Malaria

Plasmodium

commonly known as the malaria parasite, this species of the genus are known as plasmodia. Infection with plasmodia is known as malaria, a deadly disease widespread in the tropics

Species infecting humans

The most common forms of human malaria are caused by *Plasmodium falciparum* (the cause of malignant tertian malaria, Blackwater Fever)
***P. vivax* (the most frequent cause of benign tertian malaria)**
***P. ovale* (the other, less frequent, cause of benign tertian malaria)**
***P. malariae* (the cause of benign quartan malaria)**

Blackwater Fever - a complication of *P. falciparum* malaria. Hemolysis and hematuria are due to a severe immune reaction.



The vector of malaria *Anopheles*

Life cycle:

In human body

1. Exoerythrocytic stage

bite/inject into

sporozoites → exoerythrocytic schizonts

(mosquito blood) (hepatic cell)

rupture/release

exoerythrocytic sporozoites

(blood)

2. **Erythrocytic stage**

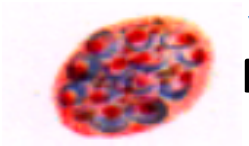




early trophozoite → **later trophozoite**

P.f/36-48hrs
P.v/48hrs

merozoite **immature schizont**



Mature schizont



***the process from trphozoite to merozoite is called schizogony.**

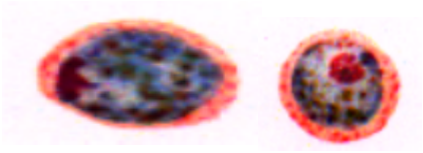
3-In mosquito (final host)

Gametocytes(♀♂) → gametes (♀♂)

(blood—stomach) (stomach of insect)

