Plasmodium

Classification:-

Kingdom → Protista → (Unicellular, microscopic & eukaryotic)

Phylum → Protozoa → (1st formed, primitive animals)

Class → Sporozoa → (exclusively endoparasite, no locomotory organelle (no contractive vacoule), (body covered by pellicle) ↳ provide definite shape.)

Genus → Plasmodium

Species → Vivax, (also → falciparum, ovale, malariae)
- Vivax → most common
- falciparum → most dangerous
- ovale → concept only, not found in Nepal
- malariae → longest I.P. (28 days)

- Common name → Malarial Parasite

Introduction of Plasmodium Vivax

→ endoparasite, blood parasite, intracellular parasite, pathogenic parasite.
(Found in RBCs & liver cells of human, ↳ disease cause गर्ने)

→ Causative agent of Malaria i.e. plasmodium discovered by Charles laveron. [IOM]

→ ~~Dacy~~ Oocyst of Plasmodium formed in stomach wall of mosquito discovered by Ronald Ross.

→ Life cycle of Plasmodium completes in stomach of ~~m~~ F.A.M (sexual cycle)
was ~~disco~~ described by Bignami & Grassi.

Sperm + Ova —fuse→ Zygote ⟶ vermiform/worm like str.

vermiform → ookinete (motile diploid stage) —penerates gut wall & form→ oocyst (double walled)

→ Malaria is transmitted by the bites of FAM i.e. Malarial-mosquito relationship discovered by Ronald Ross.

- Vector → Female Anopheles Mosquito (FAM)
  ↳ रोग Transmit गर्ने agent

Key Points:-

- Infective stage of plasmodium to Human host → Sporozoite
- Infective stage of plasmodium to FAM → Gametocyte
- Most toxic substance → Haemozoin.
  ↳ (causes chills & fever)
- Motile diploid stage of plasmodium → Ookinete.
- Most active feeding stage of plasmodium → Trophozoite
- Causative stage of plasmodium → Trophozoite

→ Plasmodium is polymorphic (many stages), but 2 important stages are i.e. sporozoite and trophozoite.

Sporozoite 	Trophozoite 
→ is sickle or spindle shaped.	→ is rounded or oval shaped.
→ covered by pellicle.	→ is covered by 2-plasma membrane.
→ found in salivary glands of inf. FAM.	→ found in RBC of Human.
→ formed in oocyst but formed from sporoblast.	→ formed in RBCs, formed from micro metacryptomerozoite.
→ uninucleated, non-vacoulated.	→ uninucleated & vacoulated.
→ यदि infected FAM ले Healthy man लाई टोकदा → sporozoite inoculate गर्दि। ↳ so, infective stage to human host	→ Most active feeding stage. or, Voracious stage ↳ अत्यकारी
→ sprozoite secrete proteolytic enzyme to dissolve liver cells.	

Q. Which of the following can start asexual cycle in Human host?
→ Sporozoite.

Asexual cycle

- Asexual cycle of P. Vivax in Human host.

→ When an infected FAM bites to a normal man, large no. of sporozoites are inoculated into the blood stream of the human along with saliva. Sporozoites reached in liver cells via blood circulation and start asexual multiplication called schizogony.

↳ asexual multiple fission.

