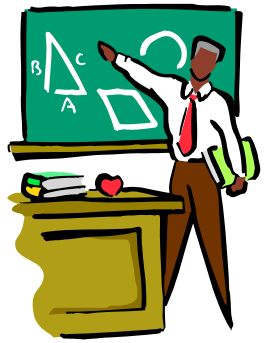
Protozoa 2
The plot thickens

BVM&S Parasitology

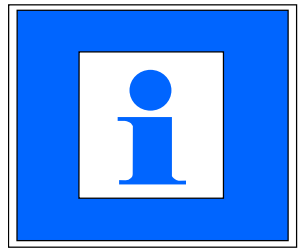
T.W.Jones

Lecture Outcomes



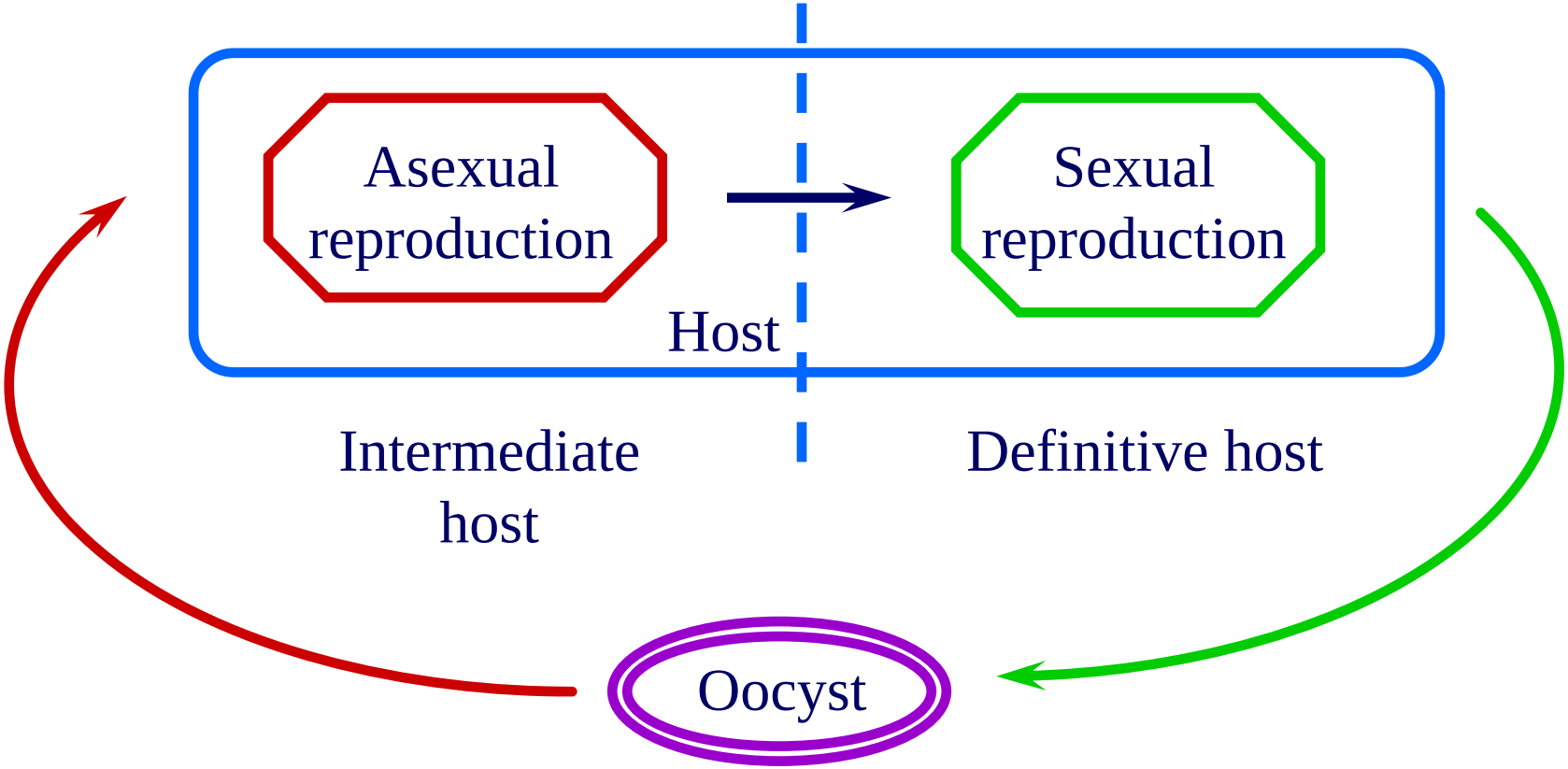
- Describe the characteristics of protozoa with indirect lifecycles in relation to their epidemiology, disease and control.
- Describe the characteristics of the lifecycles of protozoa featured in the lecture in relation to epidemiology, disease and control.
- Compare and contrast the characteristics of protozoa with direct life cycles and those with indirect life cycles.

