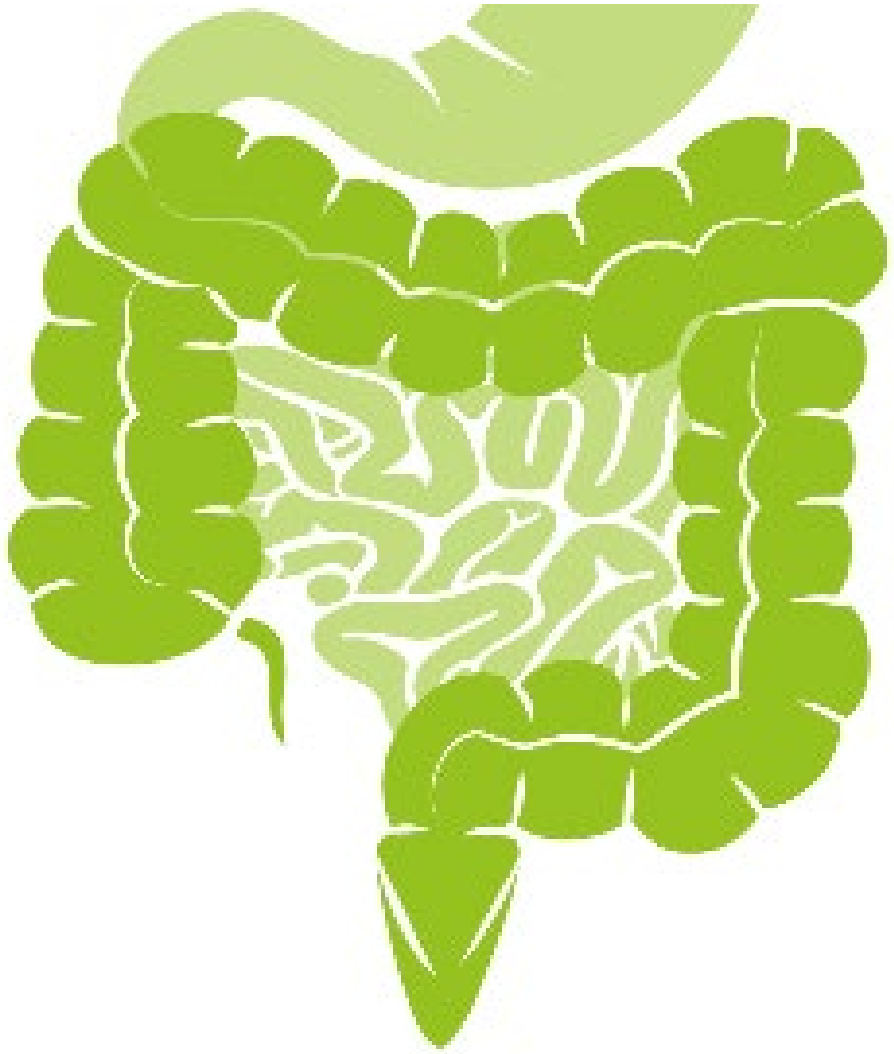


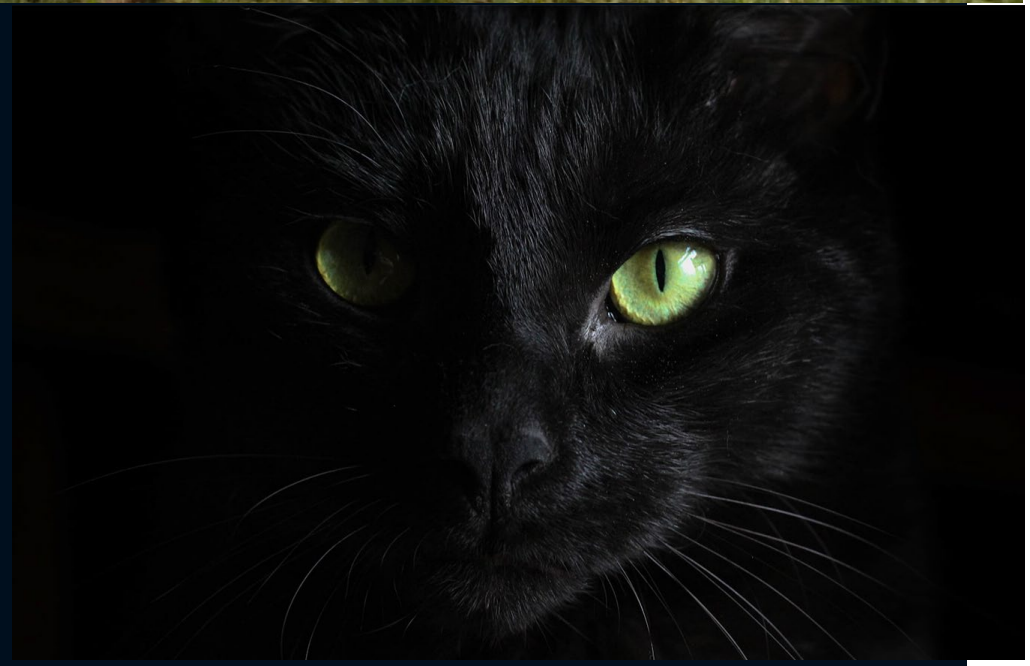
Coccidia part 3 (intestinal apicomplexans)

Cystoisospora spp.

(coccidia of carnivores)

Cystoisospora spp. (Coccidosis)

- Common Coccidian of **Carnivores**
- Direct Life Cycle
- Diarrhea!
- Many *Cystoisospora spp. and have* very high host specificity

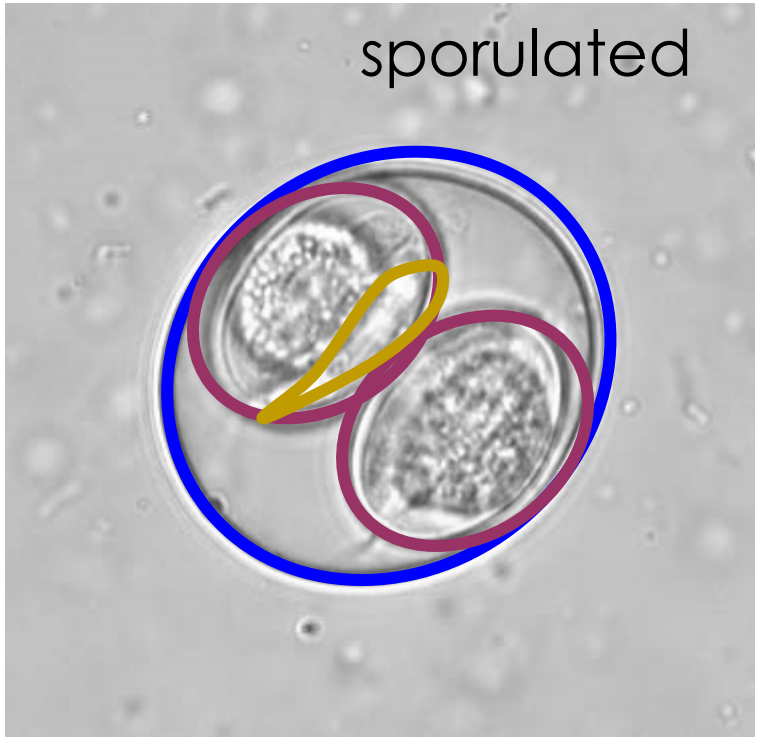


Learning Objectives: *Cystoisospora* spp.

