Describe the life cycle of plasmodium? Add a notes on prevention of malaria.

Introduction:- Human body suffer from so many diseases. Majority of diseases are caused by Parasites belonging to bacteria, Viruses, protozoans and helminthes.

Malaria is one of the several diseases of man which is caused by a protozoan parasite of genus plasmodium. This parasite causes different types of malaria. The life cycle of malaria parasites completed in two hosts. Man and female anopheles.

Parasitic Nature of plasmodium:-

1. It is a protozoan human parasites
2. It is a digenetic parasite as it has two hosts man and female anopheles.
3. It is a pathogenic parasite of man as it causes malaria.
4. It is a cytozoic parasite of man as it lives in RBC and liver cells.
5. It is a endoparasite.

Host of plasmodium:-

The plasmodium has three types of hosts, through the life cycle is completed in two hosts:—

1. Primary host - Man.
2. Secondary host or, intermediate host or, vector or, carrier host — female anopheles.
3. Reservoir host:- Monkey and chimpanzees.

Species of plasmodium and types of Malaria:-

There are four species under genus plasmodium which causes four types of malaria:—

1. Plasmodium Vivex:— Benign tertian malaria.
2. plasmodium ovale:- Benign tertian malaria.
3. plasmodium falciparum:- Malignant tertian or, ~~Easter~~ Subertian or, Aestivo - autmal or,

pernicious or, Cerebral malaria.

A. plasmodium malariae :- Quartan malaria.

In tertian malaria, the fever is repeated after 48 hours i.e on 3rd day.
In quartan malaria the fever is repeated after 72 hours i.e on 4th day.

Systematic position of Malarial parasite :-

Kingdom - Animalia.
phylum - protozoa.
Sub-phylum - plasmodroma.
class - Sporozoa.
order - Haemosporidida.
Genus :- plasmodium.
Species :- P. Vivex.

Life cycle in Man :-

The life cycle of plasmodium also known as "cycle of Golgi" and it is asexual phase.
In man the life cycle may be devided into following phases :-

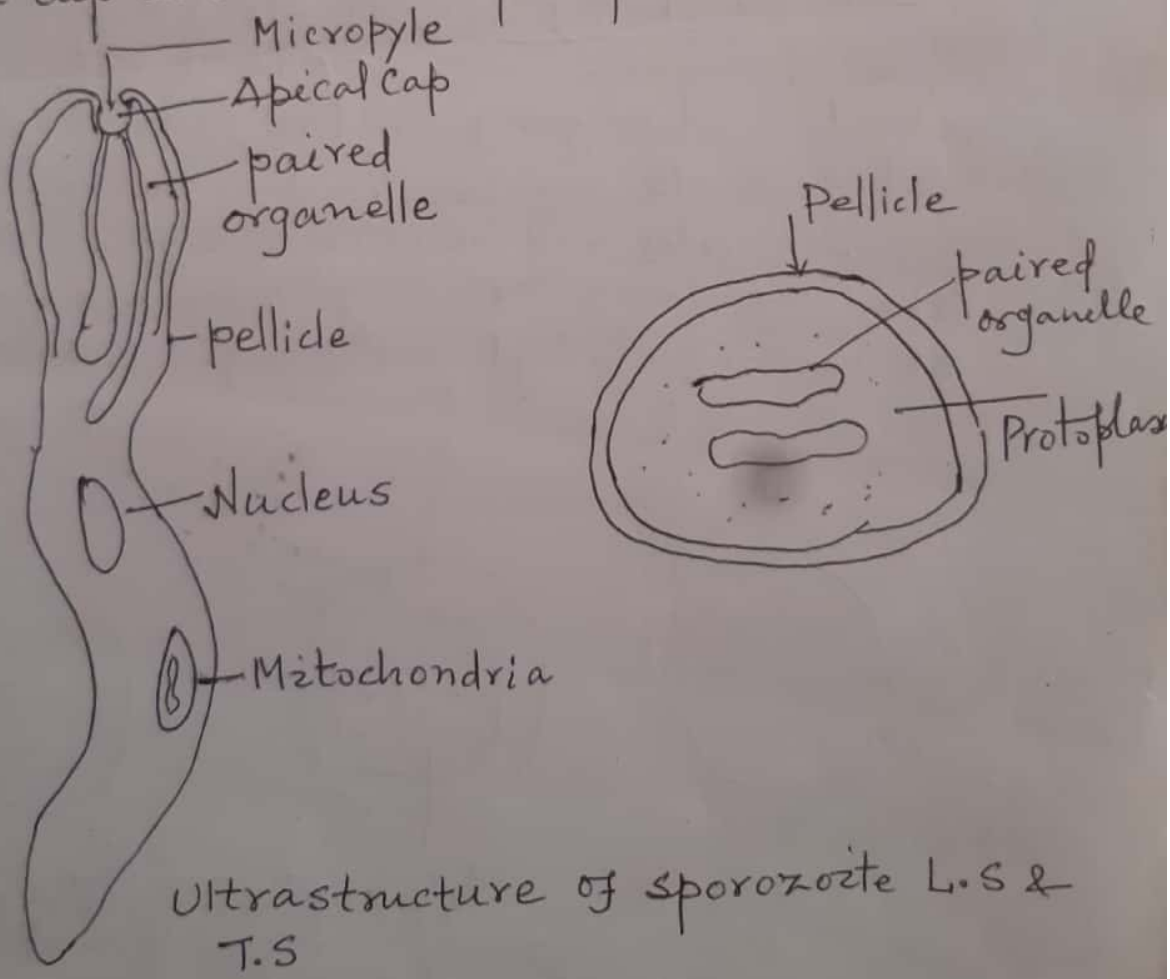
A. Infection
B. Liver Shizogony :- 1. Pre-erythrocytic cycle
2. Exo - erthrocytic cycle.
C. Blood shizogony :- Erythrocytic cycle.
D. Formation of gametocytes.

