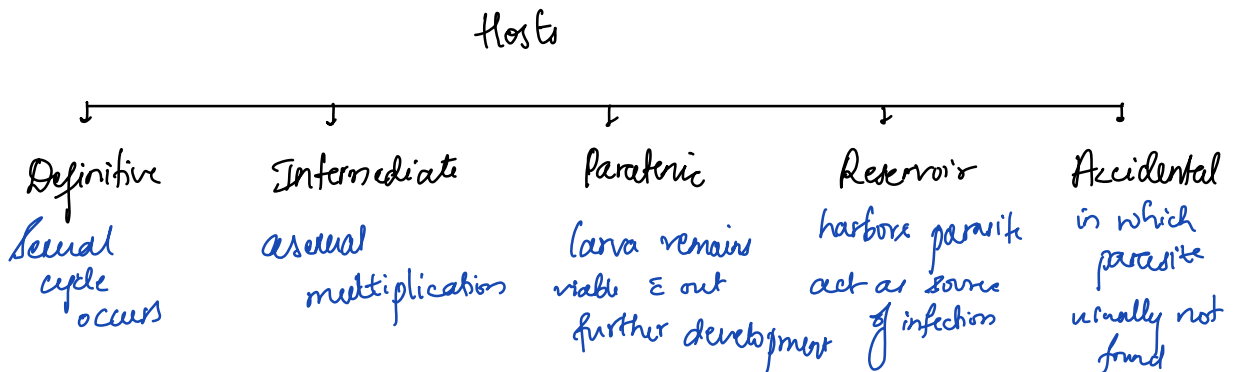
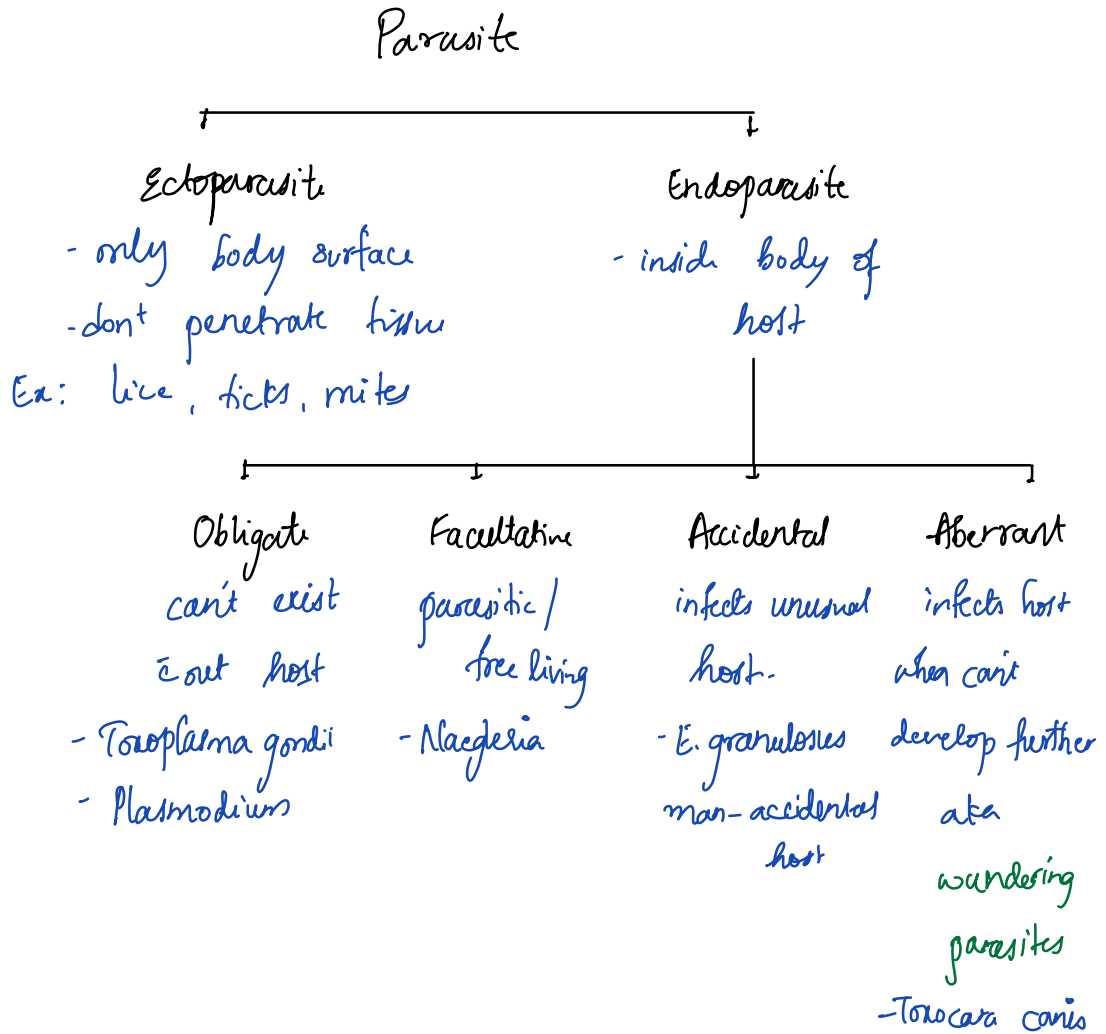
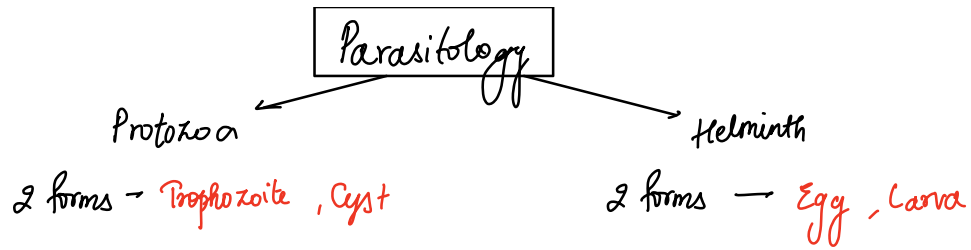




Ans. is 'c' Utilization

Carrier

- ❖ Carrier is a person who harbors the pathogenic microorganism without suffering from any disease from it.

Classification

- ❖ *Healthy carriers*: These are the persons who harbor the microorganism but had never suffered from any disease by it.
- ❖ *Convalescent carriers*: These are the persons who had been infected by that microorganism and are recovering from that infection. Even though they have no more symptoms of the disease, they continue to shed the microorganism into the environment.
- ❖ *Temporary carriers*: The carrier state lasts for less than 6 months.
- ❖ *Chronic carriers*: The carrier state extends beyond 6 months and may even last for years.
- ❖ *Contact carrier*: A person can become a contact carrier when he acquires the microorganism due to his contact with the patient.
- ❖ *Paradoxical carrier*: A person is a paradoxical carrier when he acquires the microorganism from another carrier.

