

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.

- **Five species of malaria infect humans:**

- ***Plasmodium falciparum***



- ***Plasmodium vivax***

- ***Plasmodium ovale***

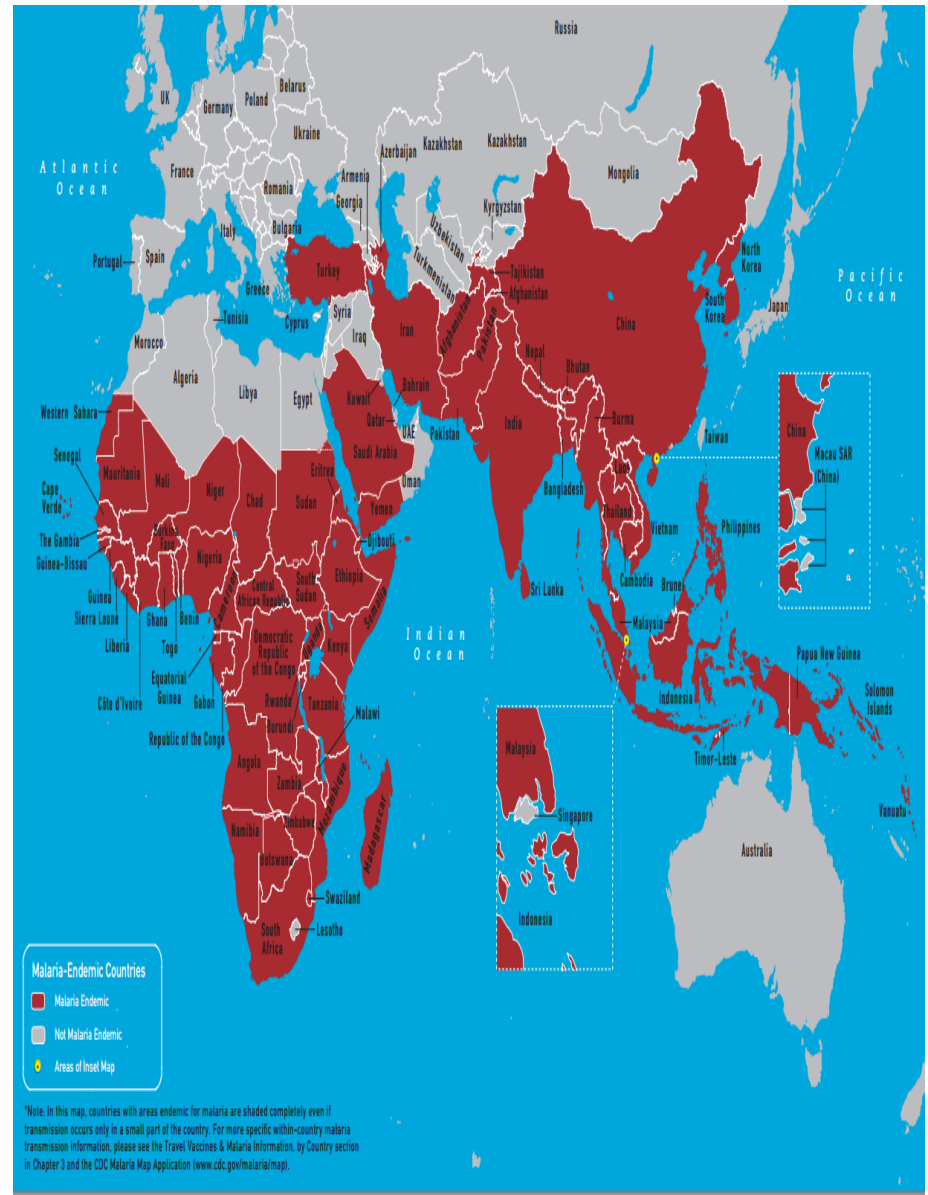
- ***Plasmodium malariae***

- ***Plasmodium knowlesi***

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 which 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



Sporozoites in mosquito saliva



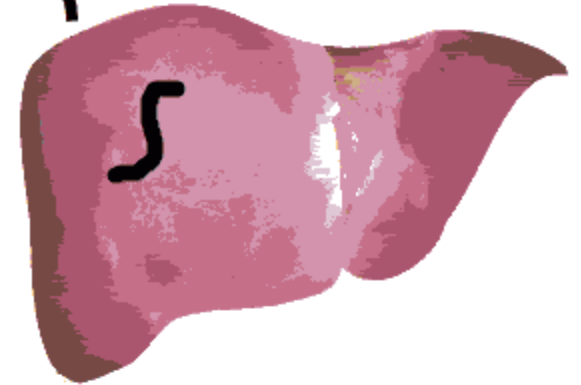
Mosquito bites uninfected human

Mosquito bites infected human



Symptoms occur

Sporozoites enter bloodstream and migrate to liver, infecting hepatocytes



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



Erythrocytes become "sticky" (PfEMP)