A. Infection :- (1) When an infected female Anopheles bites a man to suck the blood, it pours Saliva to prevent the clotting.

2. The saliva contains number of Sporozoites which enters the blood stream.
3. Thus the route of infection is cutaneous and mode of infection is innoculative.
4. The sporozoites are infective stage for man.

Structure of Sporozoites :-

1. Sporozoites are spindle shaped single called organism measuring 6μ to 15 μ.
2. It is uninucleated double walled form. The wall is pellicle and has peripheral fibrils in it.
3. The anterior end has an aperture known as micropyle which leads to apical cup.
4. There is a paired organelle associated with apical cup and anterior protoplasm.



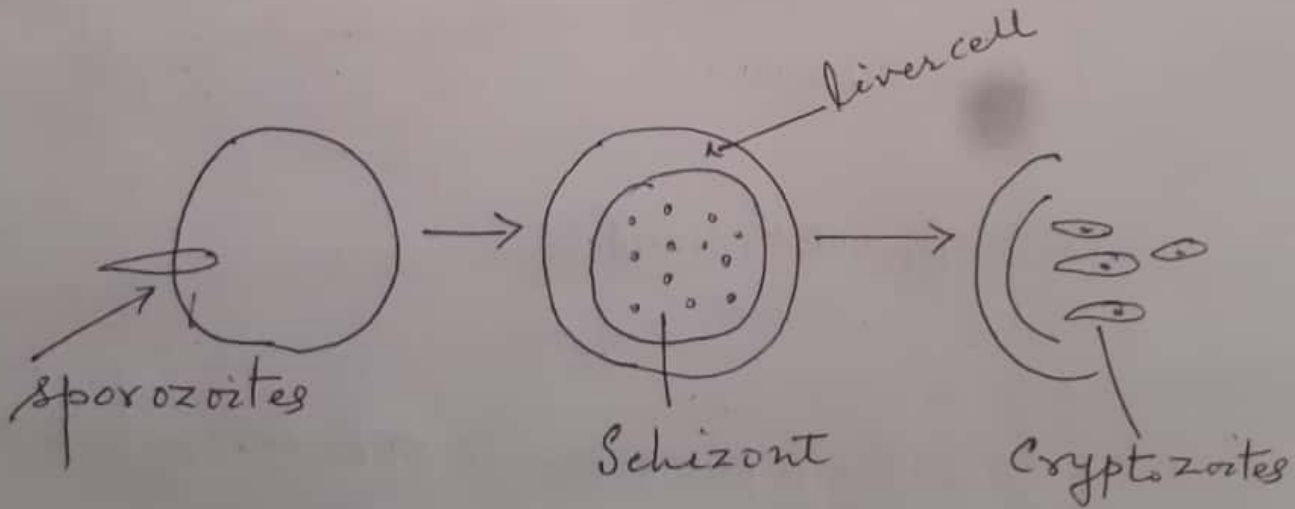
Ultrastructure of sporozoite L.S & T.S

The Sporozoites remain the blood for ½ an hour and then all goto liver (Shortt and Garnham 1948)

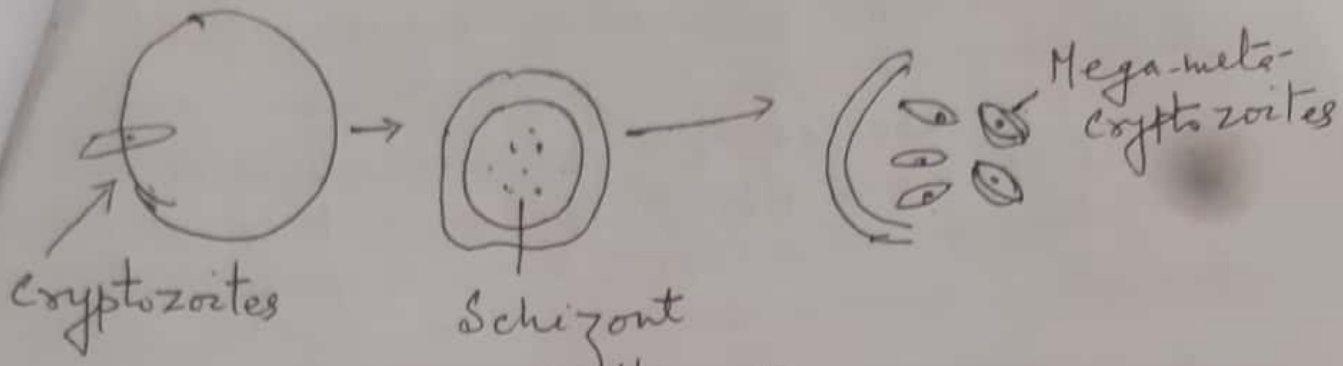
Liver schizogony – Sporozoites now [redacted] start multiplication in liver cells. There are two cycles in liver.

(A) Pre-Erythrocytic Cycle: – Sporozoites after entering the liver cells, become round. The nucleus devides into many nuclei. This multinucleated stage is known as schizont. Each nuclei become one animal. Finally they burst the liver cells and thousands of cryptozoites are released.

(B) Exo-Erythrocytic cycle – The cryptozoites released, again enter new liver cells and repeated schizogony. In this cycle two types of individuals are produced — micro-meta-cryptozoites and macro meta cryptozoites. The megacarry exo-erythrocytic cycle where as micro-meta cryptozoites enters the blood.



