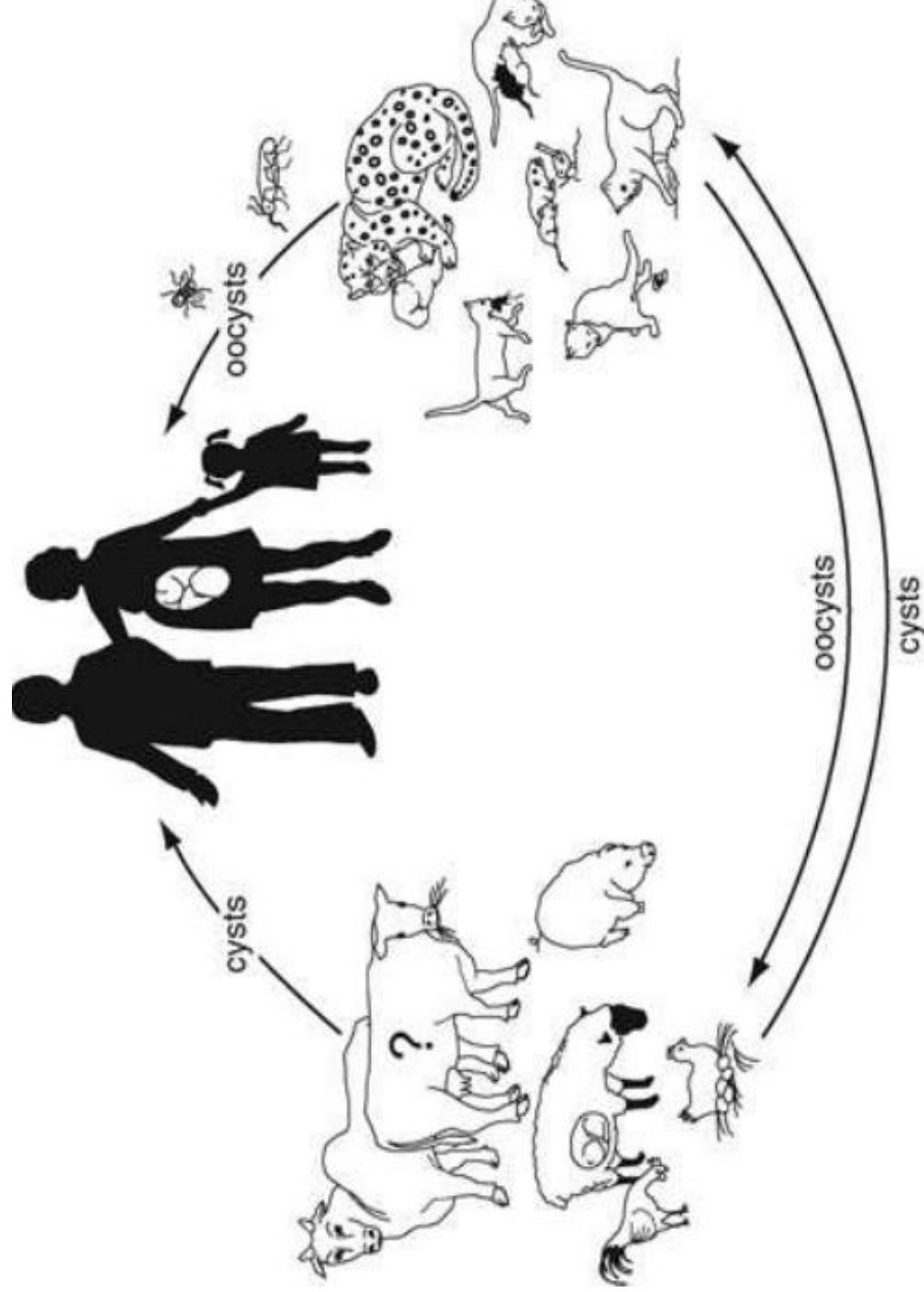


Toxoplasmosis



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- *Toxoplasma gondii* was first discovered in 1908 by Nicolle and Manceaux, in Tunisia, on a Gundi (*Ctenodactylus gundi*).
- It wasn't until 1939 that Wolf, Cowen and Paige were to conclude that *Toxoplasma gondii* had an effect on humans.

