Malaria

An Overview

of

Life-cycle,

Morphology

and

Clinical Picture

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Malaria

Malaria is the most important of all tropical parasitic disease ,causes death and debility and is endemic throughout the tropics and subtropics.

The main symptoms and signs are periodic fever, headache ,anorexia and anemia.

- **<u>The main four species of malaria infect humans:</u>**

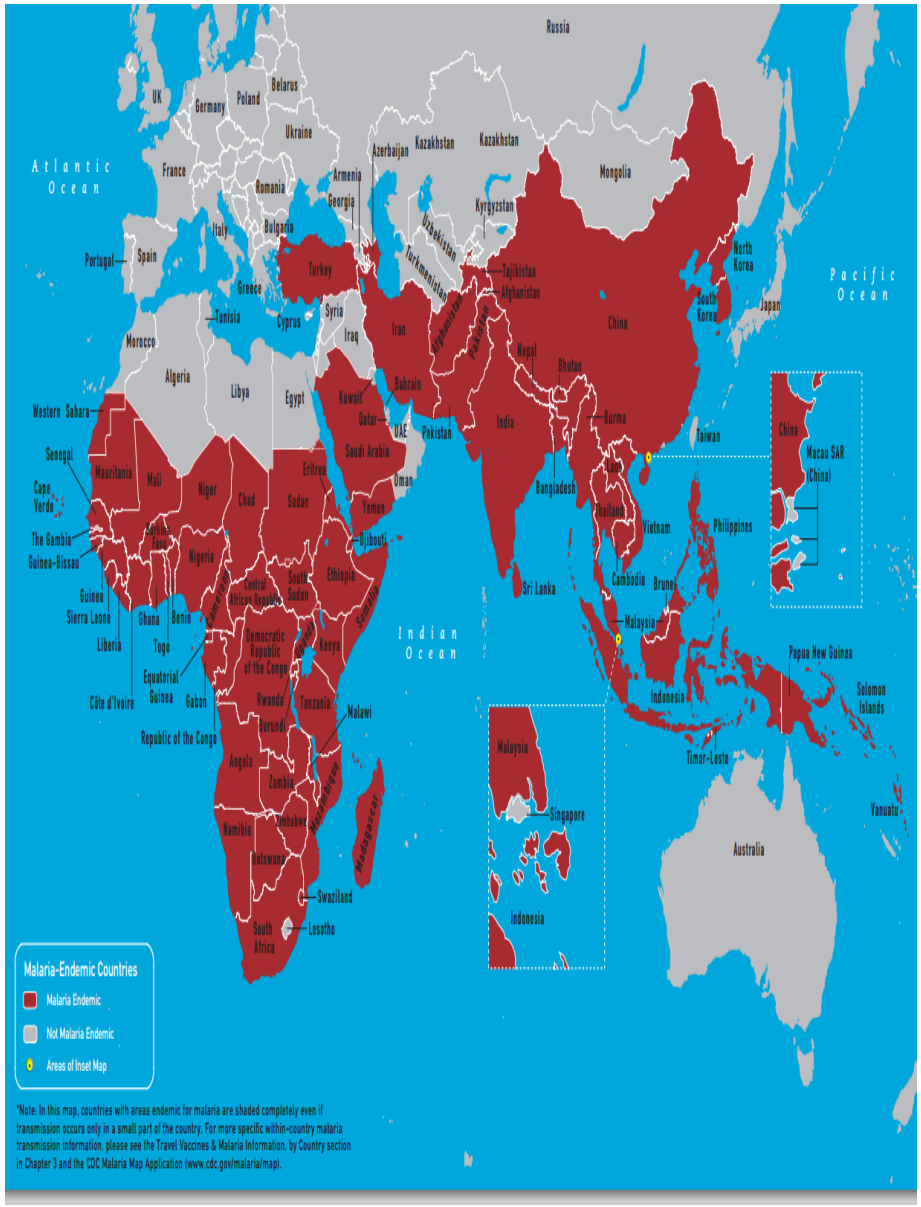
  - ***Plasmodium falciparum (fever tertian, irregular)***
  - ***Plasmodium vivax (fever every 48hours tertian)***
  - ***Plasmodium ovale (fever every 48 hours tertian)***
  - ***Plasmodium malariae (fever every 72 hours quartan)***

Epidemiology

- **Asexual stage** → **sporozoites** are injected by an infected **Anopheles Mosquito** into the blood of human and enter liver cells and will become schizonts then become Merozoites whish release in the circulation and penetrate **the Red Blood Cell** and cause the **main pathology** of the disease **hemolysis and anemia** . Some parasites develop into male and female **Gametocyte** .
- **Sexual stage** → male and female **Gametocyte** are taken up from the blood of an infected human by biting mosquito .Further sexual development takes place in the mosquito gut to produce **SPOROZOITES.**

