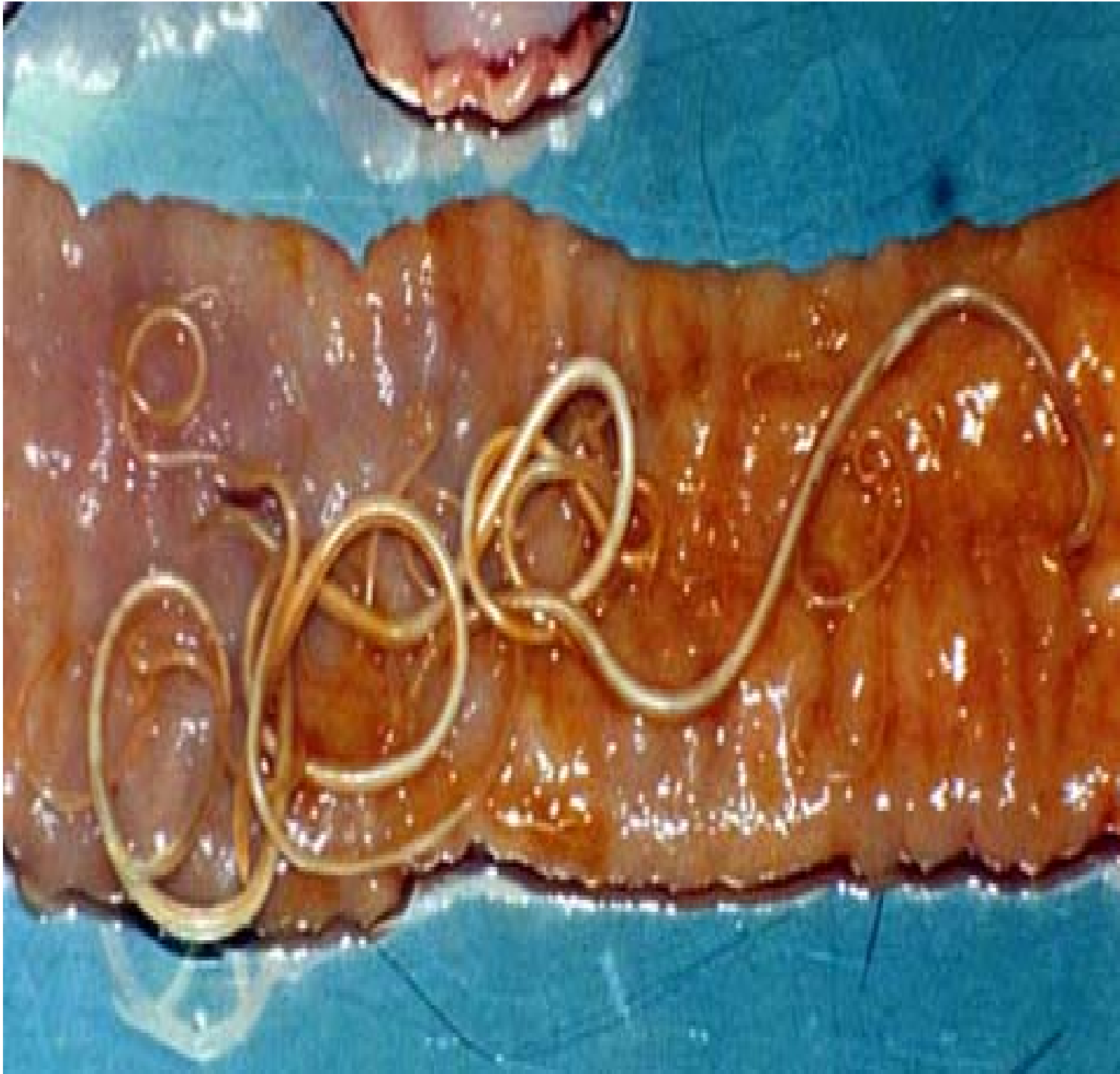
- Adults usually asymptomatic
  - few adult ascarids present in SI
  - ingestion of large number of eggs can result in vomiting with bloody enteritis
- Encapsulated larvae in tissues rarely cause clinical signs
  - possible CNS problems (convulsions) associated with larval death in brain

## Clinical signs of *T. cati* infection

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- Type & severity of signs determined by:
  - host age
  - infecting parasite stage
  - infecting dose of parasite
  - location of infecting stage
- Not as pathogenic as *T. canis*
- Adult cats usually asymptomatic





*Toxocara  
cati* in  
the small  
intestine  
of a cat.