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- Protozoal disease caused by *Toxoplasma gondii* is a protozoan parasite that infects people and other warm-blooded animals, including birds and marine mammals.
- Cats are only known definitive hosts.
- Animals and man I.M hosts asexual proliferation

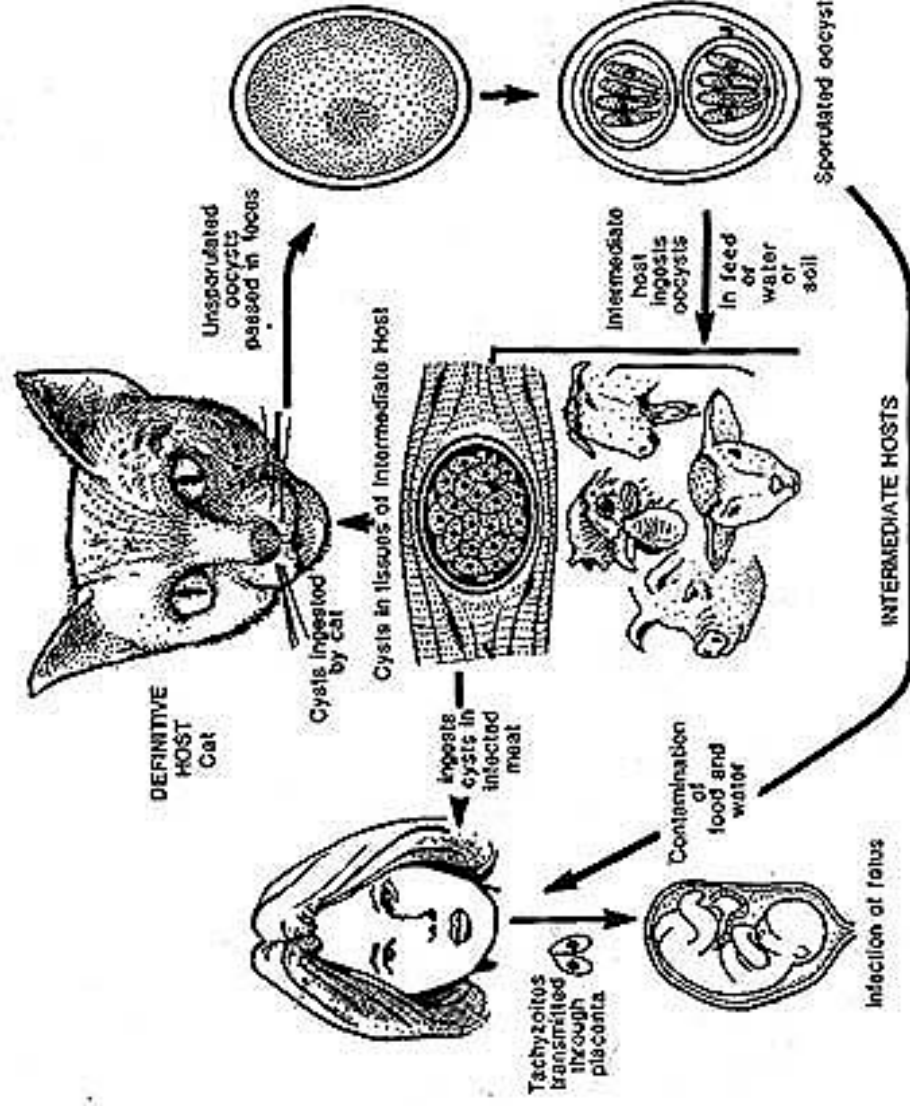
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Etiology

- *Toxoplasma gondii*, an obligate intracellular protozoan parasite
 - Sexual and asexual life cycle
 - Sexual phase intestinal cells cats
 - Asexual phase I.M (man & animal)
 - It requires more than one host species to complete its lifecycle
 - It is primarily an intestinal parasite in cats and has a wide host of intermediate hosts including sheep and mice.
 - One cat shedding oocysts can provide enough contamination to infect an entire flock of sheep
-
- The parasite has got affinity for epithelial, reticuloendothelial and blood cells. The organism could be grown in monolayer of lamb testicular cells