- **Human to human transmission can occur by blood transfusion or vertical transmission across the placenta.**

Malaria –Endemic Countries

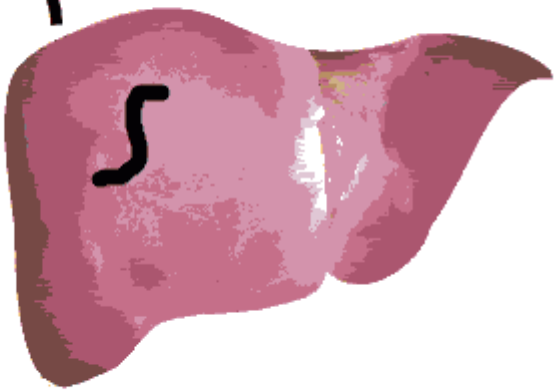



Anopheles Mosquito
CDC

Sporozoites in mosquito saliva

Mosquito bites uninfected human

Sporozoites enter bloodstream and migrate to liver, infecting hepatocytes



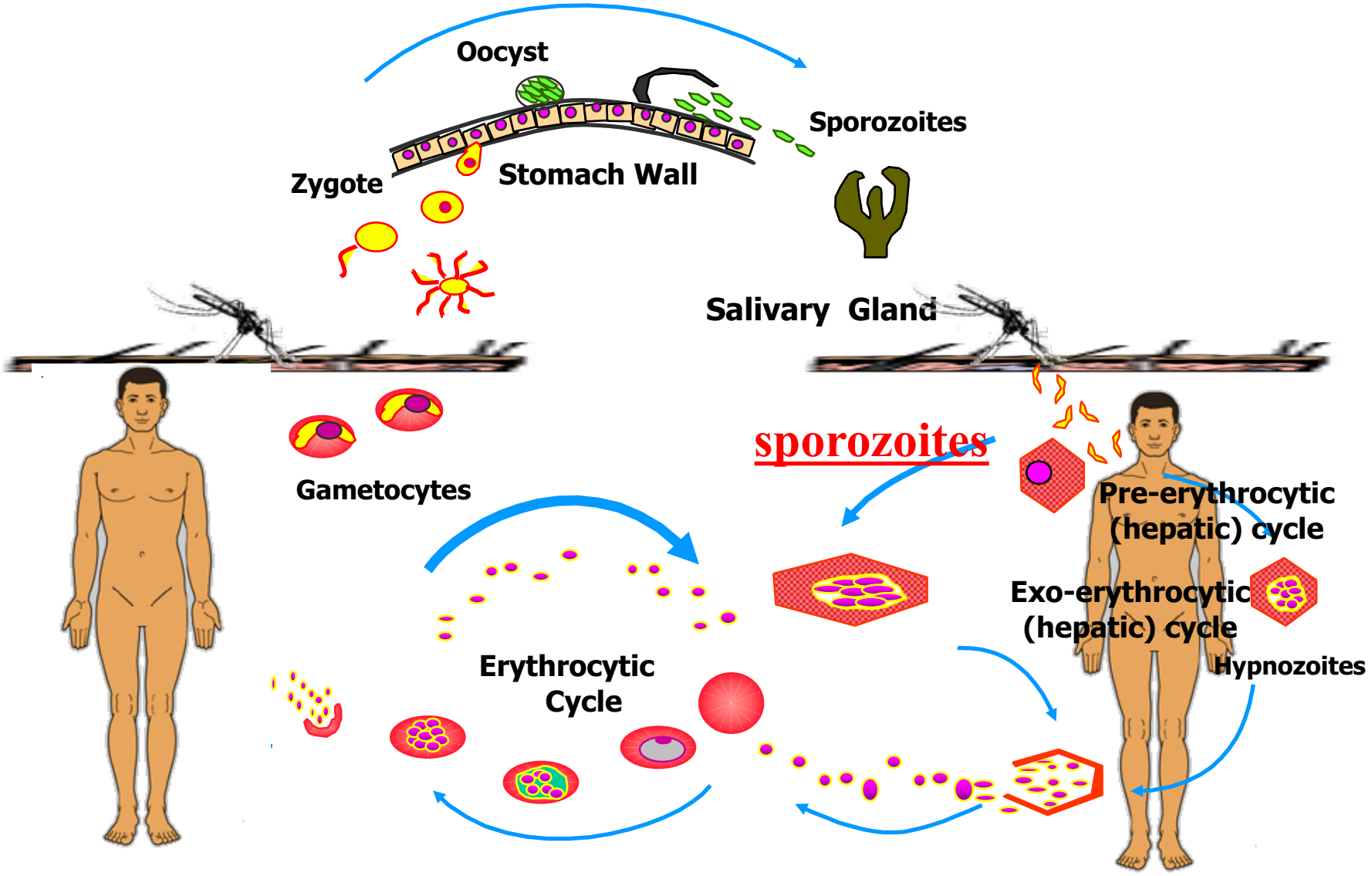
Merozoites released, infect erythrocytes (fever results from escape +reinfection of Merozoites)

