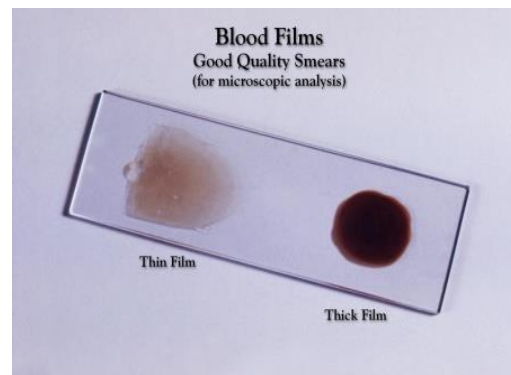




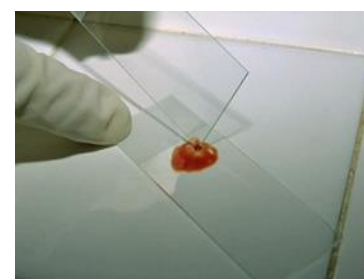
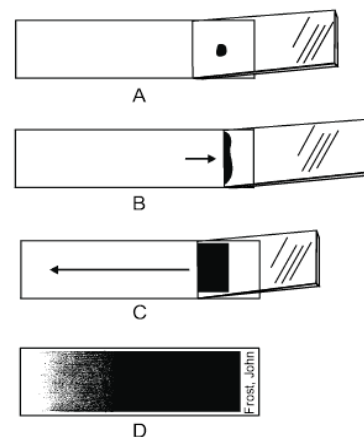
Station 1:

- **Note:** it is very important to know the history of the patient especially if he is coming or traveling to an endemic area of malaria.
- **Lab test for malaria:**
 - Blood film (gold standard).
 - Thin blood film:
 - ✓ It is used to study the morphology of RBCs (RBCs are equally distributed on the slide).
 - ✓ To detect the species of parasites and to know the percentage of parasitized red cells.
 - ✓ To detect co-infections.
 - Thick blood film:
 - ✓ Blood + one drop of water → breakdown of RBCs with hemoglobin background.
 - ✓ Severity of infection cannot be detected.
 - ✓ Also, co-infection cannot be detected.
 - ✓ It is a rapid test (qualitative) to detect if parasites are present or not.



- **Procedure of preparing thin and thick blood film:**

- Thin blood film:
 - ✓ Add one drop of blood on a slide.
 - ✓ Using another slide, put it on the first slide (with the blood drop) in a 45 angle.
 - ✓ Then spread the blood on one side in a quick motion.
 - ✓ Let the slide dry.
 - ✓ Fix the slide in methanol for 30 seconds.
 - ✓ Add eosin stain without washing the slide.
 - ✓ Add methylene blue without washing the slide.
 - ✓ Rinse with water.
 - ✓ Let it dry.
 - ✓ Examine it under the microscope.
- Thick blood film:
 - ✓ Add one drop of blood on a slide.
 - ✓ Mix the blood on the slide using a stick.
 - ✓ Let it dry.
 - ✓ Then add one drop of water.
 - ✓ Let it dry.
 - ✓ Add eosin stain.
 - ✓ Add methylene blue (without washing the slide).
 - ✓ Rinse with water.
 - ✓ Let it dry.
 - ✓ Examine under the microscope.



Station 2:

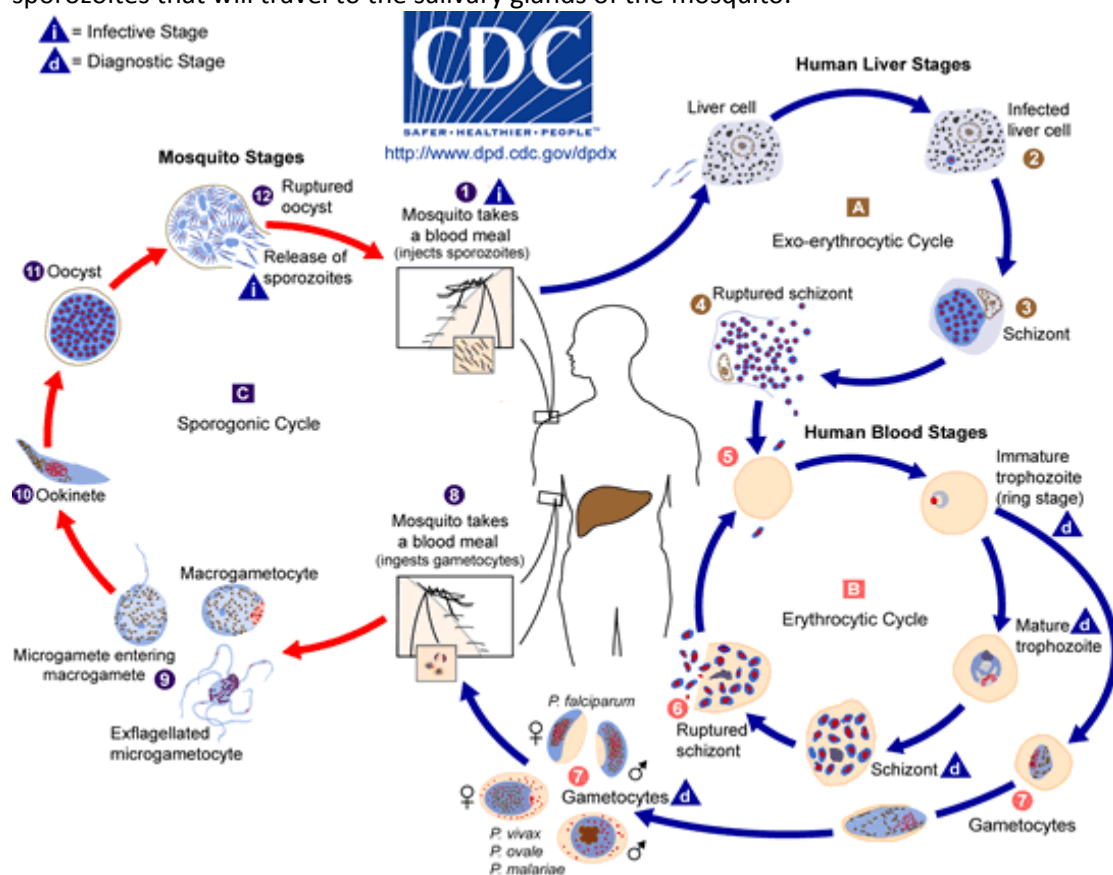
- **Malaria: it is caused by protozoa parasite:**
 - Genus: Plasmodium.
 - Species:
 - ✓ P.vivax.
 - ✓ P.malariae.
 - ✓ P.falciparum.
 - ✓ P.ovale

Note: these are sporozoa parasites (because of a stage known as sporozoites in their life cycle. This is the infectious stage).



- **Life cycle:**

- Infected female Anopheles mosquito with sporozoites in its salivary glands will inject them in the circulation of a human.
 - Sporozoites will move to the liver (infected hepatocytes: within 30 minutes).
 - Sporozoites will grow to schizonts in liver cells.
 - Schizonts will rupture releasing merozoites.
-
- Merozoites are the infective stage of RBCs. The first erythrocytic cycle will start by merozoites invading the red cells.
 - Merozoites will grow to trophozoites and then to schizonts.
 - Schizonts will rupture releasing merozoites which will infect other RBCs again and again.
-
- After several cycles, some of these merozoites will grow to gametocytes. This is considered as the second erythrocytic cycle.
 - Gametocytes will be taken by the feeding female Anopheles mosquito where they will grow to macrogametocytes (females) and microgametocytes (males).
 - Zygote will be produced and then it will be converted to oocyst which will rupture releasing sporozoites that will travel to the salivary glands of the mosquito.

