

ARTHROPOD BORNE DISEASES



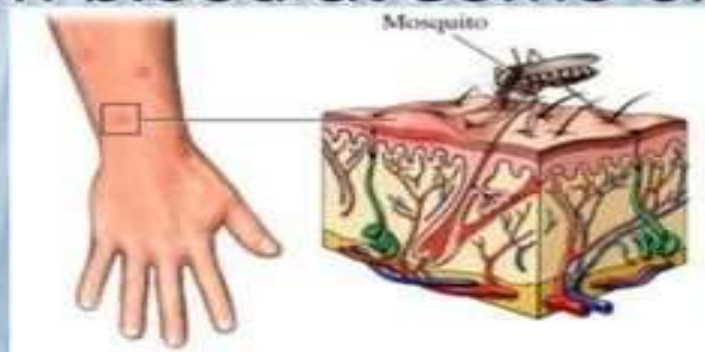
Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

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Arthropods form a major group of disease vectors with mosquitoes, flies, sand flies, lice, fleas, ticks and mites transmitting a huge number of diseases.

Many such vectors are haematophagous, which feed on blood at some or all stages of



Viral

Yellow fever

Encephalitis

Dengue fever

Rift valley fever

Bacterial

Plague

Parasitic

Malaria

Filariasis

Leishmaniasis

Rickettsial

Typhus

Q fever

Spirochet al

Relapsing fever

DENGUE FEVER (BREAK BONE FEVER)

**DENGUE
FEVER**

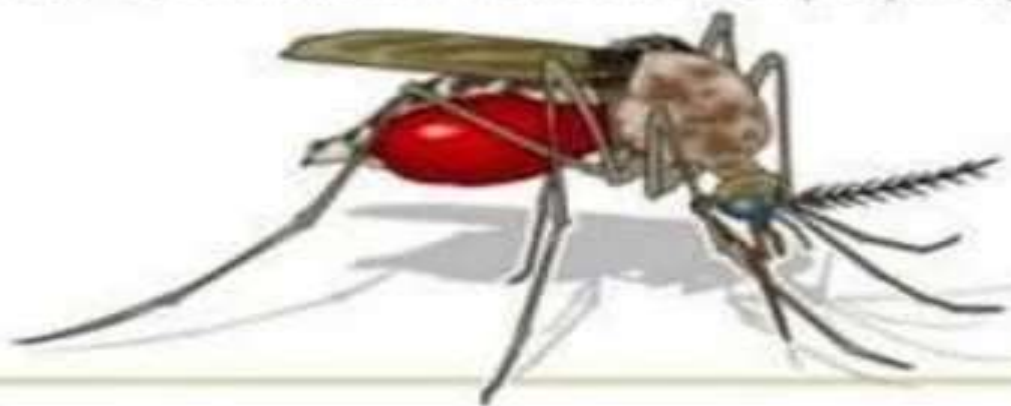


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- Communicable arthropod-borne viral hemorrhagic acute febrile disease of short duration & varying severity.
 - It is endemic in south Asia.
 - Dengue 1, 2, 3, 4 are now endemic in Africa.
 - In recent years outbreaks of dengue fever has occurred on east coast of Africa from Mozambique to Ethiopia to Saudi Arabia.

-
- **Causative agent:** viruses of dengue fever: 1, 2, 3 & 4 types.
 - **Reservoir:** Man-mosquito cycle in tropical urban centers. A monkey-mosquito cycle may serve as a reservoir in south Asia & West Africa.
 - **Mode of transmission:** bite of infective *Aedes aegypti* mosquito.

Dengue fever

A potentially lethal disease that affects 50 million people a year



Transmitted through bites of the female **Aedes aegypti** mosquito

The virus

Four distinct but related viruses cause dengue



Recovery from one gives lifelong immunity to that particular strain



A second infection by one of the different strains can lead to **dengue haemorrhagic fever (DHF)**, which has a **2.5% mortality rate**

Life cycle of the *Aedes* Mosquito

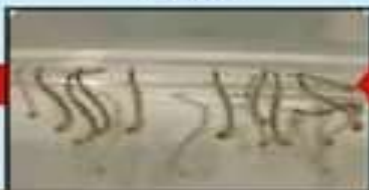
1-2 days



Pupae



Larvae



Eggs



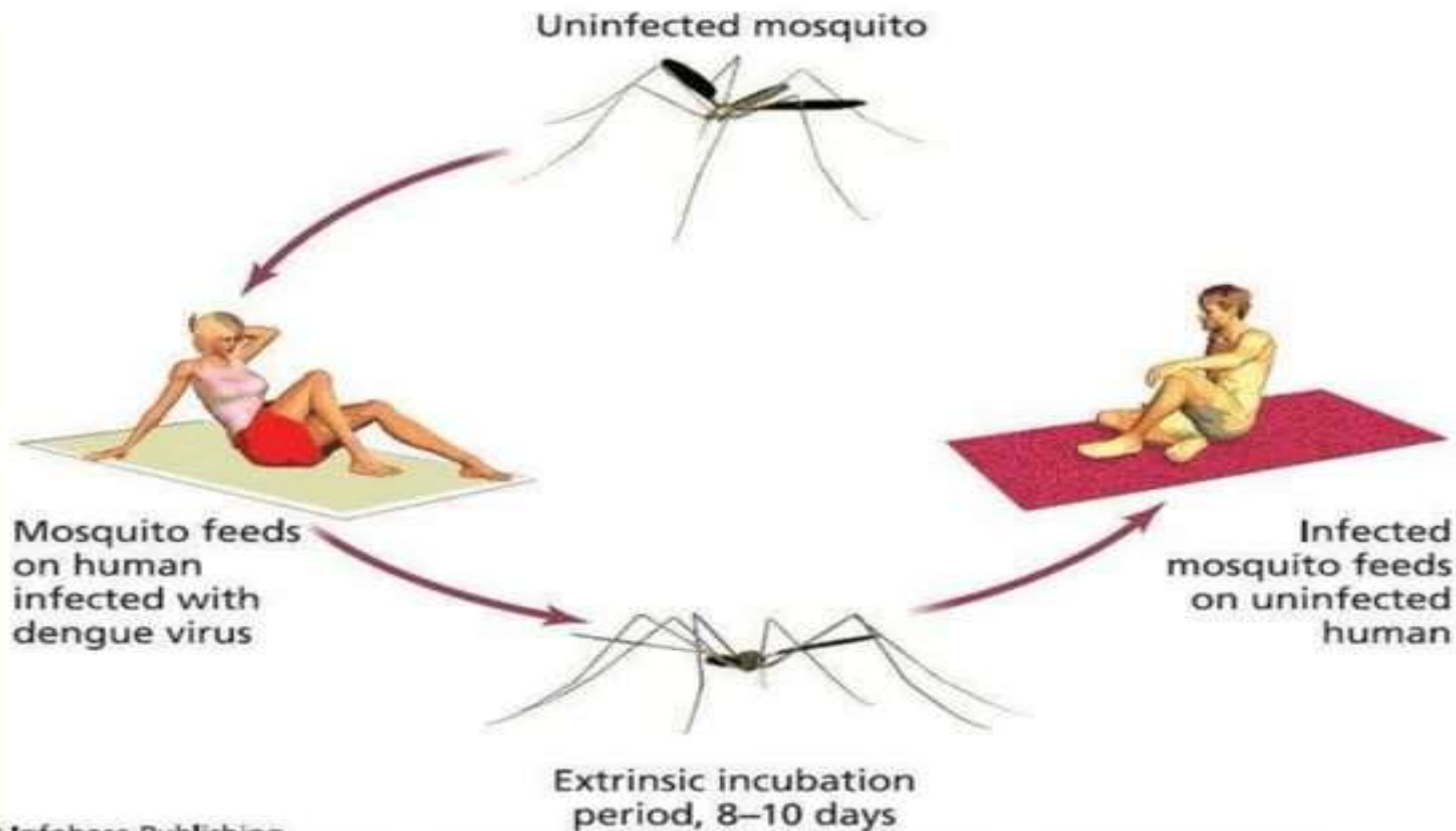
Eggs

Larvae

Pupae

Adults

Dengue Transmission



CLINICAL PICTURE:

Sudden onset of fever for 3-5 days, intense headache, rash early generalized erythema & maculopapular rash.

Minor bleeding “epistaxis, gum bleeding and petechia”.

Generalized bleeding & lymphadenopathy.

Dengue symptoms

Lloyd Healthcare Pvt. Ltd.
f t i /lloydhealthcare



High fever.



Headache



Muscle and joint pain



Pain behind eyes



Skin rashes.