## How often do you diagnose roundworms?

---

- All the time (daily to weekly)
- Sometimes (weekly to monthly)
- Only in the summertime
- Occasionally (monthly)
- Rarely (a couple times a year)
- Never



## Diagnosis of *Toxocara* infection

- History plus clinical signs
  - previous infection in litter, kennel etc.
- Presence of *Toxocara* in feces and/or vomitus
- Detection of typical eggs in feces
  - Fecal flotation



## Treatment of *Toxocara* infection

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- For dogs: Anthelmintics for treatment of intestinal stages:
  - ivermectin @ 0.1-0.2 mg/kg orally
    - NOT for collies, collie like breeds (shelties, border collies, etc.)!
    - Extra-label at dosages >0.006 mg/kg
  - ivermectin plus pyrantel (Heartguard Plus)
  - milbemycin
  - pyrantel pamoate
  - piperazine
  - dichlorvos
  - fenbendazole



## Treatment of *T. canis* infection

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- Anthelmintics with activity against larvae
  - fenbendazole for pregnant bitch
  - kills only larvae activated during pregnancy
  - need ~continuous treatment

# Prevention of *T. canis*

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- Decrease environmental contamination with eggs
  - deworm all infected dogs
  - deworm puppies before infection becomes patent
    - recommend treatment at 2, 4, 6 and 8 wks of age
  - strict hygiene practices



# Treatment: cats

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- Similar to treatment of *Toxocara* in dogs
  - Fewer anthelmintics approved for cats
  - Fenbendazole (10 mg/kg for 3 days orally)
  - Febantel approved for cats and effective
- Treat kittens at 3, 5, 7 and 9 wks of age
- Evaluate cats of all ages for eggs in feces and treat as needed





## Prevention of *Toxocara*

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- Reduce numbers of somatic larvae in breeding females
  - reduce exposure to infective eggs by sanitation
  - deworm at time of breeding and during lactation (2-3 weeks post-whelping)
- Prevent ingestion of rodents

