

NORMAL WHITE BLOOD CELL MORPHOLOGY

SEGMENTED NEUTROPHIL

Segmented neutrophils are the most common white blood cells in peripheral blood of all the common domestic species, except ruminants. Segmented neutrophils are typically 10 to 12 μm in diameter and have single nuclei with several indentations resulting in the nucleus being divided into multiple lobes. Typically there are 3 to 5 lobes or segments per cell. The chromatin pattern of the nucleus consists of very dark, condensed areas intermixed with small clear areas. The cytoplasm stains faintly blue to pink depending on the type and quality of the stain used. Sometimes very indistinct pink granules may be seen in the cytoplasm. The neutrophils of the different species look very similar. The major exception is that the cytoplasm of bovine neutrophils often stains more pink compared with that of the other species. Also, in horses, the segments of the nucleus are generally not as distinct.

BAND NEUTROPHIL

Band neutrophils may be absent or present in the peripheral blood in very low numbers. Band neutrophils look similar to segmented neutrophils except that the nuclei are band shaped. Classically, the nuclear membranes are parallel so that the nucleus has a constant width. Because band neutrophils are a stage in the gradual differentiation toward the segmented-neutrophil form, slight nuclear indentations are possible.

LYMPHOCYTE

Lymphocytes are the second most common cell type in the peripheral blood of most of the domestic species and are the most common cell type in ruminants. Typically, these cells are round, slightly smaller than neutrophils, and have round to oval and sometimes slightly indented nuclei. The chromatin pattern consists of smooth glassy areas intermixed with areas that are more clumped or smudged. A small amount of light blue cytoplasm is present. A few of the lymphocytes may have multiple, small, pinkish-purple granules in the cytoplasm. In addition to these small lym-

phocytes, many animals may have some medium to large lymphocytes. This is especially true for ruminants. Often these cells have more cytoplasm than small lymphocytes. In addition, the chromatin of ruminant nuclei is often much more accentuated with sometimes marked areas of condensation. This may lead to the false conclusion that nucleoli are present in these cells.

MONOCYTE

Monocytes are absent or present in low numbers in the peripheral blood and look very similar in all the common domestic species. These cells are typically 15 to 20 μm in diameter, and the nuclei can be different shapes: oval, oval with a single indentation (kidney bean-shaped), or have multiple indentations and lobulations. The nuclear chromatin is finely granular to lacy in appearance with only a few areas of condensation. The moderate amount of cytoplasm is typically blue-gray and may have multiple, variably sized discrete vacuoles.

EOSINOPHIL

Eosinophils are absent or present in very low numbers in normal animals. These cells are typically similar in size to neutrophils or slightly larger. The nuclei are very similar to those of neutrophils in that they are segmented, but the segments are often not as well defined. The cytoplasm stains faint blue and has multiple reddish to reddish-orange granules. The number and shapes of the granules are quite different for most of the common domestic species. Dog eosinophilic granules are round and quite variable in size and number. There are often multiple, variably sized vacuoles in the cytoplasm as well. Cat eosinophilic granules are rod shaped and typically fill the cytoplasm. Horse eosinophils have very large round, oval, or oblong granules that fill the cytoplasm and often obscure the nucleus. Ruminant eosinophils have small round, fairly uniform granules that typically fill the cytoplasm. Llama eosinophils have small round, oval, or oblong granules. The low number of granules typically does not fill the cytoplasm.

BASOPHIL

Basophils are rarely seen in the peripheral blood of all the common domestic species. They are most commonly seen in horses. Basophils are similar in size or slightly larger than neutrophils, and the cytoplasm is light purple. The nucleus is segmented but often not to the degree of the mature neutrophil. Low numbers of small, round, purple cytoplasmic granules may

sometimes be present in dog basophils. The presence or absence of granules may be dependent on the type of stain used. Cat basophils contain indistinct small, round, lavender granules. Both cow and horse basophils have several small, well-stained purple granules in the cytoplasm. Llama basophils look very similar to cow or horse basophils. Figures 5.1–5.30 show the normal white blood cells of the common domestic species.

