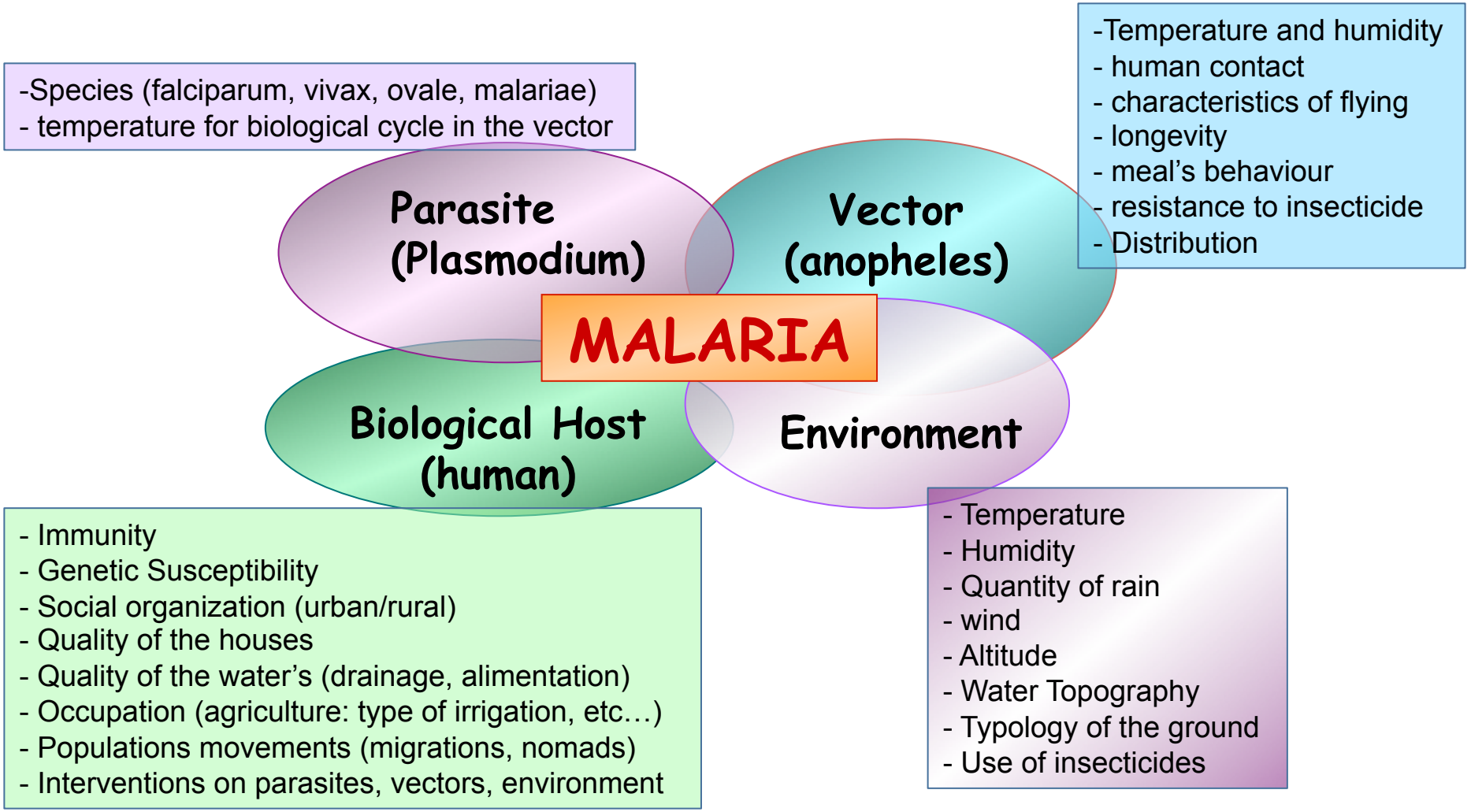
MALARIA in Children and Pregnant Women

MINGHA AFRICA ONLUS
Gianluca Russo, MD, PhD

Factors of the ecological system of malaria



Epidemiology

Global Morbidity and Mortality of Malaria (WHO, 2008)

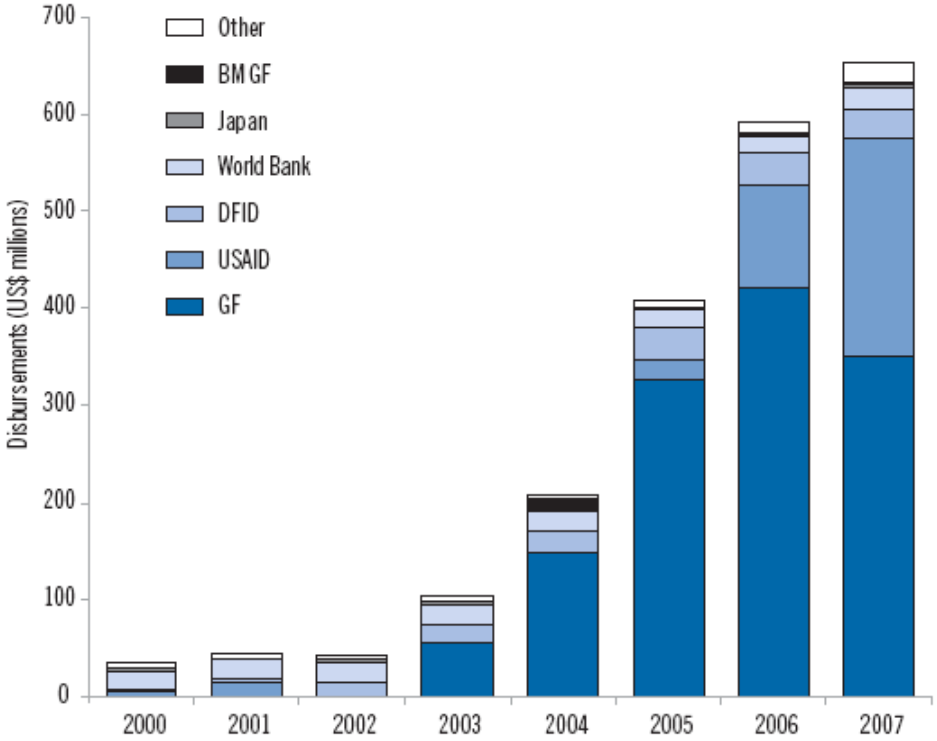
In 2008, there were an estimated **243 million cases of malaria (range 190–311 million)** worldwide. The vast majority of cases (85%) were in the African Region, followed by the South-East Asia (10%) and Eastern Mediterranean Regions (4%).

WHO REGION	CASES			
	Point	*Lower*	*Upper*	*P. falciparum (%)*
AFR	208	155	276	98
AMR	1	1	1	32
EMR	9	7	11	75
EUR	0	0	0	4
SEAR	24	20	29	56
WPR	2	1	2	79
Total	**243**	**190**	**311**	**93**

Malaria accounted for an estimated **863 000 deaths (range 708–1003 million)** in 2008, of which 89% were in the African Region, followed by the Eastern Mediterranean (6%) and the South-East Asia Regions (5%).

WHO REGION	DEATHS			
	Point	*Lower*	*Upper*	*Under 5 (%)*
AFR	767	621	902	88
AMR	1	1	2	30
EMR	52	32	73	77
EUR	0	0	0	3
SEAR	40	27	55	34
WPR	3	2	5	41
Total	**863**	**708**	**1003**	**85**

Figure 6.2 Disbursements to malaria-endemic countries 2000–2007

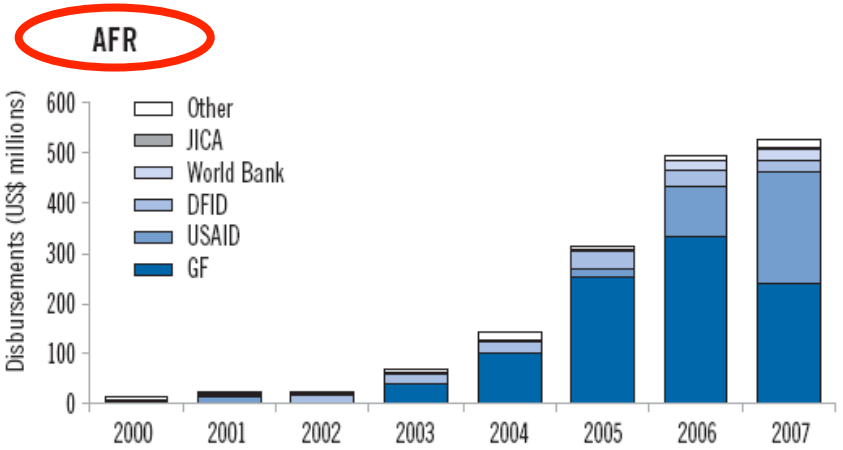


Source: *Institute of Health Metrics and Evaluation database with amendments to the President's Malaria Initiative and World Bank disbursements*

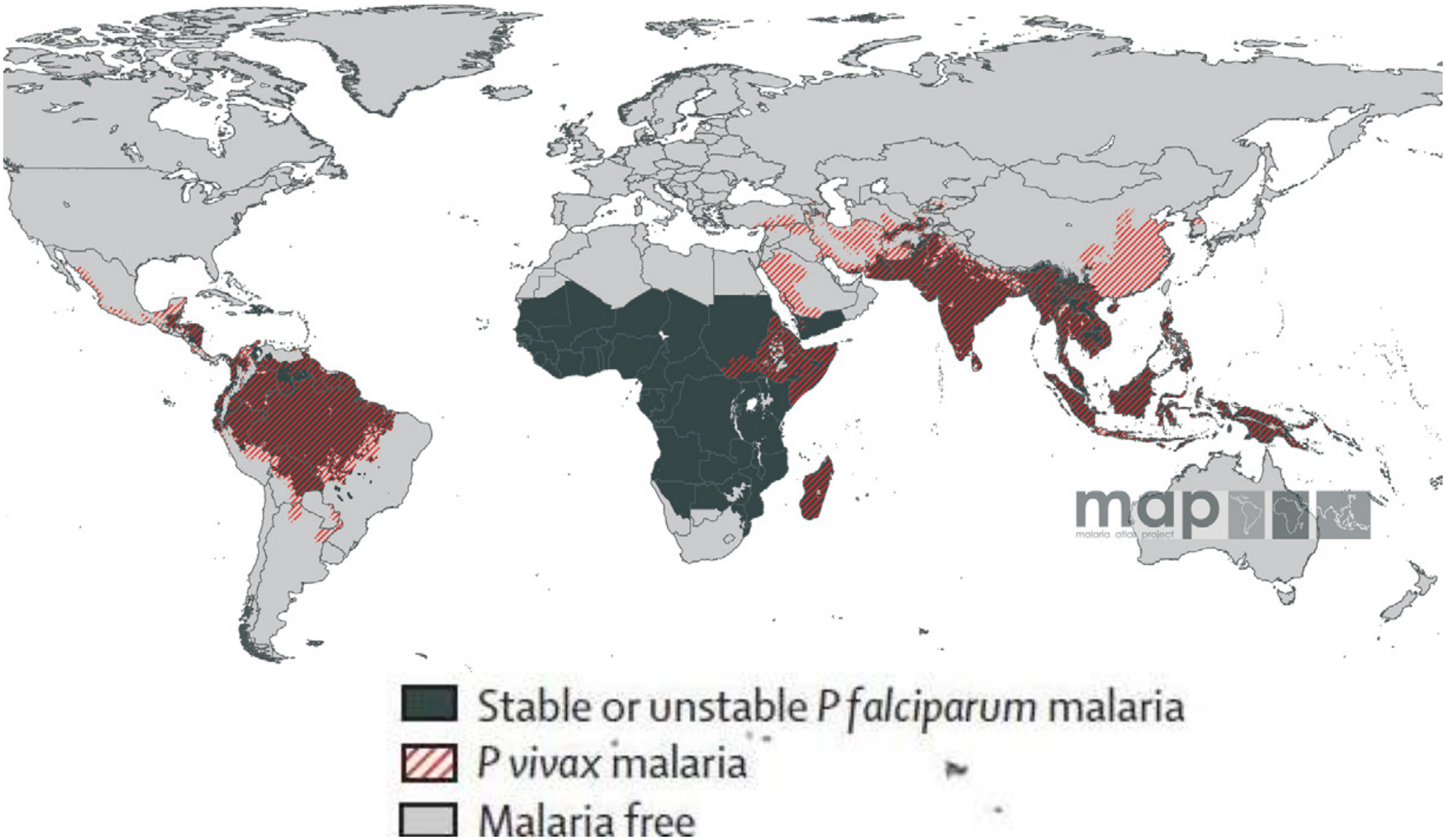
BMGF: Bill and Melinda Gates Foundation; DFID: Department for International Development (United Kingdom); USAID, United States Agency for International Development; GF: Global Fund to fight AIDS, Tuberculosis and Malaria

Disbursements to malaria endemic countries by external agencies (2000-2007)

Figure 6.4 Disbursements by external agencies for malaria by WHO Region



Malaria distribution (2007)



Malaria constitutes about 10% of Africa's disease burden

Malaria is also reported as the most common cause of school absenteeism and ill-health exemption from work

Low concentration or low performance at work or school, enormous financial burden arising from the purchase of drugs and payment of hospital bills are documented socio-economic consequences of malaria

It is reported to slow down economic growth in Africa by up to 1.3% each year

Biological aspects of *Plasmodium falciparum*

The malaria biological vector: *Anopheles*

Eggs deposition (200-400/time)

1-3 days

Favourable environment (stagnant water, 28-30°C)

Larve

2-4 weeks

Maturation (4 stades)