union of

zygote

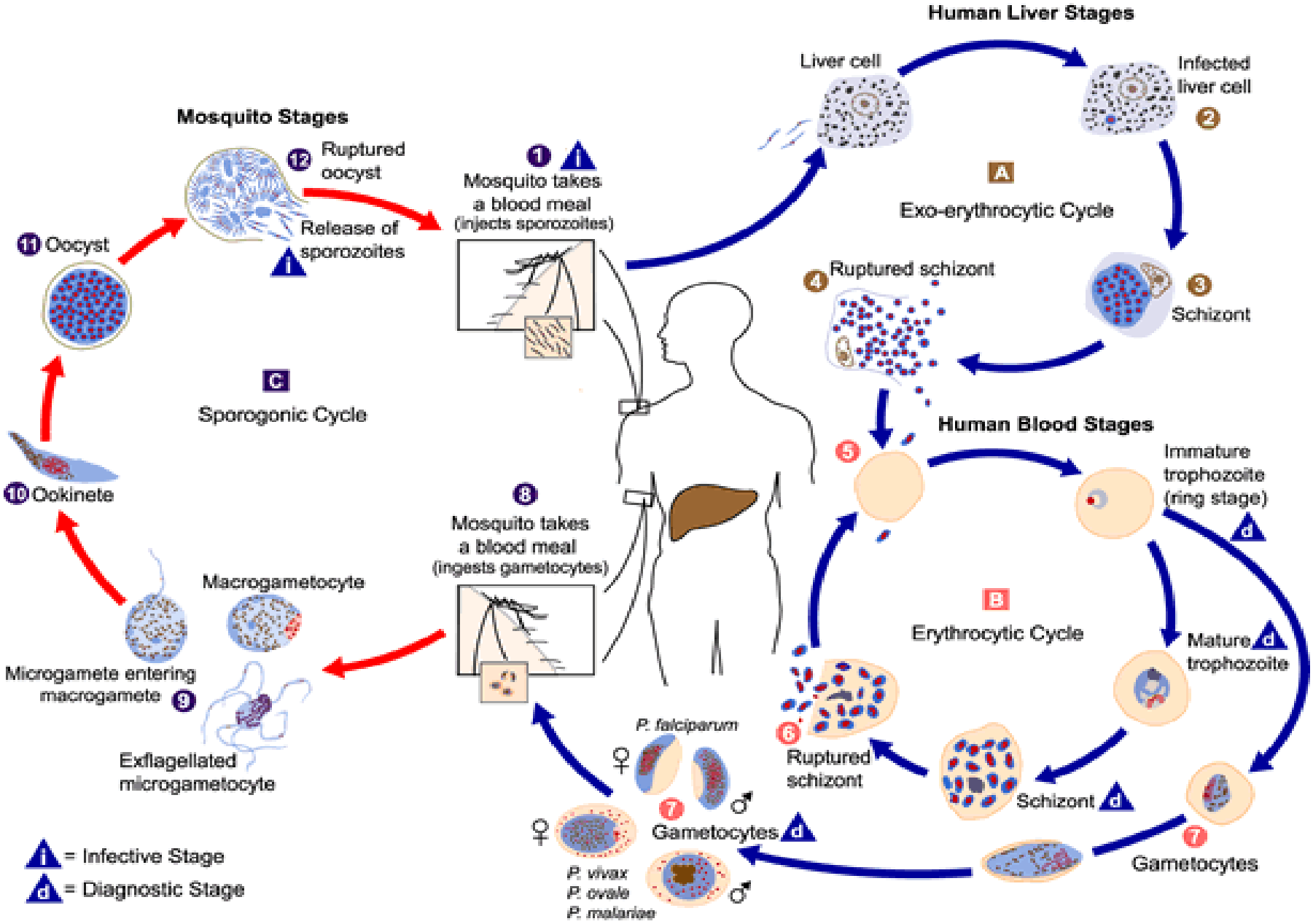


rupture/release rounds up into

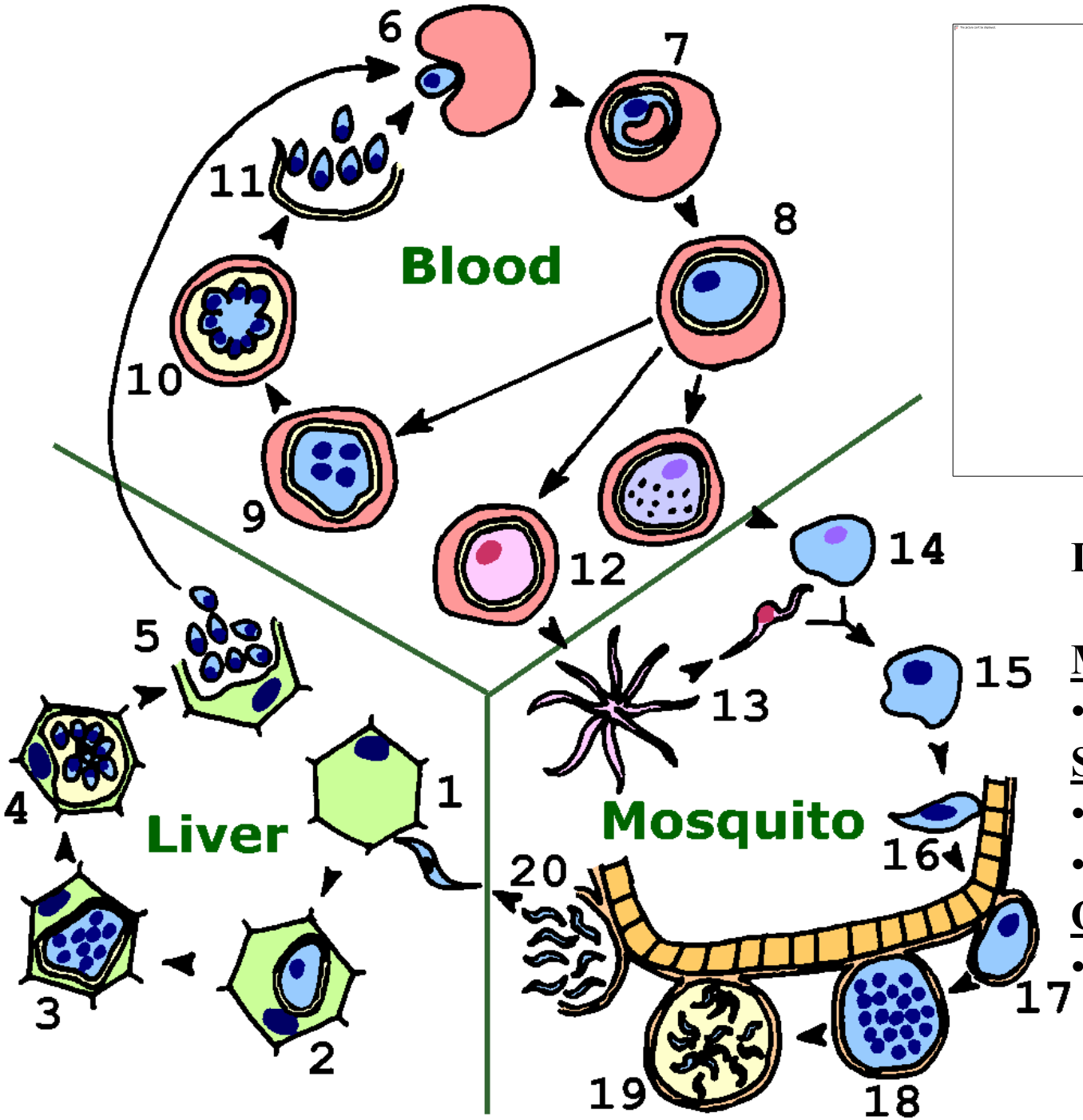
motile ookinete (the body cavity side

oocyst

sporozoites (Salivary glands)



Note: *P. vivax* and *P. ovale* can lie dormant in liver for weeks or even years.



Invasive Stages

Merozoite
- **erythrocytes**

Sporozoite
- **salivary glands**
- **hepatocytes**

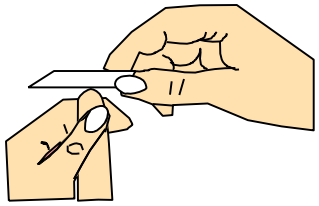
Ookinete
- **epithelium**

Specimen collection

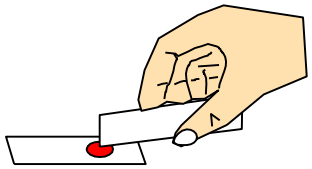
- Ideally, blood can be collected by finger prick
  - If other tests being performed, can use venipuncture
  - EDTA is preferred as the anticoagulant as heparin may lead to morphological distortion
- Smears should be prepared and stained within an hour of drawing the specimen.
  - Alterations in morphology may occur if delayed.

- Thick film considered "gold standard" for detection of parasites due to being able to use larger volume (10µl of blood)
- Thin film considered "gold standard" in species identification