1. Life cycles: understand it uses a Direct and Indirect Life Cycle
2. Transmission: understand the routes of transmission in both direct and indirect life cycles.
3. Pathogenesis: understand how it causes intestinal disease
4. Clinical signs: understand the clinical signs in dogs, cats and pigs
5. Diagnosis: understand how to diagnose coccidosis in dogs, cats and pigs
6. Treatment: understand the best methods for treating infections
7. Control: understand how to control *Cystoisospora* to reduce infections in dogs, cats and pigs
8. Epidemiology: know that *Cystoisospora* are very host specific and the specified risk factors (host and environmental)

Morphology: *Cystoisospora*

- Oocyst
  - Species-specific size, shape,
    - Unsporulated when passed
  - Sporulated oocyst contains 2 sporocysts with 4 sporozoites each = 8 sporozoites total



Life Cycles: *Cystoisospora*

Direct life cycle

Transmission

Fecal-oral, ingestion of sporulated oocyst

Invasion

Sporozoites excyst from oocyst and invade enterocytes

OR

Facultative Indirect life cycle

Transmission

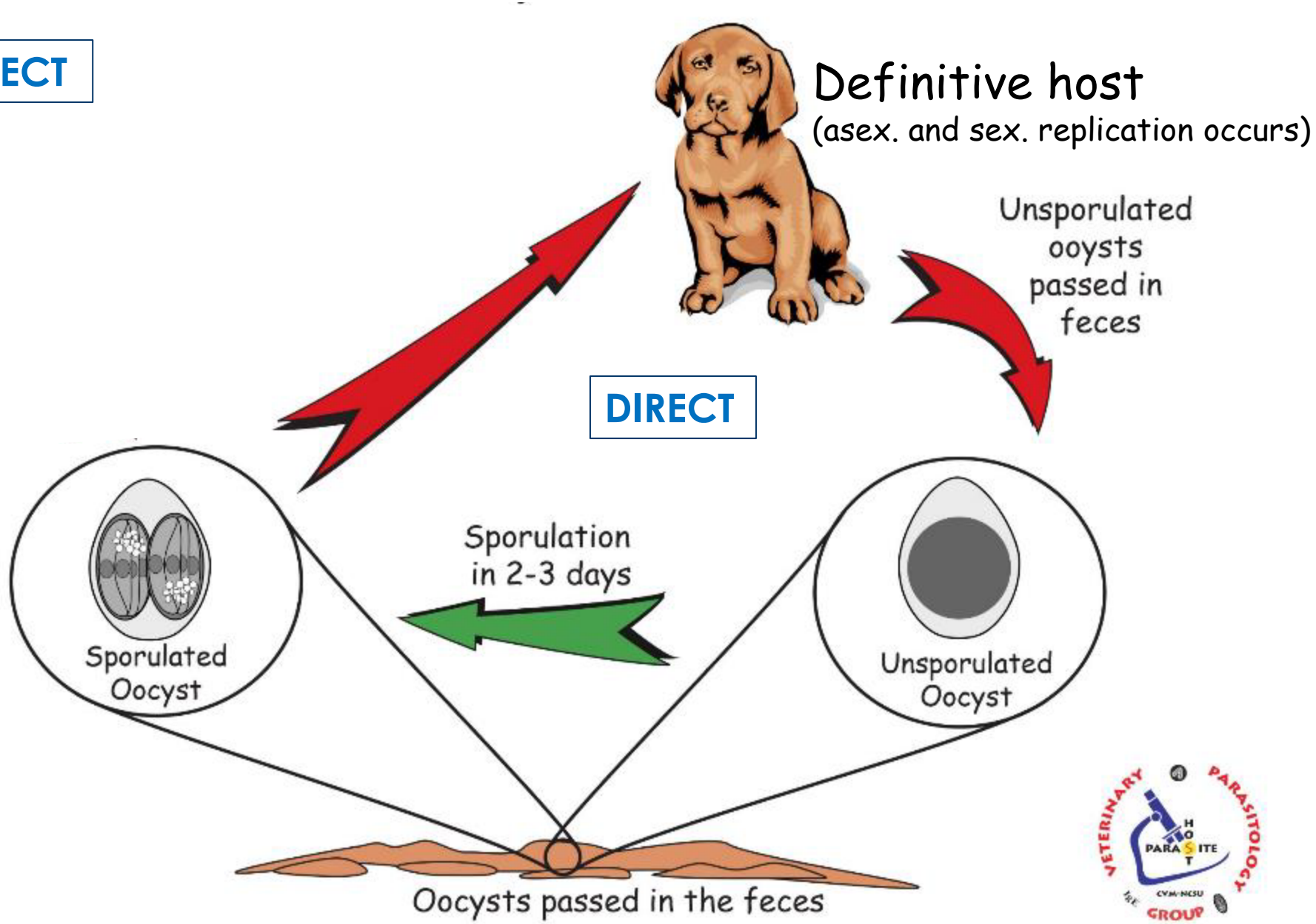
Rodent or bird paratenic host (sporozoites live in various tissues in the host)

