Toxoplasma gondii

Toxoplasmosis

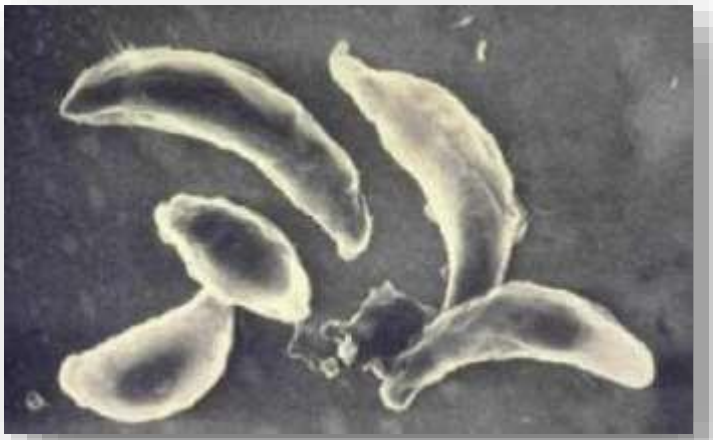
Online Skype class

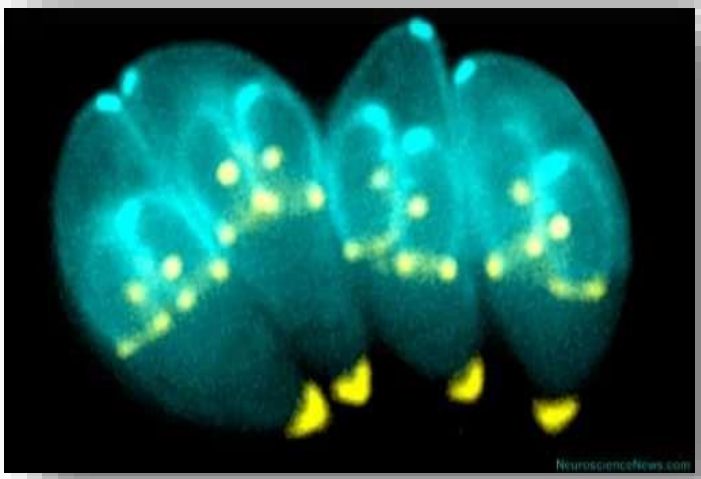
Introduction

- Obligate intracellular parasite
- It belongs to coccidian parasites
- The name toxoplasma derived from “toxon” arc or bow (curved shape of the tachyzoites)
- Phylum - sporozoa

INTRODUCTION

- Toxoplasma gondii is a protozoan, obligate intracellular parasite
- Cause Toxoplasmosis
- Infects most species of warm-blooded animals, including humans.
- Members of the cat family ,
- The only known definitive host for the sexual stages - the main reservoirs of infection.





Morphology:

Three morphological forms

Asexual forms	**Tachyzoite**
	Bradyzoite (Tissue cyst)
Sexual form	**oocyst**

- The three stages of T. gondii

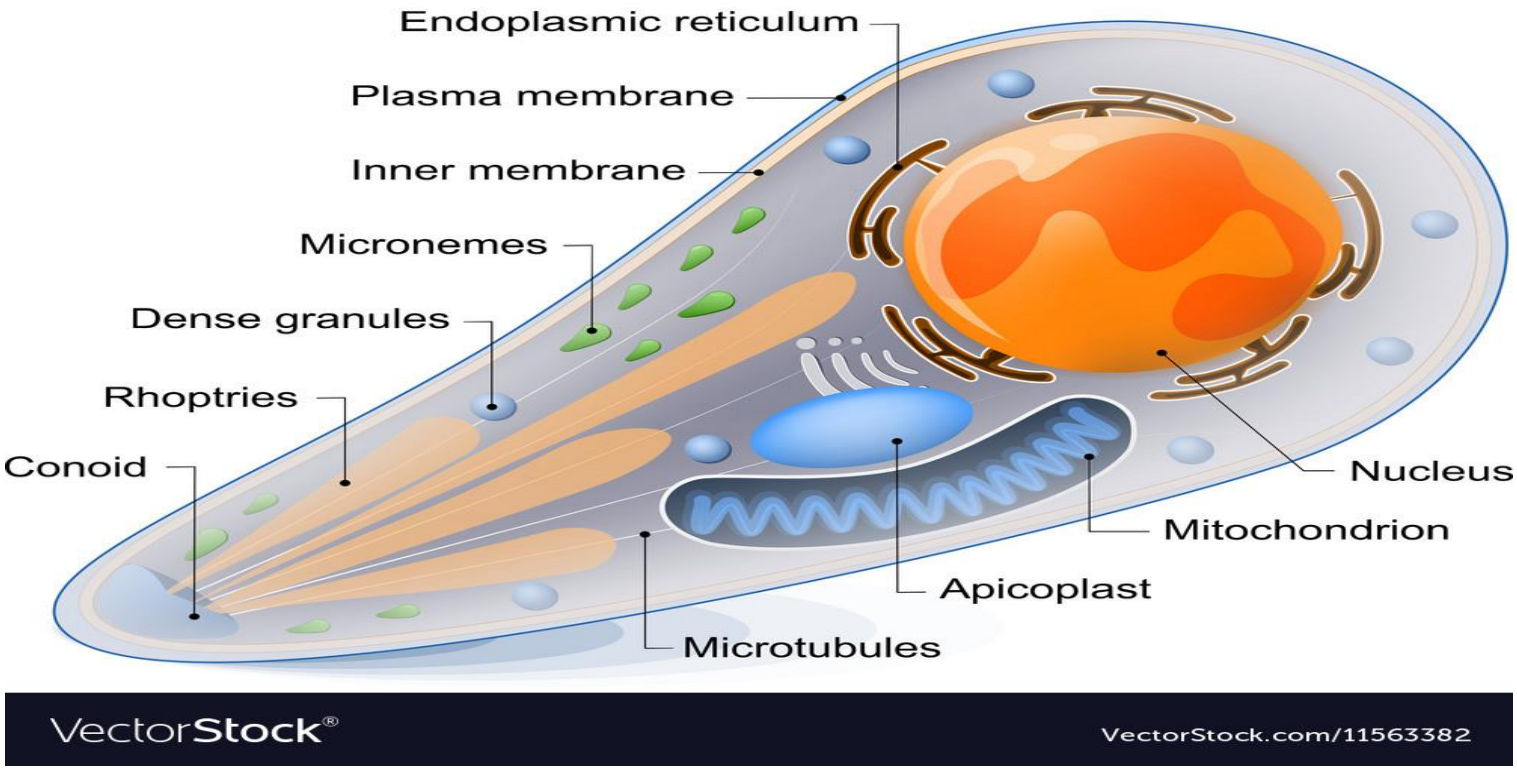
  (i)Tachyzoites (trophozoites): rapidly proliferate and destroy infected cells during acute infection.