- Smear examinations should be under oil immersion
  - Negatives should not be reported until 200 oil immersion fields have been examined
  - Additional specimens should be examined at 12-hour intervals for a subsequent 36 hours.

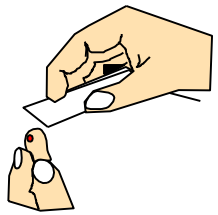
Preparing thick and thin films



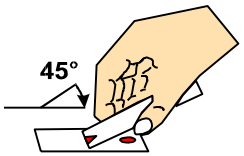
1.
Touch one drop of blood to a clean slide.



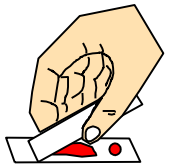
2.
Spread the first drop to make a 1 cm circle.



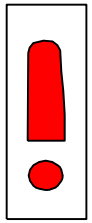
3.
Touch a fresh drop of blood to the edge of another slide.



4.
Carry the drop of blood to the first slide and hold at 45 degree angle.



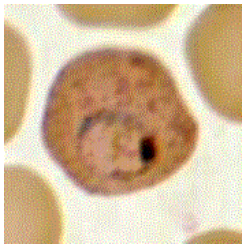
5.
Pull the drop of blood across the first slide in one motion.



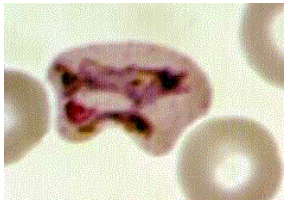
6.
Wait for both to dry before fixing and staining.

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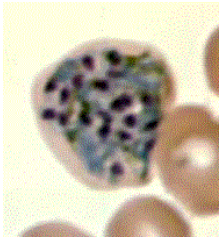
Malaria Parasite Erythrocytic Stages