Invasion

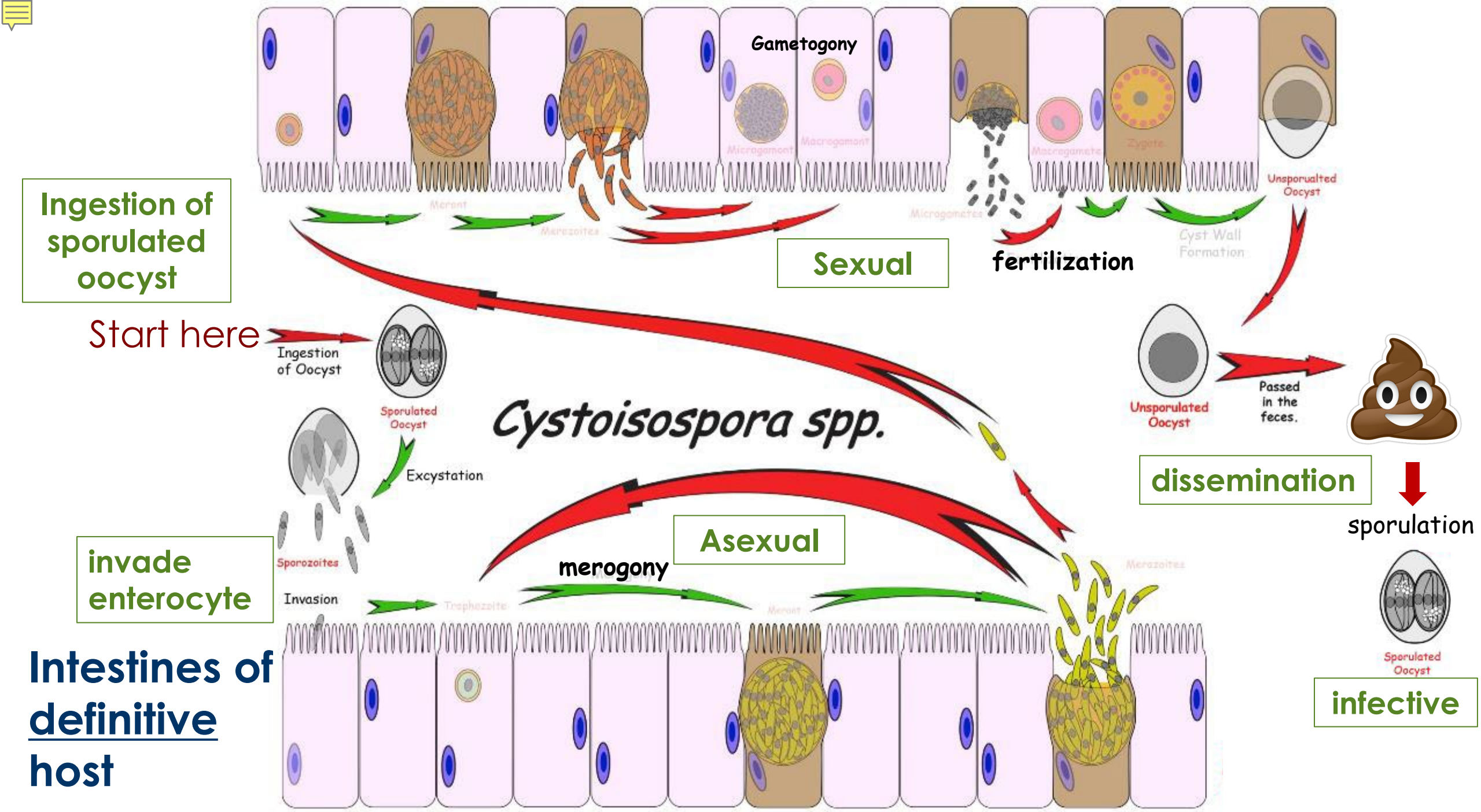
Sporozoites excyst from prey tissue and invade enterocyte of definitive hosts

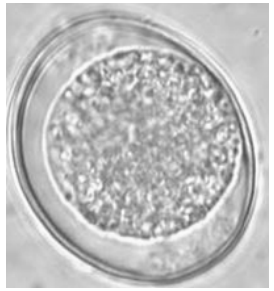
Cystoisospora canis

FACULTATIVE INDIRECT



Paratenic = not needed for the development of the parasite but helps to maintain the parasite's life cycle.


Ingestion of sporulated oocyst
Start here
Ingestion of Oocyst
Sporulated Oocyst
Excystation
Sporozoites
invade enterocyte
Invasion
Trophozoite
Meront
merogony
Merozoites
Asexual
Gametogony
Micragamont
Macragamont
Microgametes
Macragamete
Zygote
fertilization
Sexual
Unsporulated Oocyst
Cyst Wall Formation
Unsporulated Oocyst
Passed in the feces.
dissemination
sporulation
Sporulated Oocyst
infective
Cystoisospora spp.
Intestines of definitive host



Sporulation (2-3 days)

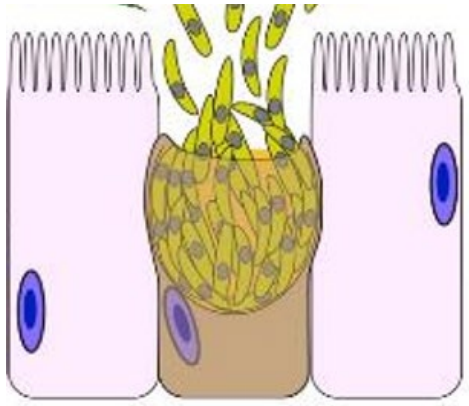
ingest

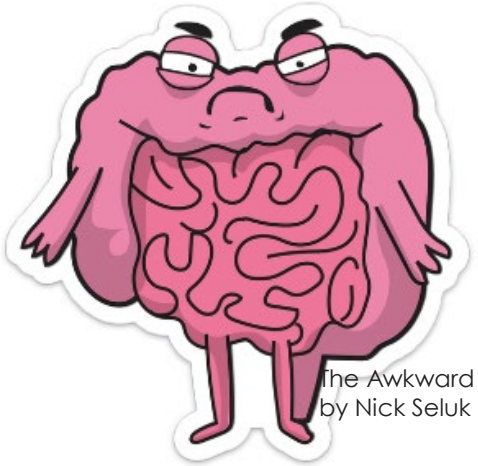
Encyst in tissue of paratenic host forming a **cystozoite**

Cystozoites do not directly cause disease in the paratenic hosts

+/- diarrhea

Pathogenesis: *Cystoisospora*





- <u>Pathogenesis</u>
- **Direct destruction of enterocytes (small intestines)**
  - destruction of epithelial lining (rare hemorrhagic ulcers)
  - villus atrophy
  - malabsorption
  - ↑ permeability, loss of fluids +/- blood
  - immune response causes hyper-secretion

