

White Blood Cell Evaluation in Blood Films

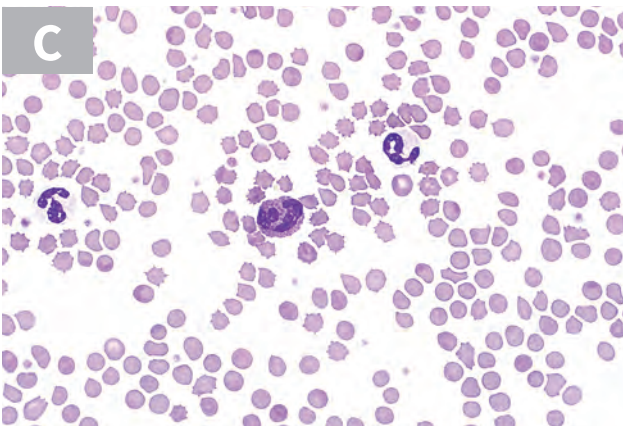
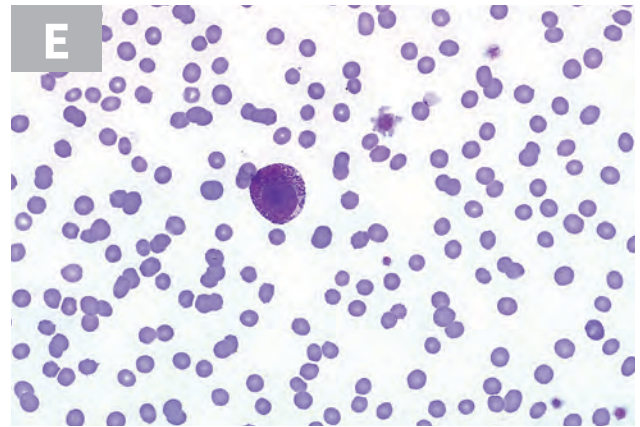
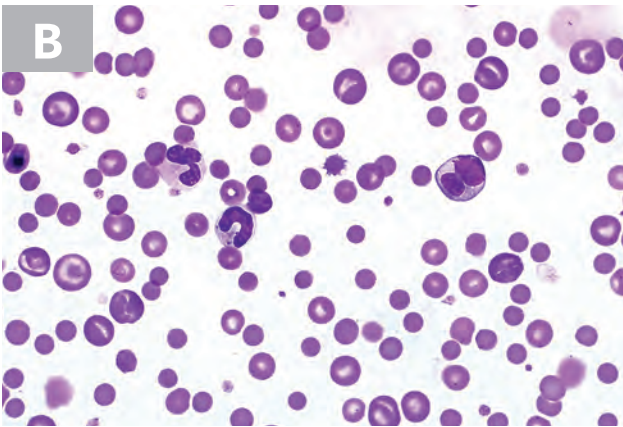
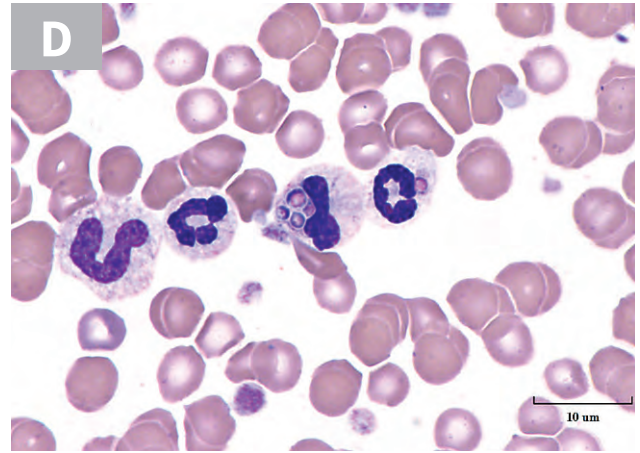
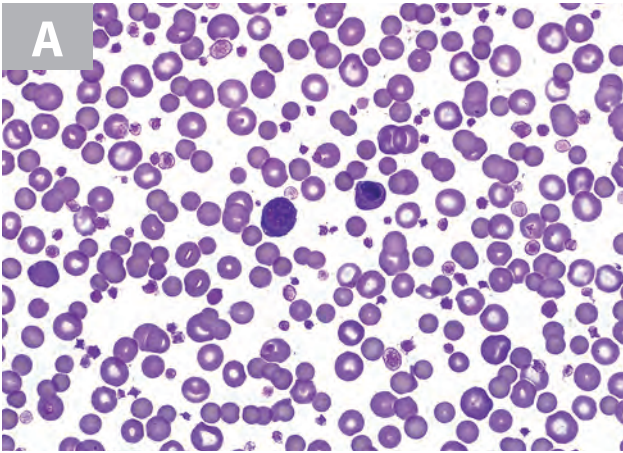
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Numeric and morphologic evaluation of WBCs are essential components of the CBC. Automated in-house hematology analyzers can aid in the numeric portion of the assessment, but no hematology analyzers are able to identify morphologic abnormalities in the cells. Toxic changes, left shifts (regenerative or degenerative), neoplastic cells in circulation, parasites, and inclusions are among the important findings that require blood film evaluation. In addition, even when all CBC values are within the reference interval, abnormalities may still be detected on the blood film. The following images and their interpretations focus on WBC morphology.