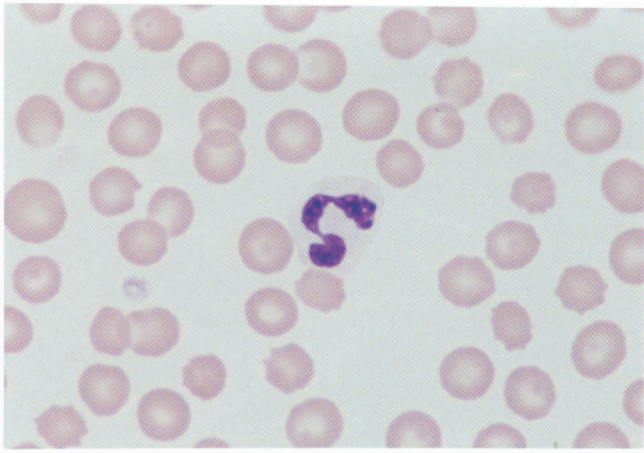


Figure 5.1. Segmented neutrophil. The cell with the segmented nucleus and pink cytoplasm is a mature neutrophil. Canine blood smear; 100× objective.

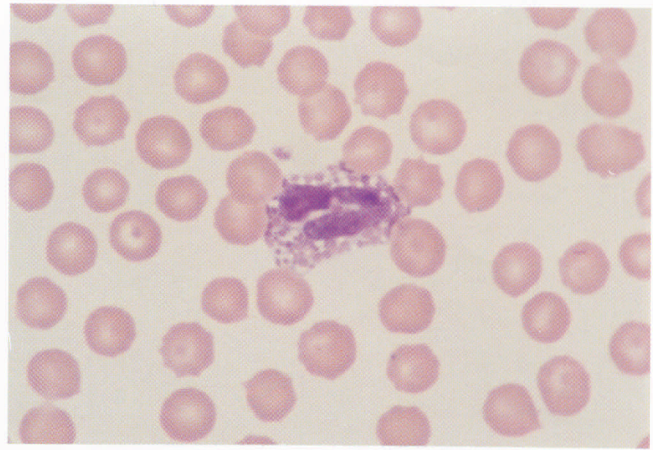


Figure 5.4. Eosinophil. The cell with a poorly segmented nucleus and multiple, round reddish granules in the cytoplasm is an eosinophil. Canine blood smear; 100× objective.



Figure 5.2. Small lymphocyte. The small cell with a round, centrally located nucleus and rim of light blue cytoplasm is a small lymphocyte. Canine blood smear; 100× objective.



Figure 5.5. Basophil. The cell with the poorly segmented nucleus and light purple cytoplasm with low numbers of small, discrete purple granules is a basophil. Canine blood smear; 100× objective.



Figure 5.3. Monocyte. The large cell with a deeply indented nucleus, blue-gray cytoplasm, and multiple, discrete cytoplasmic vacuoles is a monocyte. Note the nucleus is not as prominently segmented as the mature neutrophil. Canine blood smear; 100× objective.

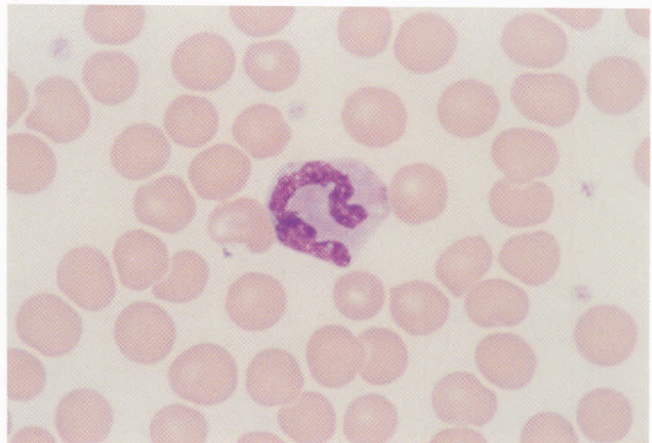


Figure 5.6. Basophil. The cell with the poorly segmented nucleus and light purple cytoplasm is a basophil. Without distinct granules, these cells can be difficult to distinguish from toxic neutrophils or monocytes. Canine blood smear; 100× objective.

