MALARIA PARASITES

PRESENTED BY

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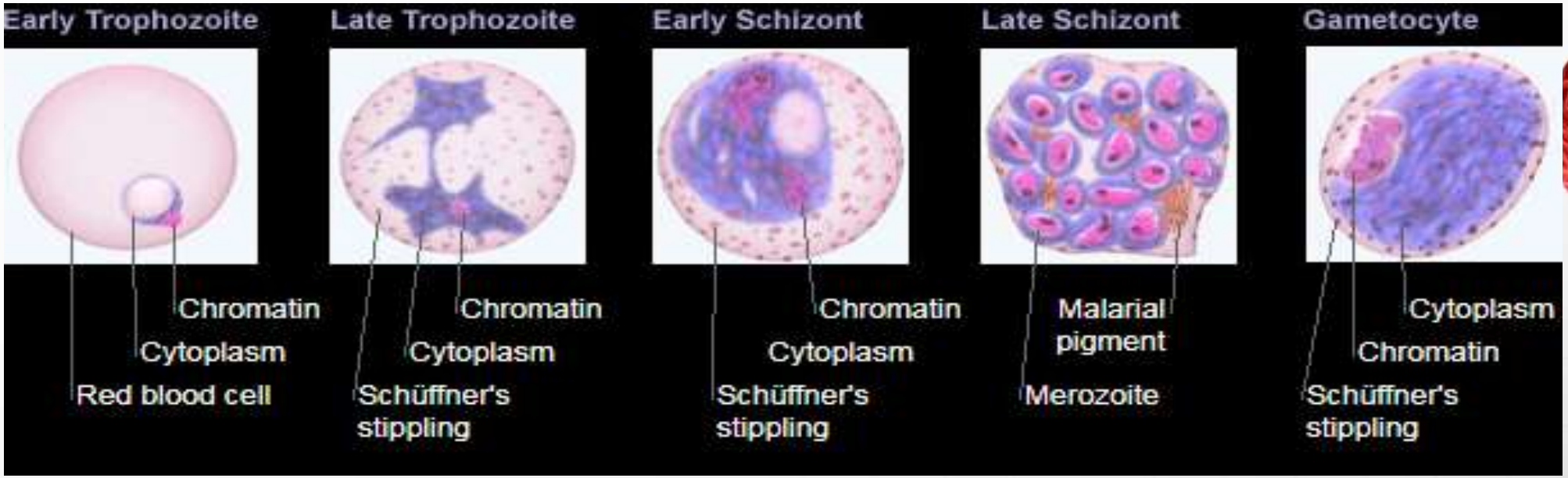
INTRODUCTION TO MP

- Malaria is **a life-threatening** disease caused by parasites that are transmitted to people through the bites of infected female ***Anopheles mosquitoes.***
- There are **5 parasite species** that cause malaria in human;
  - ***i.*** ***Plasmodium vivax***,
  - ***ii.*** ***Plasmodium falciparum***,
  - ***iii.*** ***Plasmodium knowlesi***
  - ***iv.*** ***Plasmodium malariae***,
  - ***v.*** ***Plasmodium ovale***
- Among them, ***Plasmodium falciparum*** and ***Plasmodium vivax*** pose the greatest threat.

TRANSMISSION

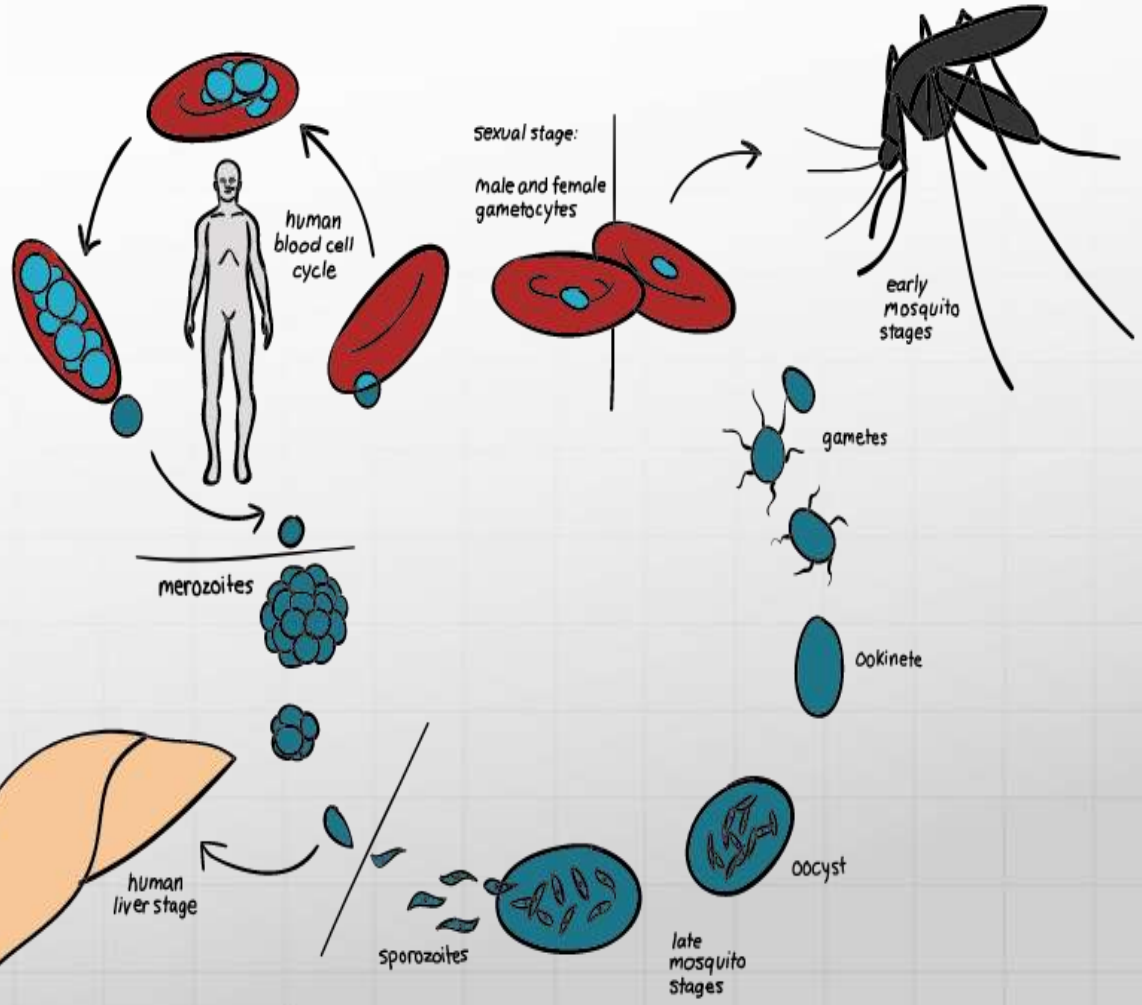
- Malaria is **transmitted by blood**, so it can also be transmitted through:
  - an organ transplant
  - a transfusion
  - use of shared needles or syringes
- An infected mother can also pass the disease to her baby at birth. This is known as **congenital malaria.**

