Protozoa of Blood and Tissues

<table>
<thead>
<tr>
<th>Organism</th>
<th>Vector</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Trypanosoma gambiense</em></td>
<td>Tse-tse fly</td>
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<tr>
<td>and <em>T. rhodesiense</em></td>
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<tr>
<td><em>Trypanosoma cruzi</em></td>
<td>Triatomine bugs</td>
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<tr>
<td><em>Leishmania</em></td>
<td>Sand flies</td>
</tr>
<tr>
<td><em>Plasmodium</em></td>
<td>Mosquitoes</td>
</tr>
<tr>
<td><em>Babesia</em></td>
<td>Ticks</td>
</tr>
<tr>
<td><em>Toxoplasma gondii</em></td>
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</tr>
</tbody>
</table>
Hemoflagellates

- Live in blood & tissues of human host
- Obligate parasites
- Incite life-threatening and debilitating zoonoses
- Spread by blood-sucking insects that serve as intermediate hosts
- Acquired in specific tropical regions
- Have complicated life cycles & undergo morphological changes
- **Trypanosoma brucei** (causes sleeping sickness)
  - *T. cruzi* (causes Chagas disease)
- **Leishmania** (causes Leishmaniasis)

*Trypanosoma*

Causative agents of African trypanosomosis (sleeping sickness) and American trypanosomosis (Chagas disease)

**Family:** Trypanosomatidae

**Subphylum:** Kinetoplasta
Trypanosoma

- *Trypanosoma brucei gambiense* and *Trypanosoma brucei rhodesiense* cause African trypanosomosis (sleeping sickness) in humans
- as fever and meningoencephalitis.
- In a chronic form (*T. gambiense*) the disease occurs mainly in western and central Africa,
- whereas the acute form (*T. rhodesiense*) is predominately distributed in eastern and southeastern Africa.
- The trypanosomes are transmitted by the bites of tsetse flies (*Glossina*).
- wild or domestic animals serve as reservoir hosts of varying significance.
- *Trypanosoma cruzi*, the causative agent of American trypanosomosis (Chagas disease) occurs in humans and many vertebrate animals in Central and South America. It is transmitted in the feces of bloodsucking reduviid bugs.

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Trypanosoma brucei

- Causes African Sleeping Sickness
- Spread by tsetse flies (*Glossina sp.*)
- Harbored by reservoir mammals
- Biting of fly inoculates skin with trypanosome, which multiplies in blood & damages spleen, lymph nodes & brain
- Chronic disease symptoms are sleep disturbances, tremors, paralysis, fever, meningoencephalitis & coma
Life cycle of *T. gambiense* and *T. rhodesiense*

- *T. gambiense* and *T. rhodesiense* parasitize extracellular in the blood plasma or in other body fluids of vertebrates.
- The trypomastigote forms are pleomorphic in human blood with increasing parasitemia.
- These forms do not divide in blood but are infective for Glossina (tsetse flies).
- The trypanosomes taken up by Glossina (tsetse flies) when they suck blood from an infected host go through a complex developmental and reproductive cycle in the insects lasting 15–35 days.
- The resulting (metacyclic) stages can then be inoculated into the skin of a host with the fly’s saliva. Infected Glossina can transmit the trypanosomes throughout their entire lifespan (up to six months).
- Trypanosomatidae multiply by longitudinal binary fission.
- In *Trypanosoma brucei* there is evidence of genetic exchange during development within the vector (sexual reproduction).
Life cycle of Trypanosoma brucei gambiense/rhodesiense
(cause of African trypanosomiasis)

**Host: Human**
- Development of trypomastigotes in
  - blood stream
  - lymph
  - cerebro-spinal fluid

**Vector: Tsetse fly**
- Multiplication and development of infective forms in salivary glands
- Injection of infective stages by tsetse fly

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**Trypanosoma brucei rhodesiense**

![Giemsa staining of a blood smear preparation.](image)
**Diagnosis of Symptoms of *T. gambiense* and *T. rhodesiense***

