Plasmodium and *Babesia*

Presented by

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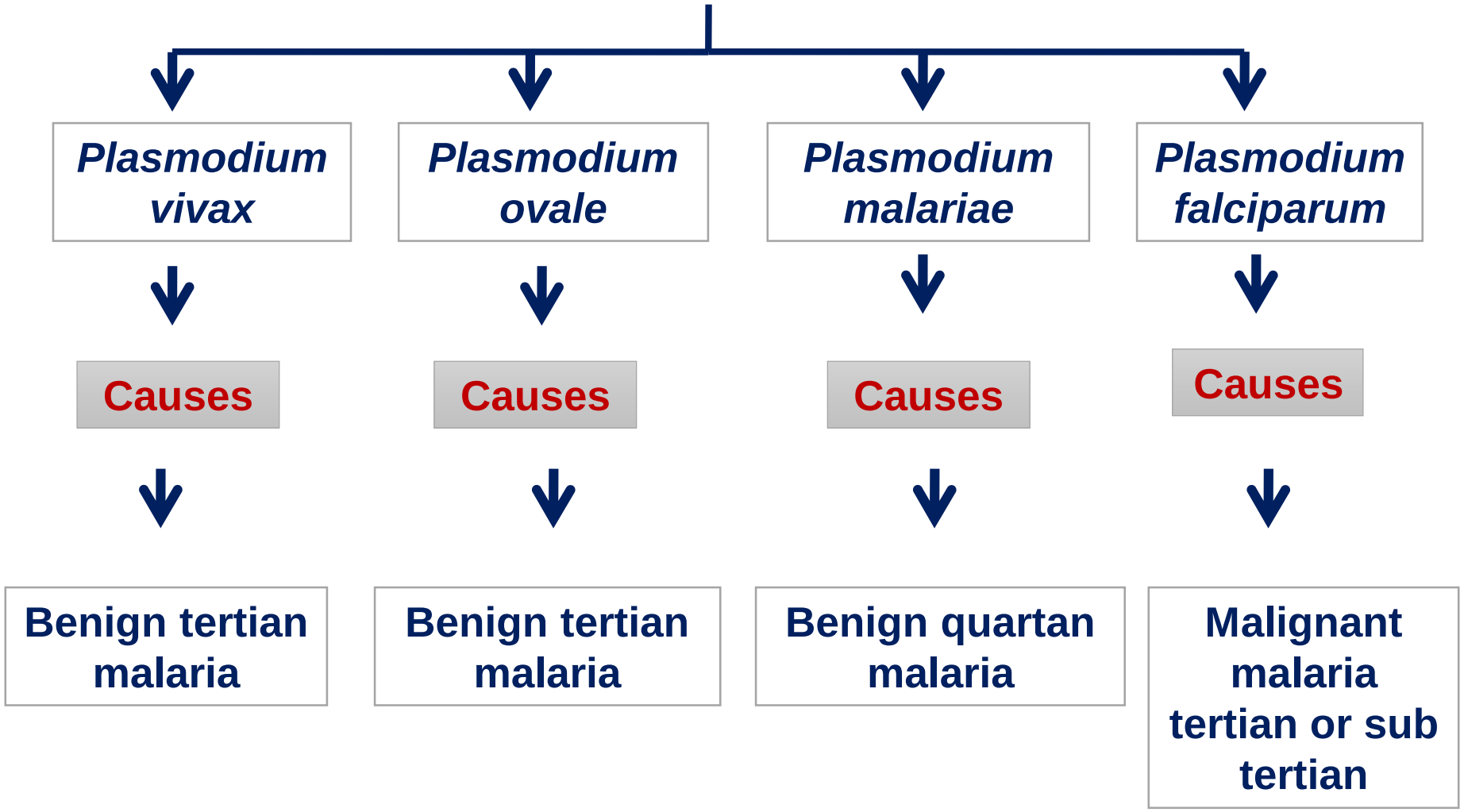
- **General characters:**

1- No special organs for locomotion (move by gliding) in some stages of their life cycle.