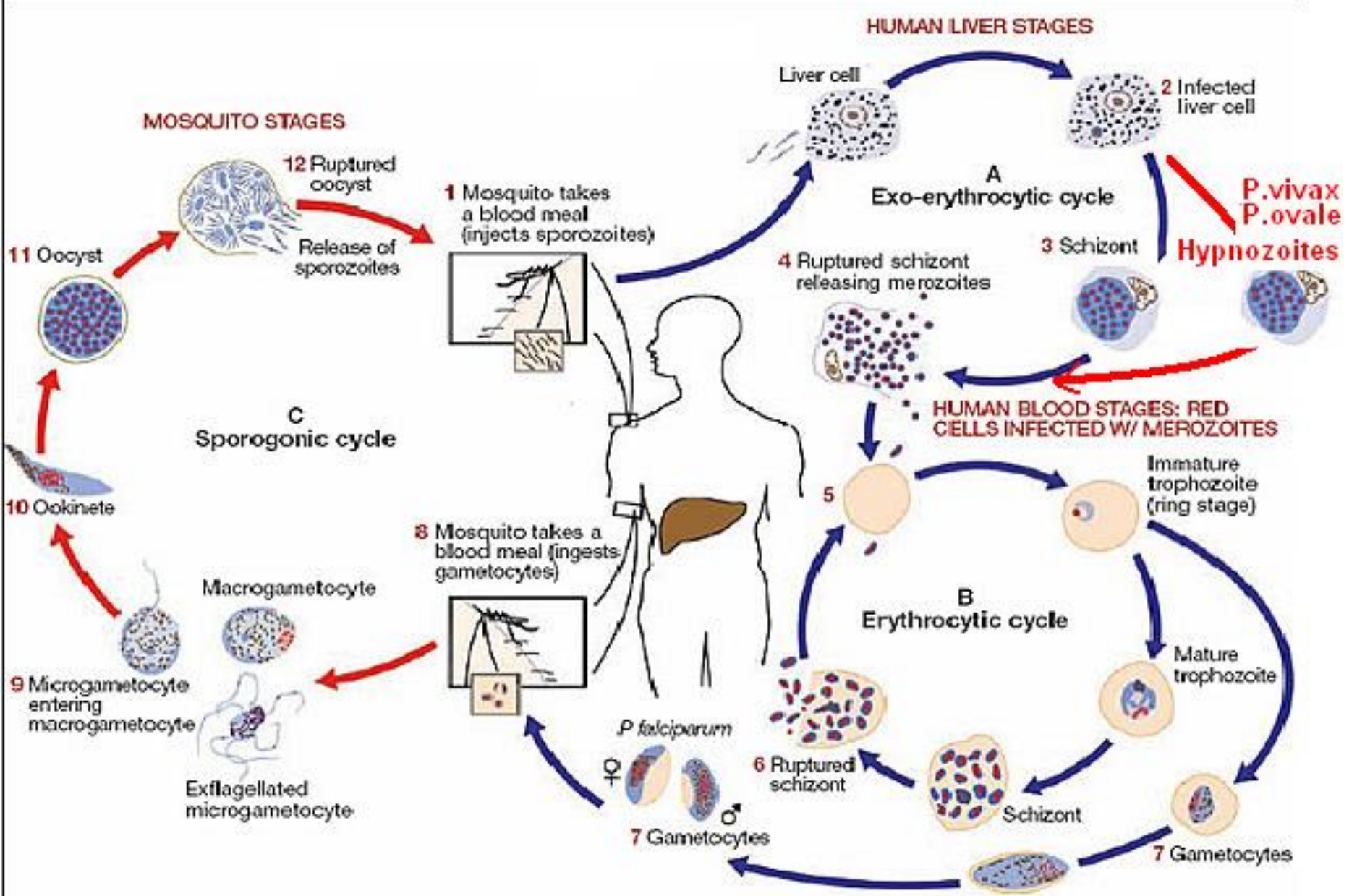
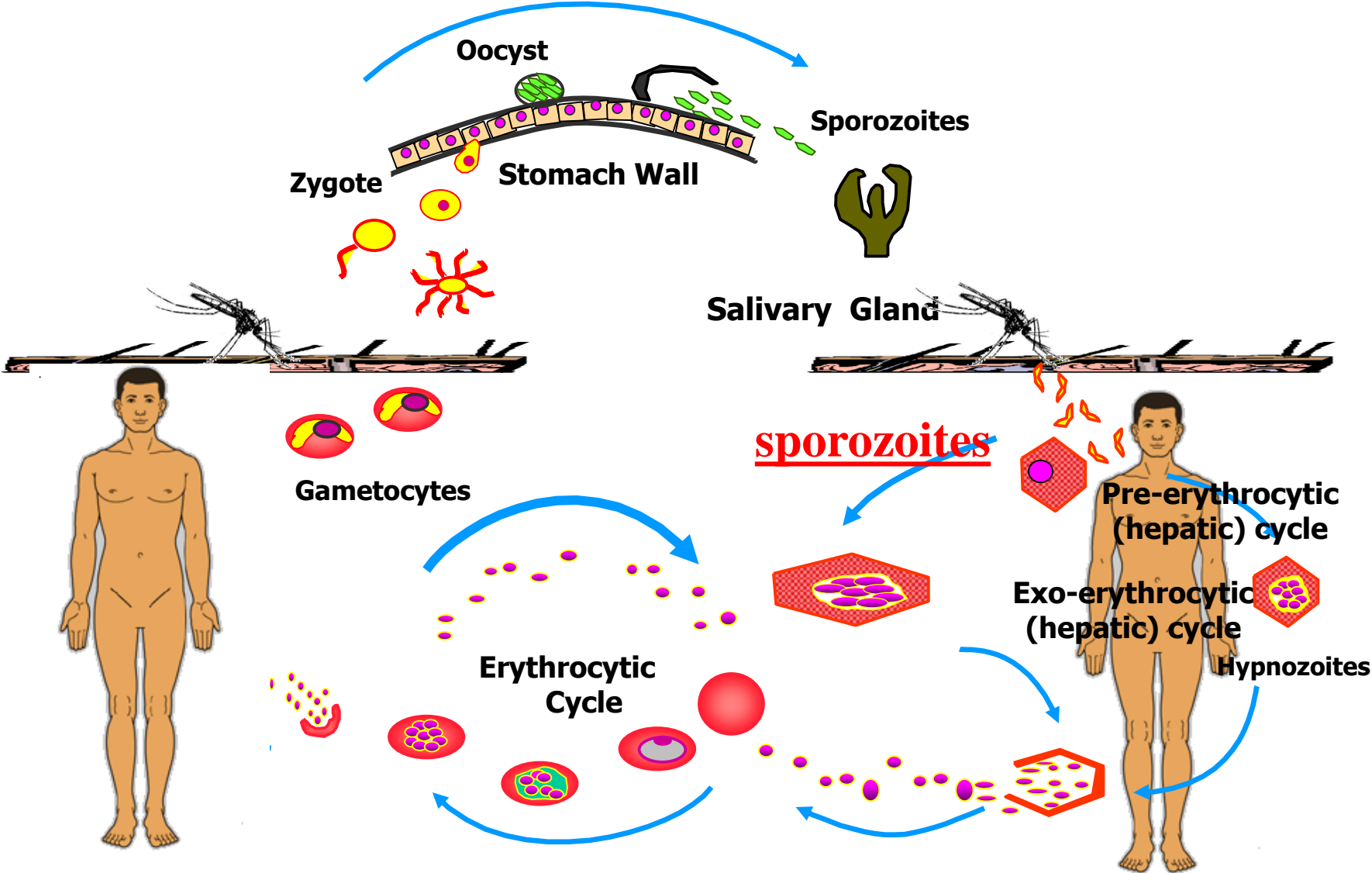
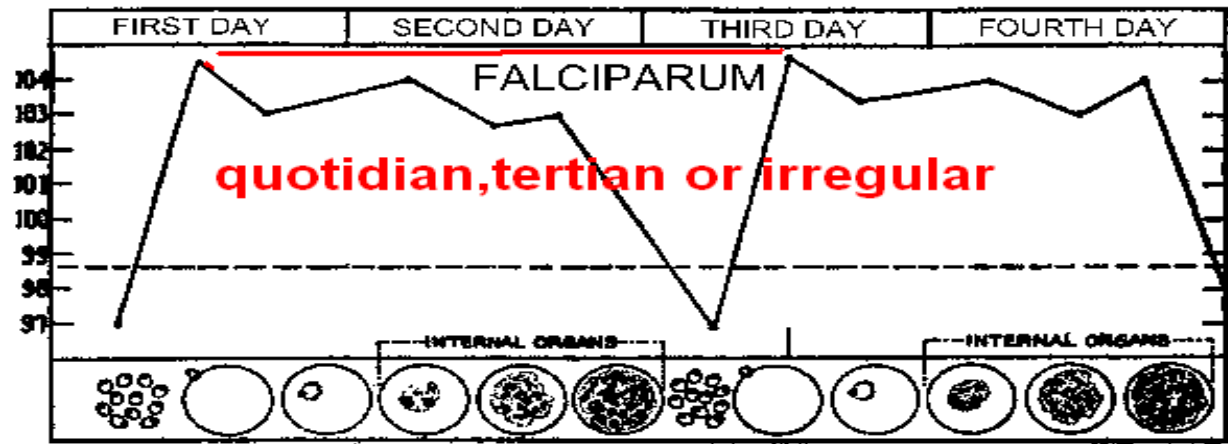


Figure 1—Malaria parasite life cycle. A malaria-infected female Anopheles mosquito inoculates sporozoites into the human host. Sporozoites infect liver cells and mature into schizonts, which rupture and release merozoites that infect red blood cells. Ring-stage trophozoites mature into schizonts, which rupture, releasing merozoites. Some parasites differentiate into sexual erythrocytic stages (gametocytes). Parasites in the blood are responsible for the clinical manifestations of the disease. Adapted from the CDC.

