Diagnosis of malaria on blood smears

Microscopic examination is the gold standard for laboratory confirmation of malaria. A blood specimen is spread as a thick or thin blood smear, stained with Giemsa, and examined with an oil immersion objective. Visual criteria are used to detect malaria parasites and to differentiate the various species.

Blood smears of *Plasmodium falciparum*

1) Ring-form trophozoites can be seen in a blood.
2) In falciparum malaria, a high proportion of infected red blood cells are seen, and doubly parasitized cells is characteristic.
3) The most definitive finding of *P. falciparum* is the identification of crescent-shaped or banana-shaped gametocytes.
4) Ameboid forms are not seen in the peripheral blood.

The period of fever in falciparum malaria is irregular between 36 to 48 hours.

Plasmodium vivax on blood smears

1) *P. vivax* selectively infects large-sized red cells (reticulocytes). The ring forms are relatively large-sized.
2) Infected red cells contain Schüffner's dots.
3) The shape of red cells remains rounded without oval change or feathered edges, unlike *O. ovale*.
4) In sharp contrast to falciparum malaria, mature trophozoites (ameboid form) and round gametocytes are observed in the peripheral blood.

The period of fever in vivax malaria (tertian malaria) is every 48 hours.

Plasmodium ovale on blood smears

1) *P. ovale* infects large-sized red cells (reticulocytes).
2) Infected red cells contain Schüffner's dots.
3) Infected red cells show an oval shape.
4) Infected red cells show feathering at cell's edges.

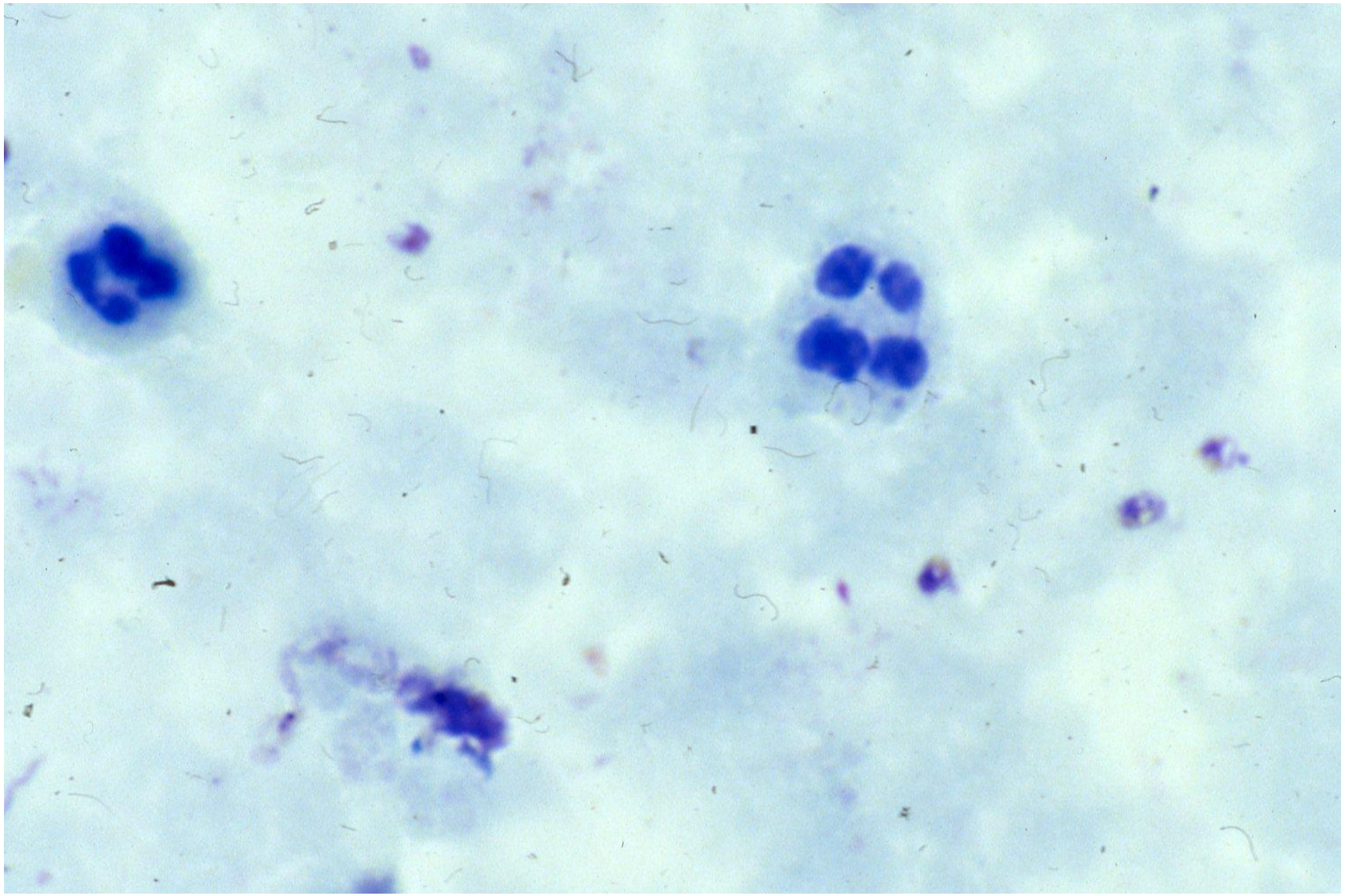
The period of fever in vivax malaria is every 48 hours.