- direct detection of the trypanosomes in the **blood**, **lymph node aspirate** and, in the **cerebrospinal fluid**
- Under a light microscope in a Giemsa-stained blood smear the trypanosomes present as spindly organisms with a central nucleus, a kinetoplast at the posterior end (both stained violet) and an undulating membrane.
- Analysis of **lymph node aspirate** has a high diagnostic value in infections with *T. gambiense*
- trypomastigote, slender form with variant **specific surface antigen** (VSSA)
- The **card agglutination trypanosomosis test** (CATT)

**Symptoms of *T. gambiense* and *T. rhodesiense***

- Fever, chills, headache, joint and muscle pain, transitory edemas, weight loss, generalized **lymphadenopathy** (swelling of lymph nodes in neck = Winterbottom’s sign); **cardiac dysfunction** (especially in *T. rhodesiense* infections), **anemia**, **thrombocytopenia**, raised serum IgM

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**Prevention and control of *T. gambiense* and *T. rhodesiense***

- Use individual prophylactic measures to protect against the diurnally active Glossina flies. It is very important that tourists
- wear clothing that covers the skin as much as possible and
- treat uncovered skin with repellents. They should also inspect the interior of cars for tsetse flies and spray with insecticides.
- Glossina flies are targeted by insecticide sprayings in preventive programs.
- More recently, the flies are also being caught in insecticide-charged traps using attractant colors and odors.
**Trypanosoma cruzi**

- Chagas disease
- *Kissing bug* is the vector (*Reduviid / Assassin Bugs*)
- Infection occurs when bug *feces* are inoculated into a *cutaneous portal*
- Local lesion, fever, & swelling of lymph nodes, spleen, & liver
- Heart muscle & large intestine harbor masses of amastigotes
  - Divide by binary fission
- Chronic inflammation occurs in the organs
  - Especially heart & brain

**Trypanosoma cruzi**

*Transmitted by* *Reduviid bugs*
*Inefficient transmission (parasite in feces of bug)*
*Associated with infestation of houses with triatomines (rural poverty)*
*Urban transmission associated with blood transfusions*
*Leading cause of cardiac disease in S. and central America*
Leishmania

- Leishmaniasis is a zoonosis transmitted among mammalian hosts by female sand flies that require a blood meal to produce eggs
- Infected macrophages carry the pathogen into the skin & bloodstream, giving rise to fever, enlarged organs & anemia
- Kala azar is the most severe & fatal form

Viscera or the internal organs, particularly the liver, spleen, bone marrow & lymph nodes

Kala (Hindi) azar (Persian) = black disease (due to hyperpigmentation of skin caused by the infection) L. donovani
Clinical Spectrum of Leishmaniasis

1. **Cutaneous Leishmaniasis (CL)**
   most common form, relatively benign self-healing skin lesions (aka, localized or simple CL)

2. **Mucocutaneous Leishmaniasis (MCL)**
   simple skin lesions that metastasize to mucosae (especially nose and mouth region)

3. **Visceral Leishmaniasis (VL)**
   generalized infection of the reticuloendothelial system, high mortality

Some *Leishmania* Species Infecting Humans

<table>
<thead>
<tr>
<th>New World Cutaneous, Mucocutaneous, and Diffuse Leishmaniasis</th>
<th>Old World Cutaneous, Recidivans, and Diffuse Leishmaniasis</th>
<th>Visceral Leishmaniasis</th>
</tr>
</thead>
</table>
| Mexicana Complex  
  *L. mexicana*  
  *L. amazonensis* | *L. tropica* | *L. donovani*  
  (old world) |
| Braziliensis Complex  
  *L. braziliensis*  
  *L. panamensis*  
  *L. guyanensis* | *L. major*  
  *L. aethiopica*  
  *L. infantum* | *L. infantum*  
  (Mediterranea)  
  *L. chagasi*  
  (Americas) |

*Both dermatrophic and viscerotrophic strains exist.
**L. chagasi (Americas) may be the same as *L. infantum* (Mediterranean)
Visceral leishmaniosis

