Tropical diseases

Working in the tropics

Major considerations

1. Unusual circumstances
2. Unusual colleagues
3. Unusual patients
4. Different symptomatology
5. Different diseases
6. Poor facilities
7. Poor diagnostics & drug supply


Australia
London
JANUARY 2009


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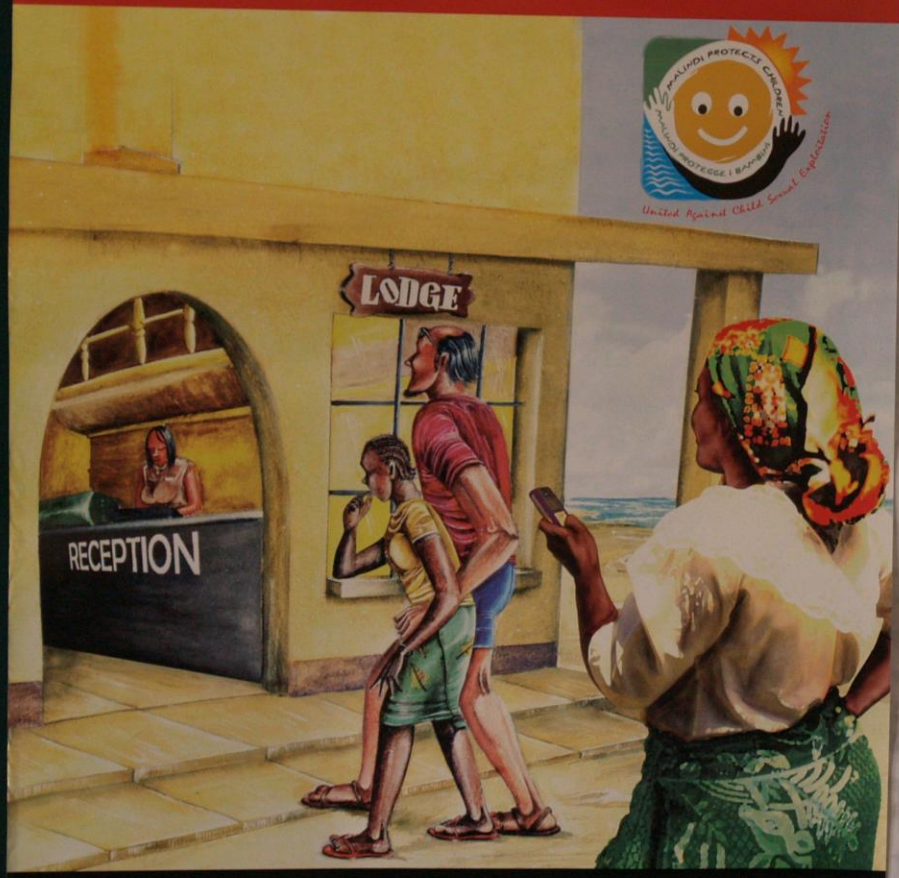
Let's Protect Our Children



Report child abuse to the police or call child helpline 116

CISP unicef

PEOPLE ARE NOT FOR SALE

Have you heard about children who are offered opportunities for education but end up working long hours with no pay and are abused by their employer?

Do you know of women who have been promised good jobs, education or marriage and then forced into prostitution?

Have you heard of people who were made to work excessive hours in farms, hotels, bars or as househelp with no pay and then beaten when they try to escape?

All these are examples of people who have been trafficked. They have been deceived about opportunities elsewhere and exploited to benefit a human trafficker. They are victims of a crime.

How can you prevent human trafficking?

- Verify all promises offered to you of a better life, promises of education or work.
- Inform trusted family members and friends about your plans to work, go to school or travel.
- If offered a job, get the offer in writing. Ask other people you trust about the job/school or about the person who has made the offer.
- Talk to your friends and family about human trafficking.

How can you help victims of trafficking?

- Report any suspected cases of trafficking to your local Children's Officer, a member of the Area Advisory Council, or other government officer in your community. They can suggest organizations that can help.
- If you know that trafficking is happening, contact the Police and file a police report about what you know.
- If you think a child has been trafficked, contact the Child Line emergency number 116.

BEWARE OF HUMAN TRAFFICKING

IOM OIM

For more information visit www.iom.int or contact mrfnairobi@iom.int

ART WORKS

I'm Joseph and I am HIV+. I nearly left it too late as I was already sick when I went for a test. The health care worker told me I had AIDS and she advised me on how I could regain my strength with Anti-Retroviral Therapy or ART. I found out that ART is not just about drugs, it's about a way of living positively with

HIV/AIDS – by ... and ... well and staying active ... look at m... I'm ... like ... before I got sick.

VISIT YOUR LOCAL HOSPITAL OR VCT CENTRE NOW.

ART
Anti-Retroviral Therapy

Supported by DFID

GOVERNMENT OF KENYA


Watts
HARDWARE $ ELECTRICAL
APPLIANCES
FUNDI WA STIMA
MAMA NGASH (KIOSK) CEREALS


RAMBO
The Famous
DJ Sloppy
BRUCE LEE
STRIKE COMMANDO
ENTER DRAGON
MEXICO
Dragon Soldier

Tömegközlekedés

Ambulancia

Kórházi tájkép

Kórterem, Laosz

Pericarditisben szenvedő gyermek

Előkészületek az ópiumszíváshoz

Kambodzsa, Pre-Veng „város”-rész

Heat disorders

Heat Cramps

- Heat cramps usually affect people who sweat a lot during strenuous activity.
- This sweating depletes the body's salt
- and moisture.
- The low salt level in the muscles causes painful cramps.
- Heat cramps may also be a symptom of heat exhaustion.

Recognizing Heat Cramps

- Heat cramps are muscle pains or spasms—usually in the abdomen, arms, or legs—that may occur in association with strenuous activity.
- If you have heart problems or are on a low-sodium diet, get medical attention for heat cramps.

What to Do

- If medical attention is not necessary, take these steps:
  - Stop all activity, and sit quietly in a cool place.
  - Drink clear juice or a sports beverage.
  - Do not return to strenuous activity for a few hours after the cramps subside, because further exertion may lead to heat exhaustion or heat stroke.
  - Seek medical attention for heat cramps if they do not subside in 1 hour.

Heat Rash

- Heat rash is a skin irritation caused by excessive sweating during hot, humid weather.
- It can occur at any age but is most common in young children.

Recognizing Heat Rash

- Heat rash looks like a red cluster of pimples or small blisters.
- It is more likely to occur on the neck and upper chest, in the groin, under the breasts, and in elbow creases.

What to Do

- The best treatment for heat rash is to provide a cooler, less humid environment.
- Keep the affected area dry.
- Dusting powder may be used to increase comfort, but avoid using ointments or creams—they keep the skin warm and moist and may make the condition worse.
- Treating heat rash is simple and usually does not require
- medical assistance.
- Other heat-related problems can be much more severe.

Heat Stroke

- Heat stroke occurs when the body is unable to regulate its temperature.
- The body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down.
- Body temperature may rise to 106°F or higher within 10 to 15 minutes.
- Heat stroke can cause death or permanent disability if emergency treatment is not provided.

Recognizing Heat Stroke

- Warning signs of heat stroke vary but may include the following:
  - An extremely high body temperature (above 103°F, orally)
  - Red, hot, and dry skin (no sweating)
  - Rapid, strong pulse
  - Throbbing headache
  - Dizziness
  - Nausea
  - Confusion
  - Unconsciousness

What to Do

- If you see any of these signs, you may be dealing with a life-threatening emergency.
- Do the following:
  - Get the victim to a shady area.
  - Cool the victim rapidly using whatever methods you can. For example, immerse the victim in a tub of cool water; place the person in a cool shower;
    - spray the victim with cool water from a garden hose;
    - sponge the person with cool water; or if the humidity is low, wrap the victim in a cool, wet sheet and fan him or her vigorously.
  - Monitor body temperature, and continue cooling efforts until the body temperature drops to 101–102°F.
  - If emergency medical personnel are delayed, call the hospital emergency room for further instructions.
  - Do not give the victim fluids to drink.
  - Get medical assistance as soon as possible.