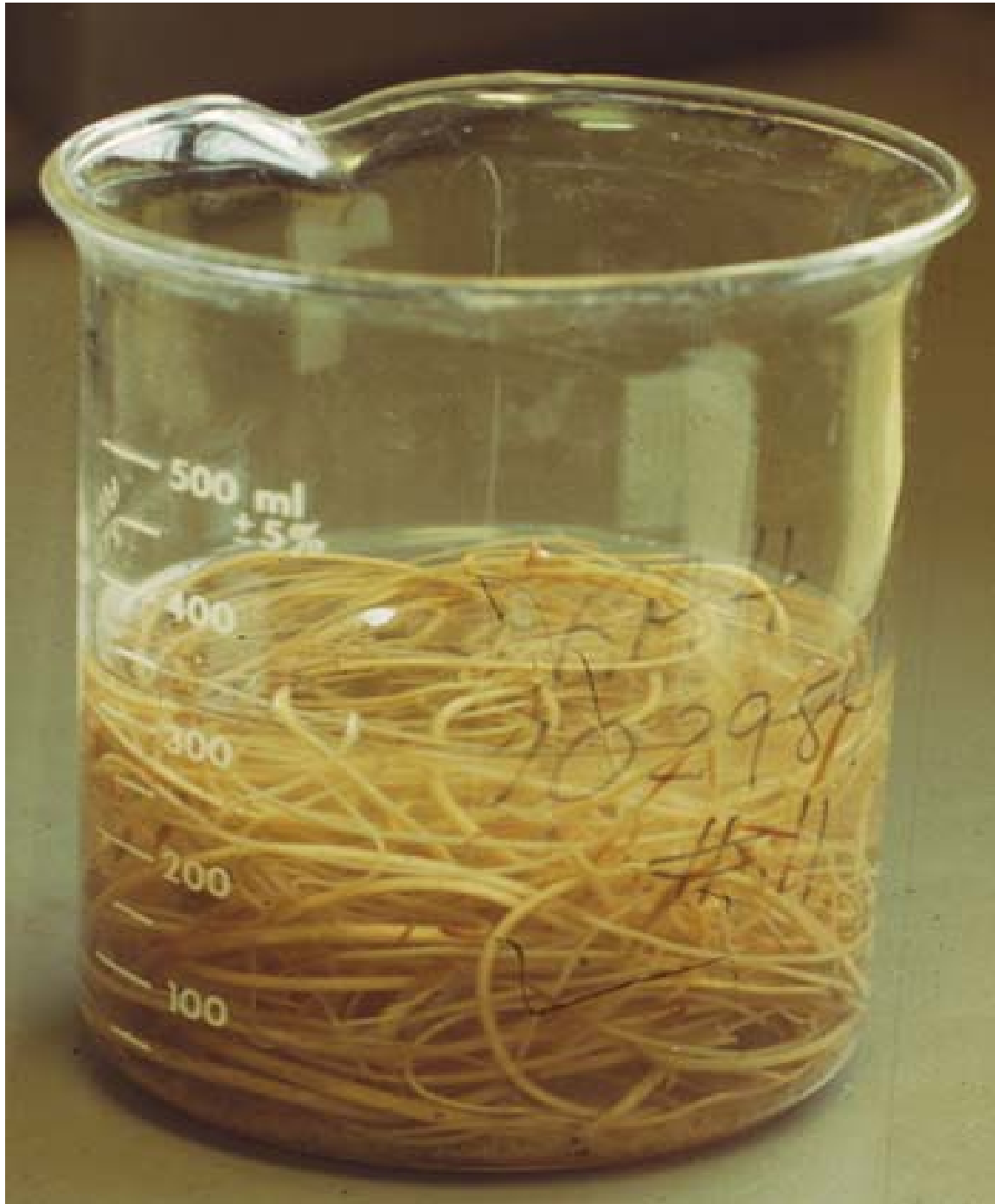
# *Baylisascaris procyonis*

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- Raccoon roundworm
  - Very common in raccoons in North America
  - Adults and egg similar to *Toxocara*
  - Ingestion egg with infective larva
  - Undergo liver-lung-tracheal migration
  - Nonpathogenic in raccoons, can also infect dogs
- Paratenic hosts have arrested larvae in tissues







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***Baylisascaris* from  
the small intestine  
of a raccoon**

Eggs of hookworm, *Toxocara*,  
and *Baylisascaris* (*B*)





Do you see raccoon roundworms at  
your shelter/clinic?

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Yes

No



# Public health significance

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- Ingestion of egg with larvae
  - Larvae highly invasive & pathogenic
  - Often in CNS of non-raccoon hosts including man
- Infection in abnormal hosts
  - possible respiratory signs
  - Nervous system signs: can mimic rabies

# Prevention and control

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- Treat captive raccoons with anthelmintic
  - Wormers effective against dog and cat ascarids should be effective against *B. procyonis*
- Keep wild raccoons out of barns, sheds
- Pick up & destroy raccoon feces
- Wash hands after handling raccoons





## Visceral larval migrans (VLM)

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- a single female roundworm can produce more than 100,000 eggs/day
- Once eggs become infective can remain infective in the soil for years
- Most commonly caused by *T. canis* in humans
- Can also be caused by: *Baylisascaris procyonis*
- *Less frequently caused by Toxocara cati, Toxascaris leonina, Ascaris suum*

# Pathogenesis

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- Sandboxes, playgrounds etc. frequently contaminated with dog/cat feces
  - children ingest dirt/sand with infective ascarid eggs
  - larvae hatch in intestine & attempt normal migration pathway
  - invade lungs, liver, eyes, brain etc. and cause disease





# Human VLM

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- Most common in children <6 yrs old
- Clinical signs and lab findings include:
  - Irritability, intermittent fever, loss of appetite, weight loss
  - Aching muscles, nausea, swelling, itching
  - Enlarged liver, inflamed lungs
  - Immune responses to parasites (eosinophils, IgE)





# Diagnosis

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- History of pica
- Clinical signs
- Detection of larvae by biopsy (liver or lung)
- Serology
  - ELISA