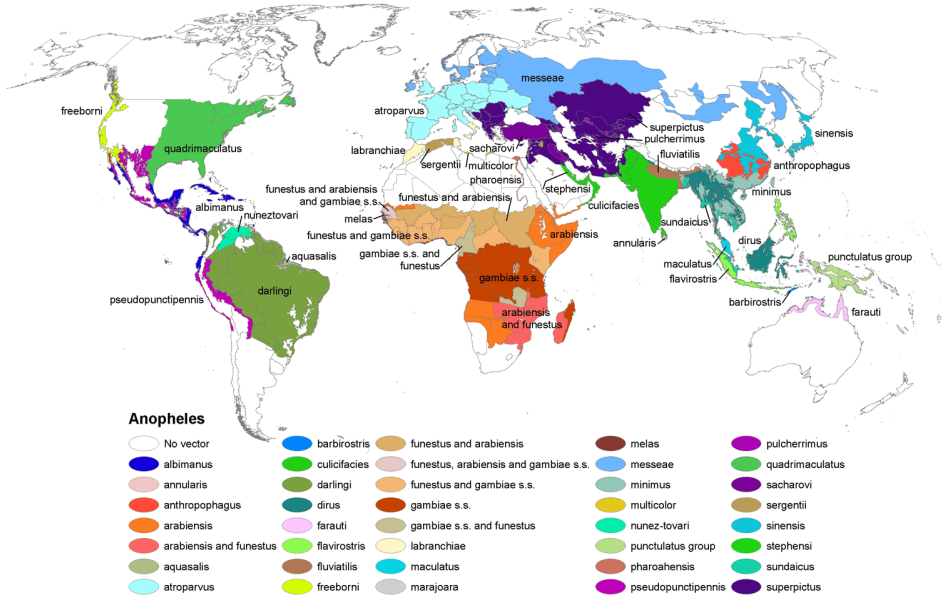
Pupa

2-4 days

Anopheles adult

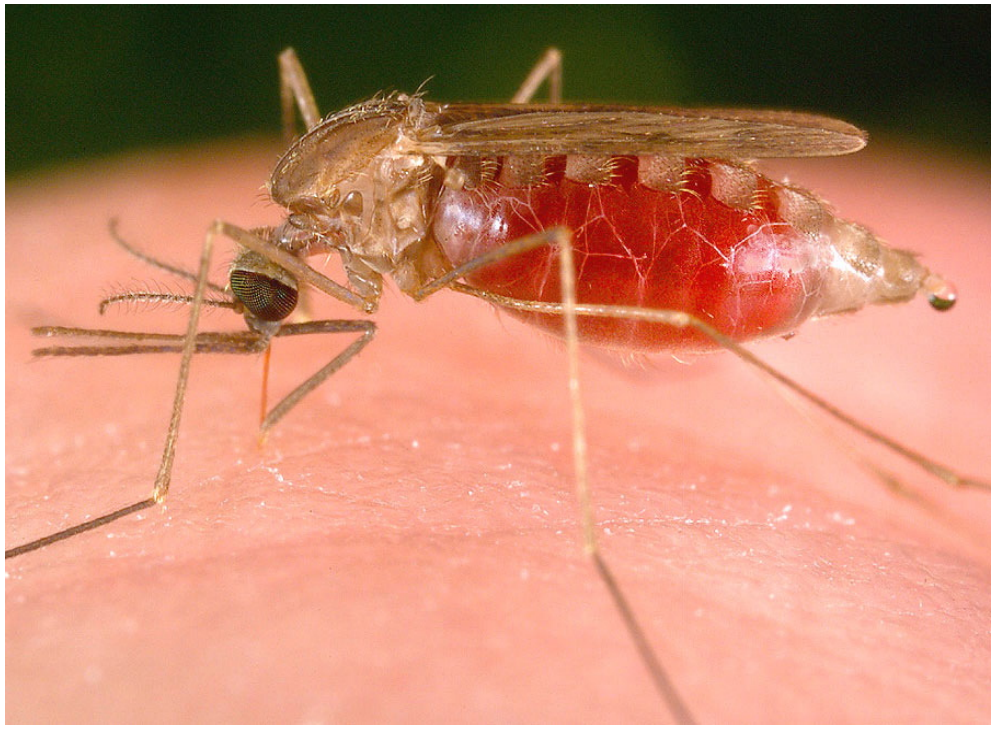
Every open water collections can represent a favourable environment for the larva development

The male lives 5-6 days and don't eat blood
The **female** lives > 2 weeks and eat blood



There is 400 species de *Anopheles,* and among them 60 play a medical role

The female of Anopheles takes her blood meal during night-time



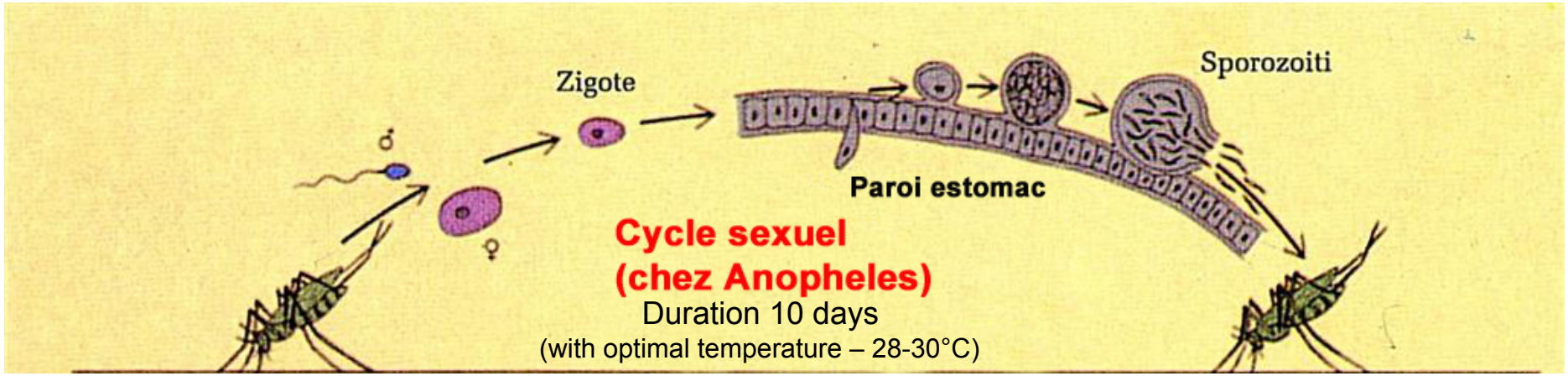
Altitude → Anopheles density

Human Bite Rate of Anopheles

Median duration of Anopheles development cycle

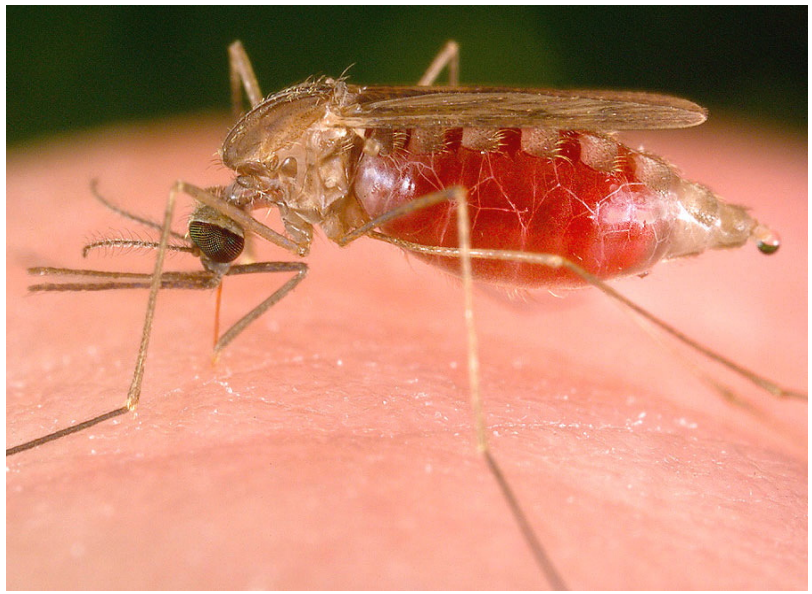

HOW MANY CHILDREN DO YOU WANT?
BILLION...!!!
JUST MARRIED

Sporogonic Cycle of *Plasmodium Falciparum*



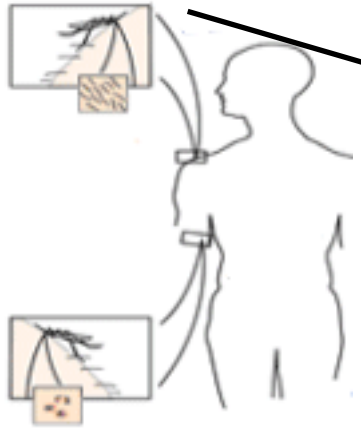
The mosquitoes become infected during her blood meals by an infected human → Beginning of the sexual cycle

Successively the gametes will complete the sexual cycle originating the sporozoites that will migrate to salivary glands for be injected in human in the next bloody meal of the mosquitoes → Beginning of the asexual cycle in human

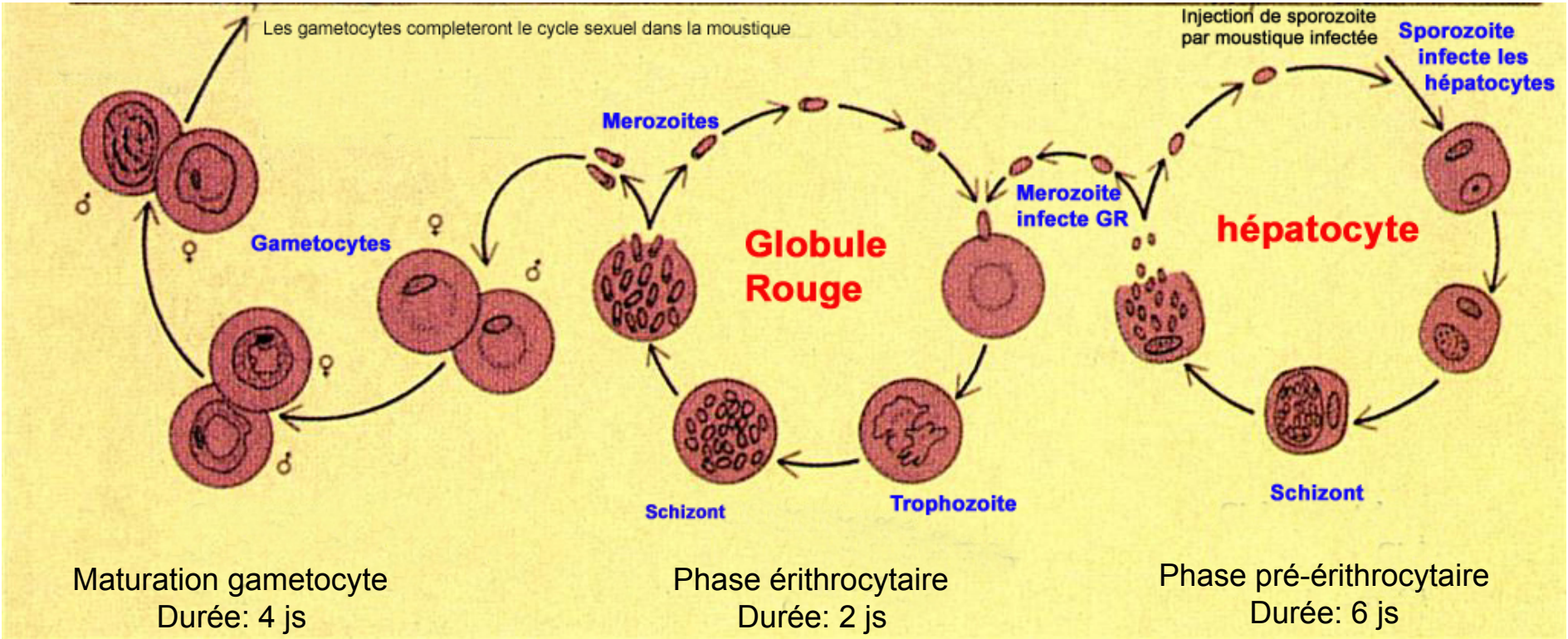


Schizogonic Cycle of *Plasmodium Falciparum*

The mosquitoes become infected during her bloody meal by aspirating the gametocytes (they can survive few weeks in the blood)