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PLATELET EVALUATION & INTERPRETATION

Find an image gallery on platelet evaluation and interpretation on blood smears at [cliniciansbrief.com/article/blood-smear-platelet-evaluation-interpretation](https://www.cliniciansbrief.com/article/blood-smear-platelet-evaluation-interpretation)



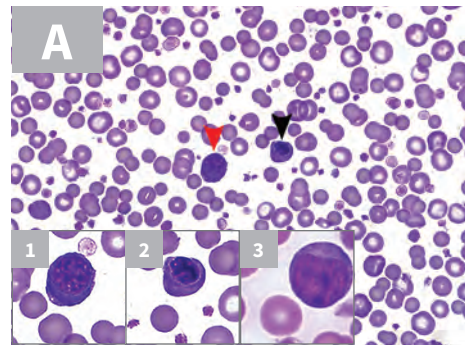
MATCH THE IMAGES

Match the images with the correct interpretation.

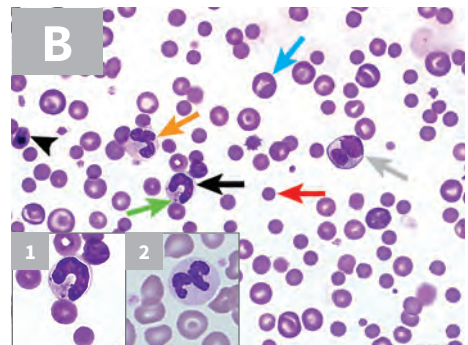
- ___ Basophilia in a cat
- ___ No WBCs seen in a blood film from a dog
- ___ Acute inflammatory leukogram in a dog with immune-mediated hemolytic anemia
- ___ Mastocytomia in a cat
- ___ Acute inflammatory leukogram in a dog with histoplasmosis

ANSWER KEY

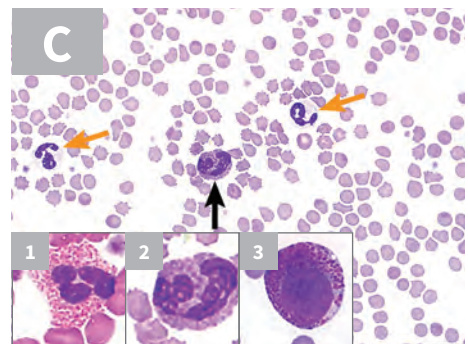
A No WBCs seen in a blood film from a dog
 The 2 nucleated cells seen in this image are nucleated RBCs (nRBCs)—more specifically, an early (ie, basophilic) rubricyte (*red arrowhead; inset 1*) and a metarubricyte (*black arrowhead; inset 2*). In routine blood film examination, differentiating between metarubricytes and rubricytes is not as important as identifying these cells as nRBCs. The ability to identify nRBCs is essential because automated hematology analyzers count nRBCs as WBCs, which falsely increases—potentially significantly—the total WBC concentration. In the author’s experience, lymphocytes are the cells most commonly confused with nRBCs by individuals who evaluate blood films without advanced training in clinical pathology. The inset images compare a lymphocyte (*inset 3*) with the nRBCs.



B Acute inflammatory leukogram in a dog with immune-mediated hemolytic anemia
 A left shift is the hallmark sign of an acute inflammatory leukogram. In healthy dogs and cats, rare to no band neutrophils should be observed.¹ Although only one band neutrophil (*black arrow*) is present in this image, if this view is representative of other fields, the bands are significantly increased. Another notable finding is the toxic change as represented by the Döhle bodies (*green arrow*) and increased cytoplasmic basophilia; this toxic change can be visualized in the band neutrophil in *inset 1* and compared with a normal segmented neutrophil in *inset 2*. Other nucleated cells include a monocyte (*gray arrow*), a segmented neutrophil (*gold arrow*), and a metarubricyte (*arrowhead*). Within the RBC population, anisocytosis (ie, variation in cell size), polychromatophils (ie, immature RBCs; one indicated by a *blue arrow*), and spherocytes (one indicated by a *red arrow*) are visible.