53. Paradoxical carriers are:

(NEET 2019)

- a. A person who acquires the microorganism due to his contact with the patient
- ☒ b. A person who acquires the microorganism from another carrier
- c. A person who is clinically recovered from an infectious disease but still capable of transmitting the infectious agent to others
- d. None

Ans. is 'b' A person who acquires the microorganism from another carrier

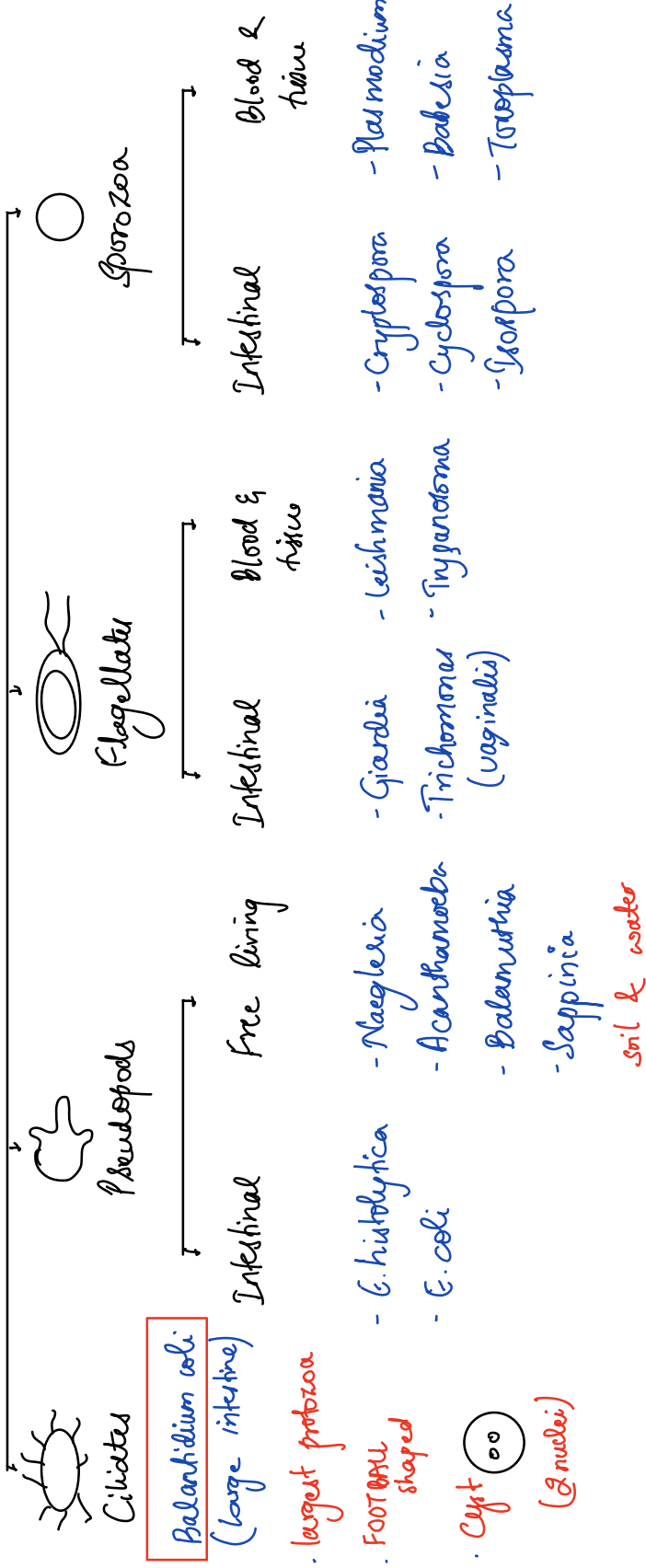
54. Carrier is defined as:

- a. Person, animal or object from which infectious agent passes to host
- b. Person, animal or object in which an infectious agent lives and multiplies
- ☒ c. Infected person harboring infectious agent without clinical features and acts as source of infection
- d. A person in which infectious agent lies dormant

Ans. is 'c' Infected person harboring infectious agent without clinical features and acts as source of infection

Protozoa

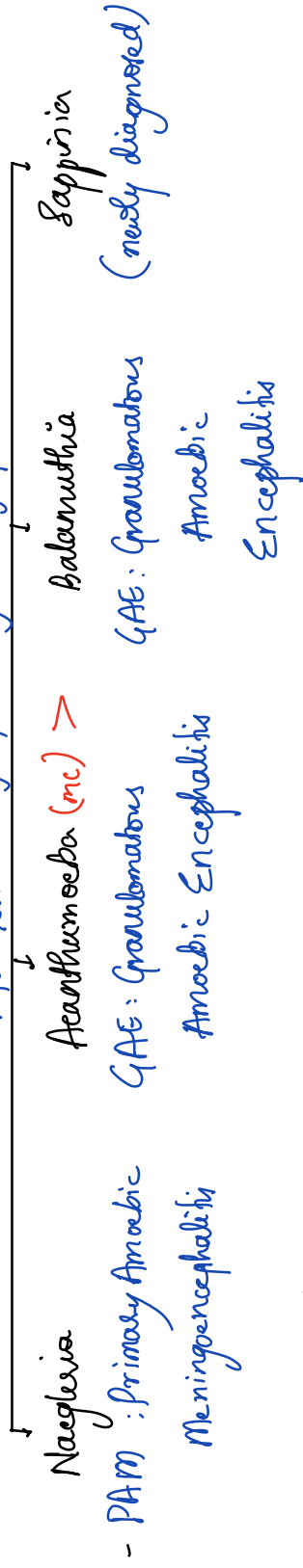
Locomotory classification



Free living amoeba (Neuropathogenic)

Habitat : Soil & water (fresh warm water)

h/o swimming, meningeal symptoms



- Acute condition
- Chronic condition
- contact lens keratitis
- corneal ulcers

Doc - Amphotericin B

No Rx

- seriously ill/died
in 3-5 days

Flagellatus

- Giardiasis
- Trichomonas vaginalis

- jerky motility
- strawberry vagina

(obligate parasite)

Cryptospora
 Cyclospora
 Tricospora

inf: sporulated
 form oocyst

immunocompromised

ACID
FAST

Cryptospora
Cyclospora
Diospora
Egg of Taenia
Mycobacteria
MTB
Nocardia

Trophozoite

↳ Infective form

Δ^{su} : Stool examination

$$e_{cyst}$$

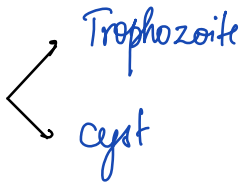
R_2 : Meconidazole

Blood & Tissue protozoa



Intestinal

Entamoeba histolytica

Morphological forms 

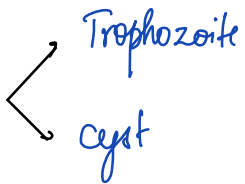
Infective form : cyst

Route of transmission : feco-oral

Diagnosis : stool examination
(look for trophozoite & cyst)

Rx : DOC : Metronidazole

Giardia lamblia

Morphological forms 

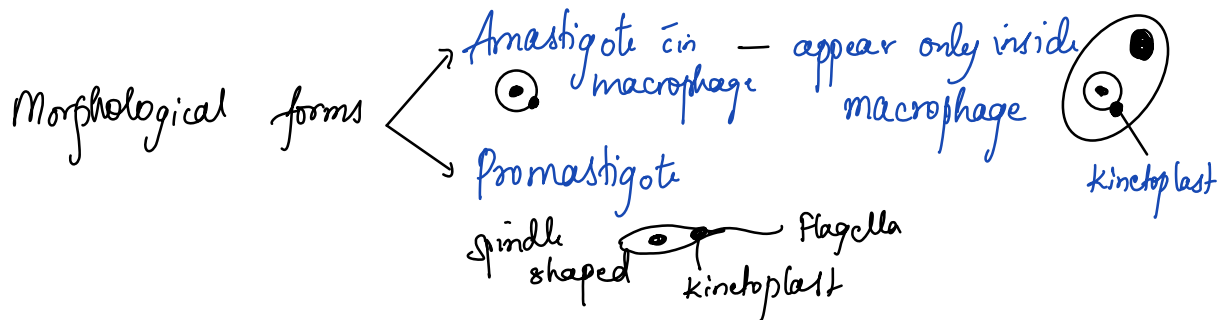
Infective form : cyst

Route of transmission : feco-oral

Diagnosis : stool examination
(look for trophozoite & cyst)

