MALARIA

INTRODUCTION

- CAUSES 1-3 MILLION DEATHS A YEAR (MAINLY CHILDREN). IT REMAINS A MAJOR BURDEN IN TROPICAL COUNTRIES.
- MALARIA MEANS MAL AIR NEAR SWAMPS.

PARASITE

- GENUS : PLASMODIUM (SPOROZOA)
- SPECIES : (HUMANS) VIVAX – FALCIPARUM – MALARIAE – OVALE.
- Plasmodium knowlesi (monkeys and humans)
- Mainly in South East Asia.

HOSTS

- PRIMARY HOST : HUMANS
- ASEXUAL MULTIPLICATION : SCHIZOGONY
- INTERMEDIATE HOST : FEMALE ANOPHELES MOSQUITO.
- SEXUAL MULTIPLICATION : SPOROGONY.

LIFE CYCLE

- SPOROZOITE IN MOSQUITO SALIVA
- BLOOD STREAM
- LIVER – CIRCUMSPOROZOITE PROTEIN (CSP)
- SCHIZOGONY IN HEPATOCYTE LEADING TO MEROZOITES.
- INCUBATION PERIOD 2 WEEKS CAN BE UP TO 6 WEEKS IN P. MALARIAE.
- EXTRAERYTHROCYTIC STAGE.

LIFE CYCLE

- E-E STAGE FINISHES BY THE RELEASE OF MEROZOITES INTO BLOOD.
- BUT IN CASES OF INFECTION WITH P. VIVAX AND OVALE A QUIESCENT FORM (HYPNOZOITES) MAY REMAIN IN THE LIVER
- THESE MAY LEAD TO RELAPSE OF DISEASE.