Principal Characteristics



- All belong to the coccidia group
- Indirect life cycles
  - Definitive host - gut
  - Intermediate hosts – gut & tissues
- Based on herbivore-carnivore cycles

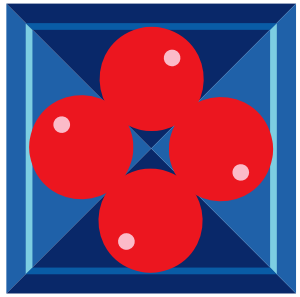
The life cycle – *a division of labour*



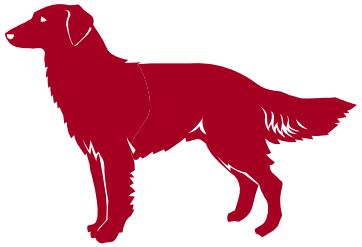
New stages to remember

- Asexual reproductive stages (int.& def. host)
  - Schizonts, merozoites
  - **Tachyzoites**
  - **Bradyzoites**
- Sexual reproductive stages (definitive host only)
  - Macrogametes,Microgametes
  - Oocysts
  - Sporocysts, sporozoites

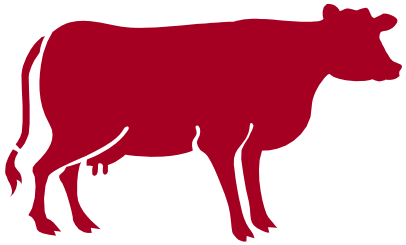
Which species are important for vets?



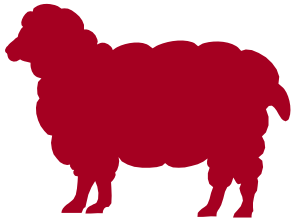
- *Sarcocystis sp*
  - Definitive host = cat or dog
  - Intermediate host = herbivore/omnivore
- *Toxoplasma gondii*
  - Definitive host =cat
  - Intermediate host = mouse
- *Neospora caninum*
  - Definitive host = dog
  - Intermediate host = cattle, sheep, horses, goats

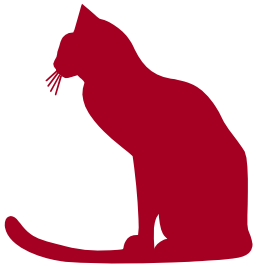


Sarcocystis sp.

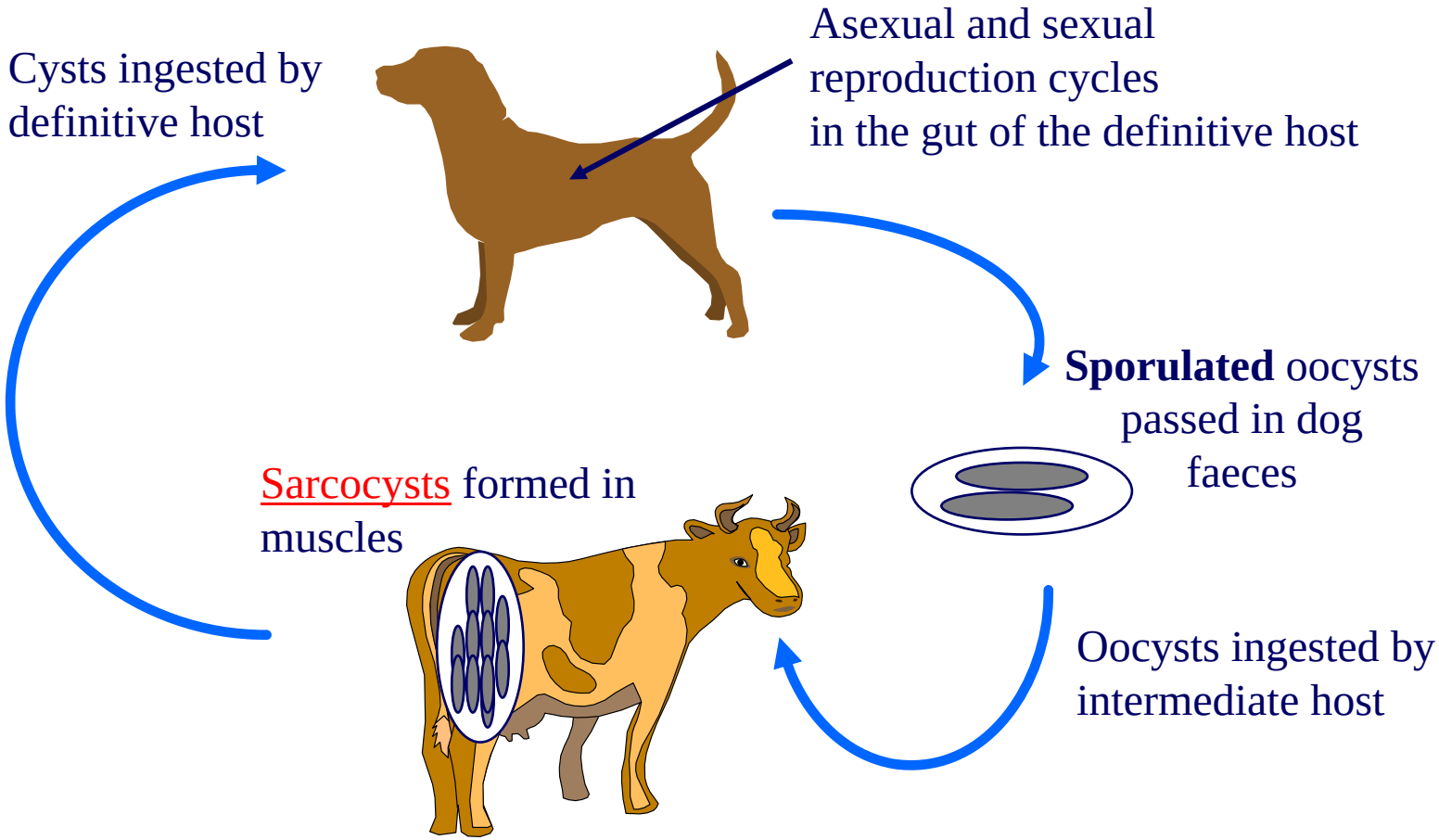


- Highly host-specific combinations e.g.
  - Cattle:dog = *S.bovicanis (syn S.cruzi).*
  - Sheep:dog = *S.ovicanis* (*syn. S.tenella*).
  - Cattle:human = *S.bovihominis.*