Plasmodium malariae on blood smears

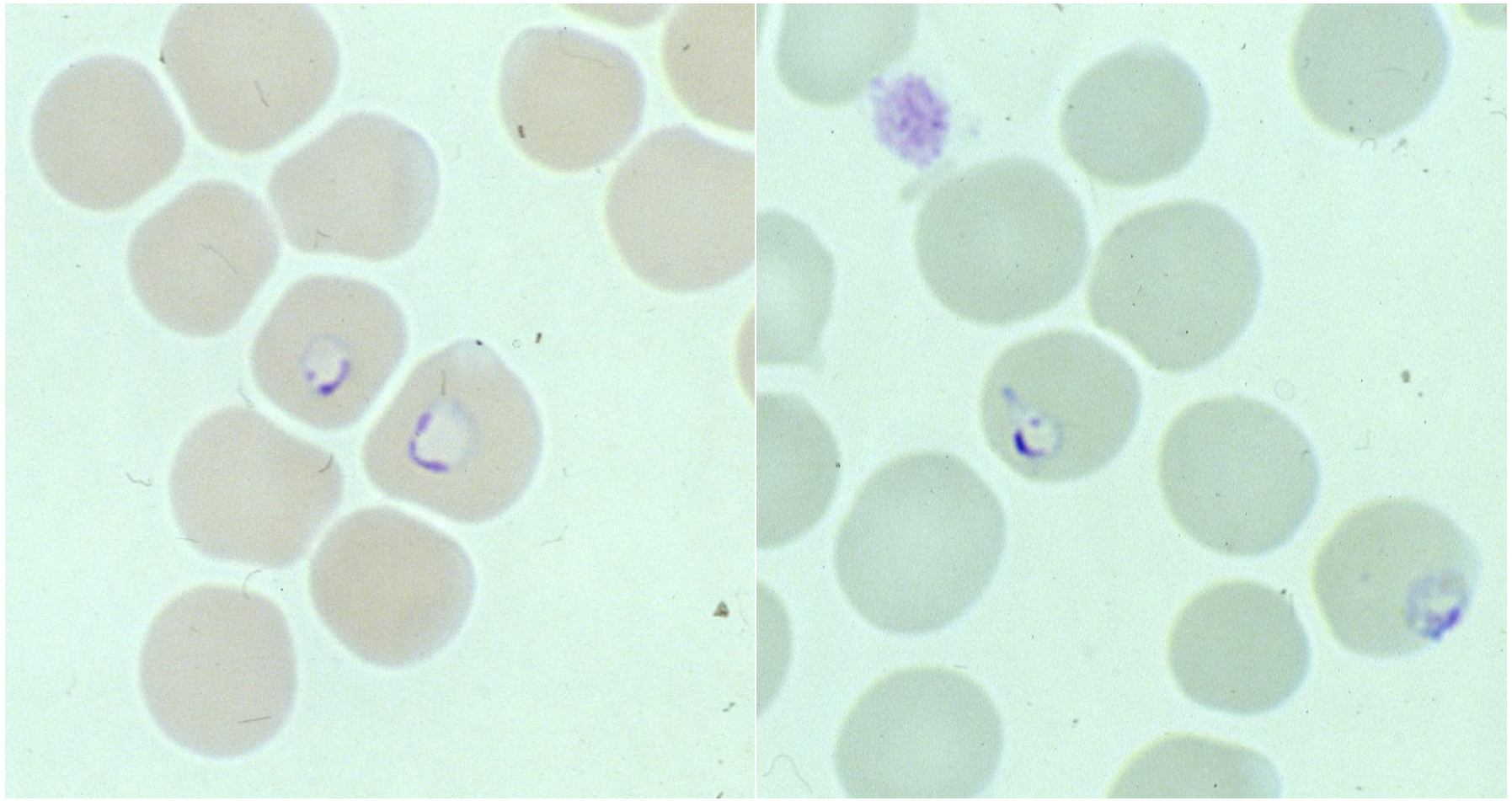
1) *P. malariae* infects senescent (small-sized) red cells.
2) Mature trophozoites of *P. malariae* show band-like or sash-like structure.
3) Rosette forms are characteristic: merozoites surround a pigmented schizont.