  (ii)Bradyzoites: slowly multiply in tissue cysts.

  (ii) Sporozoites in oocysts.

- Cats become infected with *T. gondii by carnivorism* or by ingestion of oocysts

Toxoplasma gondii



- Crescent shaped, pointed anterior, round posterior,
- Conoid: Rotate, tilt, extent
- Rhoptries: Secretory function associated with host cell penetration
- A Pellicle, apical rings, microneme, micropore, microtubules, ER, apicoplast(multi-membrane plastid like organelle)

Image of a tachyzoite

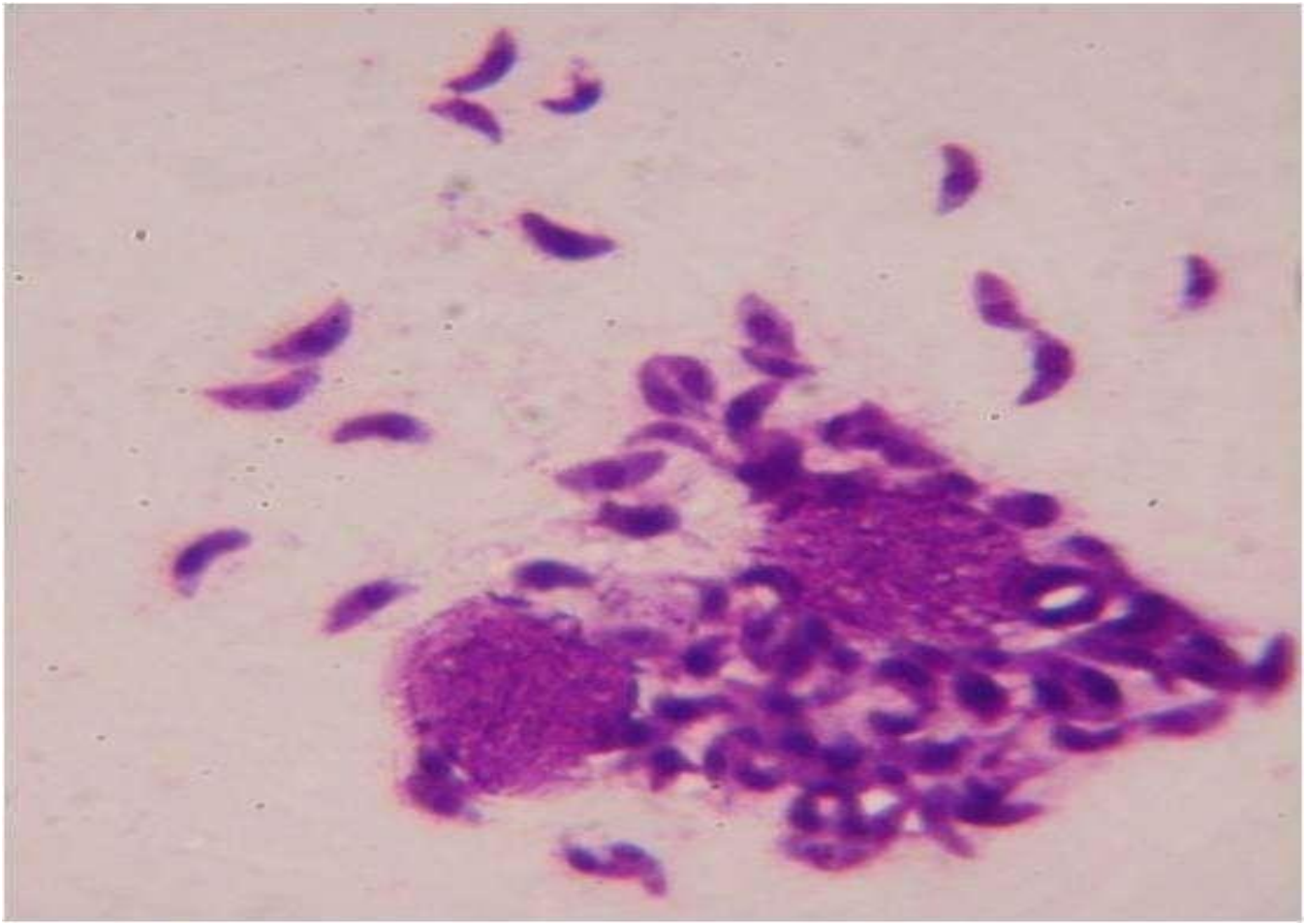
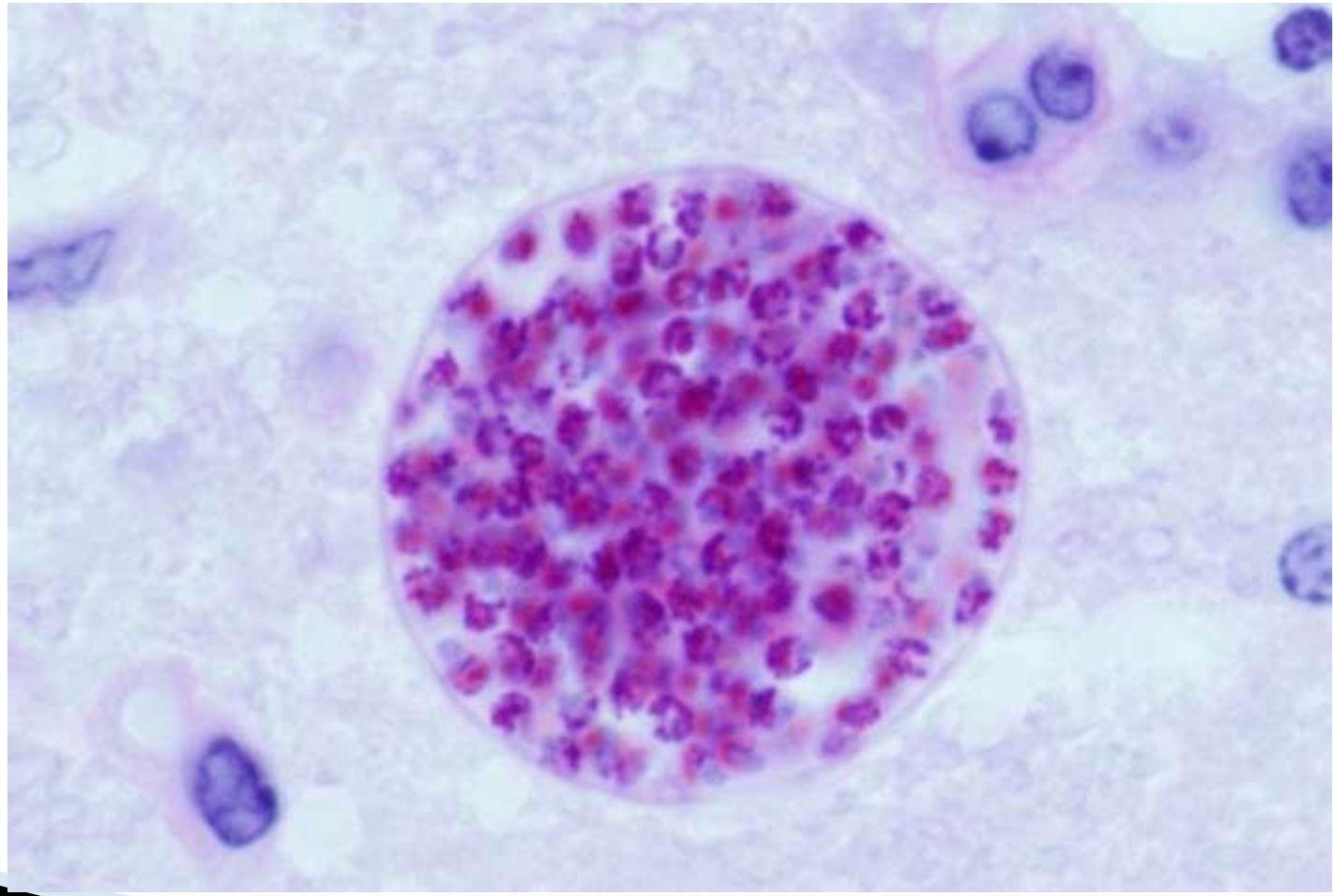
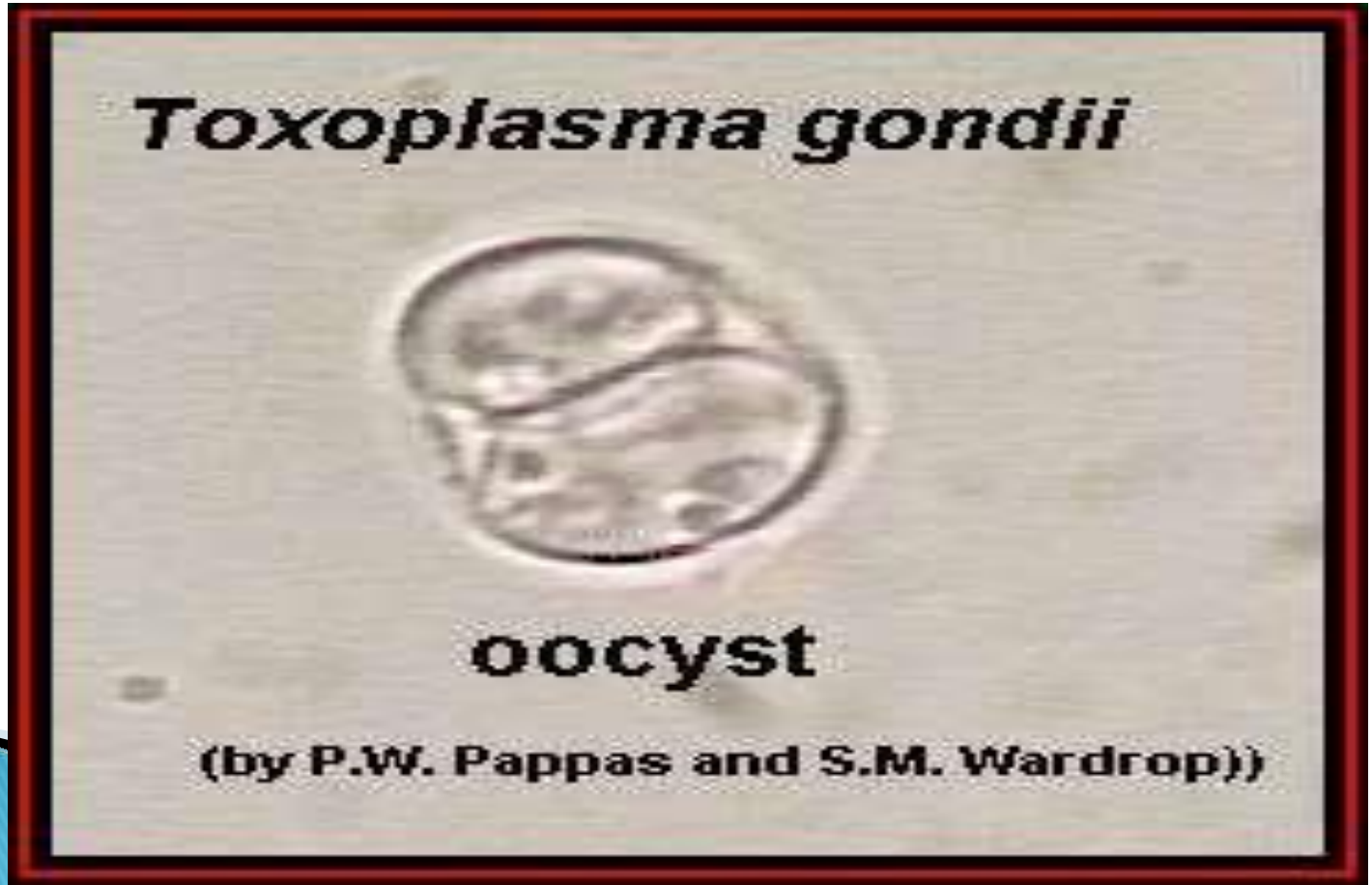