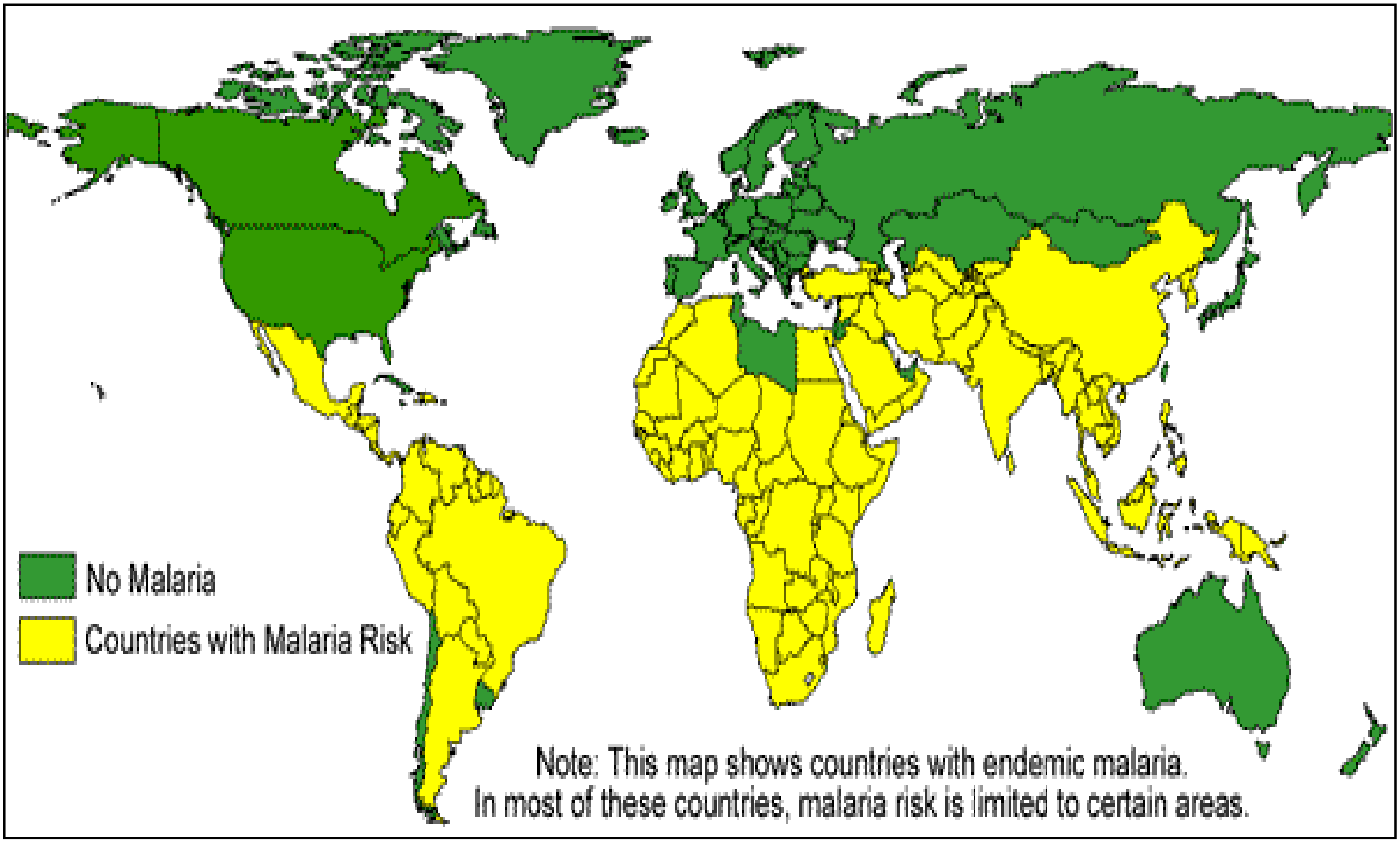
2- Multiply by alternation of sexual and asexual generations.