Vomiting



Bleeding from mouth and nose

Symptoms of Dengue fever

Febrile phase

sudden-onset fever

headache

mouth and nose
bleeding

muscle and
joint pains

vomiting

rash

diarrhea

Critical phase

hypotension

pleural effusion

ascites

gastrointestinal
bleeding

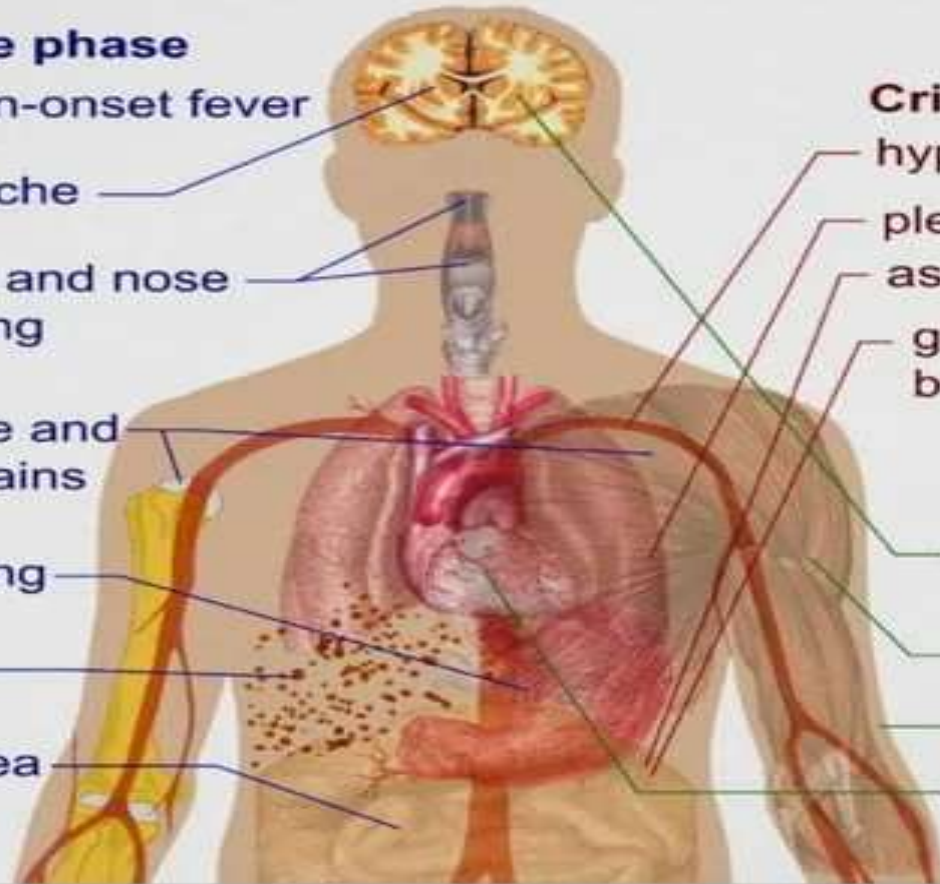
Recovery phase

altered level of
consciousness

seizures

itching

slow heart rate



Manifestations of Dengue Virus Infection

Dengue Virus Infection

Without Symptoms

With Symptoms

No Different from
other fever

Dengue Fever (DF)
Syndrome

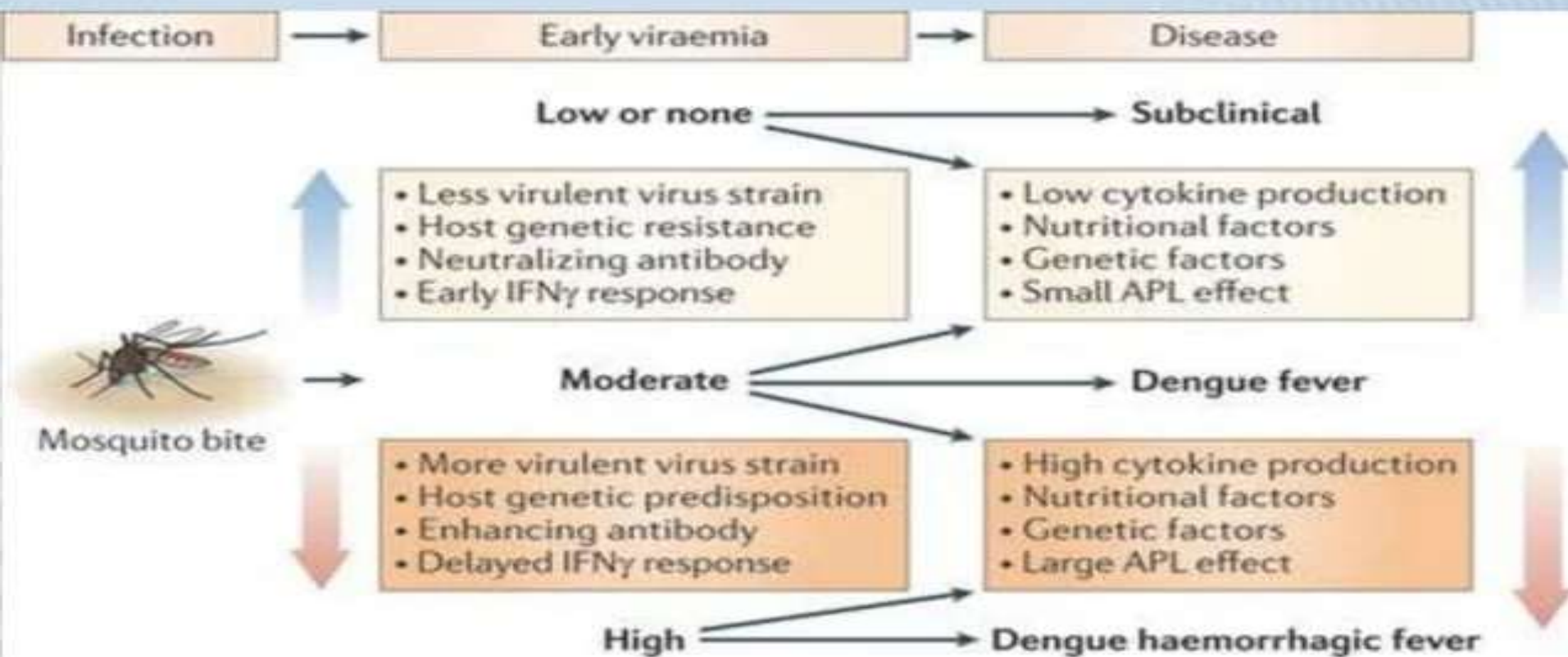
Dengue Hemorrhage
Fever (DHF)

Without
Hemorrhage

With Unusual
Hemorrhage

No Shock

Dengue Shock
Syndrome

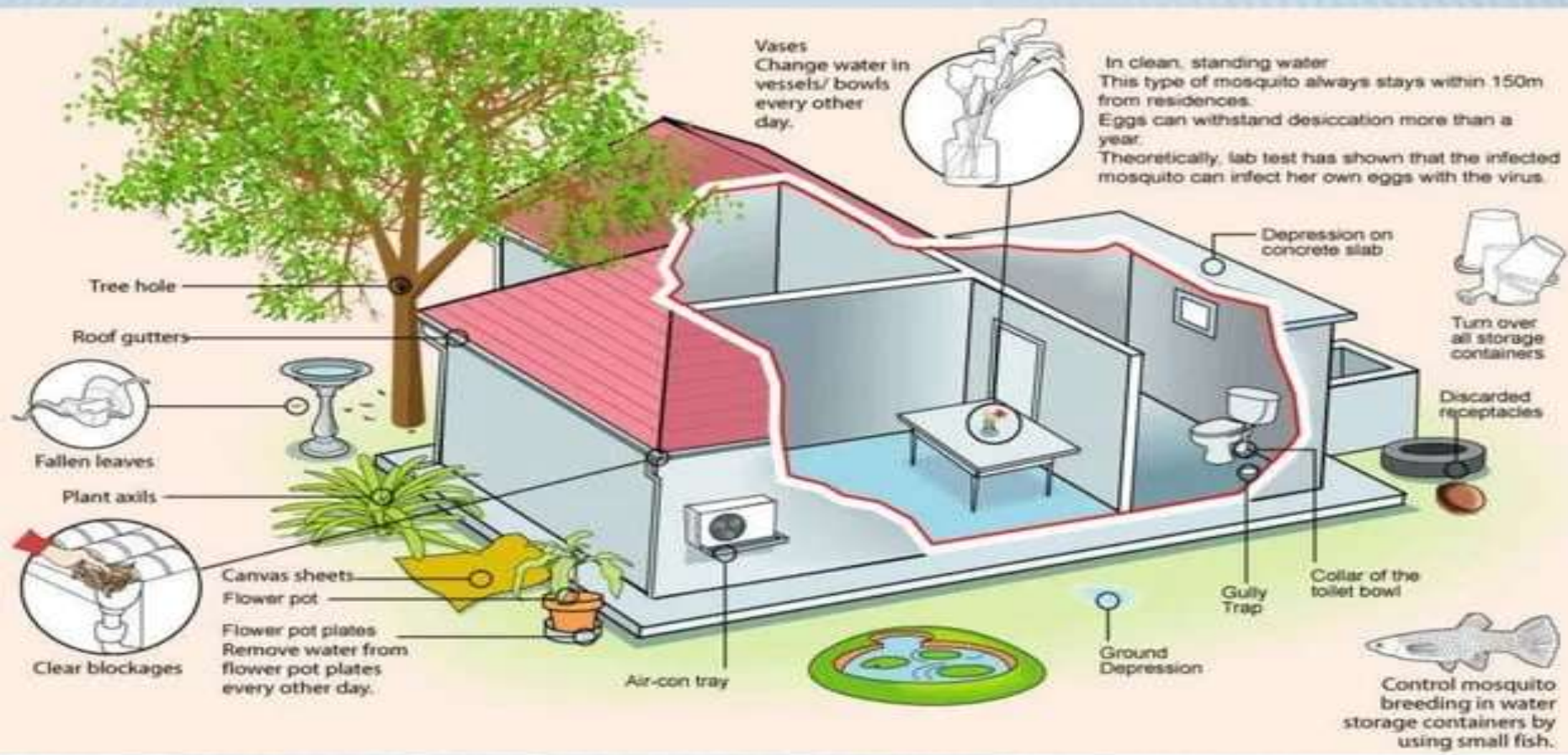


PREVENTION & CONTROL:

1. Environmental sanitation:

- b. Eradication or control of mosquito vector.
- c. Human protection against mosquitoes.

2. Health education.



Vases
Change water in
vessels/ bowls
every other
day.

In clean, standing water
This type of mosquito always stays within 150m
from residences.
Eggs can withstand desiccation more than a
year.
Theoretically, lab test has shown that the infected
mosquito can infect her own eggs with the virus.

Turn over
all storage
containers

Discarded
receptacles

Control mosquito
breeding in water
storage containers by
using small fish.

Tree hole

Roof gutters

Fallen leaves

Plant axils

Clear blockages

Canvas sheets

Flower pot

Flower pot plates
Remove water from
flower pot plates
every other day.

