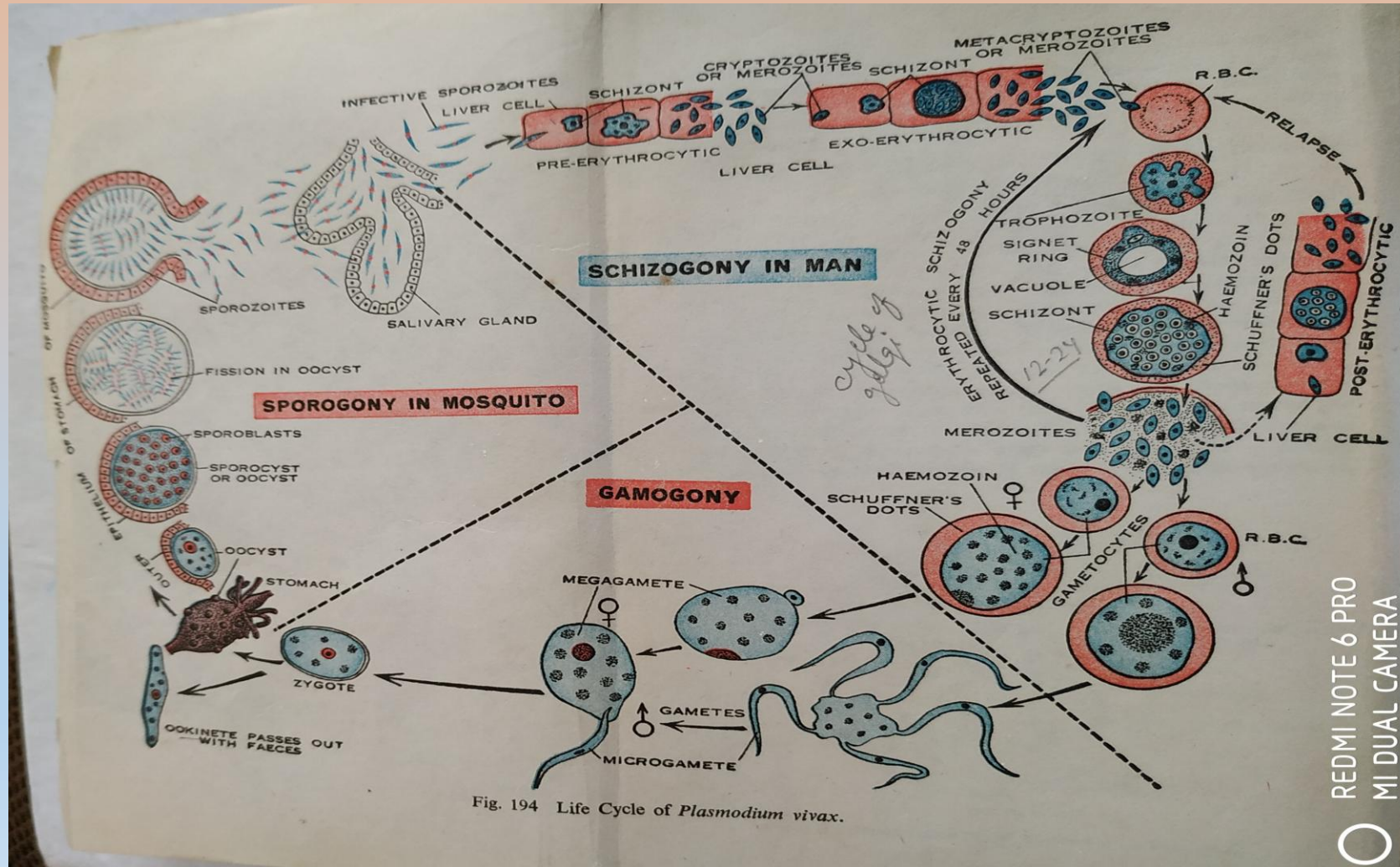


Life History of Plasmodium

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- *Plasmodium vivax* is a Malarial parasite,
- Is an intracellular blood parasite of human and other vertebrates
- It belongs to class Sporozoa of phylum Protozoa
- It is an endo-parasite which lives within the red blood corpuscles of human
- Mode of transmission to human by the bite of an infected female Anopheles.
- Anopheles is the intermediate host where the sexual cycle occurs
- Human act as a definitive host where asexual cycle occurs
- The parasite has no free living existence(obligate Parasites)
- Mode of transmission was worked out in Calcutta by Ronald Ross(1899)

Plasmodium vivax life cycle (Schematic Diagram)



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An Alteration of Generation

- Alteration of generation is associated with alteration of host
- There are three distinct cycles:
 1. The asexual cycles or Schizogony: The cycle produces merozoites which occurs in the RBC of human.
 2. The sexual cycle or sporogony: This cycle produced sporozoites inside Female *Anopheles*.
 3. The Gametogony or Formation of gametocytes: The cycle starts in RBC (Schizogony cycle) and is completed with the formation of sporozoites in mosquito (Sporogony).