Rx : DOC : Metronidazole

Blood & tissue (morphological forms are diff)
Leishmania Donovani



Infective form : Promastigote

Route of transmission : Vector Sandfly Phlebotomus



Diagnosis : PBS → promastigote form

Tissue Aspirate from RES (macrophage-rich) — Amastigote within macrophage

LD Body — Diagnostic form
(Leishman Donovan Body)

Rx : ** DOC - Amphoterecin - B

earlier - pentavalent Antimony compounds

DOC Sodium Stibogluconate (∴ development of Meglumine antimonate resistance)

Other drugs: Paromomycin
Pentamidine
(Azoles)

Stimaquine
Miltefosine (only oral drug)

Trypanosoma

	<u>T. cruzi</u>	- megaoesophagus - megacolon - cardiomegaly	<u>T. Brucei</u>
	Chagas disease aka South American		Sleeping sickness
Morphological: forms	- Amastigote - Trypomastigote		- Amastigote - Trypomastigote
Infective: form	Trypomastigote		Trypomastigote
Route of transmission	Reduviid bug		 Tse Tse fly
Diagnosis:	PBS Trypomastigote (diagnostic form)		PBS Trypomastigote (diagnostic form)
Diagnostic: signs	Romana's sign u/L conjunctival/eyelid edema 		Winterbottom sign Lymphadenopathy in post Δ ^l of neck 
Rx:	benznidazole		Suramin

Sleeping sickness

West African

East African

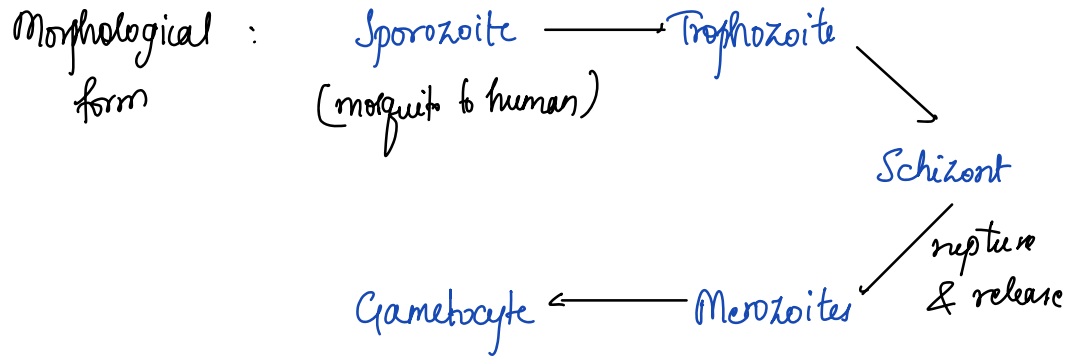
T. brucei gambiense

Rx
Early: Pentamidine
late: Eflornithine

T. brucei rhodesiense

Rx
Early - Suramin
late - Melarsazole

Plasmodium



Infective form: Sporozoite

Route of transmission: Mosquito Female Anopheles

Diagnosis: PBS (all except sporozoite are diagnostic forms)

- Trophozoite
- Schizont
- Gametocyte

Treatment: DOC - Chloroquine
Quinine
Artemisinin compounds

Babesia intracellular parasite of RBC
Species : Babesia microti
divergens

Infective form : babesia

Route of transmission : Ixodid tick → also a vector - Lyme's disease
(definitive host) for
man - intermediate host

Diagnosis : PBS  MALTESE CROSS
↓
IOC : Giemsa stain

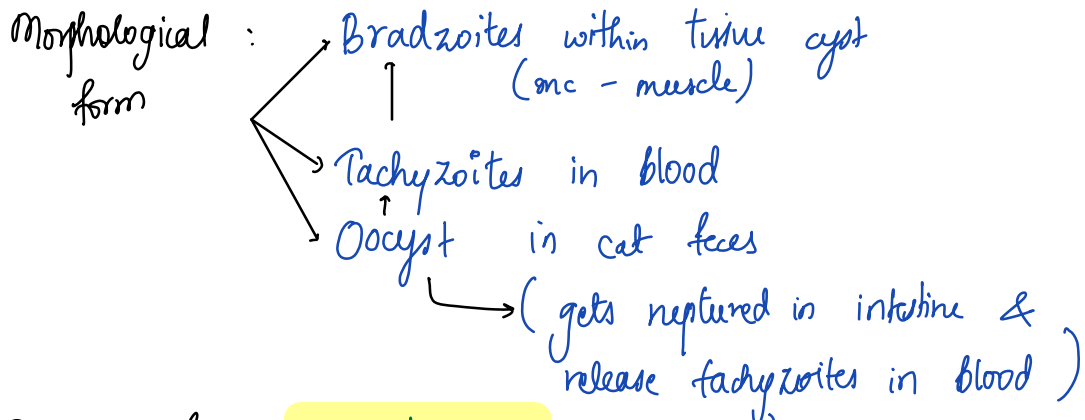
Rx : DOC : Atovaquone + Azithromycin

Severe: Clindamycin + Quinine

Note: PBS - Romanowsky stains
- Wright
- Field
- Giemsa (mc used)
- Leishman

Toxoplasma

only Tissue protozoa



Infective form: - oocyst (mc) - (feco-oral)

- tachyzoite - via Blood transmission
- bradyzoite - sheep (mc intermediate host)
∴ man is accidental intermediate host