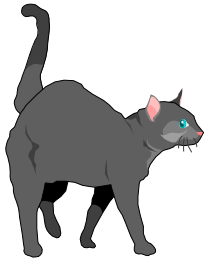


Sarcocystis life-cycle



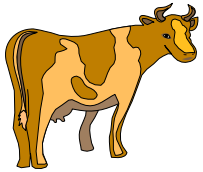
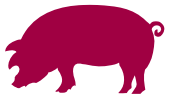
Equine Protozoal Myeloencephalitis (EPM)

- Recognised in 1995 as neurological problem in horses in USA causing caudal ataxia and weakness.
- Caused by *Sarcocystis neurona syn S.falcatula.*
- Sarcocysts develop in CNS.
- Natural cycle opossum<>birds/skunk/armadillo; Horse is accidental or “dead-end” host.

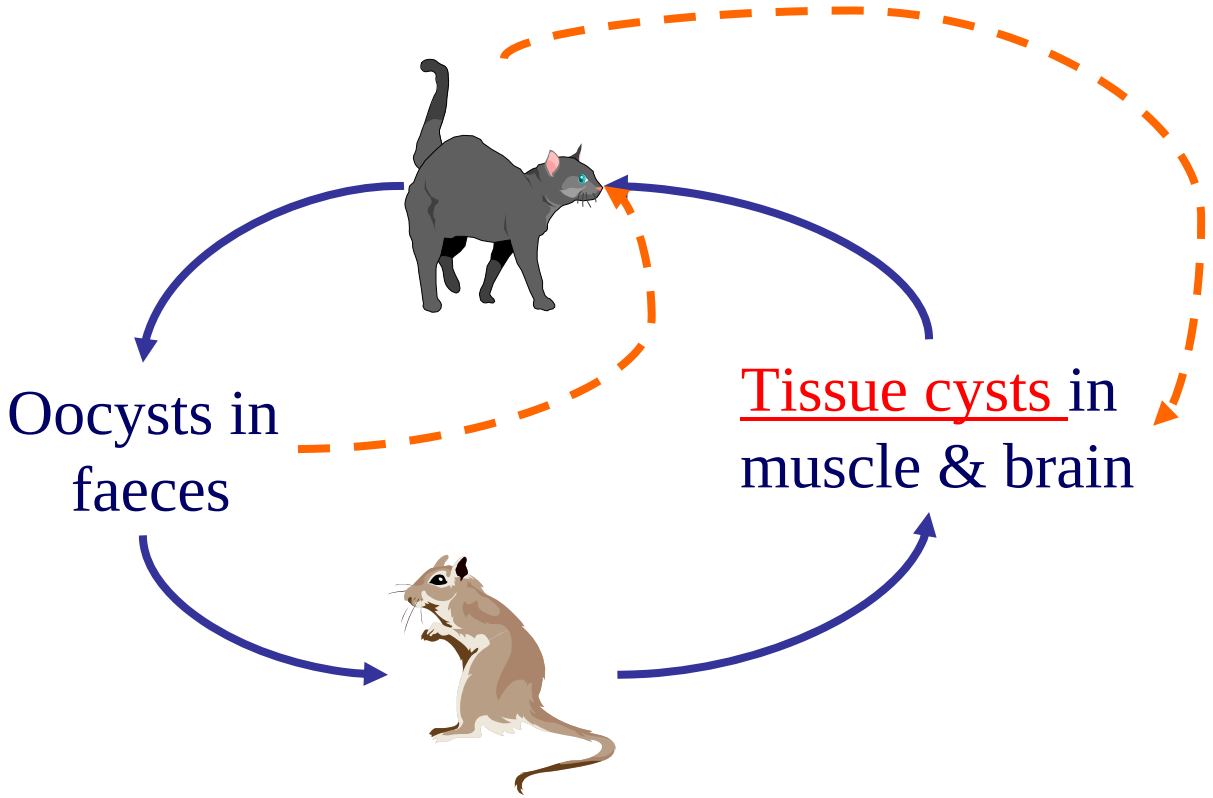