Air-con tray

Ground
Depression

Gully
Trap

Collar of the
toilet bowl

Depression on
concrete slab

WHICH BUZZ HAS MORE BITE?



ANOPHELES

Malaria

Pregnant females

Night

With abdomen sticking upwards

Predominantly rural

Bodies of water



AEDES MOSQUITO

Dengue, Yellow Fever,
Chikungunya, Lymphatic filariasis

Pregnant females

Day

Lies parallel to resting surface

Predominantly urban

Shallow water surfaces

Diseases spread

Which mosquitoes bite?

When do they bite?

Resting position

Location

Breeding ground



CHIKUNGUNYA, DENGUE, or ZIKA: What is an imported case?

A person who was bitten by an infected mosquito while traveling away from home.



A person gets bitten by an infected mosquito while traveling.

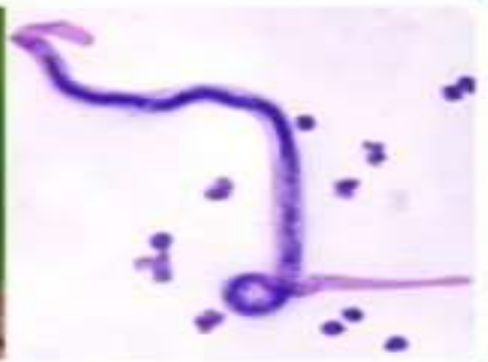
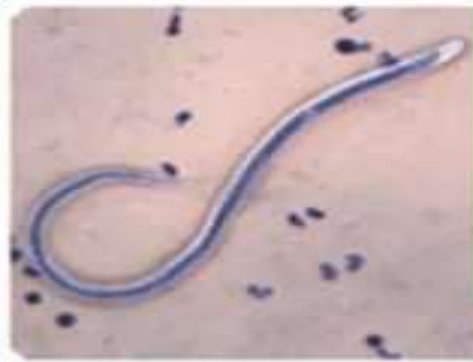
Symptoms may begin 3-7 days after being bitten by an infected mosquito.



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

For more information: www.cdc.gov/chikungunya • www.cdc.gov/dengue • www.cdc.gov/zika

FILARIASIS (BANCROFTIAN FILARIASIS)





OEH Wuchere 1866



Joseph Bancroft 1877



Sir Patrick Manson
1877

Father of Medical
entomology and Tropical
medicine





It is **endemic** in many **tropical & subtropical** countries like **Africa, Asia, Western Pacific** and **parts of America.**

FILARIASIS IN EGYPT:

It is endemic in Egypt.

Nile Delta: Qalyobia (Sandanhour), Menoufia (Kafr al Hemma & Shenawaii), Sharkia (El korain village), Dakahlia, Kafr el sheikh, Gharbia

Upper Egypt: Giza (Badrashin) & Assuit.

A program for elimination of lymphatic filariasis started in **2002** & showed successful results.

CAUSATIVE AGENT:

Nematode: **Wuchereria bancrofti** & other long thread-like worm (male 4 cm & female 7cm). Adult worm normally resides in lymphatic of infected people.

Female worms produce **microfilaria** that reach blood stream 6-12 months after infection.

The microfilaria appears in large number during night with maximum density in blood between 10 p.m & 2 a.m (**nocturnal periodicity**).

Reservoir of infection: Human with microfilaria in their blood.

Man is definitive host & mosquito is intermediate host.

Period of communicability: Human can infect mosquito when microfilaria is present in peripheral blood.

They can persist for 5-10 yrs or longer after infection, mosquito becomes infective after about 2 weeks.

MODE OF TRANSMISSION:

Bite of infective mosquito: in Egypt: female *Culex pipiens*, but it could be transmitted by bite of *Anopheles gambia* & *Aedes*.

Mosquito cycle begins when microfilaria are ingested by female mosquito during feeding. Microfilaria penetrates stomach wall of insect & develops in thoracic muscles into elongated infective filariform larva that migrate to proboscis.

When mosquito bites an individual, larvae can enter punctured skin, then passes via lymphatic where they molt & become adult.