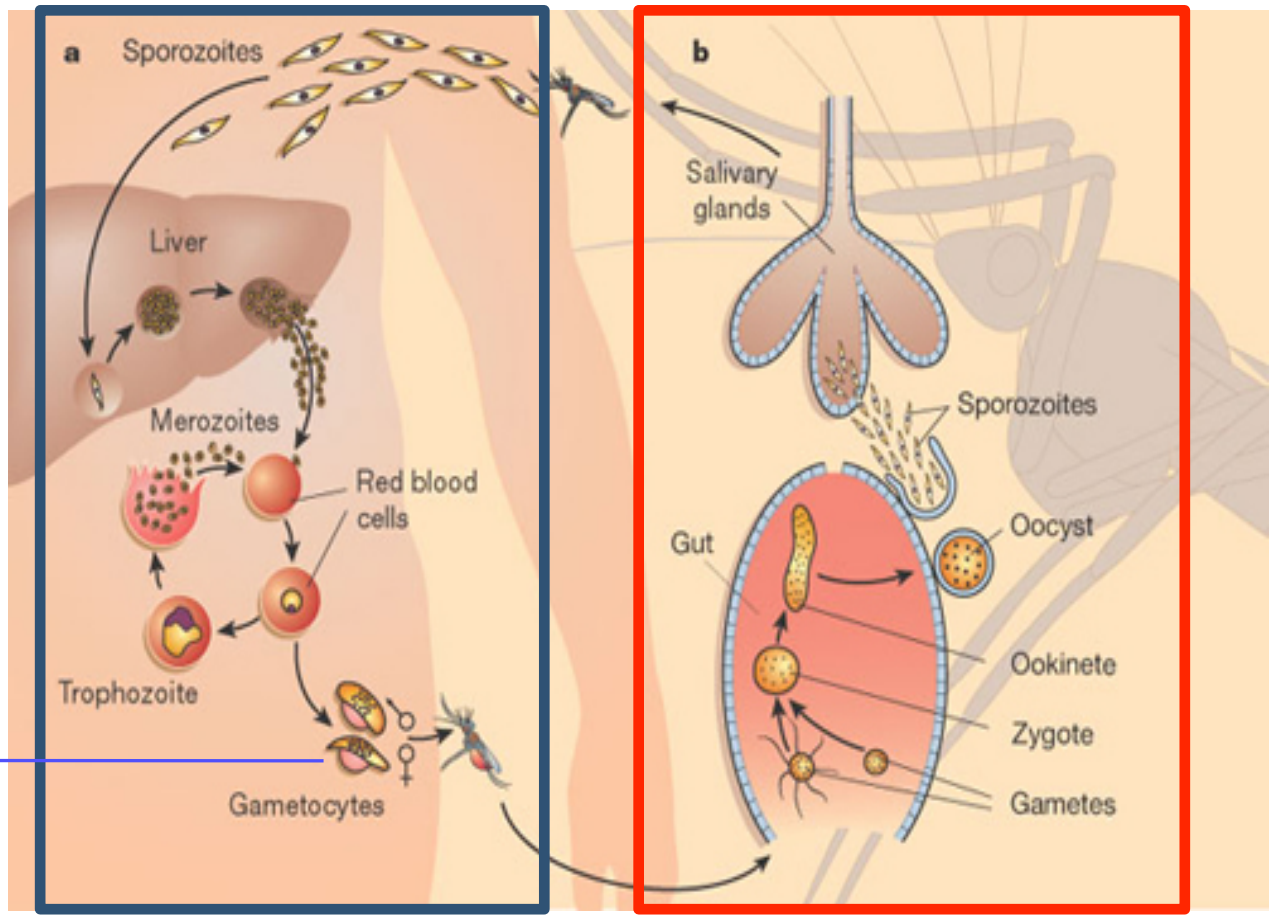
The infected mosquitoes inject into human the sporozoites during her blood meal



Maturation gametocyte
Durée: 4 js

Phase érithrocytaire
Durée: 2 js

Phase pré-érithrocytaire
Durée: 6 js



Gametocyte development: 4 days

Human

Schizogonic (asexual) cycle

- 6 days (hepatocite) + 2-days cycles (RBC) -

Anopheles

Sporogonic (sexual) cycle

-10 days-

The only reservoir of the infection is the infected human

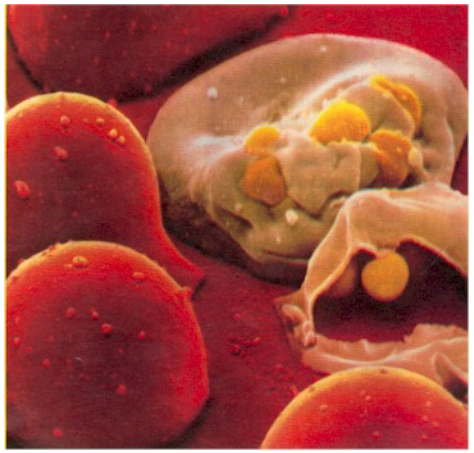
The infected human is infectious after around 12 days (hepatic cycle + red blood cells cycle + gametocyte development) from the inoculation of the sporozoites by the infected *l'Anopheles*


REMEMBER! THIS IS OUR ENEMY!

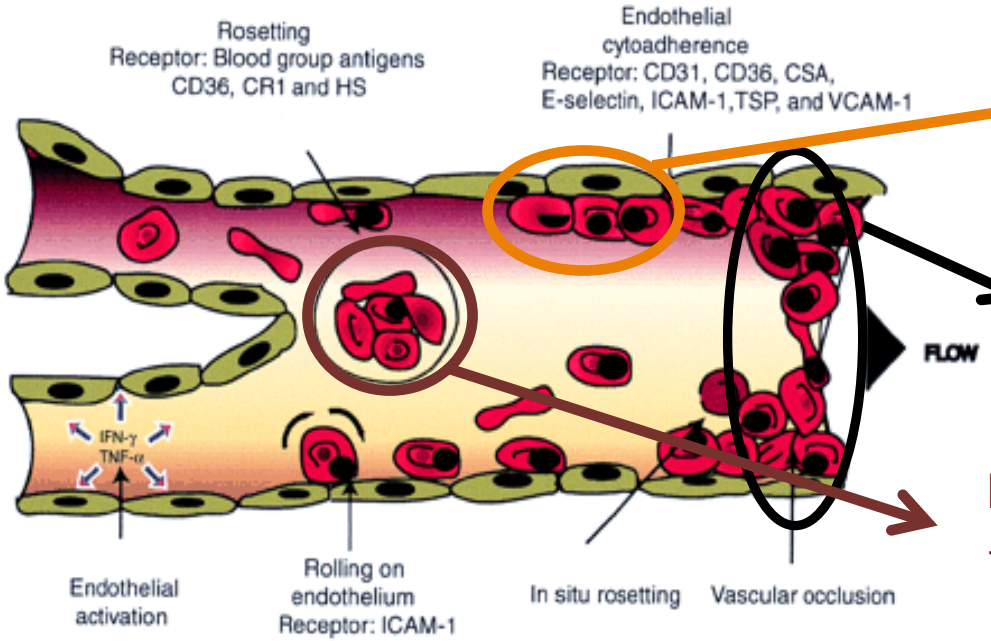
Pathogenesis *of* *Plasmodium* *Falciparum* infection

Pathogenetic mechanisms

Synchronized breaking of infected red blood cells



Sequestration & cyto-adherence & rosetting in the microcirculation (spleen, liver, Central Nervous System, kidney, etc..)

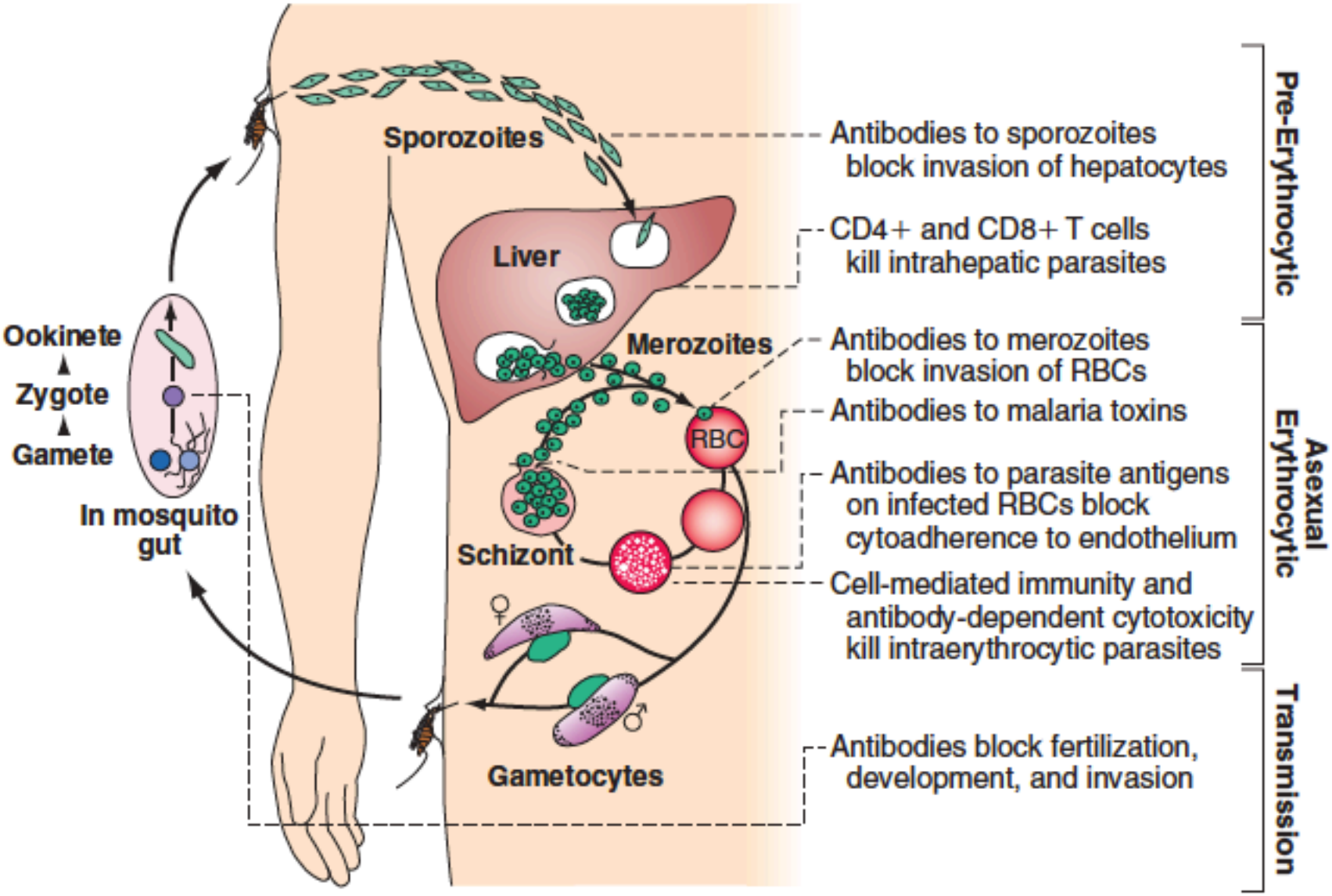


Cyto-adherence → damage of the endothelium…

Sequestration → Micro-vessel's occlusion → Hypoxia of the tissues…

Rosetting → Micro-vessel's occlusion → Hypoxia of the tissues…

The host immunitarian response



Immune-tolerance

Phenomenon in malaria endemic areas where, following a sufficient quantity of exposition to the infection, peoples develop a protective semi-immunity able to limit the parasitemie in a sub-clinical condition

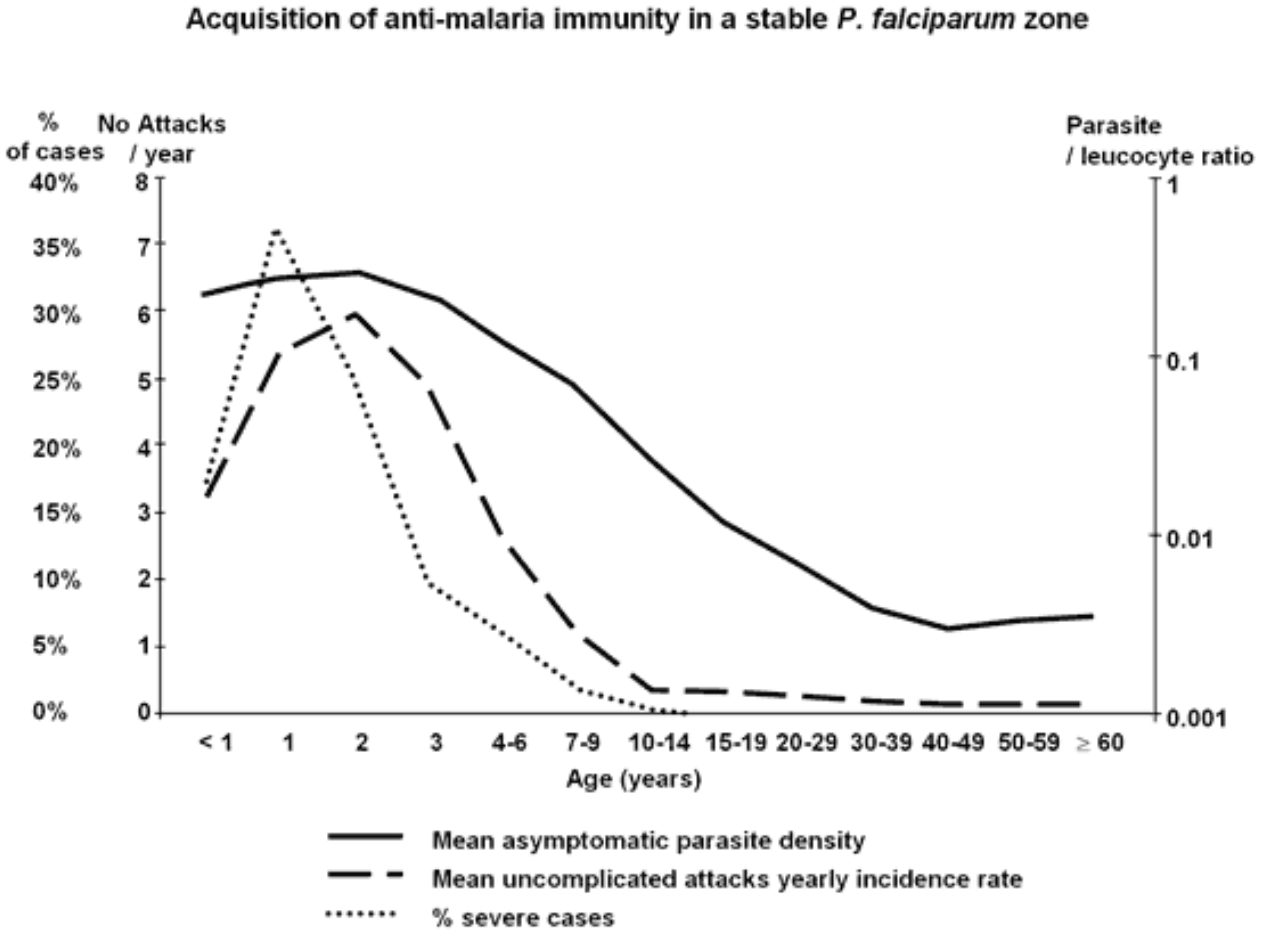
Number of circulant parasites

Human immunitaria n response

An increased number of infectious bites, or a condition of immuno-depression, facilitate the appearance of clinical manifestation of the malaria