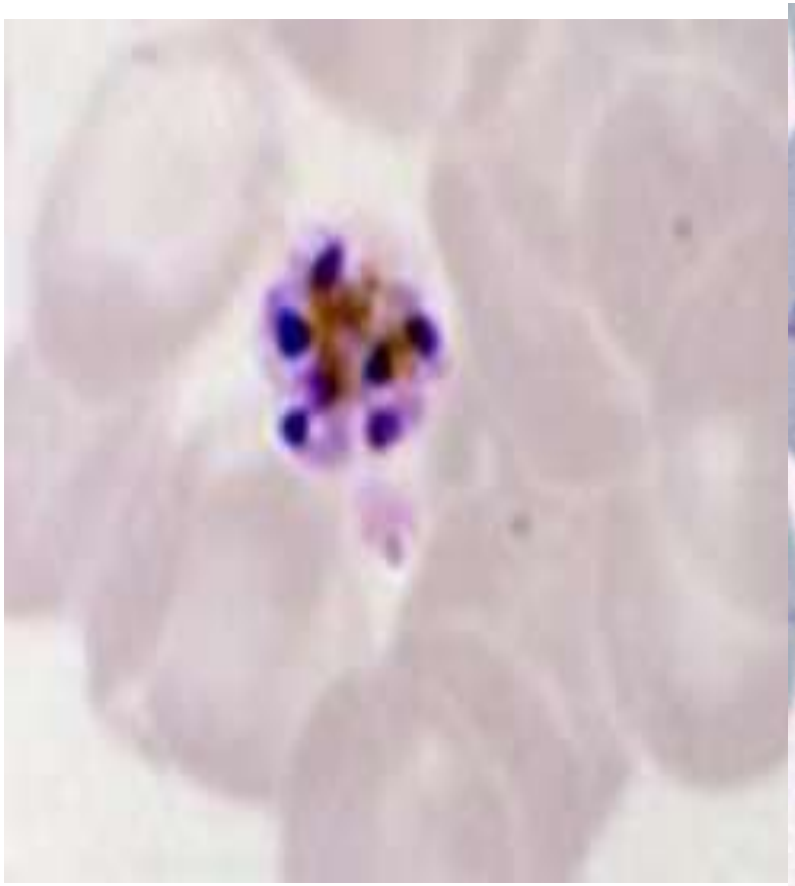
LIFE CYCLE

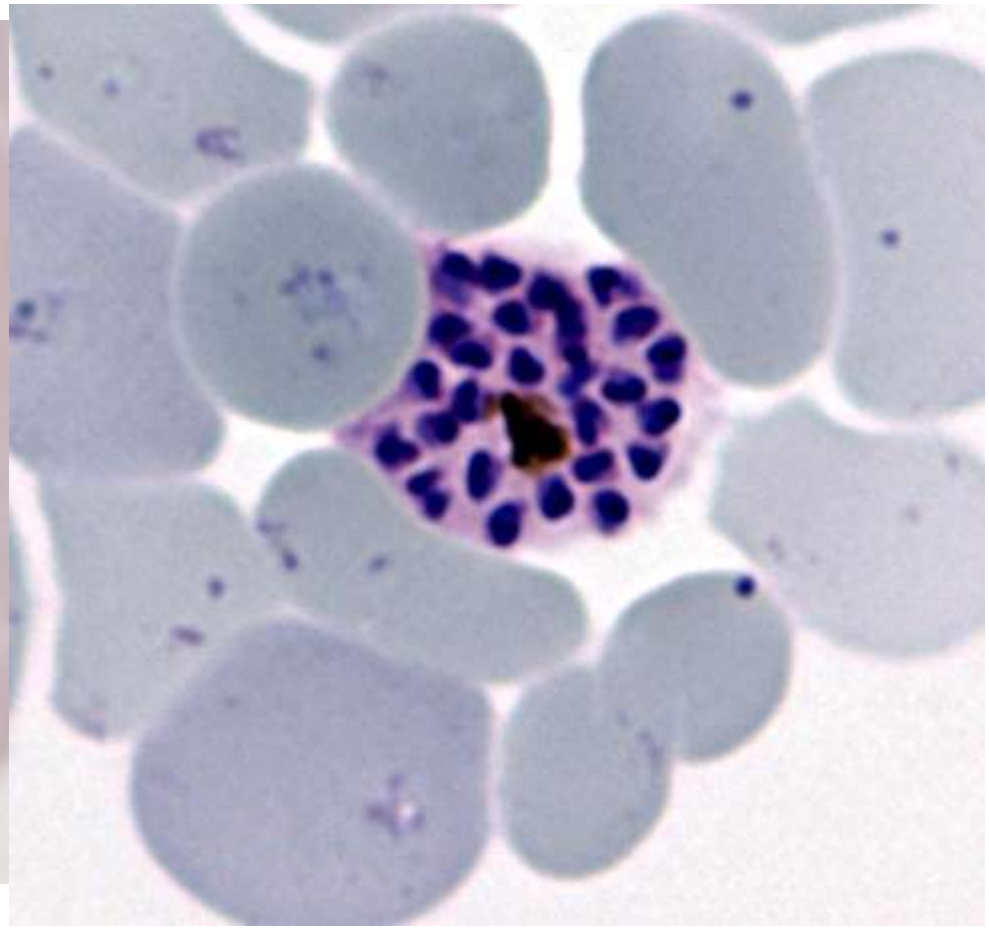
- MEROZOITES ARE RELEASED INTO BLOOD
- INVADE RBCs
- SPECIFIC RECEPTOR ON RBC : DUFFY BLOOD GROUP ANTIGEN FOR P. VIVAX, SIALOGLYCOPROTEINS FOR OTHERS.
- VIVAX AND OVALE INFECT YOUNG RBC, P. MALARIAE INFECTS OLD RBC, WHILE P. FALCIPARUM AFFECTS ALL CELLS.
- TROPHOZOITE, RING SHAPED.