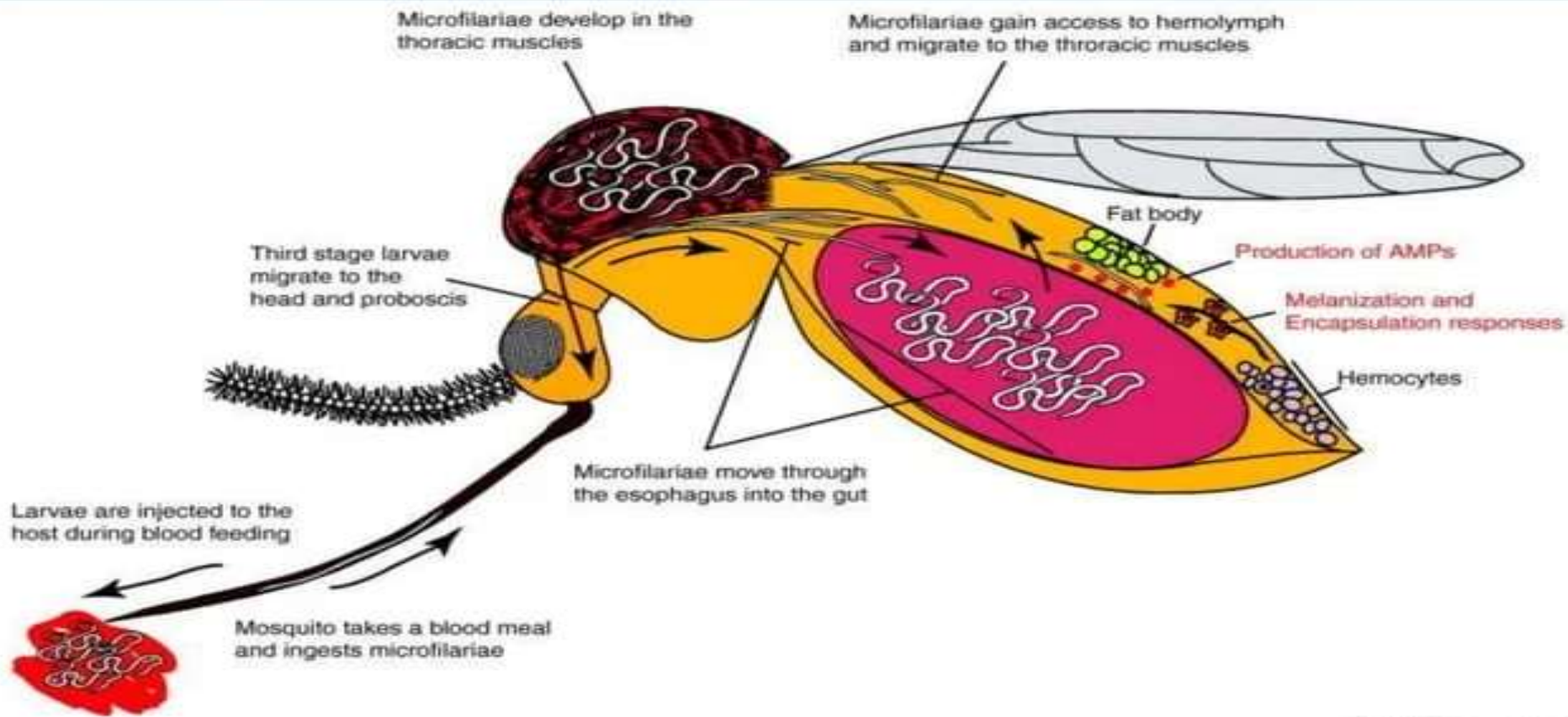
Aedes



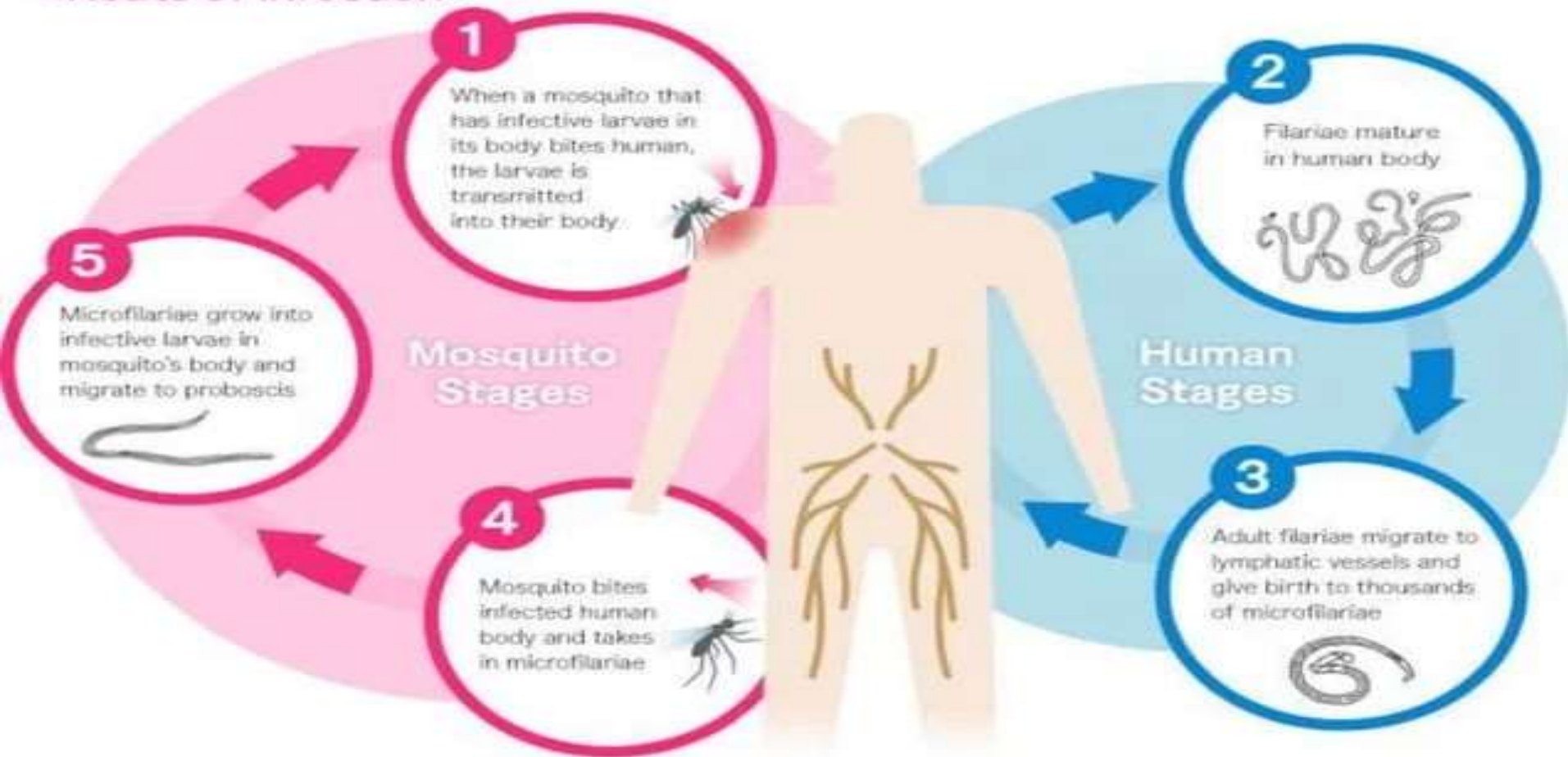
Culex pipiens



Anopheles



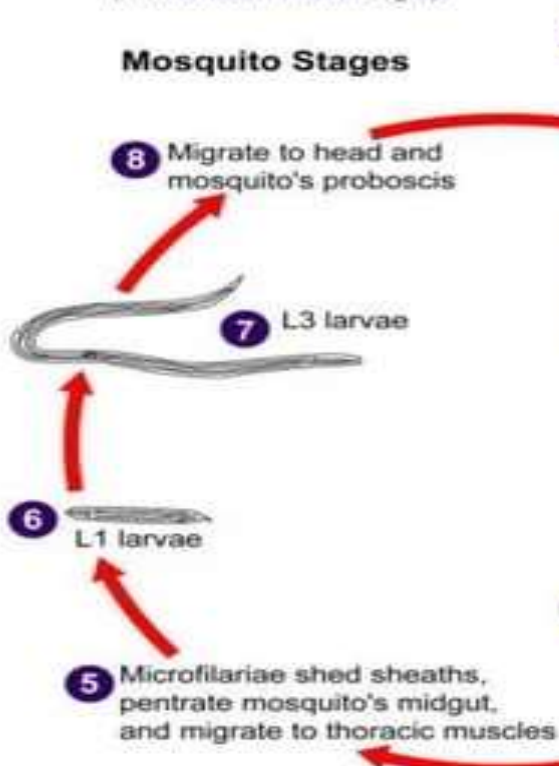
<Route of Infection>



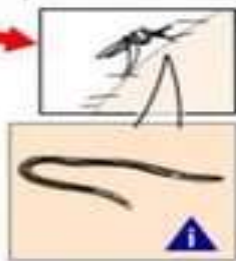
Filariasis

(*Wuchereria bancrofti*)

Mosquito Stages

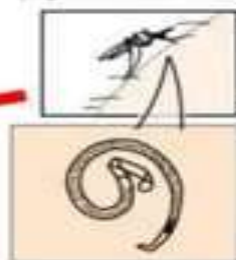


1 Mosquito takes a blood meal (L3 larvae enter skin)

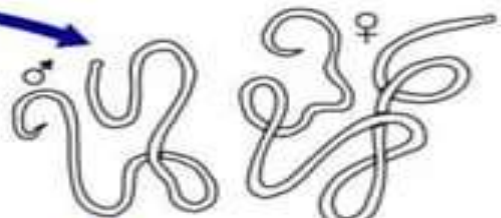


Human Stages

4 Mosquito takes a blood meal (ingests microfilariae)



2 Adults in lymphatics

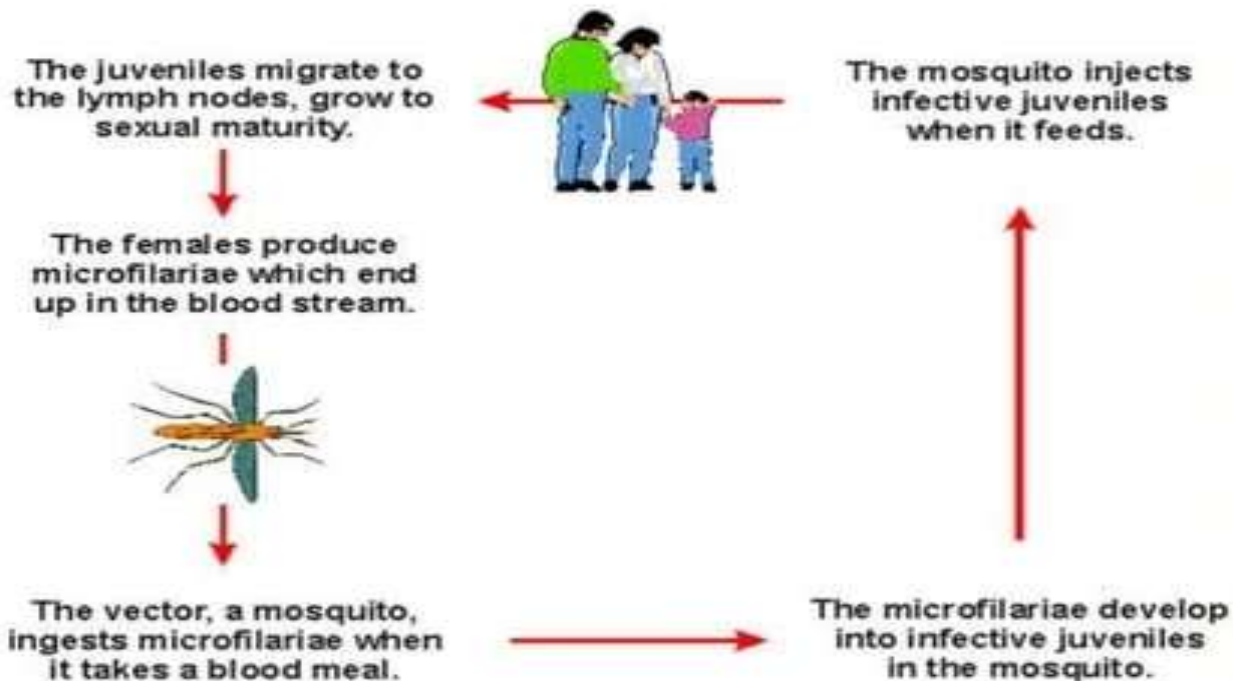


3 Adults produce sheathed microfilariae that migrate into lymph and blood channels



i = Infective Stage
d = Diagnostic Stage

**THE LIFE CYCLES OF *WUCHERERIA BANCROFTI* AND *BRUGIA MALAYI*
(LYMPHATIC FILARIASIS OR ELEPHANTIASIS)**



(Parasites and Parasitological Resources)

SUSCEPTIBILITY & RESISTANCE:

General susceptibility: Filarial disease appears only in small % of infected persons.

Immunity: Man may develop resistance only after many years of exposure to infection.

Environment: Unsanitary planning with inadequate sewage disposal, where breeding places of culex & collection of water for other species.

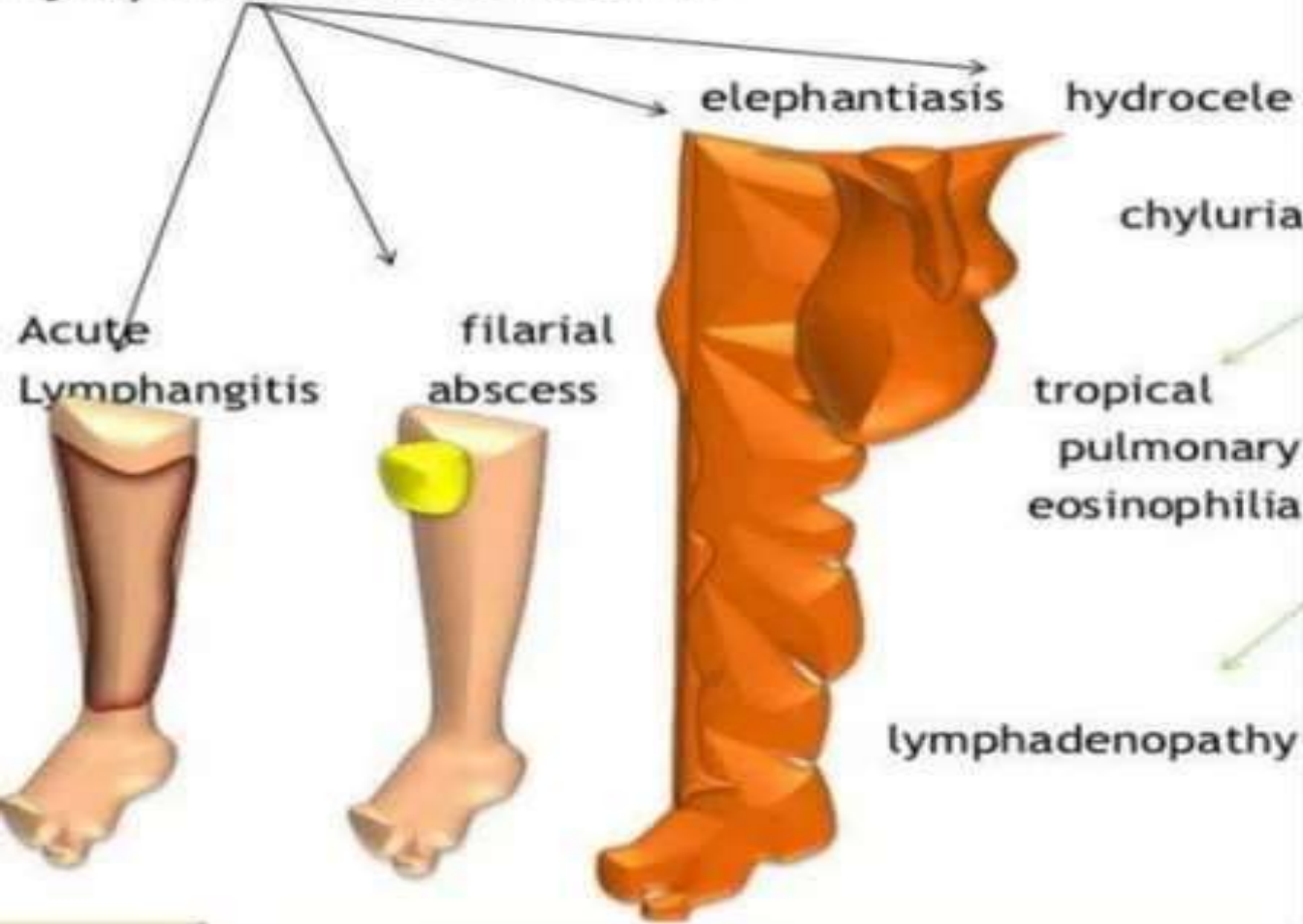
Culex quinquefasciatus breeding sites
Dirty water in blocked drains, cess pits etc.