The immune-tolerance to malaria is a reversible phenomenon that need a continuous exposition to the infection (low parasitic charge)

Immune-tolerance



Under-five children are more susceptible to develop severe malaria infections because their immune-tolerance is not sufficiently developed

Pregnant women, because of their physiological and transitorial immune-depression during pregnancy are also more vulnerable to the malaria infection

Genetic effects of the selective pressure by P. falciparum

The human genetic polymorphism is secondary to the selective pressure of the plasmodium, concern specifically the red blood cells, and represents an example of genetic imbalance in witch the genetically advantage of a part of the population (heterozygosis for some genes) is counterbalanced, in a genetic population optic, by the disadvantages of the peoples with recessive homozygosis for the same genes in the same population

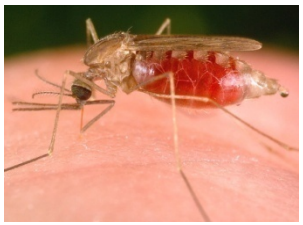
Example of genetic polymorphism secondary to the selective pressure of the plasmodium in endemic areas:

- Sickle cells anemia
- glucose-6 phosphate-dehydrogenase deficit
- Hemoglobin C
- Persistance of fœtale hemoglobin
- β-thalassemia

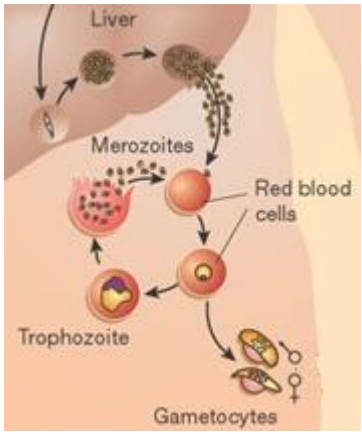
These conditions can facilitates the hemolysis and reducing the possibility of infection by the trophozoites of P. falciparum

Clinical aspects of malaria

Clinical aspect: the beginning



Infectant bite



Incubation (9-14 days)
(hepatic cycle and beginning of the red blood cells cycle)

Aspecific clinical picture

- Fever
- malaise
- headache
- anorexia
- nausea/vomiting
- hypotension
- tachycardia

Physical exam often negative

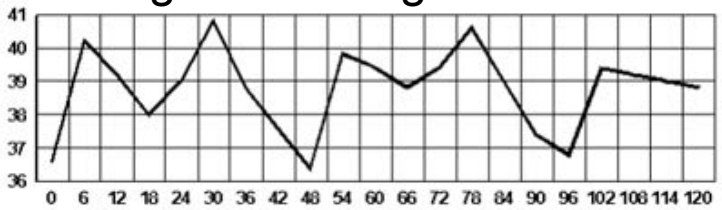
The signs and symptoms of malaria are nonspecific. Malaria is clinically suspected mostly on the basis of fever or a history of fever. Diagnosis based on clinical features alone has very low specificity and results in over-treatment. Other possible causes of fever and the need for alternative or additional treatment must always be carefully considered.

Clinical aspects

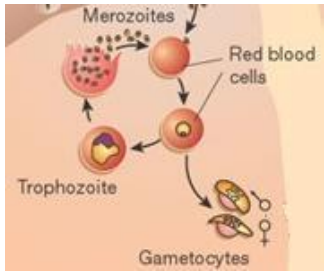
The symptoms becomes more intense

- Increasing fever (often preceding by chills and followed by transpiration)
- Headache more and more less supportable
- Increasing malaise and asthenia with suffering aspect of the patient
- nausea/vomit and, sometimes, also diarrhoea anorexie
- tachycardia
- dyspnoea
- Possible mental status alteration with agitation, delirium, anxiety, somnolence

Irregular and high fever



Progression of the parasitic cycles in the red blood cells of the patient



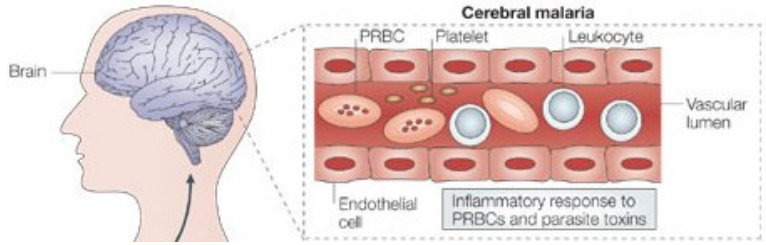
Physical exam:
- Possible splenomegaly,
- Possible hepatomegaly
- Pallor of conjunctiva and palms

Tempestive therapeutic in this phase is fundamental for stopping the clinical evolution of the infection

Clinical aspects: severe malaria

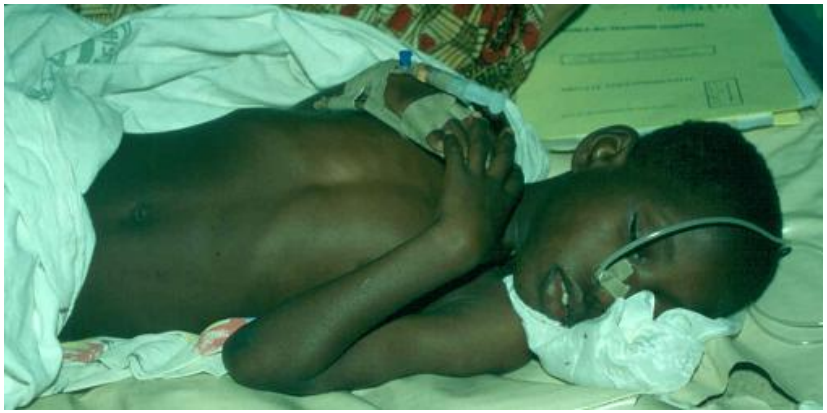
Cerebral malaria

Mechanisms
- Hypoxia (obstruction of cerebral microcirculation)
- hypoglycaemia and lactic acidosis
- high fever
- neurotransmission inhibition (↑TNF → ↑NO)



Acute or insidious beginning

- Mental status alterations (confusion, hallucinations, euphoria or somnolence, etc…)
- Aphasia
- Ataxia
- Anisocoria
- Meningismus
- Convulsions (50% of children)



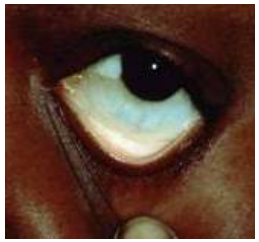
Coma → **Mortality 15-20%**

Precoce therapeutic intervention is fundamental

Clinical aspects: severe malaria

Severe Anaemia

- Dyspnoea
- Tachycardia
- etc…



Mechanism

- Massive and synchronic breaking of parasitic RBCs
- Hypersplenism (splenic « capture » of RBCs)
- Inhibition of bone marrow (secondary a ↑TNF)

Massive parasitemia → massive breaking of RBCs → haemoglobinuria → kidney damage → Acute renal failure

Clinical aspects: severe malaria

Severe Hypoglycaemia

More frequent in children and pregnant women

- Anxiety et and alteration of mental status
- Dyspnoea and tachycardia
- Transpiration and cold sensation
- Contraction of the diuresis
- hypoglycaemic coma

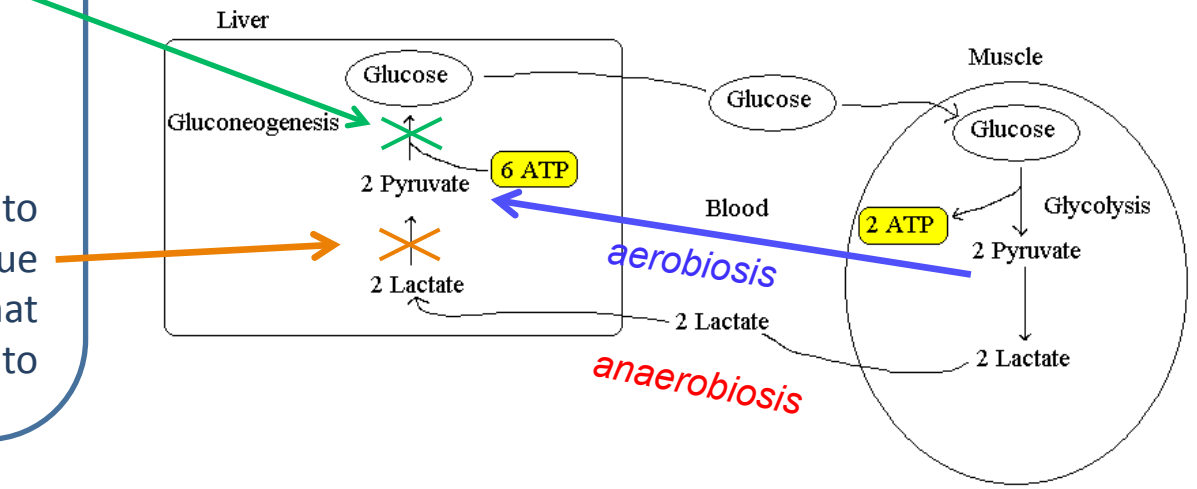
N.B.: The hypogycaemia can be also the consequence of the quinine treatment (iatrogenic hyper-insulinaemia)

Mechanisms

- ↓hepatic gluconeogenesis (by inhibition of Glucose-6-fosfatase)

- ↑ consummation of glucose (bye the host and the parasite)

- passage from aerobic to anaerobic glycolysis (due to tissue hypoxia) → excess of lactate that the liver is not capable to metabolize



Lactic acidosis

More frequent if shock, hypoglycaemia, renal failure

Typical respiratory alteration with coma

Clinical aspects: severe malaria

Renal failure

Tubular Necrosis → Contraction of the diuresis

Mechanisms

- Hypoxia (obstruction of kidney microcirculation)

- Haemoglobinuria (due to massive breaking of RBCs)

Pulmonary Edoema

Tachypnoea and dyspnoea

Mechanisms not clears

- ↑ capillary permeability
- ↑ capillary tension
- hypo-albuminaemia

Complication not rare (3-10% of the cases)

Become evident during the tardive phase of the infection, sometimes during treatment when parasitemia is low

→ Mortality 50%

Clinical aspects: severe malaria

Hyper-reactive Tropical Splenomegaly

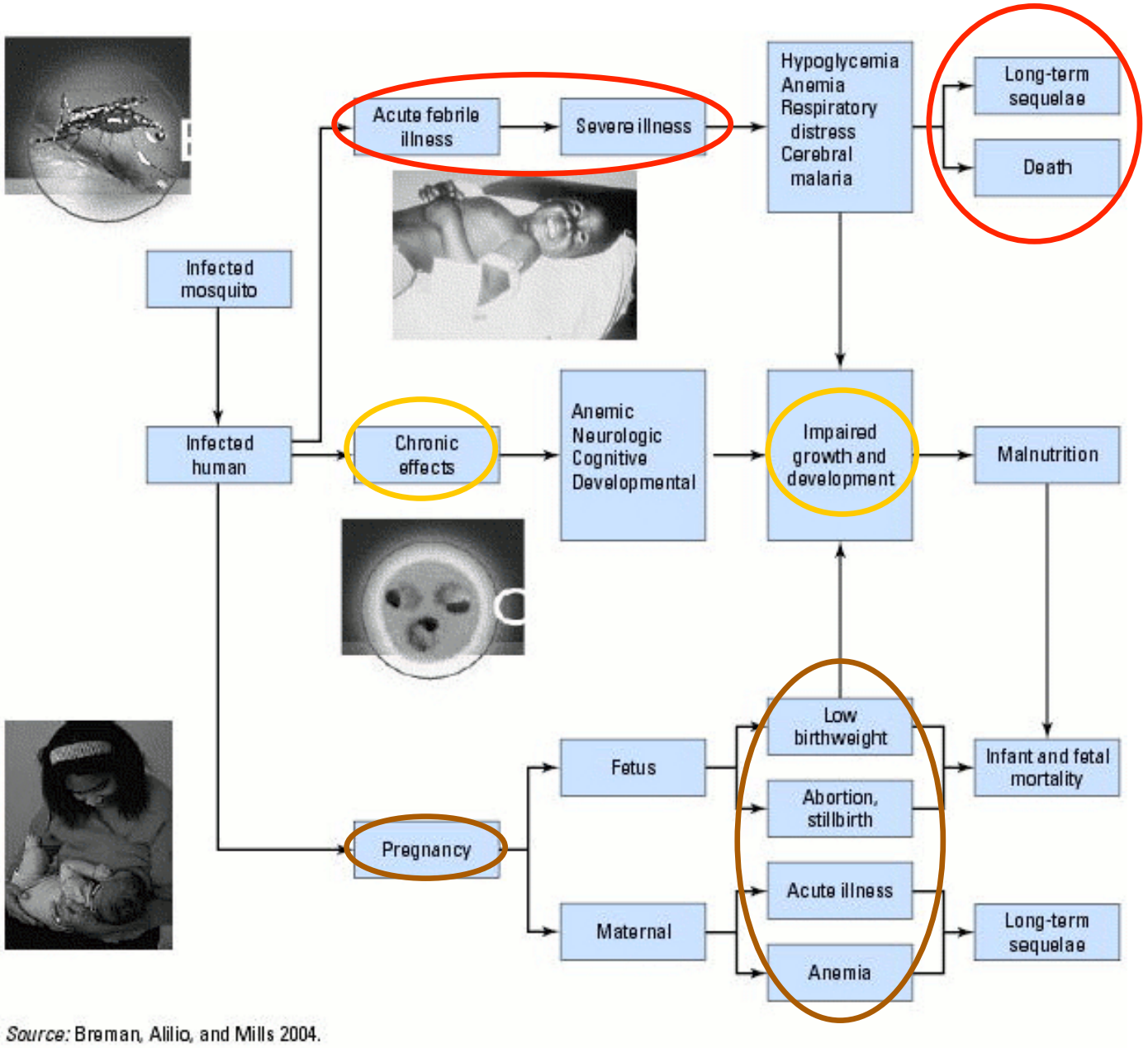
hydro-electrolytic alterations

Intravascular Disseminated Coagulation

↓

Multi-Organ Failure

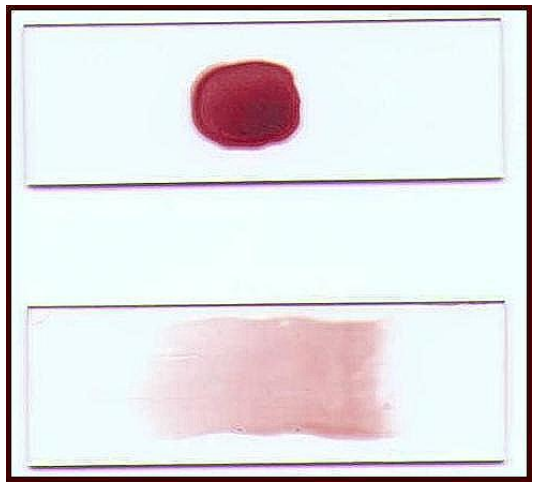
Pregnant women and Children (< 5 ans) are more vulnerable to malaria



Source: Breman, Alilio, and Mills 2004.