LIFE CYCLE

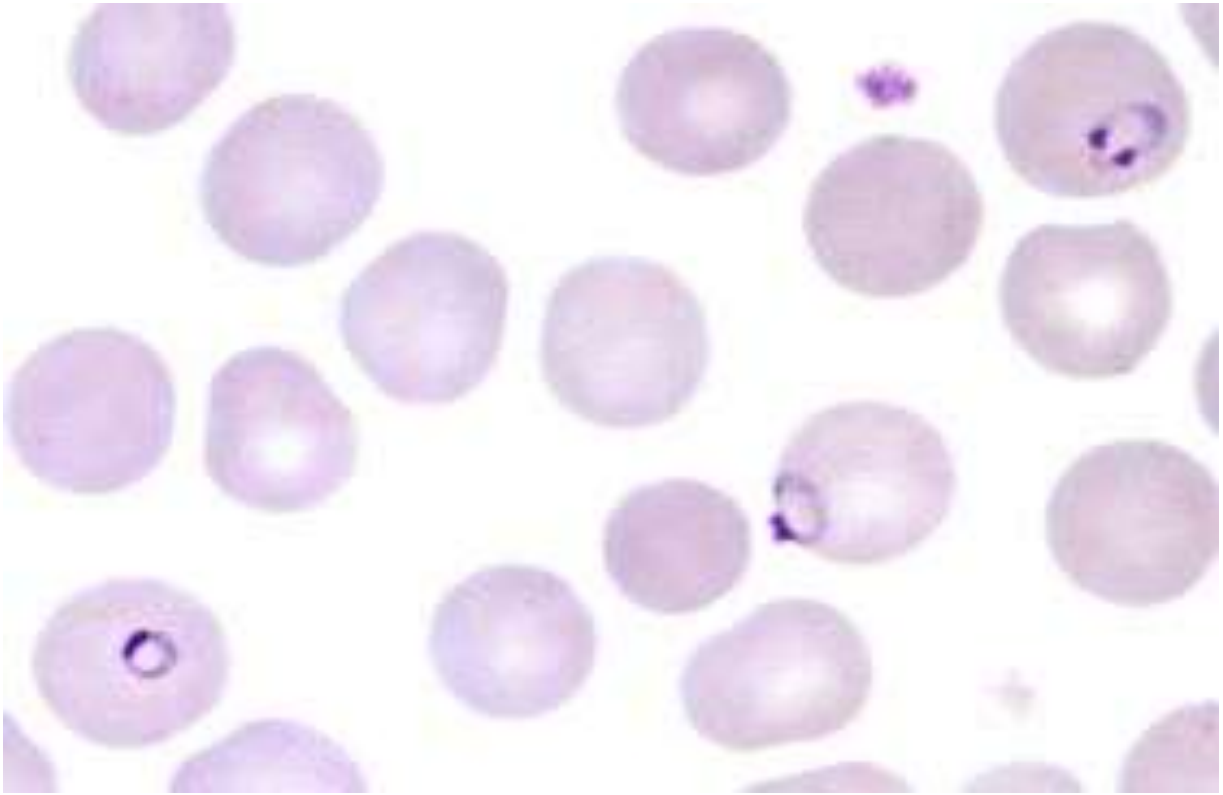
- SCHIZONT
- MEROZOITES
- HAEMOGLOBIN IS DEGRADED.
- HAEMOZOIN : MALARIA PIGMENT.
- INTRAERYTHROCYTIC STAGE
- DURATION 48 HOURS VIVAX, FALCIPARUM, OVALE.
- 72 HOURS FOR P. MALARIAE SPECIES.