- Leishmania infantum
- Leishmania donovani
- Leishmania chagasi

Cutaneous and mucocutaneous leishmanioses

- Leishmania tropica
- Leishmania major
- Leishmania aethiopica
- Leishmania species of the New World
Diagnosis

- geographical presence of parasite
- Diagnosis of VL is made by means of direct parasite detection in aspirate material from lymph nodes or bone marrow (in HIV patients also in the enriched blood leukocyte fraction) in Giemsa-stained smears
- or using PCR or serological tests
- Antibodies are detectable in nearly all immunocompetent patients (around 99%), but 40–50% of HIV-coinfected patients are seronegative.
- Diagnosis of a cutaneous leishmaniosis is usually based on clinical evidence.
- Etiological verification requires direct parasite detection in smears or excised specimens from the edges of the skin lesions.
- More reliably, the parasites can be detected by cultivation or PCR.
- Serological antibody tests are positive in only a small proportion of cases.

Organism

- The many (about 15) species of the genus Leishmania pathogenic to humans do not show morphological differences.
- They can be differentiated on the basis of biological criteria, laboratory analyzes (mainly isoenzyme patterns and DNA analysis), and the different clinical pictures,
- In humans and other vertebrates, leishmanias parasitize in mononuclear phagocytic cells (macrophages, monocytes, Langerhans cells) in the amastigote form.
- The Giemsa-stained organisms are recognizable under a light microscope as round-to-oval cells 2–5 μm in diameter with a nucleus and a small, rod-shaped kinetoplast. A rudimentary flagellum, a single mitochondrion and other cell organelles are also rendered visible on the electron microscopic level (see also Trypanosoma).
Leishmania infantum: Life Cycle

Fig. 9.9  1 Inoculation of promastigote stages by sandfly; 2 ingestion of parasites by phagocytes (Langerhans cells, dendritic cells, macrophages); 3 amastigote form in parasitophorous vacuole of a macrophage; 4 reproduction of amastigote forms in a macrophage; 5 ingestion of amastigote forms by sandfly with blood meal; 6 transformation into promastigote form and multiplication in insect; 7 dog as reservoir host.
Life cycle of Leishmaniasis

- The leishmania species are transmitted by female mosquitoes called “sandflies”.
- The amastigote stages of the parasite ingested by the insect with a blood meal are transformed in its intestine into slender, flagellate promastigote forms, which multiply and migrate back into the proboscis.
- At tropical temperatures this process takes five to 8 days.
- When infected sandflies take another blood meal the promastigote forms are inoculated into a new host (humans or other vertebrates).
- In the host, they bind host components to their surface (IgM, complement, erythrocyte receptor) and, thus equipped, couple to macrophage receptors. They are then phagocytosed and enclosed in a phagolysosome,
- where they are protected from the effects of lysosomal enzymes.

- The promastigotes quickly (within 12–14 hours) transform into amastigote stages, which are finally surrounded by a parasitophorous vacuole within the phagolysosome and reproduce by binary fission.
- The amastigote forms are then released in a process resembling exocytosis and can infect new cells.
- Amastigotes multiply in infected cells and affect different tissues, depending in part on the Leishmania species.
leishmaniasis

Fig. a Leishmania in a macrophage. b Leishmania infantum in a bursting macrophage; Giemsa staining of a bone marrow smear.
Plasmodium sp.

Plasmodium

- Causes malaria
- Female *Anopheles* mosquito is the vector
- Obligate intracellular sporozoan
- 4 species:
  1. *Plasmodium vivax* producing benign tertian malaria.
  2. *Plasmodium ovale* producing ovale tertian malaria.
  4. *Plasmodium falciparum* producing tertian or subtertian malignant malaria.
Malaria

- Malaria is one of the most important diseases in the world.

- About 500 million cases and an estimated 700,000 to 2.7 million deaths occur worldwide each year.

- Malaria was well known to the Ancient Greeks and Romans. The Romans thought the disease was caused by bad air (in Latin *mal-aria*) from swamps, which they drained to prevent the disease.

- Discovered at 1889 when Charles Louis Alphonse Laveran a French army physician identified it, a discovery for which he won the Nobel Prize in 1907.