Route of transmission: - feco-oral mc

- blood transfusion (No vector is tissue protozoa)
- ingestion of sheep meat

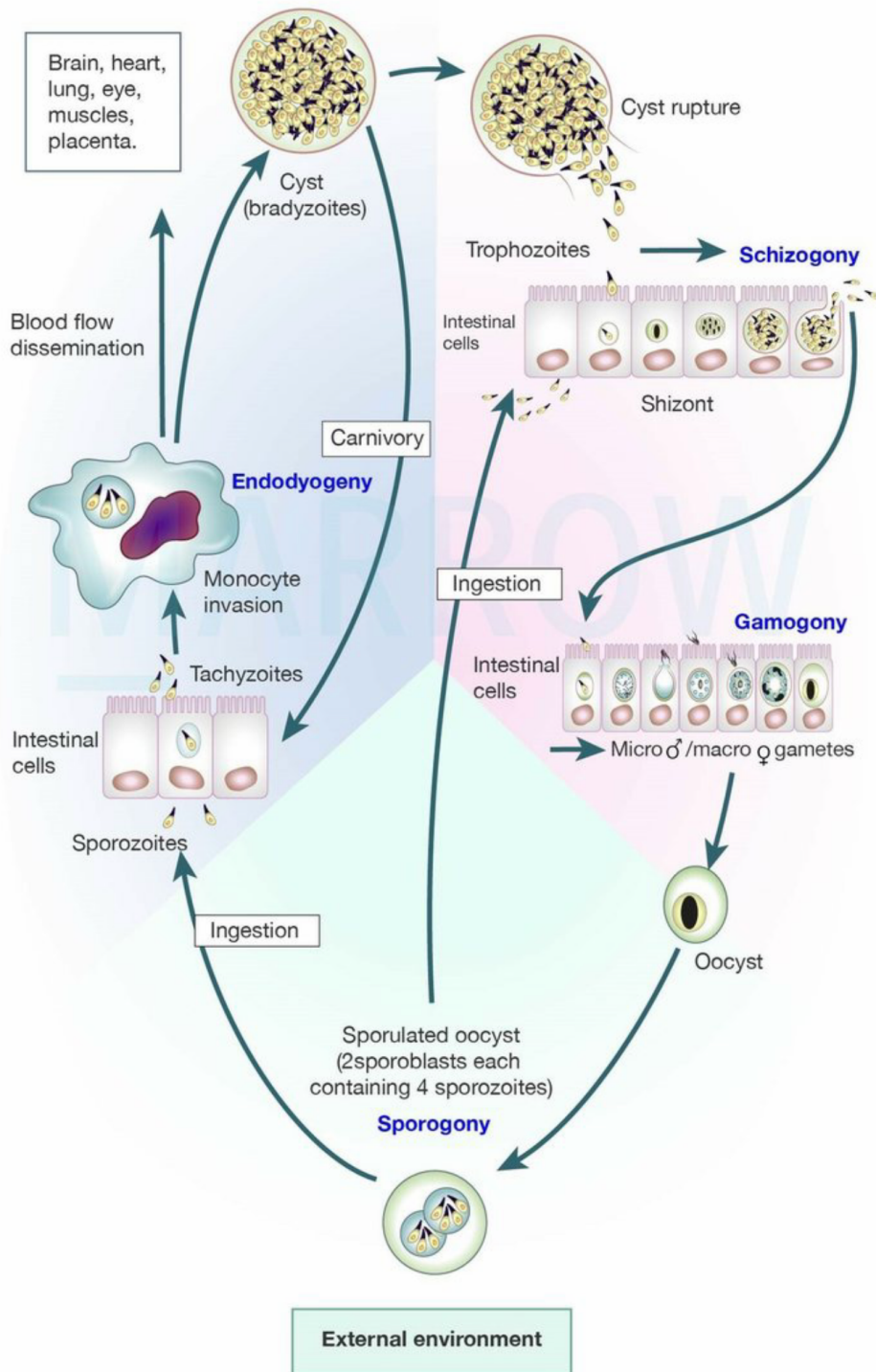
Diagnosis : PBS - Tachyzoites (diagnostic form)

Treatment : Doc is

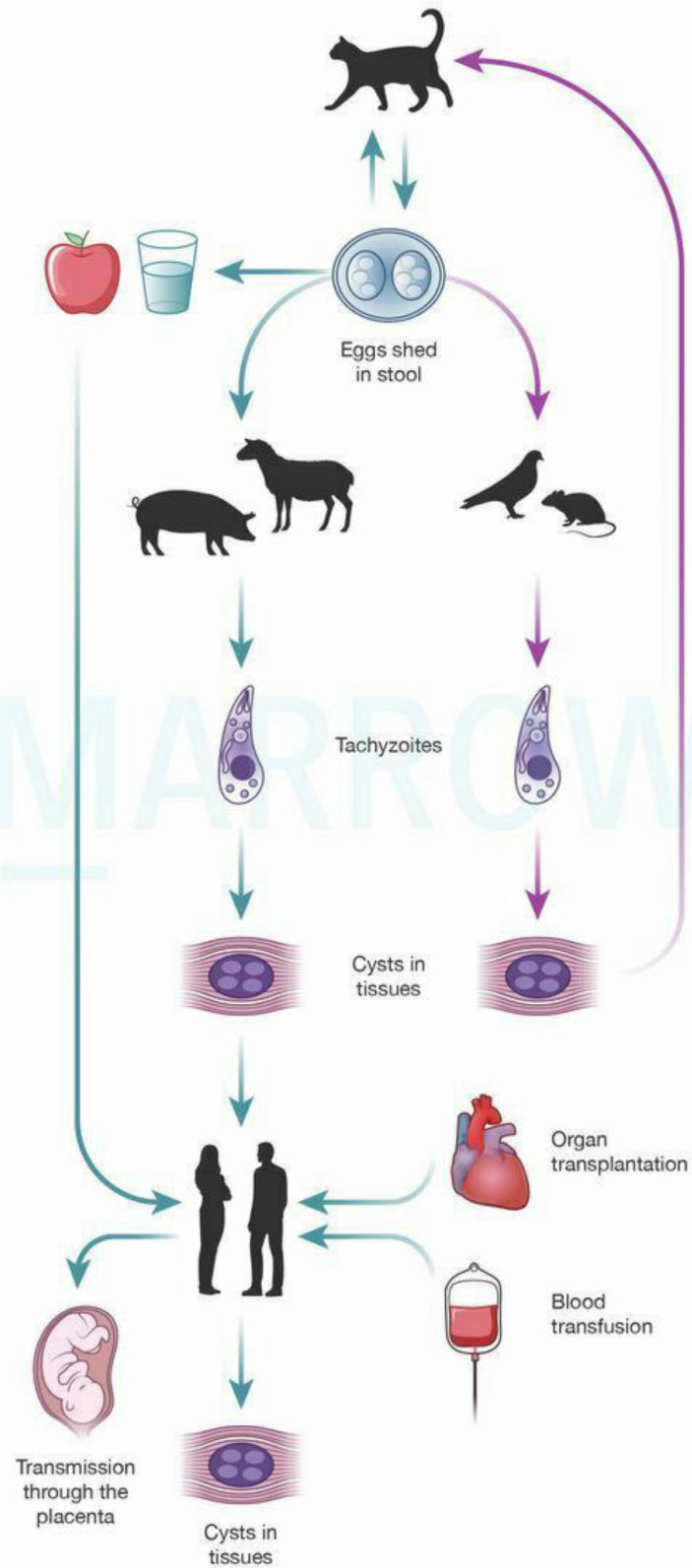
- immunocompetent - symptomatic Rx. Pyrimethamine + Sulfadiazine
- immunocompromised (Opportunistic) - Trimethoprim + Sulfamethoxazole (Cotrimoxazole)
- pregnancy - SPIRAMYCIN