Schizont: Hepatic Stage

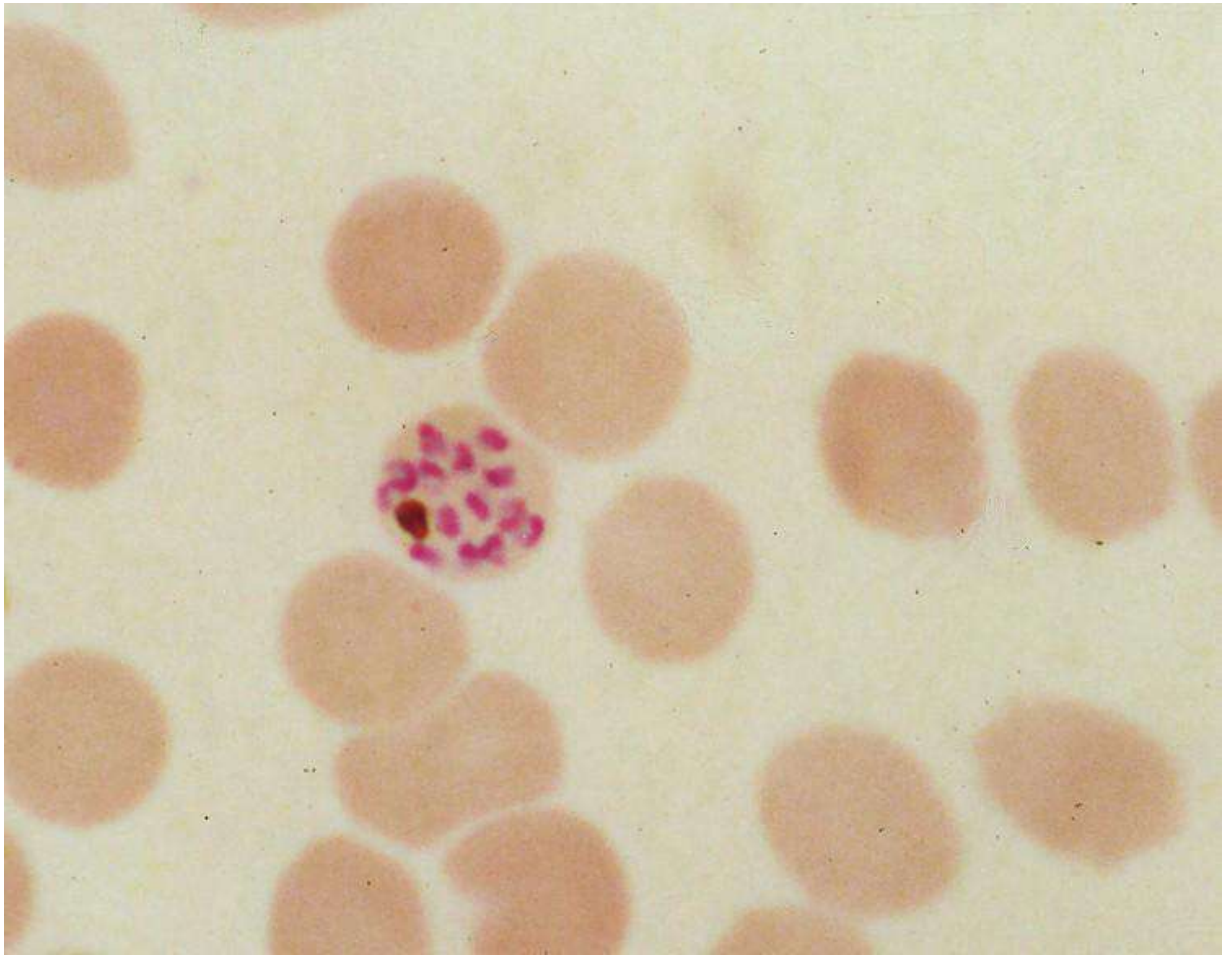




Blood Phase: Rings



HAEMOZOIN



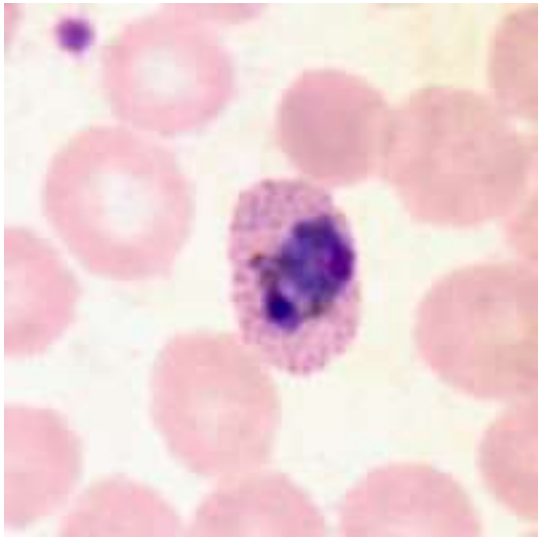
LIFE CYCLE

- PARASITE MOLECULES APPEAR ON THE SURFACE OF RBC S.
- IN P. FALCIPARUM THESE SERVE AS ADHESION MOLECULES BETWEEN RBC S (ROSETTING) AND THROMBUS FORMATION.
- OR ADHESION TO VASCULAR ENDOTHELIUM (SEQUESTRATION) AND BLOCKAGE.

LIFE CYCLE

- RBCs RUPTURE RELEASING MEROZOITES INTO BLOOD.
- RELEASED MEROZOITES INVADE FRESH RBCs AND CONTINUE THE CYCLE.
- SCHUFFNER GRANULES : VIVAX AND OVALE.
- MAURER SPOTS : FALCIPARUM.

SCHUFFNER GRANULES



LIFE CYCLE

- THE DEGREE OF PARASITAEMIA i.e. THE NUMBER OF INFECTED RBC s VARIES WITH THE SPECIES , USUALLY 2 – 3 %.
- IN P. FALCIPARUM IT COULD BE 40 % BUT MOST OF INFECTED RBCs WOULD BE SEQUESTRATED IN THE VISCERA.