- It develops through three basic life forms:
 - **Oocyst (sporozoite)**
 - Double layered egg found in the feces of young cats that survives for long periods
 - **Tachyzoite**
 - Rapidly multiplying tiny parasite found in different cells of the body and the cells burst releasing it into the **bloodstream**
 - **Bradyzoite (tissue cyst)**
 - Dormant stage found in cysts of the muscle, nervous tissue and placenta
 - Unique stage is found in the **feline** family
 - The cat becomes infected from eating oocysts or an animal cyst containing bradyzoites. The parasite invades the intestines , mate and produce millions of offspring. The offspring are then excreted as **immature oocysts** in the feces

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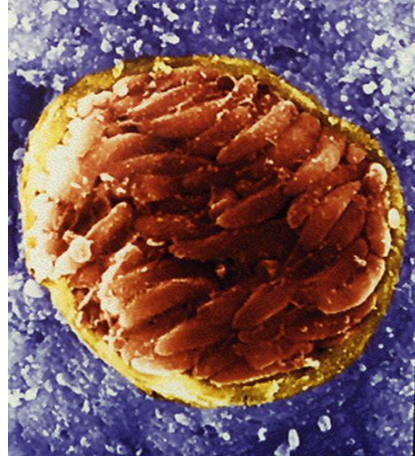
Life cycle of *Toxoplasma gondii*.

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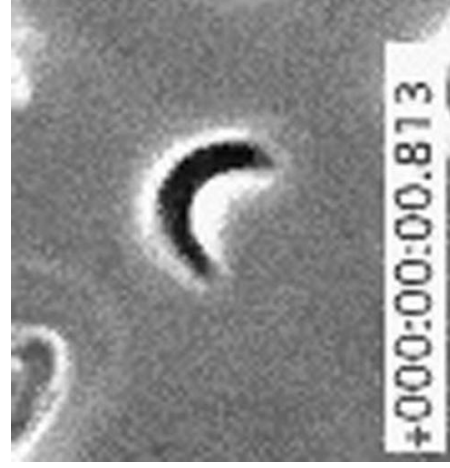
- There are three forms of *Toxoplasma gondii*



Tachyzoite – Rapidly reproducing form



Bradyzoite – A slower reproducing form, contained in tissue

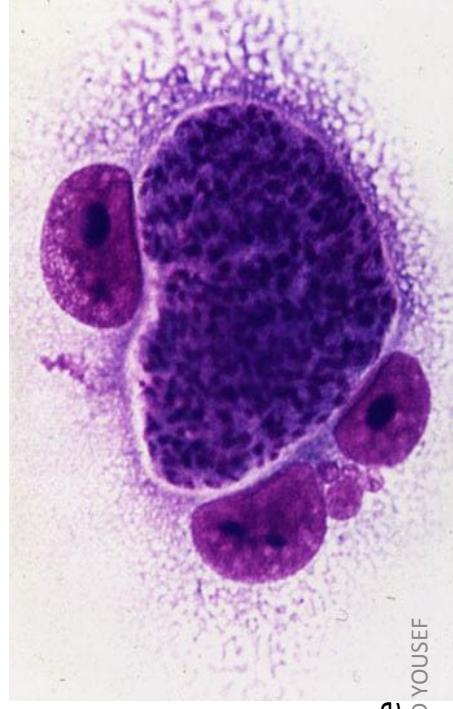


Sporozoite – Contained in oocysts

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Tachyzoite

- Tachyzoites invade cells in the body in order to multiply. They invade a cell, multiply themselves, destroy the cell, and this releases more tachyzoites to infect other cells.
- Tachyzoites are seen in many tissues and organs throughout an infected body during the acute phase of the disease.
- The **acute phase** is also called the **extraintestinal** phase because it can effect cells outside the intestines.
- **Only cats show the intestinal phase of the infection.**