Intermediate hosts:
mammals, birds

Definitive hosts:
Felids



Life cycle of *Toxoplasma gondii*



Entamoeba histolytica

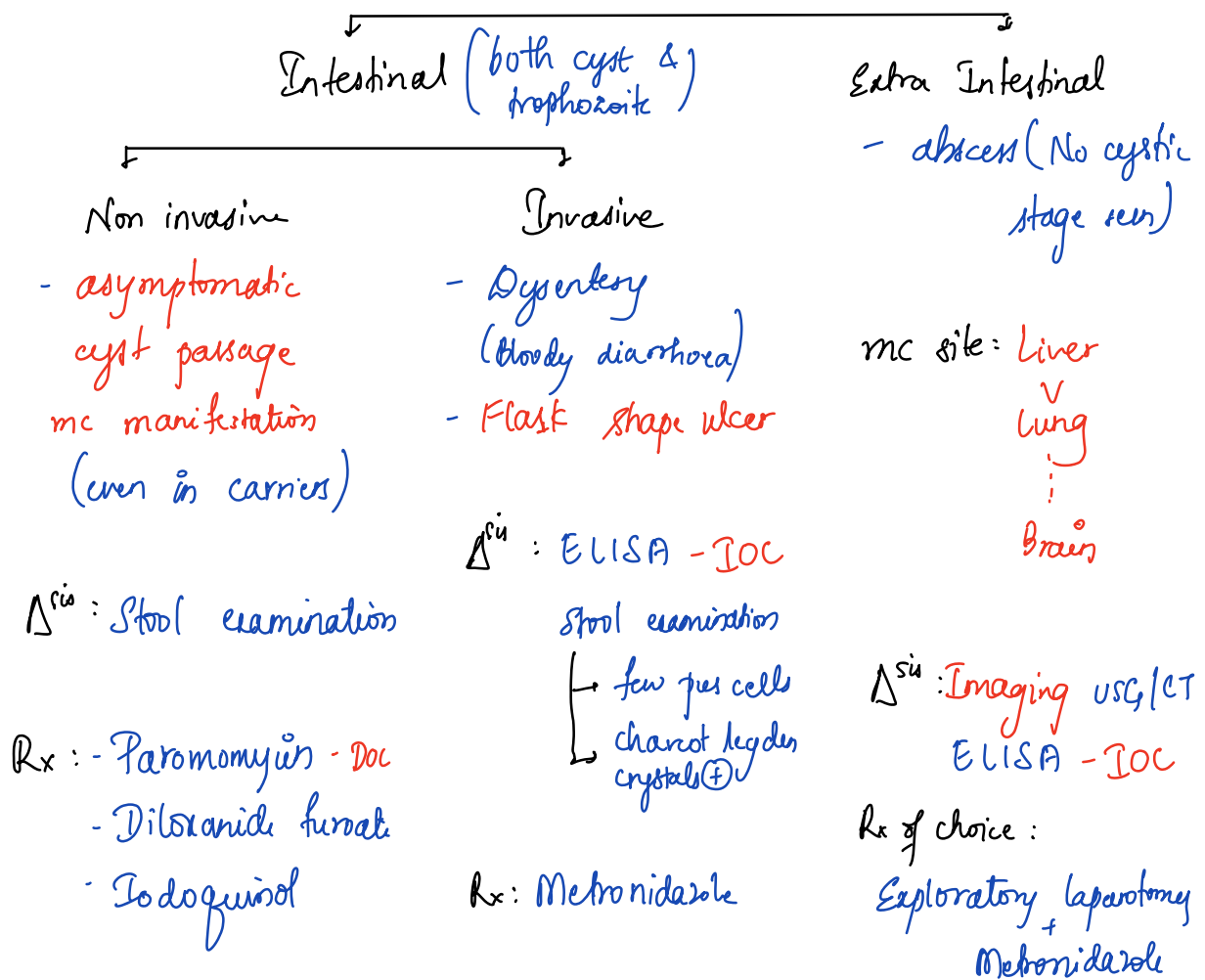
Morphological form : $\left\{ \begin{array}{l} \text{Trophozoite} \\ \text{Cyst} - \text{infective} \end{array} \right.$

Route of transmission : feco-oral

Habitat : large intestine **Caecum**

Note: large intestinal protozoa
Balanidium coli
Entamoeba histolytica

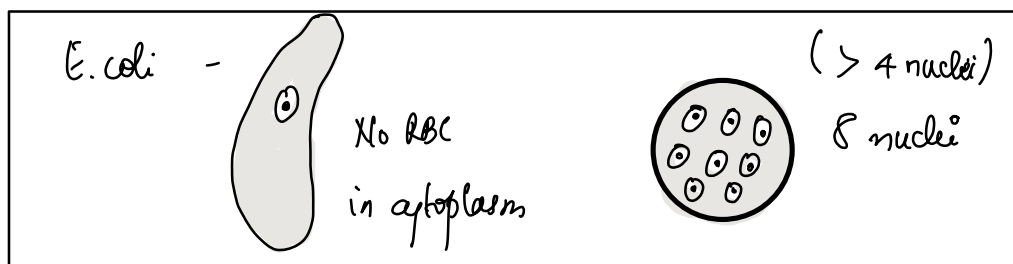
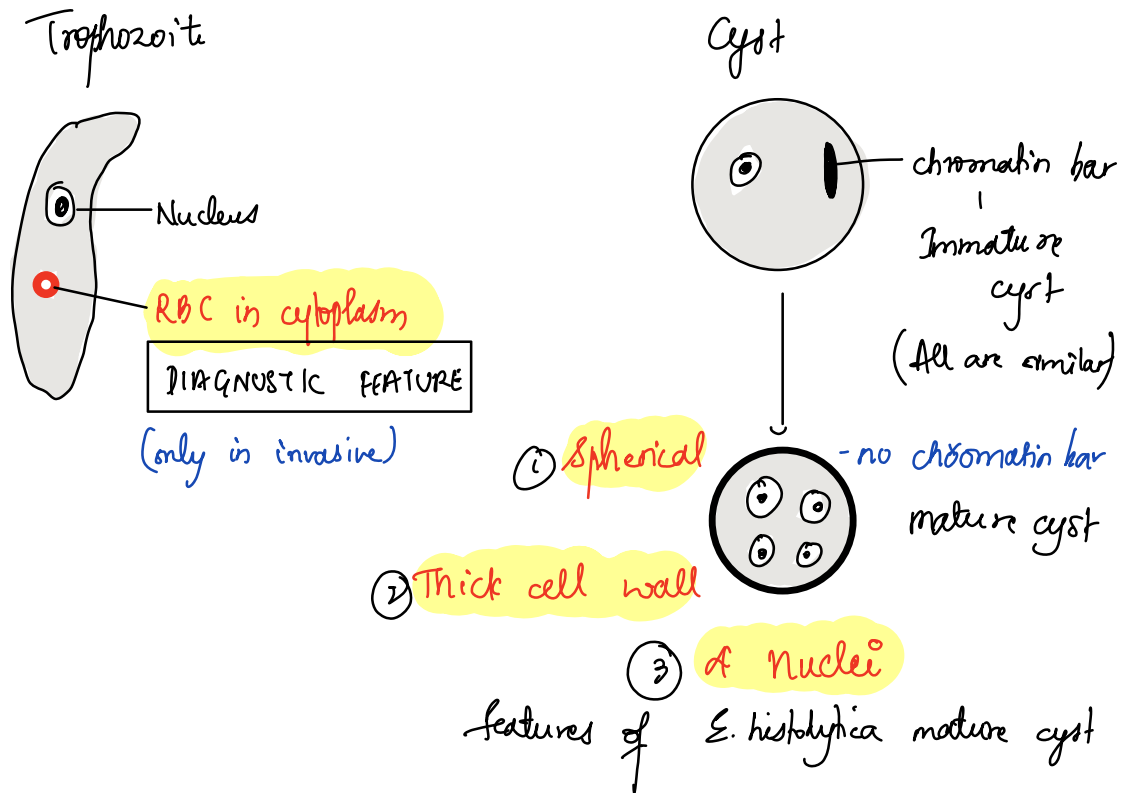
C/F : **Amoebiasis**



virulence factor: **lechin receptor**
trophozoite attach to this in intestine

Isoenzyme analysis → Isoenzyme pattern

aka **zymodene pattern**
to differentiate pathogenic from
non-pathogenic *E. histolytica*



Giardia lamblia / Giardia duodenalis

Morphological forms : $\left\{ \begin{array}{l} \text{Trophozoite} \\ \text{Cyst - infective} \end{array} \right.$