Toxoplasma gondii

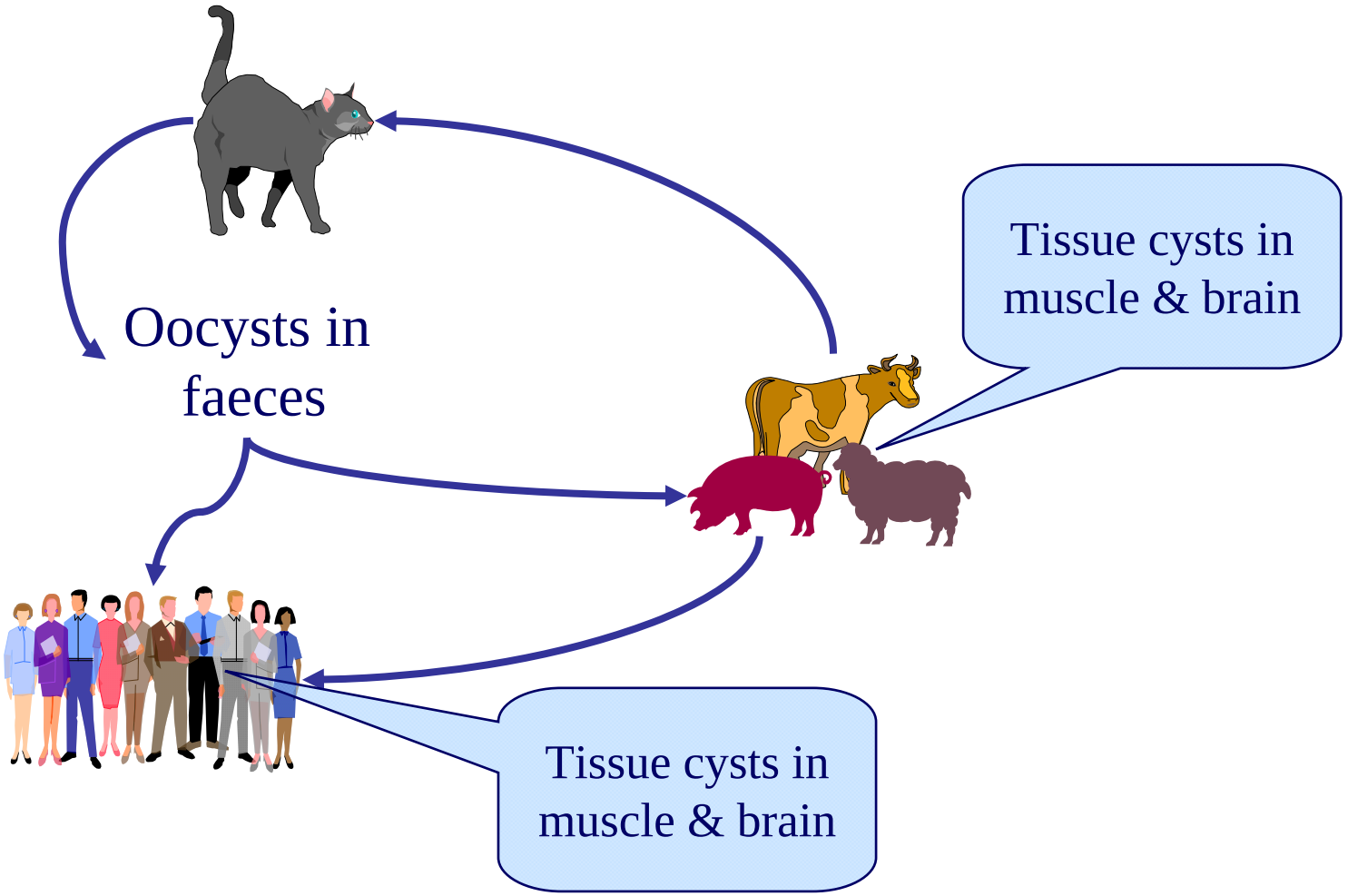
- Natural cycle is cat-mouse
- Can infect a wide range of hosts including humans
- Facultative heteroxenous parasite
- Tissue migratory phase and bradyzoite formation takes place in both definitive and intermediate host

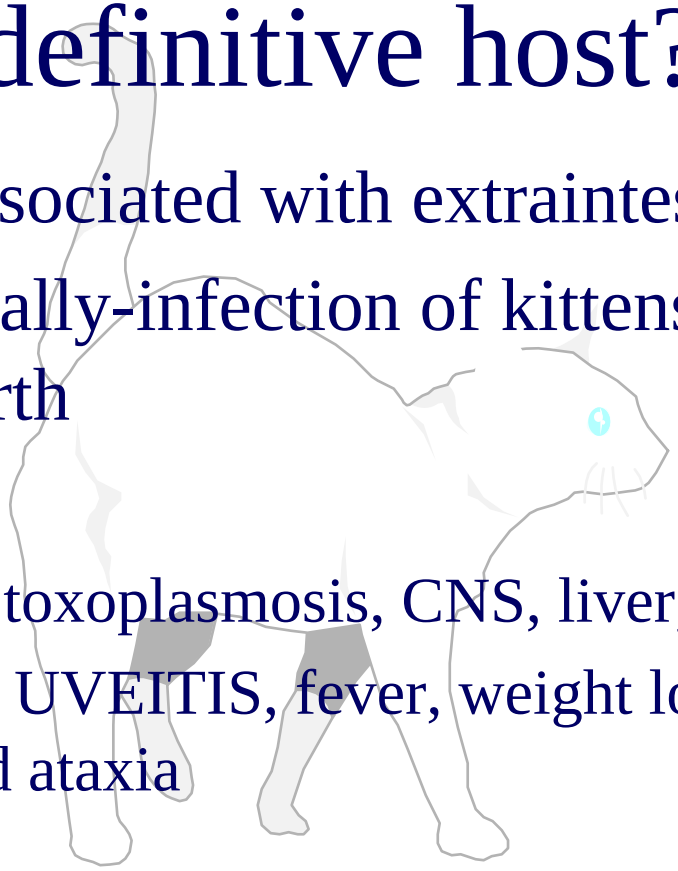
Toxoplasma – the natural cycle



Toxoplasma – accidental hosts



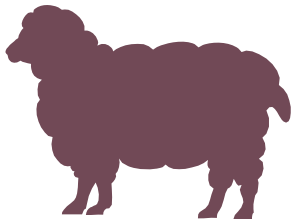
How does *Toxoplasma* affect the definitive host?