Malaria symptoms

- The severity of an infection may range from asymptomatic (no apparent sign of illness) to the classic symptoms of malaria (fever, chills, sweating, headaches, muscle pains), to severe complications (cerebral malaria, anemia, kidney failure) that can result in death.

- Factors such as the species of *Plasmodium* and the victims genetic background and acquired immunity affect the severity of symptoms.
**Plasmodium**

Organisms:

- **There are four species of Plasmodium:** *P. falciparum*, *P. vivax*, *P. ovale* and *P. malariae*.

- *P. falciparum* causes severe often fatal malaria and is responsible for most deaths, with most victims being children.

- Both *Plasmodium vivax* and *P. ovale* can go dormant, hiding out in the liver. The parasites can reactivate and cause malaria months or years after the initial infection.

- *P. malariae* causes a long-lasting infection. If the infection is untreated it can persist asymptomatically for the lifetime of the host.

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**Life cycle of malaria**

- *Plasmodium* has two hosts: mosquitoes and humans.

- Sexual reproduction takes place in the mosquito and the parasite is transmitted to humans when the mosquito takes a blood meal.
Infective forms for humans (sporozoites) enter blood with mosquito saliva, penetrate liver cells, multiply, and form hundreds of merozoites, which multiply in & lyse RBCs.
Life cycle of malaria: humans

- The mosquito injects *Plasmodium* into a human in the form of *sporozoites*.

- The sporozoites first invade liver cells and asexually reproduce to produce huge numbers of *merozoites* which spread to red blood cells where more merozoites are produced through more asexual reproduction.

- Some parasites transform into sexually reproducing *gametocytes* and these if ingested by a mosquito continue the cycle.

### I- In Man (I.H) asexual cycle:

<table>
<thead>
<tr>
<th>a) Pre-erythrocytic cycle (exo-erythrocytic):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sporozoites (infective stage) are inoculated during mosquito bites</td>
</tr>
<tr>
<td>→ blood stream ¹/₂ hour → invade the liver parenchyma cells</td>
</tr>
<tr>
<td>→ schizonts → thousands of merozoites.</td>
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</table>

<table>
<thead>
<tr>
<th>b) Erythrocytic cycle (inside R.B.Cs):</th>
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<tbody>
<tr>
<td>Merozoites (from liver cells → enter R.B.Cs → ring forms → trophozoites → schizonts rupture merozoites re-enter R.B.Cs)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>c) Gametocyte formation (inside R.B.Cs):</th>
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</thead>
<tbody>
<tr>
<td>After some repeated cycles of asexual multiplication:</td>
</tr>
<tr>
<td>Merozoites → microgametocytes and macrogametocytes</td>
</tr>
</tbody>
</table>
Life cycle of malaria: mosquitoes

- Gametocytes ingested by a mosquito combine in the mosquito’s stomach to produce zygotes.

- These zygotes develop into motile elongated ookinates.

- The ookinates invade the mosquito’s midgut wall where they ultimately produce sporozoites, which make their way to the salivary glands where they can be injected into a new human host.

II- In mosquito (gametogony, sporogony cycle or sexual multiplication):
Mosquito bite of infected person → ingestion of all blood forms → digestion of all except gametocytes.
- Macrogametocyte → Macrogamete (♀)
- Microgametocyte → exflagellation → 6-8 Microgametes (♂)
  → both ♂ & ♀ gamete fusion → zygote.

Zygote → ookinete → enter between epithelium and basement membrane of the stomach of mosquito → oocyst → sporocyst → rupture & release thousands of sporozoites (infective stages) → salivary gland of the mosquito → infect man during the bite act.

- The cycle take 10-20 days in mosquito.
Malaria

Mode of infection:

1) Bite of an infected female *Anopheles* mosquito with sporozoites in its saliva (the most common type of transmission), where exo-erythrocytic and erythrocytic cycles occur.

2) Blood transfusion.

3) Organ transplantation

4) Use of sharp contaminated syringes.

5) Transplacental through placental defect (congenital malaria).