Route of transmission : feco-oral

Habitat : small intestine **Duodenum** > Jejunum
(mesite)

C/F :

$\left\{ \begin{array}{l} \text{asymptomatic cyst passage} \\ \text{diarrhoea (never dysentery)} \\ \text{malabsorption of fat} \end{array} \right.$ mc
(steatorrhea)

Δ_{his} : $\left\{ \begin{array}{l} \text{most in \& \&} \rightarrow \text{ELISA GSA 65} \\ \text{stool} \left\{ \begin{array}{l} \text{Trophozoite} \\ \text{cyst} \end{array} \right. \left. \begin{array}{l} \text{Falling leaf motility} \\ \text{intermittently released} \\ \text{in stool} \end{array} \right\} \\ \text{alt. sample} \downarrow \end{array} \right.$
($\therefore$ repeated samples taken)

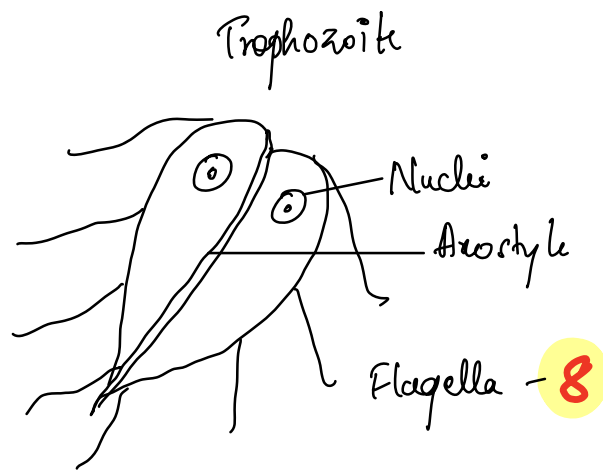
duodenal wash

ENTERO-TEST /
GELATIN STRING TEST

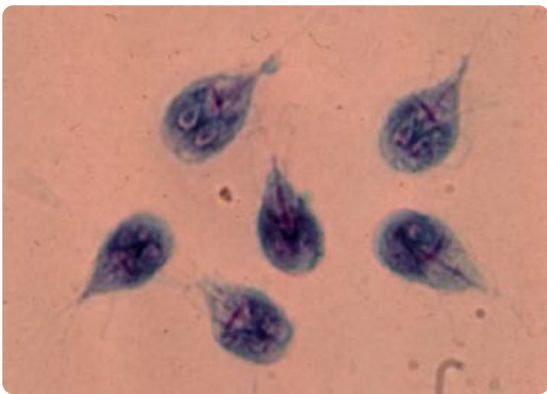
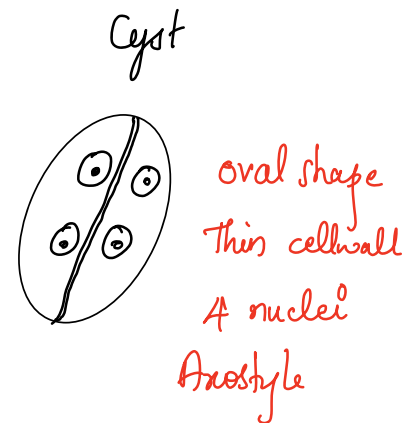
performed
for

G	Giardia
S	Strongyloides
C	Cryptospora
C	Clonchis sinensis

Rx: DOC : Metronidazole



tennis / badminton
racket shape



Note: Secretory IgA & IL-6 responsible for clearing
the infection

∴ infection occurs in immunosuppressed, agammaglobulinemia
or malnourished individuals

Entamoeba

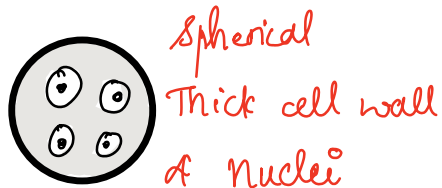
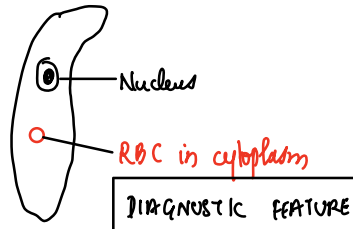
Giardia

Morphological forms $\left\{ \begin{array}{l} \text{Trophozoite} \\ \text{cyst} - \text{Infective form} \end{array} \right.$

Route : Feco-oral

Diagnosis : Stool examination

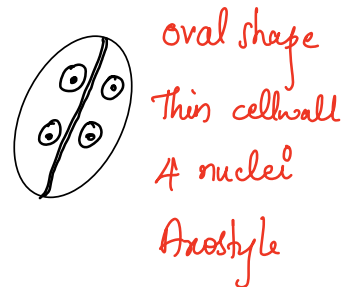
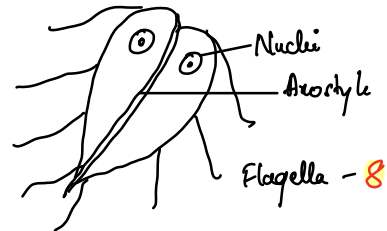
Habitat : Large intestine



C/F: $\left\{ \begin{array}{l} \text{Non invasive intestinal} \\ \text{Invasive intestinal} \\ \text{Extra intestinal} \end{array} \right.$

Rx : Metronidazole

Habitat : small intestine



- intermittent stool passage
- Other test : Entero test / Gelatin string test

C/F: $\left\{ \begin{array}{l} \text{asymptomatic} \\ \text{diarrhoea} \\ \text{malabsorption} \end{array} \right.$

Rx : Metronidazole

Leishmania

- Blood protozoa
- patient from Bihar (70-80% cases)
 - ↳ abdominal mass (Hepato splenomegaly)
 - ∴ reticuloendothelial system involved

Morphological form $\begin{cases} \text{Amastigote in macrophage (LD body)} \rightarrow \text{Diagnostic} \\ \text{Promastigote} \rightarrow \text{Infective} \end{cases}$

Vector : Sandfly (*Phlebotomus argentipes*)



C/F : abdominal mass (Hepato splenomegaly) [RES involved]

Sitel :

- aka Delhi boil / Baghdad Boil / Aleppo boil
- 1) Cutaneous aka **Oriental sore** $\rightarrow$ *L. tropica*
 - 2) Mucocutaneous aka **Espundia** $\rightarrow$ *L. braziliensis*
(Nasopharyngeal)
 - 3) Visceral aka **Kala Azar** $\rightarrow$ *L. donovani*

Complications : PKDL

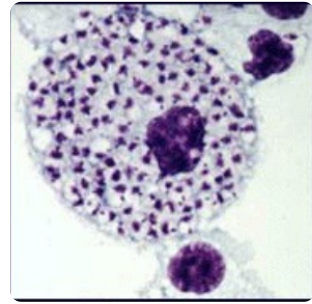
post kala Azar Dermal leishmaniasis

Butterfly erythema on face

>10% of pts even after completing Rx

Δ^{hi} : 1) m/e PBS - promastigote

Tissue aspirate - CD body
most sensitive sample: splenic aspirate
mc used sample: BM aspirate



2) Culture media : **NNN media** - Leishmania & Trypanosoma
[not used for Δ^{hi}]

Note: Culture media is parasitology

1) **NNN medium** - Leishmania & Trypanosoma

2) **Philips media** - E. histolytica

3) **RPMI 16-40 medium** - malaria & filarial parasite
(for surveillance)