Plasmodia

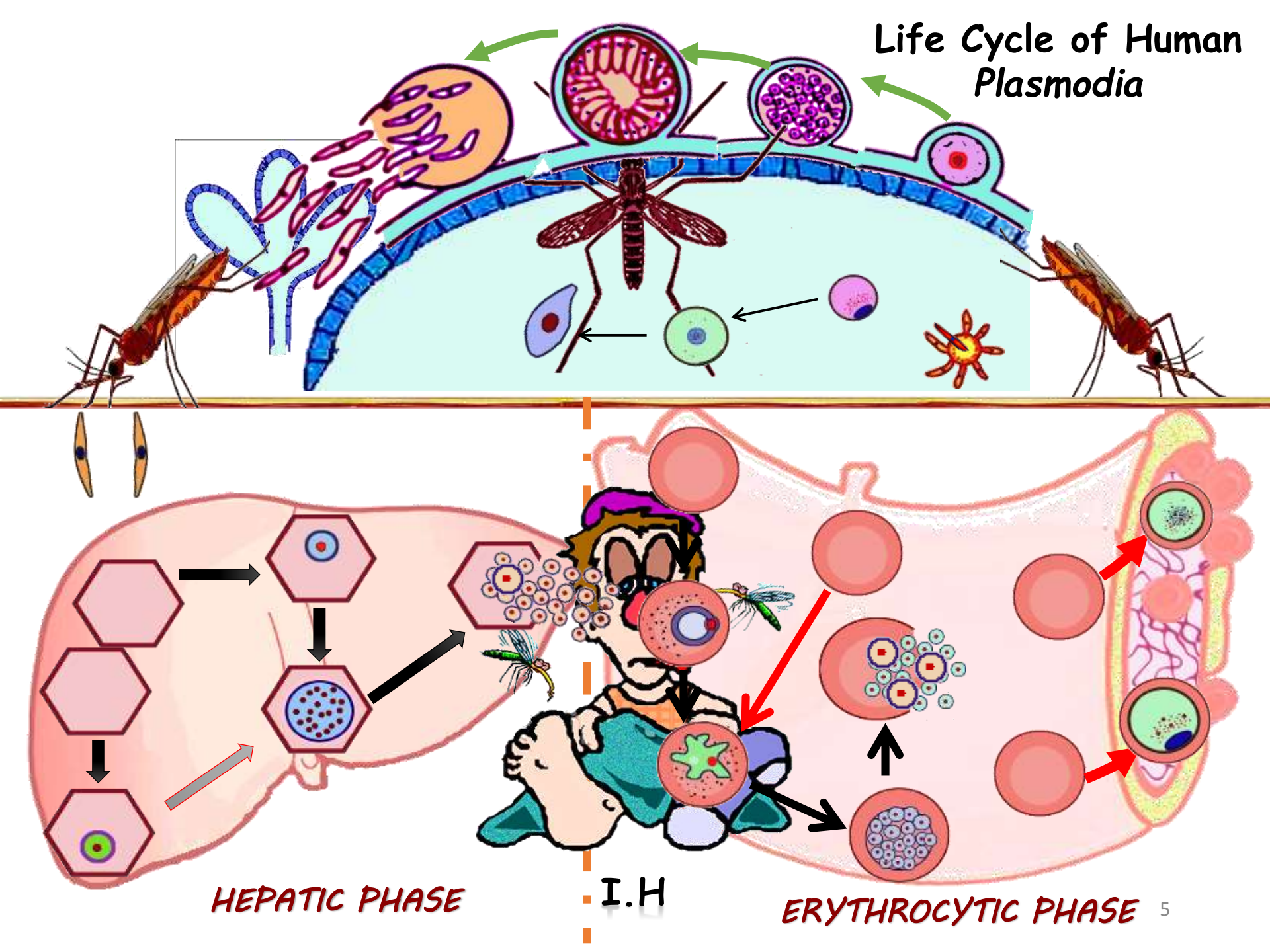
Malaria parasites

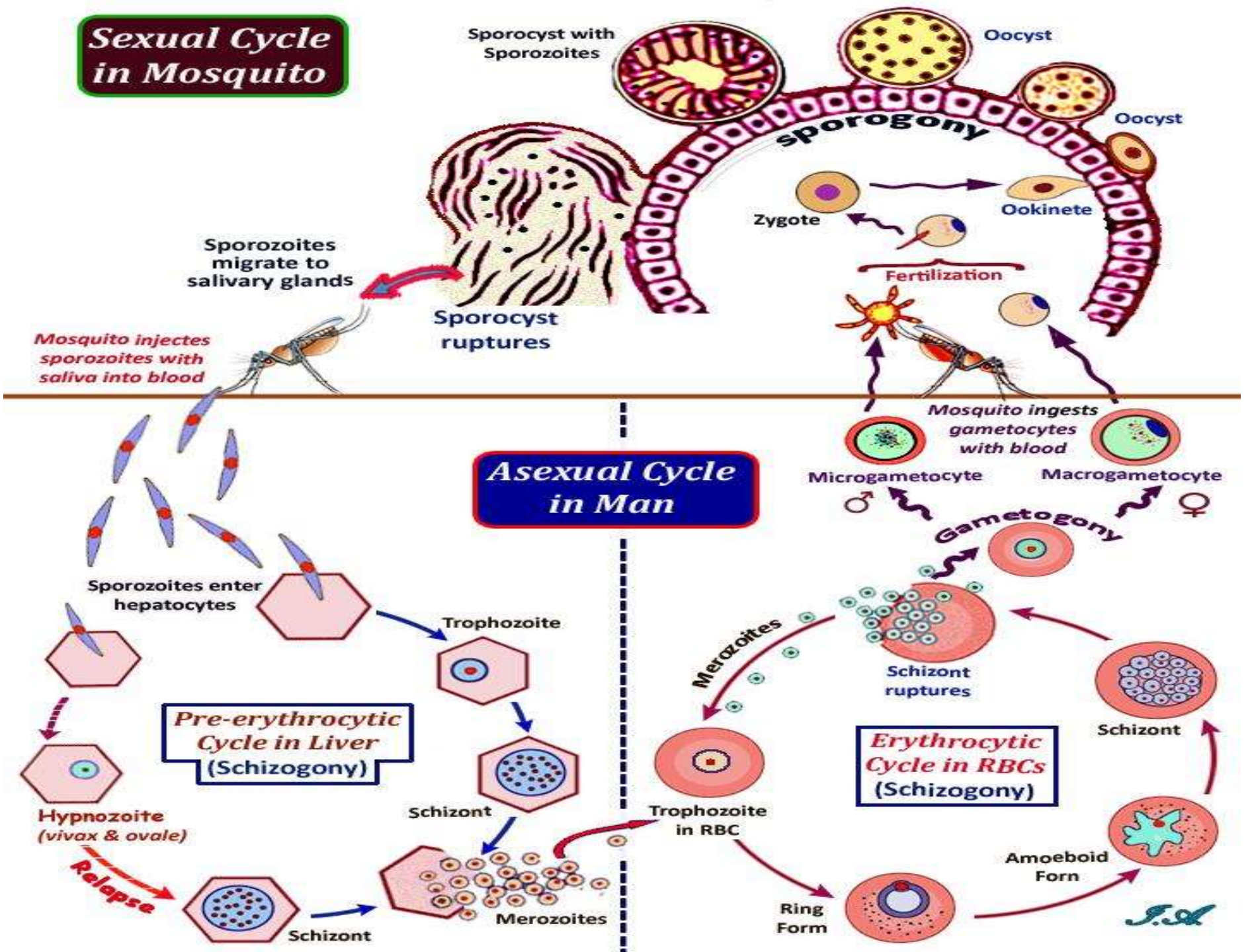


Malaria endemic areas



Life Cycle of Human *Plasmodia*




Sexual Cycle in Mosquito
Sporocyst with Sporozoites
Oocyst
Oocyst
sporogony
Zygote
Ookinete
Fertilization
Sporozoites migrate to salivary glands
Sporocyst ruptures
Mosquito injectes sporozoites with saliva into blood
Mosquito ingests gametocytes with blood
Microgametocyte
Macrogametocyte
Asexual Cycle in Man
Gametogony
Sporozoites enter hepatocytes