CLINICAL FEATURE:

- **Asymptomatic**
- **Acute form:** fever, lymphangitis & lymphadenitis
- **Chronic obstructive form:** due to fibrosis & obstruction of lymphatic vessels after repeated attacks, 10 years later, leading to elephantiasis of limbs, breast & genitalia, hydrocele, chyluria, paroxysmal nocturnal asthma & severe eosinophilia.

Reaction to adult worms in the Lymphatic vessels lead to





DIAGNOSIS:

- ✦ Detection of microfilaria in blood during maximum presence (nocturnal).
- ✦ Live microfilaria can be seen in a drop of blood, geimsa smears.



Wucheria bancrofti in blood
WHO/TDR/Stammers

PREVENTION:

General:

1. Environmental sanitation:

a. Eradication or control of mosquito vector

b. Human protection against mosquitoes: e.g. protective clothing, bed nets, repellents.

2. Health education: Modes of transmission & Protection against mosquito bites.

SPECIFIC “MASS DRUG ADMINISTRATION (MDA)”:

WHO recommends MDA in Endemic areas

Annual single dose, diethylcarbamazine citrate (DEC) 6mg/kg BW + 400 mg albendazole for 4-6 years, or regular use of DEC-medicated cooking salt for 1-2 years.

- 2 fold purpose: preventing future cases of lymphatic filariasis & helping those people who are already suffering from disease.

DEC
+
Albendazole



3) DEC-medicated salt-

- Common salt is medicated with **1-4g of DEC per kg.**



CONTROL:

Control of cases:

1. Notification: to LHO.

2. Isolation: not practical. As far as possible, patients with microfilaria treated with anti-filarial drugs should be protected from mosquitoes to reduce transmission.

3. Specific ttt: DEC (Banocid, Hetrazan).

ttt results in rapid suppression of most or all MF from blood, but may not destroy all adult worms.

Low level of MF may reappear after ttt. Therefore, ttt must usually be repeated at yearly interval, & lab follow up should be done for treated cases.

ELIMINATION OF LYMPHATIC FILARIASIS IN EGYPT

WHO has launched a global program for elimination of lymphatic filariasis worldwide.

Elimination of lymphatic filariasis means a reduction of disease incidence close to zero as a result of continued & coordinated activities.

WHO's strategy comprises 2 components: interruption of transmission, & care for those who already have disease.

To interrupt the transmission, the entire population at risk must be covered by MDA for a period long enough to ensure that level of MF in blood remains below that which is necessary to sustain transmission.

Egypt started the program for elimination since 2000 following WHO recommendation of administering DEC & Albendazole.

Global Programme to Eliminate Lymphatic Filariasis (GPELF)

Global elimination by 2020

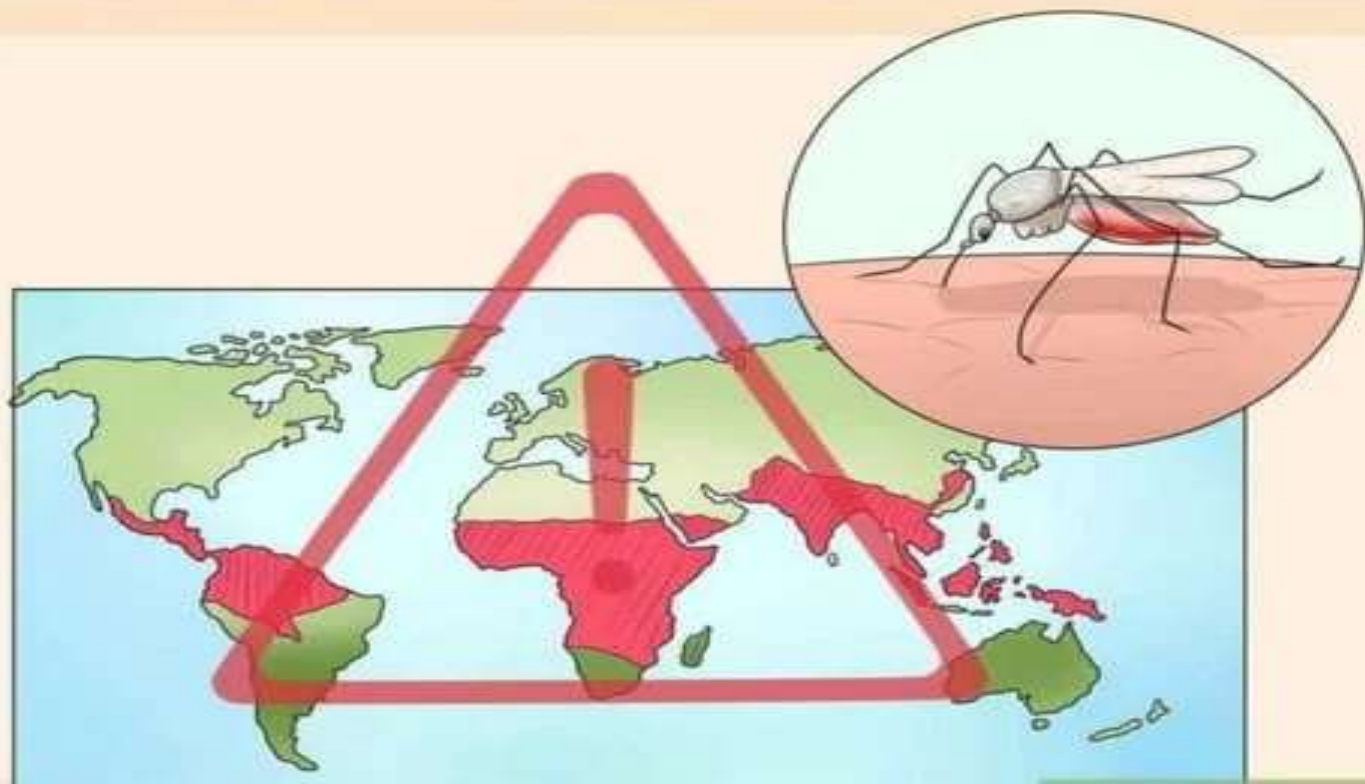
1. Stop the spread

- Reduce infection prevalence to low levels at which transmission considered unsustainable

2. Reduce suffering and improve quality of life

- Access to a basic recommended package of care

MALARIA



A parasitic **re-emerging** disease

1 million deaths/year in world
“mostly young African children”

Recently multiple foci of **drug resistant** malaria are encountered in different areas.
Tropical & subtropical areas.