villus atrophy

Clinical Disease: *Cystoisospora*

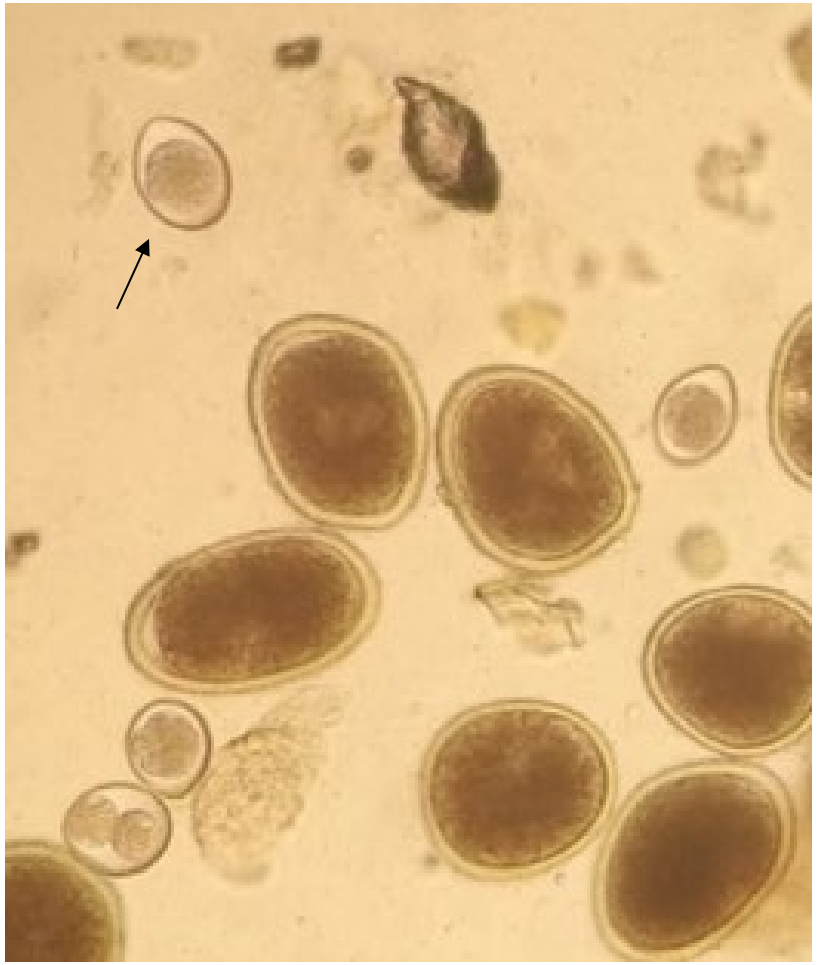
- **Mild to moderate diarrhea**
  - loose, mucoid, sometimes watery
  - sometimes bloody (rare)
- **Most often reported in nursing or recently weaned pets**
- Large infective dose of sporulated oocysts → worse clinical disease

Diagnosis: *Cystoisospora*

- Animal age and history
  - young? immune compromised? stress?

- **Fecal Float Centrifugation**
  - look for unsporulated oocysts in fresh sample
  - sporulated oocysts in older sample
  - Diarrhea may occur prior to oocyst excretion (prepatent period)
  - May need to differentiate between *Eimeria* (coprophagy) vs. *Cystoisospora*

- **PCR**



Treatment: *Cystoisospora*

Anticoccidials

- "Sulfa drugs" Sulfadimethoxine (Albon) -*static*
  - Albon®, Bactrovet®, or Tribrissen®
  - Efficacy against acute disease unclear

- Ponazuril (off label) -*cidal*
  - Toltrazuril sulfone®, Marquis®, Ponalrestat®
  - Studies indicate may be more effective

Give supportive therapy for symptoms

Once infected, have immunity against that species

Control: *Cystoisospora*

- **Sanitation**
  - Sporulated oocysts are resistant, can survive (year) in moist, protected environments
  - Susceptible to freezing or extremely high temperatures; ammonia solution
- **Prevent access to paratenic hosts**
  - Mainly rodents
- **Good nutrition important**
- **Keep Stress Low**