Erythrocytes become "sticky" (PfEMP)

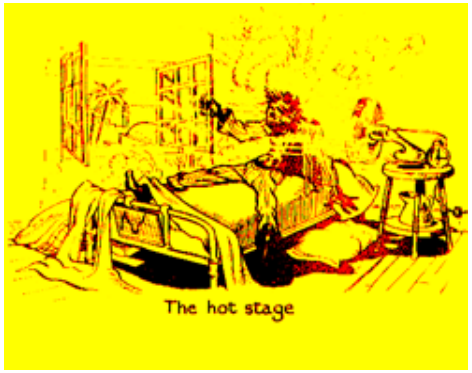
Symptoms occur

Mosquito bites infected human

LIFE CYCLE OF MALARIA



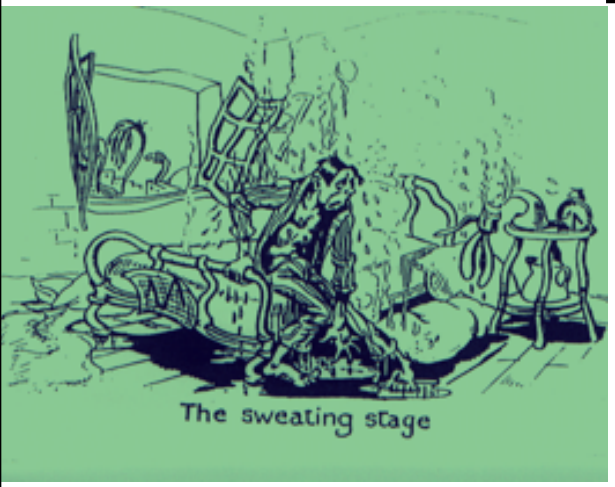
CLINICAL SIGNS & SYMPTOMS OF MALARIA

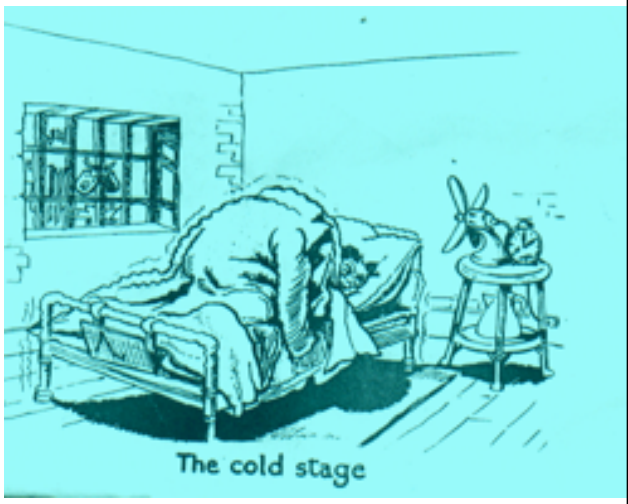


Fever

Chills

Sweating





Malarial Paroxysm

cold stage chills

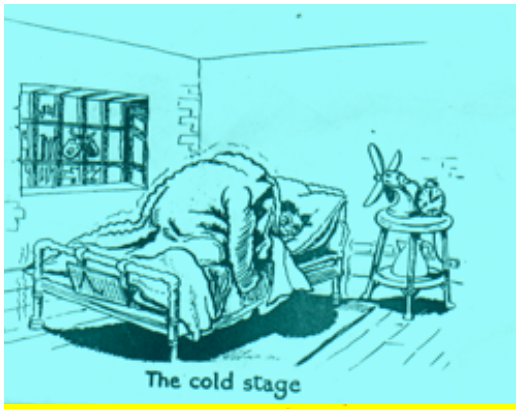
- feeling of intense cold
- vigorous shivering
- lasts 15-60 minutes