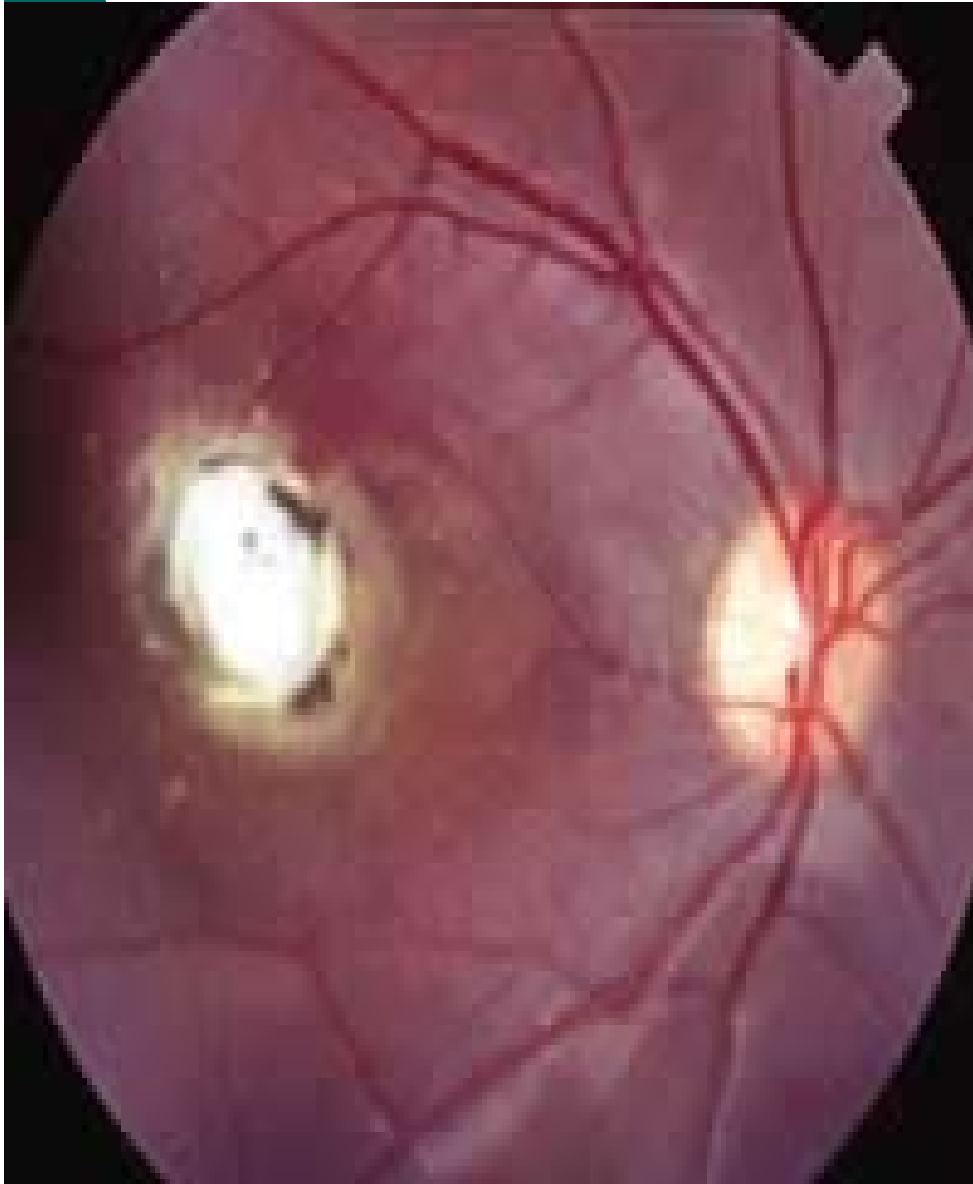
# Ocular larval migrans

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- Sequel to VLM
- Larvae of *T. canis* invade human eye
- Cause unilateral inner eye lesion similar to retinoblastoma
- Treatable



**Ocular Larva Migrans (OLM)**



## Ocular larval migrans

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Granuloma caused  
by larval *Toxocara  
canis* in eye



# Questions?

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## Coccidia- *Isospora* spp.

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- Disease: isosporosis; coccidiosis
- Very common parasites
- Life cycle
- fecal-oral transmission of sporulated oocyst
  - Addition of rodents in dog and cat spp.



# Rodent paratenic hosts

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- dog and cat *Isospora* spp.
- Rodent ingests sporulated oocysts
  - sporozoites released in GI tract
    - penetrate gut wall, enter extra-intestinal cells
    - each sporozoite forms a monozoic cyst
    - sporozoite remains viable but does not develop
  - definitive host ingests rodent
    - sporozoite released from monozoic cyst
    - initiates merogony in cat/dog intestine



# Isosporosis of cats and dogs

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- Each host parasitized by >1 *Isospora* spp.
- Location of life cycle stages
  - Unsporulated oocysts shed in feces
  - Sporogony in environment
  - Merogony & gametogony in small intestine



# Isosporosis in cats and dogs

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- *Usually* non- or mildly pathogenic
  - Can cause severe enteritis (pups & kittens)
- Signs
  - anorexia, weight loss
  - mucoid to bloody diarrhea
  - possible vomiting
  - dehydration
  - possible anemia
  - can be fatal
- Significant problem in kennels and catteries





## Diagnosis: isosporosis in cats and dogs

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- Age, history and clinical signs
- A differential in cases of diarrhea, esp. puppies and kittens
- detect oocysts in feces
  - non-sporulated in fresh feces
  - clinical signs precede oocyst shedding



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**Sporulated oocyst of**  
*Isospora rivolta*



# Treatment of isoporosis

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- Sulfonamides
  - Sulfadimethoxine (Albon)
  - Trimethoprim-sulfadiazine (Tribrissen)
  - Amprolium (Corid) – extra-label
- Supportive care



