

*Tikrit University*

*College of Nursing*

*Basic Nursing Sciences*



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**Microbiology**

**(Malaria)**

**by: assistant lecturer**

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## **Malaria**

**Malaria** :- is caused by protozoan parasites of genus Plasmodium- single –celled organisms that cannot survive outside of their hosts. It is a mosquito –borne disease. The species infecting humans are:-

1-*Plasmodium falciparum* (malignant tertian malaria)2-

*Plasmodium vivax*( benign tertian malaria)

3-*Plasmodium ovale* (ovale malaria)

4-*Plasmodium malariae*(benign quatrain malaria )

The most severe form is caused by *Plasmodium falciparum* , it is the most prevalent malaria parasite on Africa continent. It is responsible for most malaria –related deaths globally.

### **Morphology**:-

The plasmodium organisms involves over two dozen morphologic forms. However, for the purposes of this lab only six of the most commonly forms in human specimens will be discussed and listed as follows in chronologic forms order:-

1-Ring form (also known as the early or young trophozoite).2-

Late trophozoite or amoeboid form.

3-Immature schizont.

4-Mature schizont.

5-Microgametocyte.

6-Macrogametocyte.

### **Malarial life cycle phases** :-

There are two phases in life cycle that responsible of malaria infection develops are known as :-

1-Pre-erythrocytic phase that involves the liver in human body.

2-Erythrocytic phase(cycle)that involves the blood in human body.

### **Types of reproduction:-**

There are three types of reproduction in malarial life cycles:-

1-Schizogony : asexual multiplication consists of multiple nuclear division followed by cytoplasmic division that take place in human`s liver cells & RBCs.

2-Gametogony:sexual reproduction include sex cells ( males are called microgametes females are known as macrogametes)that are capable of sexual reproduction that take place in mosquito(female Anopheles).

3-Sporogony :- sexual reproduction of the plasmodium spp.resulting in the production of sporozoites that take place in mosquito.

### **Plasmodium Life cycle**

*Plasmodium* species that infect humans ,until recently, there were four *plasmodium* species that were considered responsible for malaria disease in humans: *P. vivax*, *P. falciparum*, *P. ovale* and *P. malariae*. In 2008, *P. knowlesi*, a species that used to infect exclusively apes of the genus *Macaque*, was recognised by WHO as the fifth *plasmodium* species that infect humans.

The life cycle (Figure 1) is almost the same for all the five species that infect humans and follows three stages:

- (1) infection of a human with sporozoites
- (2) asexual reproduction
- (3) sexual reproduction

The two first stages take place exclusively into the human body(intermediate host), while the third one starts in the humanbody and is completed into the mosquito organism (definitive host).