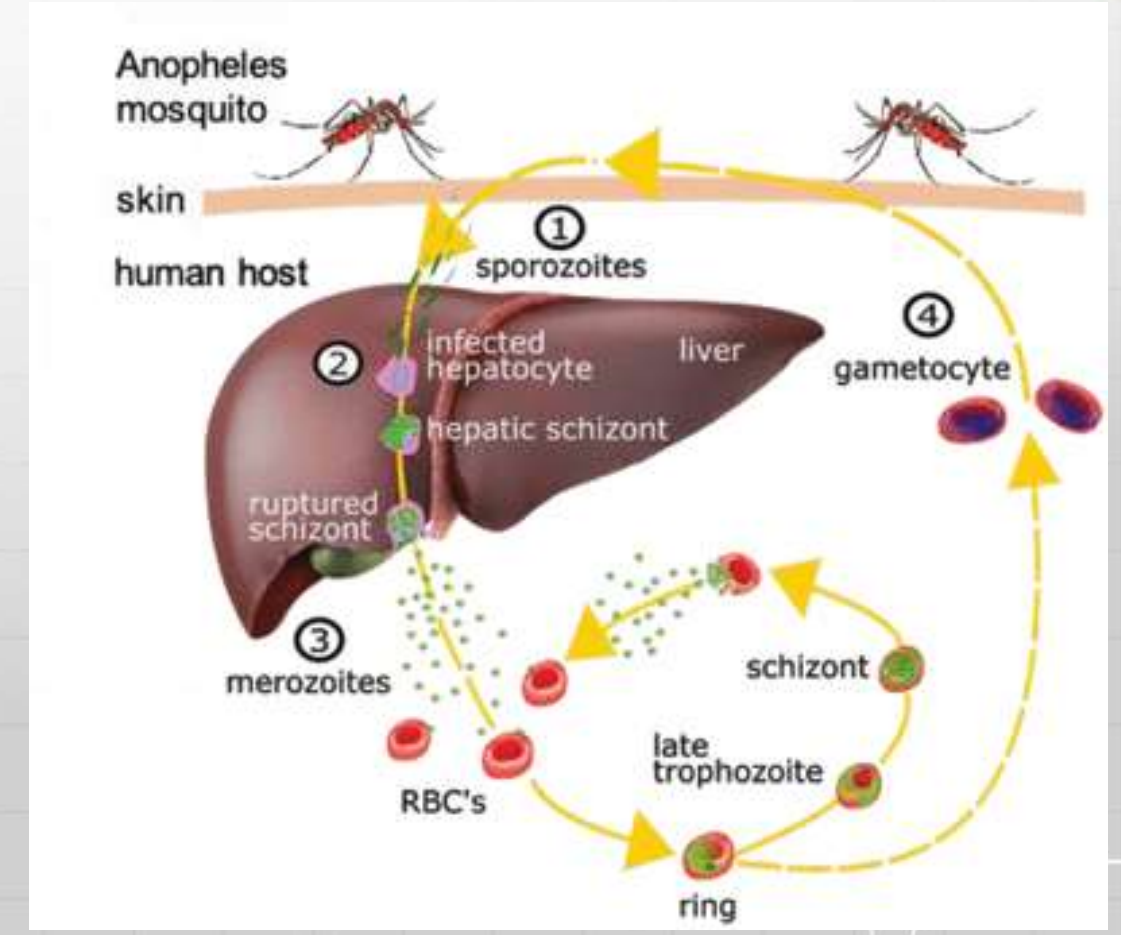
LIFE CYCLE OF MALARIA PARASITES



1. The **asexual phase** of the malarial life cycle occurs in humans.
2. Following inoculation of the human host with infectious **sporozoites** from a mosquito, an initial proliferative phase (**exoerythrocytic schizogony**) occurs in the liver.
3. Merozoites are then released into the bloodstream and invade red blood cells, initiating **erythrocytic schizogony**.
4. The parasite grows within the red cell from a early **trophozoite** to a **late schizont**, feeding on hemoglobin and producing **malarial pigment** as a waste product.
5. When the schizont ruptures, merozoites are released into the bloodstream initiating the next **schizogonic cycle.**
6. The patient's tertian or quartan fever profile approximates the time of release of **merozoites** into the bloodstream.
7. After several cycles, some merozoites develop into male and female **gametocytes** which, when ingested by a mosquito, complete the **sexual phase** of the life cycle.