3) Immunological - **Napier's Aldehyde test**
 $\uparrow$ IgG hypergammaglobulinemia
true after 3 months of inf

Any immunological test for Ab performed after 1 week

Note: Buffy coat is used to diagnose leishmaniasis

Rx: **DOC - Amphotericin - B**

earlier - pentavalent Antimony compounds

DOC $\rightarrow$ Sodium Stibogluconate ($\because$ development of
Meglumine antimonate resistance)

Other drugs: Paromomycin

Pentamidine

Stimaquine

MILTEFOSINIC - only oral drug
(Azoles)

Note: - prevalence in Bihar, West Bengal & UP
(not Assam)

- Insecticide of choice to prevent Kala Azar - **DDT**

PLASMODIUM

Species	Morphology	RBC	Pigment Hemozoin	Incubation period	Disease
i) <i>P. vivax</i> relapse	Trophozoite:  Single ring form in RBC Schizont:  nucleus Gametocyte: 	Enlarged $\bar{c}$ Schouffer's dot	yellowish brown	14d	Tertian malaria (fever every 3 rd day) called benign
ii) <i>P. ovale</i> not seen in India		Enlarged $\bar{c}$ James dot	Dark brown	12d	Tertian malaria
iii) <i>P. malariae</i> recrudescence		(N) size $\bar{c}$ basophilic / zimmerman stippling	light black	longest 24 days	Quartan malaria (fever every 4 th day) renal: Nephrotic syndrome
iv) <i>P. falciparum</i> mc in India	Trophozoite (ring):  multiple ring form seen Schizont:  acute form Gametocyte:  Banana/sickle shaped Schizont: not seen in PBS adherent to endothelium of BV	Normal in size $\bar{c}$ Murre's cleft	Dark black	shortest (2-3 days)	Tertian malaria called Malignant Renal: ATR / renal failure complication mc complication: Blackwater fever / Cerebral malaria
v) <i>P. knowlesi</i>					Quotidian malaria

Diagnosis :

1) PBS $\left\{ \begin{array}{l} \text{Thick smear} \text{ --- to identify plasmodium presence} \\ \text{(: detection done 1st)} \\ \text{Thin smear} \text{ --- to identify the species} \end{array} \right.$

2) GBC - Quantitative Buffy Coat
not performed $\because$ false positive due to artefacts

3) Immunological tests $\left\{ \begin{array}{l} \text{ELISA / Indirect Fluorescent Assay 2-3 hrs} \\ \text{Rapid tests (results in 30 mins)} \end{array} \right.$

• Immunochromatographic Assay : **plasmodium LDH** (genus specific)

• **HRP-2** (Histidine rich protein - 2) : plasmodium falciparum

Rx : $\left\{ \begin{array}{l} \text{P. vivax} \text{ --- Chloroquine (if sensitive)} \\ \quad \downarrow \text{resistant} \\ \quad \text{Quinine + Primaquine (14 days)} \\ \text{P. falciparum} \text{ --- Chloroquine (if sensitive)} \\ \quad \downarrow \text{resistant} \quad \quad \quad + \text{Primaquine (1 dose)} \\ \quad \text{Artemisin compounds} \end{array} \right.$

Note: Rapid tests

i)  lateral flow/Immunochromatographic assay

∴)  flows vertically → Vertical flow / Immunoblot / Dot blot assay

iii) $\xrightarrow{\text{sample on glass slide} + \text{latex coated Ag}}$ latex agglutination Test (LAT)

Note:

P. vivax?

→ more common in vival

P. ovalis

relapse due to reactivation of hypnozoites
to prevent kill hypnozoites
 ↓
 Primaquine

P. malariae

residence

no reactivation

few forms become resistant

P. falciparum

↳ more common in *falciparum*

to prevent recrudescence - prolong treatment

Note: - Absence of Duffy blood group Ag → protective against P. vivax

∴ Duffy Ag is receptor for P. vivax

- primary mode of resistance of chloroquine → Drug efflux pumps

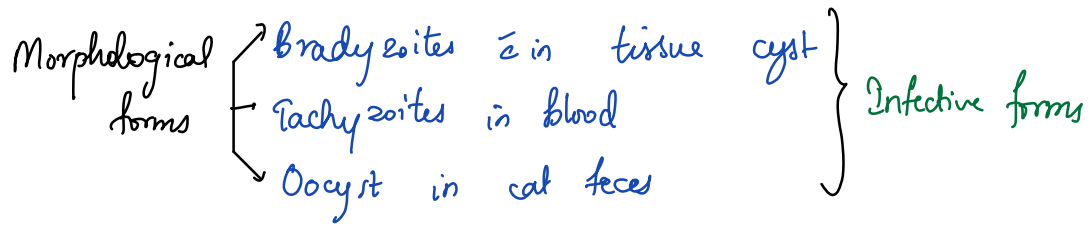
mediated by ABC transporter encoded by (Pfmdr 1)

- **Algid malaria** → rare complication of severe malaria
(shock + hypothermia)

Conditions protective against Plasmodium falciparum:

- Sickle cell trait
- Hemoglobin C
- Hb SC
- Hb E
- Hereditary persistence of HbF
- α & β thalassemia
- Band 3 mutations

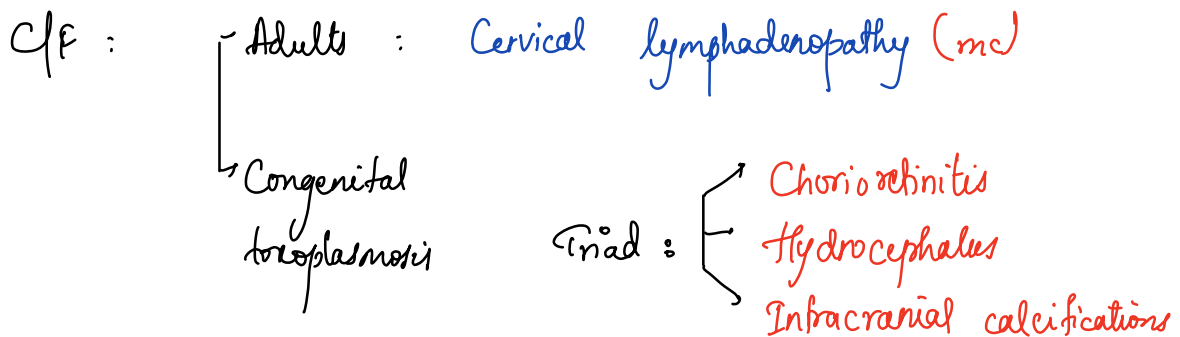
Toxoplasma (Only tissue protozoa)



Definitive host → Cat

Route of transmission:

- Oocyst (mc) - feco-oral mc
- Tachyzoites - blood transfusion
- bradyzoites - ingestion of sheep meat



Diagnosis:

In adults

- 1) PBS - look for tachyzoites
- 2) Culture - Tissue culture (∴ non cultivable protozoa)
- 3) Immunological - IgG - Sabin Fieldman Dye test

follow by

- ELISA

IgG Avidity test

IgM persists upto 2yrs
∴ cannot diff acute & chronic

acute

low < 3 months

high > 3 months chronic

Congenital Infections : mother
↓ during pregnancy/delivery
fetus

risk of transmission: 25 to 30%.