Trophozoite
Merozoites
Schizont ruptures
Schizont
Pre-erythrocytic Cycle in Liver (Schizogony)
Erythrocytic Cycle in RBCs (Schizogony)
Hypnozoite (vivax & ovale)
Schizont
Trophozoite in RBC
Relapse
Schizont
Merozoites
Amoeboid Forn
Ring Form

Life cycle

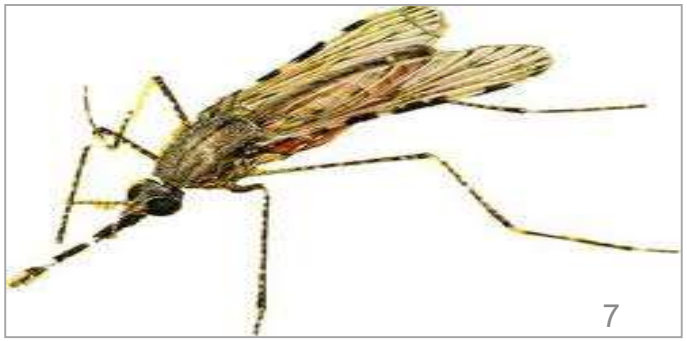
The life cycle of malaria passes in 2 alternate hosts

Man (I.H)

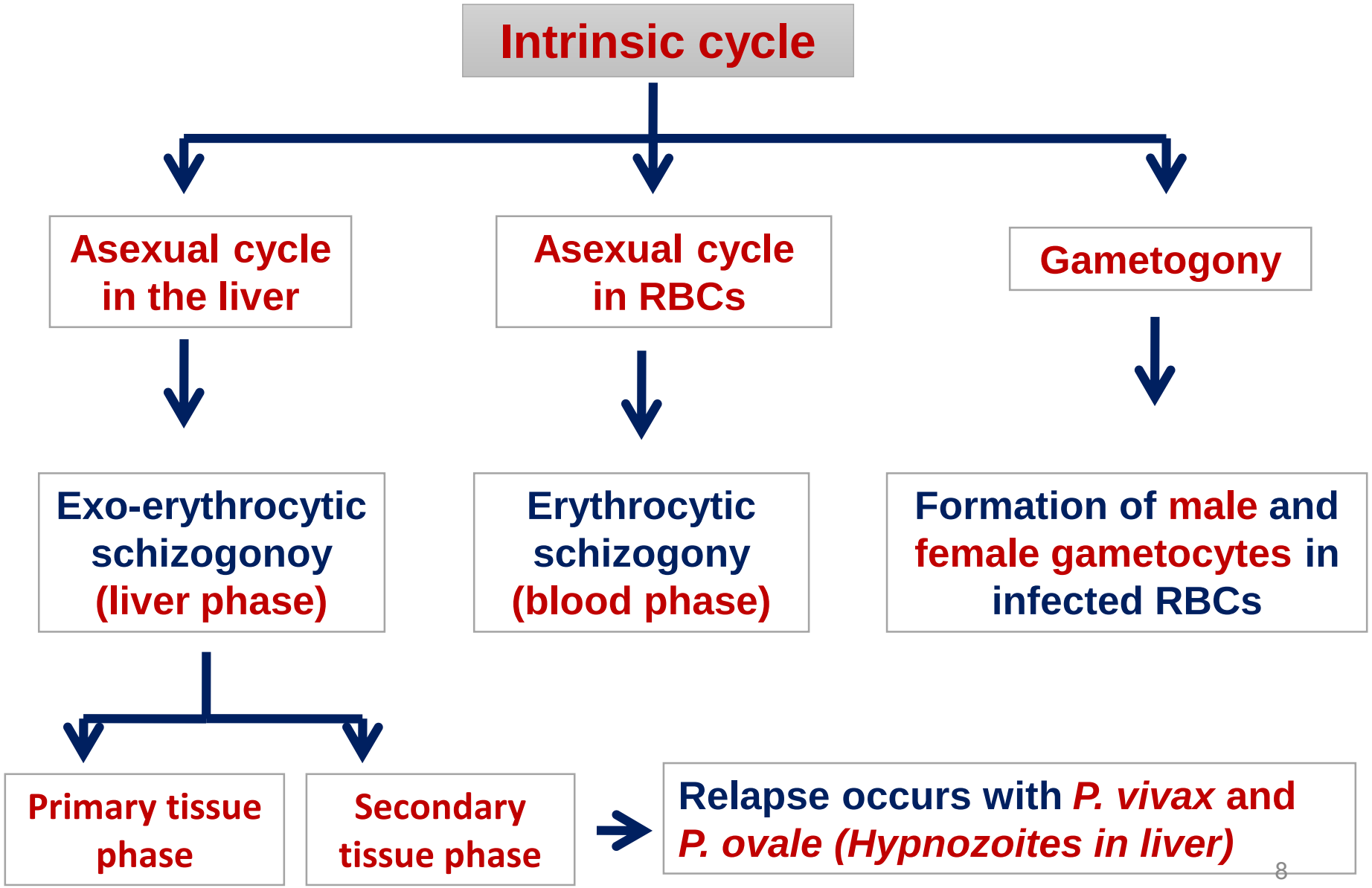
The asexual cycle (Schizogony) takes place ends by the formation of male and female gametocytes (Gametogony).