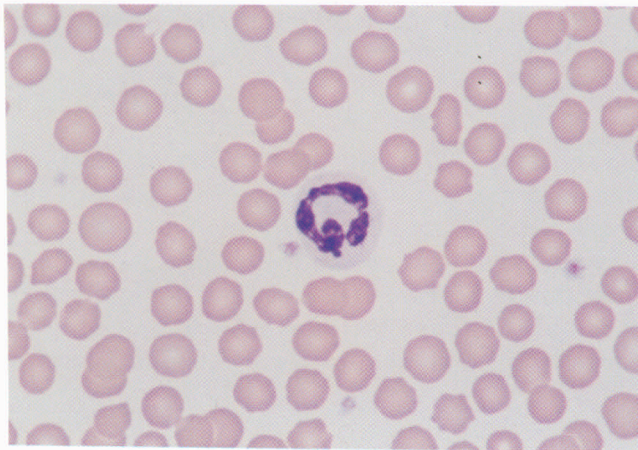


Figure 5.7. Segmented neutrophil. The cell with a segmented nucleus and light pink cytoplasm is a mature neutrophil. Feline blood smear; 100× objective.

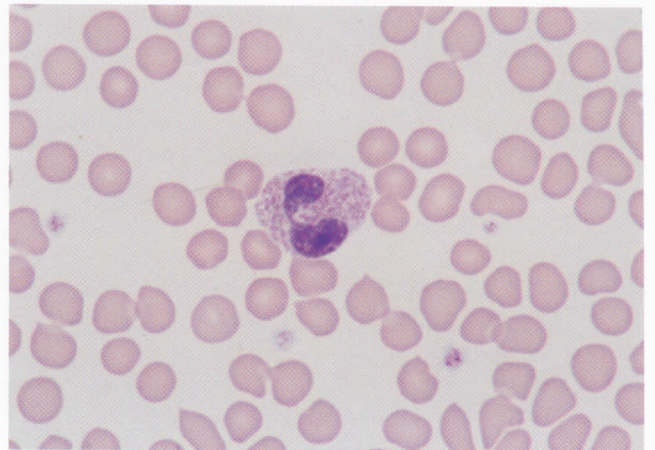


Figure 5.10. Eosinophil. The cell with a segmented nucleus and multiple, reddish rod-shaped granules in the cytoplasm is an eosinophil. Feline blood smear; 100× objective.

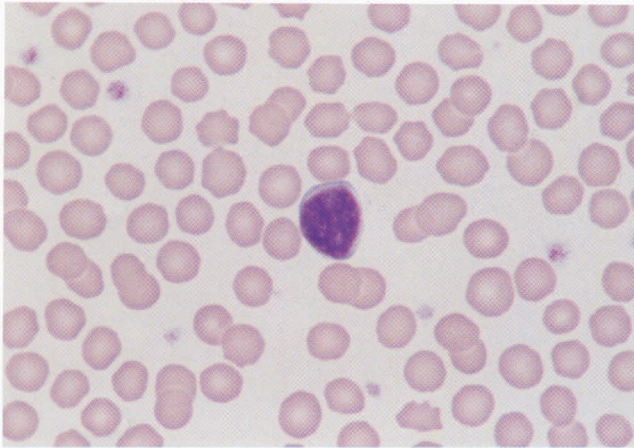


Figure 5.8. Small lymphocyte. The small cell with a round to oval, centrally located nucleus and rim of light blue cytoplasm is a small lymphocyte. Feline blood smear; 100× objective.

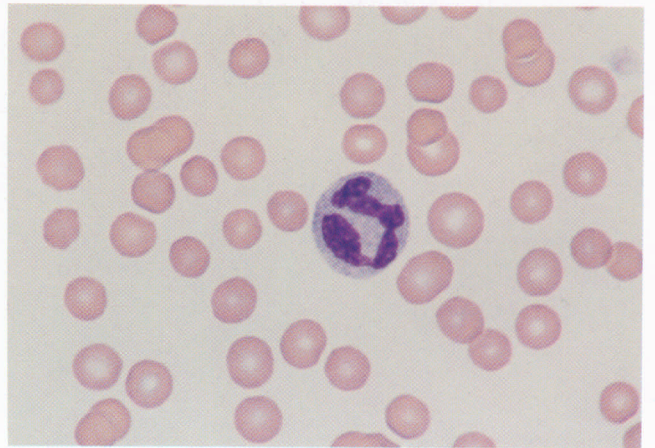


Figure 5.11. Basophil. The cell with a segmented nucleus and poorly defined, round, light purple granules in the cytoplasm is a basophil. Feline blood smear; 100× objective.