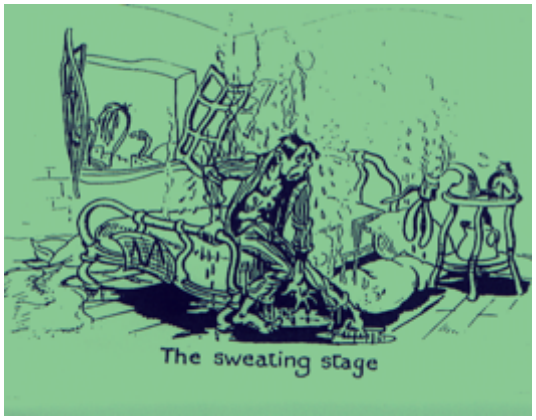
hot stage fever

- intense heat
- throbbing headache
- lasts 2-6 hours

sweating stage

- profuse sweating
- declining temperature
- exhausted and weak → sleep
- lasts 2-4 hours





The pattern of fever in different species of malaria

Plasmodium falciparum (fever tertian, irregular)

Plasmodium vivax (fever every 48hours tertian)

Plasmodium ovale (fever every 48 hours tertian)

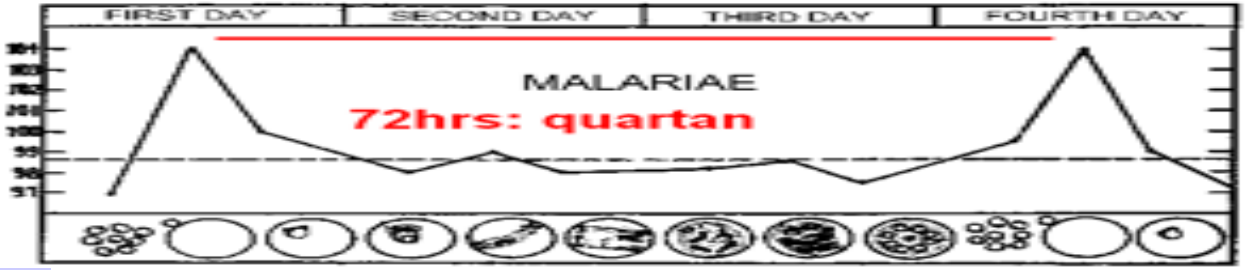
Plasmodium malariae (fever every 72 hours quartan)

Plasmodium falciparum::

Plasmodium vivax,

Plasmodium ovale

Plasmodium malariae\:



Pathogenesis of MALARIA

- Symptoms are due to:
- **Hemolysis of Red Blood Cells :** with release of metabolites and pigments from Malaria parasite.
- **Plugging of capillaries by parasitized erythrocytes :**
- In cerebral malaria there is sequestration of parasites in central nervous system capillaries Plasmodium Falciparum.