Image of a tissue cyst:



OOCYST:

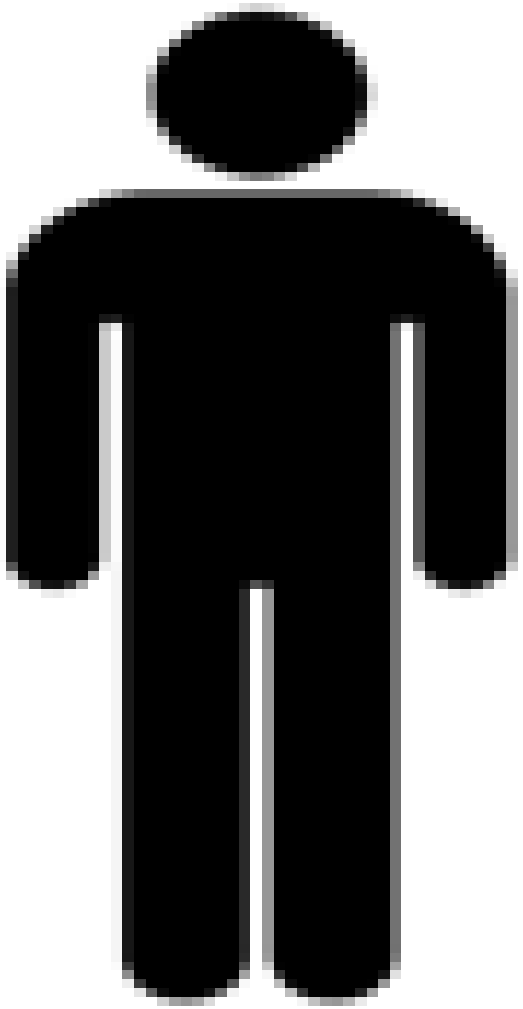
- Sexual form of the parasite found only in cats and felines