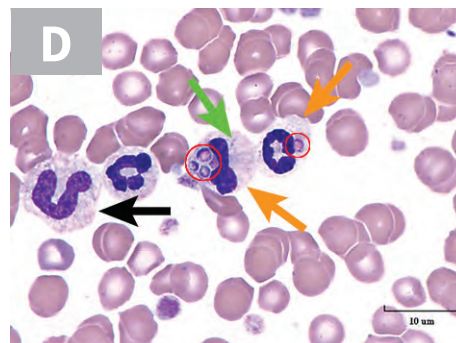


C Basophilia in a cat
 Basophils (*black arrow*) are slightly bigger than segmented neutrophils (*gold arrows*). In most species, basophil granules are dark purple, but in cats, granules stain a light lavender or gray color² and tend to fill the cytoplasm, resulting in a cobble- or pavement-stone-like appearance.¹ The nucleus is lobulated (similar to that of a neutrophil) and not round (like a mast cell). The inset photos compare a feline eosinophil (*inset 1*; contains pink, rod-shaped granules), basophil (*inset 2*), and mast cell (*inset 3*).



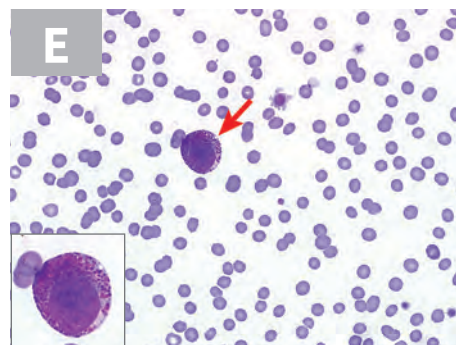
D Acute inflammatory leukogram in a dog with histoplasmosis

This patient had a history of weight loss and chronic diarrhea that was unresponsive to antibiotics. CBC revealed a total WBC count of 38 900 cells/ μ L. The manual WBC differential and morphologic assessment indicated 18 700 segmented neutrophils/ μ L (**gold arrows**), 15 600 band neutrophils/ μ L (**black arrow**), 2700 lymphocytes/ μ L, 1200 eosinophils/ μ L, and 400 monocytes/ μ L. Toxic changes characterized by foamy cytoplasm, increased cytoplasmic basophilia, and small Döhle bodies (**green arrow**) are present. Two neutrophils containing round yeast structures (**red circles**), approximately 2 to 3 μ m in diameter, with basophilic nuclei are visible; these organisms are consistent with *Histoplasma* spp.³



E Mastocytoma in a cat

Identification of one mast cell (**red arrow**) in the blood is considered sufficient for a diagnosis of mastocytoma. In dogs, mastocytoma is frequently seen with both inflammatory and neoplastic disease.⁴ In cats, however, mastocytoma is most commonly seen with mast cell neoplasia, although other conditions—including lymphoma and hemangiosarcoma—cannot be ruled out, especially if the concentration of circulating mast cells is low.⁵ Cats with mastocytoma should undergo a complete diagnostic investigation, including a thorough physical examination and imaging (eg, radiography of the thorax and abdomen, ultrasonography of the abdomen), to identify the cause. Cytology should be performed for evaluation of effusions, visceral and cutaneous masses, enlarged lymph nodes, the liver, and the spleen. Bone marrow examination may also be helpful.⁶ The variably sized, round, deep purple granules and the round nucleus can be seen more clearly in the **inset**. ■



nRBC = nucleated RBC

References

1. Weiser G. Introduction to leukocytes and the leukogram. In: Thrall MA, Weiser G, Alison R, Campbell T, eds. *Veterinary Hematology and Clinical Chemistry*. 2nd ed. Ames, IA: Wiley-Blackwell; 2012:118-122.
2. Walker D. Peripheral blood smears. In: Cowell RL, Tylet DT, Meinkoth JH, DeNicola DB, eds. *Diagnostic Cytology and Hematology of the Dog and Cat*. 3rd ed. St. Louis, MO: Mosby Elsevier; 2008:395-397.
3. Cowell RL, Tylet DT, Meinkoth JH, DeNicola DB. Selected infectious agents. In: Cowell RL, Tylet DT, Meinkoth JH, DeNicola DB, eds. *Diagnostic Cytology and Hematology of the Dog and Cat*. 3rd ed. St. Louis, MO: Mosby Elsevier; 2008:53-56.
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6. Saba CF. Mast cell tumors. In: August JR, ed. *Consultations in Feline Internal Medicine*, vol 6. St. Louis, MO: Saunders Elsevier; 2010:697-702.

RED BLOOD CELL EVALUATION

Find an image gallery on RBC evaluation in blood films at cliniciansbrief.com/article/red-blood-cell-evaluation-blood-films