Heat Exhaustion

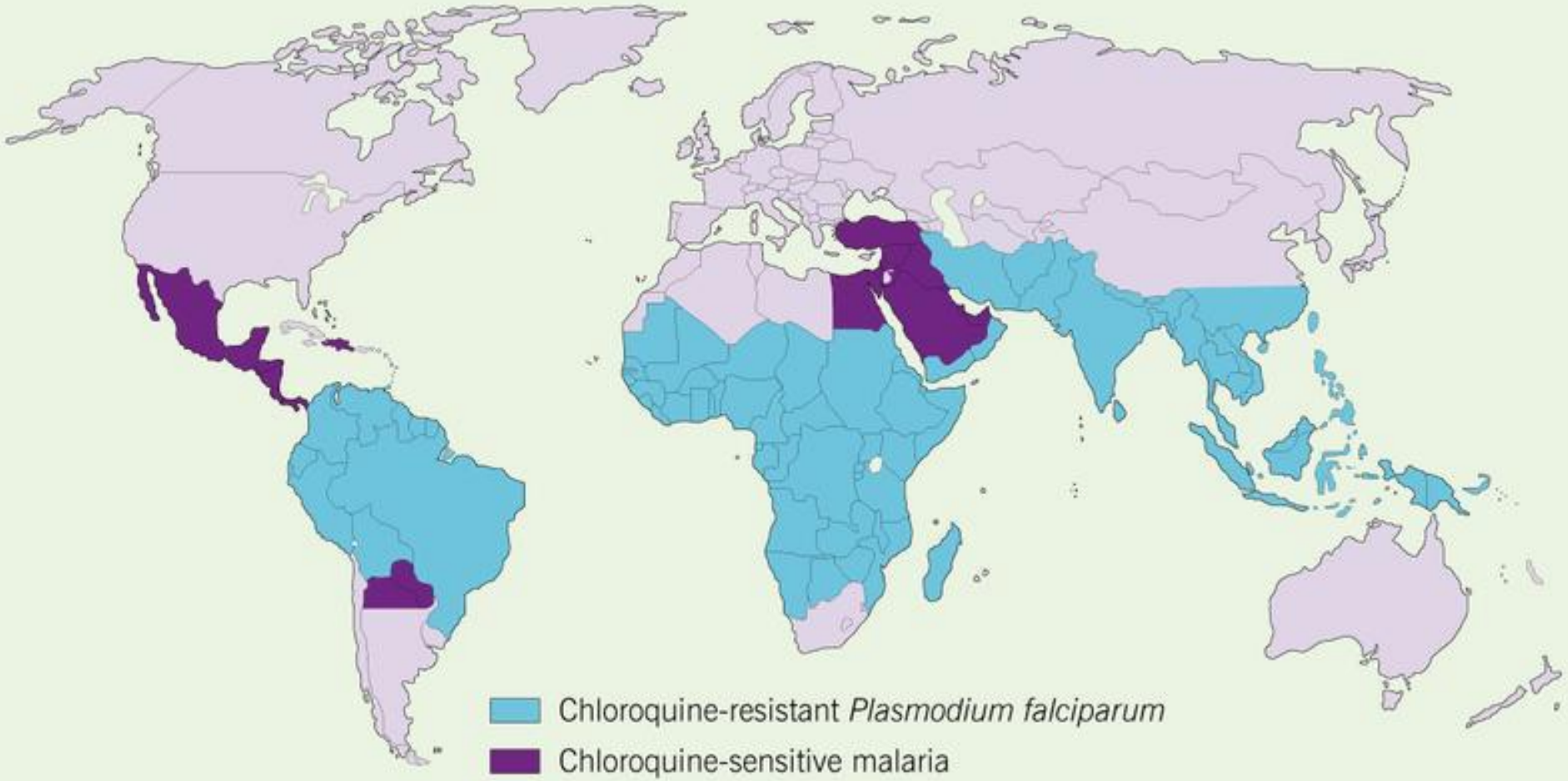
- Heat exhaustion is a milder form of heat-related illness that can develop after several days of exposure to high temperatures and inadequate or unbalanced replacement of fluids.
- It is the body's response to an excessive loss of the water and salt contained in sweat.
- Those most prone to heat exhaustion are elderly people, people with high blood pressure, and people working or exercising in a hot environment.

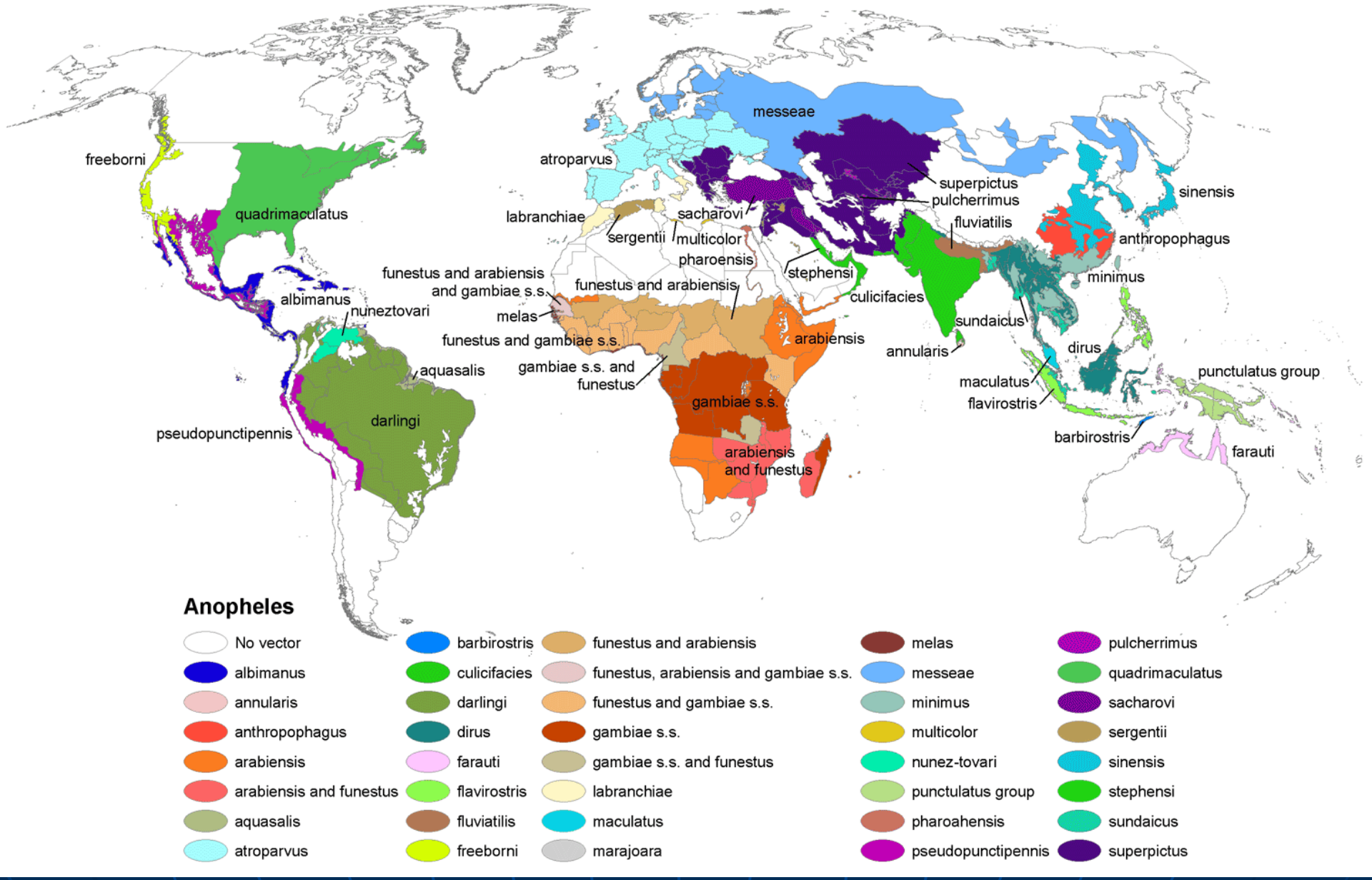
Recognizing Heat Exhaustion

- Warning signs of heat exhaustion include the following:
  - The skin may be cool and moist.
  - The victim's pulse rate will be fast and weak, and breathing will be fast and shallow.
  - If heat exhaustion is untreated, it may progress to heat stroke.
  - Otherwise, help the victim to cool off, and seek medical attention if symptoms worsen or last longer than 1 hour.

Malaria

DISTRIBUTION OF MALARIA AND CHLOROQUINE-RESISTANT *PLASMODIUM FALCIPARUM* (1996)




freeborni
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sacharovi
sergentii
multicolor
pharoensis
superpictus
pulcherrimus
sinensis
fluviatilis
anthropophagus
stephensi
minimus
funestus and arabiensis
and gambiae s.s.
funestus and arabiensis
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melas
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sundaicus
annularis
dirus
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funestus
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maculatus
flavirostris
gambiae s.s.
barbirostris
farauti
arabiensis
and funestus
Anopheles
No vector
albimanus
annularis
anthropophagus
arabiensis
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aquasalis
atroparvus
barbirostris
culicifacies
darlingi
dirus
farauti
flavirostris
fluviatilis
freeborni
funestus and arabiensis
funestus, arabiensis and gambiae s.s.
funestus and gambiae s.s.
gambiae s.s.
gambiae s.s. and funestus
labranchiae
maculatus
marajoara
melas
messeae
minimus
multicolor
nunez-tovari
punctulatus group
pharoahensis
pseudopunctipennis
pulcherrimus
quadrimaculatus
sacharovi
sergentii
sinensis
stephensi
sundaicus
superpictus

Malaria parasites

- Malaria parasites are micro-organisms that belong to the genus *Plasmodium*.
- There are more than 100 species of *Plasmodium*, which can infect many animal species such as reptiles, birds, and various mammals.
- Only four species of *Plasmodium* infect humans in nature. (There are some other species which can, exceptionally or under experimental conditions, infect humans.)