The period of fever in malarial malaria (quartan fever malaria) is every 72 hours.

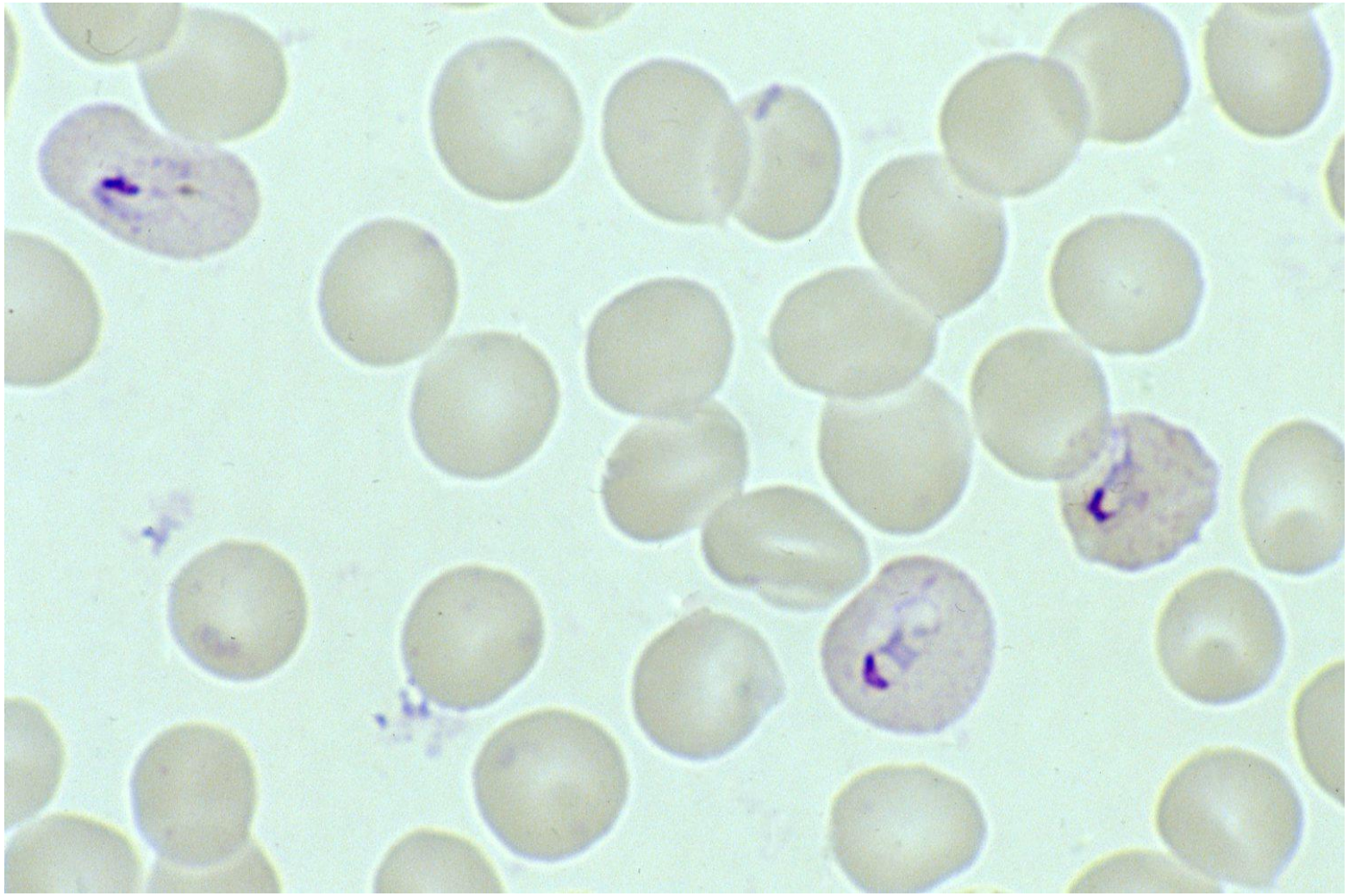
The 5th type of malaria is semian malaria caused by infection of *Plasmodium knowlesi*. Only band-forms appear in the blood smear, somewhat resembling *P. malariae*. The period of fever is every 24 hours.