# Control of isosporosis

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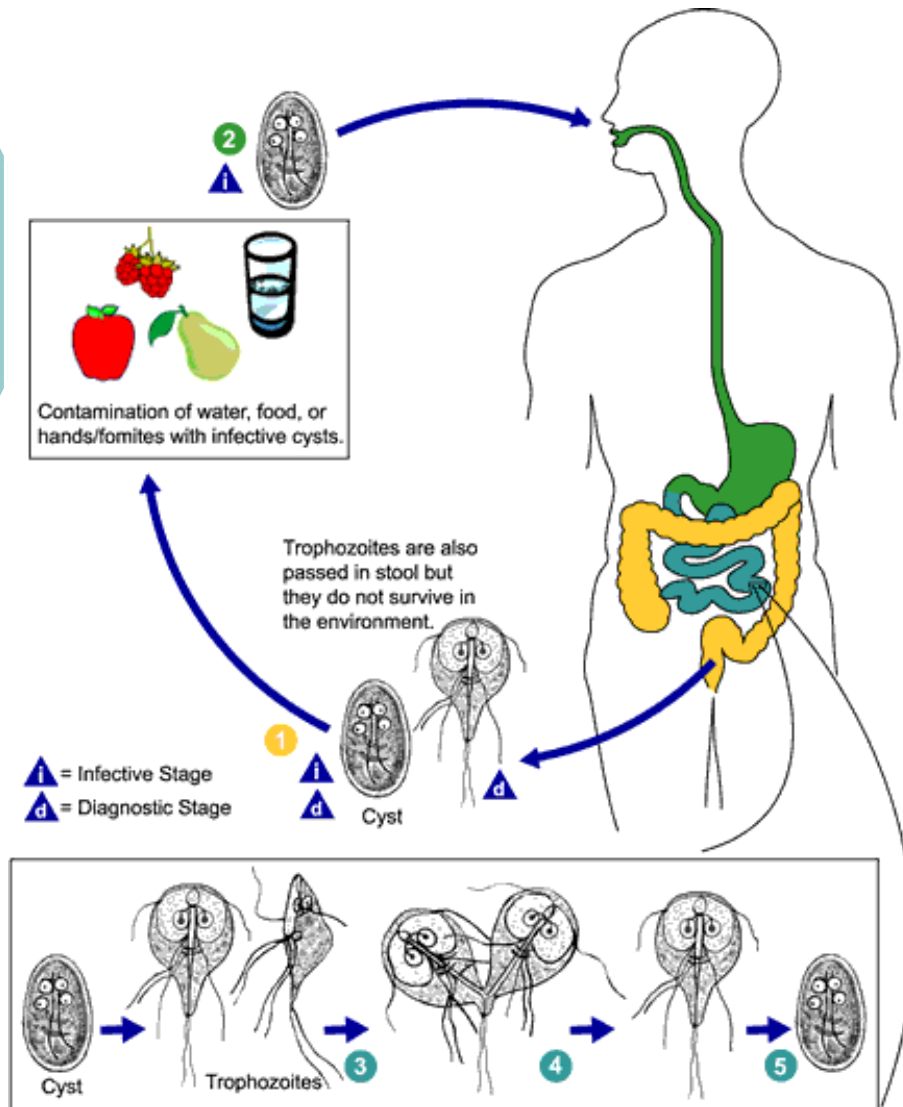
- Sanitation
  - steam cleaning, boiling water, ammonium hydroxide, bleach
- Post-partum treatment of cat or dog
- Prophylactic treatment of offspring
  - extra-label use of coccidiostat
  - amprolium (thiamine antagonist) or decoquinate



# Questions?

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# *Giardia lamblia*



Trophozoites



## ***Giardia lamblia***

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- Synonyms: *G. duodenalis*, *G. intestinalis*
- Infects wide range of mammalian hosts
- Comprised of several “Assemblages”
  - Some assemblages zoonotic
  - Human to human transmission probably more common



# *Giardia lamblia* genotypes

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- Assemblage A : zoonotic
  - Humans, livestock, dog, cat, beaver, guinea pig, deer, prairie dog, bobcat, others
- Assemblage B: zoonotic
  - Humans, cattle, dog, cat, beaver, muskrats, rat, others
- Assemblages C & D: primarily infect dogs
- Assemblage E: artiodactyl species
- Assemblage F: cats





# Prevalence of *Giardia*

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- Most common human intestinal parasite
  - ~7% of humans
- ~10% of household dogs and cats
  - Greatest prevalence in young and in kennels or catteries
  - Japan survey of dog breeding kennels (2005)
    - 100% of kennels positive for *Giardia*
    - 54.5% of pups vs. 30.9% of adults
  - 7.3% of cats <1 year old in NY in 2001
  - 7.2% of 1216 dogs seen in vet clinics in Canada