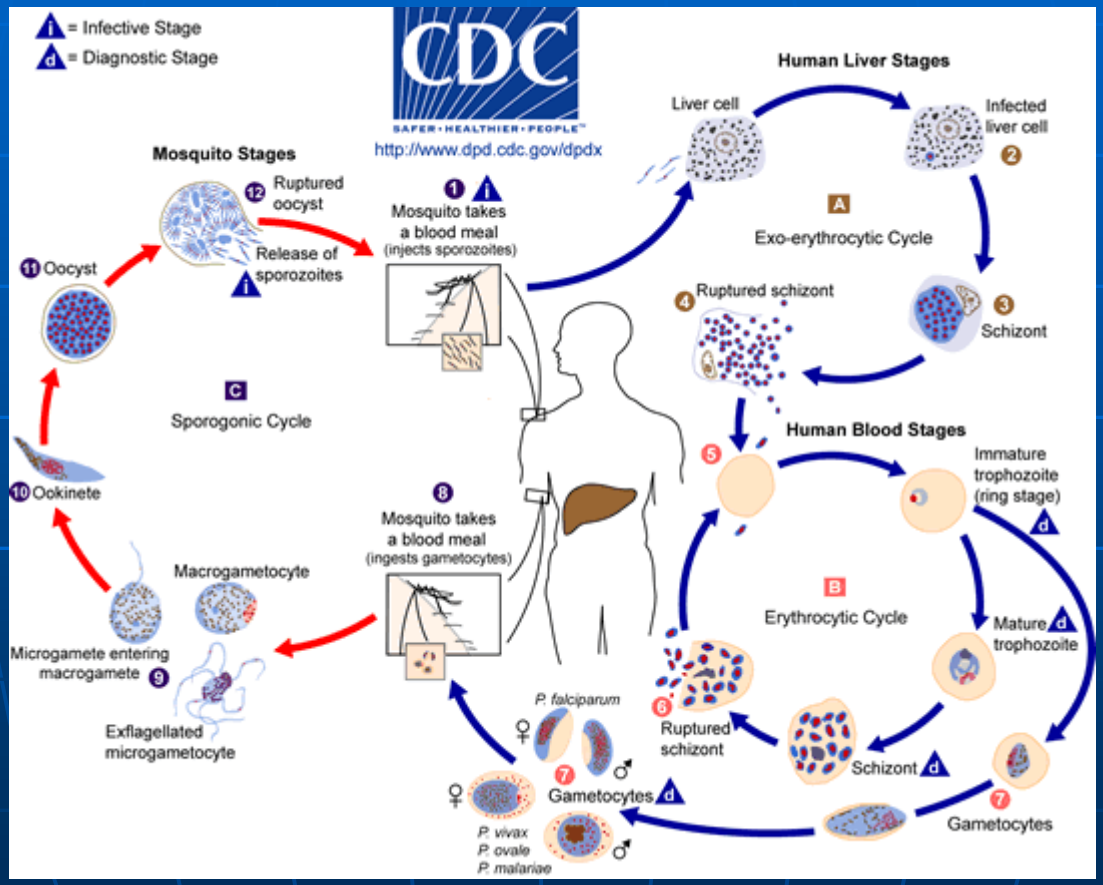
Malaria Parasites

- Four species of malaria parasites can infect humans under natural conditions: *Plasmodium falciparum*, *P. vivax*, *P. ovale* and *P. malariae*.
- The first two species cause the most infections worldwide. *Plasmodium falciparum* is the agent of severe, potentially fatal malaria, causing an estimated 700,000 - 2.7 million deaths annually, most of them in young children in Africa.
- *Plasmodium vivax* and *P. ovale* have dormant liver stage parasites ("hypnozoites") which can reactivate ("relapse") and cause malaria several months or years after the infecting mosquito bite.
- *Plasmodium malariae* produces long-lasting infections and if left untreated can persist asymptomatically in the human host for years, even a lifetime.

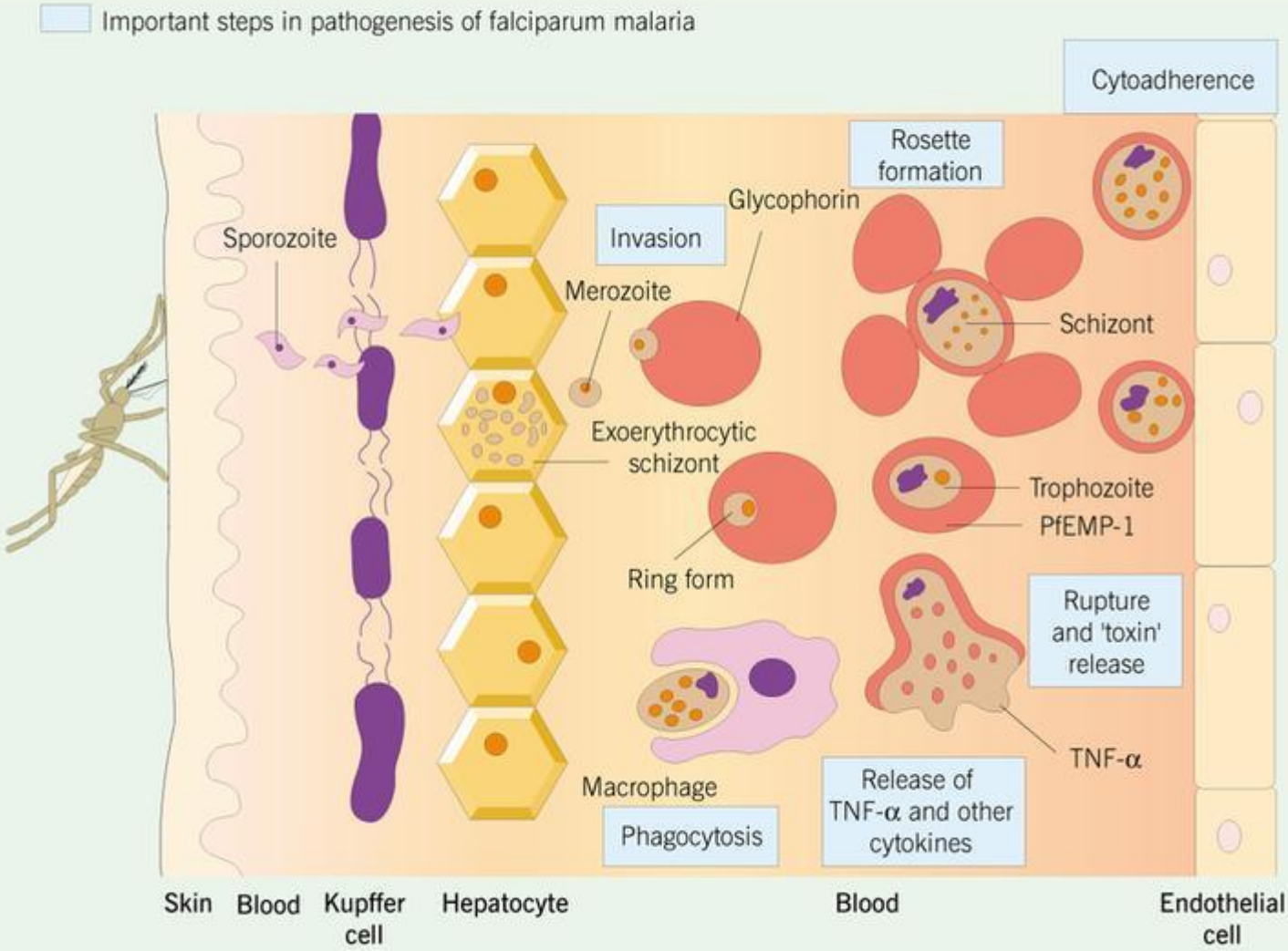
Life Cycle of Malaria

- In nature, malaria parasites spread by infecting successively two types of hosts: humans and female *Anopheles* mosquitoes. In humans, the parasites grow and multiply first in the liver cells and then in the red cells of the blood. In the blood, successive broods of parasites grow inside the red cells and destroy them, releasing daughter parasites ("merozoites") that continue the cycle by invading other red cells.
- The blood stage parasites are those that cause the symptoms of malaria. When certain forms of blood stage parasites ("gametocytes") are picked up by a female *Anopheles* mosquito during a blood meal, they start another, different cycle of growth and multiplication in the mosquito.
- After 10-18 days, the parasites are found (as "sporozoites") in the mosquito's salivary glands. When the *Anopheles* mosquito takes a blood meal on another human, the sporozoites are injected with the mosquito's saliva and start another human infection when they parasitize the liver cells.
- Thus the mosquito carries the disease from one human to another (acting as a "vector"). Differently from the human host, the mosquito vector does not suffer from the presence of the parasites.