Human cycle

- a) Inoculation: When an infected female Anopheles mosquito bites healthy person to feed on its blood, they spit in the place of bite and with sputum, numerous sporozoites enter into the blood stream along with saliva.
 - The sporozoites are small slightly curved, spindle-shaped or sickle shaped bodies with tapering ends.
- b) Pre-Erythrocytic Schizogony:
 1. Through this:
 - The sporozoite first goes to the parenchyma cells of the liver and remain within it for about **seven days**.
 - Each sporozoite develops into schizont, which carries an multiplication within the parenchyma cells is called Pre-erythrocytic cycle.

2. They multiply for first 4 days and 12000 merozoites are formed. The merozoites are very small consisting of very little amount of cytoplasm.

3. These merozoites may continue this cycle within liver sinusoids or may invade fresh parenchyma cells or attack the RBC to start erythro-cytic cycle.

c) Erythro-cytic Schizogony: it is divided into following stages-

1. Trophozoit Stage:

- After entering blood stream merozoites start invading RBC.
- Immediately each become rounded and disk-like and presents the Trophozoit stage.

2. Signet Ring Stage:

- A non-contractile Vacuole appears in its cytoplasm and it grows feeding the substance of the RBC.
- The nucleus is pushed on one side and parasite assume ring like structure.

3. Amoetageboid Stage:

- Later the vacuole disappears and the parasite assume an amoeboid stage.

4. Schizont stage:

- By thrusting its pseudopodia inside the cytoplasm of RBC, its feed upon the haemoglobin and increases the size to fill the entire corpuscles and form schizont. They secret haemozyme.

5. Merozoite Stage:

- As the parasite cannot grow in size it undergoes asexual multiplication. The nucleus divides into from 8-24 daughter individual and form merozoites.

6. Rosette Stage:

- The merozoites are found arranged towards the periphery and the haemozoin granules accumulate in the centre giving it an appearance of a rosette.

- After some time the totally exhausted erythrocyte bursts and the merozoites are liberated in the blood stream.
- The release of the merozoites is associated with the rise in temperature.
- The merozoites are oval in shape with a central nucleus.
- They attack new RBC and the erythrocytic Schizogony cycle is completed within 48-72 hours.

d) Post or Exo-Erythrocytic Schizogony:

- In this stage, they (merozoites) may continue to produce about 1000 exo-erythrocytic merozoites within the liver cells without any symptoms and may live for some years.
- After this dormant stage they may again become infective.
- These merozoites invade either fresh parenchyma cells or RBC.

e) Gametogony:

- Some of the Schizonts are modified and the resulting merozoites after entering the RBC do not form trophozoites.
- But grow slowly and specialized themselves as gamonts or gametocytes
- They are either male (Microgametocytes) or female (Macrogametocytes)
 - 1) Microgametocytes: These are more numerous but small in size(9-10 μ).
 - 2) Macrogametocytes: These are less numerous but larger in size(10-12 μ). Provided with a greater amount of dense cytoplasm.

Mosquito Cycle(exogenous or Sexual Phase)

- The female *Anopheles* takes a blood meal from the infected person
- Thus ingested both sexual and asexual forms
- The asexual form soon become digested
- The sexual forms survive and develop
- The gametocytes are set free by the rupture of RBC and develop further to form gametes.

a) Development of Microgametes(Male Gametes):

- The nucleus of microgametes divides repeatedly to form 8 haploid nuclei(Reduction division).
- Each nucleus is surrounded by a little of cytoplasm and metamorphoses into a male gametes.
- Five minutes after ingestion it become spherical and five to six filamentous motile appendages emerge.

- By the lashing movement of their flagella the male gametes swim in the stomach fluid.

b) Development of the Macrogametes (Female gametes):

- The Nucleus of the Macrogamete undergoes a reduction division forming two nuclei.
- One of them protrudes out as a polar body and the other develops into a single macrogamete.

c) Fertilization:

- The actively moving male gamete is attracted by the macrogamete and unite to form Zygote which is inert and round.
- Fertilization has been seen to occur within within 10 minutes after ingestion of blood and
- Completed within 20 minutes to 2 hours in the body of mosquito.

d) Sporogony:

1)

➤ Zygote moves actively inside the mid-gut and is known as Ookinete or Vermiculus and bore through the gut wall and come to rest under epithelium and the outer wall of stomach.

➤ Ookinete becomes round and encased in a covering or Cyst.

2) Ookinete secretes a thin membranous cyst wall and this stage is known as Sporont or Oocyst. It feed by absorption and increase size.

3) The nucleus divides repeatedly and ultimately large number of **sickle-shaped sporozoites** are formed from a single Oocyst.

i. Oocyst formation completed after 48 hrs. of ingestion

ii. After about 7 days a number of lobes are formed and sporogony occurs.

iii. Thousands of sporozoites are formed through meiotic division.

4) The Oocyst ruptured about 10 days from its formation and sporozoites liberated in the haemocoel of mosquito

5) They migrate to the salivary gland and female *Anopheles* becomes infective. The cycle in a mosquito is completed in about 2 week.