Life cycle

Definitive host (sexual cycle

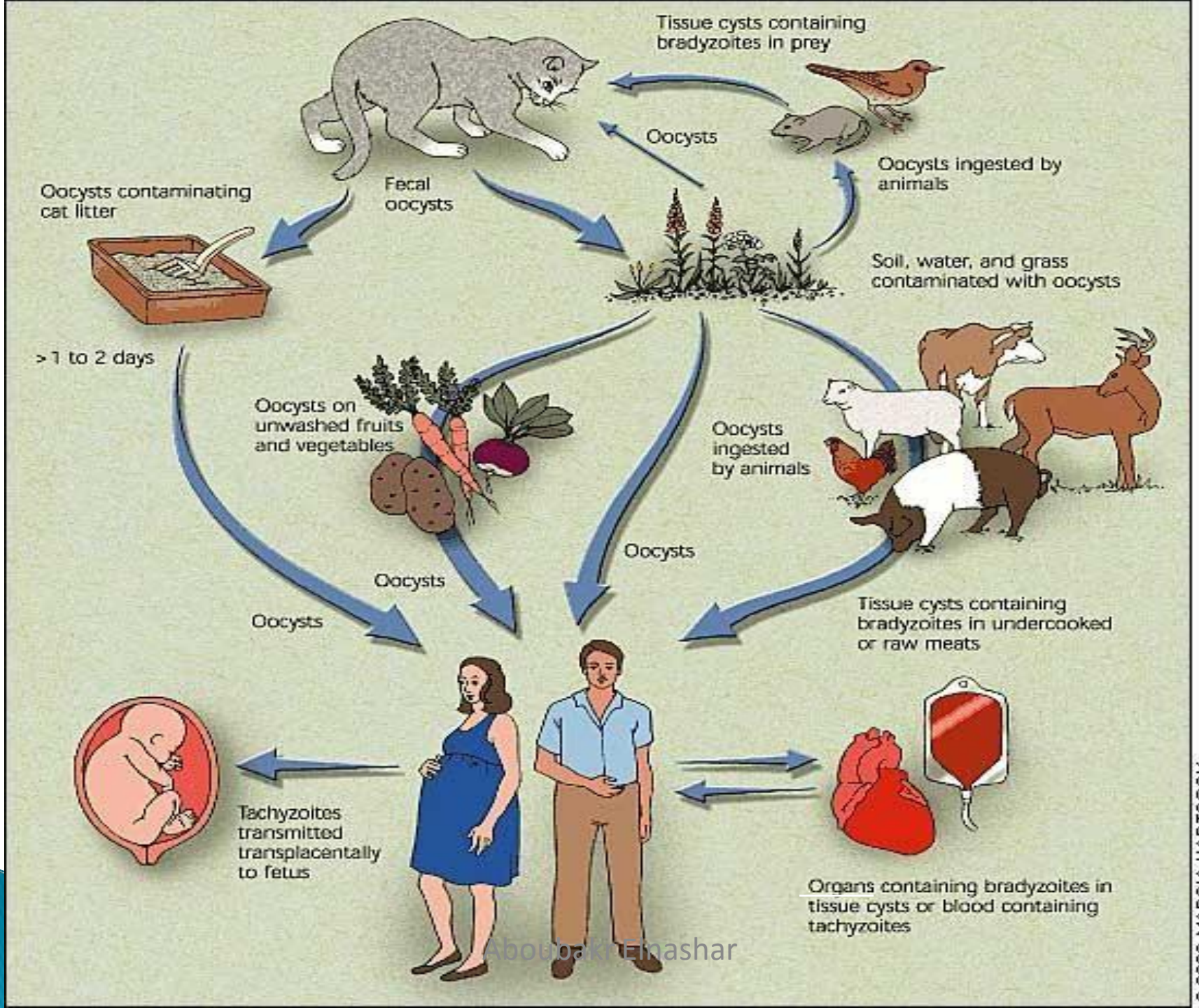
Intermediate host:supports the immature or non-reproductive forms



Life cycle – two phases:

Enteric cycle or sexual cycle

Exo enteric cycle or asexual cycle



CLINICAL SIGNIFICANCE/ PATHOGENECITY

- Toxoplasmosis can be categorized into four groups:
  - 1- Acquired in the immunocompetent patient
  - 2 - Acquired or reactivated in the immunodeficient patient
  - 3 - Congenital
  - 4 – Ocular
- Methods of diagnosis and their interpretations may differ for each clinical category.

Acquired in the immunocompetent patient (Normal immune system)

- Generally an asymptomatic infection.
- 10 to 20% of patients with acute infection a flu-like illness.
- The clinical course is benign and self-limited
- Symptoms usually resolve within weeks to months.

Acquired or reactivated in the immunodeficient patient

- Immunodeficient patients often have central nervous system(CNS) disease but may have myocarditis or pneumonitis.
- In patients with AIDS, Toxoplasmic encephalitis is the most common cause of intracerebral mass lesions
- Toxoplasmosis in immunosuppressive drugs using patients due to either newly acquired or reactivated latent

Congenital Infection

- Congenital toxoplasmosis results from an acute primary infection acquired by the mother during pregnancy.
- The incidence and severity vary with the trimester during which infection was acquired.