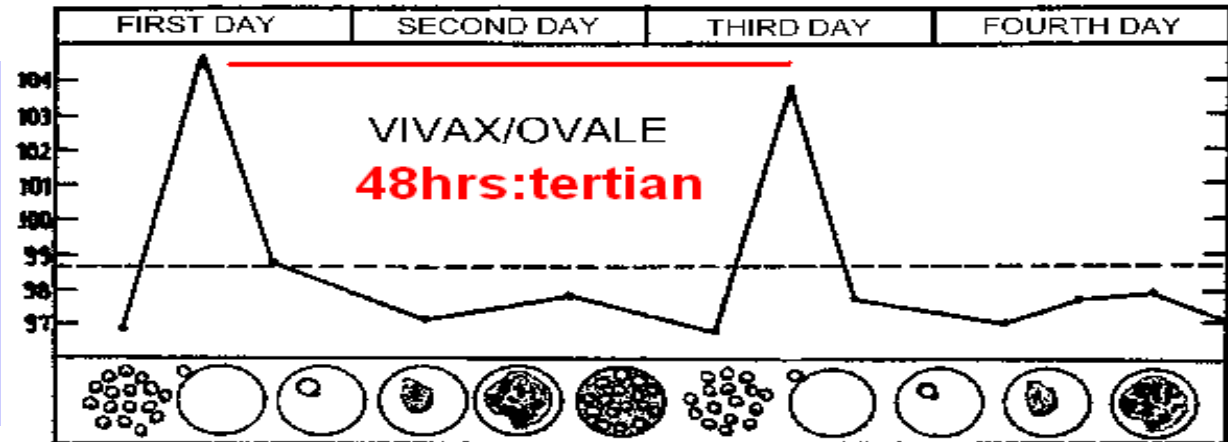
LIFE CYCLE OF MALARIA



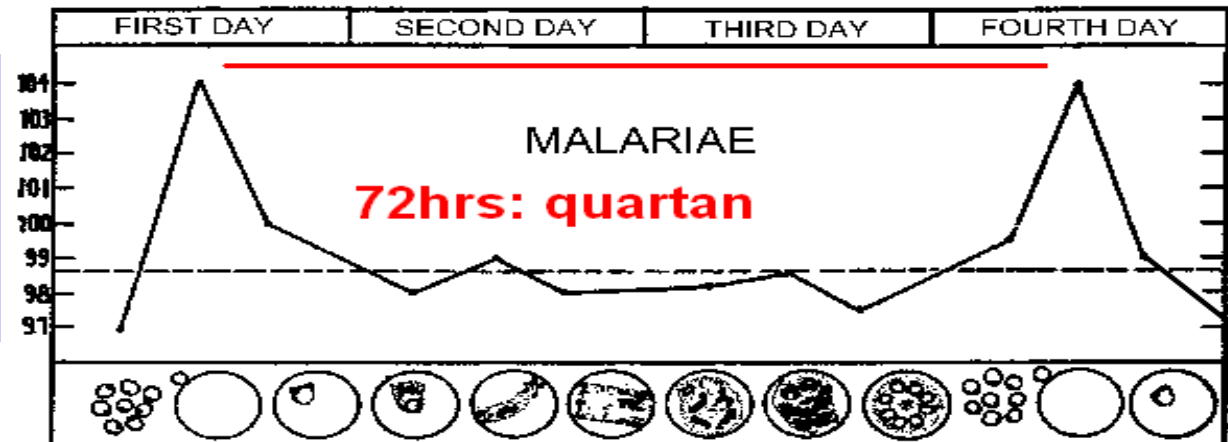
Plasmodium falciparum:



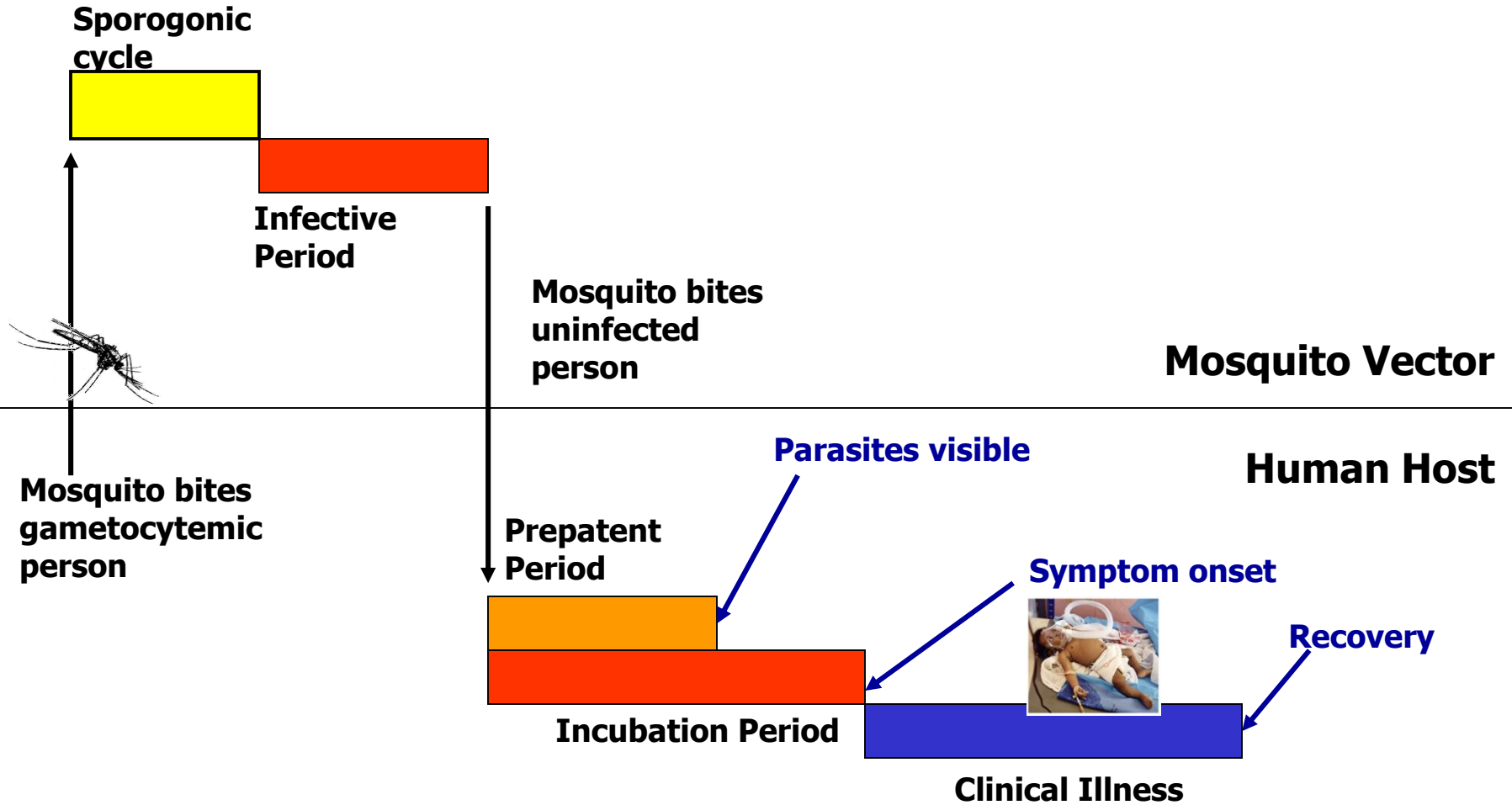
Plasmodium vivax,
Plasmodium ovale



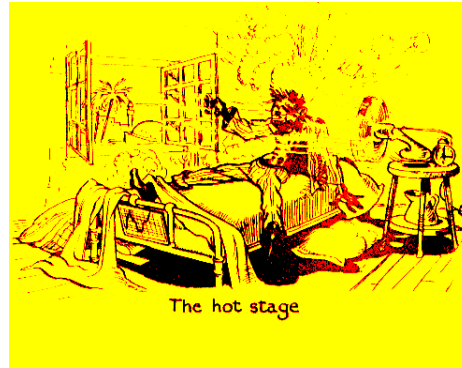
Plasmodium malariae:



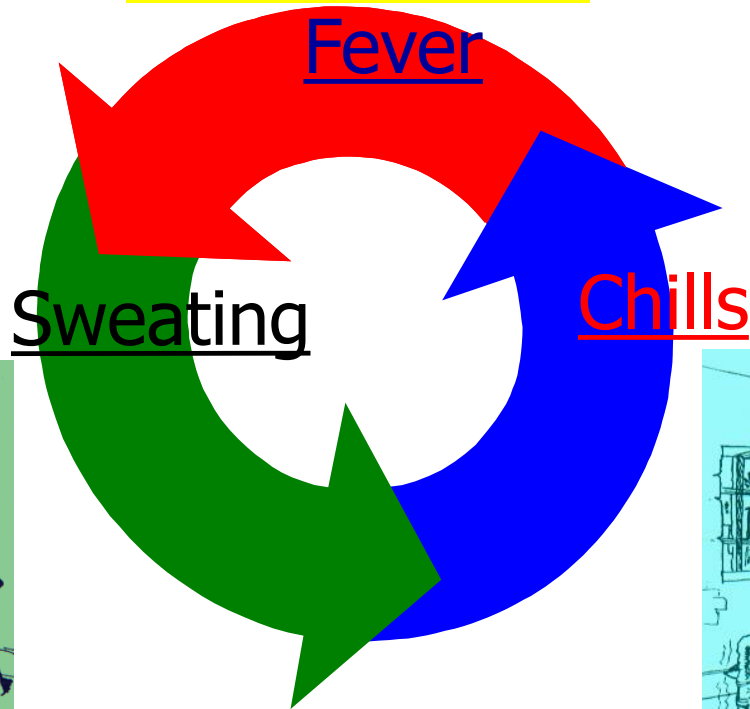
Components of the Malaria Life Cycle



CLINICAL SIGNS & SYMPTOMS OF MALARIA



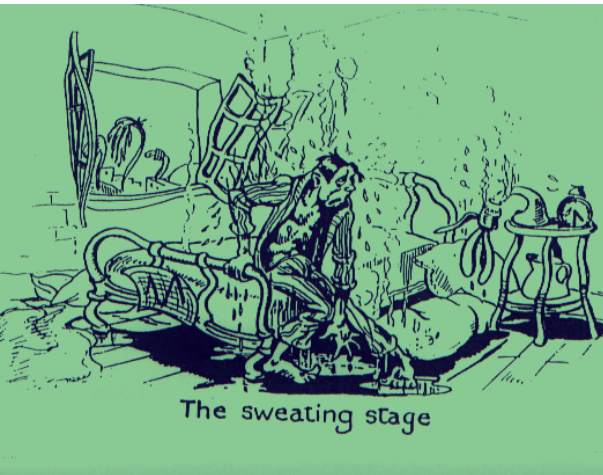
The hot stage



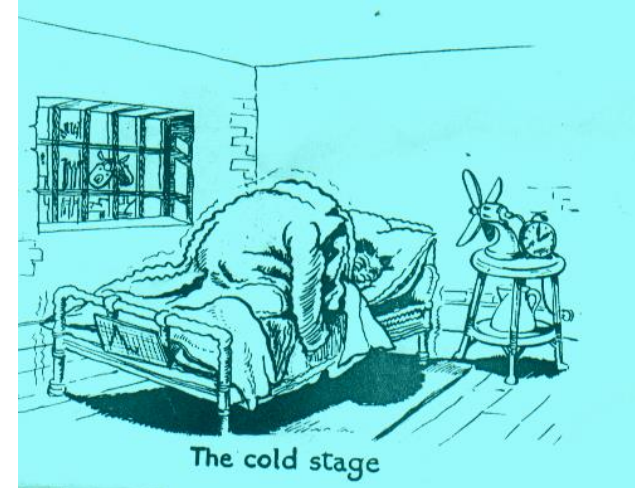
Fever

Chills

Sweating



The sweating stage



The cold stage

Malarial Paroxysm

cold stage

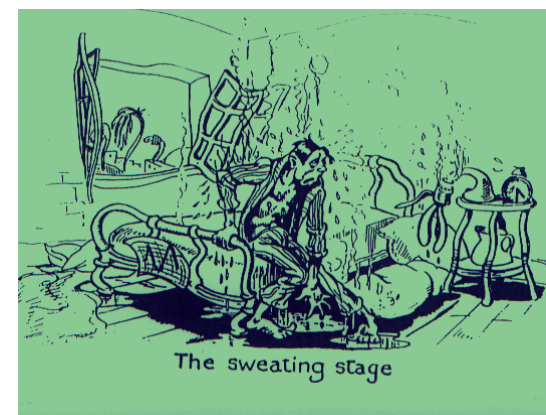
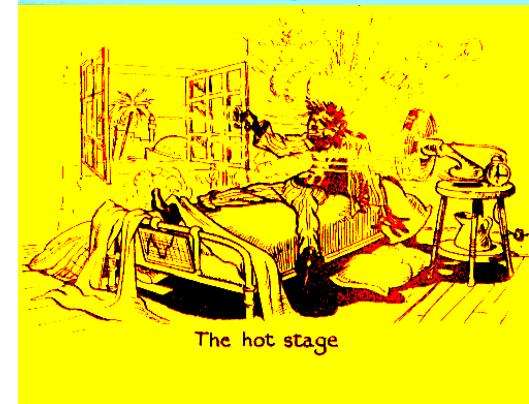
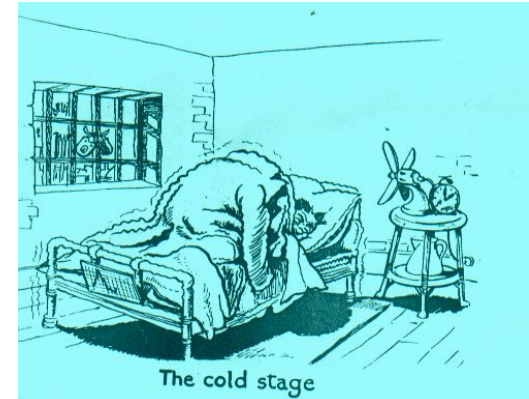
- feeling of intense cold
- vigorous shivering
- lasts 15-60 minutes

hot stage

- intense heat
- dry burning skin
- throbbing headache
- lasts 2-6 hours

sweating stage

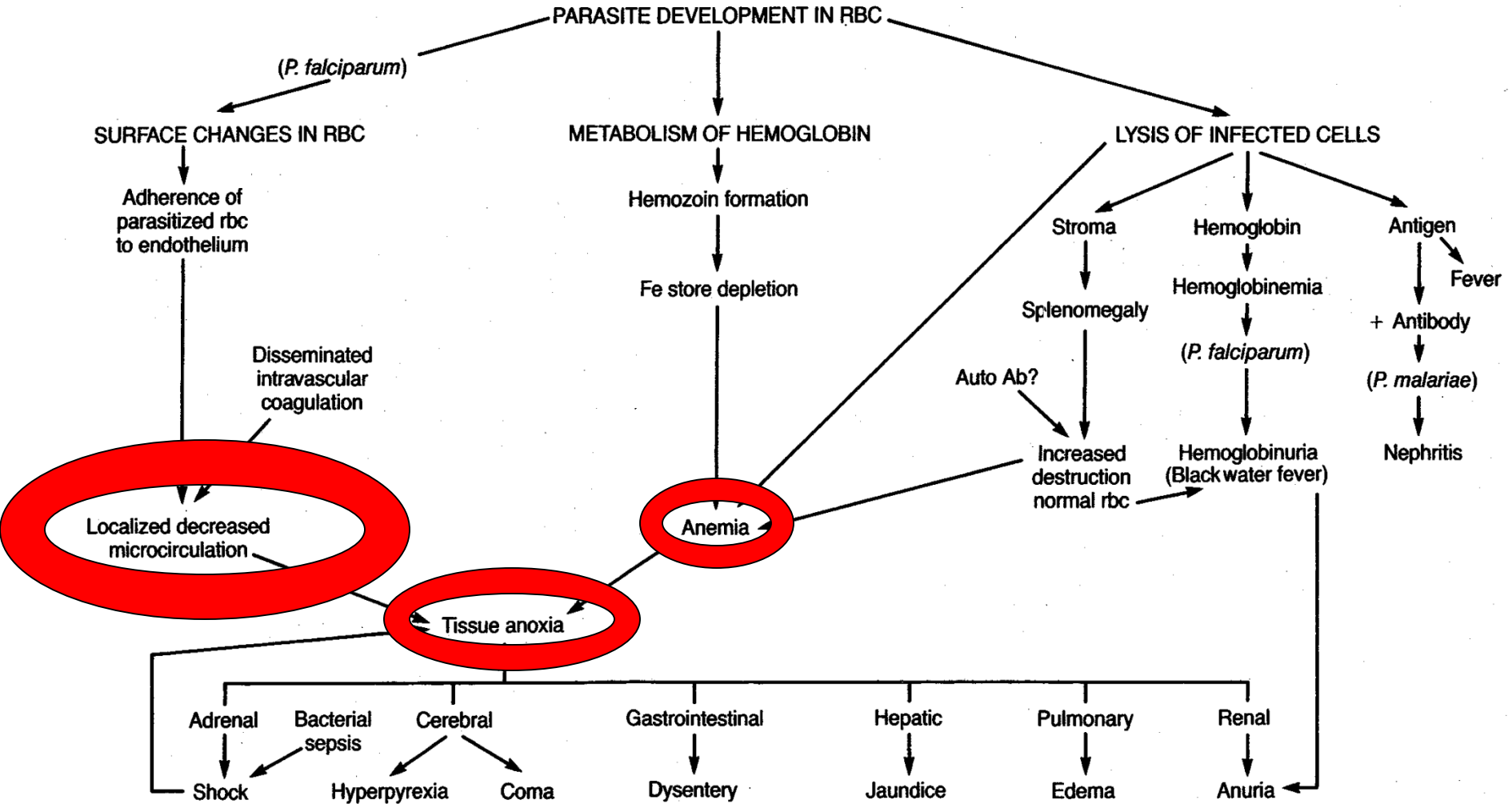
- profuse sweating
- declining temperature
- exhausted and weak → sleep
- lasts 2-4 hours