Ring form

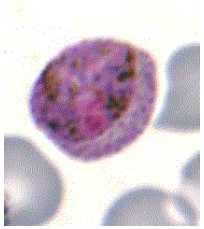


Trophozoite



Schizont



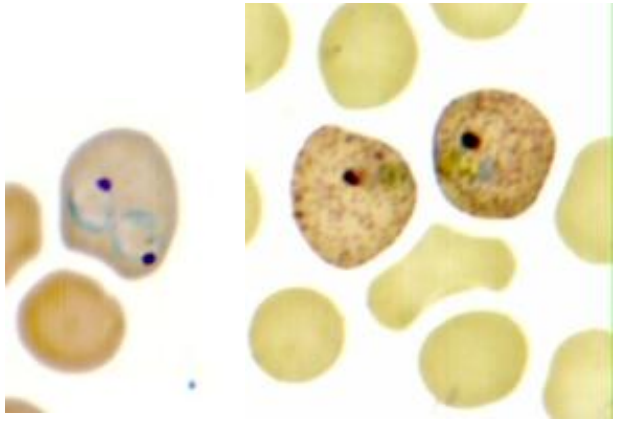


Gametocytes

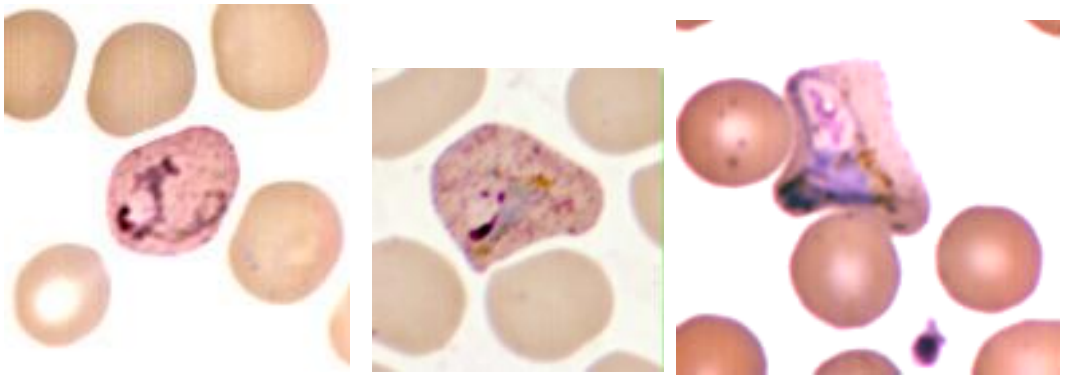
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Plasmodium vivax

Infected erythrocytes: enlarged up to 2X; deformed; (Schüffner's dots)