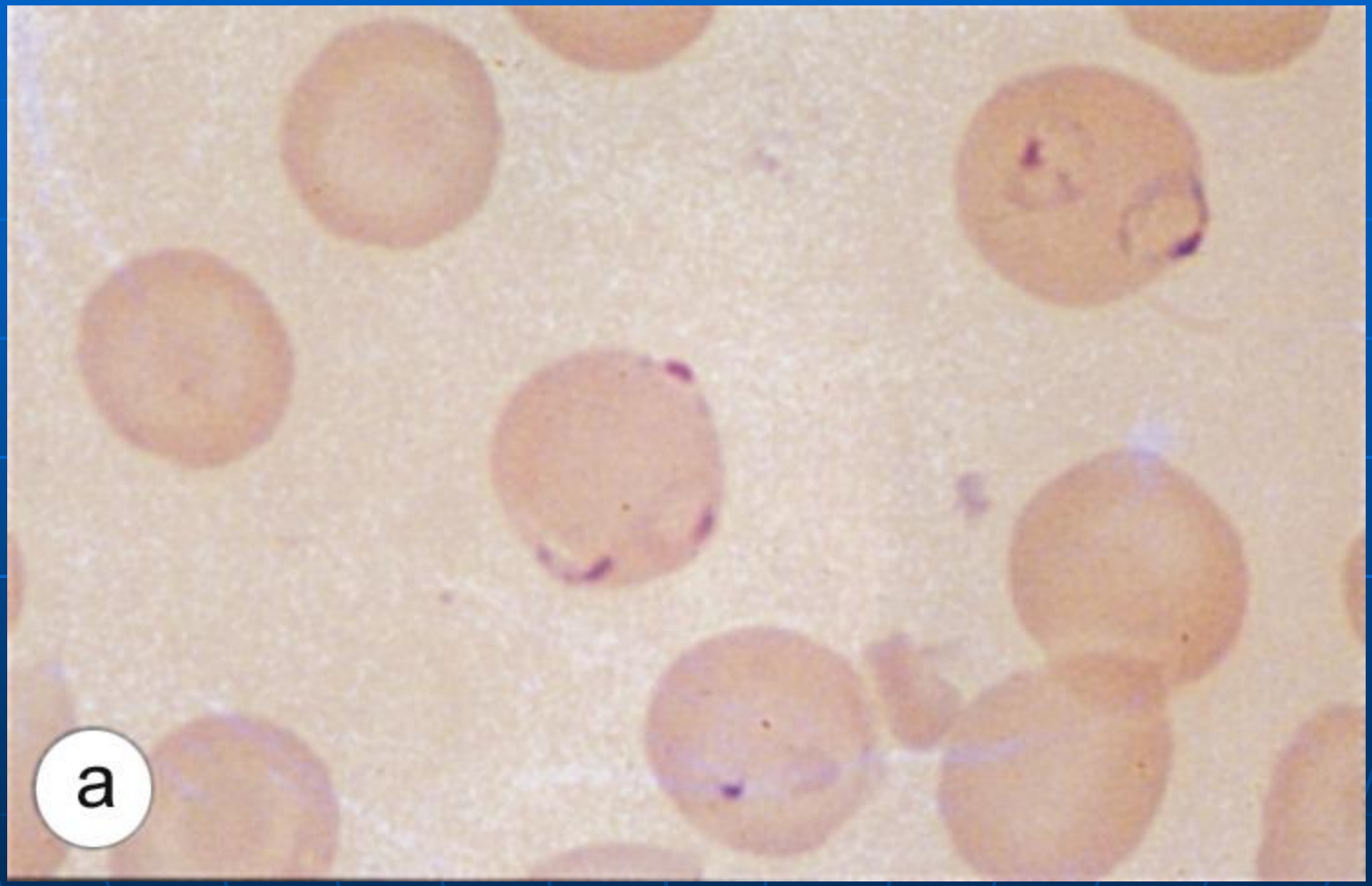
Malaria life cycle



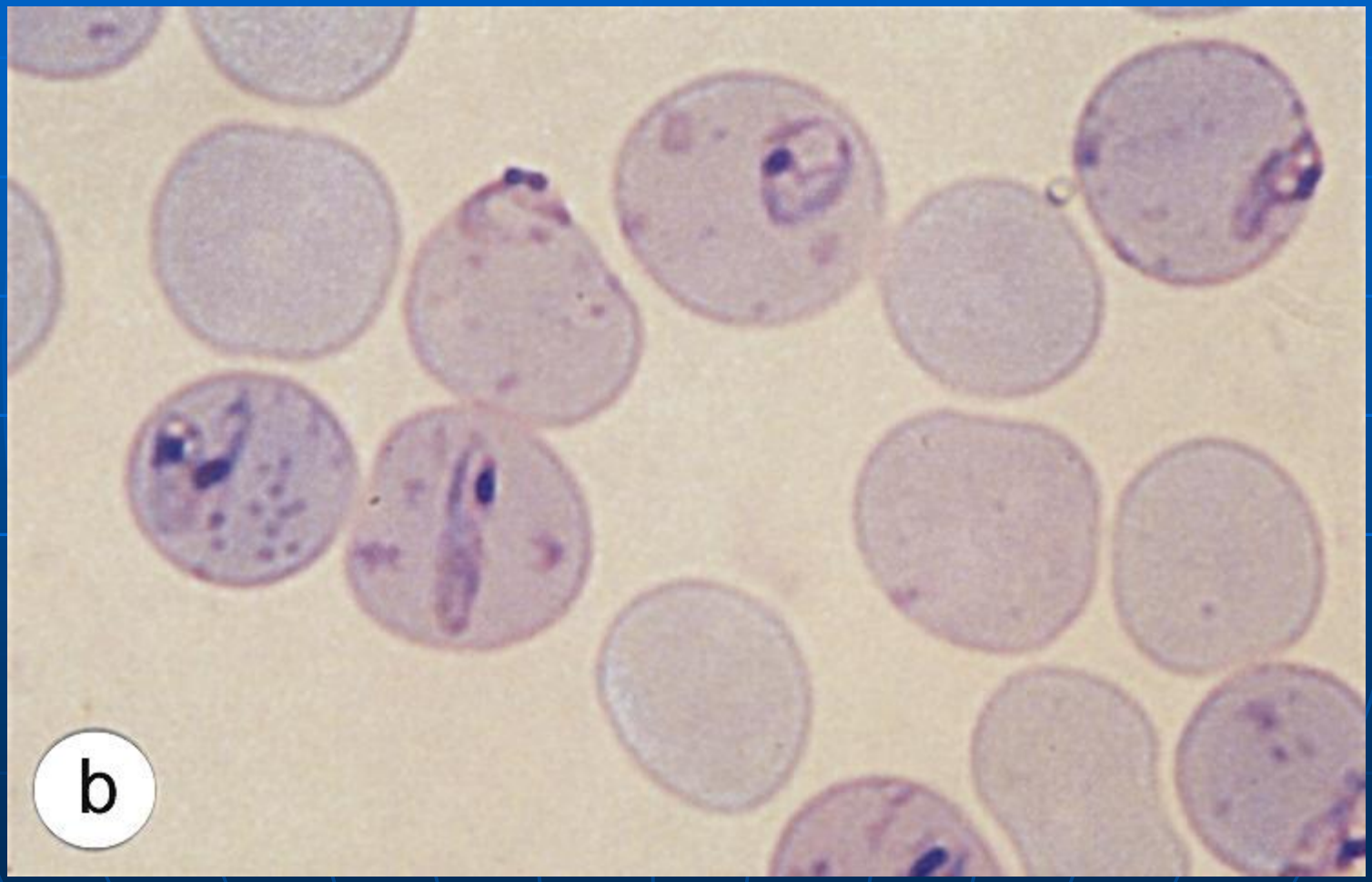
MAJOR CELL INTERACTIONS IN FALCIPARUM MALARIA



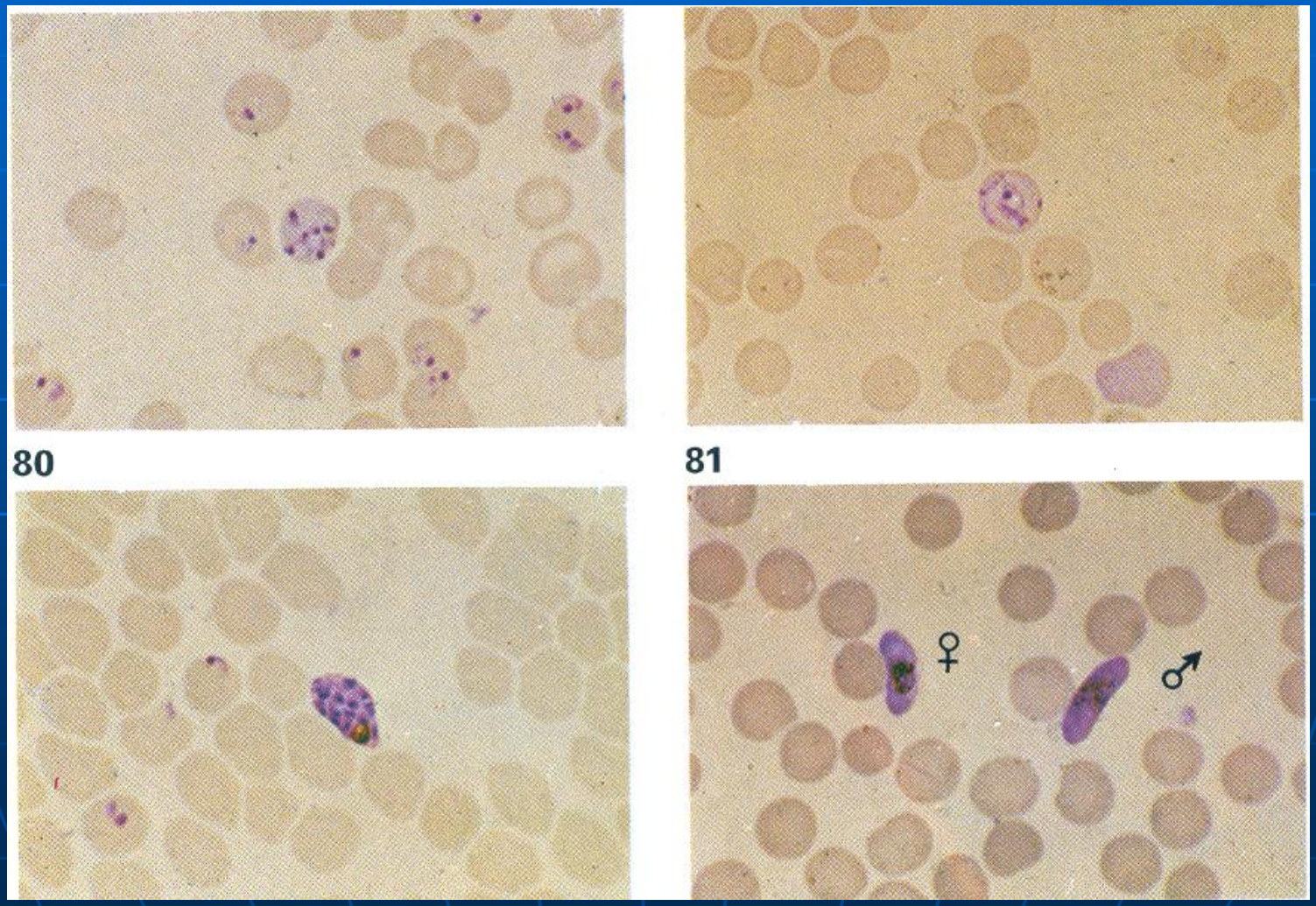
P. falciparum rings

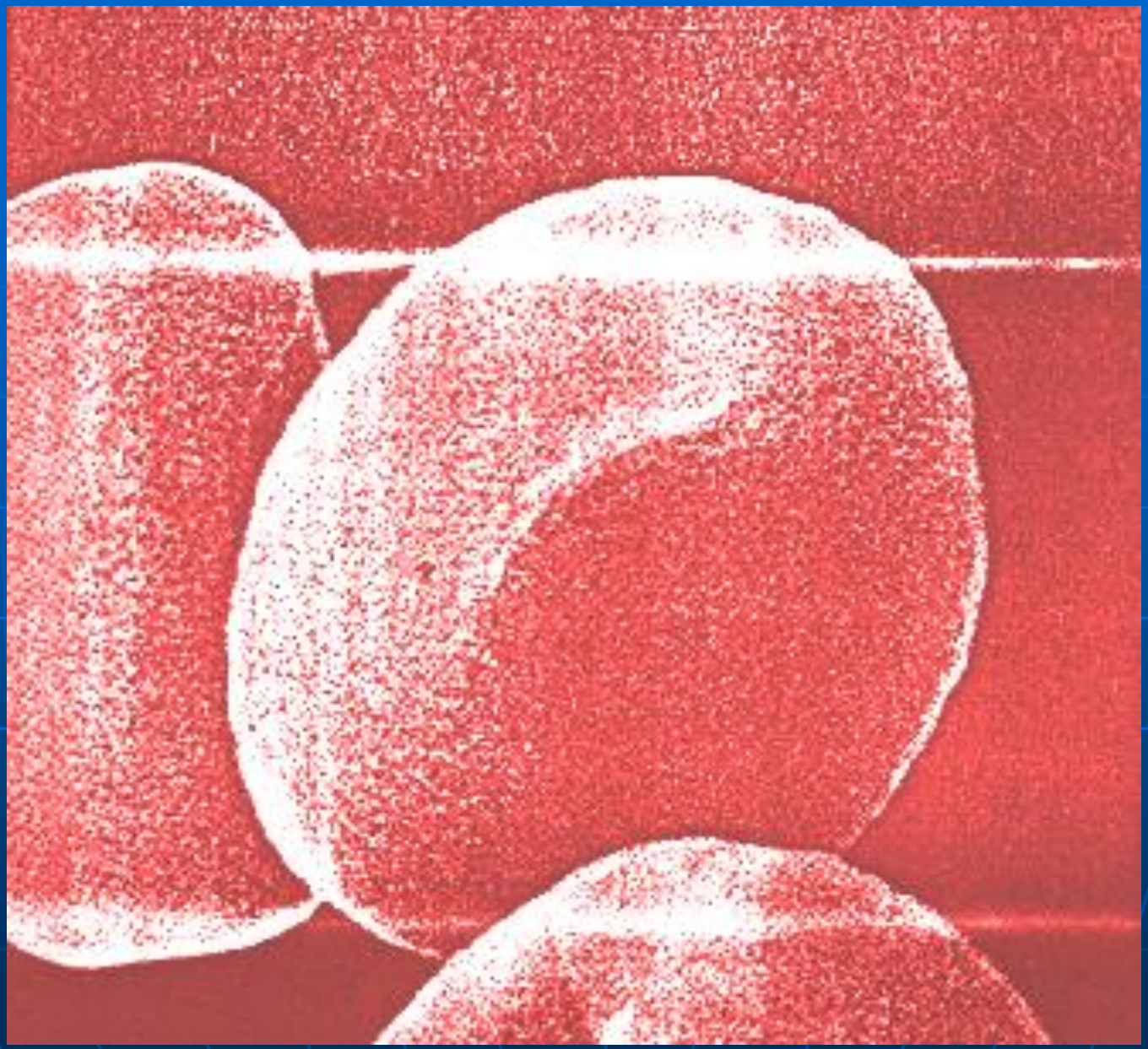


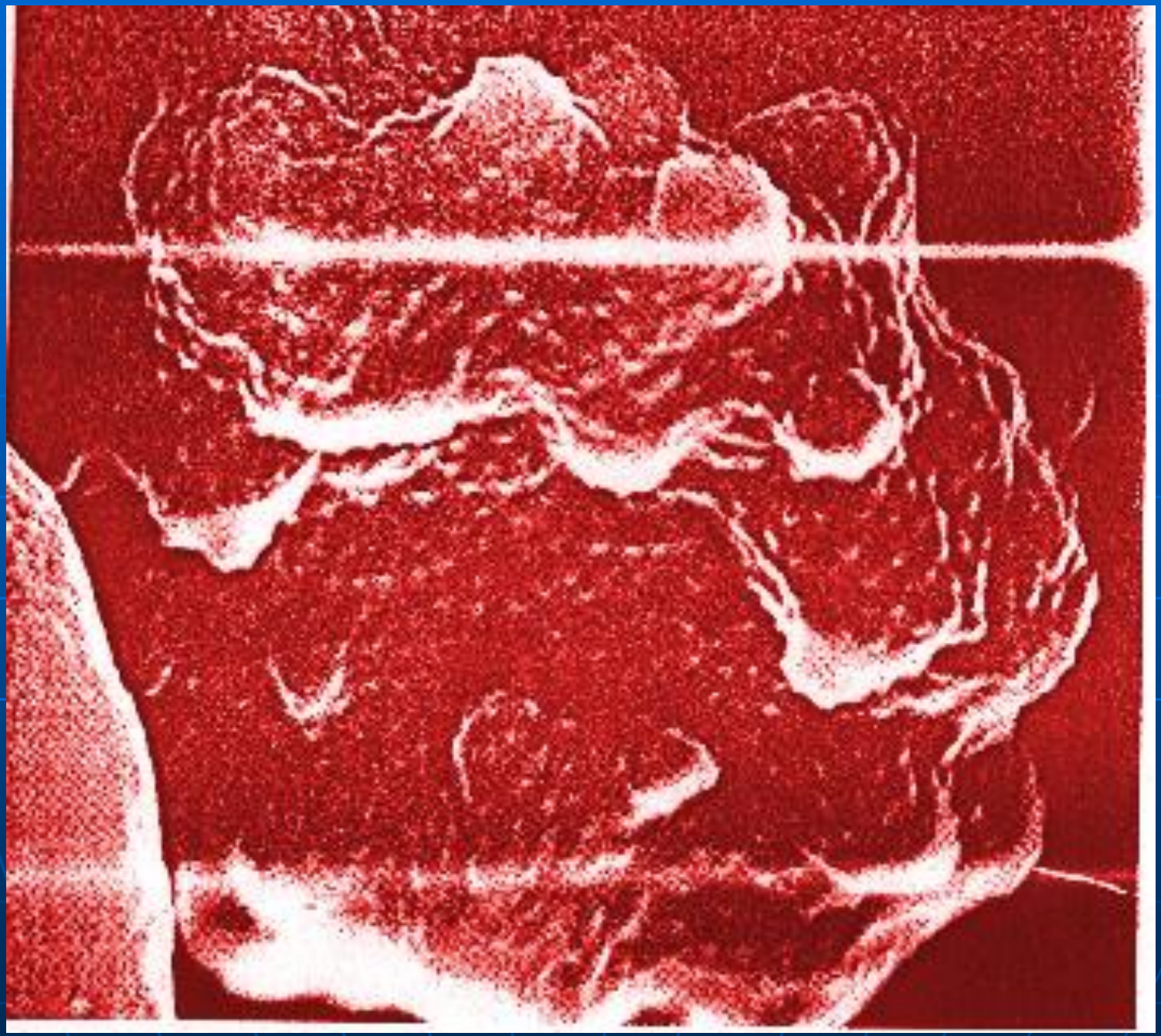
P. falciparum rings and. Maurer pigments



Different stages of malaria parasites, and gametocys







Incubation Period

- Following the infective bite by the *Anopheles* mosquito, a period of time (the "incubation period") goes by before the first symptoms appear.
- The incubation period in most cases varies from 7 to 30 days.
- The shorter periods are observed most frequently with *P. falciparum* and the longer ones with *P. malariae*.

Uncomplicated Malaria

- The classical (but rarely observed) malaria attack lasts 6-10 hours.
- It consists of:
  - a cold stage (sensation of cold, shivering)
  - a hot stage (fever, headaches, vomiting; seizures in young children)
  - and finally a sweating stage (sweats, return to normal temperature, tiredness)
- Classically (but infrequently observed) the attacks occur every second day with the "tertian" parasites (*P. falciparum*, *P. vivax*, and *P. ovale*) and every third day with the "quartan" parasite (P. malariae).

Major symptoms

- More commonly, the patient presents with a combination of the following symptoms:
  - Fever
  - Chills
  - Sweats
  - Headaches
  - Nausea and vomiting
  - Body aches
  - General malaise.
- In countries where cases of malaria are infrequent, these symptoms may be attributed to influenza, a cold, or other common infections, especially if malaria is not suspected.
- Conversely, in countries where malaria is frequent, residents often recognize the symptoms as malaria and treat themselves without seeking diagnostic confirmation ("presumptive treatment").

Physical findings

- Physical findings may include:
  - Elevated temperature
  - Perspiration
  - Weakness
  - Enlarged spleen.
- In *P. falciparum* malaria, additional findings may include:
  - Mild jaundice
  - Enlargement of the liver
  - Increased respiratory rate.