LIFE CYCLE

- SOME MEROZOITES DO NOT DEVELOP INTO SCHIZONTS.
- INSTEAD THEY GROW TO BECOME GAMETOCYTES. (MALE AND FEMALE)
- RBC s CONTAINING GAMETOCYTES ARE SUCKED BY THE NEXT MOSQUITO FEEDIND ON THE PATIENT.

Life cycle

- IN THE GUT OF THE MOSQUITO THE MICROGAMETCYTES AND MACROGAMETOCYTES FUSE TO GIVE RISE TO A ZYGOTE.
- THESE DIVIDE ASEXUALLY EVENTUALLY PRODUCING SPOROZOITES WHICH MIGRATE TO THE SALIVARY GLANDS.
- THIS IS SPOROGONY.

PLASMODIUM LIFE CYCLE

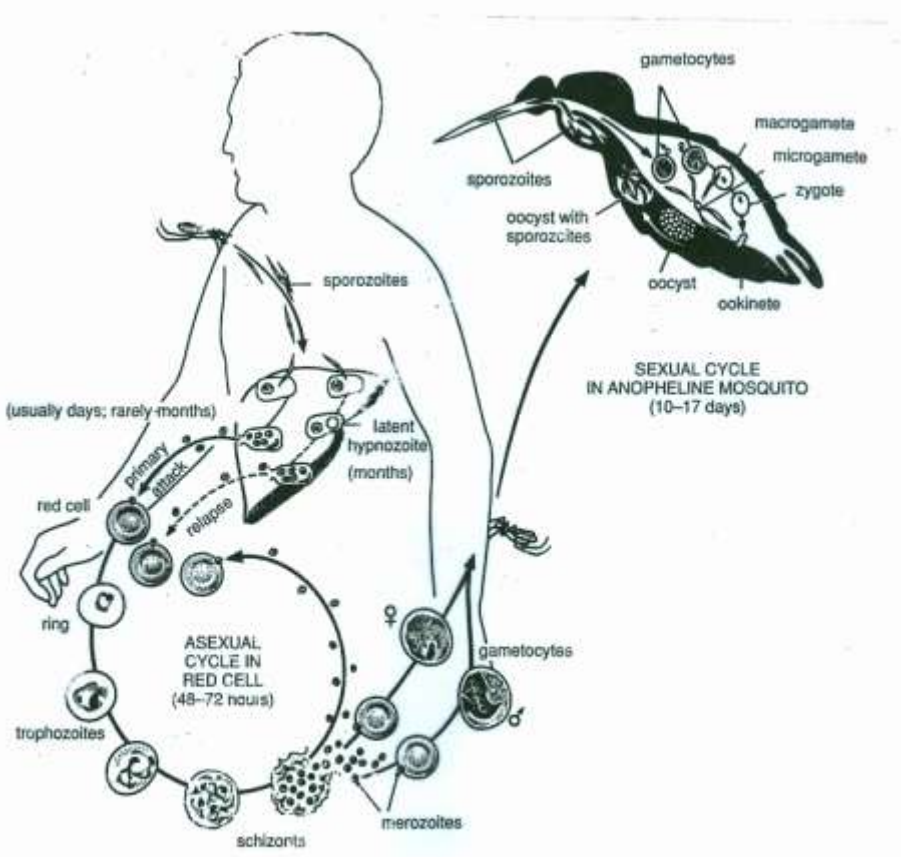


Figure 4–15. Life cycle of human malaria parasites.

CLINICAL DISEASE

- THE HALLMARK OF THE DISEASE IS THE FEVER
- THIS COINCIDES WITH RUPTURE OF RBC AND RELEASE OF DEBRIS AND ANTIGENS.
- WITH SYNCHRONISATION THIS OCCURS AFTER TWO DAYS OF RELATIVE LACK OF ILLNESS IN P. VIVAX, OVALE AND FALCIPARUM HENCE TERTIAN MALARIA.

CLINICAL DISEASE

- WITH P. MALARIAE THIS OCCURS AFTER 3 DAYS i.e. ON THE FOURTH DAY HENCE THE TERM QUARTAN MALARIA.
- FALCIPARUM : MALIGNANT TERTIAN MALARIA. VERSUS BENIGN TERTIAN MALARIA.
- EXTENSIVE PARASITAEMIA LEADS TO ASYNCHRONISATION IN P. FALCIPARUM.