Stained tachyzoite

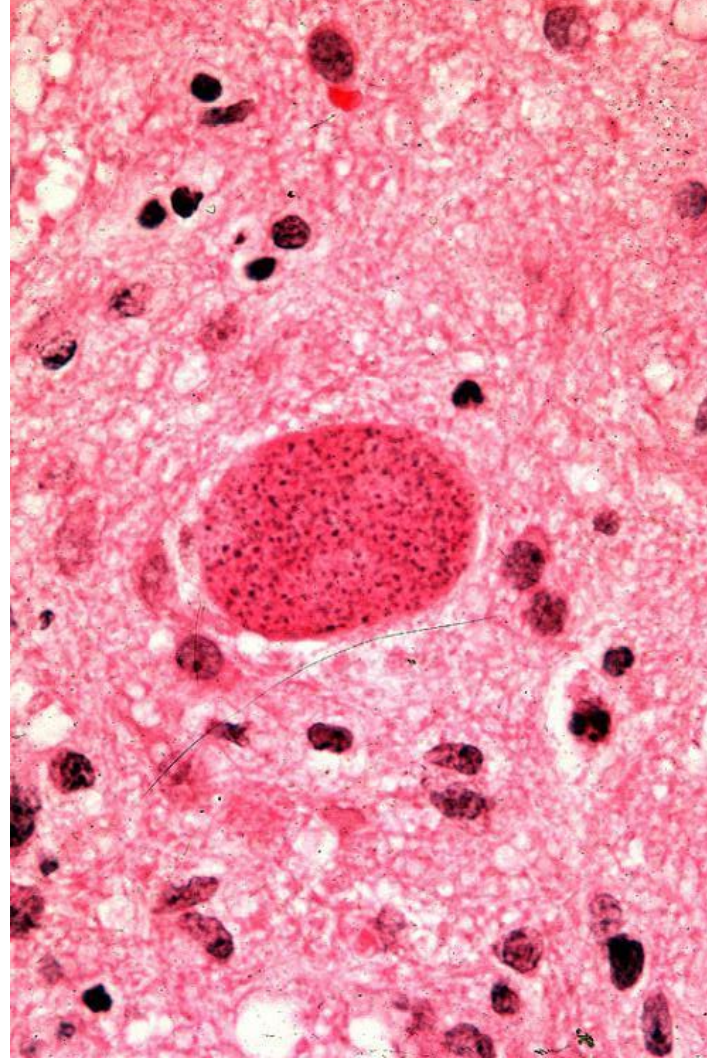
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Bradyzoites

- Two or three weeks after the first infection, the Toxoplasma microorganism begins to divide more slowly and a protective membrane forms around the parasite cells.
- The cysts containing the parasite cells are called **zoitocysts** and the cells inside the cysts are called **bradyzoites**.
- The **tissue cysts** are formed primarily in **brain, eye, heart muscle, and skeletal muscle**.
- **Bradyzoites persist in tissue for many years**, possibly for the life of the host.