- Pathology associated with extraintestinal stages
- Transplacentally-infection of kittens often die soon after birth
- Adults
  - Fatal feline toxoplasmosis, CNS, liver, kidney
  - Sub-lethal - UVEITIS, fever, weight loss, anorexia, seizures and ataxia

What are the important features of ovine toxoplasmosis?

- Important cause of abortion in ewes and perinatal death in lambs.
- Infection early in gestation (<55 days).
  - Death and expulsion of the foetus.
- Infection in mid-gestation.
  - Abortion with white lesions on foetus and placenta.
  - Mummification of foetus.
  - Still-born or born very weak lambs.



How can we control ovine toxoplasmosis?

- Exclude cats from animal feedstuff stores.
- Sheep that abort following *T.gondii* infection usually lamb normally in subsequent years.
- Mix replacement sheep with existing flocks before mating
- Vaccination of uninfected animals with - live tachyzoites

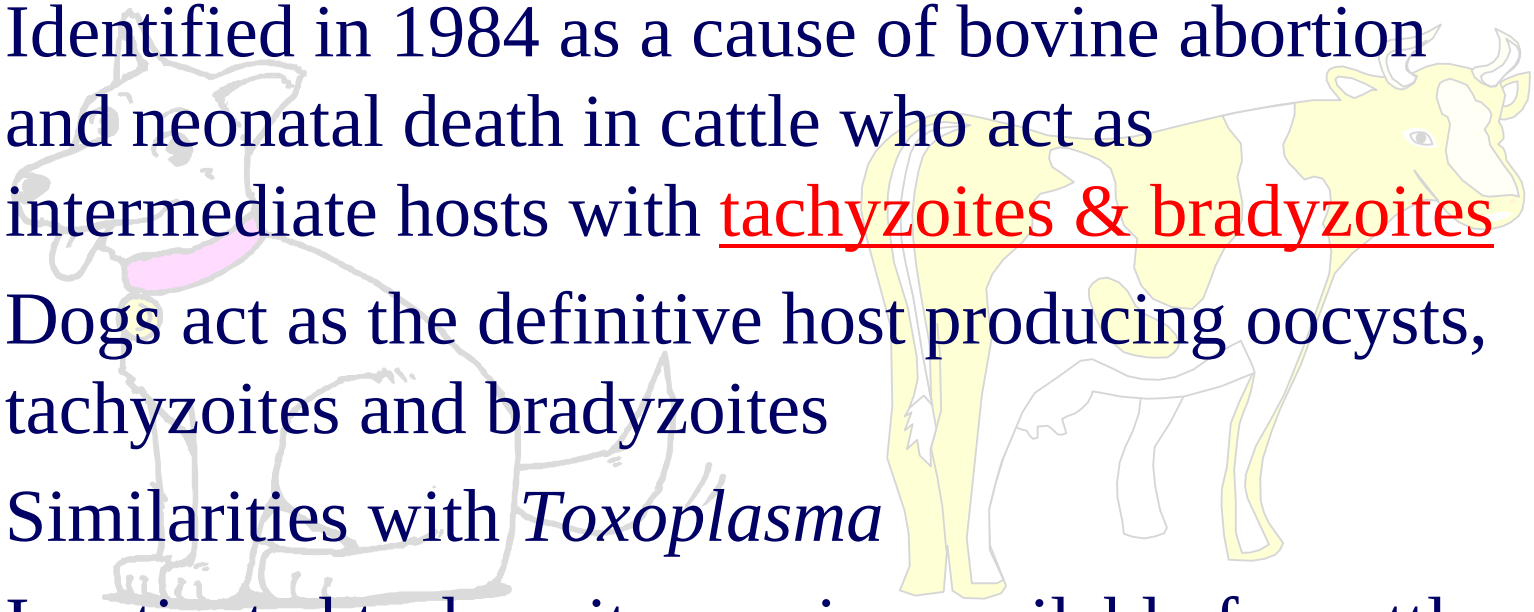
Why is human toxoplasmosis important?

- Congenital infection
  - Infection acquired during pregnancy
  - Infection re-activated during pregnancy
- Immunosupressed individuals
  - Transplant recipients
  - AIDS

How can we control human toxoplasmosis?