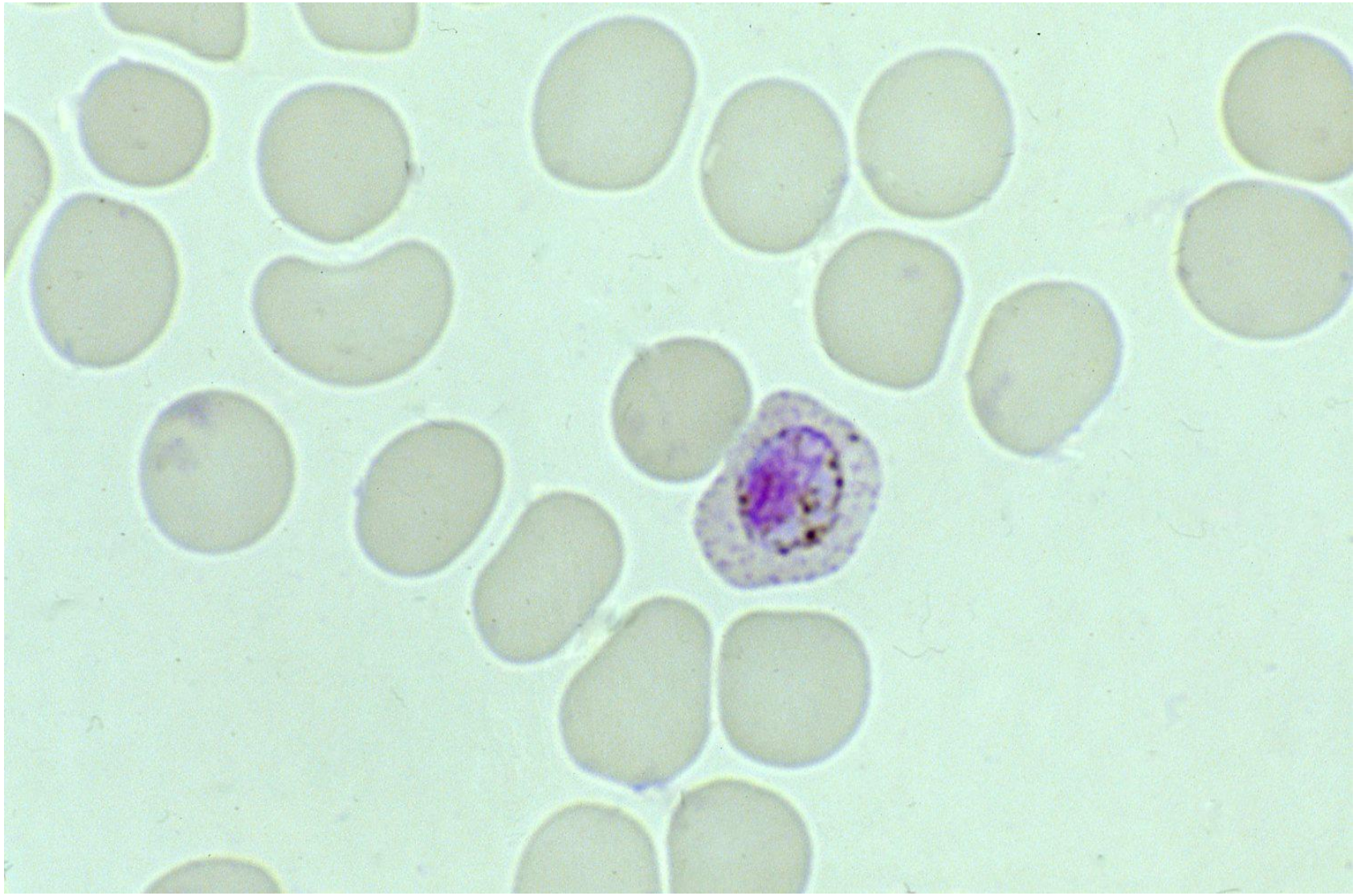
Thick smear preparation for falciparum malaria. Ring forms appear in the background of hemolysis.