CLINICAL PICTURE

Acute Disease

Non-severe Acute Febrile disease

Severe malaria e.g. Cerebral Malaria

Death

Chronic Disease

Chronic Asymptomatic Infection

Anemia

Developmental Disorders; Transfusions; Death

Infection During Pregnancy

Placental Malaria

Low Birth weight

Increased Infant Mortality

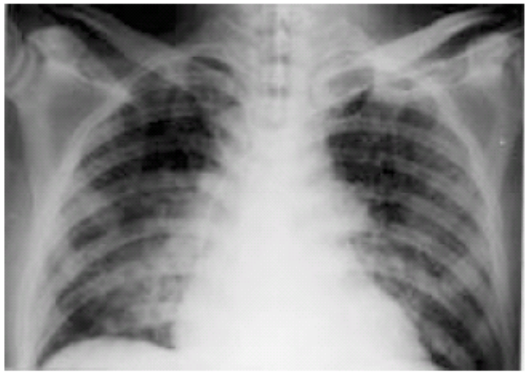
Complication of Severe MALARIA

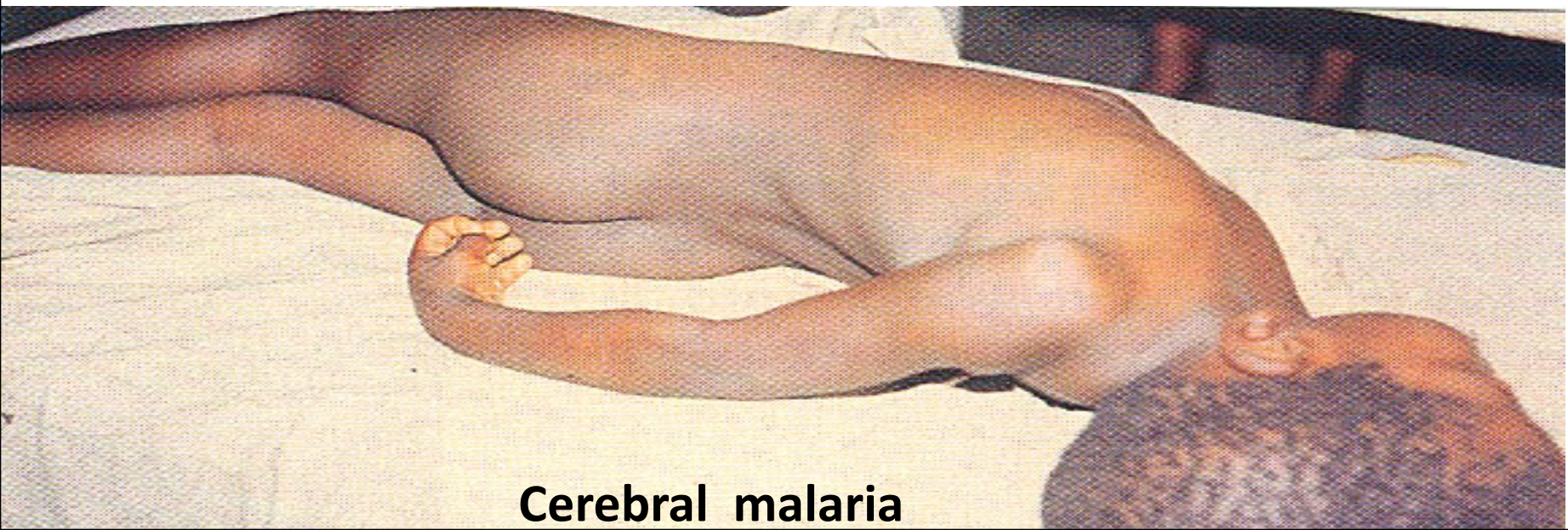
- **Severe malaria is defined as symptomatic malaria in a patient with *P. falciparum* with one or more of the following complications:**
  - **Cerebral malaria**
  - Generalized convulsions *(> 2 episodes within 24 hours)*
  - Severe normocytic anemia *(Ht<15% or Hb < 5 g/dl)*
  - **Hypo-glycaemia *and pulmonary edema in pregnancy can lead to abortion ,stillbirth seen in tropical Africa.***
  - Metabolic acidosis with respiratory distress *(arterial pH < 7.35 or bicarbonate < 15 mmol/l)*
  - Fluid and electrolyte disturbances
  - **Acute renal failure *(blackwater fever)***
  - Acute pulmonary edema and adult respiratory distress syndrome
  - Abnormal bleeding
  - Jaundice
  - Hemoglobinuria
  - Circulatory collapse, shock, septicemia
  - Hyper-parasitaemia (*≥10% in non-immune; ≥20% in semi-immune)*
  - ***Tropical splenomegaly.***

Severe Complications of malaria :

P. falciparum

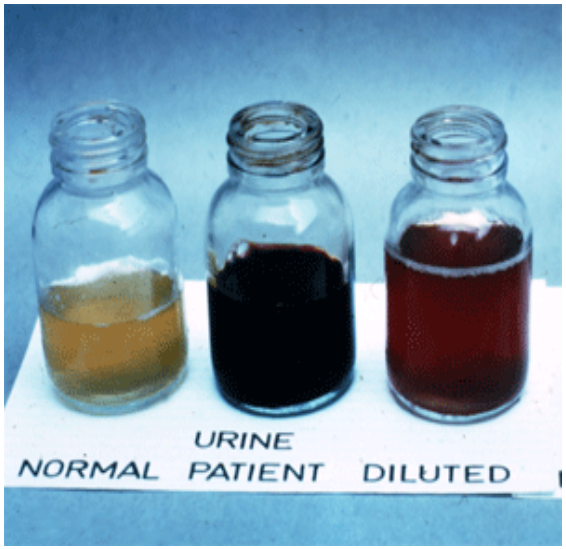
Hypo glycaemia ***and pulmonary edema in pregnancy***





Cerebral malaria

Malarial haemoglobinuria



P. falciparum

Clinical Picture :

Hemoglobinuria associated with malaria (blackwater fever) is uncommon and malarial hemoglobinuria usually presents in adults as severe disease with anemia and renal failure.