Epidemiology: *Cystoisospora*

Ubiquitous

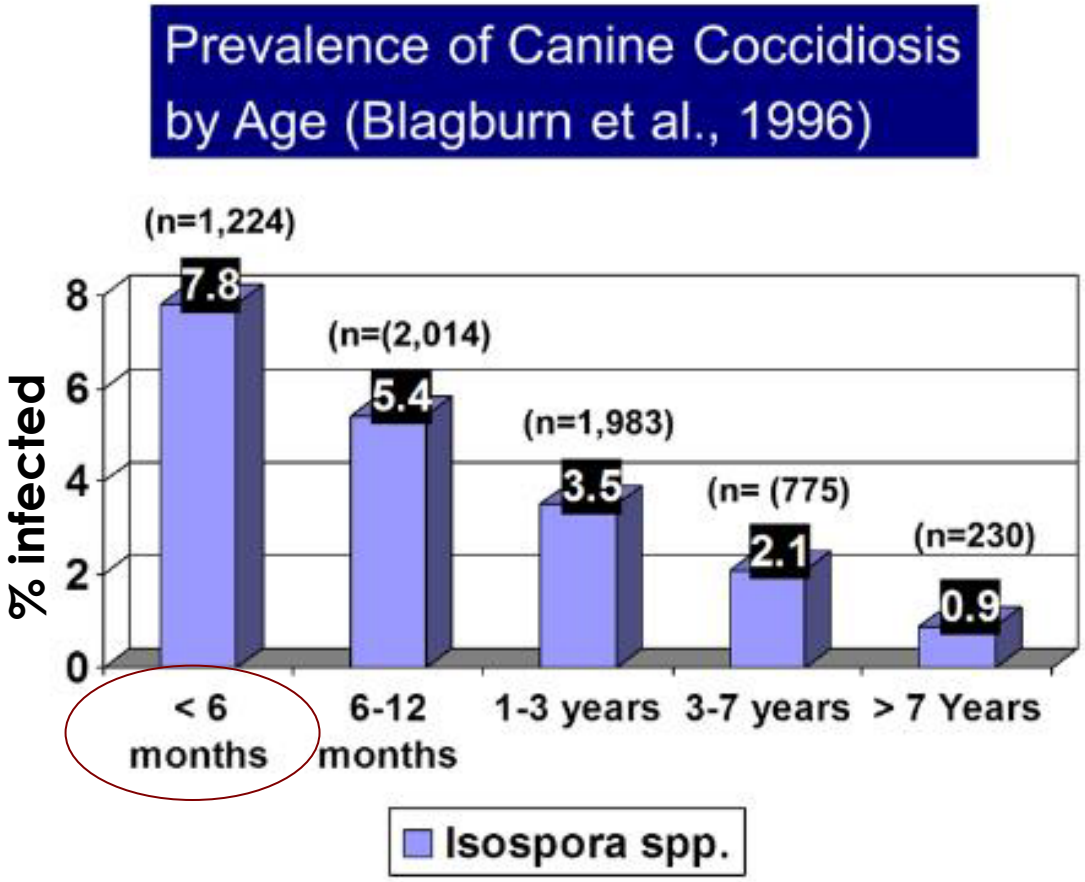
Very host specific, not zoonotic

Host risk factors

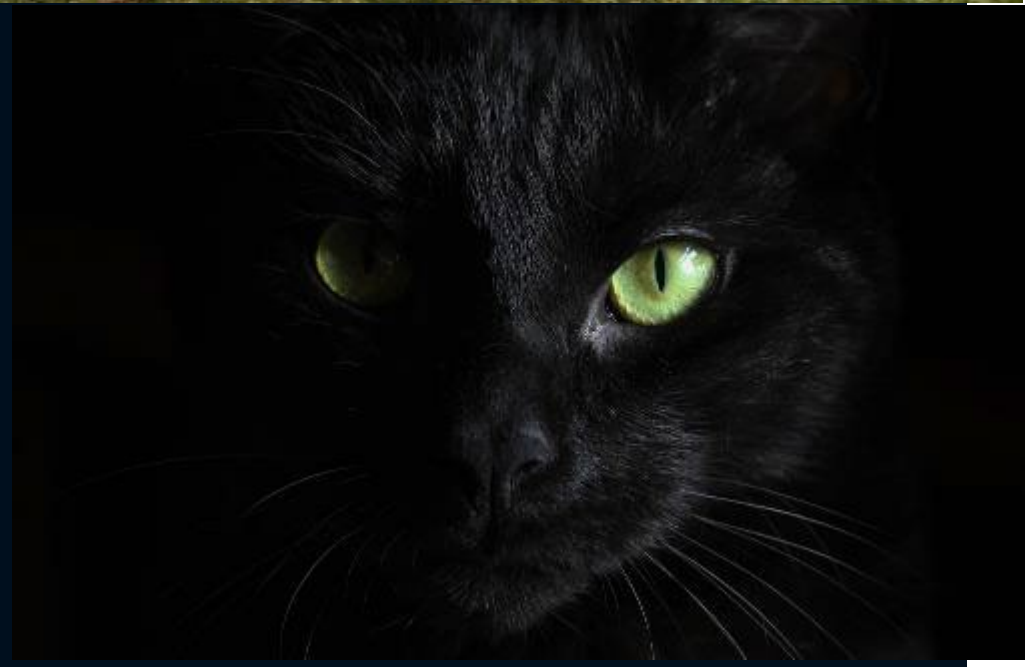
- **Immunodeficient: young, stressed, poor nutrition**

Environmental risk factors

- **Moist, unsanitary conditions**
- **Overcrowded**
- **Access to paratenic hosts** (mostly rodents)



Host species and Pathogenic *Cystoisospora spp.*



Canine *Cystoisospora*

Puppy Diarrhea!

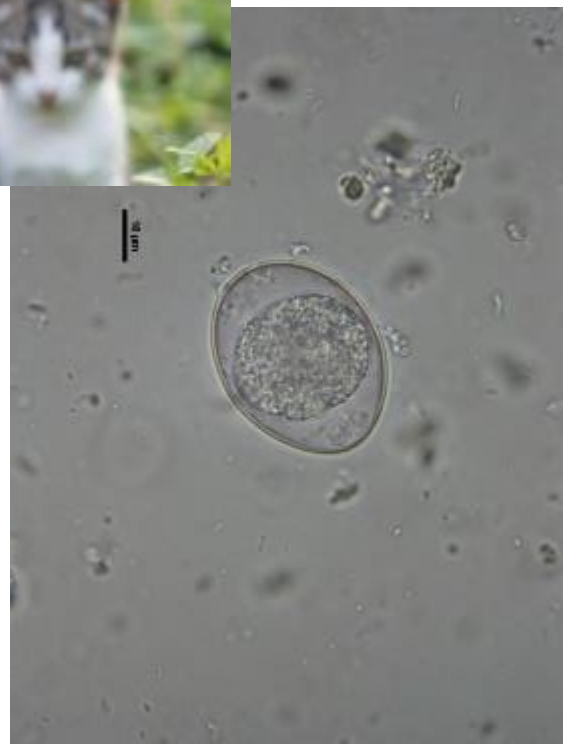
copious, watery, may persist for weeks (small bowel diarrhea)

- *Cystoisospora canis*
  - Large, oval oocyst
  - Low pathogenicity in adult dogs
- *C. ohioensis*
  - Small-medium size, spherical oocyst
  - +/- diarrhea

Feline *Cystoisospora*

Kitten Diarrhea!
Small-bowel diarrhea

- *Cystoisospora felis*
  - Large, oval oocyst,
  - +/- pathogenic for kittens



- *C. rivolta*
  - Small-medium spherical oocyst
  - small bowel diarrhea in **newborn kittens**

Large or Small bowel diarrhea?

Cystoisopora

Characteristic	Small Bowel	Large Bowel
Frequency	1-2/day	Multiple
Volume	Large	Usually small
Melena	Yes	No
frank Blood/mucus	No	Yes
Tenesmus	No	Yes
Weight loss	+/-	Rare
Vomiting	+/-	No

Tritrichomonas?

Giardia?

Susan Little, DVM, DABVP (Feline Practice)