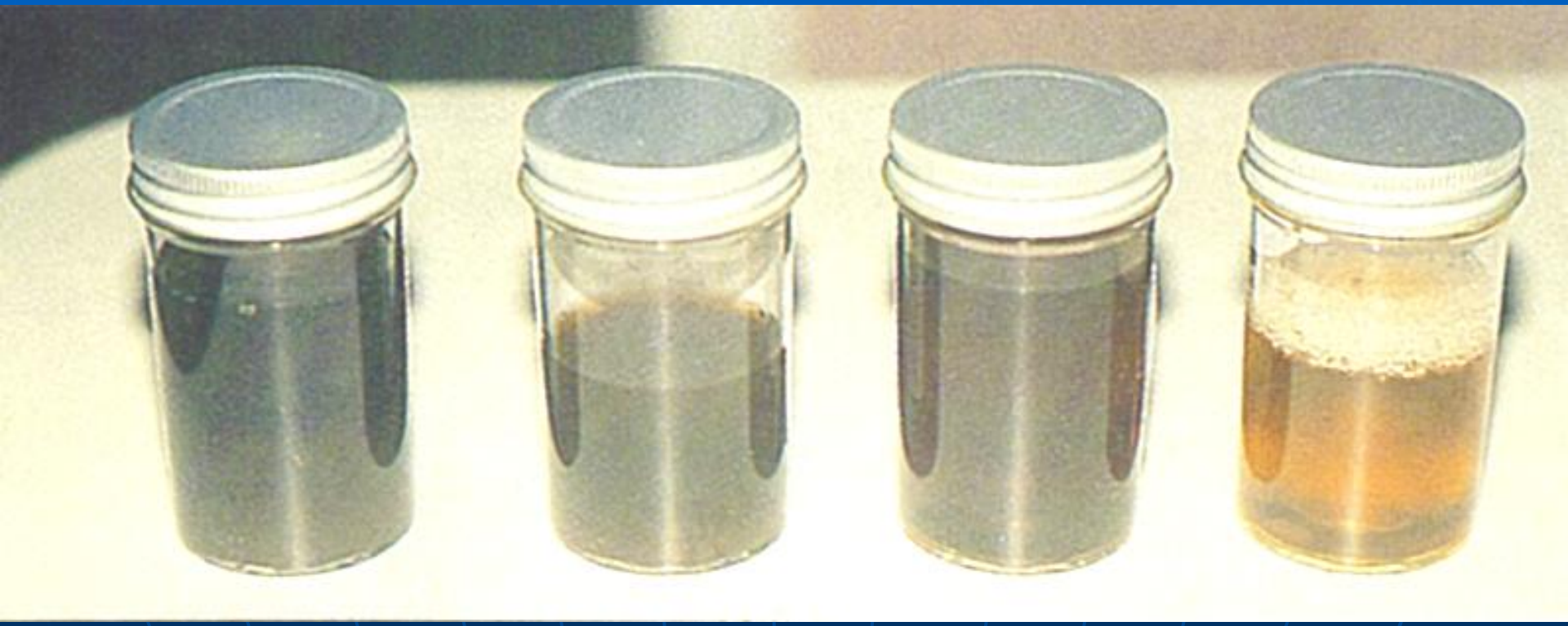
Severe Malaria

- Severe malaria occurs when *P. falciparum* infections are complicated by serious organ failures or abnormalities in the patient's blood or metabolism. The manifestations of severe malaria include:
  - Cerebral malaria, with abnormal behavior, impairment of consciousness, seizures, coma, or other neurologic abnormalities
  - Severe anemia due to hemolysis (destruction of the red blood cells)
  - Hemoglobinuria (hemoglobin in the urine) due to hemolysis
  - Pulmonary edema (fluid buildup in the lungs) or acute respiratory distress syndrome (ARDS), which may occur even after the parasite counts have decreased in response to treatment
  - Abnormalities in blood coagulation and thrombocytopenia (decrease in blood platelets)
  - Cardiovascular collapse and shock

Other manifestations

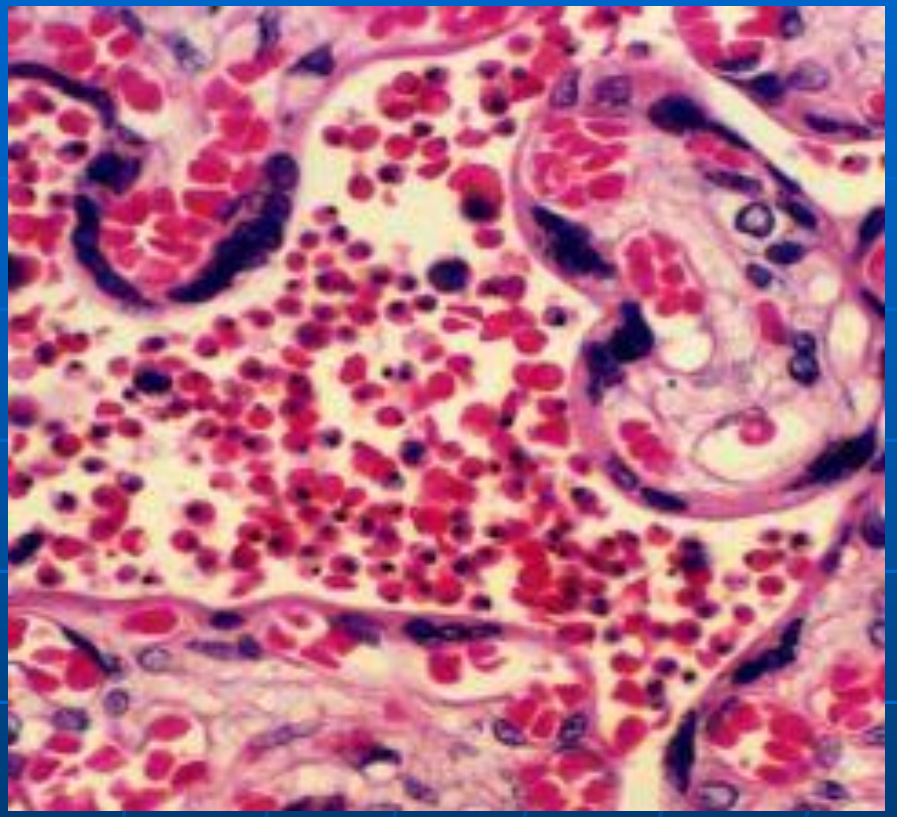
- **Other Manifestations of Malaria**
- Neurologic defects may occasionally persist following cerebral malaria, especially in children. Such defects include troubles with movements (ataxia), palsies, speech difficulties, deafness, and blindness.
- Recurrent infections with *P. falciparum* may result in severe anemia. This occurs especially in young children in tropical Africa with frequent infections that are inadequately treated.
- Malaria during pregnancy (especially *P. falciparum*) may cause severe disease in the mother, and may lead to premature delivery or delivery of a low-birth-weight baby.
- On rare occasions, *P. vivax* malaria can cause rupture of the spleen or acute respiratory distress syndrome (ARDS).
- Nephrotic syndrome (a chronic, severe kidney disease) can result from chronic or repeated infections with *P. malariae*.
- Hyperreactive malarial splenomegaly (also called "tropical splenomegaly syndrome") occurs infrequently and is attributed to an abnormal immune response to repeated malarial infections. The disease is marked by a very enlarged spleen and liver, abnormal immunologic findings, anemia, and a susceptibility to other infections (such as skin or respiratory infections).

Blackwater fever



Malaria During Pregnancy

- **Epidemiology:**
- Malaria infection during pregnancy can have adverse effects on both mother and fetus, including maternal anemia, fetal loss, premature delivery, intrauterine growth retardation, and delivery of low birth-weight infants (<2500 g or <5.5 pounds).
- It is a particular problem for women in their first and second pregnancies and for women who are HIV-positive.



Malaria-infected human placenta examined under the microscope. The intervillous spaces (central area of the picture) are filled with red blood cells, most of which are infected with *Plasmodium falciparum* malaria parasites. The parasites appear here as black dots. A malaria-infected placenta is unable to carry out normally its main function: to provide nutrients to the fetus.

Impact of Malaria During Pregnancy in Sub-Saharan Africa

- In sub-Saharan Africa, the region of the world hardest hit by malaria, malaria infection is estimated to cause 400,000 cases of severe maternal anemia and from 75,000-200,000 infant deaths annually. Maternal anemia contributes significantly to maternal mortality and causes an estimated 10,000 deaths per year.
- Low birth weight is the greatest risk factor for neonatal mortality and a major contributor to infant mortality. Although many factors contribute to low birth weight, malaria is a major factor and one of the few, along with poor nutrition, anemia, and other infections, that is amenable to intervention once a woman becomes pregnant.
- **Prevention and Control of Malaria During Pregnancy in Sub-Saharan Africa**
- The World Health Organization currently recommends a three-pronged approach to prevent these adverse effects in areas of Africa with high levels of transmission of *Plasmodium falciparum* malaria:
- Intermittent preventive treatment (IPT) with antimalarial drugs
- Insecticide-treated bed nets (ITN)
- Febrile malaria case management.

Malaria Relapses

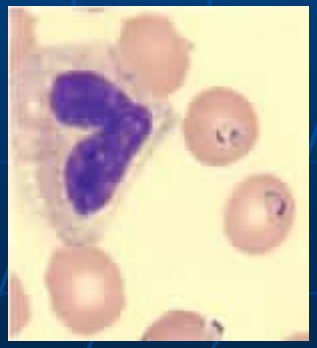
- In *P. vivax* and *P. ovale* infections, patients having recovered from the first episode of illness may suffer several additional attacks ("relapses") after months or even years without symptoms.
- Relapses occur because *P. vivax* and *P. ovale* have dormant liver stage parasites ("hypnozoites") that may reactivate.
- Treatment to reduce the chance of such relapses is available and should follow treatment of the first attack.