LIFE CYCLE OF MALARIA PARASITES





SYMPTOMS

- The symptoms of malaria typically develop within **10 days to 4 weeks** following the infection. In some cases, symptoms may not develop for several months. Some malarial parasites can enter the body but will be dormant for long periods of time.
- Common symptoms of malaria include:

✓shaking chills that can range from moderate to severe
✓high fever
✓profuse sweating
✓headache
✓nausea
✓vomiting
✓abdominal pain
✓diarrhea
✓anemia
✓muscle pain
✓convulsions
✓coma
✓bloody stools

Malaria can cause a number of **life-threatening complications.**
The following may occur:

- swelling of the blood vessels of the brain, or cerebral malaria
- an accumulation of fluid in the lungs that causes breathing problems, or pulmonary edema
- organ failure of the kidneys, liver, or spleen
- anemia due to the destruction of red blood cells
- low blood sugar

Plasmodium vivax

A: Stages of *P. vivax* in thin blood smears.

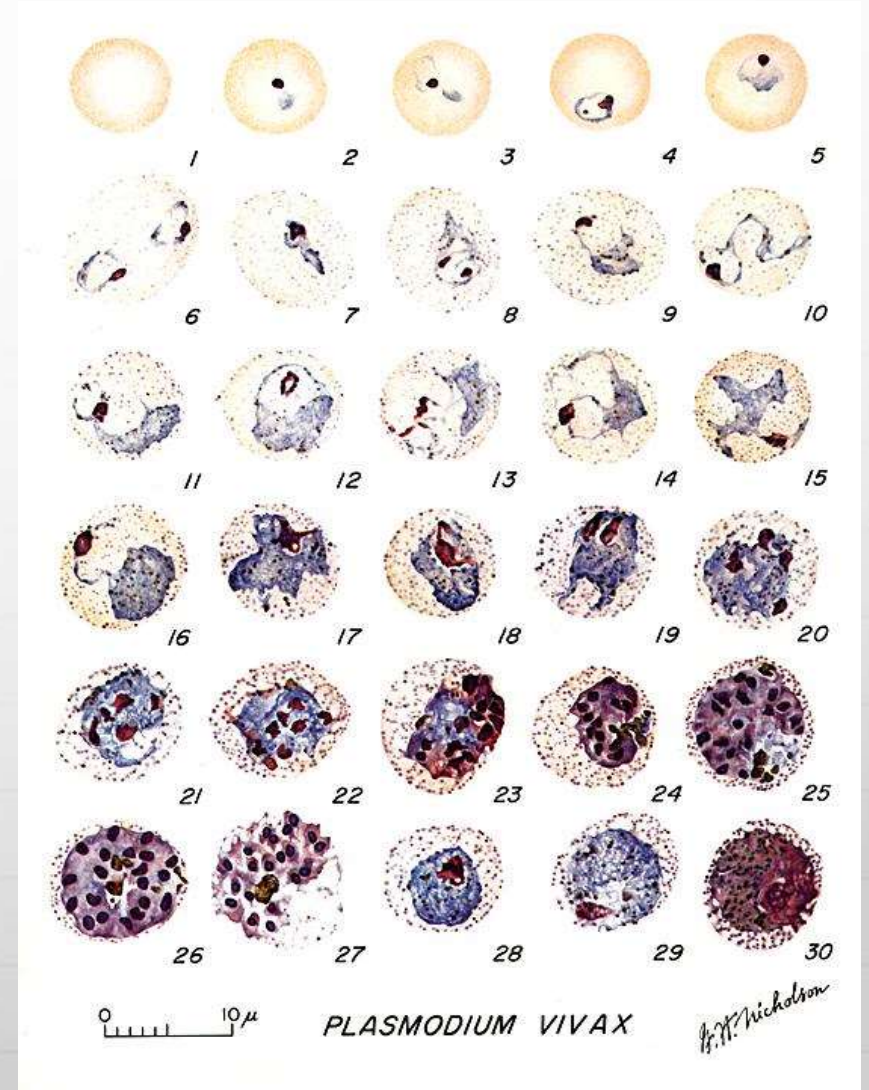
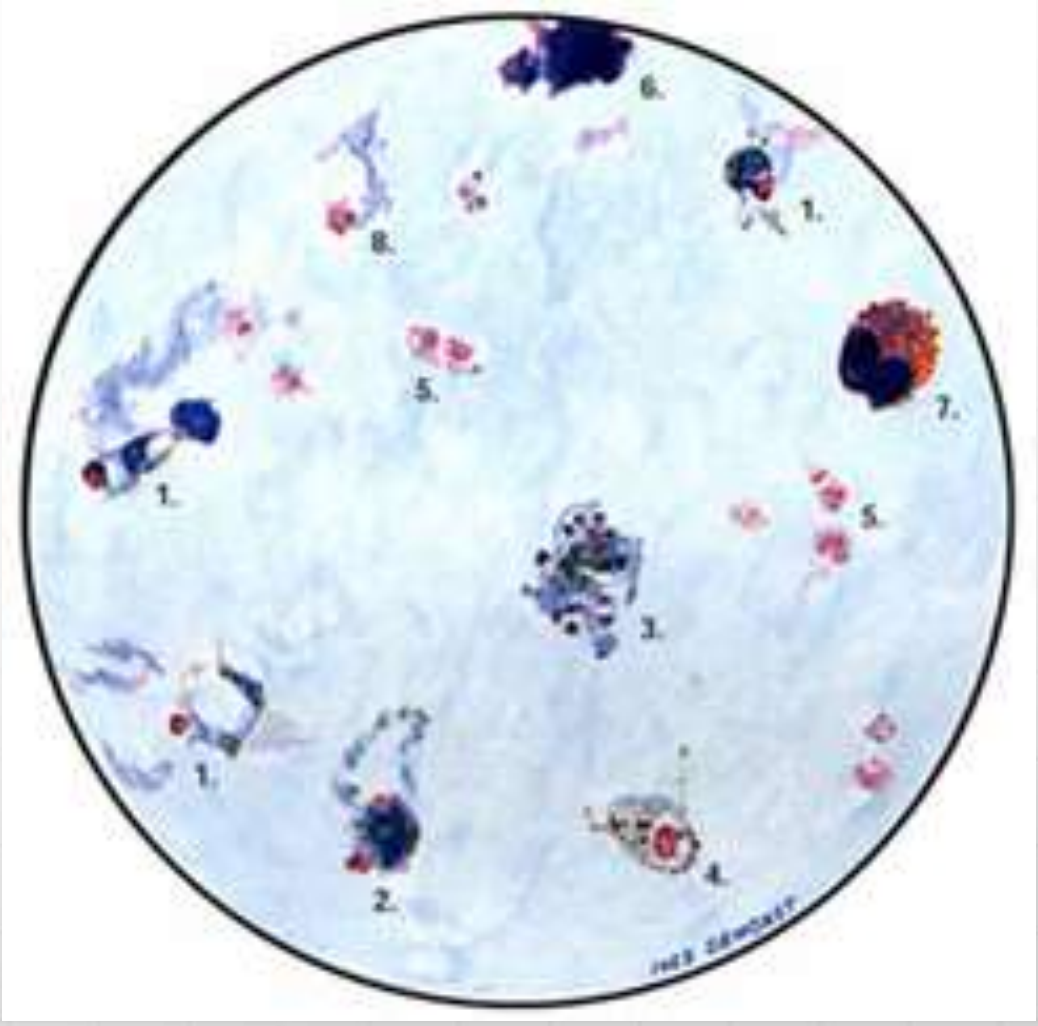