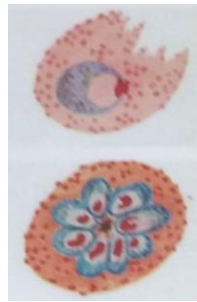


- **Plasmodium:**

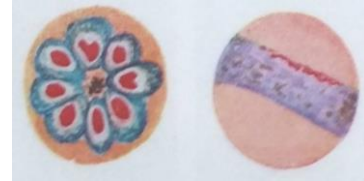
- *P. vivax*:
 - ✓ It is a common cause of malaria.
 - ✓ It is difficult to identify it from the ring stage.
 - ✓ Trophozoites: ameboid form with schuffner's dots.
 - ✓ Schizonts: large RBCs with scattered merozoites and schuffner's dots.
 - ✓ *P. vivax* infects RBCs in the reticulocyte stage.
 - ✓ It has a dormant cycle in the liver producing a latent form (hypnozoite) which will cause relapse of the disease.
 - ✓ The timing of the fever cycle is every 48 hours (benign tertian malaria).
 - ✓ The receptor of *P. vivax* is the duffy blood group antigen. More than 90% of black west Africans and many of their American descendants do not produce the Duffy antigen and are thereby resistant to vivax malaria.



- *P.ovale*:
 - ✓ Trophozoites: characterized by the presence of schuffner's dots and the RBCs look like a broken egg.
 - ✓ Schizonts: RBCs are oval in shape – merozoites are arranged like a flower with the presence of schiffner's dots.
 - ✓ It has a dormant cycle in the liver producing a latent form (hypnozoites) which will cause relapse of the disease.
 - ✓ The timing of the fever cycle is every 48 hours (benign tertian malaria).



- *P.malariae*:
 - ✓ Trophozoites: band-shape .
 - ✓ Schizonts: merozoites arranged like a flower with no schuffner's dots.
 - ✓ It is a cause of nephrotic syndrome.
 - ✓ It affects mature RBCs.
 - ✓ It causes quartan malaria: fever cycle is every 72 hours.



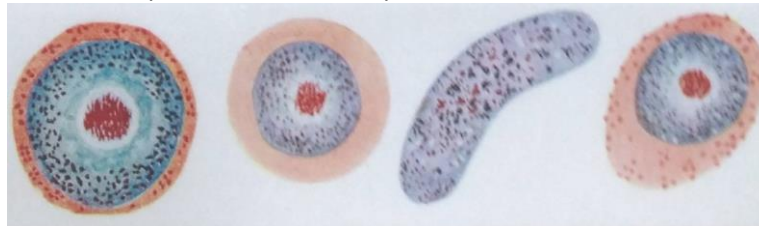
- *P.falciparum*:
 - ✓ Ring shape: more than two rings can be found in the same RBC. Also, marginal form might be found. Rings are characterized by double chromatin.
 - ✓ Trophozoites: rarely seen in peripheral blood.
 - ✓ Schizonts: rarely seen in peripheral blood – merozoites are scattered.
 - ✓ It is a common cause of malaria which will be more severe than that caused by other plasmodia.
 - ✓ It is characterized by infection of far more red cells (high level of paracytemia).
 - ✓ Occlusion of the capillaries with parasitized red cells will lead to the life-threatening condition (cerebral malaria).
 - ✓ Also, there will be extensive hemolysis and kidney damage with resulting hemoglobinuria (blackwater fever).
 - ✓ It causes malignant tertian malaria: fever every 48 hours.
 - ✓ People with G6PD deficiency are protected against severe effects of *P.falciparum* malaria.



Note: individuals with sickle cell trait (HbA/HbS) are protected against malaria because their red cells have too little ATPase activity and cannot produce sufficient energy to support growth of the parasite. Also, there is efflux of K^+ from sickled RBCs (potassium is needed for the growth of parasites).

- Gametocytes:

- *P.vivax* is characterized by large RBCs with the presence of schuffner's dots.
- *P.ovale* is characterized by RBCs (oval in shape) with the presence of schiffner's dots.
- *P.malariae* has no schuffner's dots.
- *P.falciparum* is banana-shaped or crescent-shaped.



- Treatment:

- Chloroquine is the drug of choice for acute malaria caused by sensitive strains (they kill merozoites and thus reducing parasitemia).
- Hypnozoites of *P.vivax* and *P.ovale* in the liver are killed by primaquine. Note that primaquine should not be given if the patient is G6PD deficient because it induces severe hemolysis.
- In areas where chloroquine-resistant strains of *P.falciparum* exist, the drug of choice is malarone (atovaquone + proguanil).
- In severe cases, especially of *falciparum* malaria, IV quinidine plus doxycycline should be used.