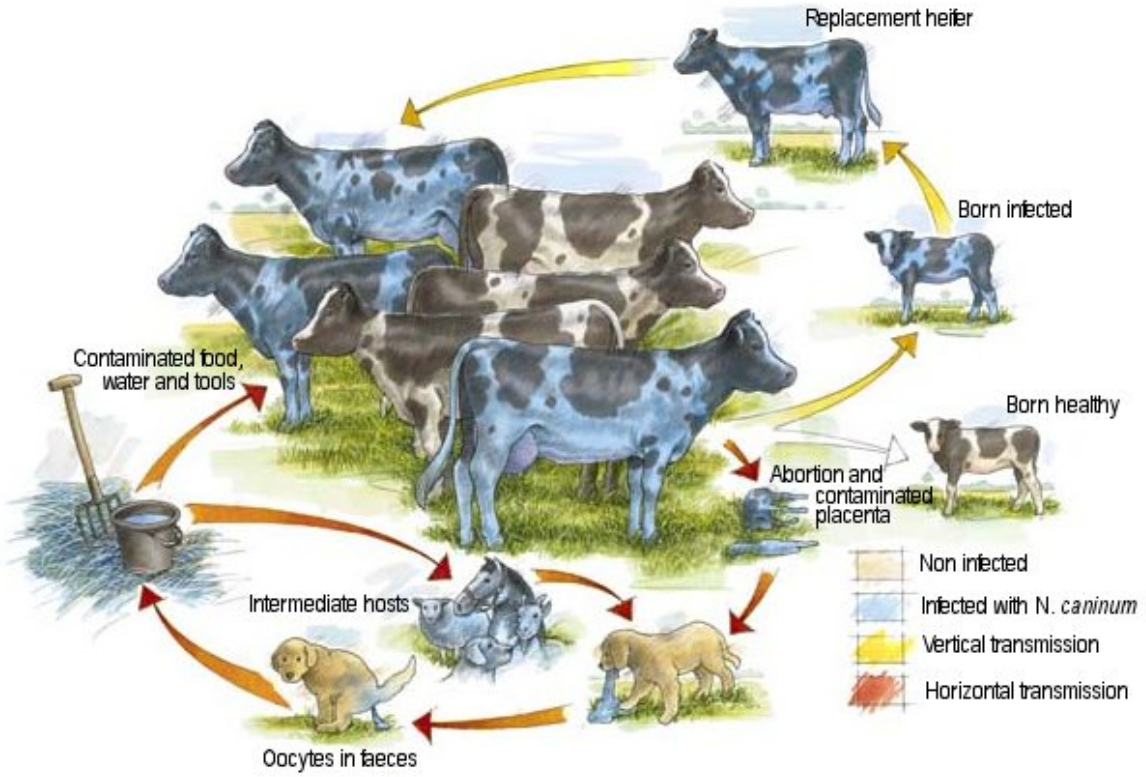
- Hygienic handling and disposal of cat faeces, esp. by pregnant women
- Don’t feed raw meat to cats
- Thorough cooking of meat products esp of sheep origin
- Vaccine on the way?

Neospora caninum



- Identified in 1984 as a cause of bovine abortion and neonatal death in cattle who act as intermediate hosts with tachyzoites & bradyzoites
- Dogs act as the definitive host producing oocysts, tachyzoites and bradyzoites
- Similarities with *Toxoplasma*
- Inactivated tachyzoite vaccine available for cattle in USA – Bovilis Neoguard™

Neospora life cycle



http://www.neosporosis.com/Life-cycle-image.asp

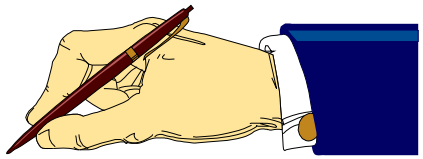
Transplacental transmission of Neospora

- Exogenous – infections resulting from ingestion of infective forms
  - Cattle – oocysts
  - Dogs – bradyzoites or tachyzoites
- Endogenous – infections resulting from reactivation of bradyzoites during pregnancy
  - Cattle – principal route of infection
  - Dogs - ?