Fig. 1: Normal red cell
Figs. 2-6: Young trophozoites (ring stage parasites)
Figs. 7-18: Trophozoites
Figs. 19-27: Schizonts
Figs. 28 and 29: Macrogametocytes (female)
Fig. 30: Microgametocyte (male)

B: Stages of *P. vivax* in thick blood smears.



1. Ameboid trophozoites
2. Schizont – 2 division of chromatin
3. Mature schizont
4. Microgametocytes
5. Blood platelets
6. Nucleus of neutrophil
7. Eosinophil
8. Blood platelet associated with cellular remains of young erythrocytes

Plasmodium vivax

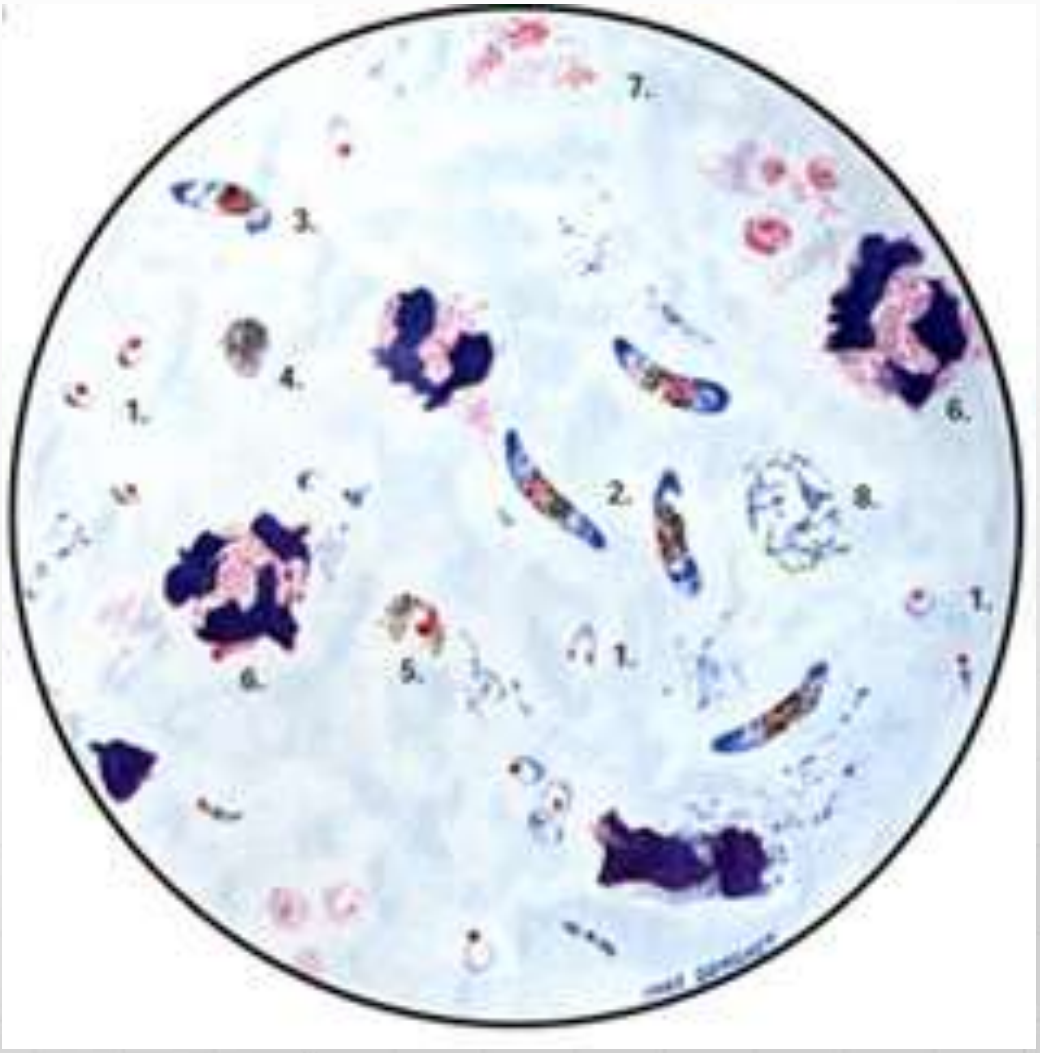
- Red cells containing parasites are usually **enlarged.**
- **Schuffner’s dot** are frequently present in the red cells.
- The mature ring form tend to be large and coarse.
- Developing forms are frequently present.

Plasmodium falciparum

A: Stages of P. falciparum in thin blood smears.

Fig. 1: Normal red cell
Figs. 2-18: Trophozoites (among these, Figs. 2-10: correspond to ring-stage trophozoites)
Figs. 19-26: Schizonts (Fig. 26 is a ruptured schizont)
Figs.27, 28: Mature macrogametocytes (female)
Figs. 29, 30: Mature microgametocytes (male)

B: Stages of P. falciparum in thick blood smears.