Diagnosis

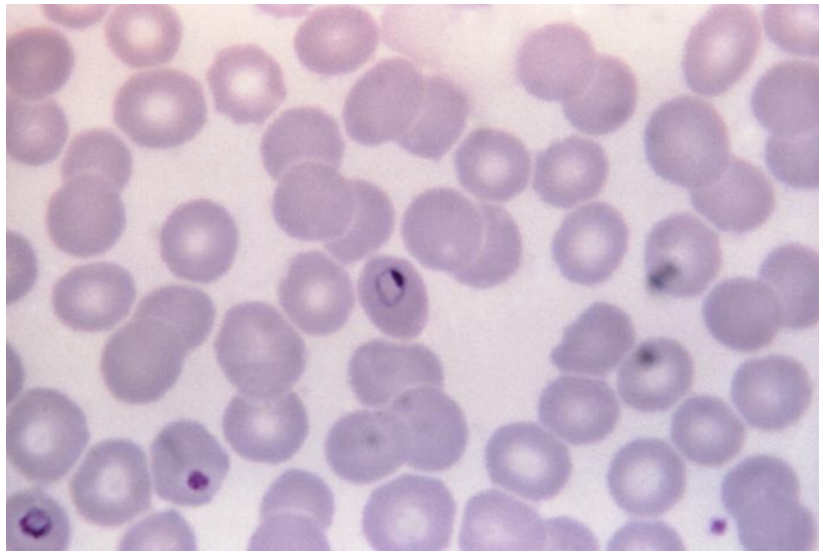
The malaria diagnosis is based on clinical picture and microscopic parasite research on blood



The parsited RBC don’t have increased size

Thick drop exam

Giemsa coloration and microscopic visualisation



Parasitemia: number of RBC parasited for microscopic camp

- Anaemia (↓ RBCs and haemoglobin)
- ↑ ESR (Erythrocyte sedimentation rate)
- ↓ platelets
- ↓ glucose
- ↑ urea
- ↑ creatinin
- ↑ bilirubin

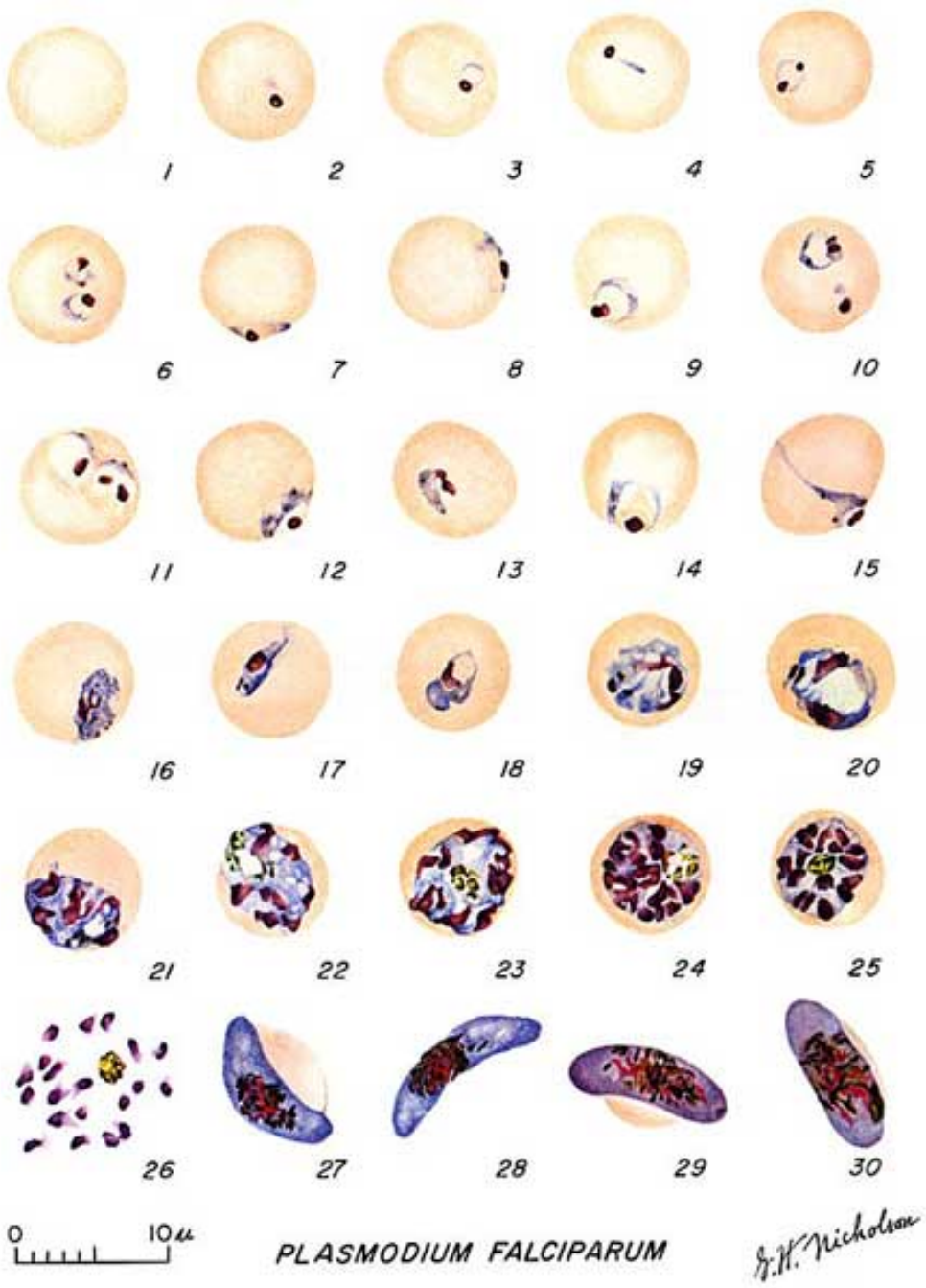


Fig. 1:
Normal red blood cell

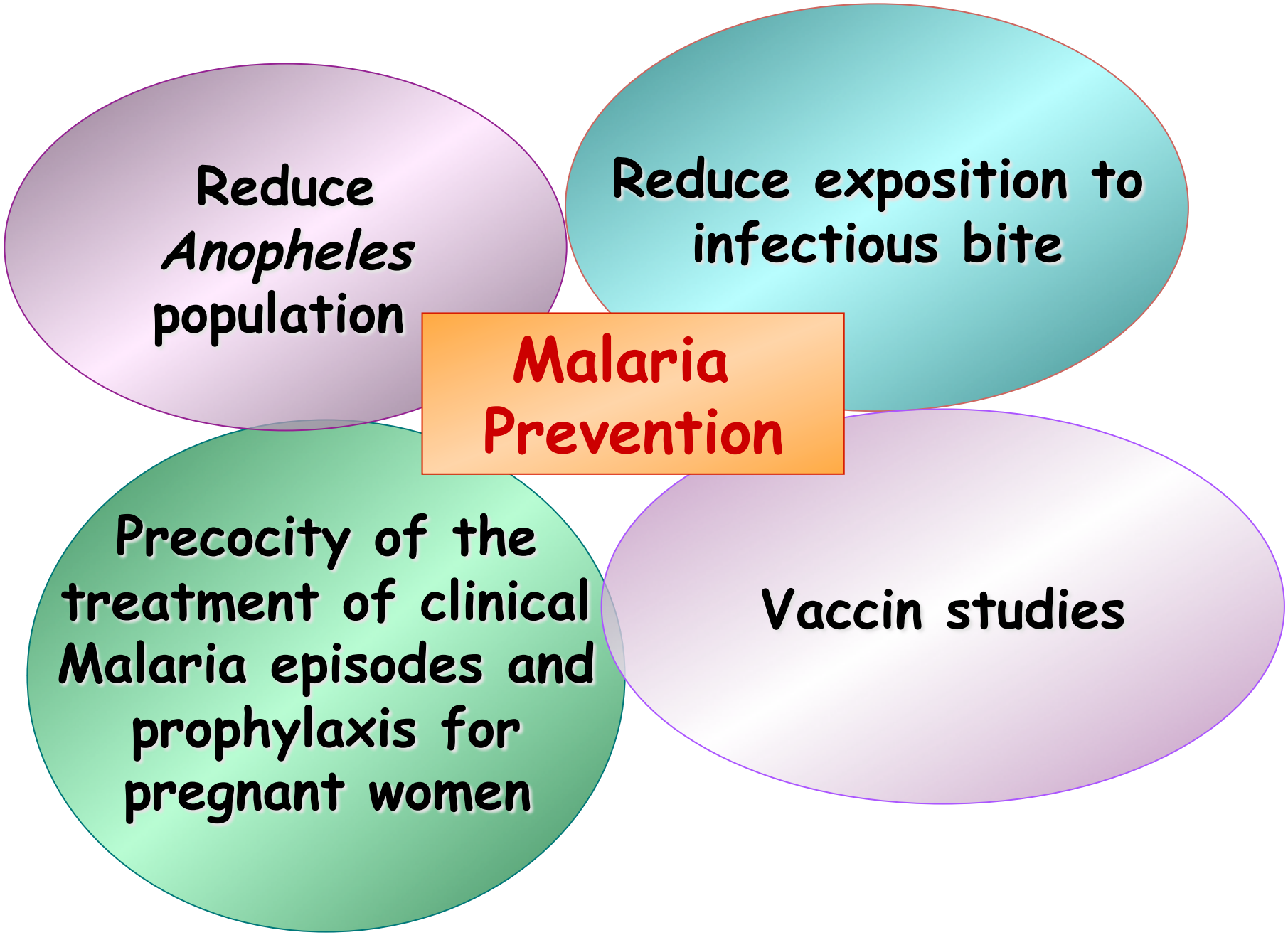
Figs. 2-18:
Trophozoites (among these, Figs. 2-10 correspond to ring-stag trophozoites)

Figs. 19-26:
Schizonts (Fig. 26 is a ruptured schizont)

Figs.27, 28:
Mature macrogametocytes (female)

Figs. 29, 30:
Mature microgametocytes (male)

Prevention


Reduce *Anopheles* population
Reduce exposition to infectious bite
Malaria Prevention
Precocity of the treatment of clinical Malaria episodes and prophylaxis for pregnant women
Vaccin studies

Prevention

Reduce *Anopheles* population

Reduce exposition to infectious bite

Reducing malaria by mosquito-proofing houses (1)

TRENDS in Parasitology Vol.18 No.11 November 2002

Angelo Celli study in 1900 in Italy

Place: Roman countryside (1900-1902)

Group 1: no intervention

Group 2:
- modification of the houses: creation of a veranda before the entry, coverage of the fireplace by a metallic net, white peinture into the house
- insect powder in the house
- quinine prophylaxy for people working outside during night-time

During the two years period of the study (1900-1902), there was a 96% reduction in malaria attacks among the group 1 (195 cases/219 inhabitant) and the group 2 (6 cases/186 inhabitant).

Reducing malaria by mosquito-proofing houses (2)

TRENDS in Parasitology Vol.18 No.11 November 2002

From these early studies, the practice of house-screening against mosquitoes began to spread to different parts of the world. By 1910, it was used to protect Europeans living in the tropics [4] and those building the Panama Canal [5,6]. It is thought that the reduction in malaria in the USA was largely a result of improved housing [7,8].

In 1941, Kiker [10] wrote that, in places where larval control was impractical, 'the improvement of homes by the application of mosquito-proofing,…is probably the most practical, economical, and effective malarial control measure available'.

Since then, public health scientists have continued to show that simple changes in house design have the potential for protecting people against this life-threatening disease. Yet today, this type of intervention remains virtually ignored.

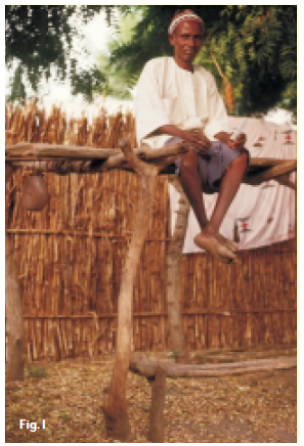
Anopheles gambiae :

- have an antropophilia of around 100%: she's attracted by human odours (red points in the figure).
- have the characteristic of flying from down to high when she meet an obstacle: this can permit to better penetrate into the houses through the free space among the walls and the roof (in absence of false ceiling)

Many studies showed that reducing the capacity of *A. gambiae* to penetrate into the houses means reducing the prevalence of malaria attacks

Moreover:

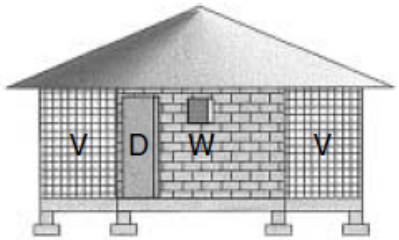
- Don't sleep on the ground*(…Herodotus 450-420 a.C. …)*
- Raising houses from the ground level
- Sitting outside not at the ground level



All this can contribute significatively to reduce infectious bite rate and consequent malaria attacks in endemic areas.