CLINICAL SYMPTOMS

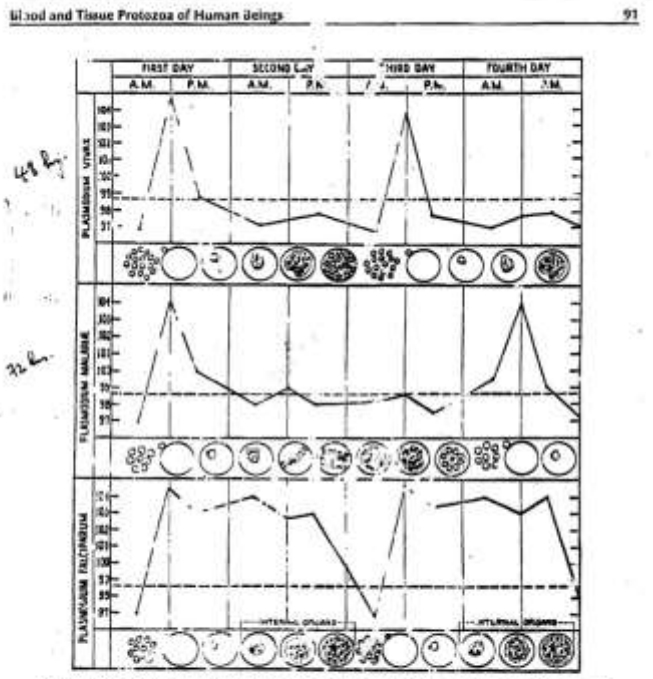


Figure 4-11. Temperature curves in malaria showing relation to growth and schizogony of malarial parasites.

SYMPTOMS

- THE PAROXYSM STARTS WITH CHILLS AND SHIVERING FOR 1-3 HOURS.
- FOLLOWED BY HIGH FEVER.
- MALAISE, HEADACHE, NAUSEA, VOMITING
- FOLLOWED BY DIAPHORESIS (EXCESSIVE SWEATING) AND DROPPING OF TEMPERATURE BACK TO NORMAL.

SYMPTOMS

- OTHER CLINICAL MANIFESTATION :
- JAUNDICE. HAEMOGLOBINURIA : BLACK WATER FEVER.
- ANAEMIA
- HYPOGLYCAEMIA.
- SPLENOMEGALY.
- ACUTE TUBULAR NECROSIS.
- IMMUNE COMPLEX GLOMERULONEPHRITIS.
- CEREBRAL MALARIA

SYMPTOMS

- RECURRENCE :
- RELAPSE : HYPNOZOITES.
- RECRUDESCENCE : PLASMODIUM malariae.

- CERTAIN GENETIC CONDITIONS WHICH HAVE SIMILAR DISTRIBUTION TO MALARIA ARE BELIEVED TO AFFORD PROTECTION AGAINST THE DISEASE.
- THALASSAEMIA, SICKLE CELL ANAEMIA, GLUCOSE 6 PHOSPHATE DEHYDROGENASE DEFICIENCY.
- MECHANISM.

MECHANISM

- SICKLE CELL : ACTIN FILAMENTS IN NORMAL RBC FORM A BRIDGE TO TRANSPORT FALCIPARUM ADHESION MOLECULES TO SURFACE. THIS DOES NOT OCCUR IN SICKLE CELLS.
- G6PDD FREE OXYGEN RADICALS ACCUMULATE KILLING THE PARASITE. STRESSED RBC IS PHAGOCYTOSED QUICKLY.
- THALASSAEMIA : RBCs ARE MORE NUMEROUS WITH LESS Hb THIS PROTECTS AGINST THE

MECHANISM

- DEVELOPMENT OF ANAEMIA.