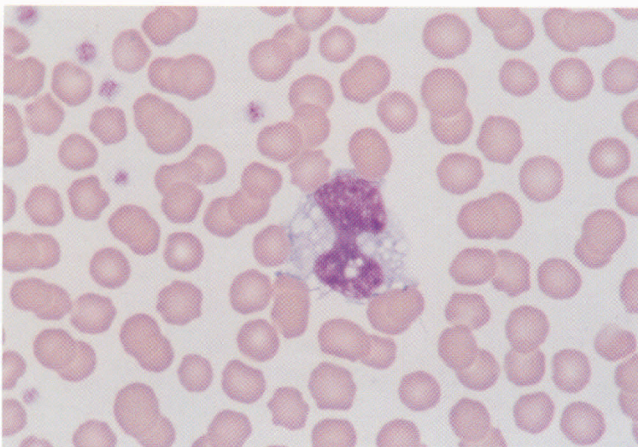


Figure 5.9. Monocyte. The large cell with a deeply indented nucleus, blue-gray cytoplasm, and multiple, discrete cytoplasmic vacuoles is a monocyte. Feline blood smear; 100× objective.



Figure 5.12. Segmented neutrophil and basophil. The cell to the lower left is a segmented neutrophil, and the cell to the upper right is a basophil. Note the slightly larger size of the basophil as well as the poorly defined, round, light purple cytoplasmic granules. Feline blood smear; 100× objective.



Figure 5.13. Segmented neutrophil. The cell with a segmented nucleus and light blue to pink cytoplasm is a mature neutrophil. Equine blood smear; 100× objective.

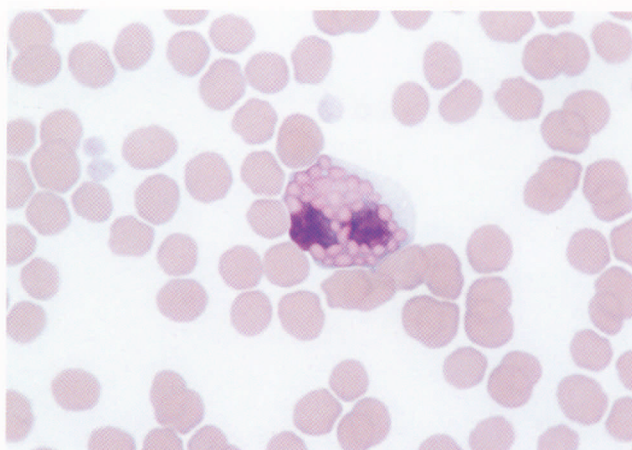


Figure 5.16. Eosinophil. The cell with the bilobed nucleus and very large, round to oval reddish granules in the cytoplasm is an eosinophil. Note that the granules are obscuring part of the nucleus. Equine blood smear; 100× objective.

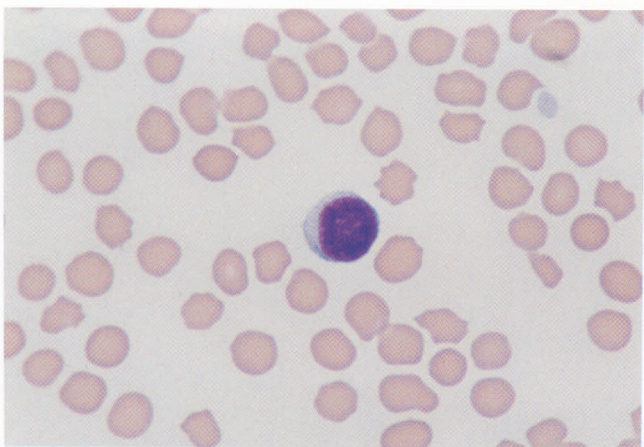


Figure 5.14. Small lymphocyte. The small cell with a round nucleus and a rim of light blue cytoplasm is a small lymphocyte. Equine blood smear; 100× objective.



Figure 5.17. Basophil. The cell with bilobed nucleus and numerous small, purple cytoplasmic granules is a basophil. Note that the granules are obscuring part of the nucleus. Equine blood smear; 100× objective.