Pre-Erythrocytic cycle

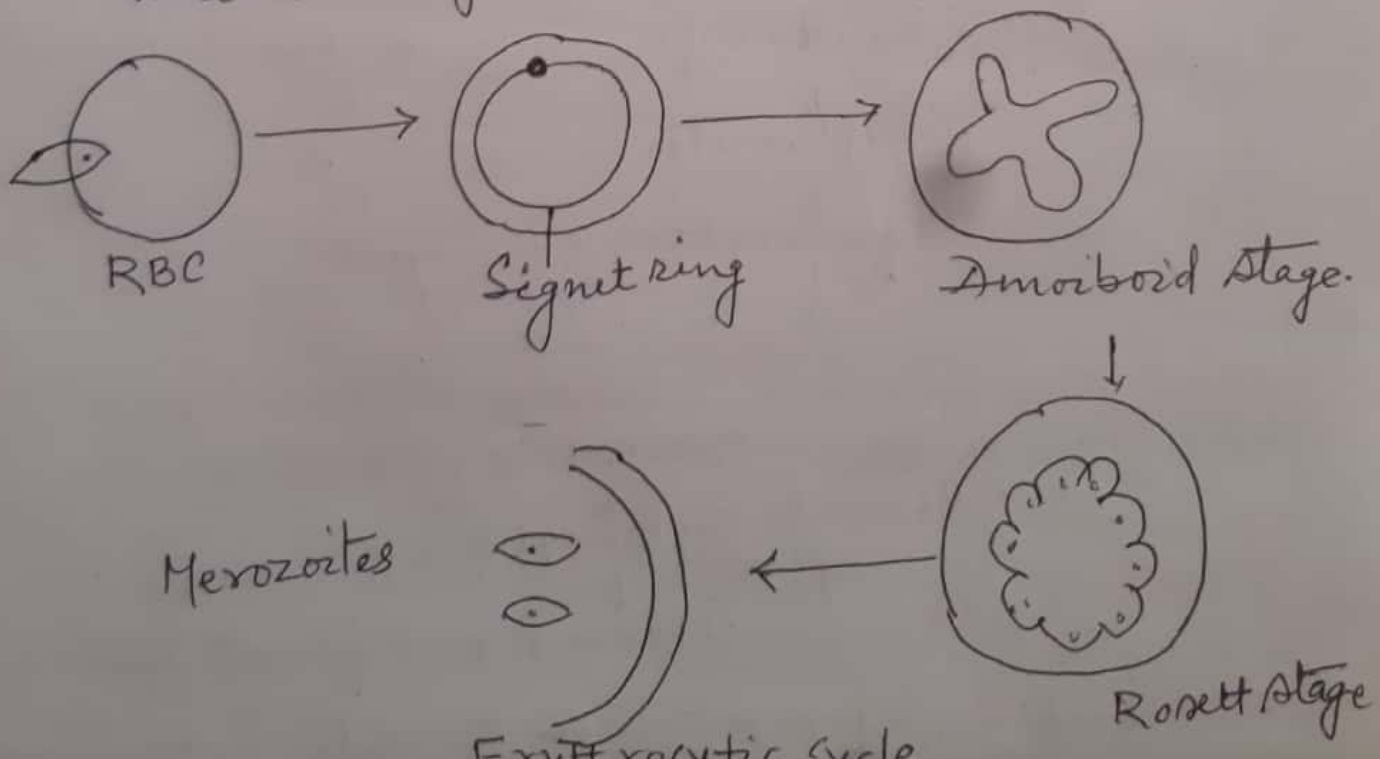


Exo-Erythrocytic cycle

Exo-Erythrocytic Cycle

Blood Schizogony - Erythrocytic cycle:-

1. Micrometacryptozoites now becomes trophozoites and enters the RBC (erythrocyte)
2. The trophozoites feed upon haemoglobin and multiply.
3. It passes through signet ring stage, amoeboid stage and rosett stage.
4. Finally RBC breaks to release many merozoites.
5. The haemoglobin is broken to "haemozoin" which is an yellow toxin causing fever.



The merozoites again enter new RBC and repeat the cycle after every fourty eight hours. So fever is repeated after 48 hours. This causes fever and distruction of RBCs. It takes about 10-12 days from mosquito bites to fever. This period is known as incubation period

Formation of Gametocytes:-

After many cycle of erythrocytic phase, number of RBC is reduced and become less than the number of merozoites. So merozoites change the cycle and become gametocytes. There are two type of gametocytes micro and mega. They require low temp. for further development. If a female anopheles sucks the blood of such person, the gametocytes are taken. Gametocytes continue the cycle in mosquito.

Sporozoites
↓
Into human blood through saliva.
↓
Pre-Erythrocytic cycle in man
↓
Cryptozoites
↓
Exo-Erythrocytic cycle
↓
Macrometa cryptozoites → Erythrocytic cycle → Merozoites → Gametocytes

Micrometa cryptozoites → Erythrocytic cycle → Merozoites → Gametocytes

Graphic representation of cycle in man.