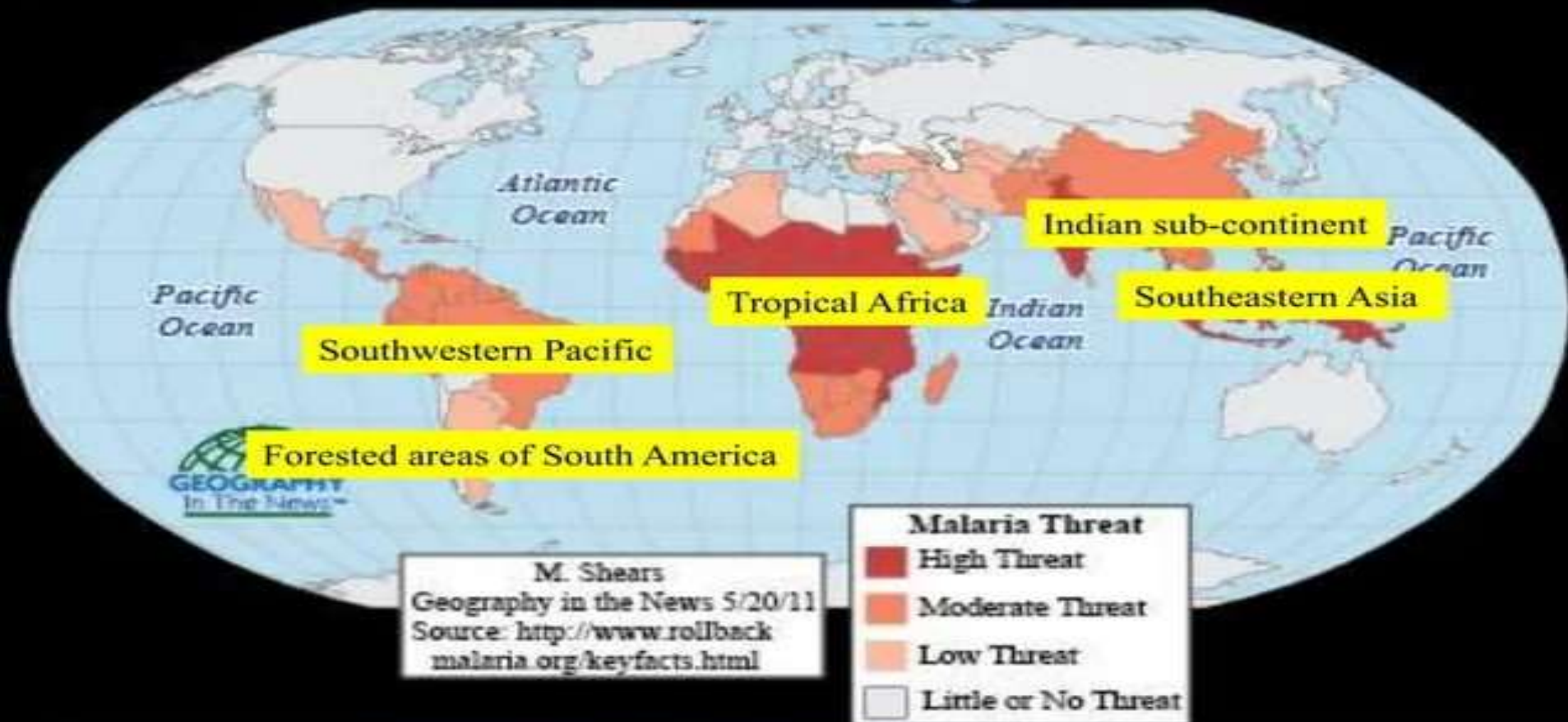
MALARIA
KILLS 2000
CHILDREN
EVERY DAY

1 HOUR FEVER
SHIVERING
2 HOURS SWEATING
ACHING BODY
WEAKNESS
12 HOURS CONVULSIONS
COMA
24 HOURS DEATH

Malaria Consortium
is helping to get the government and thousands
away from the malaria zone that will start battle.

malaria consortium
www.malariaconsortium.org

Chance of Encountering Malaria



M. Shears

Geography in the News 5/20/11

Source: <http://www.rollbackmalaria.org/keyfacts.html>

CAUSATIVE AGENT:

Protozoan parasites with asexual & sexual phase
“*Plasmodium vivax*, *P. falciparum*, *P. ovale* & *P. malaria*.”

Mixed infections are not infrequent in endemic areas.

RESERVOIR:

Humans: only important reservoir of human malaria.

Case may have several plasmodia species at same time.

Infective stage to vector is **gametocytes** which have to be mature, both sexes, sufficient density & viable.

Antimalarial drugs lose viability of gametocytes.

Female anopheline mosquito is definitive host

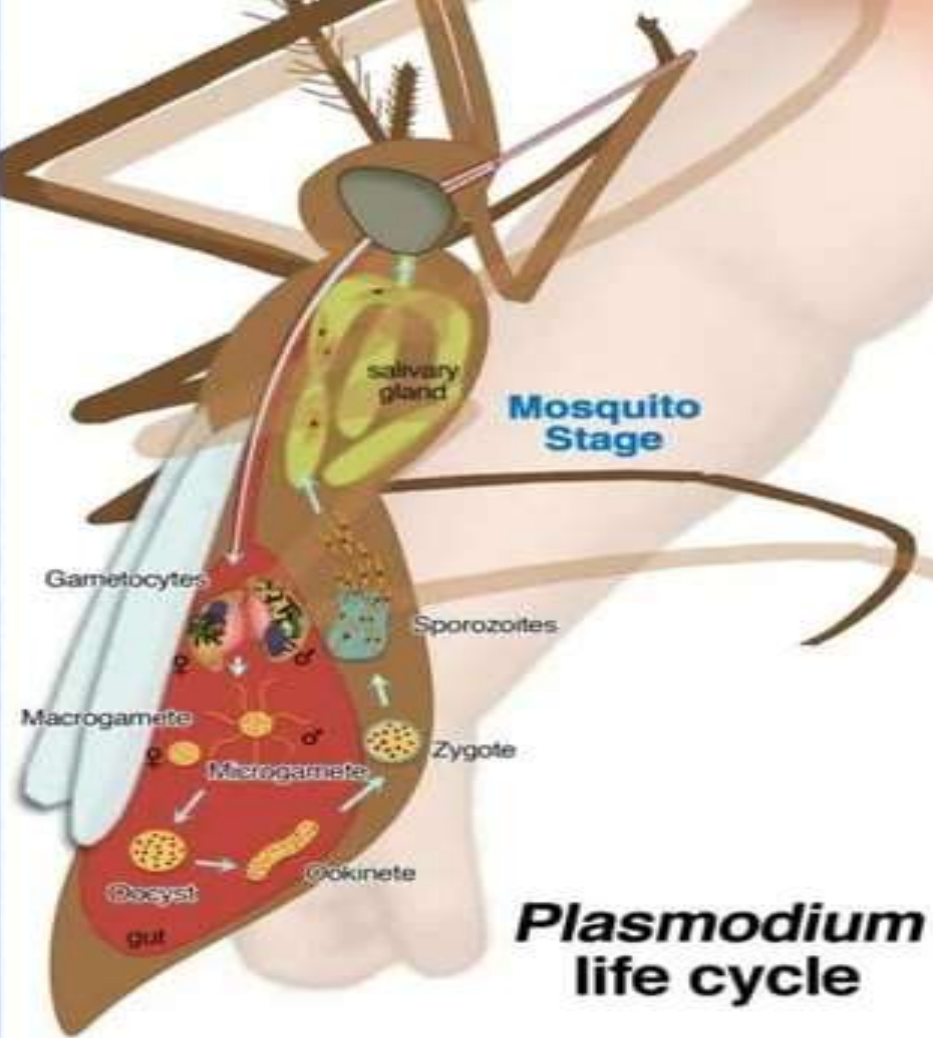
Infective stage to man is **sporozoite**.

PERIOD OF COMMUNICABILITY:

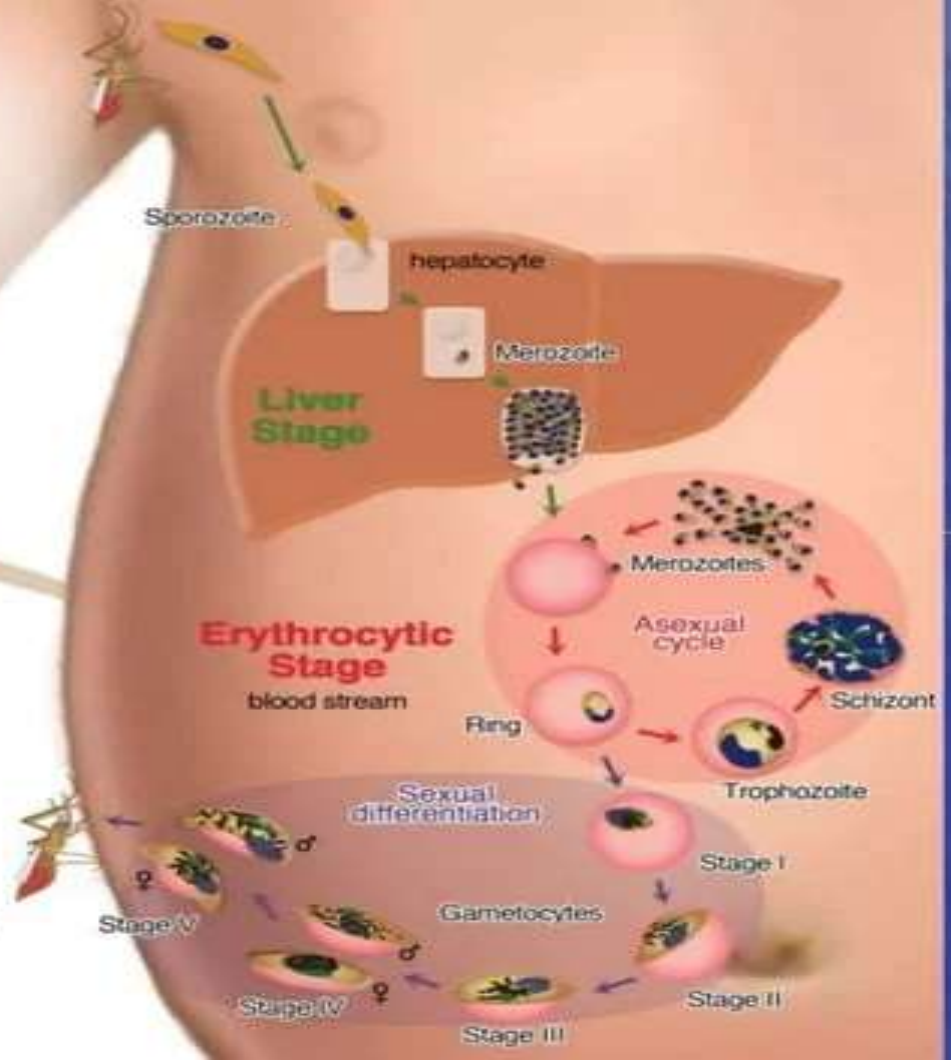
As long as infective macro gametes are present in blood of patients. This varies with parasite species. In untreated cases it may reach up to 3 years, however, with antimalarial drugs the period is shortened greatly.

Humans may infect mosquitoes as long as infective gametocytes are present in the blood, this varies with parasite species and with response to therapy. Untreated or insufficiently treated patients may be a source of mosquito infection for one to several years.