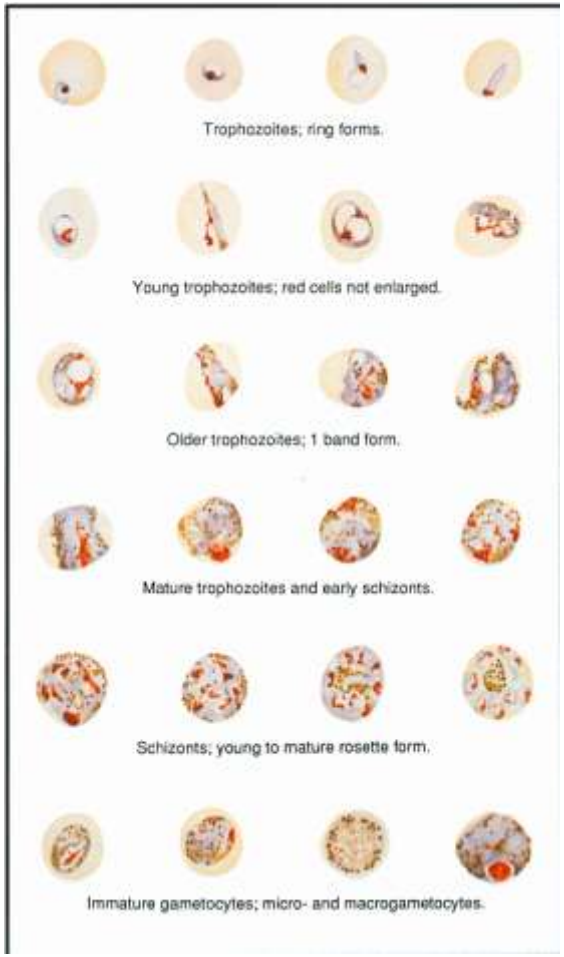
DIAGNOSIS

- BLOOD SMEAR : GIEMSA STAIN.
- PREFERABLY MORE THAN ONE SAMPLE.
- THICK SMEAR.
- THIN SMEAR
- P. vivax : large RBC (probably because it infects reticulocytes), Schuffner granules, variable shapes of trophozoite (amoeboid), schizont 16 merozoites.
- P. malariae : band form, rosette (8) schizont, small RBC (not enlarged)(old).

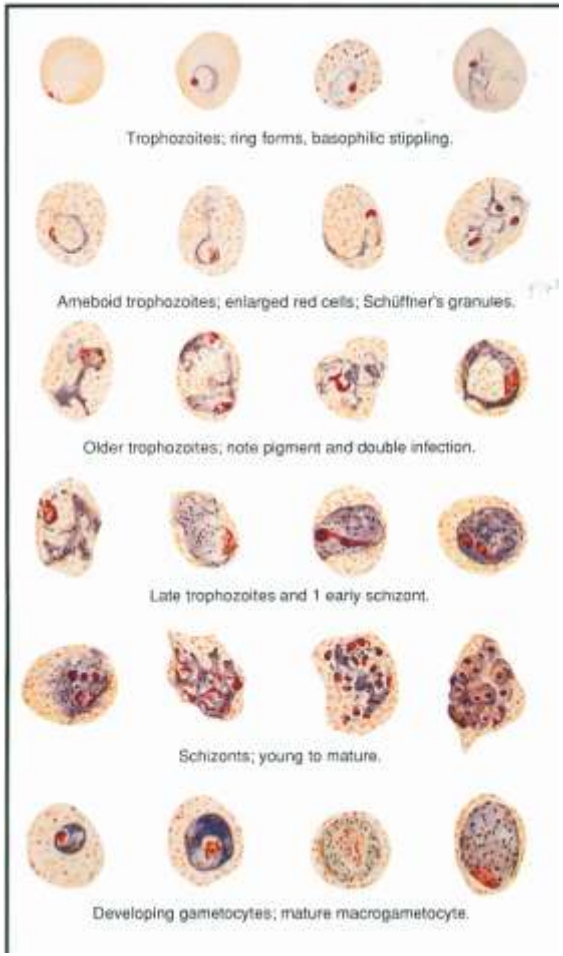
DIAGNOSIS

- P. falciparum : double infection, double dots on ring form, schizonts not seen in peripheral blood, banana shaped gametocytes, Maurer (comma shaped) dots.
- P. ovale : distorted RBC (oval), irregular edges, Schuffner granules