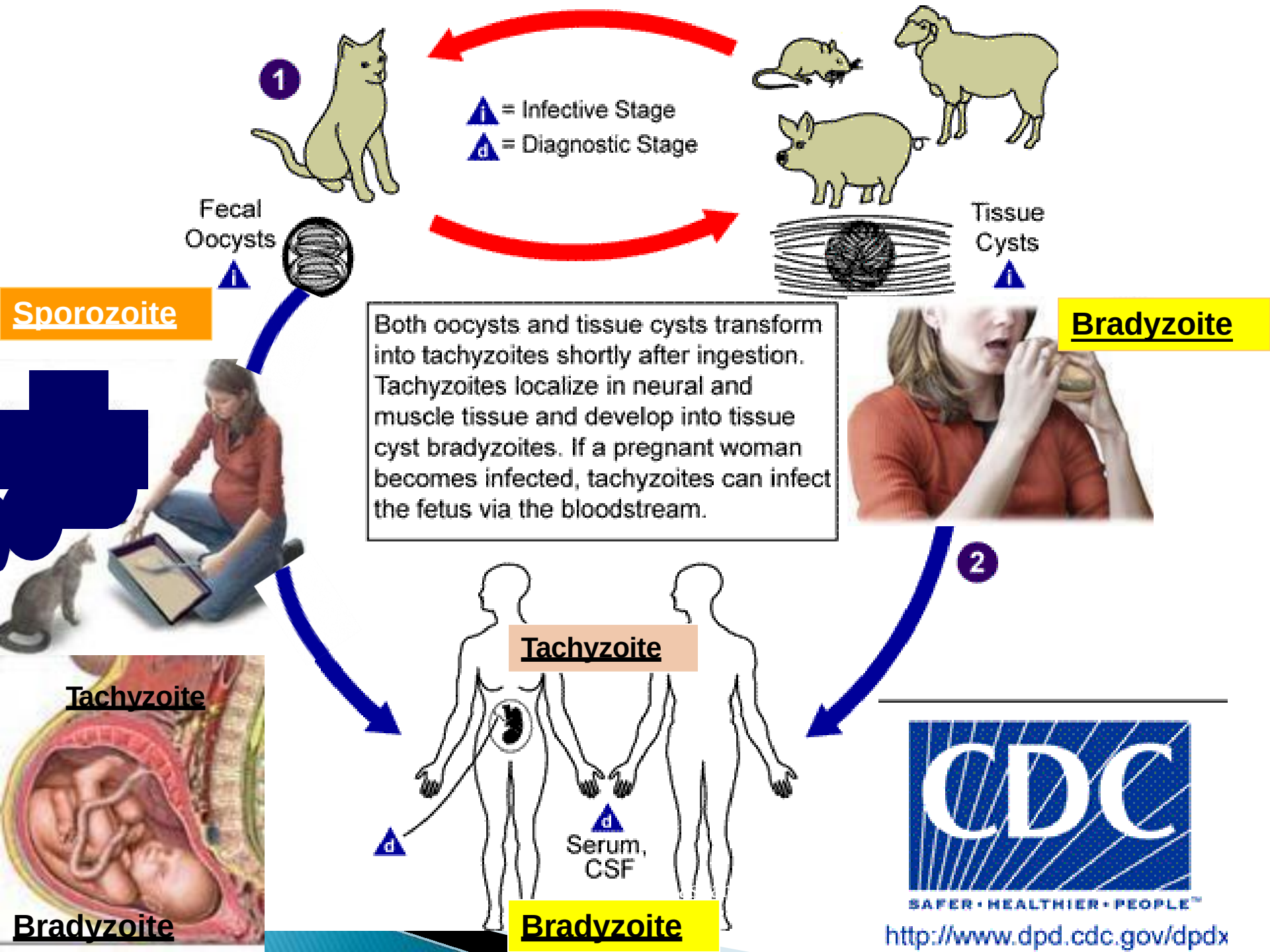
A fetus may contract toxoplasmosis through the placental connection with its infected mother

The mother may be infected by:

Improper handling of cat litter

Handling or ingesting contaminated meat

A.D.A.M.


1
= Infective Stage
= Diagnostic Stage
Fecal Oocysts
Tissue Cysts
Sporozoite
Bradyzoite
Both oocysts and tissue cysts transform into tachyzoites shortly after ingestion. Tachyzoites localize in neural and muscle tissue and develop into tissue cyst bradyzoites. If a pregnant woman becomes infected, tachyzoites can infect the fetus via the bloodstream.
2
Tachyzoite
Tachyzoite
Serum, CSF
Bradyzoite
Bradyzoite
CDC
SAFER • HEALTHIER • PEOPLE™
http://www.dpd.cdc.gov/dpdx

Congenital toxoplasmosis

Clinical manifestations. Hydrocephalus, lesions in the organs of the vision (chorioretinitis), cirrosis of the liver and enlargement of the spleen.

TRANSMISSION OF INFECTION

1. ORAL:

Tissue cysts: 10 % of lamb, 25 % of pork, beef, poultry. Pork and lamb carry a higher risk of infection than beef or poultry.