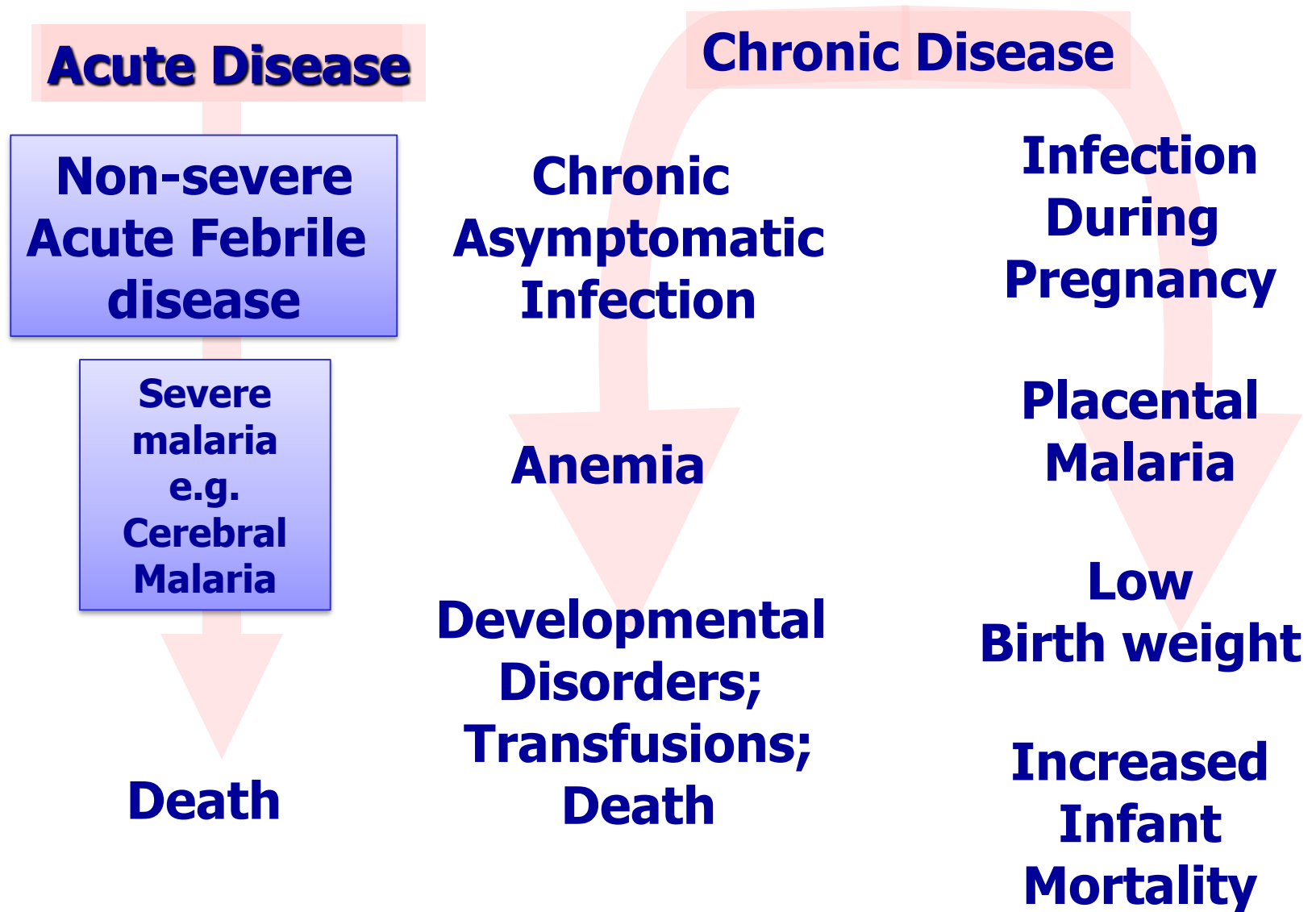
Pathogenesis of MALARIA

- 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.

PATHOGENESIS OF MALARIA



CLINICAL PICTURE



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.**

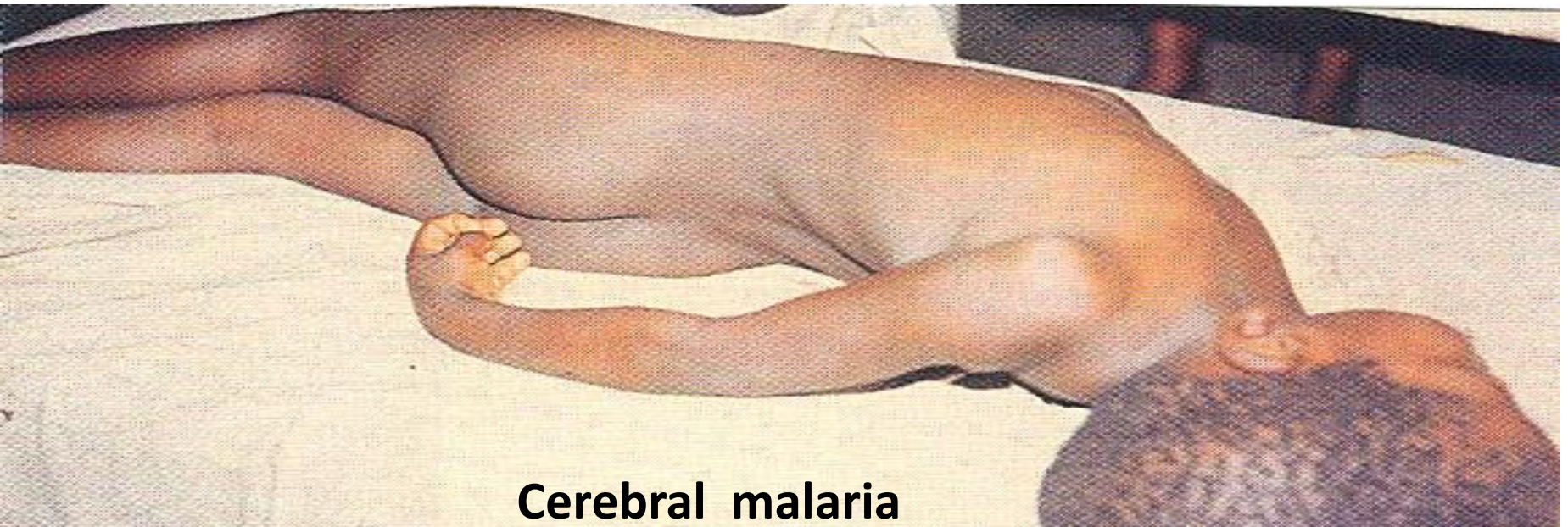
Severe Complications of malaria :

P. falciparum

Hypo glycaemia
and pulmonary
edema in
pregnancy



© D. A. Morrell



Cerebral malaria

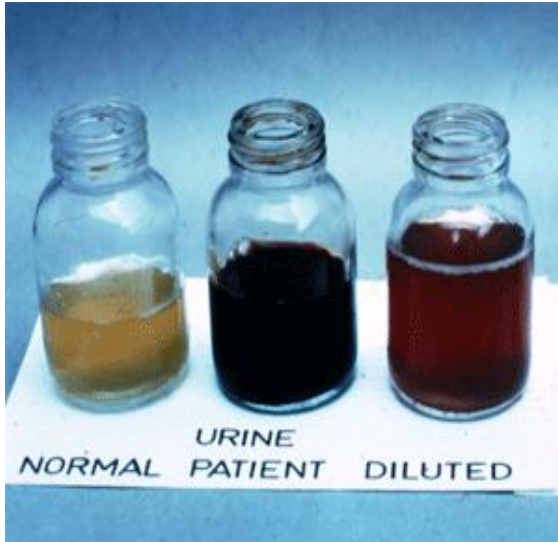
P. falciparum

Child with severe malaria anemia in conjunction with acidosis and respiratory distress