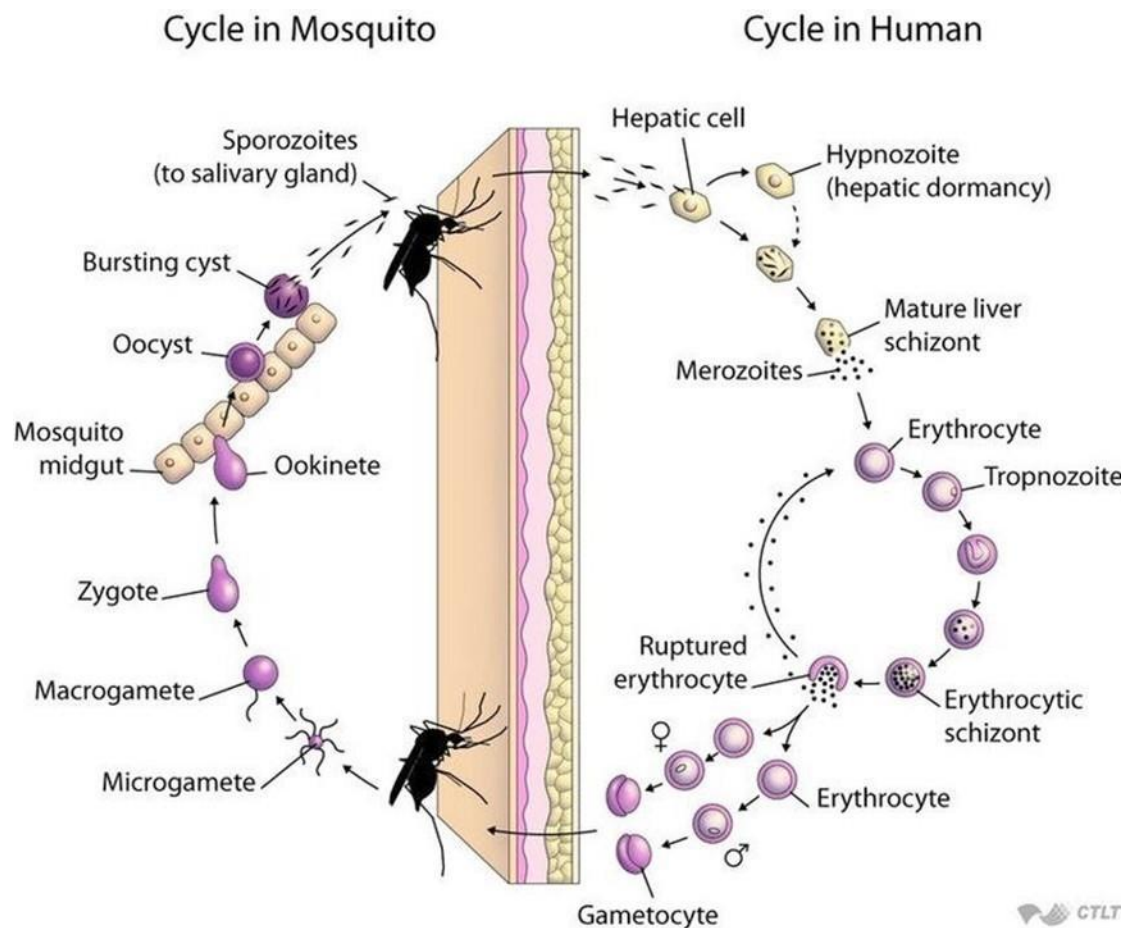


Figure 1. *Plasmodium* life cycle

The malaria parasite life cycle involves two hosts. During a blood meal, a malaria-infected female *Anopheles* mosquito inoculates sporozoites into the human host. Sporozoites infect liver cells and mature into schizonts, which rupture and release merozoites. (Of note, in *P. vivax* and *P. ovale* a dormant stage [hypnozoites] can persist in the liver (if untreated) and cause relapses by invading the bloodstream weeks, or even years later.) After this initial replication in the liver (exo-erythrocytic schizogony), the parasites undergo asexual multiplication in the erythrocytes (erythrocytic schizogony). Merozoites infect red blood cells. The ring stage trophozoites mature into schizonts, which rupture releasing merozoites. Some parasites differentiate into sexual erythrocytic stages (gametocytes). Blood stage parasites are responsible for the clinical manifestations of the disease. The gametocytes, male (microgametocytes) and female (macrogametocytes), are ingested

by an Anopheles mosquito during a blood meal . The parasites' multiplication in the mosquito is known as the sporogonic cycle . While in the mosquito's stomach, the microgametes penetrate the macrogametes generating zygotes . The zygotes in turn become motile and elongated (ookinetes) which invade the midgut wall of the mosquito where they develop into oocysts . The oocysts grow,rupture, and release sporozoites, which make their way to the mosquito's salivary glands. Inoculation of the sporozoites into a new human host perpetuates the malaria life cycle.

**Hypnozoites**:- dormant liver cells infected with either *P.vivax* or *P. Ovale* .These cells may remain dormant for months to years and when reactivated may cause relapsing malaria infections.

**Paroxysm**: chills and fever syndrome associated with malaria.Chills occur in response to schizont development followed by a fever which corresponds to the release of merozoites and toxic waste byproducts from infected red blood cells.

**DIAGNOSIS**:- laboratory diagnosis of malaria requires the identification of the parasite or its antigens/ products in the patient's blood.

The requirements of a diagnostic test are specificity, sensitivity, ease of performance and a reasonable cost.