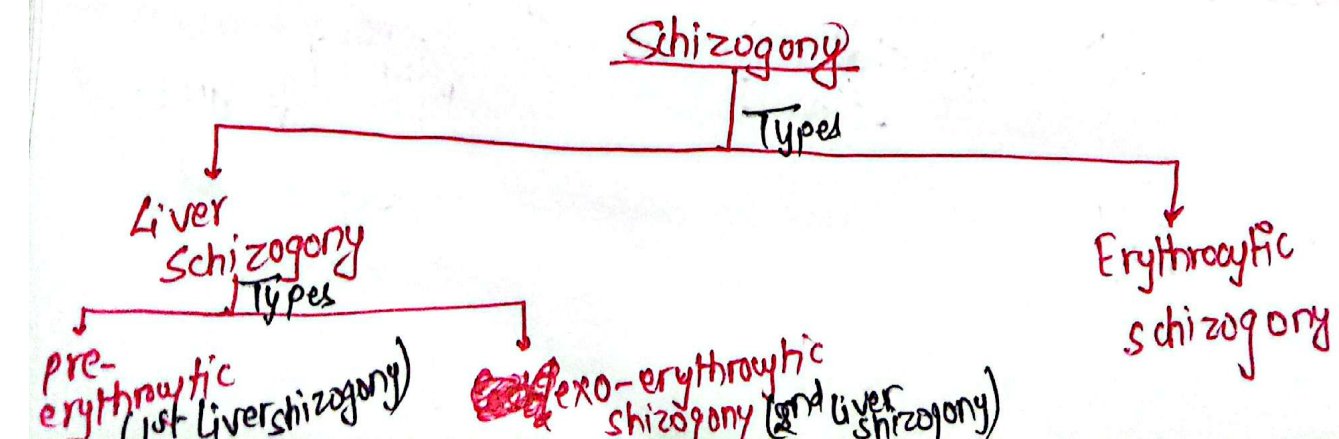
Q. common character found in plasmodium and paramecium is ?

(a) Nutrition (b) Locomotory organelles

(c) Both reproduce by fission (d) Habitat

Sporozoite 1st attack :-

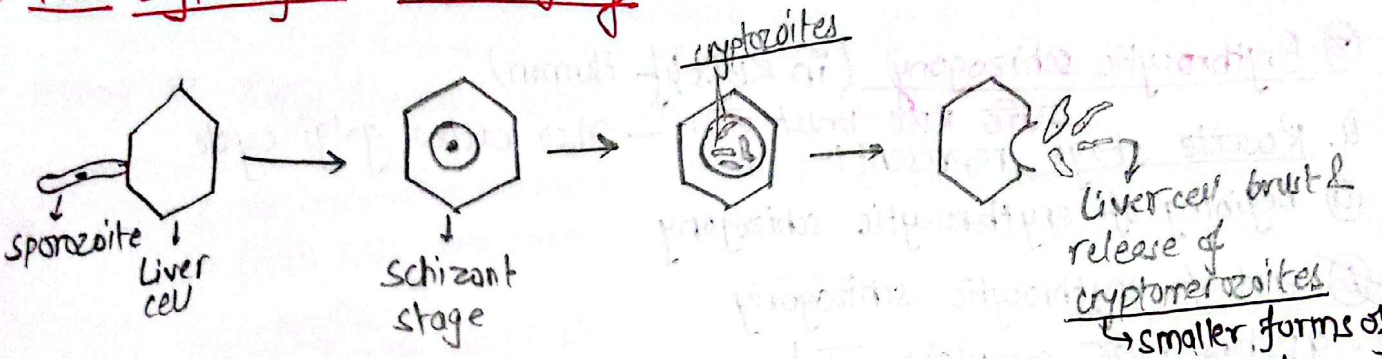
(a) WBC (b) RBC (c) Liver cell



Asexual cycle → ① Pre- E.S.
② Exo- E.S.
③ Erythrocytic S.
④ Post + E.S
⑤ Formation of Gametocyte.