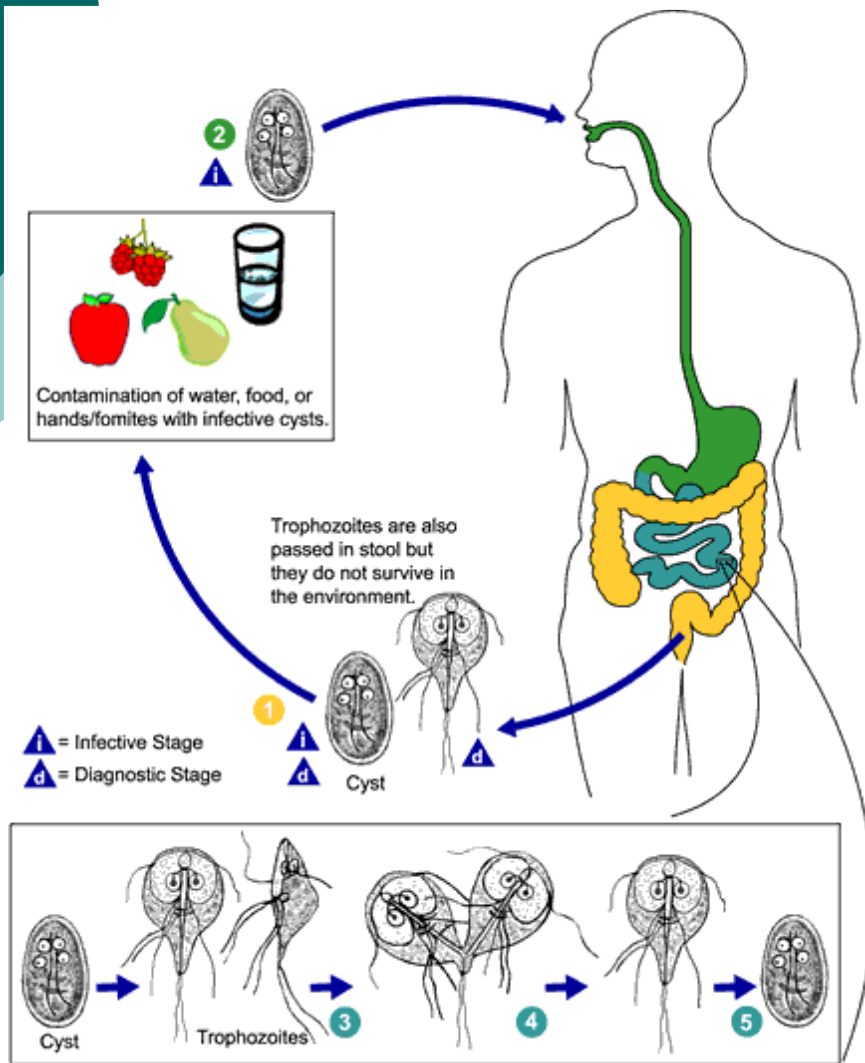


# Prevalence of *Giardia*

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- Increasing reports from calves, lambs, kids, foals
  - Ruminants from 2 weeks - 2 months old
  - Recent US study in calves
    - began shedding cysts at 4 days of age
    - peak numbers at 14 days of age
  - Foals 2 weeks to ~6 months old

# Life cycle: direct



- Cysts ingested with food or water contaminated by feces
  - Cysts survive weeks to months in cool, moist conditions
  - Contaminated water important source of infection
- Cysts excyst in small intestine
  - Duodenum (dogs) or jejunum/ileum (cats)



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*Giardia*  
trophozoite  
showing  
flagella  
and two nuclei



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**Trophozoite of  
*Giardia***

**What characteristic  
of the diplomonads  
is evident?**



# Pathogenesis

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- Trophozoites attach/detach from gut epithelial cells
- Infection results in:
  - Villous atrophy
  - Diffuse loss of microvillous brush border
  - Disaccharidase insufficiency
  - Impaired absorption
    - Electrolytes, nutrient, water
  - Results in diarrhea



# Giardiasis

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## Clinical features-humans

- Spectrum varies from asymptomatic carriage to severe diarrhea and malabsorption.
- Acute giardiasis
  - develops after 5-6 day incubation period
  - usually lasts 1 to 3 weeks
  - diarrhea, abdominal pain, bloating, nausea, and vomiting.
- Chronic giardiasis
  - acute symptoms are recurrent
  - and malabsorption and debilitation may occur.



# Clinical signs-animals

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- Persistent diarrhea
- Character of feces
  - Liquid to semi-formed
  - Pale & malodorous
  - ↑ mucus (especially in cats)
  - Steatorrhea
- ↑ Borborygmi





## Clinical signs-animals cont

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- Afebrile
- Bright & alert
- Not anorexic
- Rarely see melena, vomiting, serious dehydration
- Chronic giardiasis can result in weight loss, retarded growth



# Diagnosis

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- Clinical signs are relatively non-specific
  - Numerous differentials
- Always do a fecal exam on an animal with diarrhea to obtain a definitive diagnosis of giardiasis