Pathogenesis of malaria:

The major clinical symptoms are attributed to:

I- Anaemia and tissue anoxia due to massive destruction of erythrocytes.

II- Host-inflammatory response as an immune response of the host to liberated parasite metabolites and pigments.

II- Additional causes in *P. falciparum* only.
Malaria Diagnosis

• symptoms: fever, chills, headache, malaise, etc.
• history of being in endemic area
• splenomegaly and anemia as disease progresses
• **Direct**: microscopic demonstration of parasite in blood smear (distinguish species)
  • **thick film**: more sensitive
  • **thin film**: species identification easier
  • **repeat smears every 12 hours for 48 hours if negative**
  • Concentrating parasites in venous blood by centrifugation when they cannot be found in blood films.
• **Indirect**: Using a **malaria rapid diagnostic test** (RDT) to detect malaria antigen. **PCR**

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**TROPHozoITE**
- Chromatin
- Ring of cytoplasm

**SCHIZONT**
- Pigment
- Merozoites

**GAMETOCYTES**
- Nucleus

**Note**: Compared with the male gametocyte, the female gametocyte is often larger, stains more deeply, and has a more compact nucleus.

*P. vivax*. a Trophozoites, gametocytes, and schizonts in thin film.

Schizont (mature), gametocyte, and trophozoite
### Malarial Plasmodia: Differential Diagnosis in Blood Smears

<table>
<thead>
<tr>
<th>A: Young trophozoite</th>
<th>B: Older trophozoite</th>
<th>C: Schizont</th>
<th>D: Macrogametocyte</th>
<th>E: Microgametocyte</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plasmodium falciparum</strong></td>
<td></td>
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<tr>
<td>Infected erythrocyte: size and form normal, multiple infection more frequent than with other <em>Plasmodium</em> species, rarely; Maurer's clefts</td>
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<tr>
<td>Small rings: 1/3 to 1/5 of EDT, binuclear form frequent, narrow plasmic fringe, vacuole small</td>
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<tr>
<td>Vacuoles small or lacking, pigment dispersed or in clumps</td>
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<tr>
<td>8–24 merozoites, sometimes more, pigment usually peripheral</td>
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<tr>
<td>Sickle-shaped, nucleus compact and central, pigment arranged around nucleus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sickle-shaped, plumper than D, nucleus larger than D, pigment finer than D and dispersed diffusely</td>
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<table>
<thead>
<tr>
<th><strong>Plasmodium vivax</strong></th>
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<tbody>
<tr>
<td>Infected erythrocyte beginning at stage B: often larger than normal, often with red Schüffner's dots</td>
</tr>
<tr>
<td>Rings 1/3 to 1/2 EDT, vacuole large, plasmic fringe narrow</td>
</tr>
<tr>
<td>Large rings or irregularly cleft form with diffuse pigment dispersal</td>
</tr>
<tr>
<td>12–24 merozoites, 1 to 2 pigment clumps, peripheral or central</td>
</tr>
<tr>
<td>Rounded, larger than EDT, nucleus small and excentric, pigment thin and dispersed diffusely</td>
</tr>
</tbody>
</table>

Fig. EDM = erythrocyte diameter (according to Geigy R, Herbig A, Erreger und Überträger tropischer Krankheiten. Basel: Verlag für Recht und Gesellschaft; 1995).
Toxoplasma gondii
**Toxoplasma gondii**

- Causes **toxoplasmosis**
- Obligate parasite with extensive distribution
- Lives naturally in cats that harbor oocysts in the GI tract
- Acquired by **ingesting raw meats or substances contaminated by cat feces**
- Most cases of toxoplasmosis go **unnoticed except in the fetus & AIDS patients which can suffer brain & heart damage**