Q. Which of the following can start pre-erythrocytic schizogony?
→ Sporozoite.

① Pre- Erythrocytic Schizogony

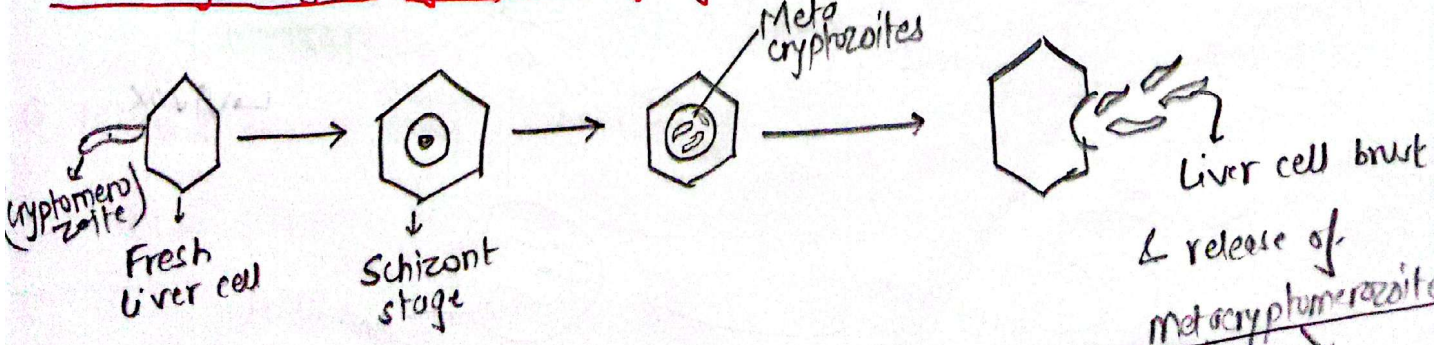


* Pre Erythrocytic schizogony takes place in liver cells.
* The resultant products of pre Erythrocytic S. → Cryptomerozoites

Q. Schizont stage formed in
ⓐ Liver cells only ⓑ RBC only
ⓒ Both ⓓ Salivary gland of FAM.

Note:- यदि मलाई Trophozoite stage, Signet ring stage, Amoeboid stage, rosette stage भनेर सोध्यो भने → RBC only वा Tick लाउँदु।
तर मलाई schizont stage भनेर सोध्यो भने → (RBC + Liver cells) दुवैमा Tick लगाउँदु।
→ This stage is resistant to drug.

② Exo-erythrocytic cycle / schizogony



Q. Which of the following can start Exo-erythrocytic schizogony
→ Cryptomerozoites

→ This cycle is absent in plasmodium Falciparum.

Note:- The micrometacryptomerozoites enter the RBCs to start erythrocytic schizogony while the macrometacryptomerozoites invades the fresh liver cells to continue the exo-erythrocytic schizogony.

- Liver schizogony completes within 10-12 days.
  (pre + exo)

③ Erythrocytic schizogony (in RBCs of Human).

Q. Rosette stage represent:- → यदि RBC brust भो. — Also called golgi cycle.

ⓐ begining of erythrocytic schizogony

ⓑ end of erythrocytic schizogony

- 48 hrs लाग्छ complete हुन्।
- Trophozoite stage ① (RBC only) → Signet ring stage ② → Amoeiboid stage ③ → Schizont stage ④ (both in liver cells & RBC) → Rosette stage ⑤ (RBC brust)

→ Single micro-metacryptomerozoite invades single RBC and passes through the above stages.