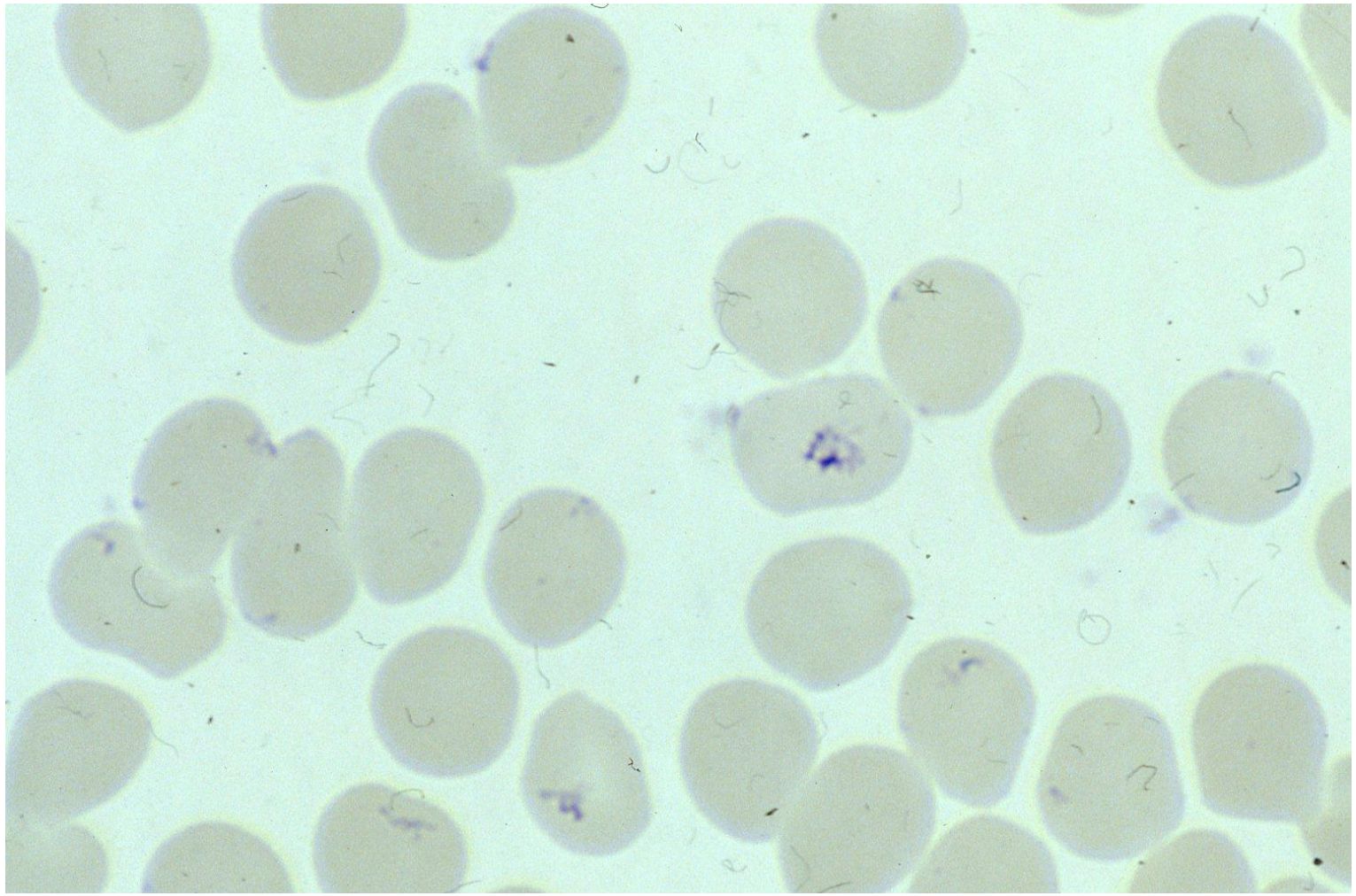
Thin smear preparation for falciparum malaria. Difference of the May-Giemsa-stained features between solution pH at 6.4 (left) and at 7.2 (right). Red cells are stained bluish with May-Giemsa at pH 7.2, and the ring forms (and Schüffner's dots) are visible more clearly. This Kenyan female patient is an Ekiden runner (athlete) attending at an international competition held in Japan. She has completed the full interval running with falciparum malaria in the blood.