VETVINE

Porcine *Cystoisospora*

Piglets

Cystoisospora suis

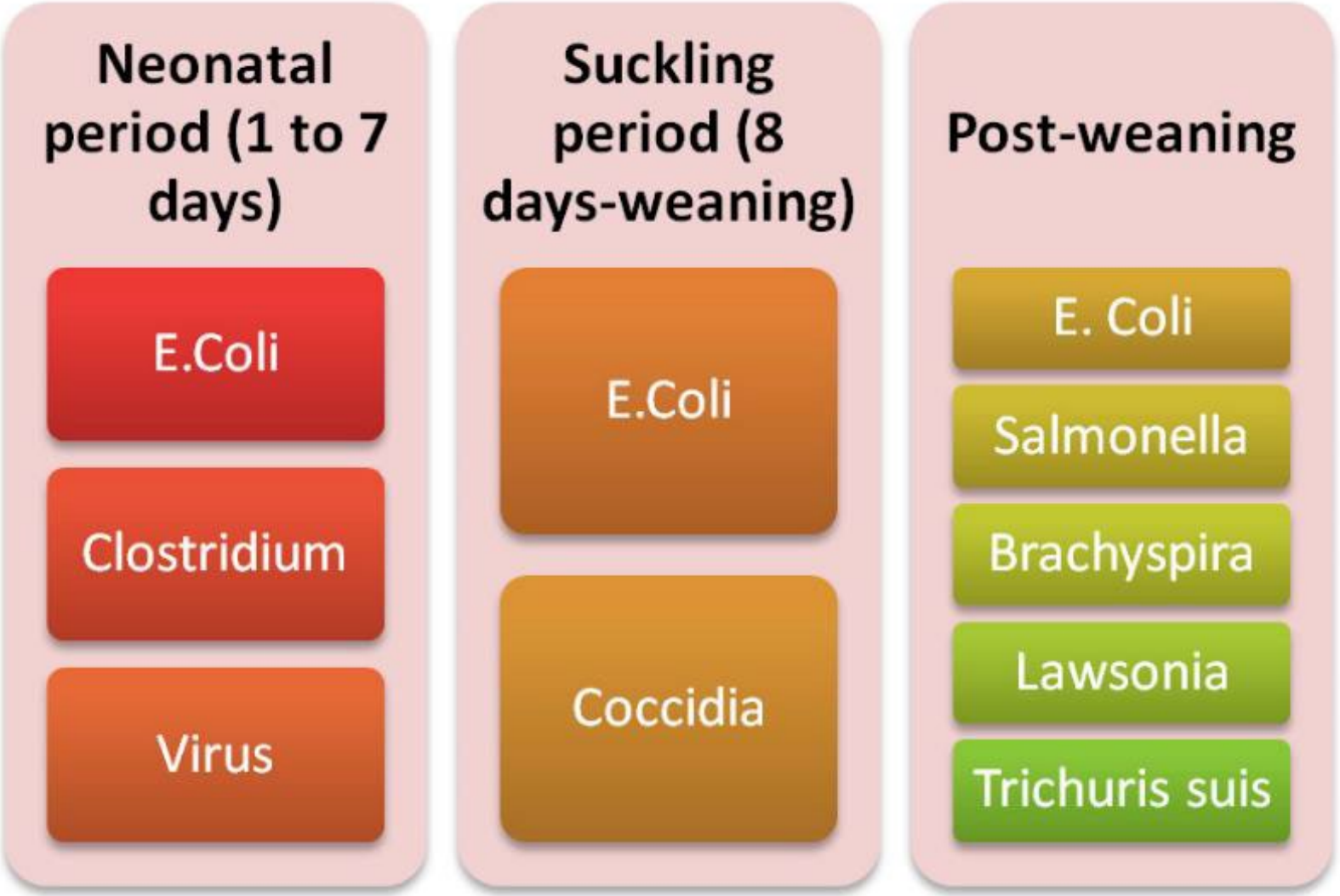
- Direct life cycle –NO Facultative Cycle
- **Pre-weaning 1-2-week-old suckling piglets**

(sometimes post-weening)

- Non-hemorrhagic diarrhea, dehydration, weight loss (SI infection)
- **High morbidity, Low mortality; very short course of disease (~4 days)**
- **Impaired growth, economic loss**
- As piglet gets older, ↓susceptibility and pathology
- Immunity is complete against reinfection

Piglet Scours

Important to distinguish b/w coccidiosis, viral or bacterial diseases

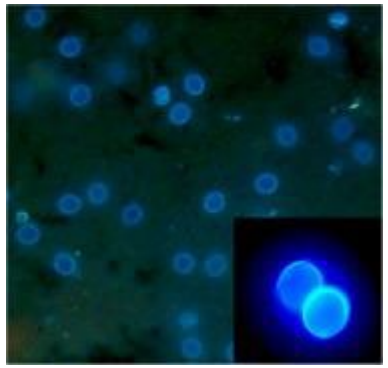


FYI: other specific infectious agents

Cystoisospora suis

Won't see *C. suis* clinical signs before 6 days of age…WHY??

Porcine *Cystoisospora*



Diagnose

- **Diagnose with fecal float**, histopathology, stained fecal smears, autofluorescence microscopy, PCR
  - Test multiple sample days (sporadic shedding)
  - 8 *Eimeria* spp. so differentiate by oocyst morphology

Cystoisospora have **2 sporocysts / no polar cap**

Eimeria have 4 sporocysts / polar cap

Treatment/Control

- Coccidiostats have proven to be moslty ineffective
- Toltrazuril (ponazuril) treatment suppress oocyst excretion and improve piglet health
- **Rigorous sanitation with steam cleaning**; slatted floor (no porous flooring)

Cystoisospora Take Home Points

1. Direct Life Cycle or Facultative Indirect (transmission via poo or predation)
2. Direct destruction of the enterocytes causes diarrhea
3. Primarily disease of young, immunocompromised animals
4. On a fecal, oocysts with 2 sporocysts, no polar cap
5. Anticoccidials and supportive care
6. Prevention is key!
7. Very host specific (not zoonotic)

In-Class Discussion

A 6-month-old kitten is brought in with diarrhea

What are your top protozoal infectious differentials?

Name that Coccidian (genus) from a goat

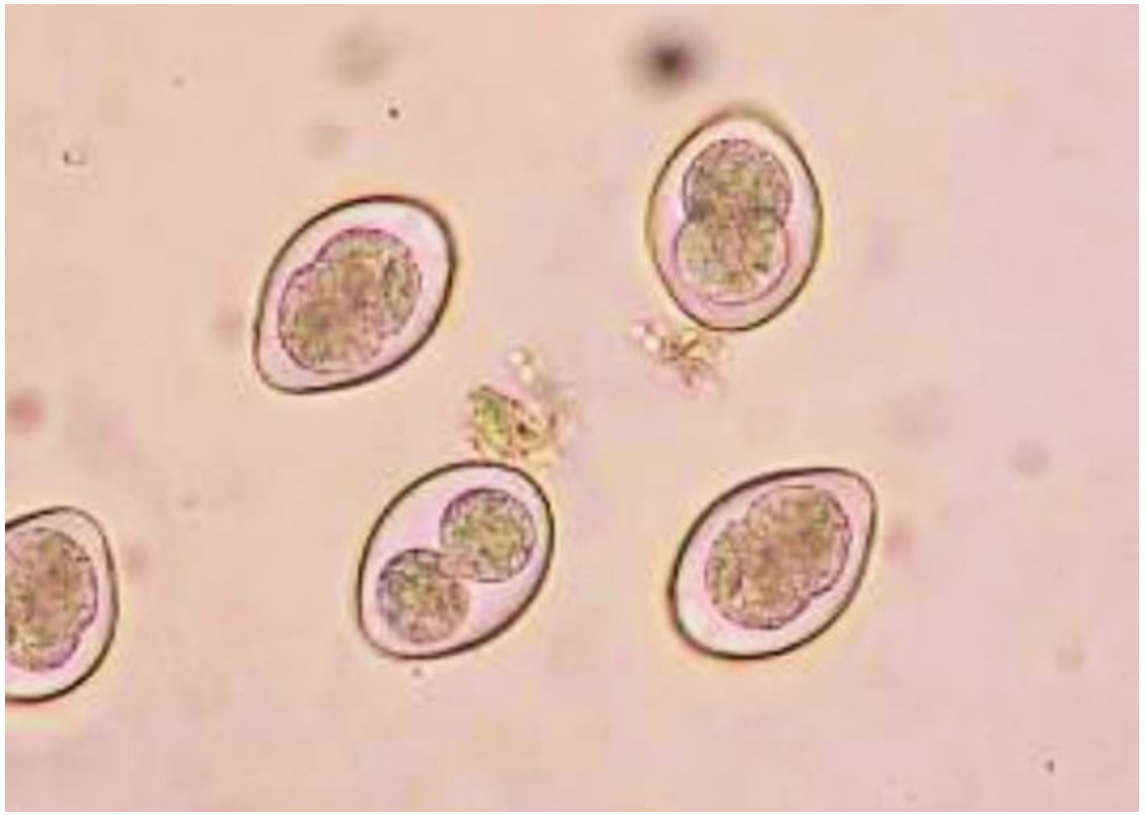
Is it infective?