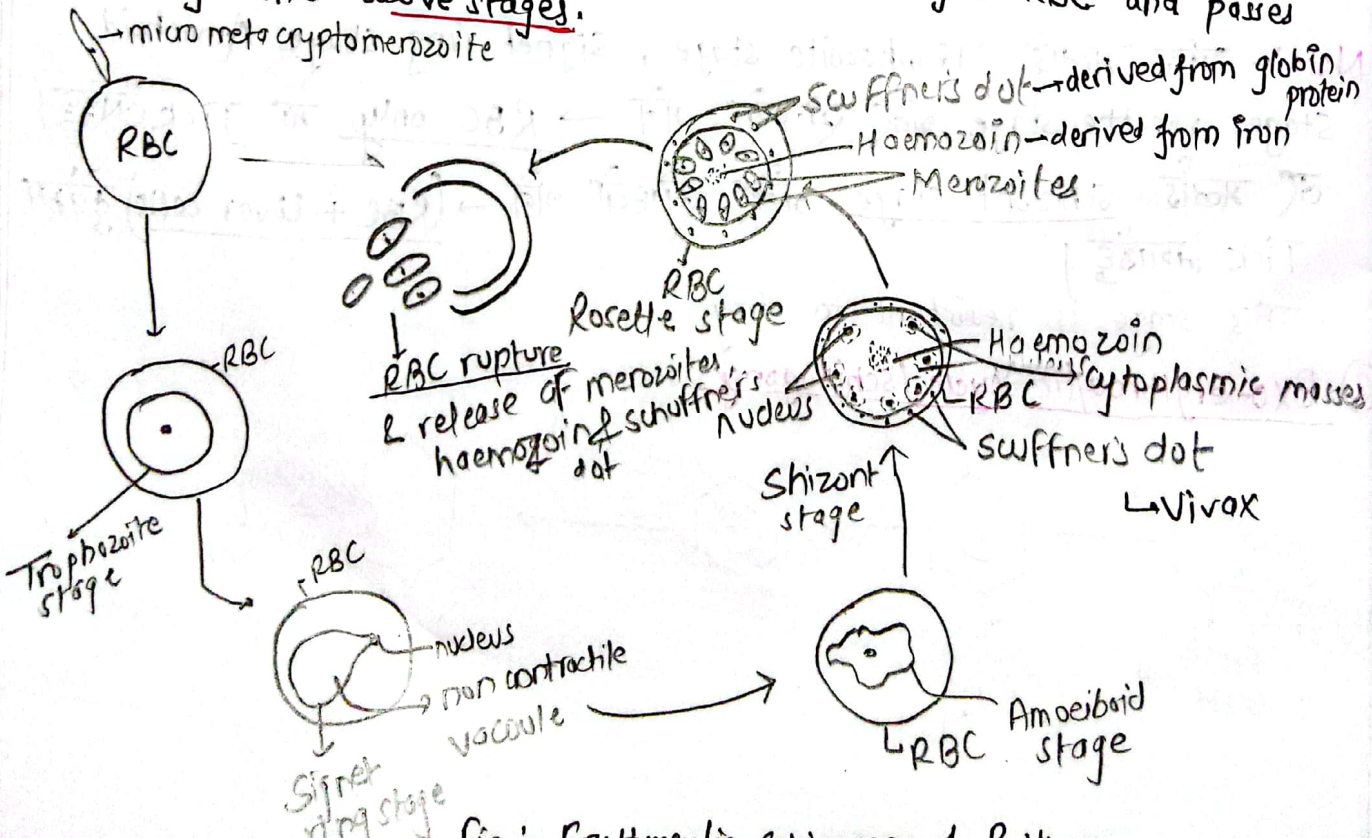


Fig:- Erythrocytic schizogony of P. Vivax

- P. ovale → James dot
- P. Malariae → Ziemans dot → Benign Quarton Malaria
  ↳ चौथो दिन मा fever
- P. Falciparum → Maurer's dot → Malignent Terterian Malaria
  ↳ fatal

→ Schuffner's dot ले कुन type को Malaria लागेको हो र कुन Type को species बाट cause गरेको daignose गर्छ।
↳ cause Benign Terterian Malaria in P. Vivax.
Benign → not fatal (mild)
Terterian → प्रत्येक तेर्सो दिन fever हुन्छ।

→ Haemozoin is a toxic substance and causes chills and fever.
↳ ferric ion derivative of haem.

→ Blood मा RBC Rupture भएर Merozoite release भयो।
- some merozoites invades in fresh RBC and form Gametocytes
  ↳ Gamete forming cell.
- some of the merozoite enters into liver cell & develop another liver schizogony called post erythrocytic schizogy
  ↳ Ross cycle

Q. In life cycle of plasmodium, the Gametocytes are formed in:-
(a) Stomach of FAM
(b) Liver cells of Human
(c) RBCs of Human
(d) Salivary glands of FAM

- But gametocytes are formed from Merozoites
  ↳ बाँच्न को लागि low tempr चाहिन्छ so, Gut मा जान्छ Mosq. को।

Gametocytes
↓
Dimorphic
- Micro-gametocytes
  ↳ Stomach मा जान्छ
  ↓
  Micro/Female gamete बनाउँछ
- Macrogametocytes
  ↳ Stomach मा जान्छ → Macro/Female gamete बनाउँछ

Q. Micro & Macro gametocytes → RBC of Human मा बन्छ

Q. Micro & Macro gametes → Stomach of FAM मा बन्छ

→ The further development of gametocyte requires low tempr, therefore transmission of another host (mosquito) becomes necessary
↳ (poikiolothermeric)

Sexual cycle of Plasmodium Vivax in Vector (Mosquito)

Note:- FAM is vector as well as ~~[illegible]~~ ~~[illegible]~~ Host.
↳ रोग सार्नै agent ↳ primary