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



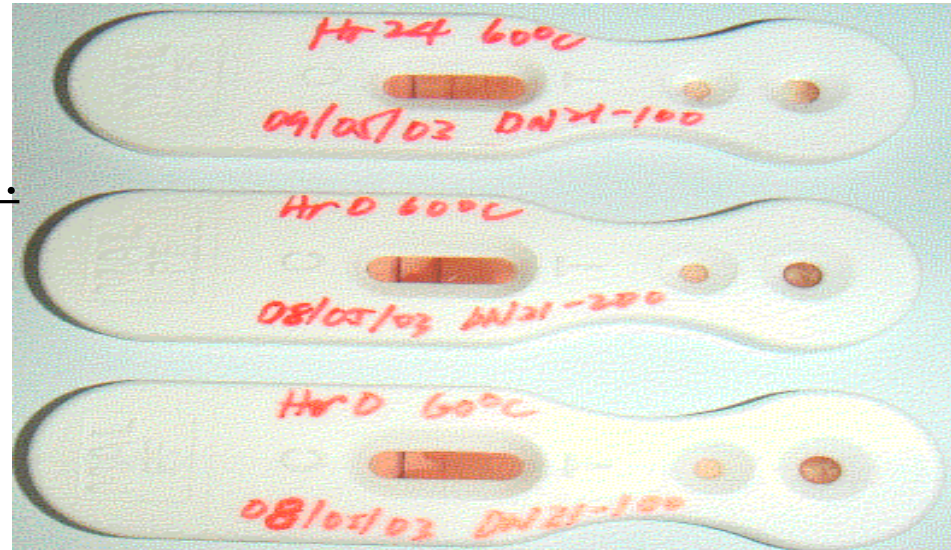
**Child with severe
malaria anaemia and
no other malaria
complication**

Common two methods for parasitological diagnosis of malaria

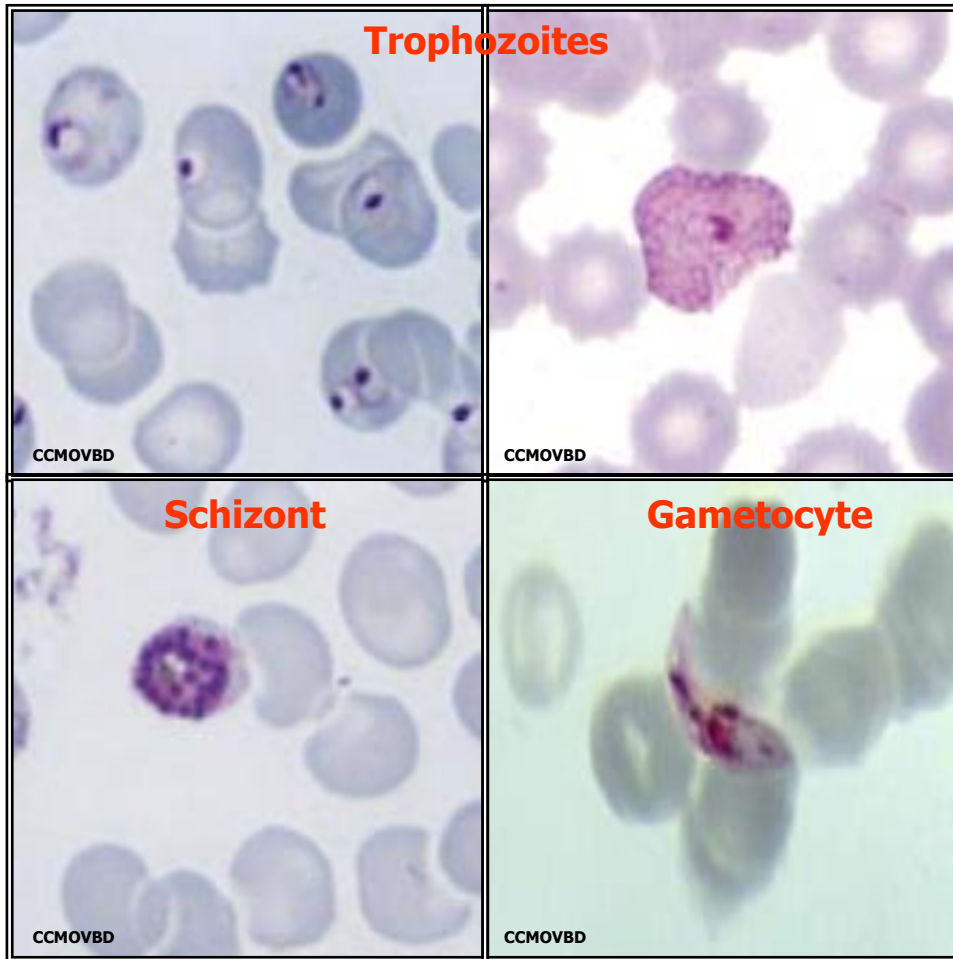
1: Light microscopy Thin film & thick film



2: Rapid diagnostic tests (RDTs).