Figure 5.15. Monocyte. The large cell with a deeply indented nucleus, blue-gray cytoplasm, and multiple, discrete cytoplasmic vacuoles is a monocyte. Equine blood smear; 100× objective.

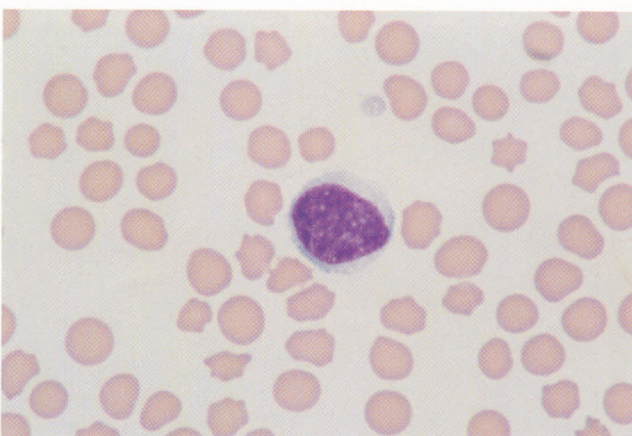


Figure 5.18. Large lymphocyte. The large round cell with an oval nucleus and a rim of light blue cytoplasm is a large lymphocyte. Equine blood smear; 100× objective.



Figure 5.19. Segmented neutrophil. The cell with a segmented nucleus and light pink cytoplasm is a mature neutrophil. Bovine blood smear; 100× objective.

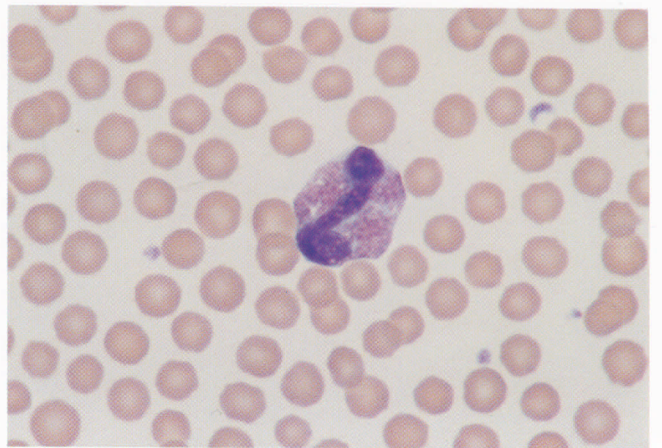


Figure 5.22. Eosinophil. The cell with the elongated nucleus and abundant, small, round reddish granules in the cytoplasm is an eosinophil. Bovine blood smear; 100× objective.



Figure 5.20. Small lymphocyte. The cell with the round to oval nucleus and a rim of light blue cytoplasm is a small lymphocyte. Bovine blood smear; 100× objective.



Figure 5.23. Basophil. The cell with the segmented nucleus and numerous, small purple granules in the cytoplasm is a basophil. Bovine blood smear; 100× objective.



Figure 5.21. Monocyte. The large cell with the deeply indented nucleus and blue-gray cytoplasm is a monocyte. Note the lack of vacuoles; not all monocytes contain vacuoles. Bovine blood smear; 100× objective.



Figure 5.24. Large lymphocyte. The cell with a round to slightly indented nucleus with small amounts of light blue cytoplasm is a large lymphocyte. Note the accentuated nuclear chromatin pattern that is often seen in normal bovine lymphocytes. Bovine blood smear; 100× objective.

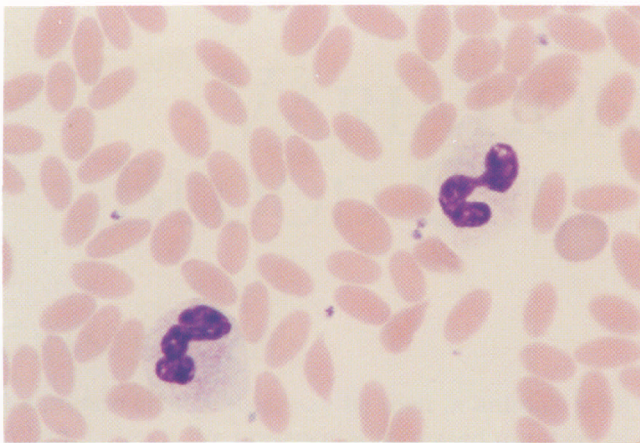


Figure 5.25. Neutrophils. The two cells with segmented nuclei and light blue to pink granular cytoplasm are segmented neutrophils. Llama blood smear; 100× objective.