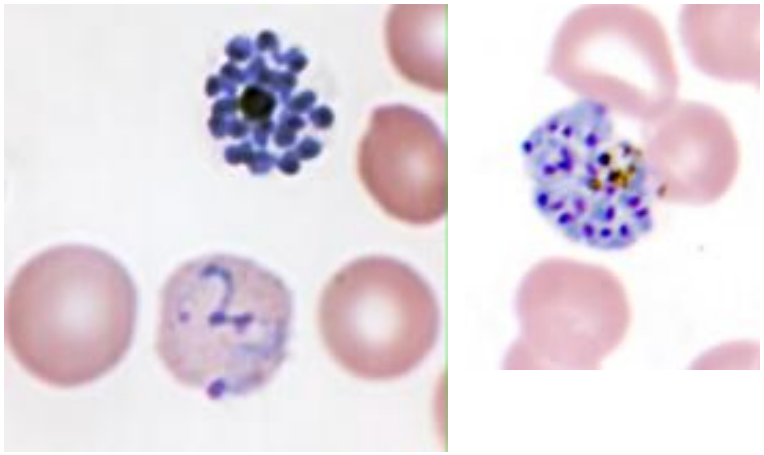


Rings

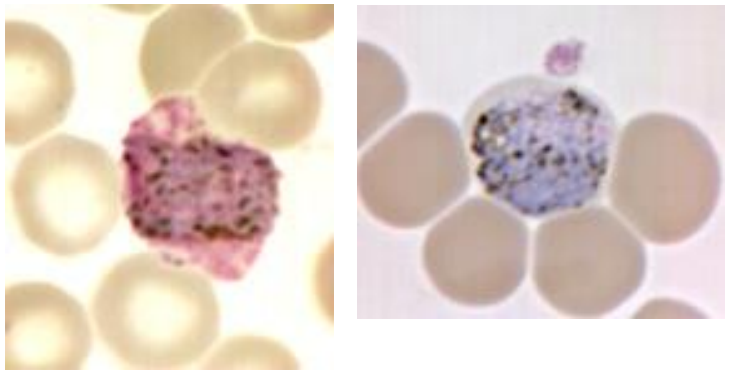


Trophozoites: ameboid; deforms the erythrocyte

Schizonts: 12-24 merozoites



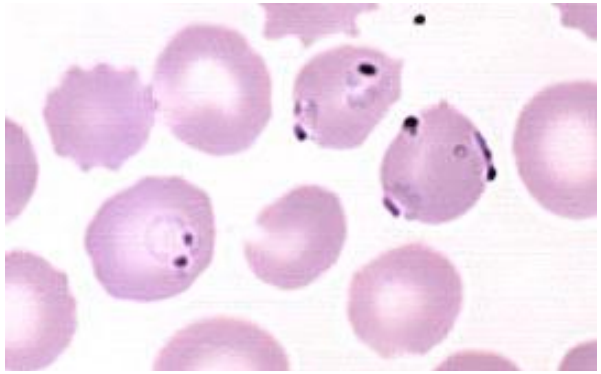
Gametocytes: round-oval

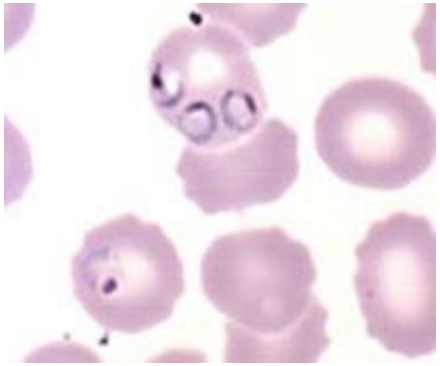


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Plasmodium falciparum

Infected erythrocytes: normal size



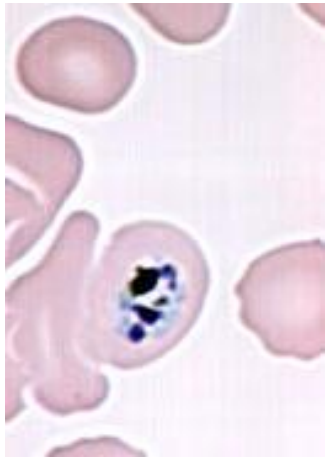


Rings: double chromatin dots; appliqué forms; multiple infections in same red cell





Gametocytes: mature (M)and immature (I) forms (I is rarely seen in peripheral blood)



Trophozoites: compact (rarely seen in peripheral blood)



Schizonts: 8-24 merozoites (rarely seen in peripheral blood)

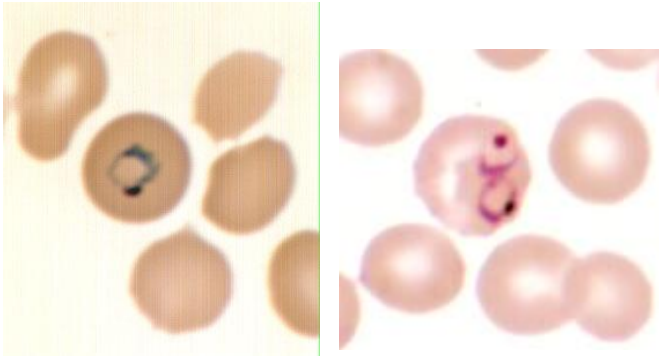




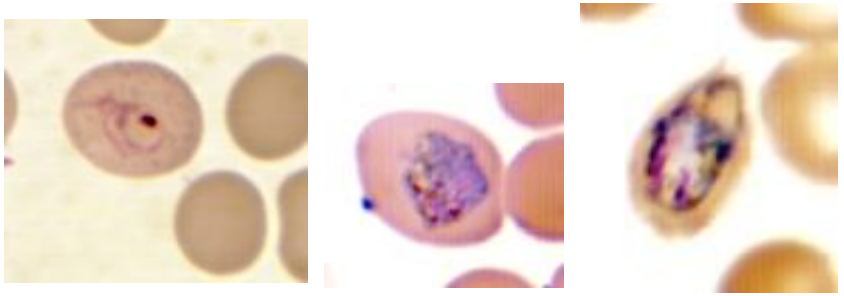
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Plasmodium ovale

Infected erythrocytes: moderately enlarged (1 1/4 X); fimbriated; oval; (Schüffner's dots)
"*malariae* - like parasite in *vivax* - like erythrocyte"