Life cycle of plasmodium in female Anopheles:-

Female anopheles is the secondary or, carrier or, vector or, intermediate host of plasmodium. The plasmodium completes the sexual cycle in this host. No disease is caused to anopheles. The cycle in mosquito include following stages:—

(A) Sucking of gametocytes from man.
(B) Gamete formation and fusion.
(C) Sporogony

Sucking of gametocytes from man:-

When a healthy female anopheles sucks the blood of man suffering from malaria, it sucks the gametocytes also. Through the sucked blood, thousands of gametocytes are carried in.

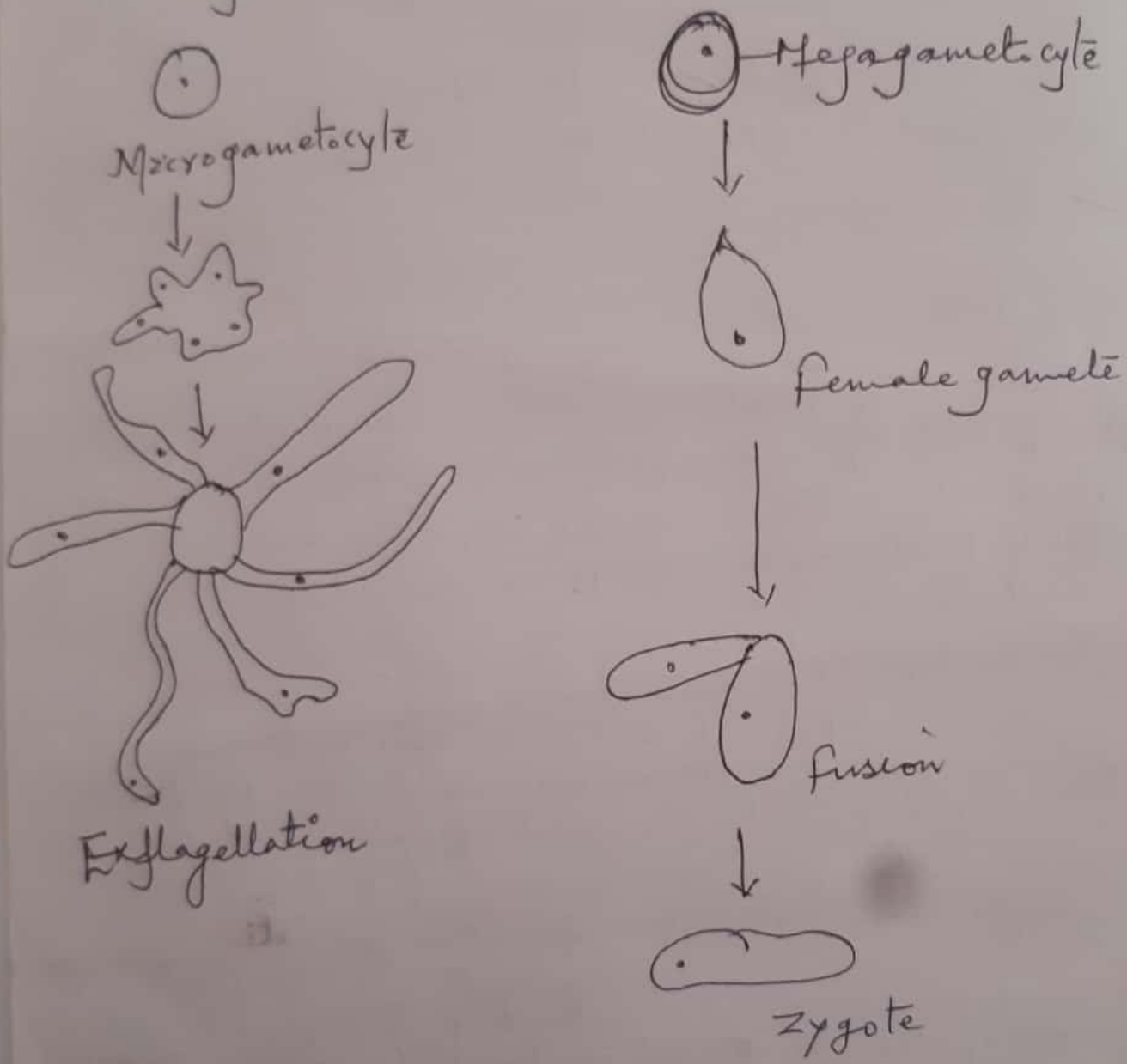
Gamete formation and fusion:-

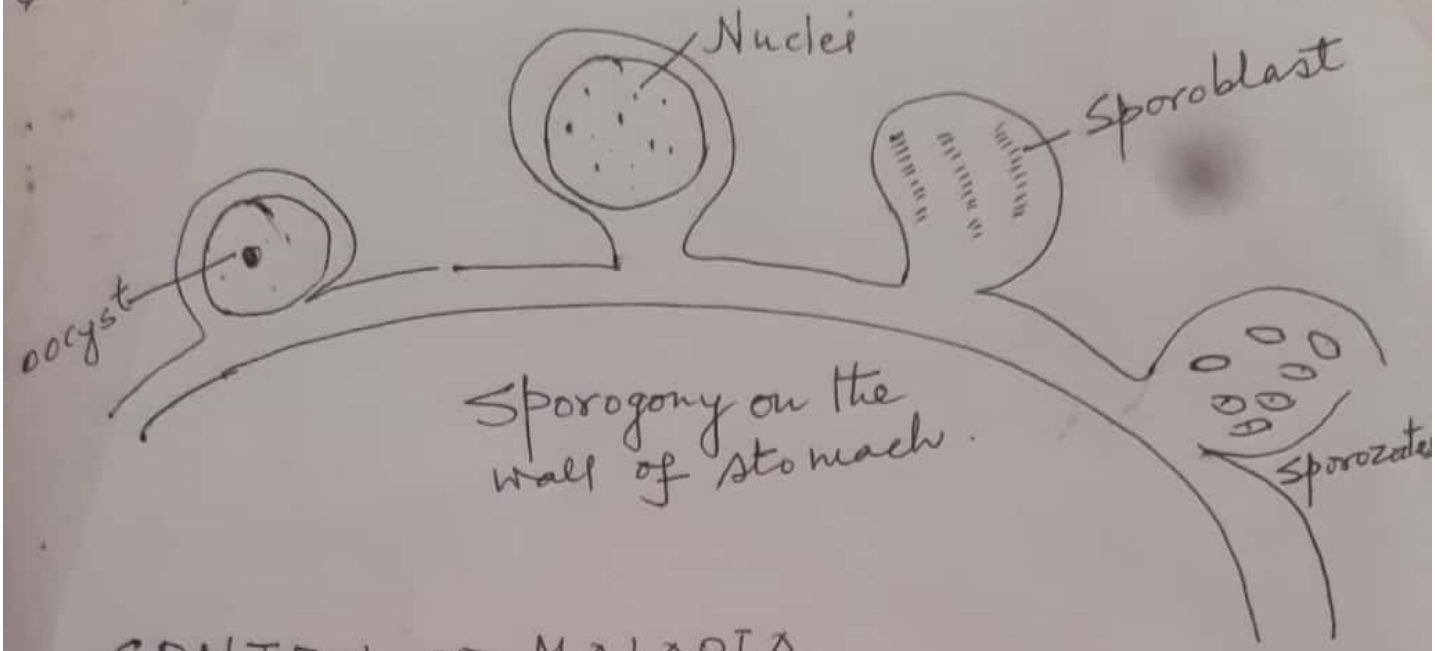
In the stomach of the anopheles, the gametocy pass through gametogenesis and form gametes. The microgametocytes produces many thread like male gametes by exflagellation. Megagametocytes form female gamete The zygote formed becomes Ookinet and penetrate stomach wall and form Oocyst. Many Oocytes appear on the wall of stomach.

Recent studies by Howar (1960) suggested that Ookinetes are dying zygotes which fail to penetrate the wall of stomach.

Sporogony:- Oocyst now start multiple fission. Numerous nuclei formed in it become sporozoites. More than 1000 sporozoites are produced in one Oocyst, when the Oocyst bursts sporozoites find their way to salivary gland.

Now the mosquito is ready to infect a man.





CONTROL OF MALARIA

1. Destruction of mosquitoes by the use of the insecticides, by larvivorous fishes and by spray of oil on water.
2. Prevention from mosquito bite and
3. proper treatment.

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