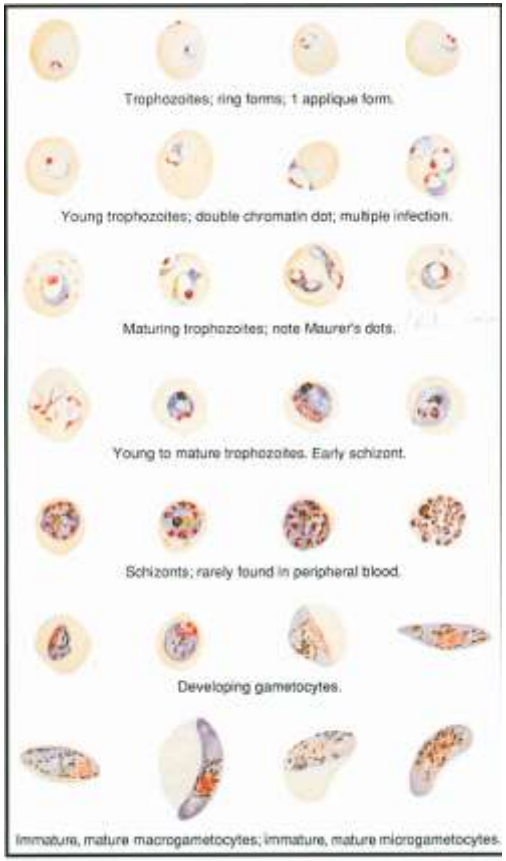
DIAGNOSIS


Trophozoites; ring forms.
Young trophozoites; red cells not enlarged.
Older trophozoites; 1 band form.
Mature trophozoites and early schizonts.
Schizonts; young to mature rosette form.
Immature gametocytes; micro- and macrogametocytes.

DIAGNOSIS

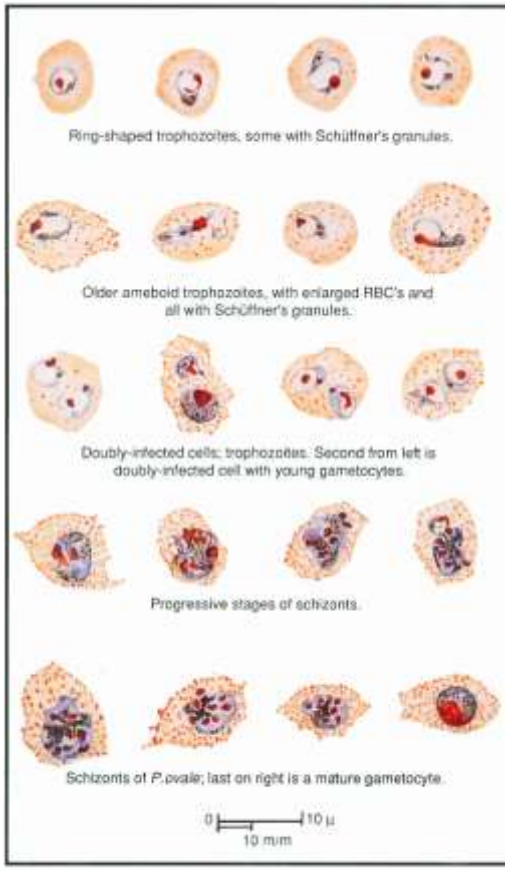

Trophozoites; ring forms, basophilic stippling.
Ameboid trophozoites; enlarged red cells; Schüffner's granules.
Older trophozoites; note pigment and double infection.
Late trophozoites and 1 early schizont.
Schizonts; young to mature.
Developing gametocytes; mature macrogametocyte.

DIAGNOSIS



Plasmodium falciparum

DIAGNOSIS



Plasmodium ovale

MANAGEMENT

- PREVENTION :
- ERADICATION OF VECTOR : INSECTICIDES, DRAINAGE OF SWAMPS.
- USE OF INSECT REPELLENTS AND BED NETS.

MANAGEMENT

- DRUG PROPHYLAXYSIS :
- ANTIMALARIAL DRUGS LIKE CHLOROQUINE TAKEN 1 WEEK BEFORE, DURING STAY AND 4 WEEKS AFTER RETURN.
- NO EFFECTIVE VACCINATION
- TREATMENT : BLOOD STAGE, LIVER STAGE.

BABESIOSIS

- CAUSED BY A PROTOZOAN BABESIA
- DISEASE OF ANIMALS : e.g. HORSES, CATTLE
- BABESIA microti MAY INFECT HUMANS.
- INTERMEDIATE HOST IS A TICK.
- SIMILAR CLINICAL DISEASE TO MALARIA.
- SPOROZOITES INVADE RBCs – TROPHOZOITES – MEROZOITES.

BABESIOSIS

- SOME MEROZOITES DEVELOP INTO GAMETOCYTES TO BE TAKEN UP BY THE TICK TO BECOME SPOROZOITES THROUGH SEXUAL REPRODUCTION.
- DIAGNOSIS : BLOOD SMEAR, TETRADS OF MEROZOITES (MALTESE CROSS) LACK OF PIGMENT IN RBCs.
- IMMUNOFLUORESCENCE.