Female *Anopheles* (D.H)

The sexual cycle (Sporogony) takes place.



Life cycle of malaria parasites in man



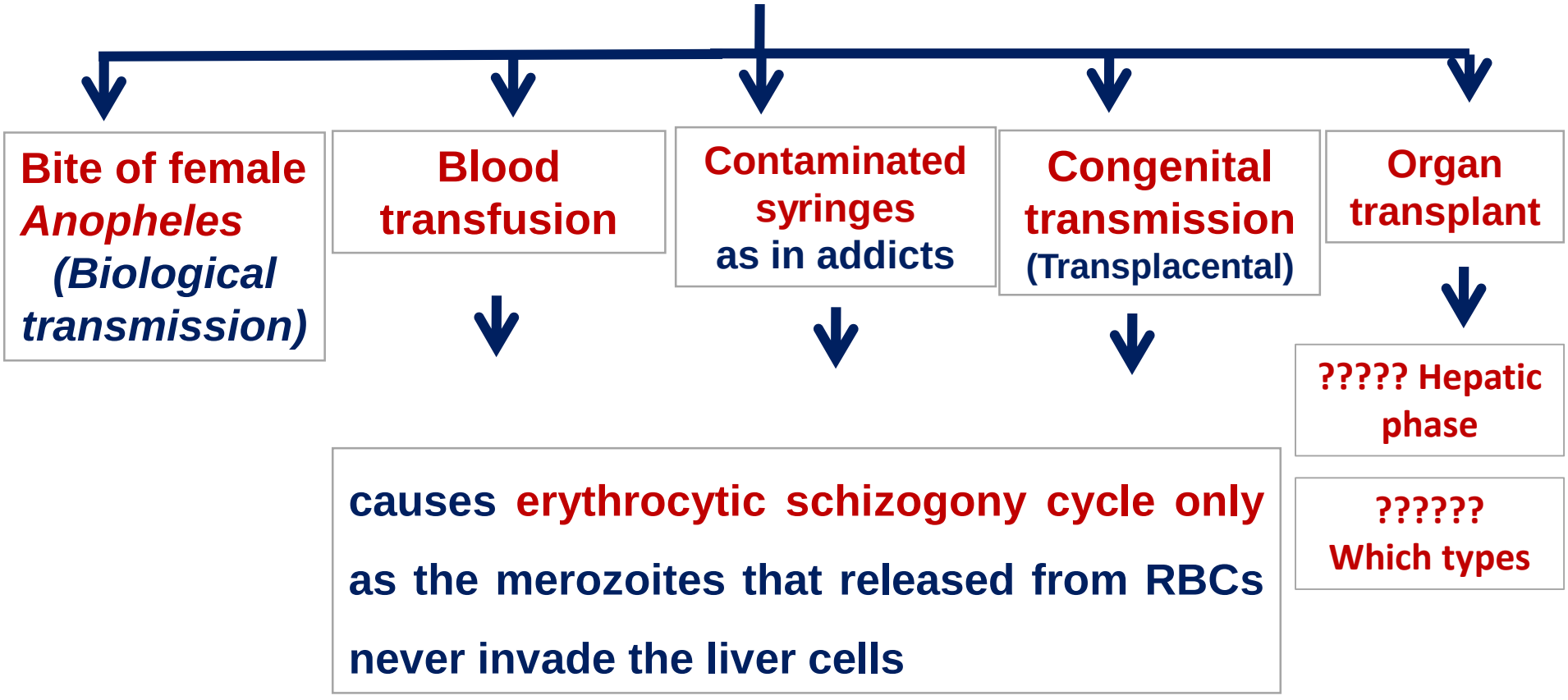
Life cycle of malaria parasites in mosquito

Extrinsic cycle or Sporogony

➢**Start when female *Anopheles* bites infected person for blood meal that containing all stages of malaria parasite. All the stages are digested in the stomach of the mosquito except the gametocytes (I.S to mosquito).**