Changes in house design reduce exposure to malaria mosquitoes

Tropical Medicine and International Health
VOLUME 8 NO 6 PP 512–517 JUNE 2003

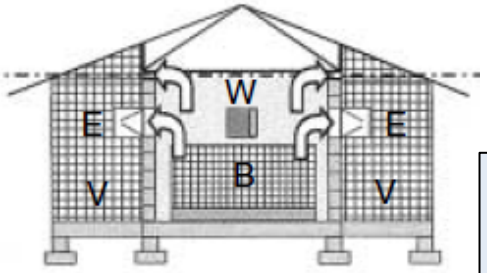


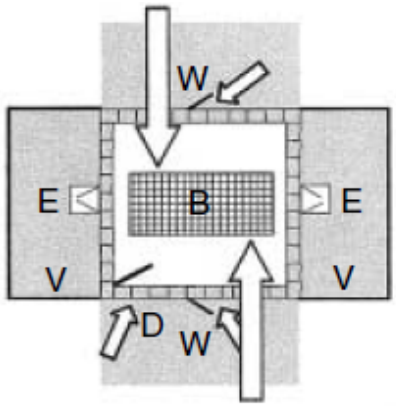
V = verandah
W = windows
B = untreated bednet
D = door
E = Exit trap

Rural Gambia
Raised Houses

Gr. 1

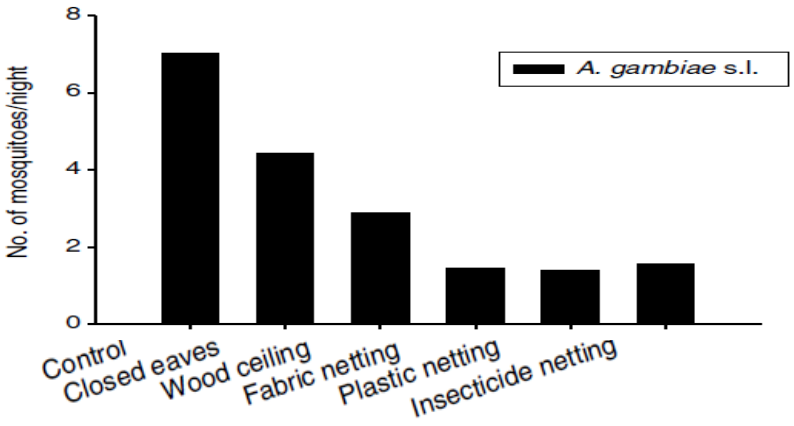
No false ceiling
(free space walls-roof)





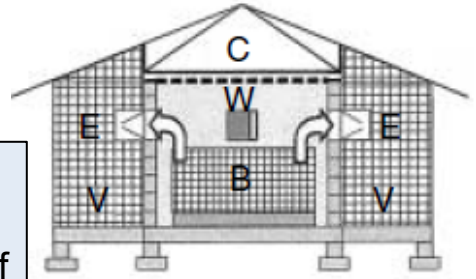
The mosquitoes fly-in trough windows, doors and free space among walls and roof

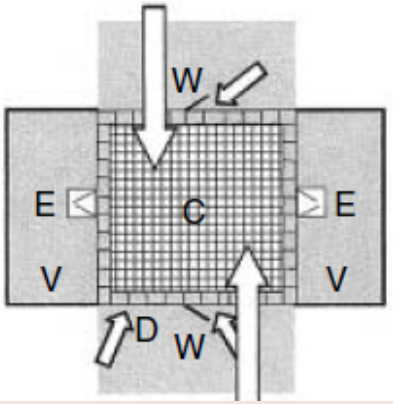
The false ceiling reduce significatively the entry of mosquitoes into the houses
(Reduction of 59% if wood-false ceiling, 78%-80% if mosquitoes-nets are used). The simple seal of the walls-roof space can reduce of 37% the mosquitoes entry.



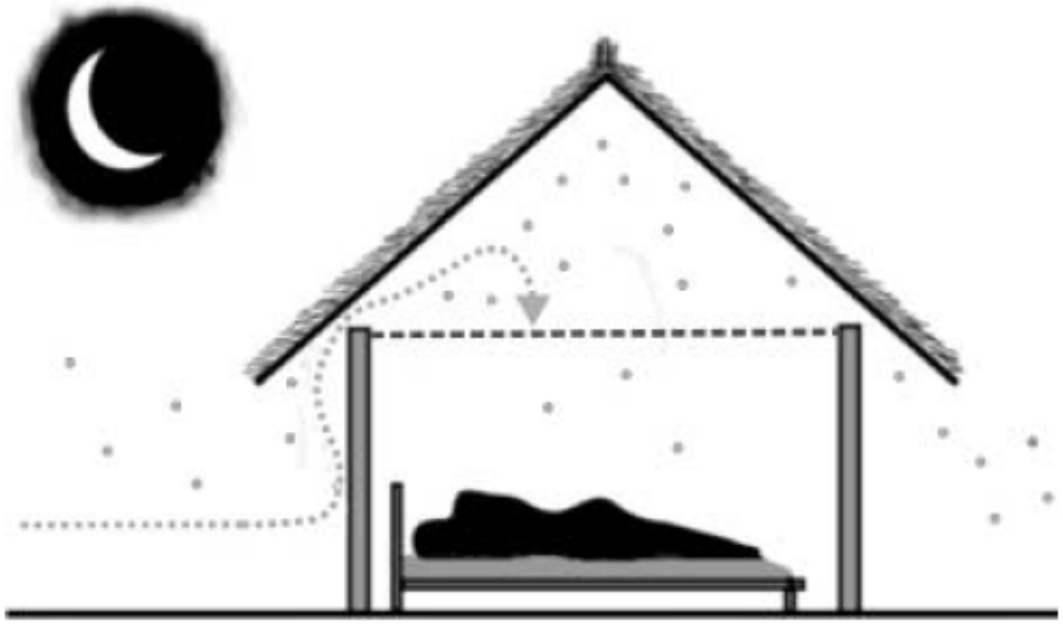
Gr. 2

Yes false ceiling
(seal walls-roof space)





The mosquitoes can fly-in only through windows and doors



The protection afforded by a netting ceiling was not enhanced by insecticide treatment, suggesting that treatment did not repel mosquitoes from entering via the door and window. However, if insecticide was applied to curtains around the door and windows it is likely that protection would be improved because treating curtains with permethrin in experimental huts in Burkina Faso was associated with a reduction in malaria transmission by about 63% (Majori *et al.* 1987).

Elimination of favourable environment for the development of Anopheles

Stagnant water at the temperature of 28-30 °C

Mosquito-nets

20% of children mortality

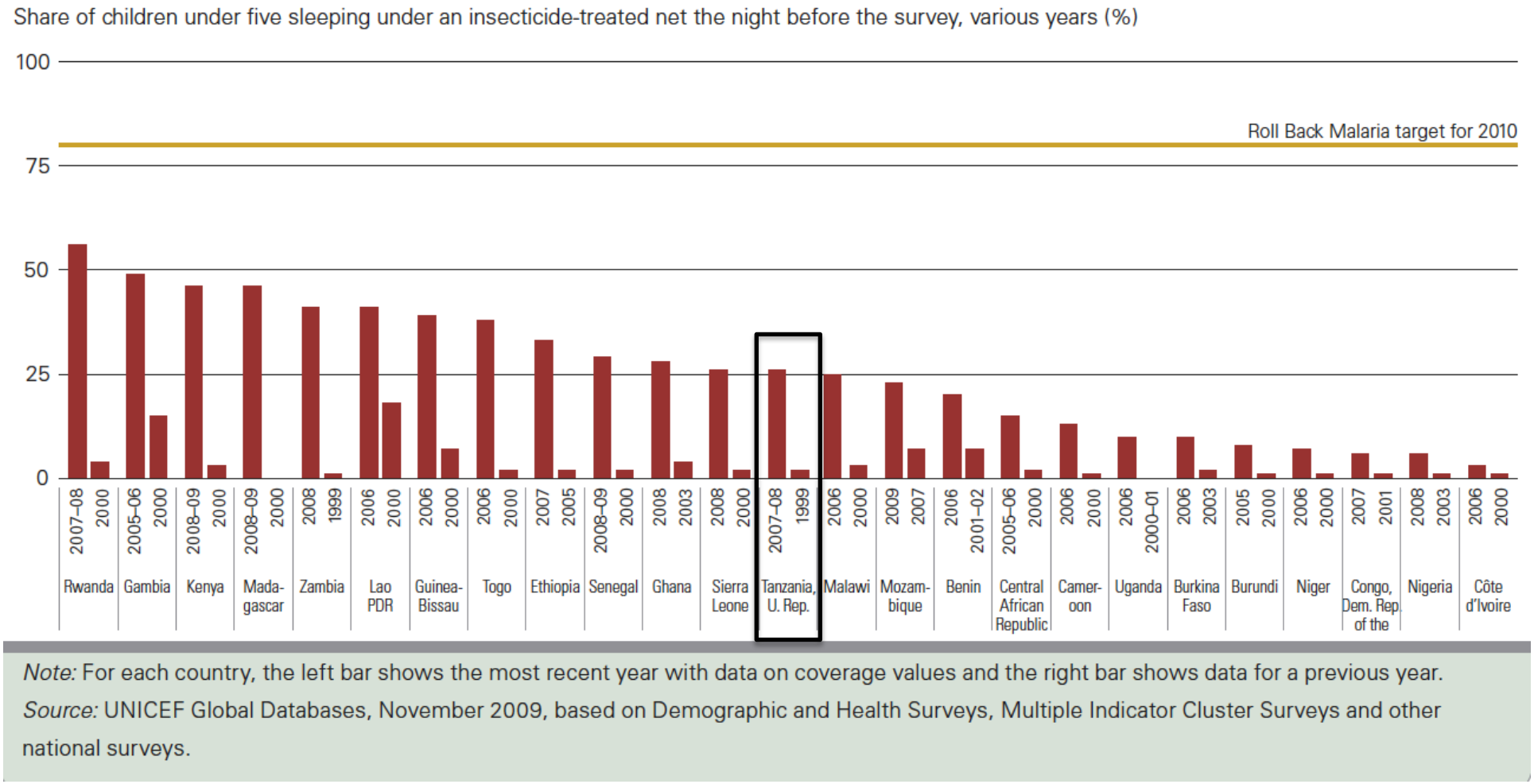
23% low-birth weight

33% avortments and perinatal mortality

50% of malaria infant morbidity in children

Attention: ….Resistance has already been reported for all four classes of insecticides in the major African malaria vectors….

Children under-five sleeping under Insectide-Treated Net



Note: For each country, the left bar shows the most recent year with data on coverage values and the right bar shows data for a previous year.
Source: UNICEF Global Databases, November 2009, based on Demographic and Health Surveys, Multiple Indicator Cluster Surveys and other national surveys.

The WHO estimate that in Africa the mosquito-nets distribution was 17% des in 2006, and 31% in 2008