Oocyst: 30 - 80 % of cats (low parasite dose)

2.TRANSPLACENTAl:

Primary acute infection during pregnancy

↓

Maternal parasitaemia [**Tachyzoites**] (limited to 3 W): Placentitis:

↓

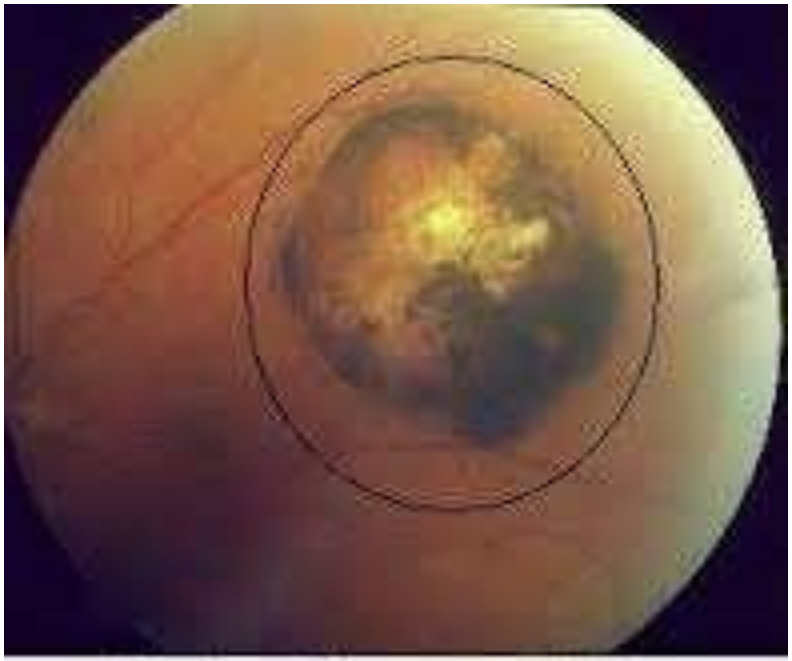
Fetal infection

3 . BLOOD or LEUCOCYTES TRANSFUSION (Tachyzoites) or

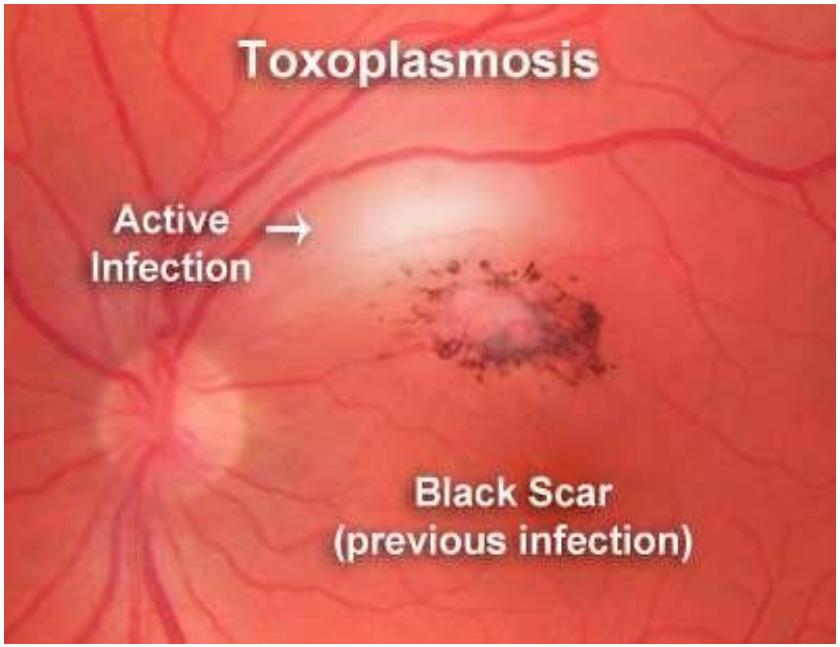
ORGAN TRANSPLANTATION (Tissue cysts): (Rare)

Ocular Infection

- Ocular toxoplasmosis, an important cause of **Chorioretinitis** in the United States, may be the result of congenital or acquired infection
- Congenitally infected patients are often asymptomatic until the second or third decade of life
- **Lesions** develop in the eye presumably **due to cyst rupture** and subsequent release of tachyzoites and bradyzoites.



Chorioretinitis as a result of a Toxoplasmosis infection



Immunocomptent

- Mild & self-limited
- I.P :1-3 w
- 90 %: asymptomatic
- 10 %: lymphadenitis (painless, cervical LN), fever, sore throat, rash

  lymphocytosis, atypical lymphocytes
- DD: flu, inf. mononucleosis

Immunocompromised

- Severe, fulminate, CNS, Eye

Immunodeficient

- Fatal, CNS, Eye, heart &lung

Transmission To The Fetus

Transmission risk (mother to fetus)

15% 25% 65%

Severity of Damage to fetus

Most 60% less 20% least 5%

- Hydrocephalus.
- Intracranial calcification,
- Retinochoroiditis

1st Trimester 2nd Trimester 3rd Trimester

[Evidence level 3] Foulon et al. A.J. of Obst&Gynecology 1999;180:410–5

DIAGNOSIS

- **DIRECT EXAMINATION** :
  - Microscopy
  - Antigen Detection
  - Nucleic Acid Detection Techniques
- **SEROLOGIC TESTS :**
  - Determination of Immune Status
  - Diagnosis of Acute Acquired Infections
  - Diagnosis of Congenital Infection
  - Diagnosis of Infection in the Newborn