Transfusion transmission may occur as long as asexual forms remain in the circulating blood. Stored blood can remain infective for at least a month.



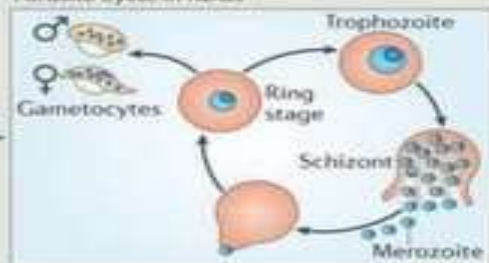
Plasmodium life cycle



a Plasmodium life cycle

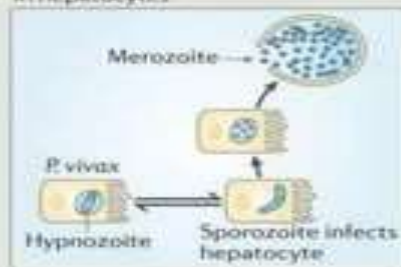
Asexual stage (bloodstream)

Parasite cycle in RBCs



Asexual stage (liver)

Infection and parasite replication in hepatocytes

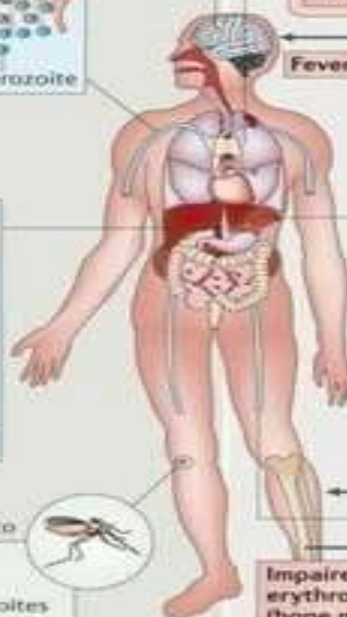
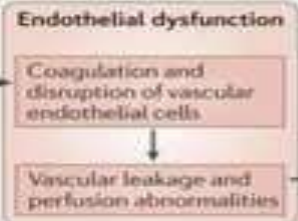
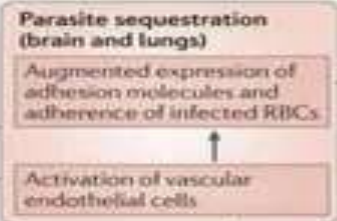


Sexual stage (mosquito)

Parasite development in the mosquito



b Pathogenesis of malaria



Fever

Pro-inflammatory cytokines

Sepsis (spleen)
Uptake of infected or altered RBCs resulting in macrophage activation and cytokine production

Destruction of RBCs

Pro-inflammatory cytokines

Impaired erythropoiesis (bone marrow)

Anaemia (bloodstream)
Adhesion and rupture of infected and altered RBCs

Low levels of RBCs

Cerebral malaria

Placental malaria

Acute respiratory distress

Renal impairment and metabolic acidosis
• Increased glycolysis and lactic acid accumulation
• Hypoxia
• Hyperventilation.

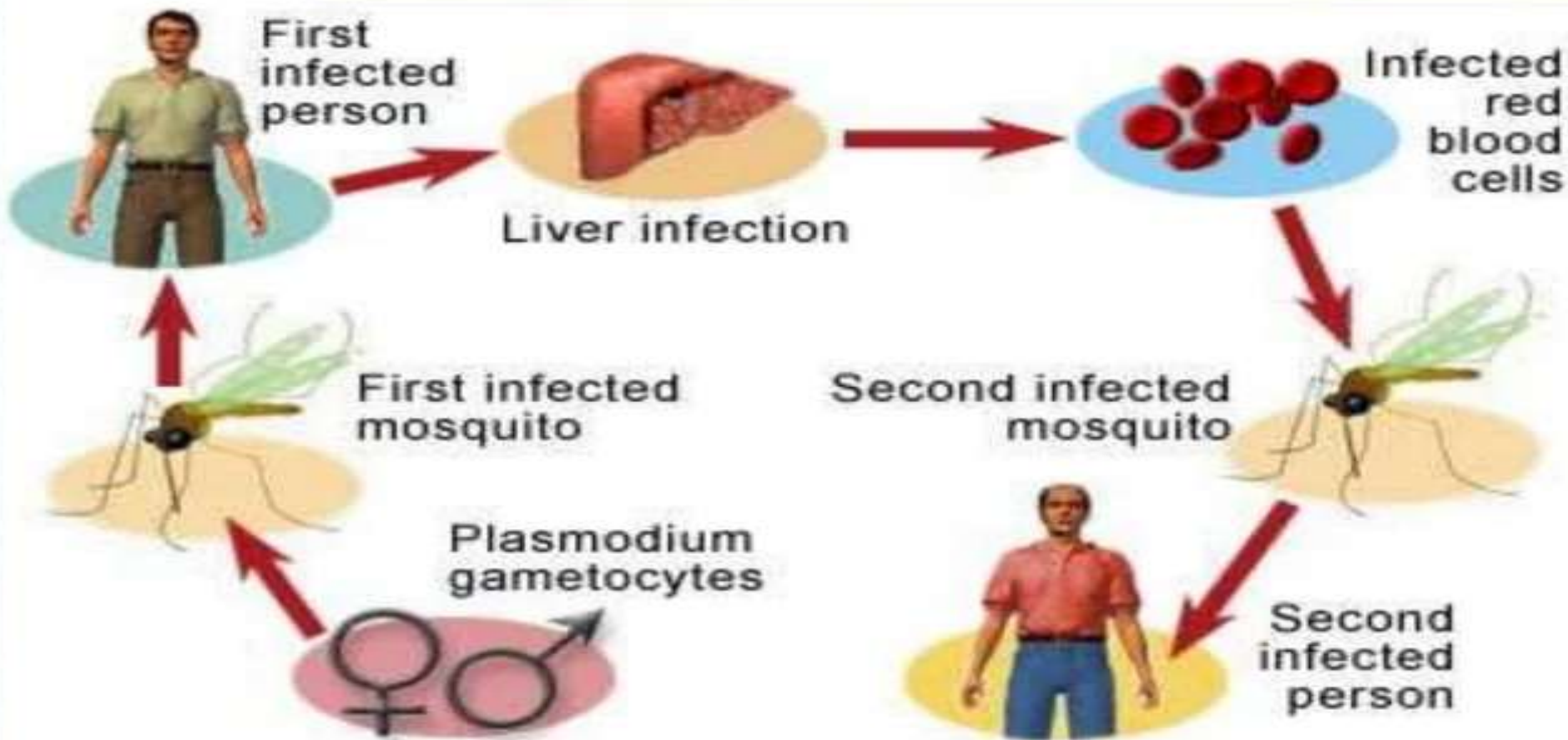
MODE OF TRANSMISSION:

1- Bite of infective female anophiline mosquito, where sporozoite are present in salivary glands. Most species feed at night; some important vectors also bite at dusk or in the early morning.

2- Infection or transfusion of infected blood or use of contaminated needles & syringes (e.g. injecting drug users) may also transmit malaria.

3- Congenital transmission occurs rarely. However, pregnant women are vulnerable than others to falciparum malaria (and possibly other plasmodium species).

Malaria transmission cycle



INCUBATION PERIOD:

Time between infective bite & appearance of clinical symptoms is 9-40 days according to type of malaria species.

With infection through blood transfusion, IP depend on the number of parasites infused & are usually short, but may range up to about 2 months.

SUSCEPTIBILITY:

It is universal except in human with specific genetic traits.

Age:

- All ages are affected.
- Tolerance to clinical disease is present in adults in highly endemic areas where exposure to infective anopheline is continuous over many years.

Sex: -Males are more exposed usually due to outdoor life.

Immunity:

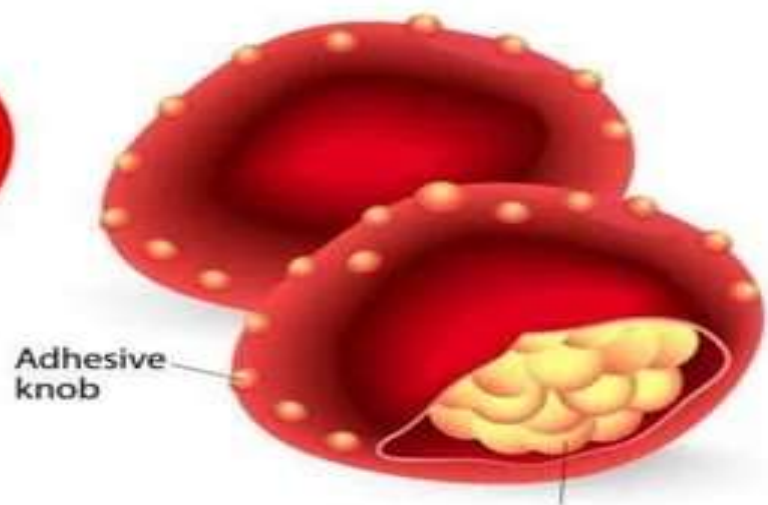
- no natural immunity.
- Infection induces species specific immunity.
- Some sort of active immunity develops in endemic areas.

MALARIA

Normal cell



Infected RBC



Adhesive knob

Malaria parasites multiply in the red blood cells

Genetic: Most indigenous populations of Africa show a natural resistance to infection with *P. vivax* which is associated with absence of Duffy factor on their erythrocytes.

Persons with sickle cell trait (heterozygotes) show relatively low parasitaemia when infected with *P. falciparum*, so relatively protected from severe disease; homozygotes suffering from sickle cell disease are at increased risk of severe *falciparum* malaria especially anemia.

HIV infection: increased risk of symptomatic *falciparum* malaria & its severe manifestations.

Sociocultural & environmental factors: Low socioeconomic standard, outdoor sleeping, agricultural societies & vitiated air contribute to spread of infection.