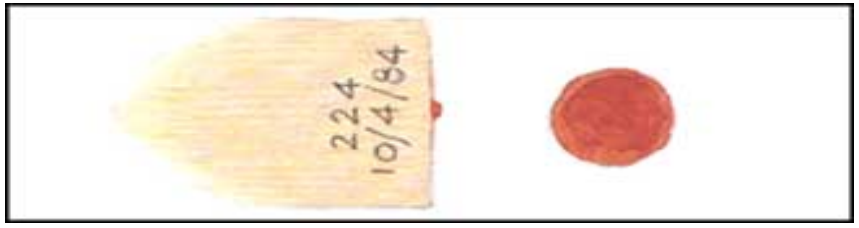
Complications of malaria :

anaemia

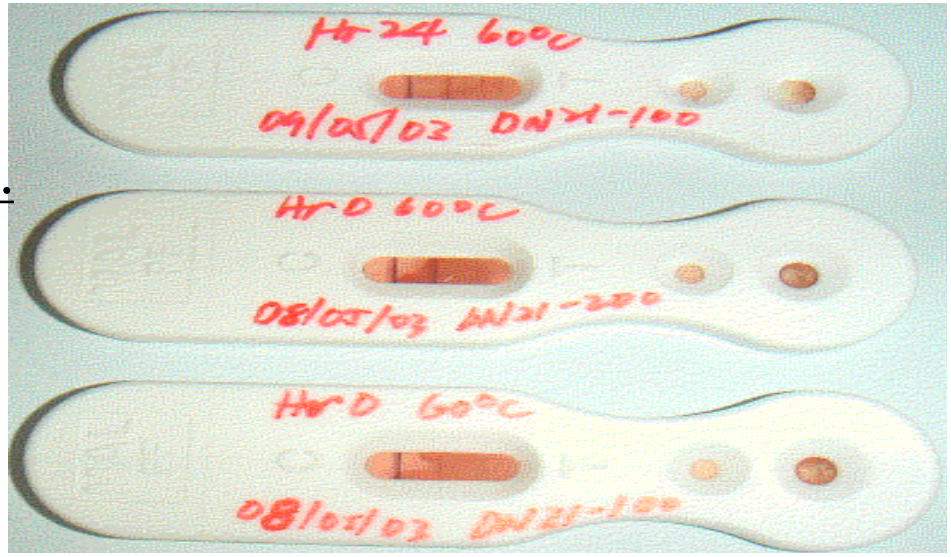
Child with severe malaria anaemia and no other malaria complication

Common two methods for parasitological diagnosis of malaria

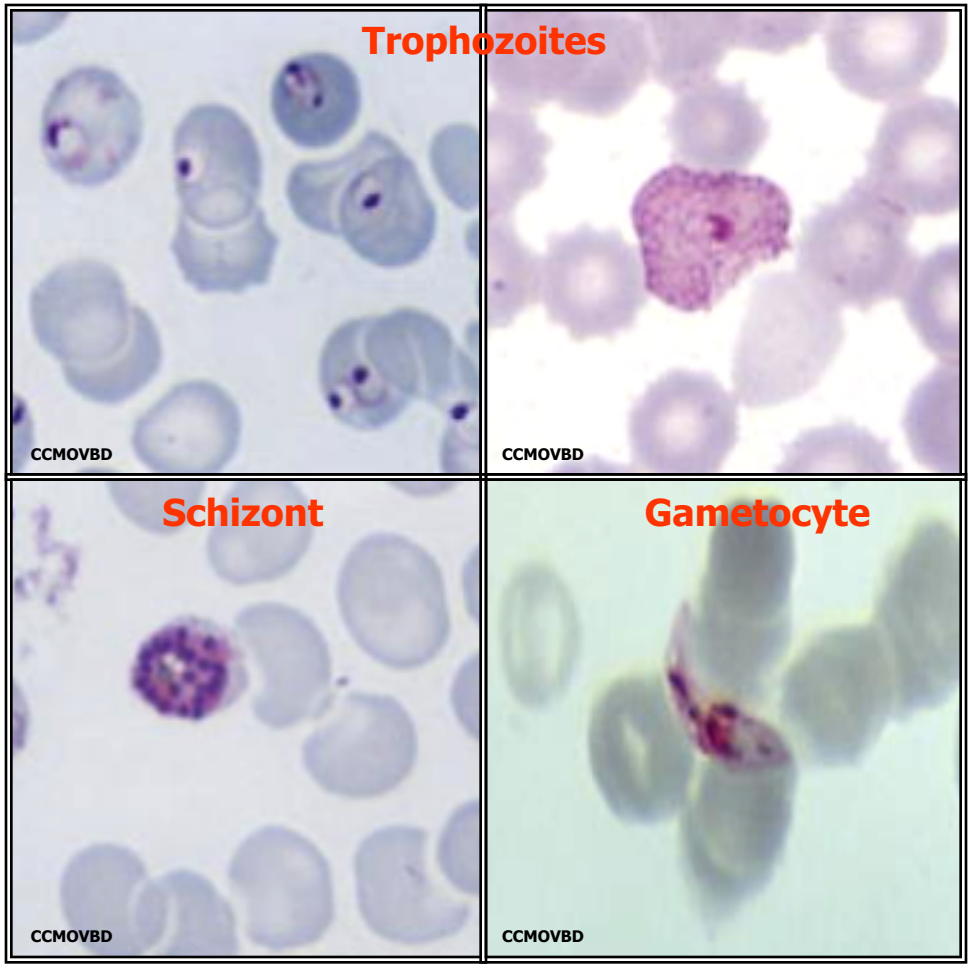
1: Light microscopy
Thin film&thick film



2: Rapid diagnostic tests (RDTs).