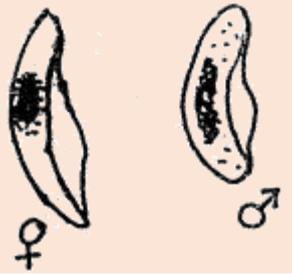
➢**End by Fertilization between microgamete & the macrogamete forming a zygote ➲ elongated ookinete ➲ spherical oocyst ➲ sporocyst containing a large number of sickle- shaped sporozoites (I.S to man).**

Mode of transmission

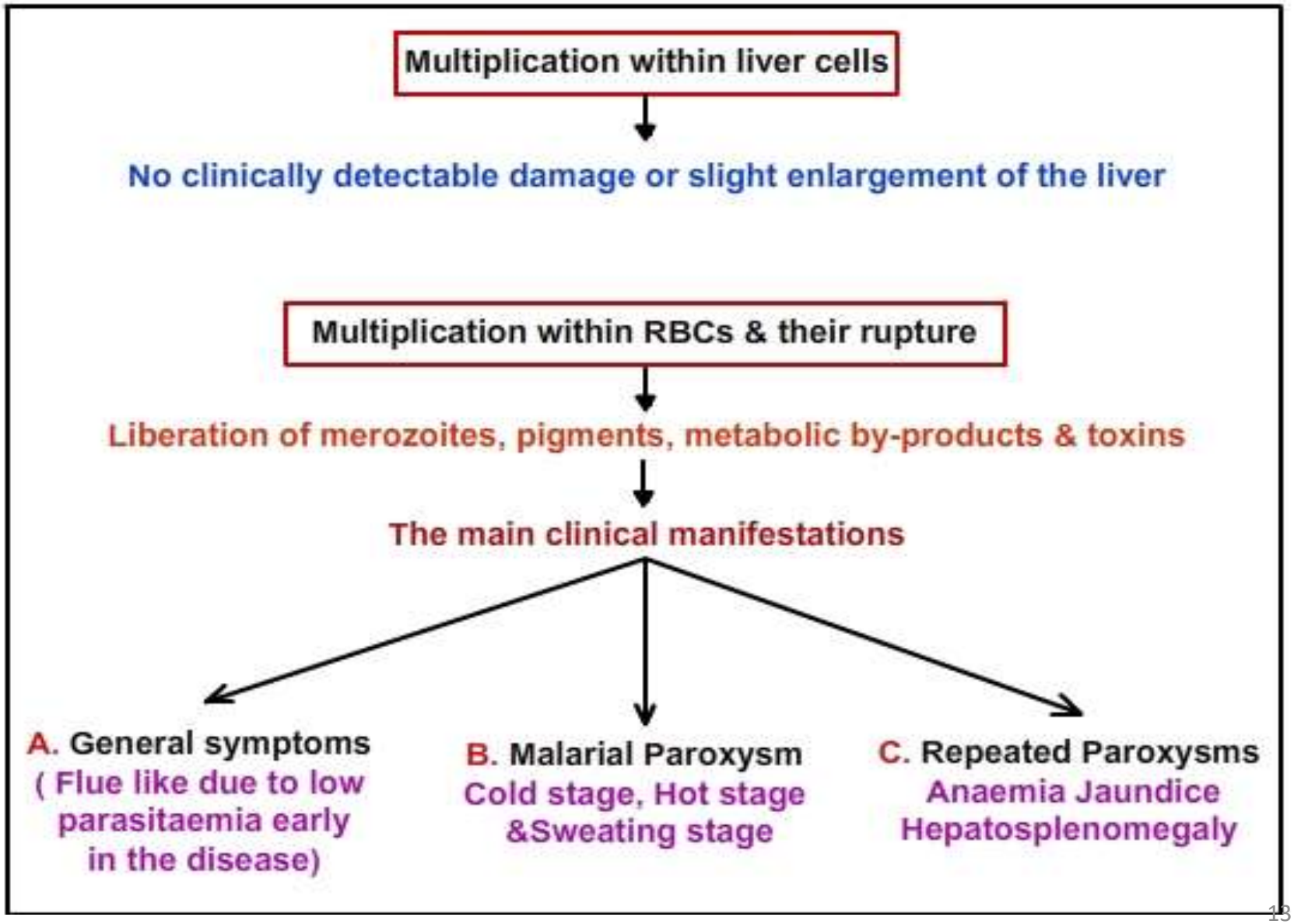


Infective stages ??????????????????

- **Habitat:** Liver and red blood cells of man.
- **D.H:** Female anopheles mosquito (sexual cycle)
- **I.H:** Man (asexual cycle).
- **R.H:** No except for malariae, Chimpanzee in some parts of Africa.
- **Diagnostic stage:** All erythrocytic stages.
- **Infective stage:** According to mode of infection

	Plasmodium vivax	*Plasmodium ovale*	*Plasmodium malariae*	*Plasmodium falciparum*
Trophozoite (ring stage)				
Mature trophozoite				
Schizont				
Gametocyte				
	Infect young RBCs		**Old RBCs**	**All RBCs ages**

Pathogenesis



Clinical pictures

1) General symptoms in all types of malaria

A- Prodromal symptoms (Low parasitemia and asynchronous RBCs rupture)

Low grade fever, malaise, headache and pain in bone and joints.