1. Small trophozoites
2. Gametocytes – normal
3. Slightly distorted gametocyte
4. “Rounded up” gamtocyte
5. Disintegrated gametocyte
6. Nucleus of leucocyte
7. Blood platelets
8. Cellular remains of young erythrocyte

Plasmodium falciparum

- Red cells are **not enlarged.**
- Rings appear fine and delicate and there may be several in one cell.
- Some rings may have **two chromatin dots** .
- Presence of **marginal or applique forms.**
- It is unusual to see developing forms in peripheral blood films.
- Gametocytes have a characteristic **crescent shape** appearance.
  *However, they do not usually appear in the blood for the first 4 weeks of infection.
- **Maurer's dot** may be present.

Plasmodium ovale

A: Stages of *P. ovale* in thin blood smears.

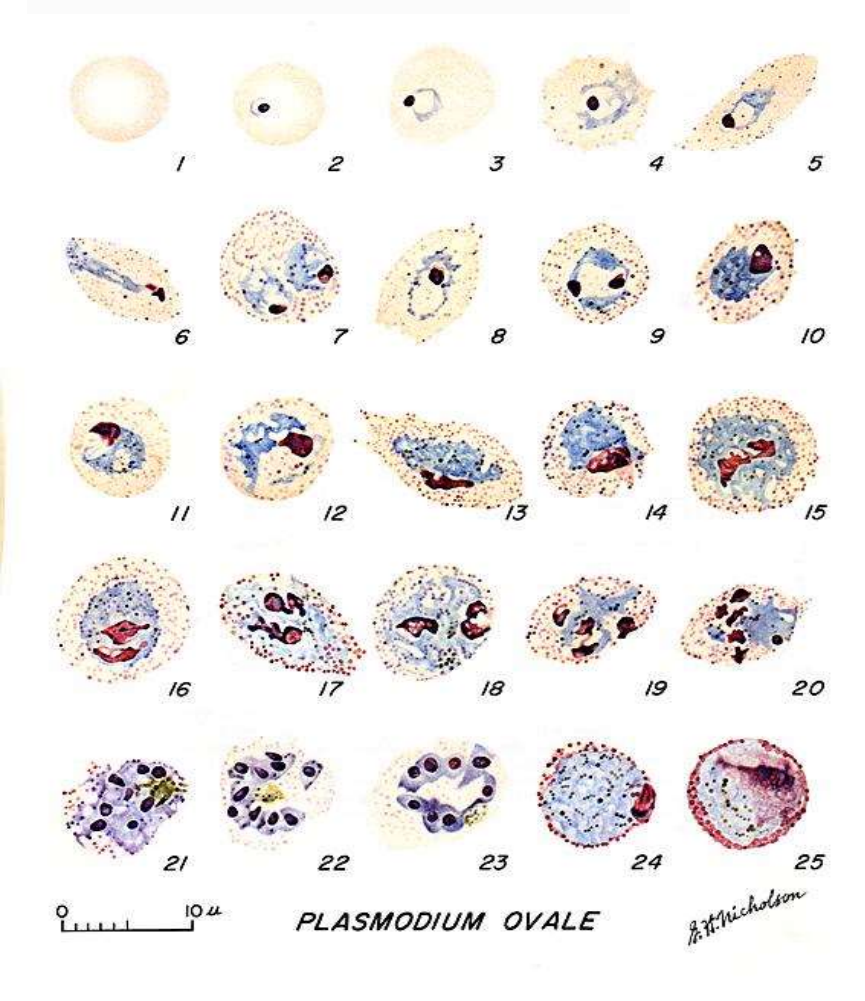
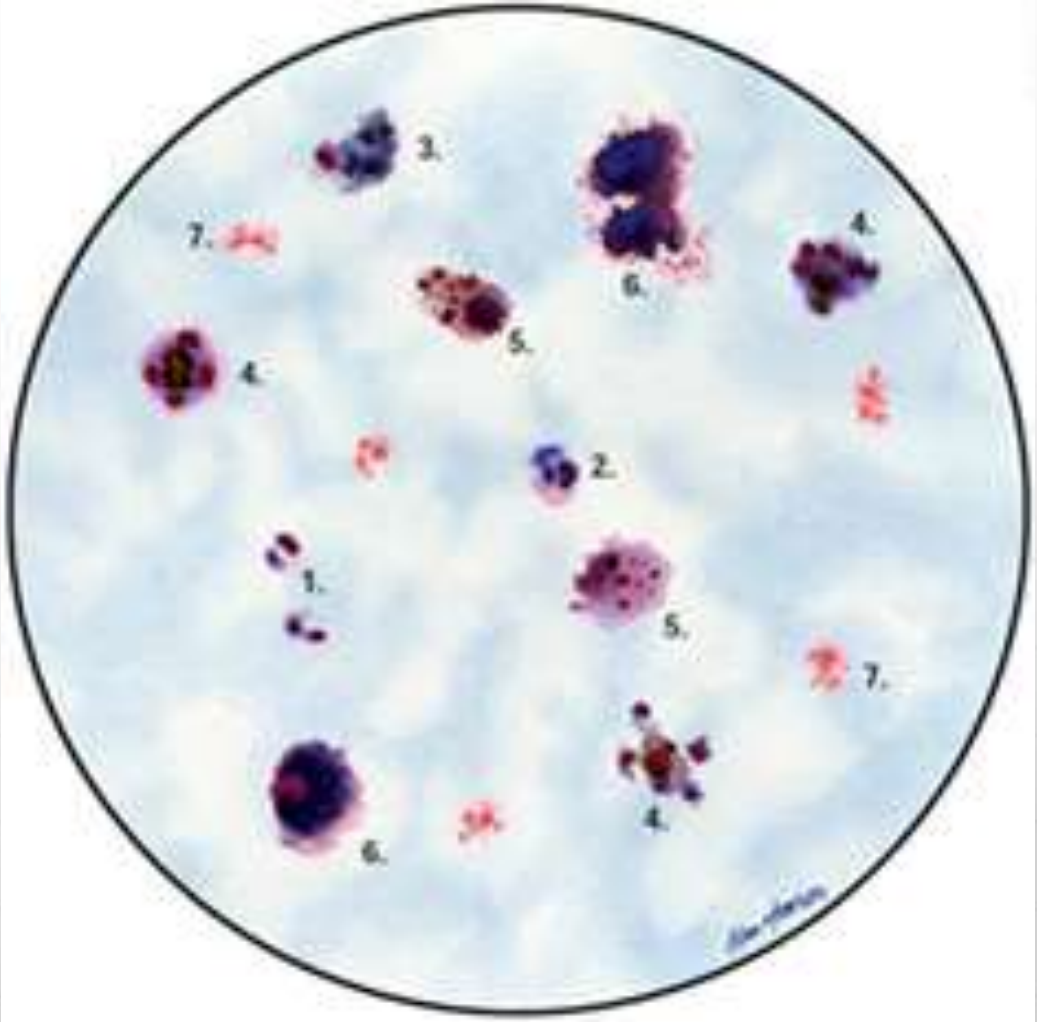