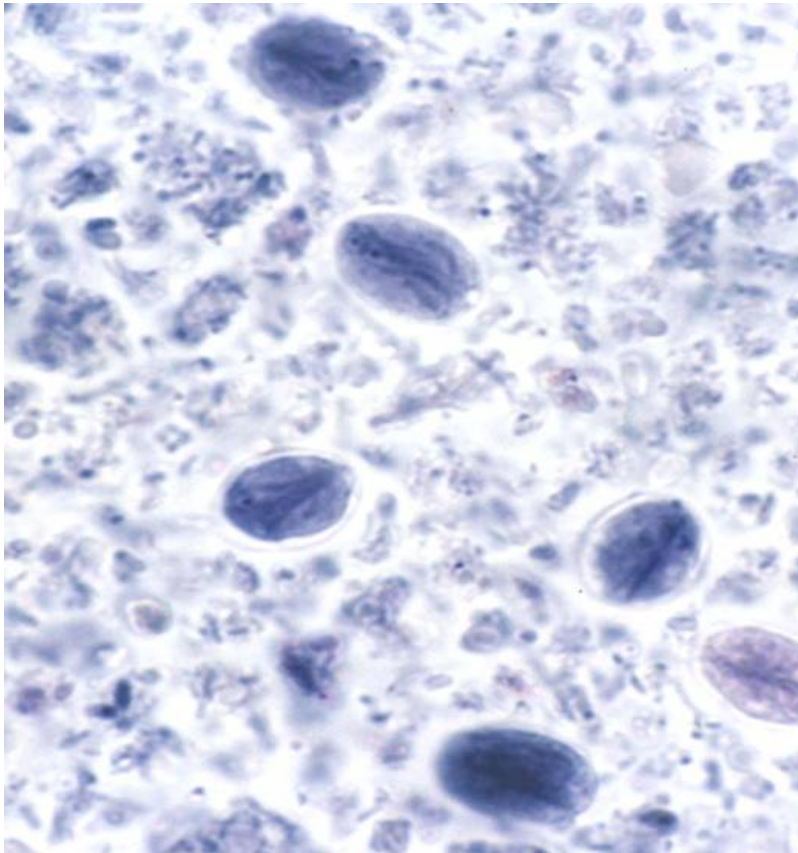
## Definitive diagnosis-fecal flotation

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- Trophozoites more likely in loose stools
- Need fresh feces kept cool and examined *asap* or preserved promptly
  - Wet mount of fresh sample - "falling leaf"
  - Stained smear (Dif-Quik works well)
  - Can also find trophozoites in small intestinal samples collected by endoscopy or laparotomy

# Definitive diagnosis-fecal flotation

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- Cysts more likely in semi-formed or formed feces
- Best method: centrifugal flotation in zinc sulfate
  - sugar distorts cysts
- Cysts shed intermittently
  - 1 exam detects ~77% of positive dogs
  - 3 exams detect ~95% of positive dogs
- Recommend fecal exams every other day X3



## Definitive diagnosis-other methods

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- IFA - detects cysts using fluorescent antibody
- ELISA – detects antigen in feces
  - SNAP Giardia, IDEXX
  - ProSpecT *Giardia* Rapid Assay, Alexon
- Check with lab for sample submission
  - Submit fresh chilled or formalin-fixed feces
  - Dilute feces in 5-10% NBF and/or PVA



## Definitive diagnosis

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- Comparative studies:
- IFA and ELISA tests comparable
- Both are more sensitive and specific than zinc sulfate flotation method

NOTE: cysts disappear temporarily after barium enema, laxatives, kaopectate...



## Treatment – all extra-label

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- Metronidazole - human drug
- Fenbendazole:
  - Labeled for helminth infections - dogs, cats, cattle, horses & pigs
  - **Safest for pregnant dog**
- Febantel – metabolized to fenbendazole
- Albendazole
  - Effective but not recommended because of serious potential side-effects



# Treatment & control

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- Refractory cases
  - Is re-infection occurring?
  - Repeat treatment with same, different or a combination of drugs
- Sanitation important
- Vaccine available
  - GiardiaVax – Ft. Dodge
  - Additional tool for use in treatment and control





# Questions?

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# *Tritrichomonas foetus*



- Worldwide venereal disease of cattle
  - Bovine trichomoniasis
- Higher prevalence in older bulls (vs. young)
  - bulls >4 yrs old = permanent carriers
  - function of preputial epithelium structure
- More common in beef herds than dairy
- Finding in shelter cats in IA, CO- why?