Name that Coccidian (genus and species)

From young sheep with diarrhea that were just transported to a new state

Name that Coccidian (genus and species)

From Dog



Hint: it's big!

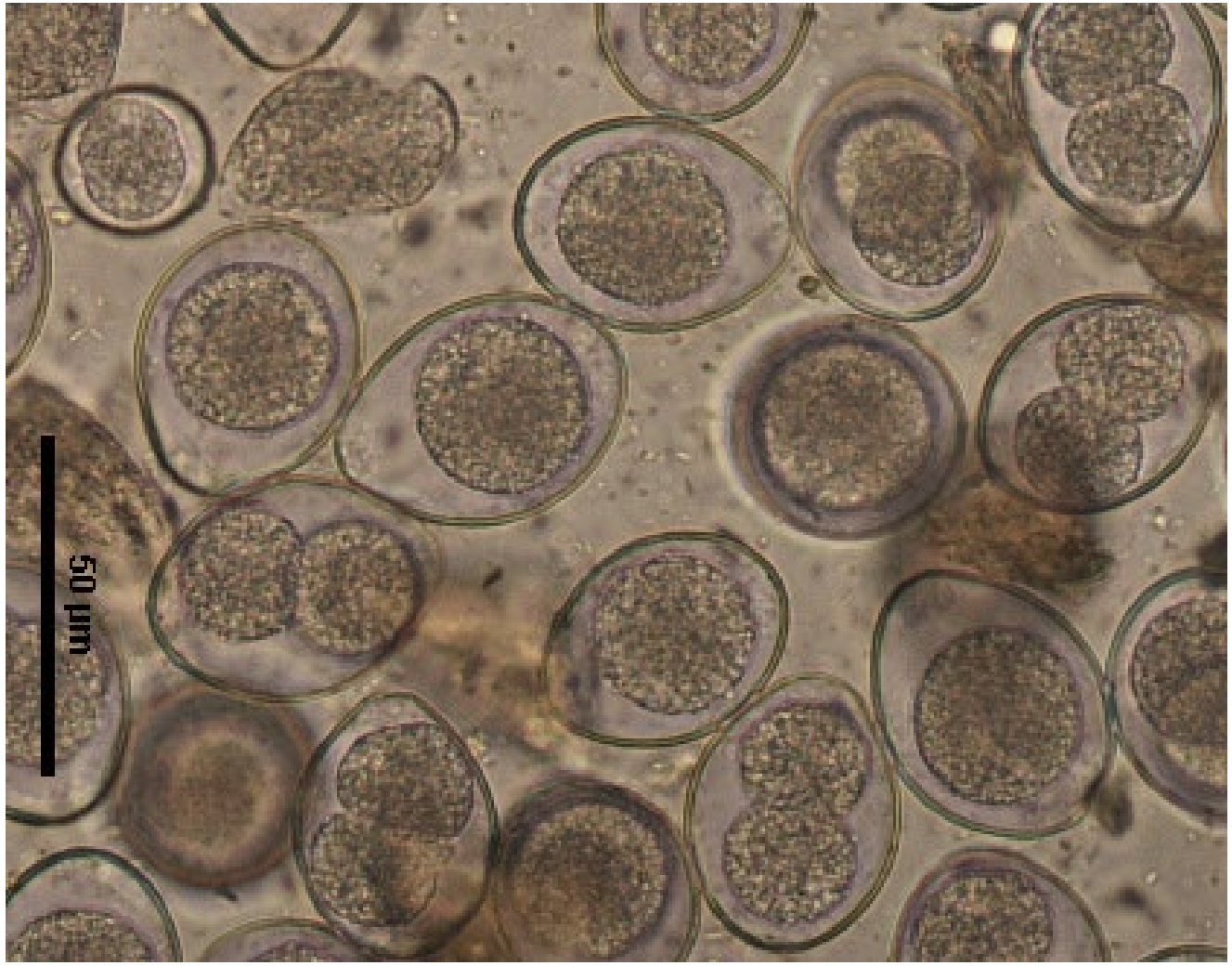
Name that Coccidian (Genus)

Fecal float from a calf

Hint: it's tiny!

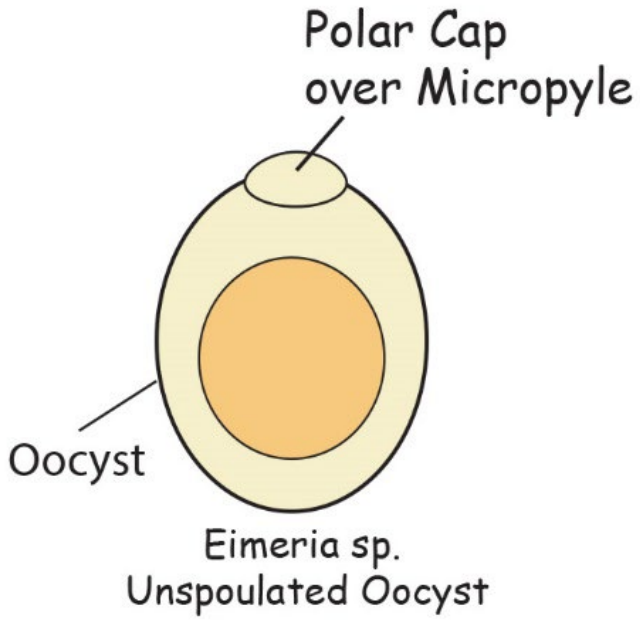
Name that Coccidian (genus and species)