B- Malarial paroxysm

➢Due to synchronous rupture of a large number of parasitized RBCs and liberation of merozoites with malarial pigment and toxin into the circulation.

- **Cold stage (1/2- one hour):** Sensation of cold, shivering and the patient is feverish. The skin is pale and cyanotic.
- **Hot stage (1-4 hours):** High fever (40 C° or more), hot dry skin, flushed face, headache and pain in limbs and back .
- **Sweating stage (1-4 hours):** Profuse sweating with ↓ temperature, moist and coal skin).

C - Repeated paroxysms (Anemia, jaundice, hepatosplenomegaly)

✍**N.B.** **The patient becomes normal and temperature is normal till the second paroxysm occurs. Malaria paroxysms occur for at least 2 weeks or more with decreasing intensity then stop.**

The attacks recur at the following interval

In benign tertian malaria (*P. vivax&p. ovale*)	In benign quartan malaria (*P. malariae*)	In malignant malaria (*P. falciparum*)
↓	↓	↓
The attack is repeated on the 3rd day	The attack is repeated on the 4th day	The attack is irregular

2) Specific symptoms

In *P. malariae*

Antigen antibody complex is deposited in the kidney glomeruli ➲ **nephrotic syndrome** with the occurrence of edema and protein and cast in urine.

In *P. falciparum*

➢ **Adhesion phenomena (pernicious syndrome)** occurs in infected RBCs containing **trophozoites and schizonts.** RBCs clump together and stick to the endothelium of the blood vessels ➲ **vascular obstruction of small blood vessels of internal organs** ➲ tissue anoxia of organs including brain, kidney, GIT, heart, lung, liver and adrenal

➢ **Black water fever**

Acute massive intravascular haemolysis of infected RBCs ➲severe anaemia, fever, jaundice, haemoglobinuria (dark red urine) and acute renal failure due to inadequate quinine treatment.

➢ **Cerebral malaria:** headache, high fever, convulsion, paralysis, coma and death.

➢ **Algid malaria :**shock, collapse , sudden ⬇ in blood pressure due to adrenal insufficiency

➢ **Gastrointestinal malaria:** diarrhoea or dysentery with bloody loose stool ➲ malabsorption and dehydration

➢ **Congenital malaria** ➲ abortion.

- **Why *Plasmodium falciparum* causes malignant malaria and is more dangerous ??????????**

- **Differences between malarial relapse and recrudescence ?????**

Laboratory Diagnosis

Direct

Microscopic: Thin and thick blood films stained with **Giemsa and Leishman** reveal different stages (rings, trophozoites, schizonts and gametocytes) in all types of malaria except in *P. falciparum* only rings and gametocytes are seen in the peripheral blood (due to adhesion phenomena).

Indirect

1-Serological tests: CFT, IHT, ELISA, FAT, or rapid strip or dip stick test to detect circulating antigens using monoclonal antibodies.

2-Molecular diagnosis: by PCR.

Treatment

- **Tissue schizonticide and hypnozoiticides**
  - ➢ Primaquine
  - It is also gametocidal
- **Blood schizonticides**
  - **Chloroquine-sensitive**
    - ➢ Chloroquine
  - **Chloroquine-resistant**
    - Fansidar: Pyrimethamine &sulphadoxine
    - Artemisinin-based: Pyrimethamine/ sulphadoxine + artesunate
    - Mefloquine:
- **Treatment of complications**
  - ➢ Blood transfusion in severe anaemia.
  - ➢ Haemodialysis in renal failure.
- **Chemoprophylaxis**
  - ➢ Weekly mefloquine
  - ➢ Daily doxycycline
  - When and How long?????

Malaria- Prevention

Key methods to prevent malaria transmission are:

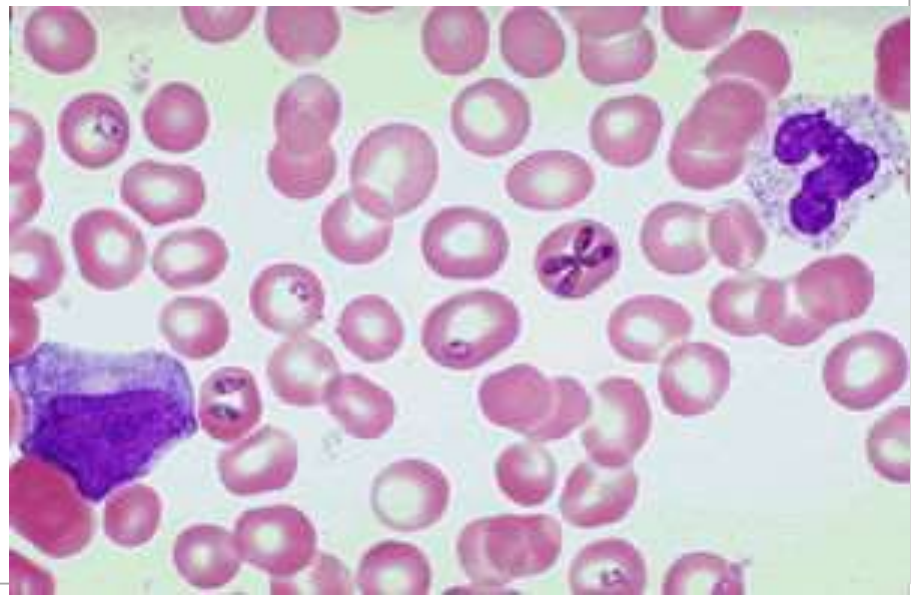
- Long lasting insecticide impregnated nets (LLINs)
- Indoor residual spraying
- Mosquito repellents
- Preventative drug treatments