The Malaria Parasite



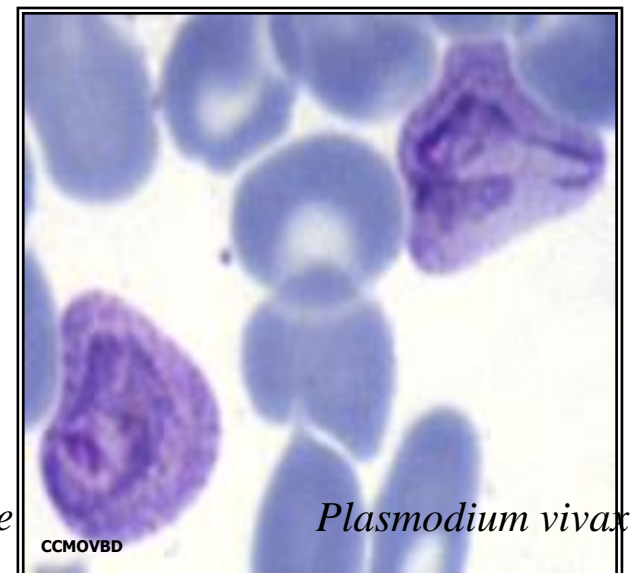
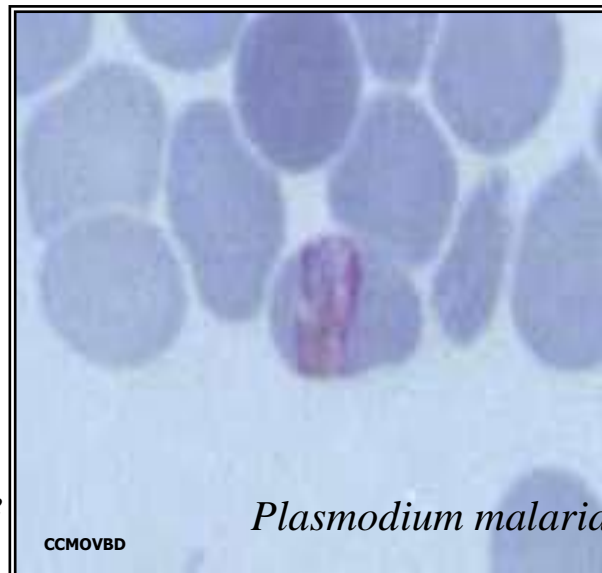
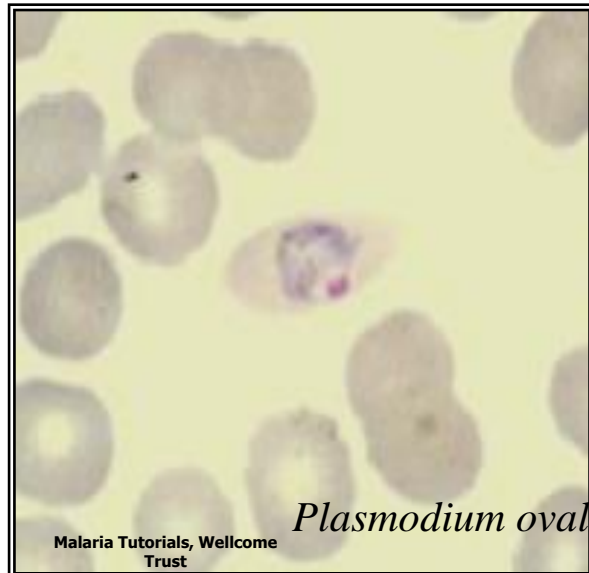
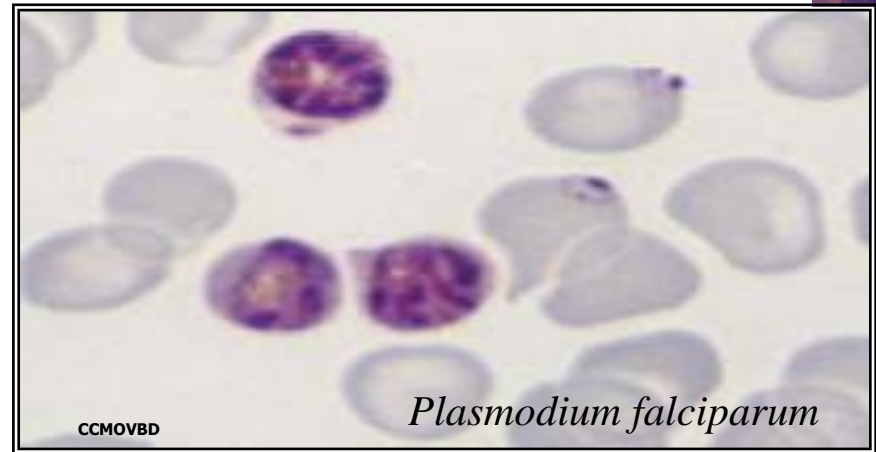
Three developmental stages seen in blood films:

1. Trophozoite
2. Schizont
3. Gametocyte

Microscopy is the gold standard for diagnosis of malaria



- Parasite density
- Species diagnosis
- Monitoring response to treatment

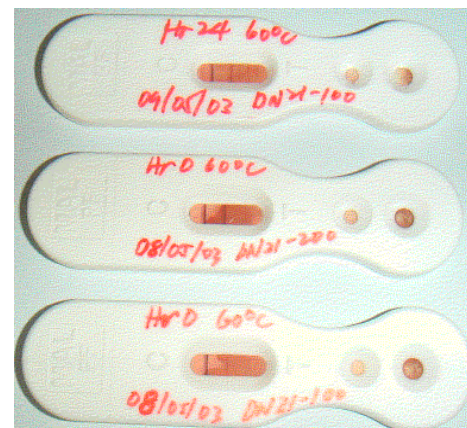
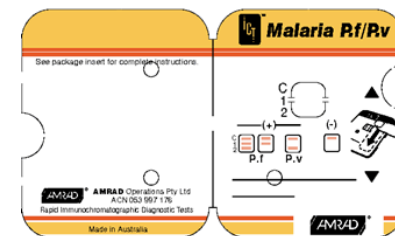


Laboratory diagnosis of malaria

Rapid diagnostic tests detect malaria antigens

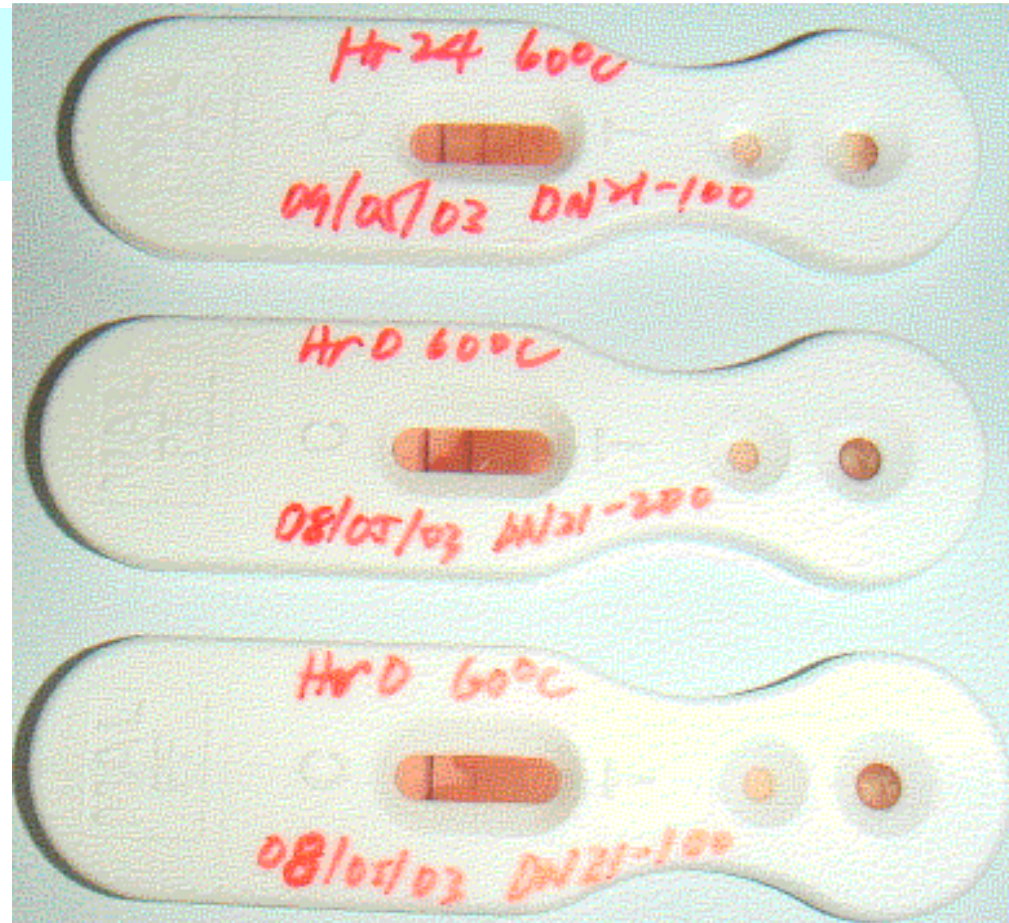
The products come in a number of formats:

- 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