Fig. 1: Normal red cell
Figs. 2-5: Young trophozoites (Rings)
Figs. 6-15: Trophozoites
Figs. 16-23: Schizonts
Fig. 24: Macrogametocytes (female)
Fig. 25: Microgametocyte (male)

B: Stages of *P. ovale* in thick blood smears.



1. Small trophozoites
2. Growing trophozoites
3. Mature trophozoites
4. Schizonts
5. Gametocytes
6. Nucleus of leucocyte
7. Blood platelets

Plasmodium ovale

- Red cells are **enlarged** .
- **Comet forms** common.
- Rings large and coarse.
- **Schuffner’s dots** when present, may be prominent.
- Matured schizonts similar to those of *P. malariae* but larger and more coarse.

Plasmodium malariae

A: Stages of *P. malariae* in thin blood smears.

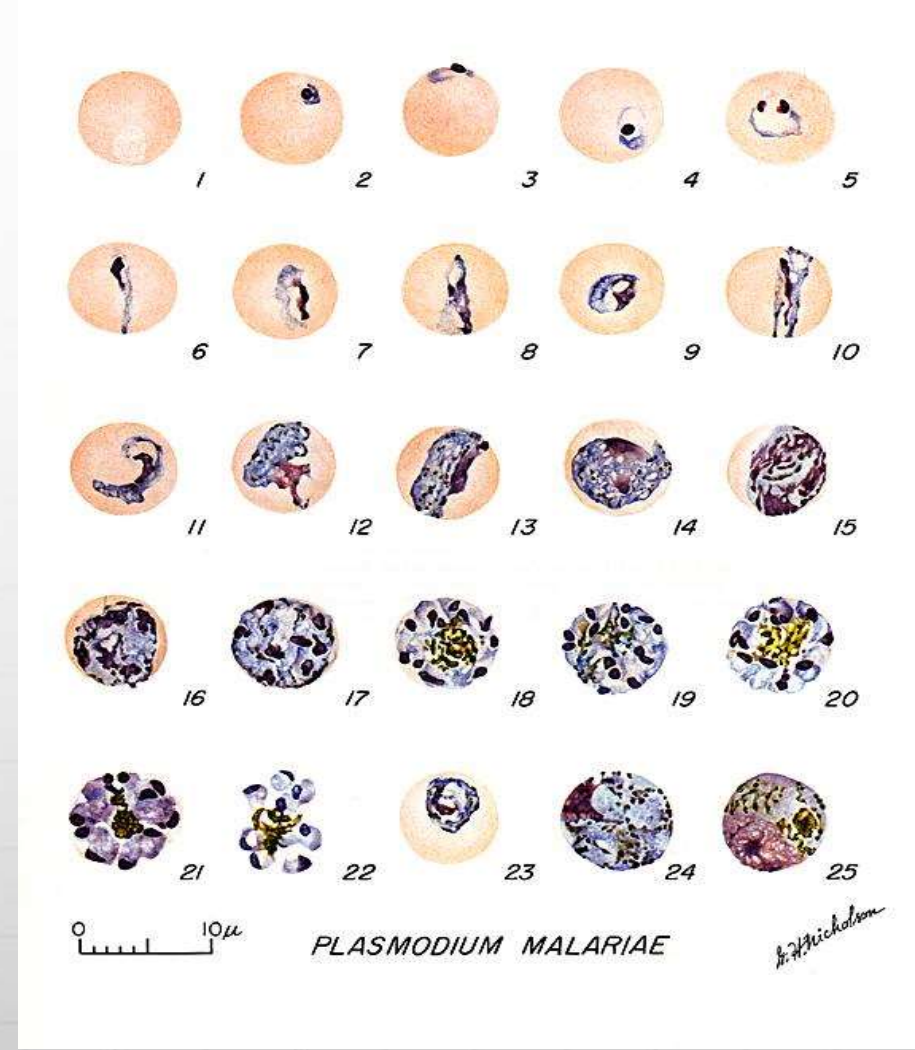
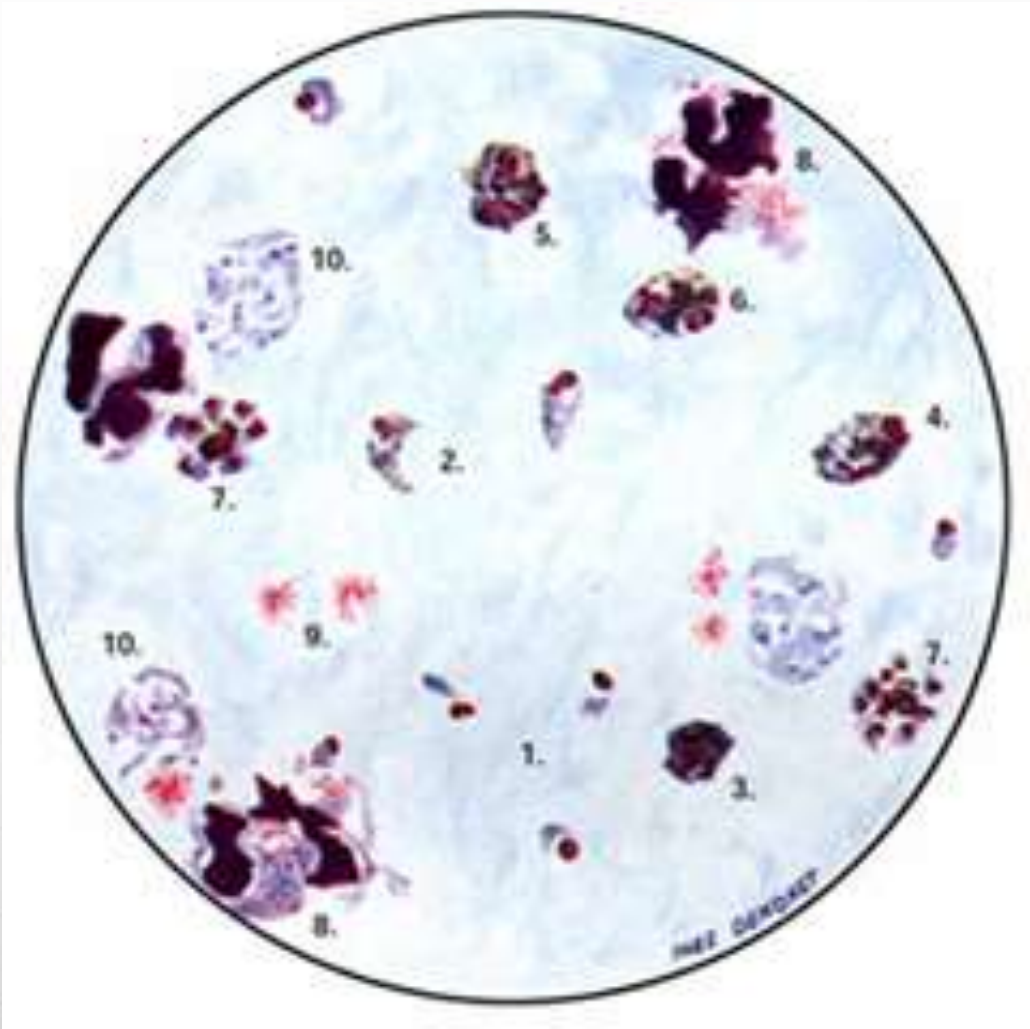