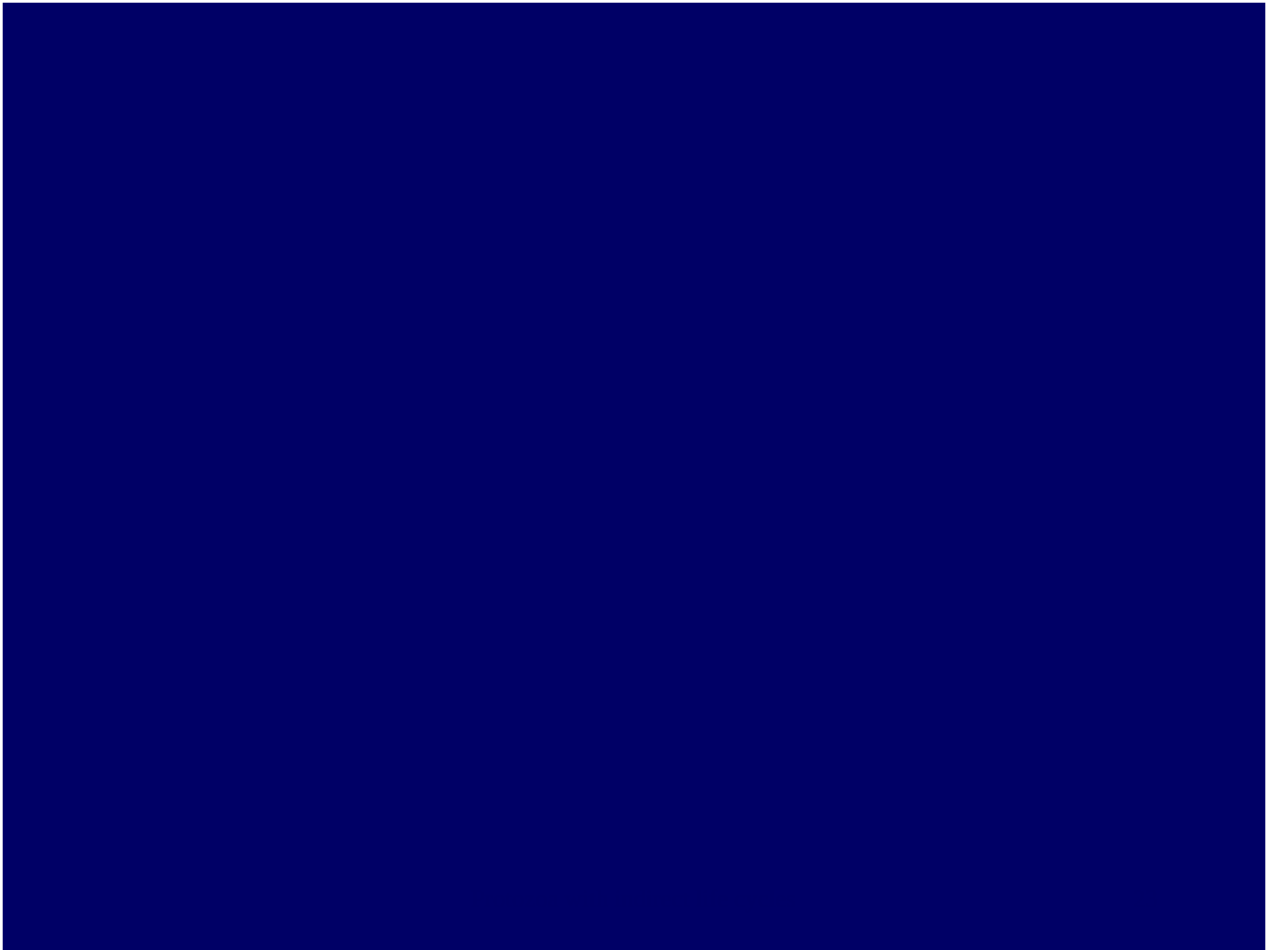
Toxoplasma vs Neospora

Property	Toxoplasma	Neospora
Definitive host	Cat	Dog
Int. host	Mouse	Cattle
Other hosts	Horses, cattle, sheep, birds, humans…	Horses, sheep, goats…..
Exogenous TPT	Cats (bradyzoites), Mice (oocysts), sheep (oocysts), humans (oocysts& bradyzoites)	Dogs (bradyzoites), cattle, sheep etc (oocysts)
Endogenous TPT	Unusual – humans & cats	Cattle – principal means of transmission, Dogs?
Importance	Abortion in sheep Human birth defects	Abortion in cattle Paralysis in dogs

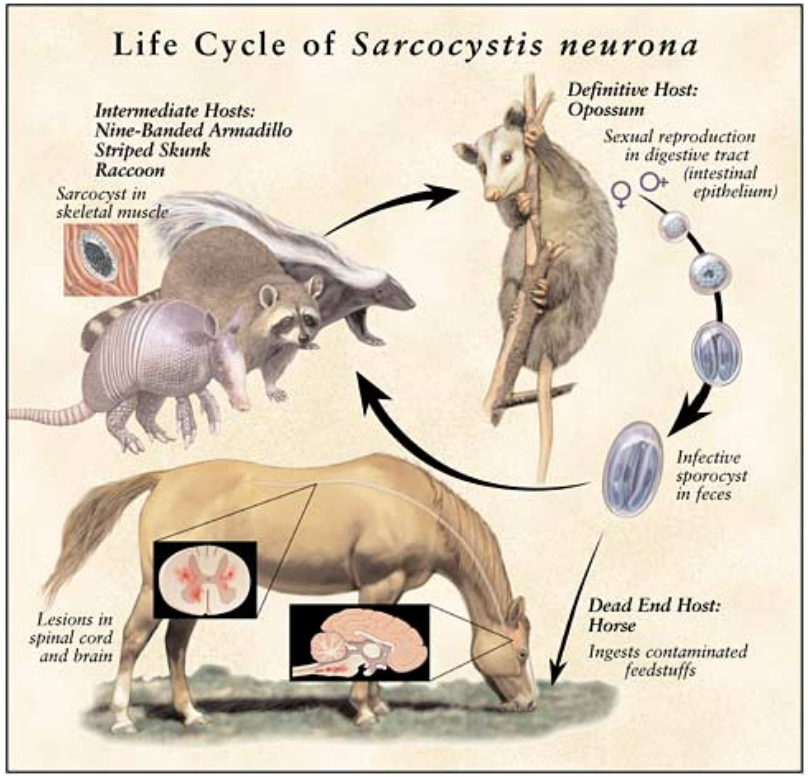
Summary



- Herbivore: carnivore cycles.
- Distinct cycles of development in the different host types.
  - **Definitive host -** principally sexual reproduction in the gut with oocyst production.
  - **Intermediate host -** asexual reproduction with tissue migration and cyst formation.