Diagnosis

- Diagnosis of malaria can be difficult:
- Where malaria is not endemic any more (such as the United States), health care providers are not familiar with the disease. Clinicians seeing a malaria patient may forget to consider malaria among the potential diagnoses and not order the needed diagnostic tests. Laboratorians may lack experience with malaria and fail to detect parasites when examining blood smears under the microscope.
- In some areas, malaria transmission is so intense that a large proportion of the population is infected but not made ill by the parasites. Such carriers have developed just enough immunity to protect them from malarial illness but not from malarial infection. In that situation, finding malaria parasites in an ill person does not necessarily mean that the illness is caused by the parasites.
- In many malaria-endemic countries, lack of resources is a major barrier to reliable and timely diagnosis. Health personnel are undertrained, underequipped and underpaid. They often face excessive patient loads, and must divide their attention between malaria and other equally severe infectious diseases such as pneumonia, diarrhea, tuberculosis and HIV/AIDS.

Microscopic Diagnosis

- Blood smear stained with Giemsa, showing a white blood cell (on left side) and several red blood cells, two of which are infected with *Plasmodium falciparum* (on right side).
- Malaria parasites can be identified by examining under the microscope a drop of the patient's blood, spread out as a "blood smear" on a microscope slide. Prior to examination, the specimen is stained (most often with the Giemsa stain) to give to the parasites a distinctive appearance.
- This technique remains the gold standard for laboratory confirmation of malaria.
- However, it depends on the quality of the reagents, of the microscope, and on the experience of the laboratorian.



Antigen detection, molecular diagnosis

- **Antigen Detection**
  - Various test kits are available to detect antigens derived from malaria parasites. Such immunologic ("immunochromatographic") tests most often use a dipstick or cassette format, and provide results in 2-10 minutes. These "Rapid Diagnostic Tests" (RDTs) offer a useful alternative to microscopy in situations where reliable microscopic diagnosis is not available. Malaria RDTs are currently used in some clinical settings and programs. However, before malaria RDTs can be widely adopted, several issues remain to be addressed, including improving their accuracy; lowering their cost; and ensuring their adequate performance under adverse field conditions. Malaria RDTs are currently not approved by the U. S. Food and Drug Administration (FDA) for use in the United States. The World Health Organization's Regional Office for the Western Pacific (WHO/WPRO) provides technical information, including a list of commercially available malaria RDTs, at http://www.wpro.who.int/rdt/.
- **Molecular Diagnosis**
  - Parasite nucleic acids are detected using polymerase chain reaction (PCR). This technique is more accurate than microscopy. However, it is expensive, and requires a specialized laboratory (even though technical advances will likely result in field-operated PCR machines).
- **Serology**
  - Serology detects antibodies against malaria parasites, using either indirect immunofluorescence (IFA) or enzyme-linked immunosorbent assay (ELISA). Serology does not detect current infection but rather measures past experience.

"Presumptive Treatment"

- In highly endemic areas (particularly in Africa), the great prevalence of asymptomatic infections and lack of resources (such as microscopes and trained microscopists) have led peripheral health facilities to use "presumptive treatment".
- Patients who suffer from a fever that does not have any obvious cause are presumed to have malaria and are treated for that disease, based only on clinical suspicion, and without the benefit of laboratory confirmation.
- This practice is dictated by practical considerations and allows the treatment of a potentially fatal disease.
- But it also leads frequently to incorrect diagnoses and unnecessary use of antimalarial drugs.
- This results in additional expenses and increases the risk of selecting for drug-resistant parasites.

Treatment

Clinical Diagnosis/ *Plasmodium* species	Region Infection Acquired	Recommended Drug and Adult Dose[1,7]	Recommended Drug and Pediatric Dose[1,7] *Pediatric dose should NEVER exceed adult dose*
Uncomplicated malaria/ *P. falciparum* or Species not identified If "species not identified" is subsequently diagnosed as *P. vivax* or *P ovale*: see *P. vivax* and *P ovale* (below) re. treatment with primaquine	**Chloroquine-sensitive** (Central America west of Panama Canal; Haiti; the Dominican Republic; and most of the Middle East)	**Chloroquine phosphate (Aralen™ and generics)** 600 mg base (=1,000 mg salt) po immediately, followed by 300 mg base (=500 mg salt) po at 6, 24, and 48 hours Total dose: 1,500 mg base (=2,500 mg salt)	**Chloroquine phosphate (Aralen™ and generics)** 10 mg base/kg po immediately, followed by 5 mg base/kg po at 6, 24, and 48 hours Total dose: 25 mg base/kg
	Chloroquine-resistant or unknown resistance [1] (All malarious regions except those specified as chloroquine-sensitive listed in the box above. Middle Eastern countries with chloroquine-resistant *P. falciparum* include Iran, Oman, Saudi Arabia, and Yemen. Of note, infections acquired in the Newly Independent States of the former Soviet Union and Korea to date have been uniformly caused by *P. vivax* and should therefore be treated as chloroquine-sensitive infections.)	**A. Quinine sulfate[2] plus one of the following: Doxycycline, Tetracycline, or Clindamycin** **Quinine sulfate:** 542 mg base (=650 mg salt) po tid x 3 to 7 days **Doxycycline:** 100 mg po bid x 7 days **Tetracycline:** 250 mg po qid x 7 days **Clindamycin:** 20 mg base/kg/day po divided tid x 7 days	**A. Quinine sulfate[2] plus one of the following: Doxycycline[3], Tetracycline[3] or Clindamycin** **Quinine sulfate:** 8.3 mg base/kg (=10 mg salt/kg) po tid x 3 to 7 days **Doxycycline:** 4 mg/kg/day po divided bid x 7 days **Tetracycline:** 25 mg/kg/day po divided qid x 7 days **Clindamycin:** 20 mg base/kg/day po divided tid x 7 days
		B. Atovaquone-proguanil (Malarone™)[4] **Adult tab = 250 mg atovaquone/ 100 mg proguanil** 4 adult tabs po qd x 3 days	**B. Atovaquone-proguanil (Malarone™)[4]** **Adult tab = 250 mg atovaquone/ 100 mg proguanil** **Peds tab = 62.5 mg atovaquone/ 25 mg proguanil** 5 - 8kg: 2 peds tabs po qd x 3 d 9-10kg: 3 peds tabs po qd x 3 d 11-20kg: 1adult tab po qd x 3 d 21-30kg: 2 adult tabs po qd x 3d 31-40kg: 3 adult tabs po qd x 3d > 40 kg: 4 adult tabs po qd x 3d
		C. Mefloquine (Lariam™ and generics)[5] 684 mg base (=750 mg salt) po as initial dose, followed by 456 mg base (=500 mg salt) po given 6-12 hours after initial dose Total dose= 1,250 mg salt	**C. Mefloquine (Lariam™ and generics)[5]** 13.7 mg base/kg (=15 mg salt/kg) po as initial dose, followed by 9.1 mg base/kg (=10 mg salt/kg) po given 6-12 hours after initial dose Total dose= 25 mg salt/kg
Uncomplicated malaria/ *P. malariae*	**All regions**	**Chloroquine phosphate:** Treatment as above	**Chloroquine phosphate:** Treatment as above

Alternatives For Pregnant Women 1.

- Malaria infection in pregnant women is associated with high risks of both maternal and perinatal morbidity and mortality.
- While the mechanism is poorly understood, pregnant women have a reduced immune response and therefore less effectively clear malaria infections.
- Pregnant women are three times more likely to develop severe disease than non-pregnant women acquiring infections from the same area. In addition, malaria parasites sequester and replicate in the placenta.
- Malaria infection during pregnancy can lead to miscarriage, premature delivery, low birth weight, congenital infection, and/or perinatal death.
- For pregnant women diagnosed with uncomplicated malaria caused by *P. malariae*, *P. vivax*, *P. ovale*, or chloroquine-sensitive *P. falciparum* infection, prompt treatment with chloroquine (treatment schedule as with non-pregnant adult patients) is recommended.
- For pregnant women diagnosed with uncomplicated malaria caused by chloroquine-resistant *P. falciparum* infection, prompt treatment with quinine sulfate and clindamycin is recommended. Quinine treatment should continue for 7 days for infections acquired in Southeast Asia and for 3 days for infections acquired in Africa or South America; clindamycin treatment should continue for 7 days regardless of where the infection was acquired.
- For pregnant women diagnosed with uncomplicated malaria caused by chloroquine-resistant *P. vivax* infection, prompt treatment with quinine for seven days is recommended regardless of where the infection was acquired.
- There are no adequate, well-controlled studies to support the addition of clindamycin to quinine when treating chloroquine-resistant *P. vivax* infections.