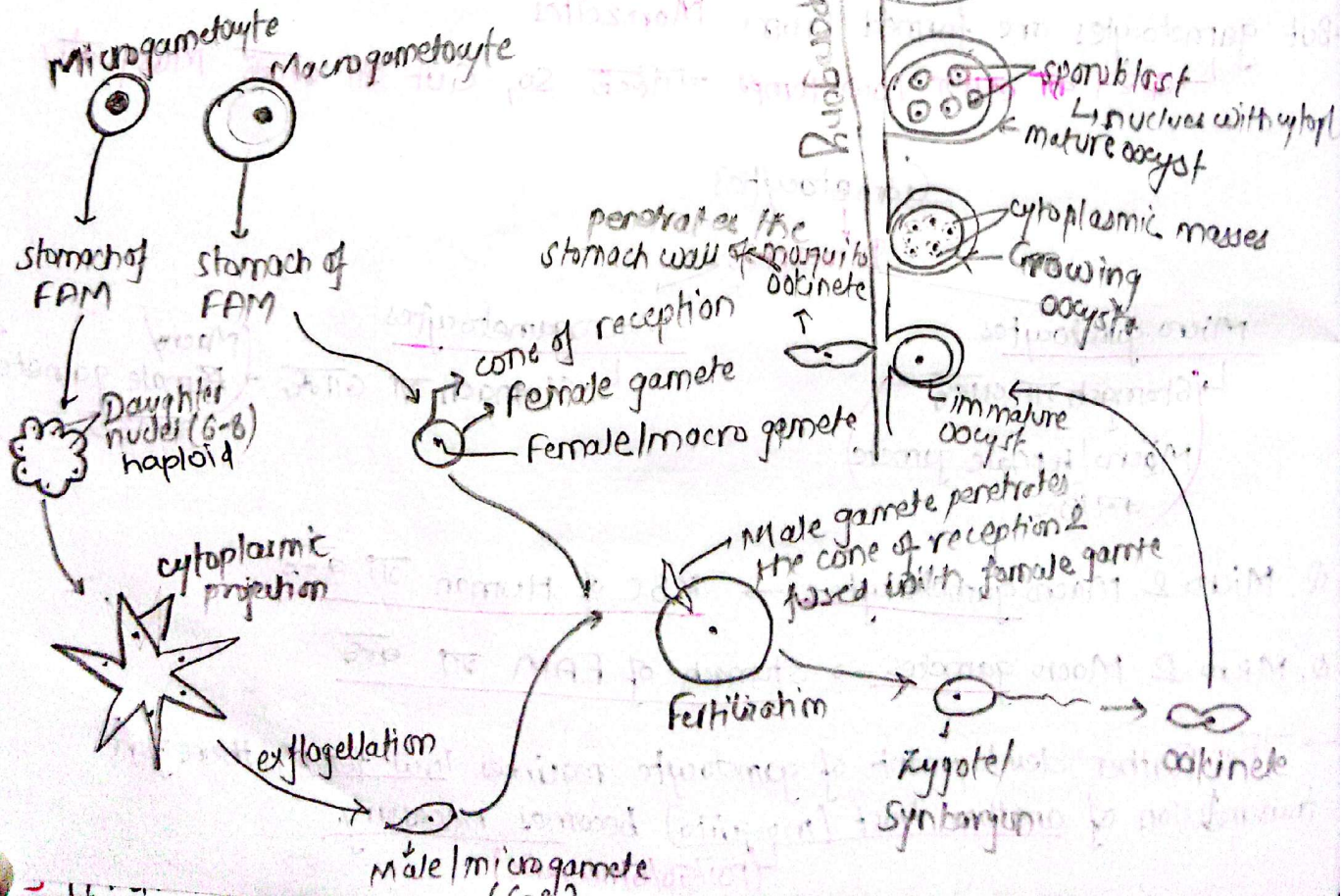
→ Infection of mosquito occurs when FAM sucks the body of an infected man. Mosquito recieves different stages of erythrocytic cycle including Gametocyte.
↳ सबै stages हरू Mosquito को stomach मा digest हुन्छन तर Gametocyte digest हुदैन।

Q. All the stages of plasmodium digest in stomach of mosquito except:- Gametocyte

→ So, infective stage of plasmodium to mosquito → Gametocyte
→ Start sexual cycle in Mosquito →

· Sexual cycle of plasmodium includes following steps in mosquito:-

1. Gametogenesis or Gametogony
   ↳ process of formation of micro (male) gamete & macro (female) gamete from micro & macro gametocyte respectively.
2. Fertilization
3. formation of Zygote / synkaryon
4. " of ookinete
5. Sporogony



oocyst rupture भएर sporozoites release भयो ति sporozoites हरु अब Mosquito को Haemocel मा जान्छ अनि Haemocel बट migrate गरेर salivary glands मा पुग्छ। → Mosquito infected.