Suitable environment for mosquito breeding “hot+humid+rainfall”

CLINICAL PICTURE:

slowly rising fever, chills, malaise, headache, nausea, lassitude, muscle & joint pain, then rigor sensation & rapidly rising temperature ending by profuse sweating.

The cycle of fever, chills, sweating is repeated either daily or every other day or every 3rd day or irregularly according to malaria species.

Relapses may occur after a period of cure without parasitaemia at irregular interval up to 5 years.

Symptoms of Malaria



CENTRAL
- Headache

SYSTEMIC
- Fever

MUSCULAR
- Fatigue
- Pain

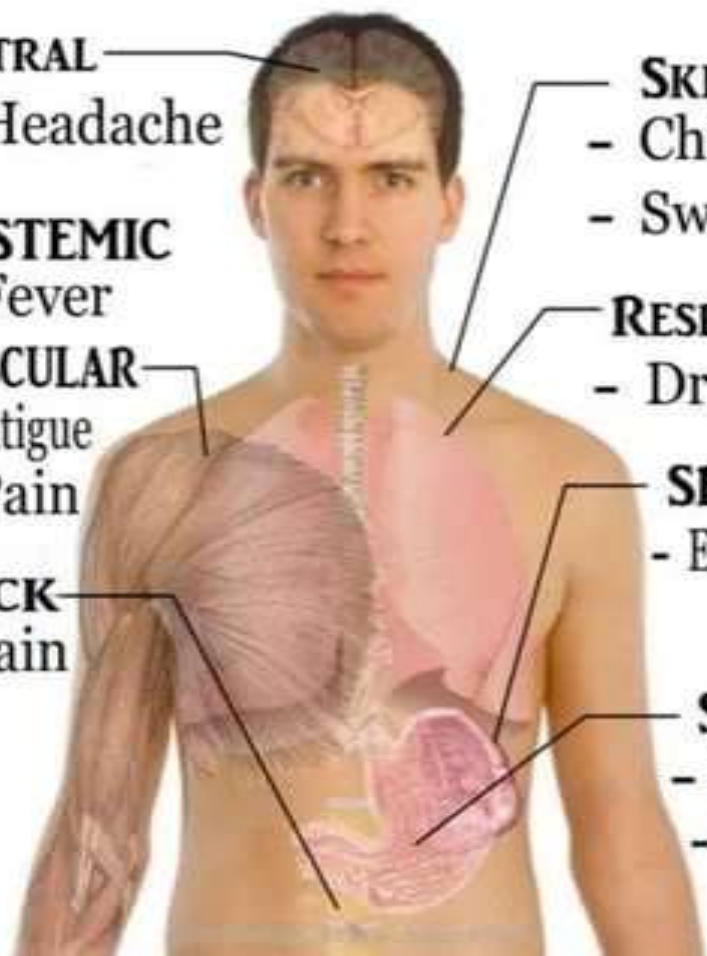
BACK
- Pain

SKIN
- Chills
- Sweating

RESPIRATORY
- Dry cough

SPLEEN
- Enlargement

STOMACH
- Nausea
- Vomiting



COMPLICATIONS:

- Anemia.
- Splenomegaly.
- Abortion & fetal infection.
- Falciparum malaria may be associated with respiratory distress, jaundice, liver failure, encephalopathy, pulmonary & cerebral edema, coma & death.

DIAGNOSIS:

- Malaria parasites in thick blood film.
- Repeated microscopic examination every 12-24 hs may be necessary to cover all parasite species.

- Several tests have been developed: The most promising are:
 - Rapid diagnostic tests: plasmodial antigens in blood.
 - PCR: most sensitive method.
 - Demonstrating antibodies which appear after 1st week of infection but may persist for years denoting past malaria infection.

P. falciparum

P. vivax

P. malariae

P. ovale

Rings



Schizonts



Gametocytes



Rapid Diagnostic Test



Add 2 Drops
of Buffer



Negative



P.falciparum



Mixed
Infection /
P.falciparum

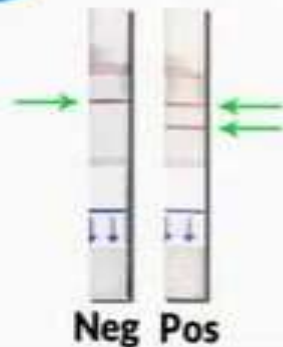
A Urine Dip



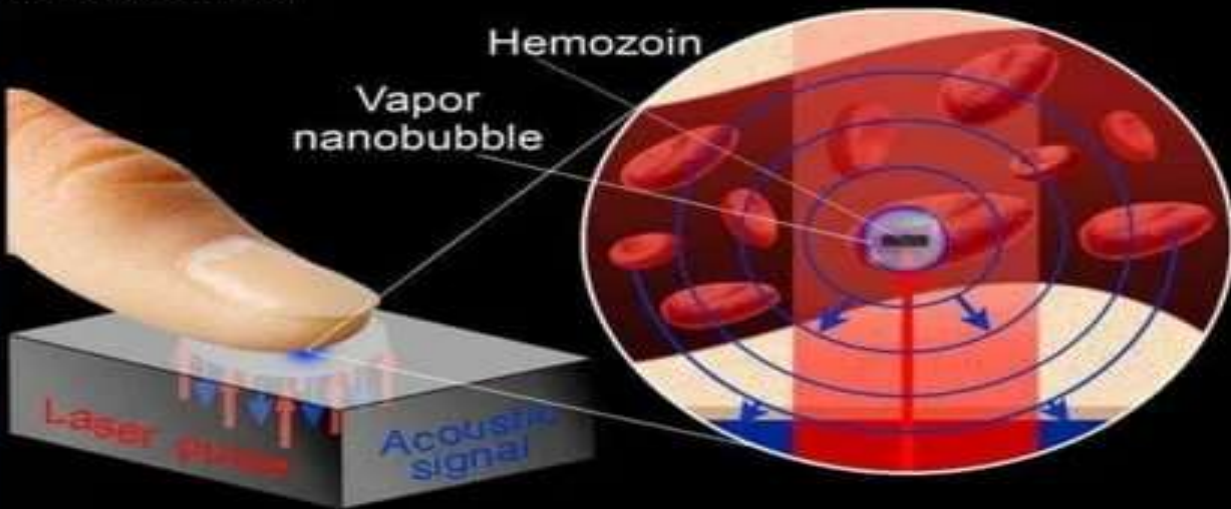
B Incubate 20 min



C Read Result



Transdermal detection of malaria



PREVENTION:

1. General preventive measures: of arthropod borne disease.

- **Environmental sanitation, vector control and Health education:**

* Elimination of the breeding sites of mosquito.

* Eradication of larval stages by spraying crude oil & larvicides on water surface.

* Destruction of adult mosquitoes by using suitable insecticides (liquid aerosol, pyrethrium).

- **Human protection:**

* Screening of windows and doors, using bed nets and animal barrier between breeding places and human habitation.

- using protective cloths.

- Apply of repellents to exposed skin between dusk

- Avoid going outdoors & down when anopheline mosquitoes commonly bite.

- **Health education:** public, at risk groups and travelers.

- **Avoid taking blood** from any individual giving history of malaria or a history of travel to, or residence in, a malarious area.

2. Specific measures:

Chemoprophylaxis for international travelers going to endemic areas.

- Chloroquine or hydroxy chloroquine 5 mg /kg/week or chloroquine phosphate (500 mg for average adult).
- Continued for 4-6 weeks after leaving endemic areas.
- In areas with chloroquine-resistant *P. falciparum*, mefloquine is recommended (5mg/kg/week) for adults, 1-2 week before travel, during stay & 4 weeks after leaving endemic area.

CONTROL:

Case: Early case finding:

- * By lab examination of clinically suspected persons.
- * By periodic survey.
- * Through malaria campaign.

ttt: Using antimalarial drugs as chloroquine or mefloquine etc.

Contacts:

- Investigation for early case findings.
- Investigation for source of infection or exposure.

MALARIA SURVEY

Field study in endemic areas to find out magnitude of problem, ecological factors & to plan for prevention and control.

Planning:

- Mapping area to identify water channels, collections, cultivated lands, houses & climatic conditions.
- Study population characteristics e.g age, sex, occupation, habits etc.
- Study vector; types of mosquitoes, density, species, life span, breeding places, resistance to insecticides.
- Choose the suitable representative sample.

Preparation of:

- Team of work.
- Equipments (microscope, slides ect)
- Transportation facilities.

Investigation: Clinical &lab examination.

Statistical analysis: to show malarionometric indices.

HUMAN INDICES:

1-Splenic index (non-specific): % of children between 2-6ys showing splenomegally “excluding other causes”.

Interpretation:

- Below 10% low endemicity.
- 10-25% moderate endemicity.
- 25-50% hyperendemic.

2-Parasitic index (specific): % of infants below one year showing malaria parasites in their blood, it is most sensitive index of recent infection. Gametocytic index; is % of those having gametocytes in their blood.

3-Vector index: Oocytic index is % of oocytes or ookinetes in stomach wall of female anopheles.

4-Sporozoite index is % of female anopheles having sporozoites in salivary glands.

MALARIA ERADICATION

Eradication is the highest level of disease control

Aiming at elimination of reservoir of infection, complete cure of cases & prevention of disease transmission by destruction of vectors.

To eradicate malaria in certain area **4 phases** have to be done:

- 1. Preparatory phase:** preparation, planning surveying to study vector & magnitude of problem.
- 2. Attack phase:** complete coverage of area by insecticides. D.D.T. is applied twice a year during period of malaria transmission.
- 3. Surveillance system** for early case finding & presumptive treatment with chloroquine of any case with fever & completion of treatment in +ve blood film cases.
- 4. Consolidation phase:** insecticides are stopped & continue with presumptive & radical treatment.

THANK YOU