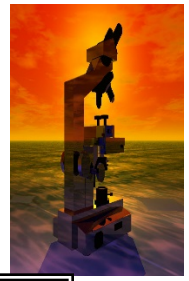
The Malaria Parasite



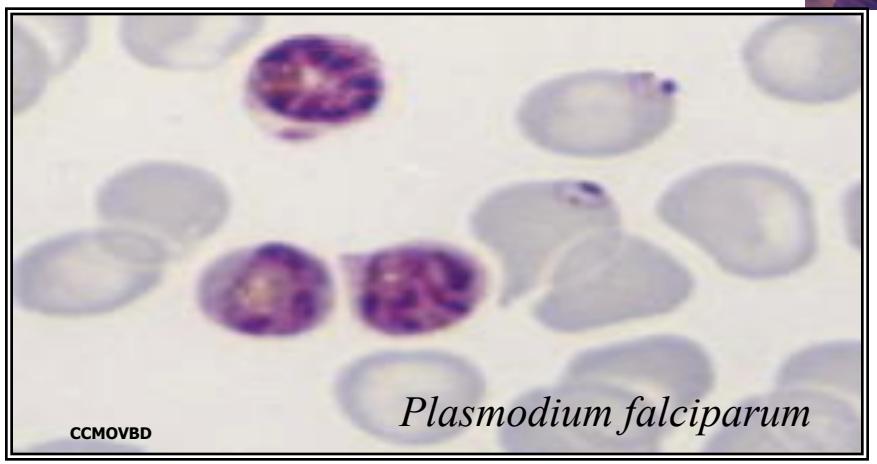
Three developmental stages seen in blood films:

1. Trophozoite
2. Schizont
3. Gametocyte

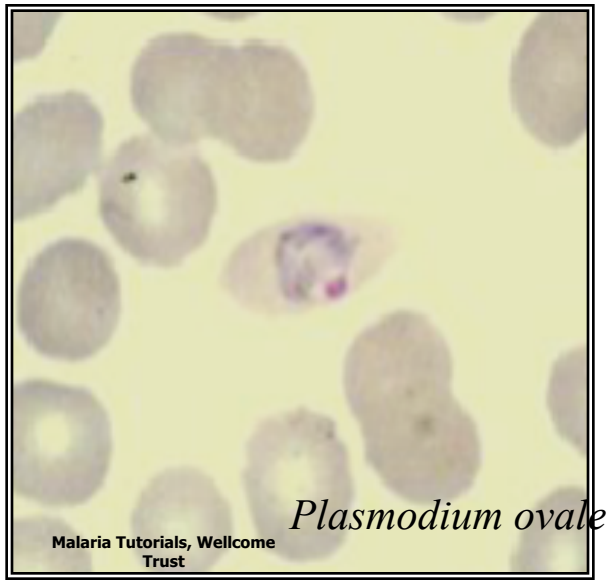
Microscopy is the gold standard for diagnosis of malaria



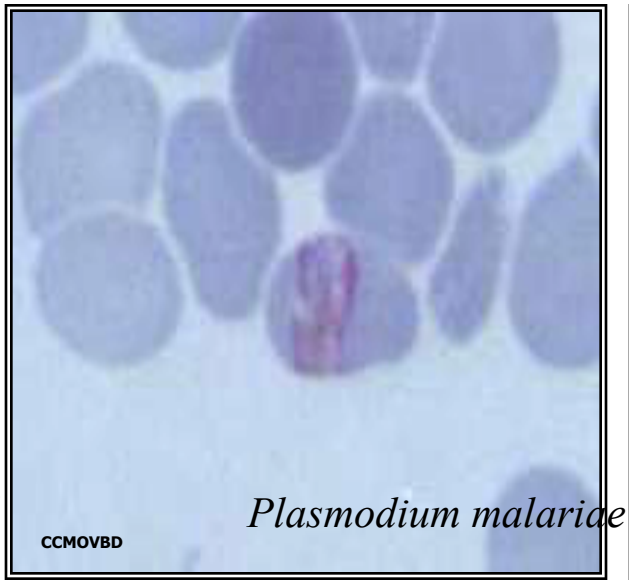
- Parasite density
- Species diagnosis
- Monitoring response to treatment