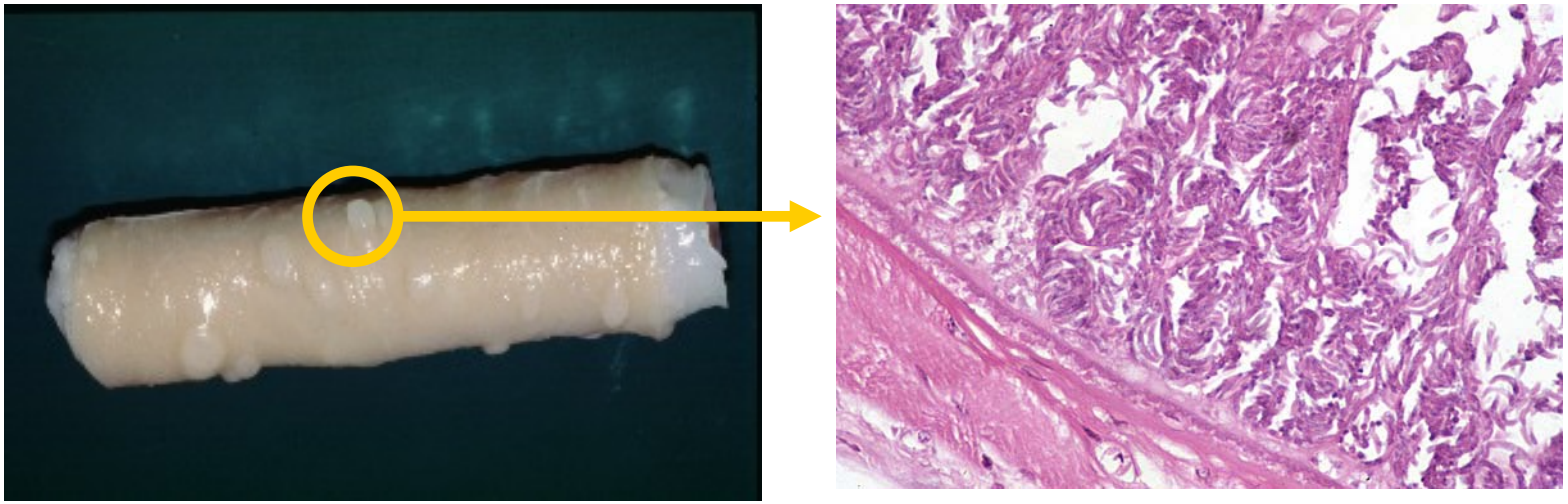


Sarcocystis neurona

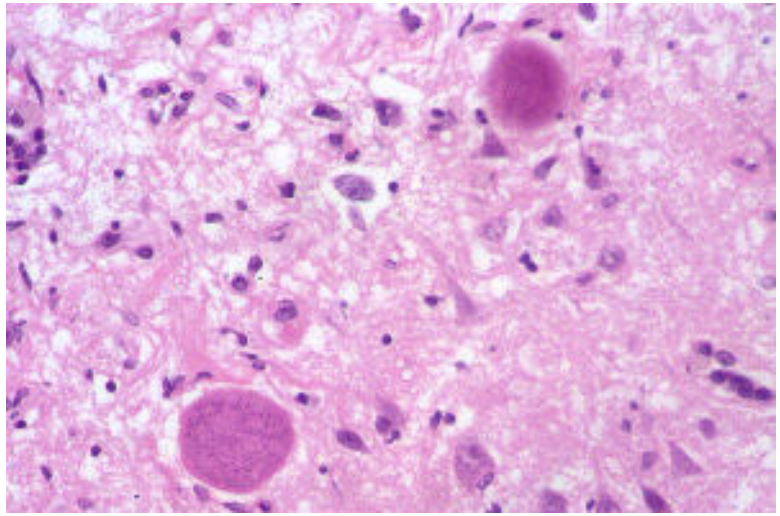


http://www.yourhorseshealth.com/epm/index.html

Sarcocysts in sheep oesophagus



Toxoplasma

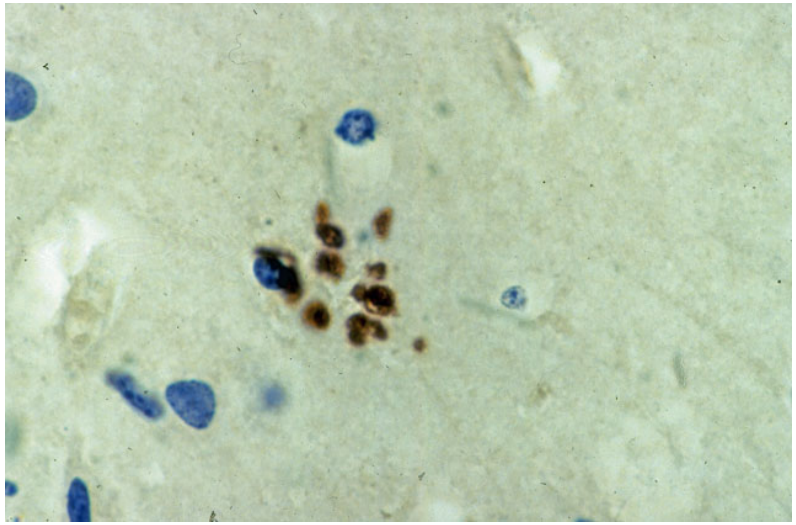


Tissue cysts

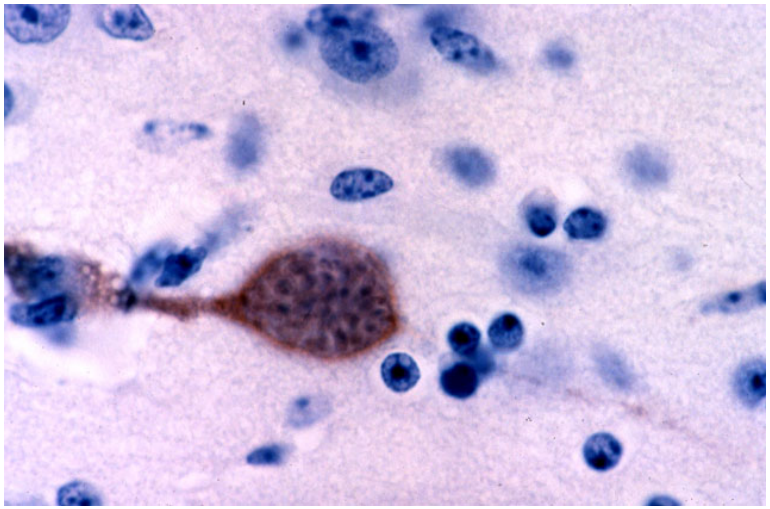
Toxoplasma in sheep

Infected placenta

Neospora in cattle



Tachyzoites



Bradyzoite cyst