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Bradyzoite



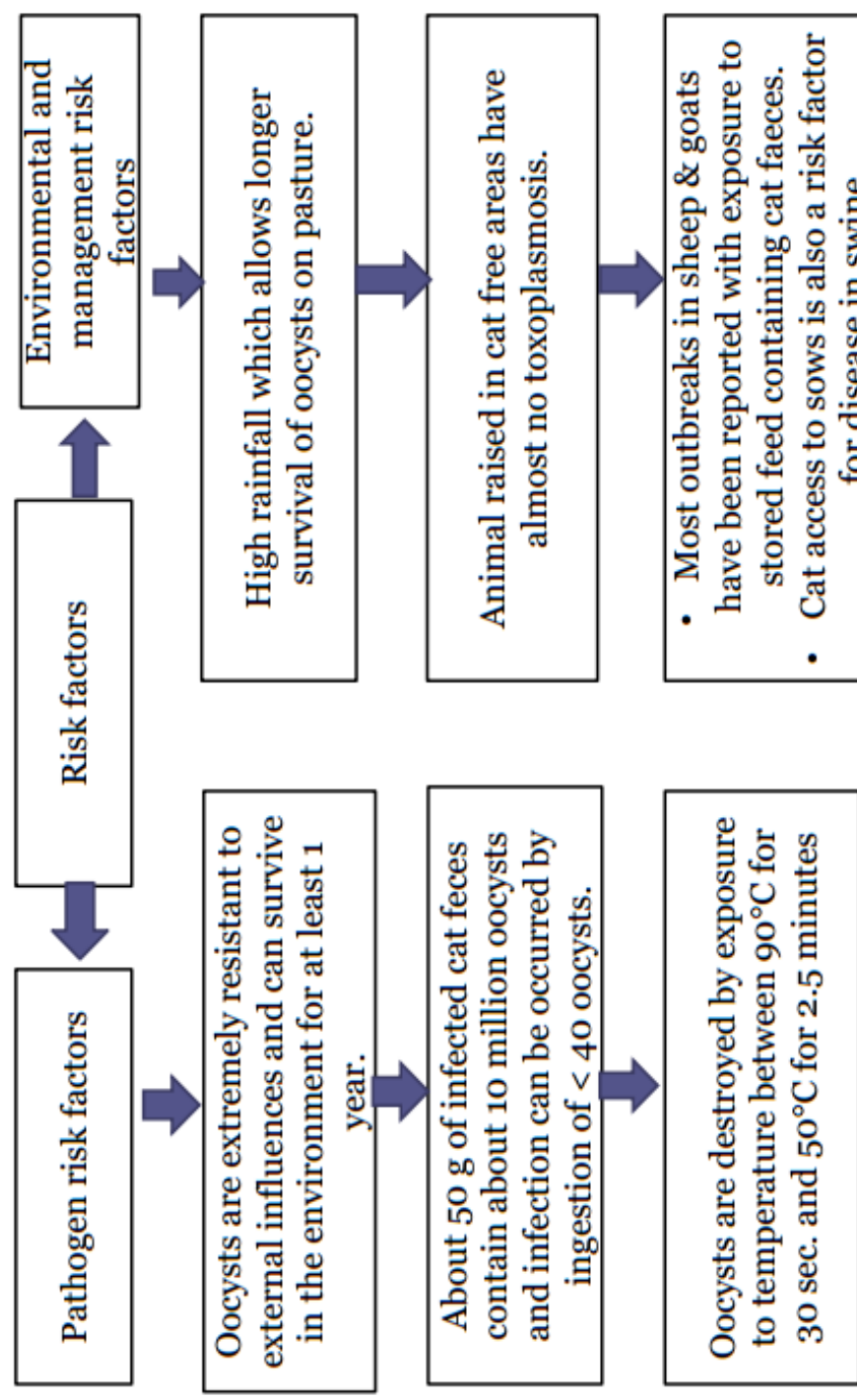
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Oocysts

- In cats, the Toxoplasma parasites infect **the lining of the small intestine** where they reproduce asexually.
- After a few days of rapid reproduction the cells transform into a **sexual form**, combine, and become enclosed in **a cyst called an oocyst**.
- **Oocysts** contain the **sporozoite** form of the Toxoplasma parasite.
- **Oocysts** are found in **both wild and domestic cats but not in any other animals or birds**.

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Risk factors:



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Economic importance

- Abortion and neonatal mortality in sheep and goats (ovine abortion)
- Zoonotic importance: AIDS
- :Meningoencephalitis
- Tachyzoites: foetus transplacentally
- Women from accidental ingestion of oocyst from cat faeces.

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Mode of transmission:

- Toxoplasma has been reported to be transmitted by the following ways in man and animals-

(a) **Through cat** : The cat is the only definitive host of the parasite. Infected cats shed large number of oocysts in the faeces . Stray cats contaminate the soils around the human habitations and thus play a vital role in the transmission of toxoplasmosis.

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(b) Meat & meat products :

Consumption of raw or under cooked meat or meat products are important source of toxoplasmosis.

(c) Congenital infection :

From infected mother (dam) to the fetus

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(d) Other methods:

- Inhalation and ingestion of infected milk may transmit the infection.
- Infection has been traced to be transmitted through semen.
- Experimental transmission can be made by intramuscular , subcutaneous or intraperitoneal inoculation of infected materials.