Fig. 1: Normal red cell
Figs. 2-5: Young trophozoites (rings)
Figs. 6-13: Trophozoites
Figs. 14-22: Schizonts
Fig. 23: Developing gametocyte
Fig. 24: Macrogametocyte (female)
Fig. 25: Microgametocyte (male)

B: Stages of *P. malariae* in thick blood smears.



1. Small trophozoites
2. Growing trophozites
3. Mature trophozoites

4. – 6. Immature schizonts with varying numbers of divisions of the chromatin

7. Mature schizonts
8. Nucleus of leucocyte
9. Blood platelets
10. Cellular remains of young erythrocytes

Plasmodium malariae

- Ring forms may have a **squarish** appearance.
- **Band forms** are a characteristic of this species.
- Mature schizonts may have a typical **daisy head appearance** with up to ten merozoites.
- Red cells are **not enlarged.**
- **Chromation dot** may be on the inner surface of the ring.

Plasmodium knowlesi

A: Stages of *P. knowlesi* in thin blood smears.

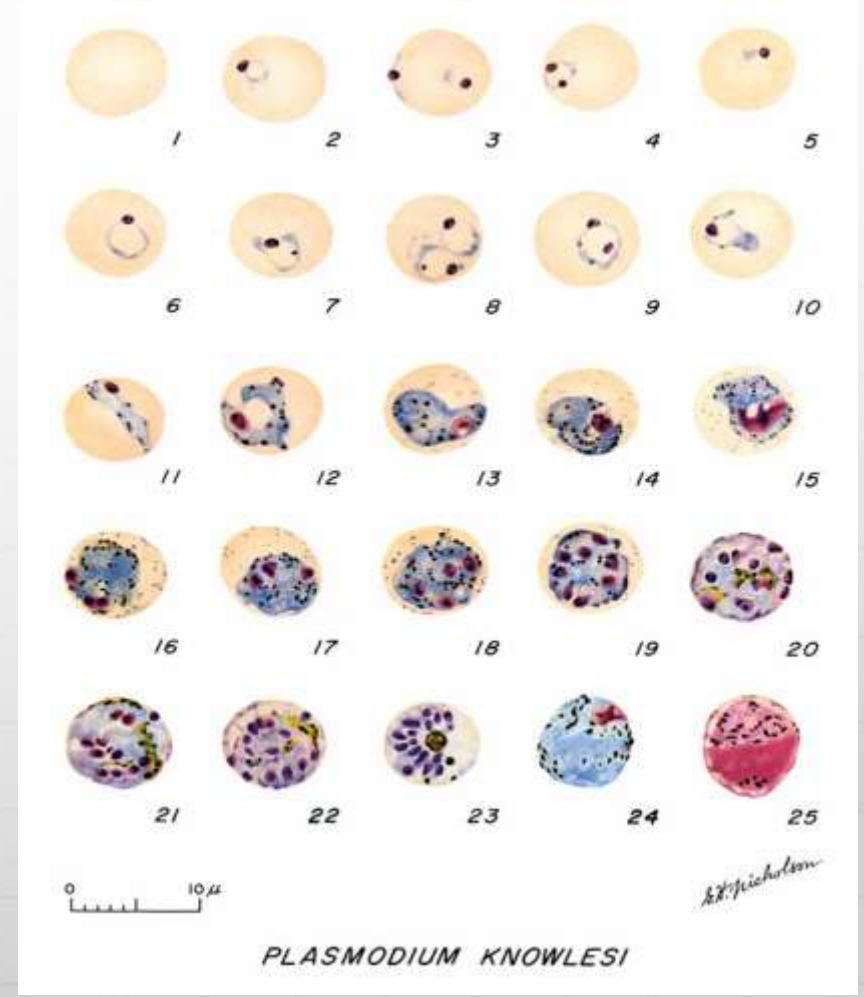