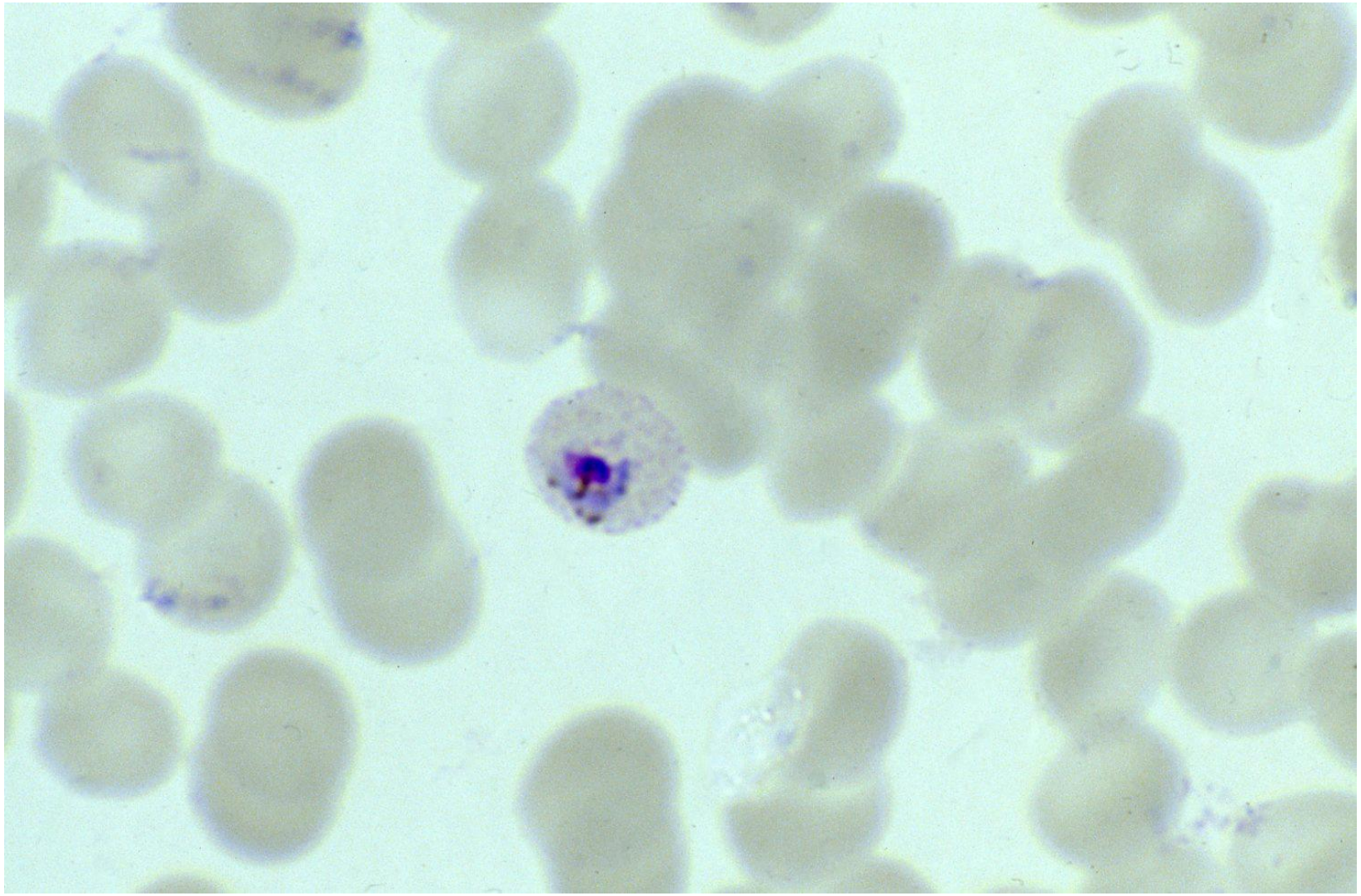
The ring form of vivax malaria infects large-sized red cells.
Schüffner's dots are observed. May-Giemsa