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- Toxoplasmosis is zoonotic
- Transmission can occur in 3 ways
 - Fecal-oral
 - Eating contaminated meat/prey
 - Transplacental
- The parasite can only produce oocytes (or eggs) when infecting a cat. The organism then multiplies in the wall of the small intestine and produces oocysts during the intraintestinal infection cycle.

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Life cycle in final host:

- Cats become infected by ingestion of rodent whose tissues contain tachyzoites or bradyzoites.
- ➔
- Infection also occur through the ingestion of oocysts.
- ➔
- The cyst wall (either badyzoites,tachyzoites or oocyst) is digested in cat stomach.
- ➔

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- The liberated organisms penetrate the intestinal wall and initiates schizogonas cycle followed by gametogonas development.
- The oocysts are produced within 3-10 days and shade within 1-2 weeks.
- The organisms also invade intestinal organ and development of tachyzoites, badyzoites, oocyst as in intermediate host.

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In intermediate host:

The I.H(cattle) are infected by ingestion of sporulated oocyst.



Liberated sporozoites inter into cell wall and spread via hematogenous route and cause tachyzoites

Tachyzoites inter into cell and multiply by budding.

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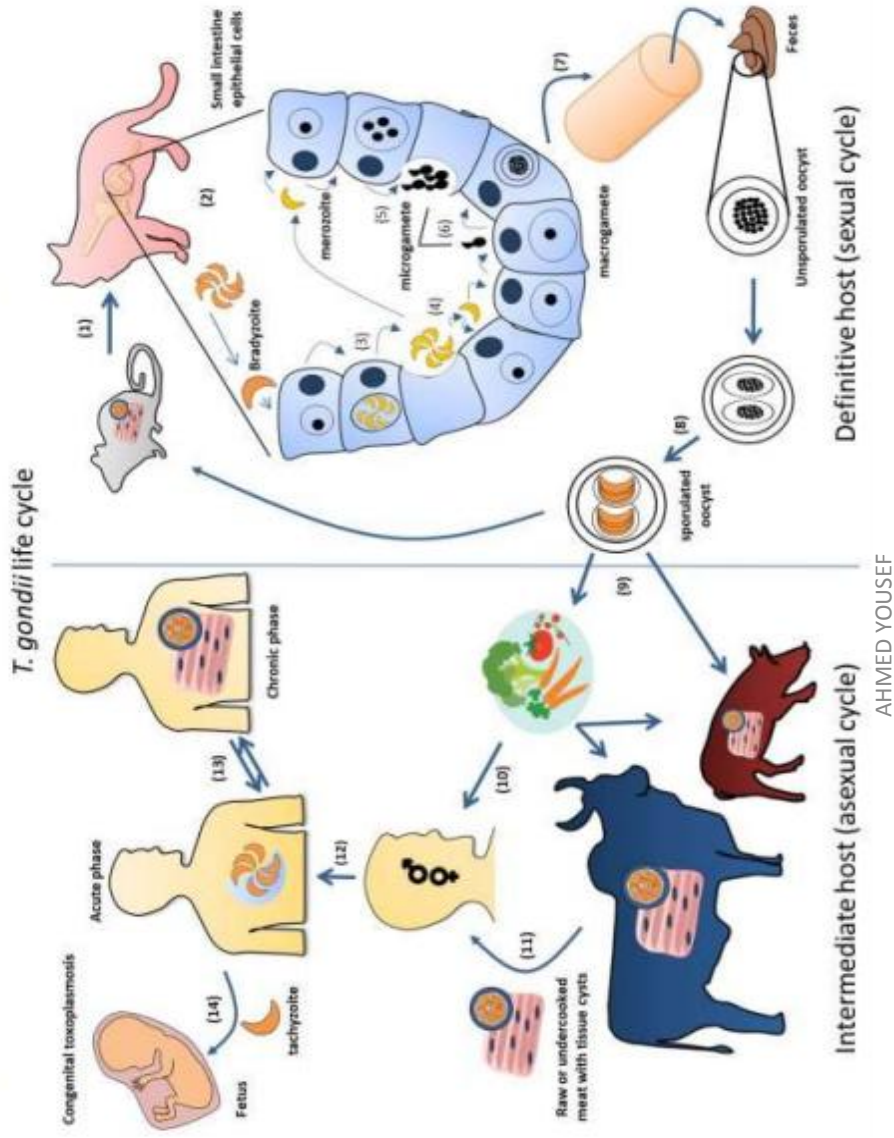
- Following this process 8-16 tachyzoites accumulated and infected cell ruptured and new cells infected.
- 
- In most cases the host survive and antibody produced which limits the invasiveness.
- 
- Followed by bradyzoites formation.
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- If immunity suppress, cyst may rupture releasing bradyzoites .
- 
- Bradyzoites become activated and resume the invasive characteristics of tachyzoites.
- 
- The F.H. is infected by the ingestion of either bradyzoites, tachyzoites containing tissue of I.H.