Figure 5.28. Eosinophil. The cell with a band-shaped nucleus and low numbers of poorly defined, small, round to oblong reddish granules in the cytoplasm is an eosinophil. Often llama eosinophils have low numbers of cytoplasmic granules. Llama blood smear; 100× objective.

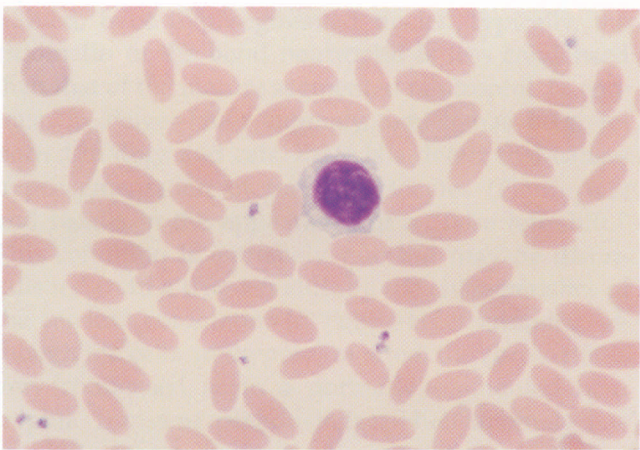


Figure 5.26. Small lymphocyte. The cell with the round nucleus and small amount of light blue cytoplasm is a small lymphocyte. Llama blood smear; 100× objective.

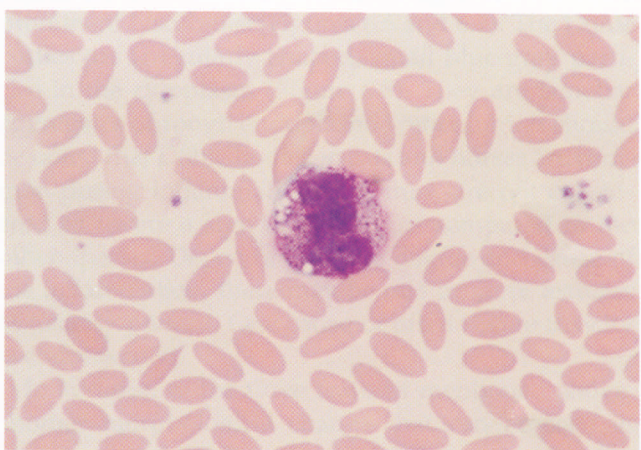


Figure 5.29. Basophil. The cell with the poorly segmented nucleus and multiple, small purple cytoplasmic granules is a basophil. The granules partially obscure the nucleus. Llama blood smear; 100× objective.



Figure 5.27. Monocyte. The large cell with a deeply indented nucleus, blue-gray cytoplasm, and multiple, discrete cytoplasmic vacuoles is a monocyte. Llama blood smear; 100× objective.

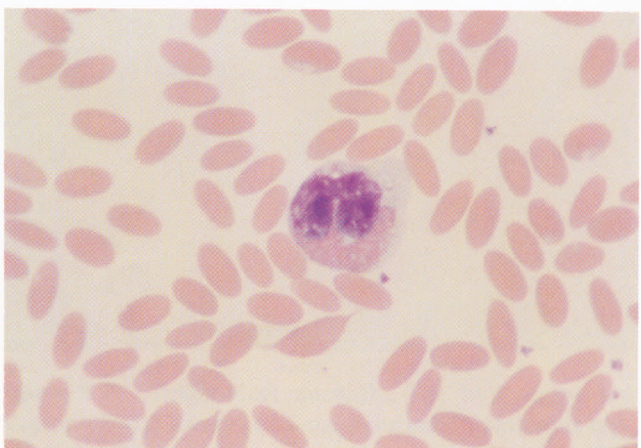


Figure 5.30. Eosinophil. The cell with a bilobed nucleus and multiple, round reddish granules is a well-granulated eosinophil. Llama blood smear; 100× objective.