1st trimester → congenital defects
2nd trimester/delivery — infection only
(more common) no congenital defects

immediate manifestations of signs & symptoms
signs & symptoms in later part of life

Diagnosis : ELISA

- IgM - high sensitivity
- IgG - X (can pass through placenta)
- IgA - low sensitivity

∴ IgM ELISA done

To diagnose : paired IgG samples taken 1-2 weeks apart
= IgG

IgG titre → IgG titre

- ↑se (baby's IgG)
- same/↓se (mother)

Note: most of Abs from mother disappear by 6 months
& all Abs disappear by 18 months

Diagnosis of congenital toxoplasmosis

In this case IgA ELISA has more sensitivity than IgM ELISA

∴ IgA ELISA used

Rx : immunocompetent - Pyrimethamine + Sulfadiazine

immunocompromised - Cotrimoxazole

pregnancy - Spiramycin

Leishmania

amastigote (diagnostic)
promastigote (infective)

C/F : - Cutaneous - Oriental sore
- mucocutaneous - Espundia
- Visceral - Kala azar

Δ^{tu} : - PBS - promastigote
- Tissue aspirate - LD bodies
- Culture - NNN media
- **Napier's aldehyde test**

Rx: **DOC - Amphoterecin B**
Earlier: Sodium stibogluconate
meglumine antimonate

Others: Paromomycin
Pentamidine
Stimargin
Miltefosine
Azoles

Toxoplasma

bradyzoites } infective
diagnostic-tachyzoites }
oocyst mc }

Adult - Cervical lymphadenopathy

congenital $\left\{ \begin{array}{l} \text{Chorioretinitis} \\ \text{Hydrocephalus} \\ \text{intracranial calcification} \end{array} \right.$

Δ^{tu} : - PBS - Tachyzoites

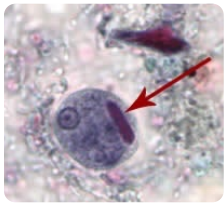
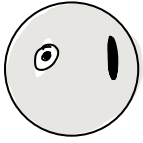
- non cultivable protozoa
- **Sabin Fieldman dye test**
- **ELISA**

Rx: immunocompetent : Pyrimethamine
+ Sulfadiazine

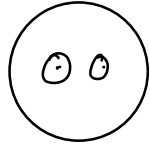
immunocompromised - Cotrimoxazole

pregnancy - **Spiramycin**

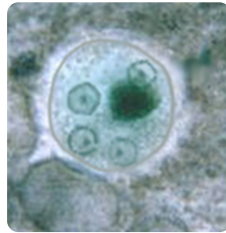
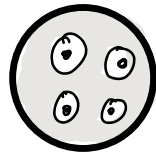
Immature cyst



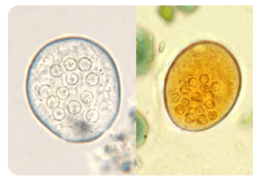
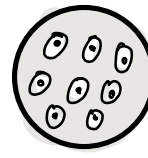
B. coli



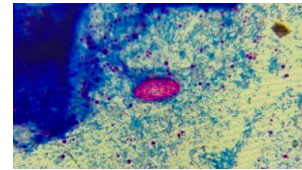
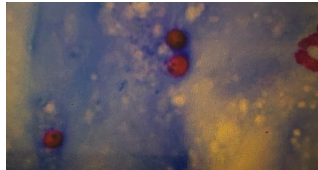
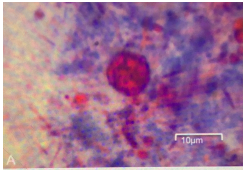
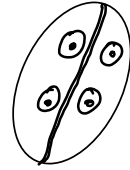
E. histolytica



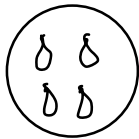
E. coli



G. lamblia



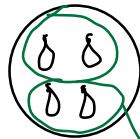
Cryptospora



round shape
4 sporozoites

5µ

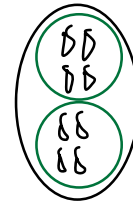
Cyclospora



sporozoite

10 µ

Isospora
(Cystoisospora)

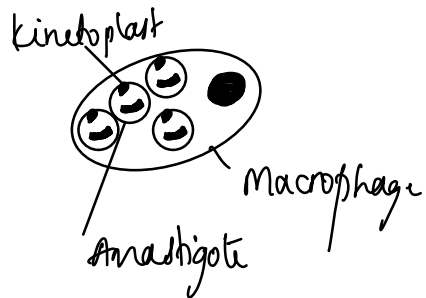


oval shape

30 µ

Kingoun stain

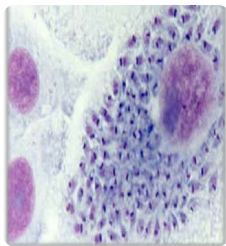
Leishmania



Trypanosoma

same

LD bodies - skin, tissue



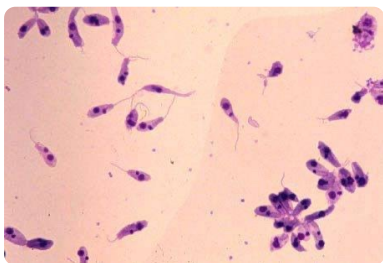
macrophages
blood macrophages

LD bodies - skin, tissue

macrophages
Not seen in blood



promastigote



metacyclic trypomastigote



Plasmodium

P. vivax

1) Trophozoite

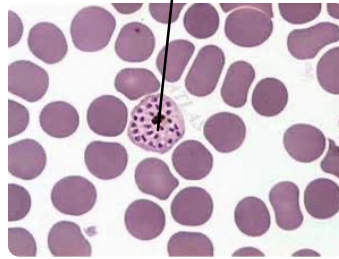


single ring form
in RBC

2) Schizont



3) Gametocyte



P. falciparum

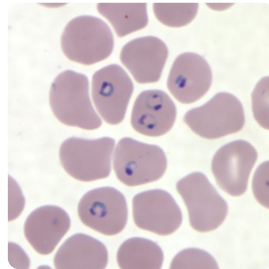
1) Trophozoite (ring)



multiple ring
form seen



accolé form

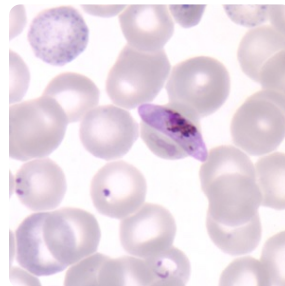


2) Schizont not seen in PBS
∴ adherent to endothelium
of BV

3) Gametocyte

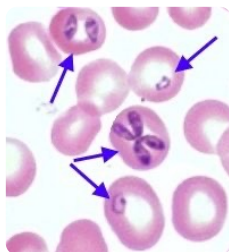


Banana/sickle
shaped



Babesia

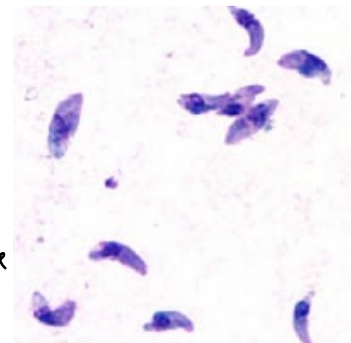
mature cross



Toxoplasma

Tachyzoites

spindle shape
no flagella



Antigen parasite pairs

- WKK & rk39 - leishmania
- HRP-2 antigen - Plasmodium falciparum
- Vivax specific pLDH - plasmodium vivax
- Giardia specific Ag 65 - Giardia lamblia
- Galactose lectin Ag - Entamoeba histolytica
- OG4C3 A 20 kDa Ag - Wuchereria bancrofti