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Life cycle of *Toxoplasma* sp:



- Cats generally develop immunity after the initial infestation, therefore, only shed oocysts once in their lifetime.

Clinical findings :

- **Cattle and buffalo**- high rise of temperature and **enlargement of lymph node**.
- **Sheep** - **abortion** in ewes.
- **In goats**- high rise of temperature, dyspnea, diarrhea, muscular tremors, paresis of hind quarters, erythropenia and anemia.

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Some pictures of Toxoplasmosis:



Fig: aborted fetus



Fig. Enlarged lymph node in sheep

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- In puppies and kittens, tachyzoite spread systemically and cause interstitial pneumonia, myocarditis, hepatic necrosis, meningoencephalomyelitis, chorioretinitis, lymphadenopathy and myositis.
- Man and animal: parasitemia 5 days
- Congenital: encephalitis
- Post-natally: enterocolitis, pneumonitis.
- Characteristic granulomatous lesions (hypersensitivity reaction)
- Multiple necrotic foci (placenta)
- Still birth, weak and die

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Diagnosis

- Clinical signs are non-specific and organism is difficult to demonstrate.

Therefore,

diagnosis in man and animals is accompanied by serological tests.

(a) **Isolation of T. gondii** – Parasites can be demonstrated from lymph fluid, placenta, cotyledons and muscles.

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- (b) **Methylene blue dye test: Sabin and Feldman first described it.**

- This test now a days is carried out by in microtitre plates and can be judged by employing empty microscope.

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- (c) By complement fixation test(CFT).
 - (d) By indirect hemagglutination tests(HI).
 - (e) By direct agglutination tests.
 - (f) By fluorescent antibody tests(FAT).
 - (g) By enzyme linked immuno sorbent assay (ELISA)
 - (h) By DNA test.
-
- IgM: early- 3 mo- IgM titre > 1:256 recent infestation.
 - IgG: 4th week- years subclinical infestation
 - Must be measured in paired sera from the acute and convalescent stages (3-4 weeks apart) and must show 4-fold increase in titre.
 - CSF: tachyzoites or antibodies.
 - Tissue impression smears (tachy and brady)

- **Mouse inoculation: homogenates from tissue samples, I.P, mice**
- **Giemsa stained peritoneal fluid or squash preparations of mouse brain**
- **Immunohistochemistry: formalin fixed materials**

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Treatment

- (a) There is no satisfactory treatment. Drugs like **pyremethamine** and **sulphonamide** are effective.
- 3 days for 3 periods with intervals of 5 days between the start of each treatment.
- **Clindamycin for dogs and cats**, at 10-40 mg/kg and 25-50 mg/kg respectively for 14-21 days.

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control

- Control programme may be aimed based on three methods-
 - a) **Epidemiological control-**
 - **Lowering of cat population in endemic zones.**
 - Cat should not be allowed to feed raw meat.
 - Cat faeces should be properly disposed through burning.
 - Hands should be properly cleaned with soap after handling of raw meat.
- Pregnant lady should not handle soil and raw meat.
- Raw meat should not be consumed.
 - (b) **Chemotherapeutical control-** Prophylactic measures should be taken with drugs shown in treatment.
 - Monensin 15 mg/ head per day during first 100 days of gestation (reduce lamb loss) experimentally.
 - (c) **Control by immunization-** No fruitful vaccine is available. A vaccine containing *T. gondii* used to control disease.