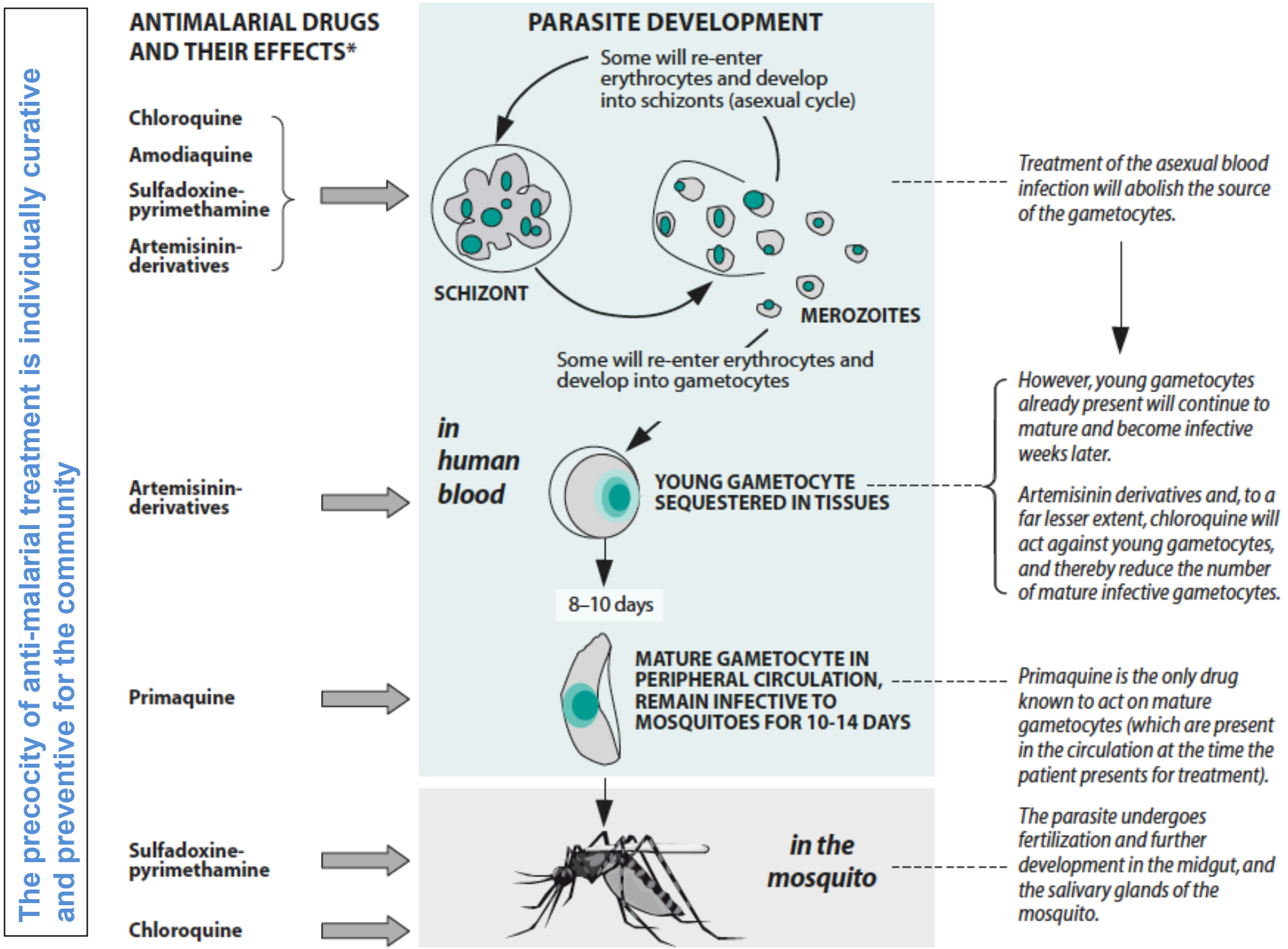
Malaria Prevention

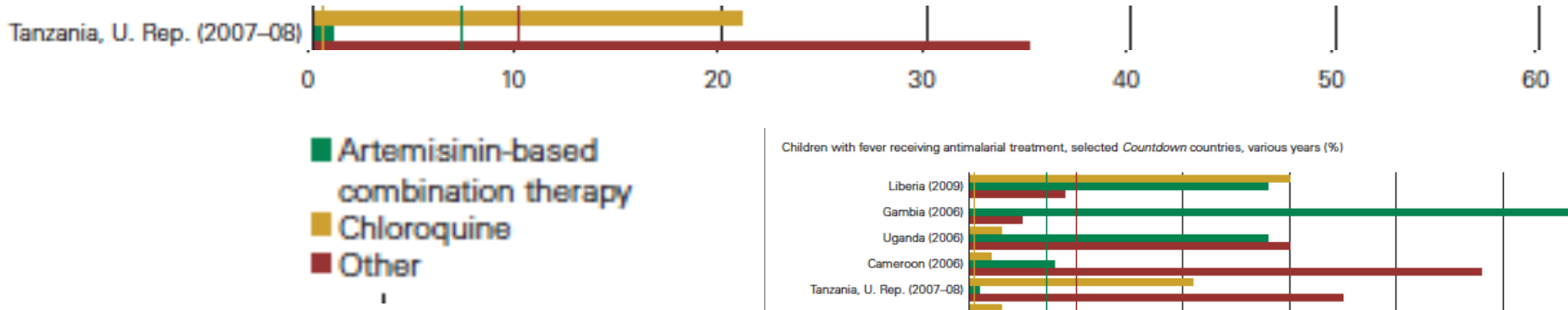
Precocity of the
treatment of clinical
Malaria episodes

and

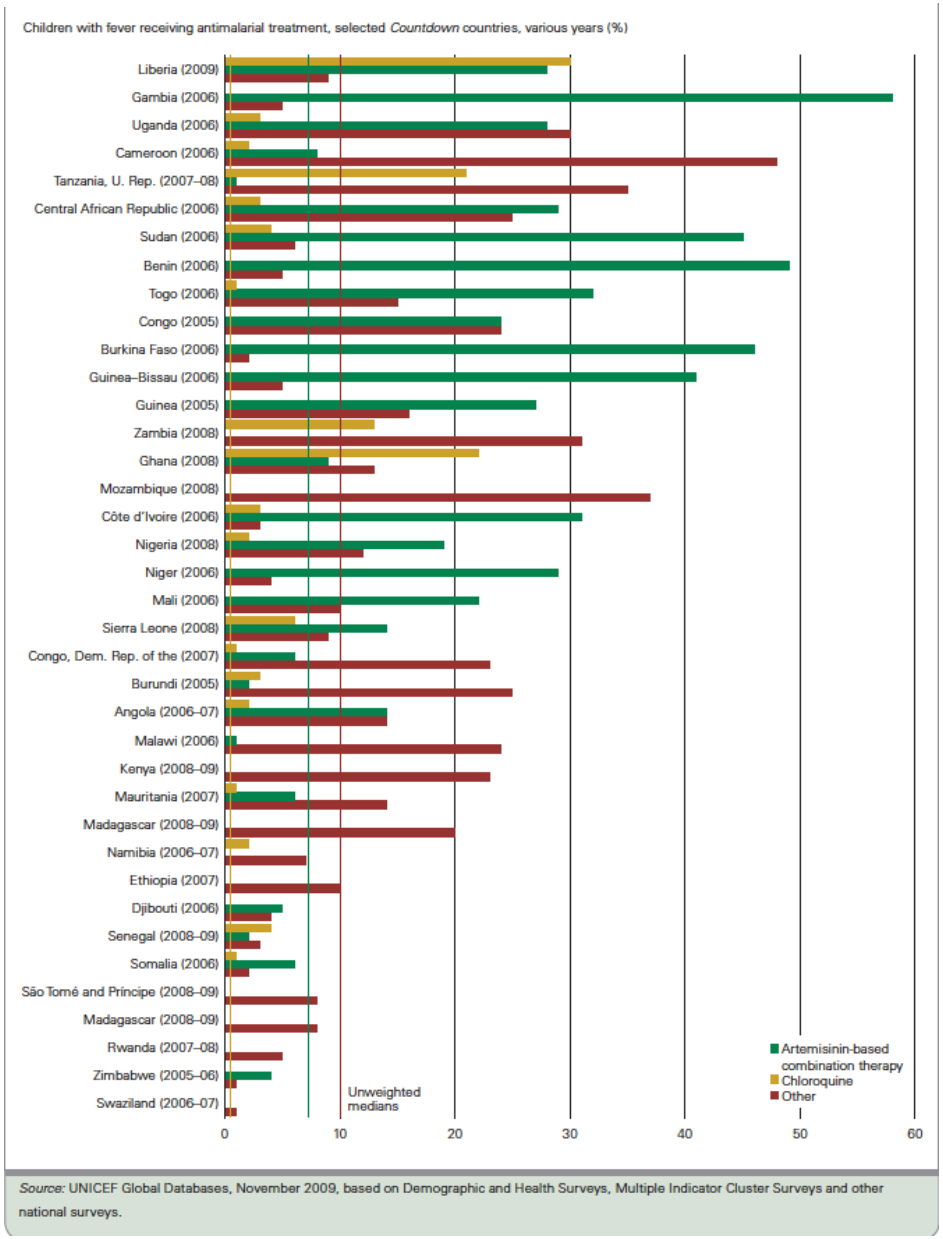
prophylaxis for
pregnant women

The precocity of anti-malarial treatment is individually curative and preventive for the community





Children with fever receiving antimalarial treatment (2007-2008)



TREATMENT OF UNCOMPLICATED *P. FALCIPARUM* MALARIA

- Artemisinin-based combination therapies (ACTs) are the recommended treatments for uncomplicated *P. falciparum* malaria.
- The following ACTs are recommended:
  - artemether plus lumefantrine, artesunate plus amodiaquine, artesunate plus mefloquine, and artesunate plus sulfadoxine-pyrimethamine.
- The choice of ACT in a country or region will be based on the level of resistance of the partner medicine in the combination.
- Artemisinin and its derivatives should not be used as monotherapy.
- Second-line antimalarial treatment:
  - alternative ACT known to be effective in the region;
  - artesunate plus tetracycline or doxycycline or clindamycin; any of these combinations to be given for 7 days;
  - quinine plus tetracycline or doxycycline or clindamycin; any of these combinations should be given for 7 days.

TREATMENT OF SEVERE MALARIA

- Severe malaria is a medical emergency. After rapid clinical assessment and confirmation of the diagnosis, full doses of parenteral antimalarial treatment should be started without delay with whichever effective antimalarial is first available.
- For adults, artesunate IV or IM:
  - quinine is an acceptable alternative if parenteral artesunate is not available.
- For children (especially in the malaria endemic areas of Africa) the following antimalarial medicines are recommended as there is insufficient evidence to recommend any of these antimalarial medicines over another:
  - artesunate IV or IM;
  - quinine (IV infusion or divided IM injection);
  - artemether IM (should only be used if none of the alternatives are available as its absorption may be erratic).
- Give parenteral antimalarials in the treatment of severe malaria for a minimum of 24 h, once started (irrespective of the patient's ability to tolerate oral medication earlier) and, thereafter, complete treatment by giving a complete course of:
  - an ACT;
  - artesunate plus clindamycin or doxycycline;
  - quinine plus clindamycin or doxycycline.
- If complete treatment of severe malaria is not possible, patients should be given pre-referral treatment and referred immediately to an appropriate facility for further treatment. The following are options for pre-referral treatment : rectal artesunate, quinine IM, artesunate IM, artemether IM.

Additional management considerations in severe malaria (1)

- Patients with severe malaria require intensive nursing care
- Fluid requirements should be assessed individually
- Clinical observations should be made as frequently as possible. These should include monitoring of vital signs, coma score, and urine output. Blood glucose should also be monitored every four hours, if possible, particularly in unconscious patients.
- If blood glucose is < 2.2 mmol/l, then hypoglycaemia should be treated immediately (0.3–0.5 g/kg body weight of glucose). Hypoglycaemia should be suspected in any patient who deteriorates suddenly.

Additional management considerations in severe malaria (2)

- The use of corticosteroids increases the risk of gastrointestinal bleeding and seizures, and has been associated with prolonged coma resolution times when compared with placebos
- The degree of fluid depletion varies considerably in patients with severe malaria. As a result, it is not possible to give general recommendations on fluid replacement. Each patient must be individually assessed and fluid resuscitation based on estimated deficit.
  In high-transmission settings, children commonly present with severe anaemia and hyperventilation (sometimes termed “respiratory distress”) resulting from severe metabolic acidosis and anaemia; they should be treated by blood transfusion.
- In high-transmission settings, blood transfusion is generally recommended for children with a haemoglobin level of < 5 g/100ml (haematocrit < 15%). In low-transmission settings, a threshold of 20% (haemoglobin 7 g/100 ml) is recommended. However, these general recommendations still need to be tailored to the individual.
- Prophylactic anticonvulsants are not recommended.
- The threshold for administering antibiotic treatment should be low in severe malaria. Septicaemia and severe malaria are associated and there is a diagnostic overlap, particularly in children. So broad-spectrum antibiotic treatment should be given initially until a bacterial infection is excluded

Oral antimalarial drugs

Drugs	5-14 kg	15-24 kg	25-34 kg	> 34 kg
Artemether (20 mg) plus lumefantrine (120 mg)	1 tab twice a day for 3 days	2 tab twice a day for 3 days	3 tab twice a day for 3 days	4 tab twice a day for 3 days
Artesunate plus amodiaquine	4 mg/kg/day (artesunate) + 10 mg/kg/day (amodiaquine) for 3 days			
Artesunate (50 mg) plus sulfadoxine-pyrimethamine (SP) (500 mg-25 mg)	4 mg/kg/day (artesunate) once a day for 3 days and a single administration of 25/1.25 mg/kg SP on day 1			
Artesunate (50 mg) plus doxycycline (100 mg)	2 mg/kg (artesunate) once a day for 7 days + 3.5 mg/kg (doxycicline) once a day for 7 days			

Artemisinins should not be used as monotherapy, as this will promote resistance to this critically important class of antimalarials.

Individual patients derive the maximum benefit from ACTs, if they can access these within 24–48 hours of the onset of malaria symptoms. At a population level, their impact in terms of reducing transmission and delaying resistance depends on high coverage rates.

Patient adherence is a major determinant of the response to antimalarials, as most treatments are taken at home without medical supervision.

Parenteral antimalarial drugs

Drug	
Artesunate	2.4 mg/kg iv at time 0h-12h-24h and then once a day
Quinine	20 mg salt/kg iv at time 0h, then 10 mg/kg every 8 hours
Artemether	3.2 mg/kg im at time 0h, then 1.6 mg/kg im once a day

Malaria treatment in pregnant women (1)

Pregnant women with symptomatic acute malaria are a high-risk group, and they must **promptly receive effective antimalarial treatment**.

In high-transmission settings, despite the adverse effects on fetal growth, malaria is usually asymptomatic in pregnancy or associated with only mild, non-specific symptoms. There is insufficient information on the safety and efficacy of most antimalarials in pregnancy, particularly for exposure in the first trimester.

Malaria treatment in pregnant women (2)

First trimester

Although data from prospective studies are limited, antimalarial medicines considered safe in the first trimester of pregnancy are:

- quinine,
- chloroquine,
- clindamycin.

Pregnant women in the first trimester with uncomplicated *falciparum* malaria should be treated with:

-**quinine** (10 mg salt/kg every 8 h) **+ clindamycin** (10 mg/kg twice a day) for seven days (and quinine monotherapy if clindamycin is not available).

- Artesunate plus clindamycin for seven days is indicated if this treatment fails.

Malaria treatment in pregnant women (3)

Second and third trimesters

There have been no adverse effects on the mother or fetus. The current assessment of benefits compared with potential risks suggests that the artemisinin derivatives (**ACT**) should be used to treat uncomplicated falciparum malaria in the second and third trimesters of pregnancy. The choice of combination partner is difficult because of limited information.

Malaria treatment in pregnant women (4)

Second and third trimesters

- Sulfadoxine-pyrimethamine (SP), though considered safe, is compromised for treatment in many areas because of increasing resistance.

- Quinine is associated with an increased risk of hypoglycaemia in late pregnancy, and it should be used only if effective alternatives are not available.