Babesia

- ***Babesia*** **species cause a disease known as babesiosis.**
- **Causative organisms:**
  - ***Babesia microti***
  - ***Babesia divergens*** **(commonly affects splenectomized-persons)**
- **Habitat: RBCs.**
- **D.H and vector of transmission: Hard tick**
- **I.H: Cattle and rodents and occasionally man.**

Differences between *Babesia* and *Plasmodium*

- **No hepatic stage.**
- **Merozoites arranged in pairs or Maltese cross**
- **No pigments**
- **Vector is the hard tick**



Mode of transmission:

1- Bite of hard tick (sporozoites)

2- Blood transmission (erythrocytic stages)

Pathogenesis & symptomatology

❖**Disease : Babesiosis.**

The parasite invades the RBCs where it multiplies by budding ➲ the cell ruptures and the released parasites invade other cells leading to anaemia, jaundice, and hepatosplenomegaly.

Laboratory diagnosis

Direct

- **Stained blood film by Giemsa or Leishman to detect the intraerythrocytic paraites.**
- **Animal inoculation : blood sample is injected intraperitoneally in hamester, the parasites can be detected in animal blood after 2 weeks in positive cases.**

Indirect

- **Serological tests**
- **PCR to detect *Babesia* DNA**

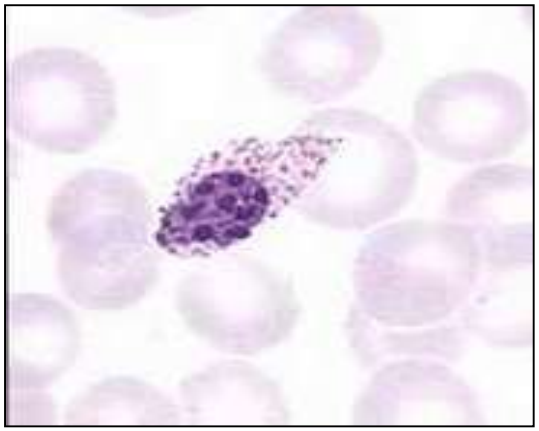
Treatment

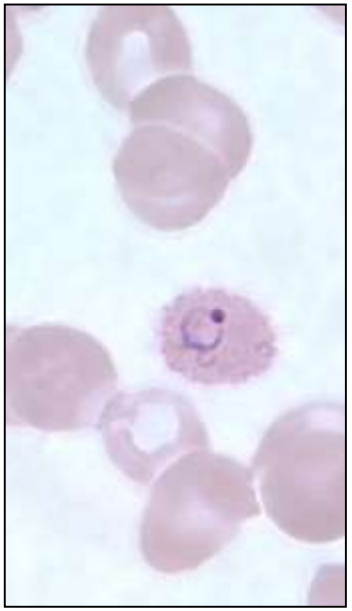
1. Quinine + clindamycin.

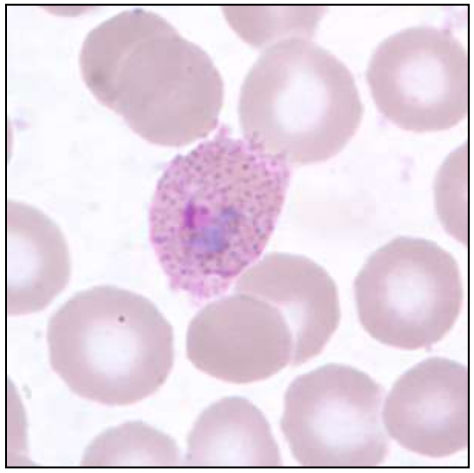
2. Exchange blood transfusion in severe cases

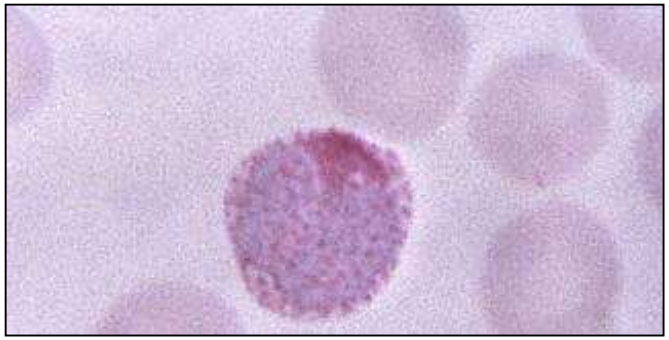

?
Quiz
Time

Guess the stage?









Guess what is this?