Plasmodium falciparum



Plasmodium ovale



Plasmodium malariae

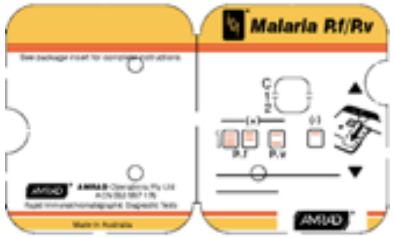
Plasmodium vivax

Laboratory diagnosis of malaria

Rapid diagnostic tests detect malaria antigens

The products come in a number of formats:

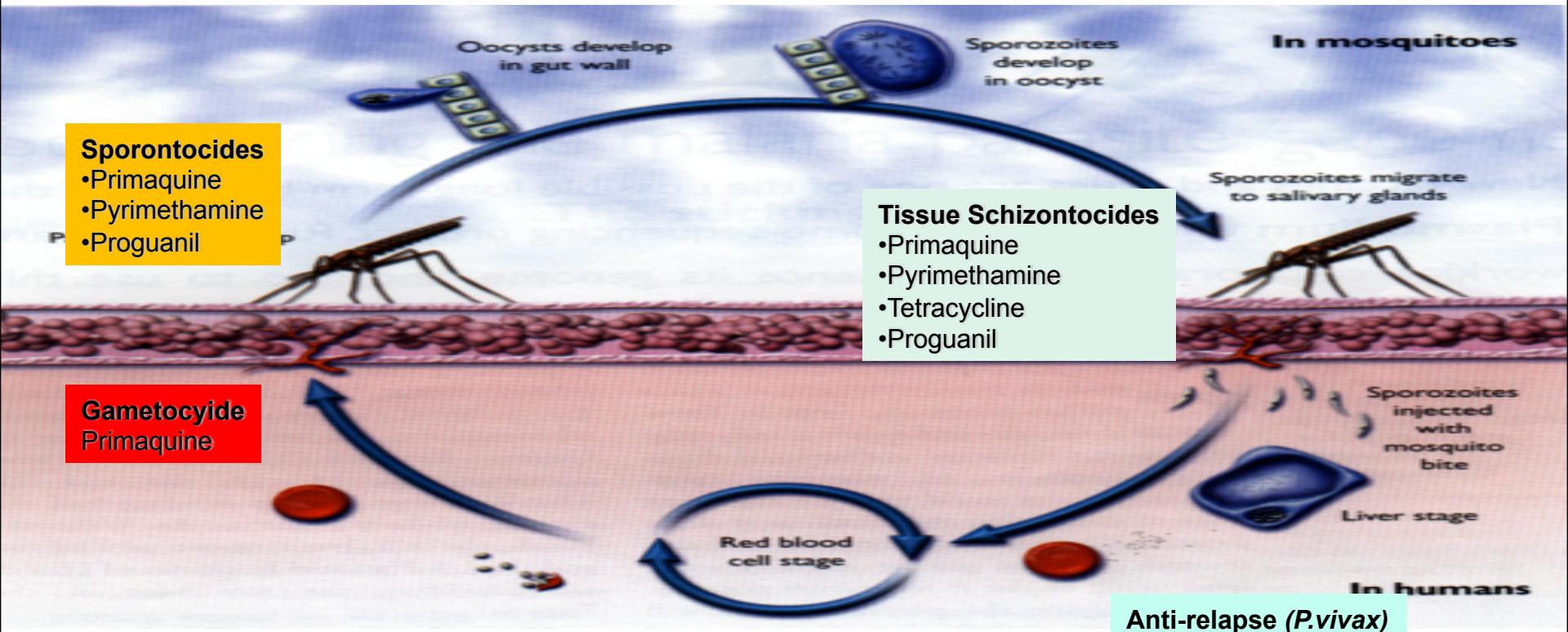
- Plastic cassette
- Card
- Dipstick
- Hybrid cassette-dipsticks



Rapid diagnostic tests detect malaria antigens

Plastic cassette format of RDT

ACTION OF ANTIMALARIAL DRUG IN THE DIFFERENT LIFE STAGES OF THE MALARIA PARASITE



Sporontocides
- Primaquine
- Pyrimethamine
- Proguanil

Tissue Schizontocides
- Primaquine
- Pyrimethamine
- Tetracycline
- Proguanil

Gametocyide
Primaquine

Anti-relapse *(P.vivax)*
- primaquine

Blood Schizontocides
- Chloroquine
- Sulfadoxine/Pyrimethamine
- Quinine
- Artemisinins