Diagnosis :

- Direct microscopy → Detection of tachyzoites in blood and tissue cyst in tissue biopsy

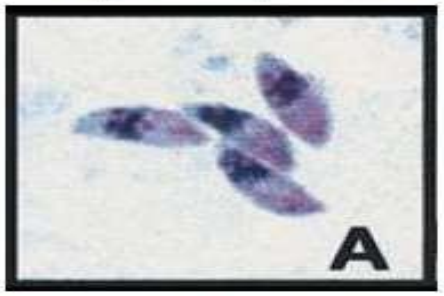
- Staining methods:

1. Giemsa
2. PAS
3. Silver stains
4. Immunoperoxidase stain

DIRECT EXAMINATION

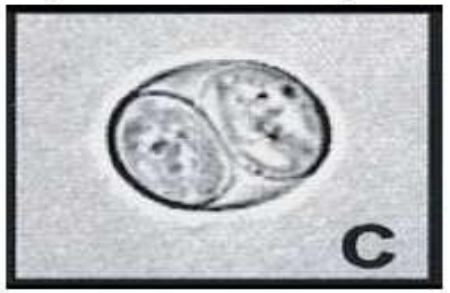
- MICROSCOPY:
- The slides should be air dried, fixed in methanol, and stained with Giemsa for microscopic examination.
- Tachyzoites may be observed as free organisms or within host cells such as leukocytes.
- Well preserved tachyzoites are crescent shaped and stain well
- Degenerating organisms may be oval and stain poorly.
- Tissue imprints stained with Giemsa may reveal *T. gondii cysts.*

Tachyzoites, Giemsa stain.



Cyst with bradyzoites

Sporulated oocysts



DIRECT EXAMINATION…

- ANTIGEN DETECTION:
- Immunologic methods are used to identify parasites in tissue sections or tissue cultures
- For detecting tachyzoites in tissue sections
  - Fluorescein isothiocyanate-labeled antisera
  - Peroxidase-labeled antisera
- Enzyme immunoassay(EIA) antigen detection
  - Due to lack sensitivity for human samples it is not recommended.
- NUCLEIC ACID DETECTION:
  - Important use of PCR appears to be in the prenatal diagnosis of congenital toxoplasmosis
  - PCR of amniotic fluid has been shown to be more sensitive for the confirmation of fetal infection

Serology:

- Detection of Toxoplasma antigen by ELISA

- Detection of Toxoplasma antibody by

1. Sabin feldman dye test
2. IgM ELISA
3. IgG ELISA
4. IgG avidity test

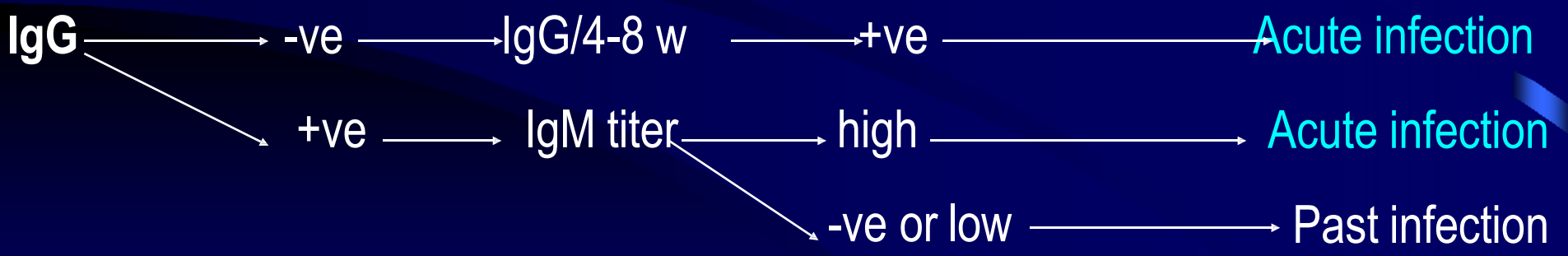
Diagnosis of Infection in the Newborn

- Diagnosis *is made* through a combination of serologic testing, parasite isolation, and nonspecific findings
  - An attempt should be made to isolate *T. gondii from the placenta, amniotic* fluid, and cord blood
  - The child's serum should be tested for total IgG and IgM antibody levels and *Toxoplasma-specific IgG, IgM, and IgA* antibodies.
  - A child with suspected congenital toxoplasmosis should have a thorough general, neurologic, and ophthalmologic examination and a computed tomographic

- If IgG is +ve before pregnancy: No need for retesting or treatment. No fear of congenital infection.
- Acute infection is diagnosed if IgM is high or IgG

Preconceptional:

First antenatal visit:



Prevention

- Consumption of cooked meat
- Hand hygiene
- Prenatal and antenatal screening to detect Toxoplasma infection in women of child bearing age
- Proper handling of pet cats
- Screening of blood donors and organ donors

Questions

1. Name the parasite causing Toxoplasmosis ?
2. How to people get toxoplasmosis ?
3. What are the sign and symptoms of this disease ?
4. What are the diagnosis method used ?
5. If I am at risk can I keep my cat ?
6. What is congenital toxoplasmosis ?