From an older kitten



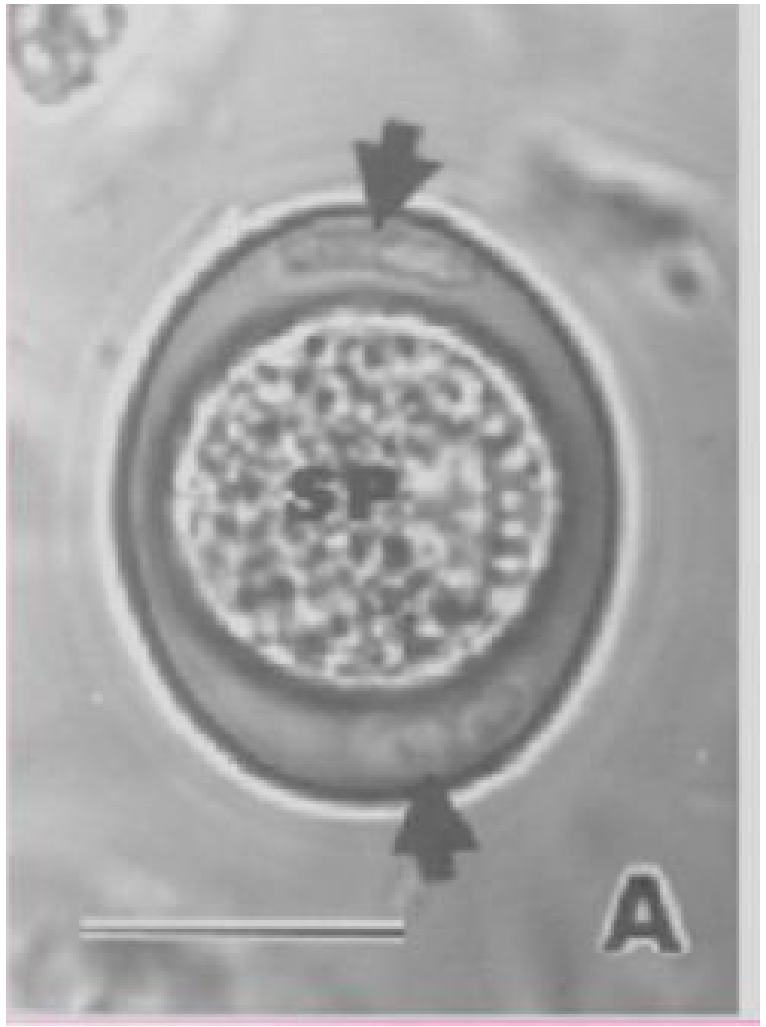
Name that Coccidian (genus)

From Cow



Name that Coccidian

From Piglet



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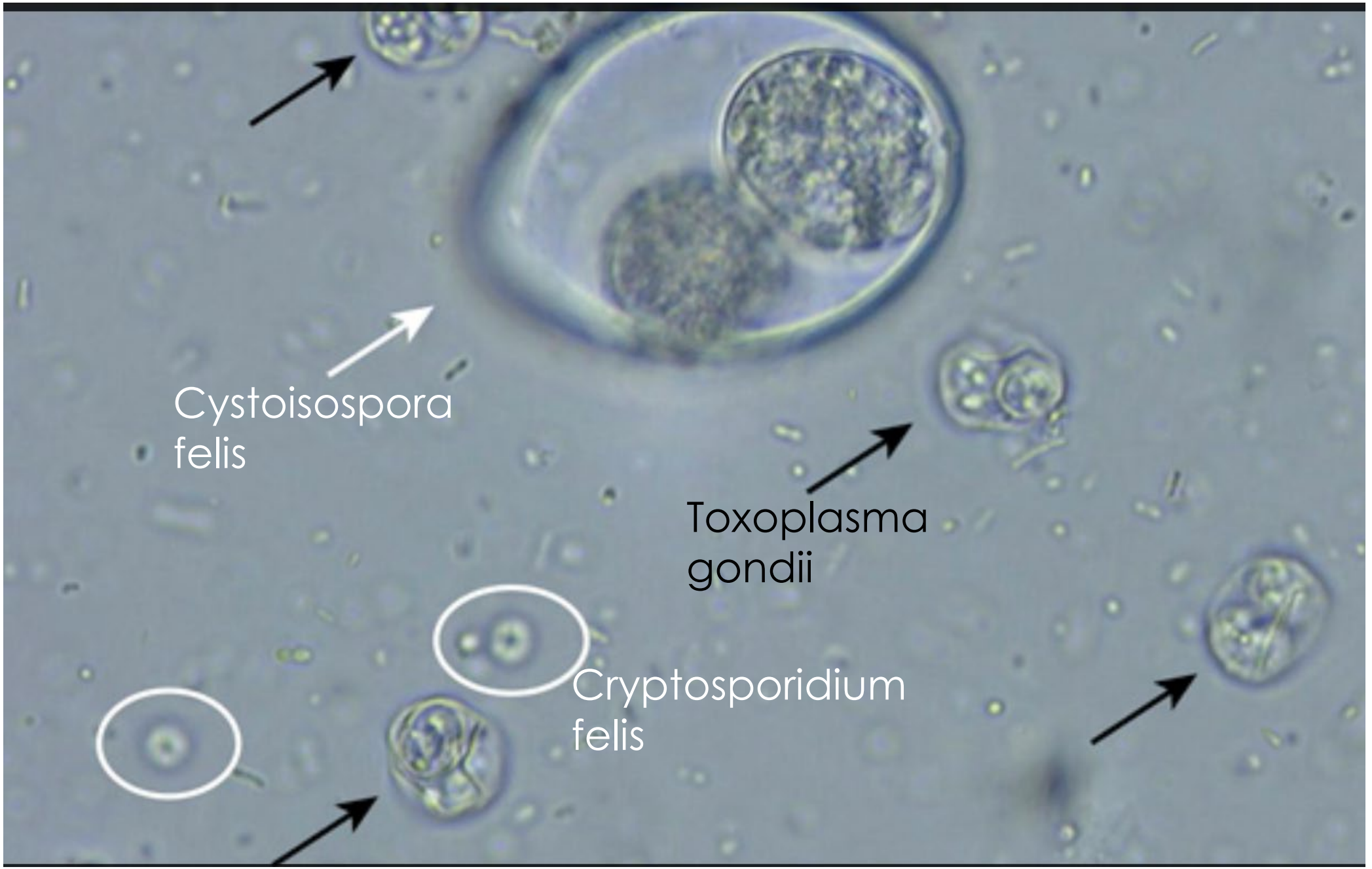
Cystoisospora felis
Toxoplasma gondii
Cryptosporidium felis

Have Questions?

baquroll@ncsu.edu

Illustration by Allie Brosh, http://hyperboleandahalf.blogspot.com/