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Q. Exflagellation of plasmodium takes place in:-

(a) Microgametocyte (b) Macrogametocyte

Q. In plasmodium, the exflagellation is associated with the formation of:-

(a) Microgamete (b) Macrogamete

Q. In plasmodium, the oocysts is formed in:-

(a) Salivary gland of FAM (b) Stomach wall of FAM

Q. Sporogony of plasmodium takes place in:-

(a) stomach wall of mosquito

* Key point of sexual cycle of P. Vivax

1. Sporogony takes place in stomach wall of mosquito.
2. Oocyst formed in stomach wall of mosquito.
3. Sporozoites are formed in oocyst.
4. Sporozoites are formed from sporoblast.
5. Motile diploid stage of plasmodium is called ookinete.
6. Ookinete is formed from zygote.
   ↳ Vermiform like str. (worm) → motile zygote
7. Exflagellation takes place in microgametocyte.
8. Exflagellation is associated with the formation of male or micro gametes → sperm

Malaria Types:

→ All the species of plasmodium cause benign malaria except P. Falciparum.

→ All the species of plasmodium causes tertrian malaria except P. Malariae.

P. Vivax → Benign Terterian Malaria or Vivax malaria

P. Malariae → Benign Quarton Malaria

Benign → Mild
↳ low death rate so, not fatal

P. Ovale → Benign Tertrian Malaria or ovale malaria

Tertian → repeat in every 3rd day
Quarton → repeat in every 4th day.

P. Falciparum → Malignent Terterian Malaria or cerebral malaria or Pernicious Malaria or Severe Malaria or black water fever
Malaria → Fatal
↳ high death rate

Note: P. Falciparum को case मा rupture भएका RBC जती accumulate हुन्छ & block the cappillary blood circulation in organs like brain, heart, lungs & spleen.

Relapsing malaria:- कुनै रोग complete निको भएको जस्तो लाग्ने तर फेरी Relapse भइदिने।
Caused by → P. vivax, Malarie & Ovale

~~Dif~~

Species	Dots/granules
① P. Vivax	Schuffner's dot
② P. Ovale	Jame's dot
③ P. Malariae	Ziemann's dot
④ P. Falciparum	Maurer's dot

Incubation period:- Time interval between the entry of parasite and appearance of 1st malarial symptoms.

① P. Vivax → 14 days
② P. Ovale → 14 days
③ P. Falciparum → 12 days → exo-erythrocytic cycle (X)
④ P. Malaria → 28 days

Prepatent period → Time interval betw the entry of parasite (sporozoite) & appearance of malarial parasite in blood.

① P. Vivax → 8 days

② P. Ovale → 8 days

③ P. Malariae → 20 days → Longest

④ P. Falciparum → 6 days

Anti Malarial drugs → such as →

→ Quinine or chloroquinine – extracted from the bark of Cinchona tree

→ Mepacrine

→ Paludrin

Preventive measure:–

Biological control → Mosquito को larva र pupa खाने fish

stagnant water छोड्ने – Gambusia fish
└ Varasius fish
(हतकाले)

Mosquito

(egg → larva → pupa → adult) → Holometabous
wriggler, tumbler, imago
(Complete metamorphosis)

Key Point

Erythrocytic schizogony मा RBC brust हुन्छ।
└ brust or rupture भएका
RBC हरू spleen मा गएर बसयो
अनि spleen swelling भयो।
So, swelling of spleen → called Graveyard of RBC
└ swelling भएको spleen ले Lysolecithin subst produce गर्छ र त्यो substance ले RBC लाई break गर्छ।
(enzyme)

Q. Lysolecithin is secreted by :– Spleen
brust → RBC.

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