- Clindamycin is also considered safe, but it must be given for seven days in combination with quinine.

- Primaquine and tetracyclines should not be used in pregnancy

Malaria treatment in lactating women

Lactating women should receive standard antimalarial treatment (including ACTs) except for:

- dapsone,
- primaquine and
- tetracyclines,

which should be withheld during lactation

…Transmissibility of malaria…

- Needs of a biological vector: female of *Anopheles*

- Needs of a source of infection: sick person

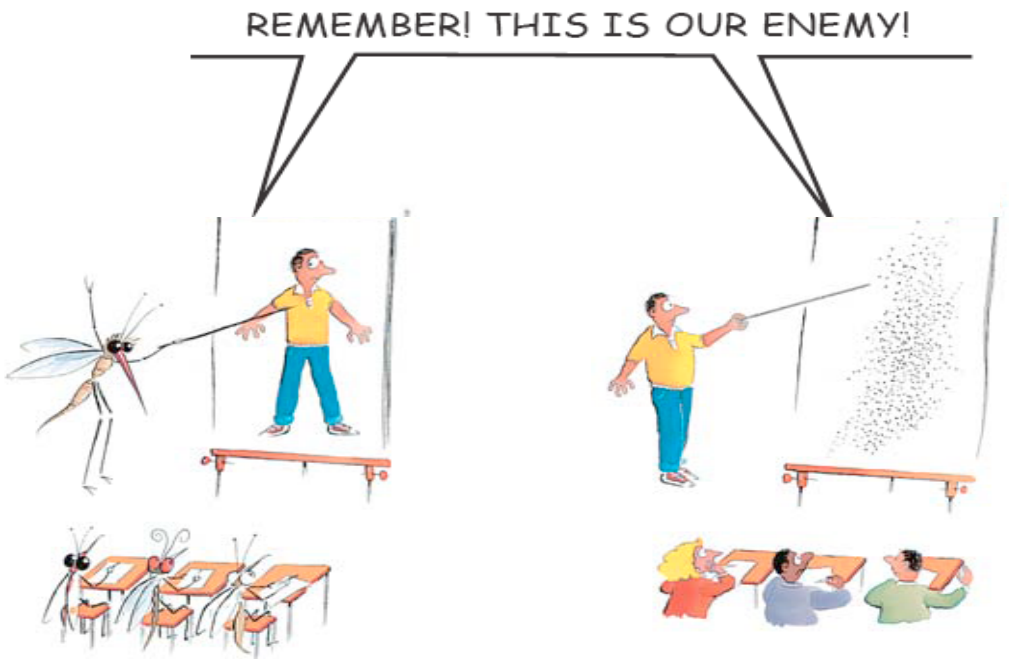
The sick person can transmit the infection when in his blood the plasmodium gametocytes are present (around 12 days after parasite inoculation by the infected mosquito)

The sick person on antimalarial treatment remain able to transmit the infection to an Anopheles during few weeks after recovery if the antimalarial used is not able to kill the residual gametocytes (…artemisines and derivatives are able to kill young gametocytes…)..a single dose of primaquine can facilitate a complete gametocyde clearance…

Implications of the pharmaco-resistance of *Plasmodium Falciparum*

Selective advantage:

The resistant *P. falciparum can produce* more gametocytes than a non resistant plasmodium. Consequently there is more anopheles that can become infected, and more anopheles can deliver more eggs…



Intermittent Preventive Treatment (IPT)

Pregnancy:

- The WHO suggest two-three IPT during the second and third trimesters (with a minimal interval of 35 days among drug administration)

- 33 African countries introduced IPT

- The drug used is the sulphametoxazine-Pyrimethamine (SP), but alternatives are under study

Children:

- The WHO suggest IPT during the session of vaccination, especially in areas with stable malaria transmission during the year

- The IPT has been introduced in some african countries with a range of efficacy (reduction of total number of malaria attack) variable from 19 to 39%.

- The drug used is the sulphametoxazine-Pyrimethamine (SP), but alternatives are under study

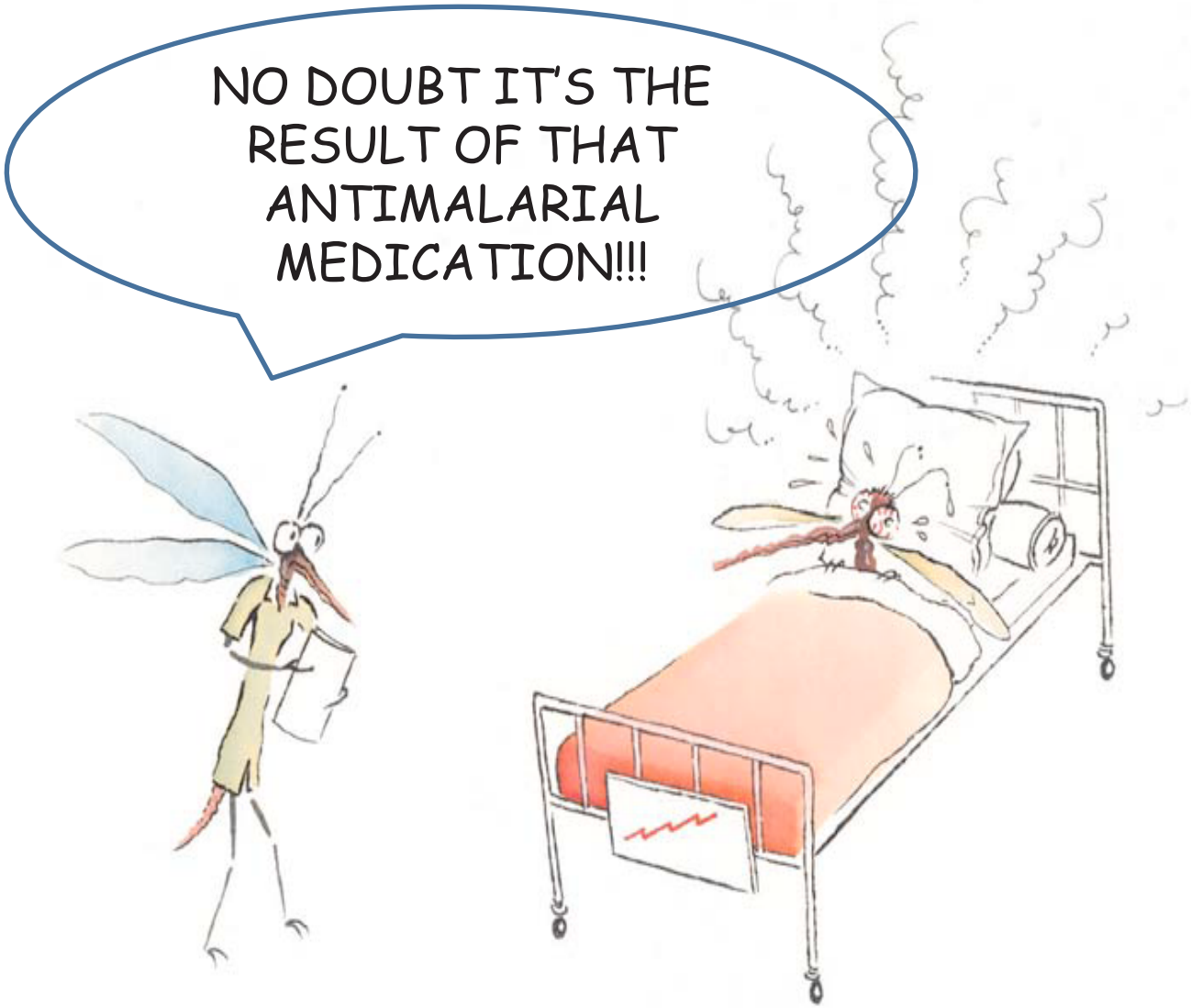
Intermittent Preventive Treatment (IPT)

Pro vs Cons

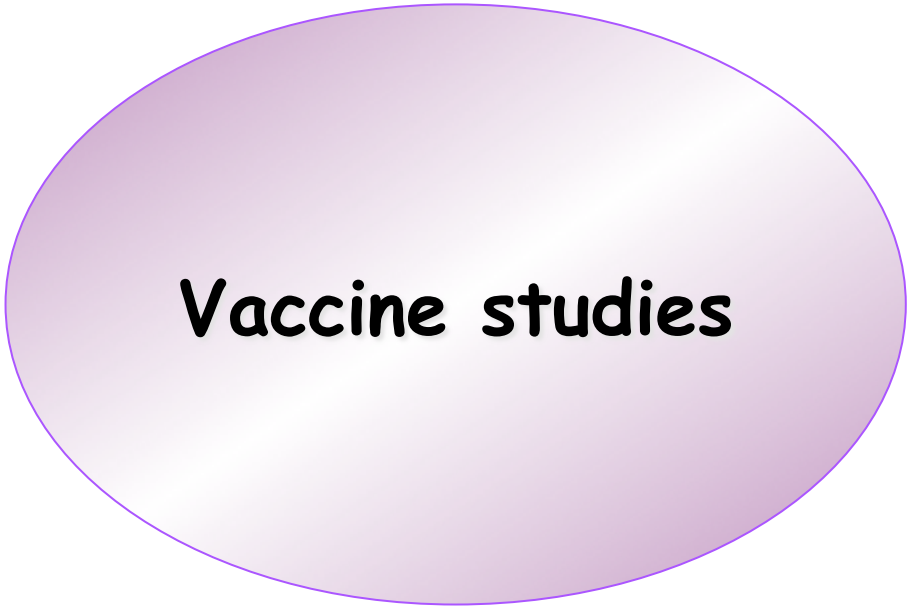
- The efficacy of IPT in pregnancy is well established

- The efficay of IPT in children is not completely evident

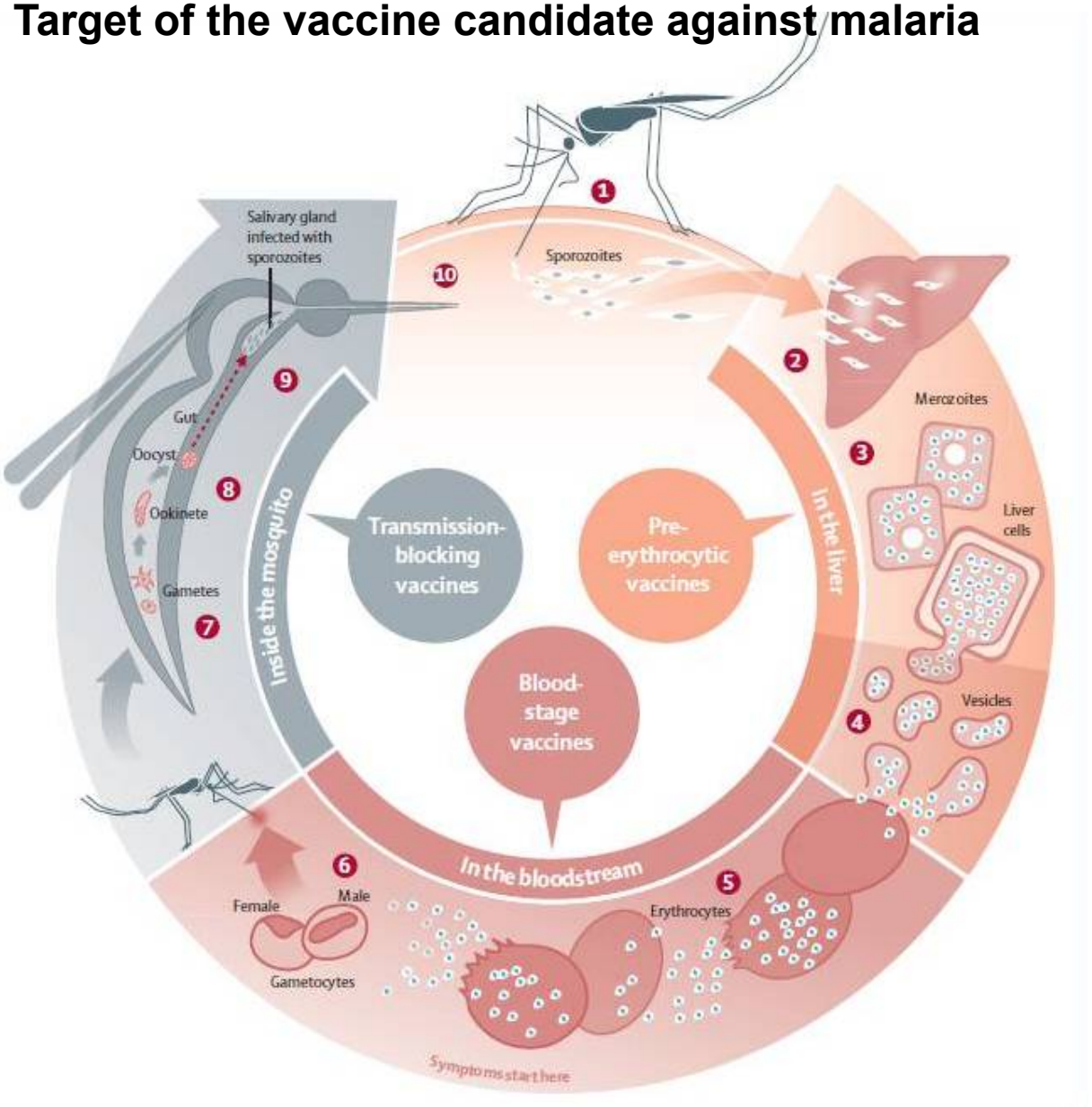
- There is the risk of developing resistance to the drug (SP) used for IPT


NO DOUBT IT'S THE RESULT OF THAT ANTIMALARIAL MEDICATION!!!

Malaria prevention



Target of the vaccine candidate against malaria



Results ongoing, but the conclusion (vaccine safe and efficacious) seems to be still far….

La Malaria, 1884

Tank you for your attention