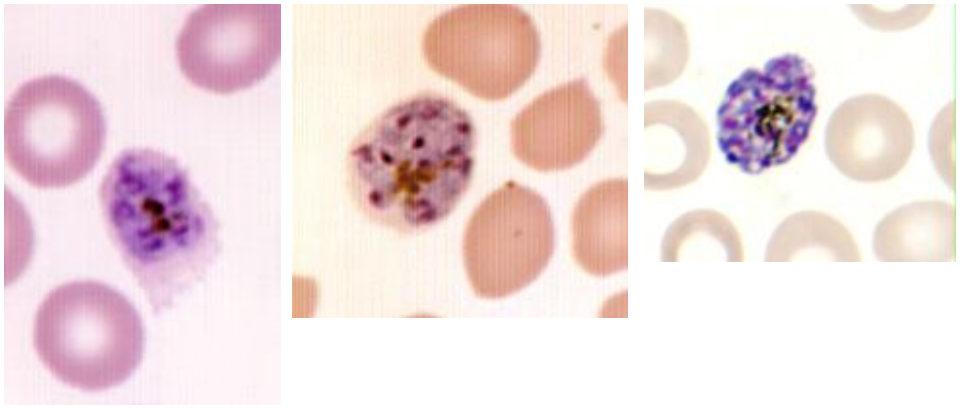


Rings

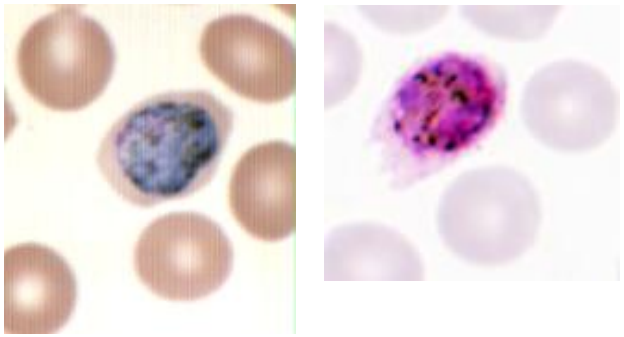


Trophozoites: compact

Schizonts: 6-14 merozoites; dark pigment; ("rosettes")



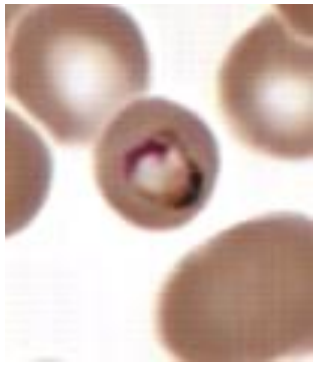
Gametocytes: round-oval



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Plasmodium malariae

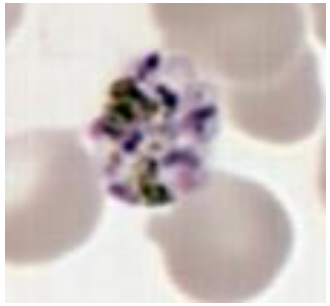
Infected erythrocytes: size normal to decreased (3/4X)



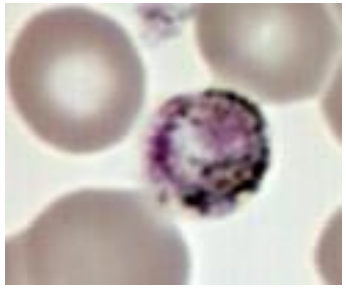
Trophozoite: compact



Trophozoite: typical band form



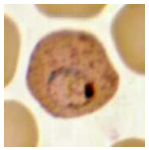
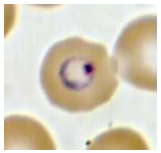
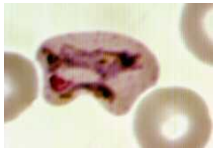
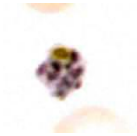
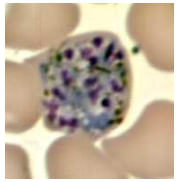
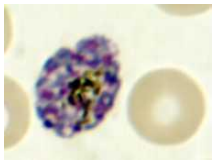
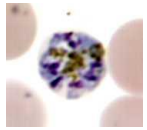
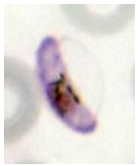
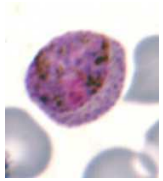
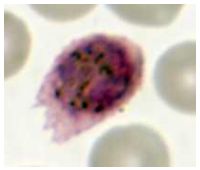
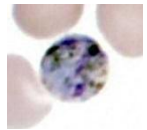
Schizont: 6-12 merozoites; coarse, dark pigment



Gametocyte: round; coarse, dark pigment

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Species Differentiation on Thin Films

	P. falciparum	*P. vivax*	*P. ovale*	*P. malariae*
Rings				
Trophozoites				
Schizonts				
Gametocytes				

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