Antimalarial Drug Information

- Travelers to areas with malaria risk in Africa, South America, the Indian Subcontinent, Tajikistan, Asia, and the South Pacific should take one of the following antimalarial drugs (listed alphabetically):
  - **atovaquone/proguanil**
  - **doxycycline**
  - **mefloquine**
  - **primaquine (in special circumstances).**

Atovaquone/proguanil (brand name: Malarone ™)

- Atovaquone/proguanil is a combination of two drugs, atovaquone plus proguanil, in one tablet. It is available as the brand name, Malarone.
- **Directions for Use**
  - **The adult dosage is 1 adult tablet (250 atovaquone/100 mg proguanil) once a day.**
  - **Take the first dose of atovaquone/proguanil 1 to 2 days before travel to the malaria-risk area.**
  - **Take your dose once a day during travel in the malaria-risk area.**
  - **Take your dose once a day for 7 days after leaving the malaria-risk area.**
  - **Take your dose at the same time each day and take the pill with food or milk.**
- **Side Effects and Warnings**
  - The most common side effects reported by travelers taking atovaquone/proguanil are stomach pain, nausea, vomiting, and headache.
  - Most people taking this drug do not have side effects serious enough to stop taking it; if you cannot tolerate atovaquone/proguanil, see your health care provider for a different antimalarial drug.
- **Travelers Who Should Not Take Atovaquone/Proguanil for Prophylaxis**
  - The following travelers should **not** take atovaquone/proguanil to prevent malaria and should take a different antimalarial drug (see your health care provider):
  - **children weighing less than 25 pounds (11 kilograms)**
  - **pregnant women**
  - **women breast-feeding infants weighing less than 25 pounds (11 kilograms)**
  - **patients with severe renal impairment**
  - **patients allergic to atovaquone or proguanil.**

Doxycycline (many brand names and generic drugs are available)

- Doxycycline is related to the antibiotic tetracycline.
- **Directions for Use**
  - **The adult dosage is 100mg once a day.**
  - **Take the first dose 1 or 2 days before arrival in the malaria-risk area.**
  - **Take your dose once a day, at the same time each day, while in the risk area.**
  - **Take your dose once a day for 4 weeks after leaving the risk area.**
- **Side Effects and Warnings**
  - One of the most common side effects reported by travelers taking doxycycline include sun sensitivity (sunburning faster than normal). To prevent sunburn, avoid midday sun, wear a high SPF sunblock, long-sleeved shirts, long pants, and a hat.
  - Doxycycline may cause nausea and stomach pain. Take the drug on a full stomach with a full glass of liquid. Do not lie down for 1 hour after taking the drug to prevent reflux of the drug (backing up into the esophagus).
  - Women may develop a vaginal yeast infection on doxycycline. Treat vaginal discharge or itching with either an over-the-counter yeast medication or ask your health care provider for a prescription pill or cream.
  - Most people taking this drug do not have side effects serious enough to stop taking it; if you cannot tolerate doxycycline, see your health care provider. Other antimalarial drugs are available.
- **Travelers Who Should Not Take Doxycycline**
- The following travelers should **not** take doxycycline and should take a different antimalarial drug (see your health care provider):
  - **pregnant women**
  - **children under the age of 8 years**
  - **persons allergic to doxycycline or other tetracyclines**

Mefloquine (brand name Lariam ™ and generic)

- **Directions for Use : The adult dosage is 250 mg (one tablet) once a week.**
  - **Take the first dose 1 week before arrival in the malaria-risk area.**
  - **Take your dose once a week, on the same day of the week, while in the risk area.**
  - **Take your dose once a week for 4 weeks after leaving the risk area.**
  - **Take the drug on a full stomach with a full glass of liquid.**
- **Side Effects and Warnings**
  - The most common side effects reported by travelers taking mefloquine include headache, nausea, dizziness, difficulty sleeping, anxiety, vivid dreams, and visual disturbances. Mefloquine has rarely been reported to cause serious side effects, such as seizures, depression, and psychosis. These serious side effects are more frequent with the higher doses used to treat malaria; fewer occurred at the weekly doses used to prevent malaria.
  - Mefloquine is eliminated slowly by the body and thus may stay in the body for a while even after the drug is discontinued. Therefore, side effects caused by mefloquine may persist weeks to months after the drug has been stopped.
  - Most travelers taking mefloquine do not have side effects serious enough to stop taking the drug. (Other antimalarial drugs are available if you cannot tolerate mefloquine; see your health care provider.)
- **Travelers Who Should Not Take Mefloquine**
  - The following travelers should **not** take mefloquine and should ask their health care provider for a different antimalarial drug:
  - **persons with active depression or a recent history of depression**
  - **persons with a history of psychosis, generalized anxiety disorder, schizophrenia, or other major psychiatric disorder**
  - **persons with a history of seizures (does not include the type of seizure caused by high fever in childhood)**
  - **persons allergic to mefloquine**
  - **Mefloquine is not recommended for persons with cardiac conduction abnormalities (for example, an irregular heartbeat).**

Primaquine

- In special situations when other antimalarial drugs cannot be taken and in consultation with malaria experts, primaquine may be used to prevent malaria while the traveler is in the malaria-risk area (primary prophylaxis).
- **Directions for Use**
  - Note: Travelers **must** be tested for G6PD deficiency (glucose-6-phosphate dehydrogenase) and have a documented G6PD level in the normal range before primaquine use. **Primaquine can cause an hemolysis (bursting of the red blood cells) in G6PD deficient persons, which can be fatal.**
  - **The adult dosage is 2 tablets (30 mg base primaquine) once a day.**
  - **Take the first dose 1-2 days before travel to the malaria-risk area.**
  - **Take the dose once a day, at the same time each day, while in the risk area.**
  - **Take the primaquine once a day for 7 days after leaving the risk area.**
- **Side Effects and Warnings**
  - The most common side effects reported by travelers taking primaquine include stomach cramps, nausea, and vomiting. The following travelers should **not** take primaquine and should ask their health care provider for a different drug:
  - **persons with G6PD deficiency**
  - **persons who have not had a blood test for G6PD deficiency**
  - **pregnant women (the fetus may be G6PD deficient, even if the mother's blood test is in the normal range) women breast-feeding infants unless the infant has a documented normal G6PD level**
  - **persons allergic to primaquine**
  - **Do not share primaquine with others; they may be G6PD deficient and suffer bursting of their red blood cells, which can be fatal.**

Chloroquine phosphate (brand name Aralen ™ and generics)

- Travelers to malaria-risk areas in Mexico, Haiti, the Dominican Republic, and certain countries in Central America, the Middle East, and Eastern Europe should take chloroquine as their antimalarial drug (Hydroxychloroquine sulfate is available as an alternative; see below).
- **Directions for Use**
  - **The adult dose is 500 mg chloroquine phosphate once a week.**
  - **Take the first dose of chloroquine 1 week before arrival in the malaria-risk area.**
  - **Take your dose once a week, on the same day of the week, while in the risk area.**
  - **Take your dose once a week for 4 weeks after leaving the risk area.**
  - **Chloroquine should be taken on a full stomach to lessen the risk of nausea and stomach upset.**
- **Side Effects and Warnings**
  - The most common side effects reported by travelers taking chloroquine include nausea and vomiting, headache, dizziness, blurred vision, and itching. Chloroquine may worsen the symptoms of psoriasis. Most travelers taking chloroquine do not have side effects serious enough to stop taking the drug. Other antimalarial drugs are available; see your health care provider.
  - Note: In malaria-risk areas where chloroquine is the recommended drug but chloroquine cannot be taken, atovaquone/proguanil, doxycycline, mefloquine, or primaquine can be used as your antimalarial drug.
  - The following travelers should **not** take chloroquine and should ask their health care provider for a different drug:
  - **patients allergic to chloroquine**

Hydroxychloroquine sulfate (brand name: Plaquenil ™)

- **Hydroxychloroquine sulfate** is an alternative to chloroquine phosphate, although less evidence exists on its effectiveness as an antimalarial drug.
- **Directions for use**
  - **The adult dosage is 400 mg once a week.**
  - **Take the first dose 1 week before arrival in the malaria-risk area.**
  - **Take your dose once a week, on the same day of the week, while in the risk area.**
  - **Take the dose once a week for 4 weeks after leaving the risk area.**
  - **Take hydroxychloroquine sulfate on a full stomach to lessen nausea and stomach upset.**
- **Side Effects and Warnings**
  - Nausea and vomiting, headache, dizziness, blurred vision, difficulty sleeping, and itching have been reported with hydroxychloroquine sulfate use. Minor side effects usually do not require stopping the drug. Hydroxychloroquine sulfate may worsen the symptoms of psoriasis. Other antimalarial drugs are available; see your health care provider.
  - Note: In malaria-risk areas where hydroxychloroquine sulfate is the recommended drug but hydroxychloroquine sulfate cannot be taken, atovaquone/proguanil, doxycycline, mefloquine, or primaquine can be used as your antimalarial drug.

Prophylaxis

Table 2. Drugs Used for The Prophylaxis of Malaria

Drug	Adult dosage	Pediatric dosage
Mefloquine (Lariam)R	228 mg base (250 mg salt) orally, once/week	15-19 kg: 1/4 tab/week 20-30 kg: 1/2 tab week 31-45 kg: 3/4 tab week > 45 kg: 1 tab/week
Doxycycline	100 mg orally, once daily	> 8 years of age: 2 mg/kg orally, once daily up to adult dose of 100 mg/day
Chloroquine phosphate (Aralen)R	300 mg/base (500 mg salt) orally, once/week	5 mg/kg base (8.3 mg/kg salt) orally, once/week up to maximum adult dose of 300 mg base
Hydroxychloroquine sulfate (Plaquenil)R	310 mg/base (400 mg salt) orally, once/week	5 mg/kg base (6.5 mg/kg salt) orally, once/week up to maximum adult dose of 310 mg base
Proguanil (Paludrine)R	200 mg orally, once/day in combination with weekly chloroquine	< 2 years: 50 mg/day 2-6 years: 100 mg/day 7-10 years: 150 mg/day > 10 years: 200 mg/day
Primaquine	15 mg base (26.3 mg salt) orally, once/day for 14 days	0.3 mg/kg base (0.5 g/kg salt) orally, once/day for 14 days