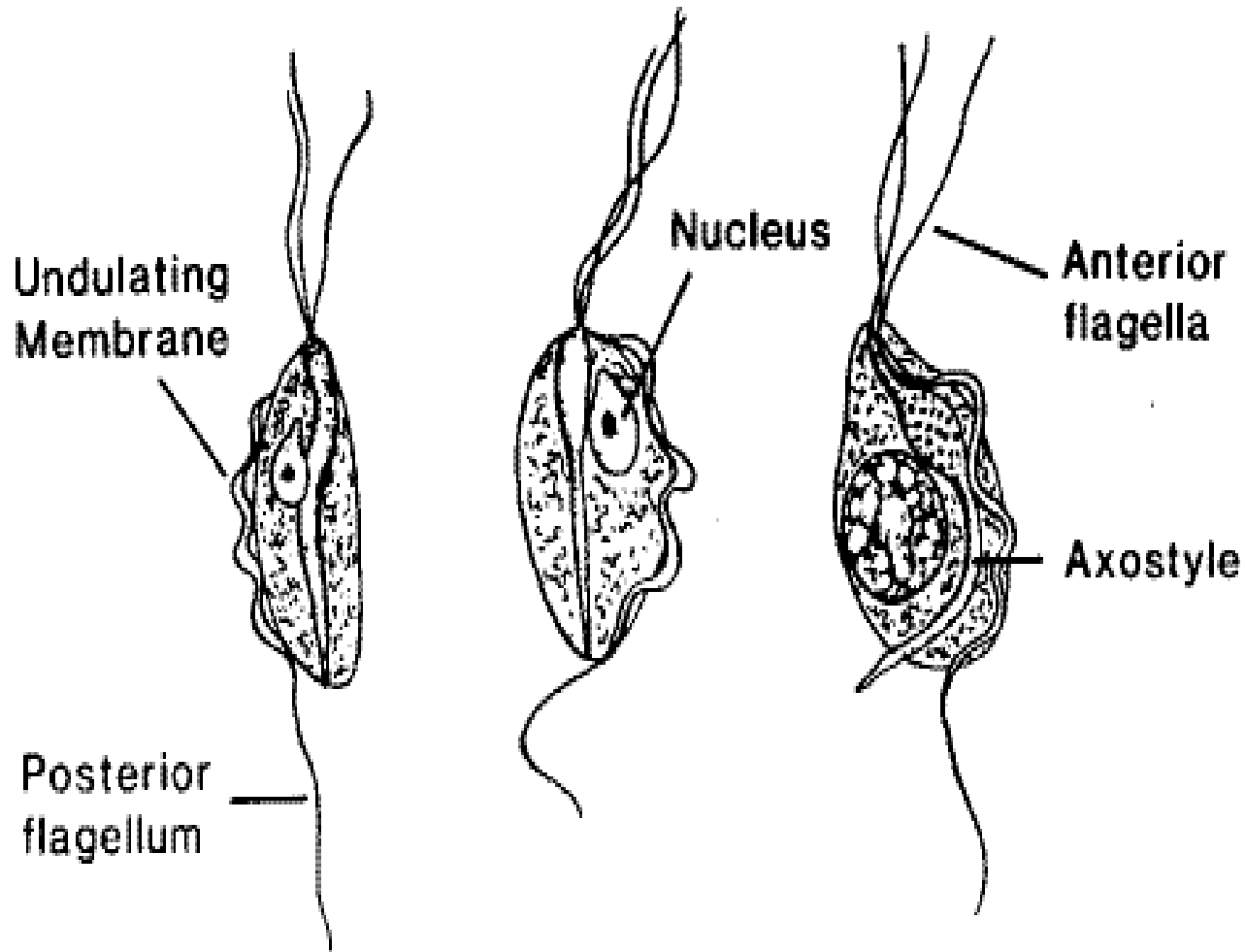
# Transmission- cows

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- Trophozoite stage only (**No cyst**)
- Mechanical transmission during coitus
- Iatrogenic
  - AI: bull semen to cow or cow to cow (repro exam)
- Bull to bull transmission possible
  - Use of same artificial vagina by infected and clean bull within short time frame



Photo courtesy of Dr. Diane Addie



**Diagnostic characteristics of**  
*Tritrichomonas foetus*



## Feline trichomoniasis

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- Large bowel diarrhea caused by a trichomonad indistinguishable from *T. foetus*
  - Morphology: light, transmission, and scanning electron microscopy
  - rRNA gene sequence analysis
  - RFLP-PCR



# Feline trichomoniasis

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- Cases reported from 12 states
  - Alaska to Florida
  - Also reported in England, Scotland, Germany
- More prevalent in shelters, cat colonies and multi-cat households
- Most commonly affects cats <1 yr old
- Cat to cat spread believed to occur via direct contact



# Questions?

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## Resources on this topic:

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- Georgis' parasitology for veterinarians, 8<sup>th</sup> ed, 2003
- CFSPH Technical Fact Sheets- for instance, Baylisascariasis, at <http://www.cfsph.iastate.edu/DiseaseInfo/default.htm>
- CDC web site. Baylisascariasis at <http://www.cdc.gov/ncidod/dpd/parasites/baylisascaris/default.htm>
- CAPC web site (although sponsored by Pharma companies, so very pro-year round preventatives), for example, ascarids at [http://www.capcvet.org/?p=Guidelines\\_Ascarid&h=0&s=0](http://www.capcvet.org/?p=Guidelines_Ascarid&h=0&s=0)