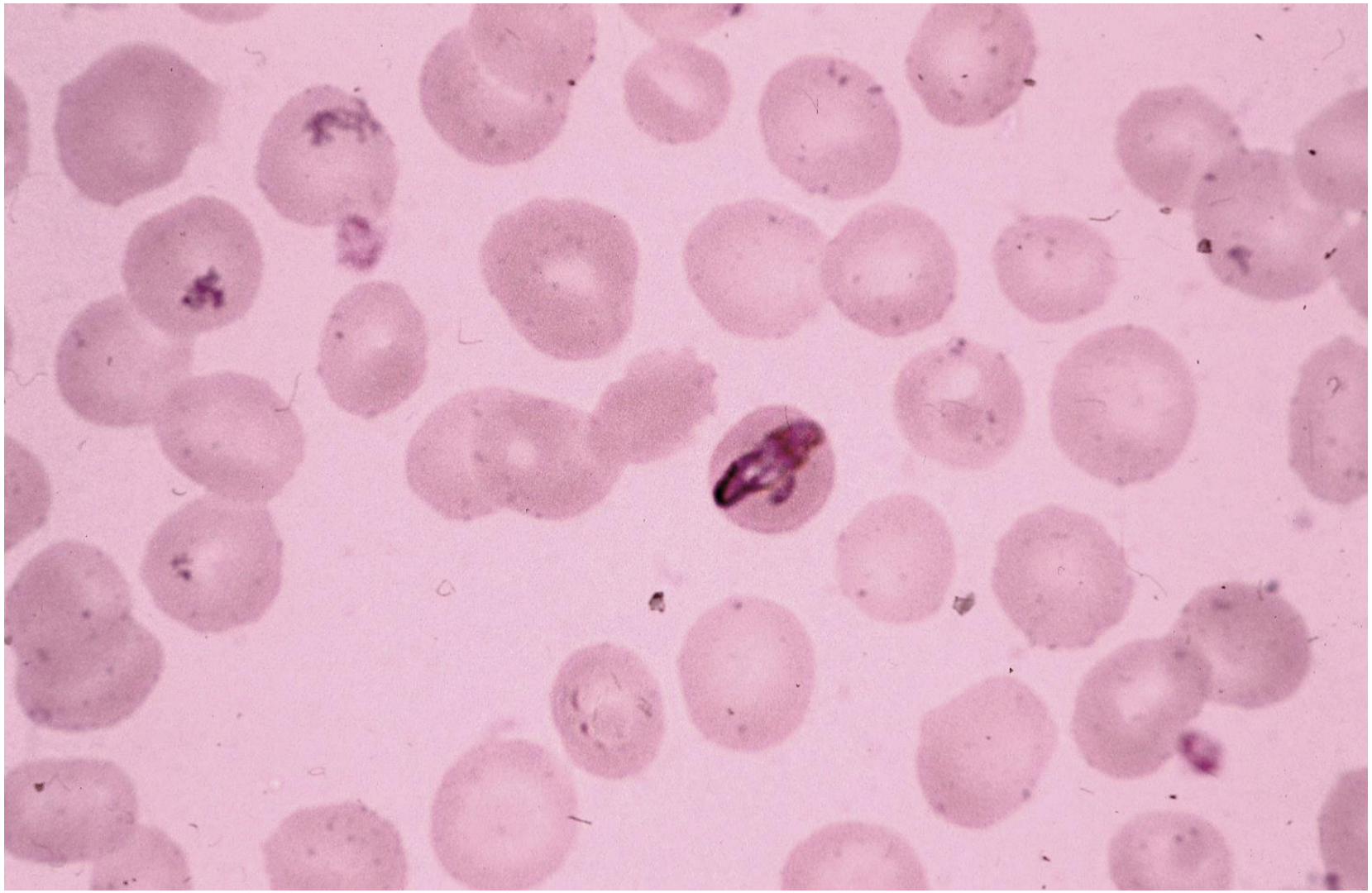
The ameba form of vivax malaria infects large-sized red cells. Formation of malaria pigments and association of Schüffner's dots are observed. May-Giemsa



The ring form of oval malaria infects large-sized red cells. Schüffner's dots are observed. The infected red cell is oval in shape. May-Giemsa



The ameba form of oval malaria infects large-sized red cells.
Schüffner’s dots are observed. May-Giemsa



Malarial malaria. The mature trophozoite of *P. malariae* shows band-like or sash-like structure.