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**Toxoplasma gondii**

- is the causative agent of a zoonosis that occurs
- Humans are infected by ingesting **oocysts excreted by the definitive hosts (cats)** or by eating unprocessed meat containing **Toxoplasma cysts**.
- If a women contracts toxoplasmosis for the first time during pregnancy,
- **diaplacental transmission** of the pathogen to the fetus is possible with potential severe consequences (for example **malformations, eye damage, clinical symptoms during childhood**). **Renal infections**. There is, however, no risk to the fetus from mothers who had been infected before their first pregnancy and have produced serum antibodies (about 35–45%).
- **Latent infections** can be activated by immunodeficiencies (e.g., in AIDS patients) and may result in **cerebral or generalized symptomatic toxoplasmosis**. Serological surveillance in pregnant
- **women is important to prevent prenatal infections.**
**Occurrence of *Toxoplasma gondii***

- *T. gondii* occurs worldwide.
- The low level of host specificity of this organism explains its ready ability to infect a wide spectrum of warm blooded vertebrate species (for example humans, sheep, pigs, cattle, horses, dogs, cats, wild mammals, bird species).
- It is estimated that approximately **one-third** of the world population is infected with *T. gondii*, although prevalences vary widely depending on age and region.
Parasite

- The life cycle of *T. gondii* includes various stages: **Tachyzoites** (endozoites), **Bradyzoites** (cystozoites) and **Oocysts**.

**Tachyzoites** (endozoites)
- are proliferative forms that reproduce rapidly in nucleate host cells by means of endodyogeny (endodyogeny: formation of two daughter cells from a mother cell by endogenous budding).
- An apical complex is located at the anterior pole, consisting of several components.
- The apical complex contributes to parasite penetration into host cells.
- *Toxoplasma* and several other apicomplexan protozoa (e.g., *Plasmodium*) contain, in addition to the chromosomal and mitochondrial genomes, a further genome consisting of circular DNA localized in a special organelle called the apicoplast.
- Tachyzoites also multiply in experimental animals and cell cultures.
**Bradyzoites (cystozoites)**
- are stages produced by slow reproduction within the cysts.
- The cysts develop intracellularly in various tissues, have a relatively resistant wall, grow as large, and can contain up to several thousand bradyzoites.
- They have a long lifespan in the host. Humans and animals can be infected by oral ingestion of meat containing cysts.

**Oocysts**
- are rounded and encysted stages of the organism, surrounded by a resistant cyst wall. They are the final product of a sexual reproductive cycle in the intestinal epithelia of Felidae (cat family).
- They contain a zygote and are shed in feces. Sporulation takes place within 1-5 days, producing two sporocysts with four sporozoites each.
- Sporulated oocysts are infective for humans and animals.
Life cycle of *Toxoplasma gondii*

- Members of the cat family (Felidae) are the only known definitive hosts for the sexual stages of *T. gondii* and thus are the main reservoirs of infection.

- *Cats become infected with* *T. gondii* *by carnivorism. After tissue cysts or oocysts are ingested by the cat, viable organisms are released and invade epithelial cells of the small intestine where they undergo an asexual followed by a sexual cycle and then form* oocysts, *which are excreted.*

- *The unsporulated oocyst takes 1 to 5 days after excretion to sporulate (become infective). Although cats shed oocysts for only 1 to 2 weeks, large numbers may be shed.*

- *Oocysts can survive in the environment for several months and are remarkably resistant to disinfectants, freezing, and drying, but are killed by heating to 70°C for 10 minutes.*

Human infection may be acquired in several ways:

a. ingestion of undercooked infected meat containing *Toxoplasma* cysts.

b. ingestion of the oocyst from fecally contaminated hands or food.

c. organ transplantation or blood transfusion.

d. transplacental transmission.

e. accidental inoculation of tachyzoites. The parasites form tissue cysts, most commonly in skeletal muscle, myocardium, and brain; these cysts may remain throughout the life of the host.
Life cycle

- The developmental cycle of *T. gondii* involves three phases: intestinal, external, and extraintestinal.
- The **intestinal phase** with production of sexual forms (gamogony) takes only place in enterocytes of definitive hosts. Only domestic cats,
- Only **extraintestinal** development is seen in intermediate hosts (pigs, sheep, and many other animal species) as well as in dead-end hosts (humans).
- Following primary infection of a cat with *Toxoplasma* cysts in raw meat, asexual reproductive forms at first develop in the small intestine epithelium, with sexually differentiated stages and oocysts following later.
• **External phase.**
  • Oocysts excreted in *cat feces* *sporulate* at room temperature within 1 to 5 days, rendering them infective. Kept moist, they remain infective for up to five years and are not killed by standard disinfectant agents.