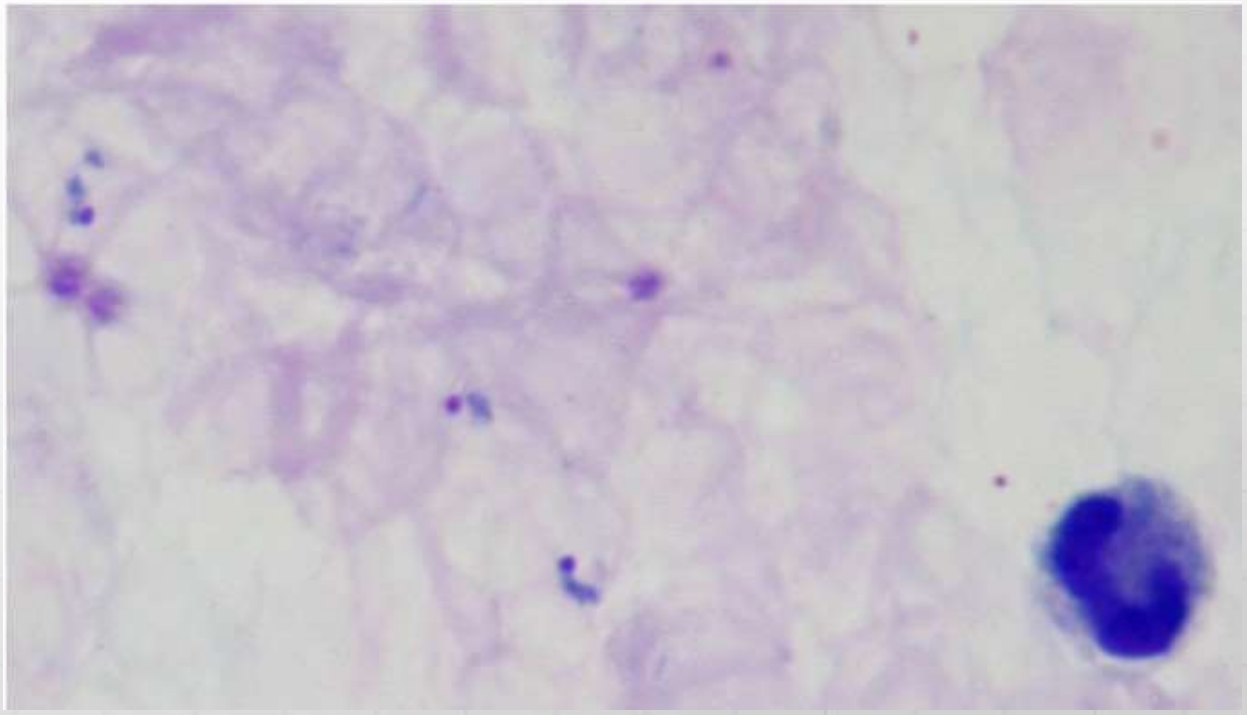


Fig. 1: Normal red cell
Figs. 2-9: Young trophozoites (ring-form trophozoites)
Figs. 10-12: Developing trophozoites
Figs. 13-15: Mature trophozoites
Figs. 16-23: Developing, nearly mature and mature schizonts
Fig. 24: Mature macrogametocyte (female)
Fig. 25: Mature microgametocyte (male)

B : Giemsa-stained thick blood film showing late trophozoites of *P. knowlesi*.



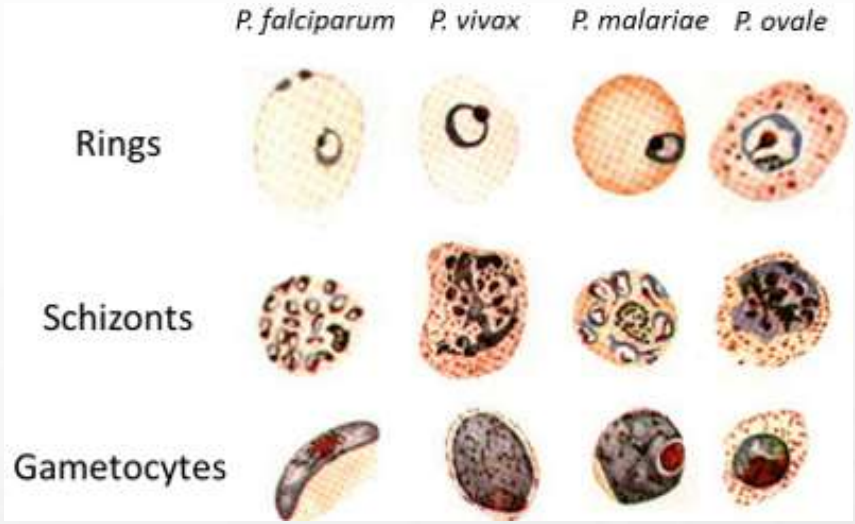
CALCULATION OF PARASITEMIA

$$\text{Percentage } of\ infected\ RBCs = \frac{no\ of\ infected\ RBC}{total\ no\ of\ RBC\ counted} \times 100$$

- The percentage of infected RBCs (parasitemia) is determined by enumerating the number of infected RBCs in relation to the number of uninfected RBCs.
- A minimum of 500 RBCs total should be counted.

SUMMARY

Differentiation of different stages of various malaria parasites



Species / Stage	Falciparum	Vivax	Malariae	Oval
Ring Stage				
Trophozoite				
Schizont				
Gametocyte