• **Extraintestinal phase.**
  • This phase follows a peroral infection with oocysts or cysts and is observed in intermediate hosts (dogs, sheep, pigs, other vertebrates, birds) and dead-end hosts (humans), as well as in the definitive hosts (cats). Starting from the intestine, the *Toxoplasma* organisms travel in blood or lymph to various organs and multiply in nucleate host cells, especially in the reticulohistiocytic system, in musculature, and in the CNS.

• Repeated endodyogenic cycles produce as many as 32 individual daughter cells in the expanding host cell before it bursts. The tachyzoites thus released attack neighboring cells.
  • These processes result in focal necroses and inflammatory reactions in affected tissues. Generalization of the infection can lead to colonization of the placenta and, about three to four weeks later, infection of the fetus.
  • Cysts that elicit no inflammatory reactions in the near vicinity are produced early in the course of the infection. Such cysts (tissue cysts) are found above all in the CNS, in the skeletal and heart muscles as well as in the retina, the uterine wall, and other organs. They can remain viable for years without causing noticeable damage to the host.
Clinical Features

- Acquired infection with Toxoplasma in immunocompetent persons is generally an asymptomatic infection. However, 10% to 20% of patients with acute infection may develop cervical lymphadenopathy and/or a flu-like illness. The clinical course is benign and self-limited; symptoms usually resolve within a few months to a year.
- Immunodeficient patients often have central nervous system (CNS) disease but may have retinochoroiditis, or pneumonitis.
- In patients with AIDS, toxoplasmic encephalitis is the most common cause of intracerebral mass lesions and is thought to be caused by reactivation of chronic infection. Toxoplasmosis in patients being treated with immunosuppressive drugs may be due to either newly acquired or reactivated latent infection.

- Congenital toxoplasmosis results from an acute primary infection acquired by the mother during pregnancy. The incidence and severity of congenital toxoplasmosis vary with the trimester during which infection was acquired. Because treatment of the mother may reduce the incidence of congenital infection and reduce sequelae in the infant, prompt and accurate diagnosis is important.
  - Most infants with subclinical infection at birth will subsequently develop signs or symptoms of congenital toxoplasmosis unless the infection is treated.
  - Ocular Toxoplasma infection, an important cause of retinochoroiditis in the United States, is frequently a result of congenital infection. Patients are often asymptomatic until the second or third decade of life, when lesions develop in the eye.
Laboratory Diagnosis:
Microscopy or Serological detection but Serologic testing is the routine method of diagnosis and may be supported by (CT) or (MRI).

The diagnosis of toxoplasmosis may be documented by:
• Observation of parasites in patient specimens, such as bronchoalveolar lavage material from immunocompromised patients, or lymph node biopsy.

Detection of T. gondii parasites in c.s.f.
• Occasionally T. gondii tachyzoites can be found in specimens such as c.s.f. in AIDS patients with cerebral involvement. The c.s.f. usually contains Trophozoites may occasionally be found and neutrophils and mononuclear cells.

Toxoplasma in tissue sections
• Toxoplasma may occasionally be found in a tissue section in which the organisms may appear round
• A blood lymphocytosis with many atypical lymphocytes is usually found in acute Toxoplasma infections.

• A low platelet count may also be found.
• Most infections with T. gondii are diagnosed serologically.
• But Serological testing, however, has only a limited value in diagnosing Toxoplasma encephalitis in AIDS patients.

Serological diagnosis of toxoplasmosis
• The most reliable test for the diagnosis of acute toxoplasmosis in pregnancy,
• is the Sabin-Feldman dye test. This highly sensitive and specific test is a complement-mediated neutralizing antigen-antibody reaction which uses live trophozoites to measure Toxoplasma specific antibody.
• The Eiken Toxoreagent latex agglutination test is a simpler test.
Giemsa stained trophozoites (tachyzoites) of *T. gondii*.