

Performance of the IDEXX inVue Dx Cellular Analyzer for a 6-part white blood cell differential and platelet estimation in cats

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Introduction

Blood morphology provides essential insights that cannot always be captured through automated cell counts alone, particularly in cats, whose hematologic parameters present unique diagnostic challenges for automated hematology analyzers. Blood morphology complements the complete blood count (CBC) by confirming or updating cell counts from the automated CBC and adding information about the morphology of the cells. Feline platelets have a tendency to clump, requiring a blood morphology evaluation to distinguish between true thrombocytopenia and pseudothrombocytopenia caused by the clumping. Furthermore, cats are prone to physiologic leukocytosis, which must be distinguished from an inflammatory leukogram and from circulating neoplastic cells.¹

The IDEXX inVue Dx™ Cellular Analyzer automates blood morphology and overcomes many of the limitations of traditional, in-clinic blood films. The IDEXX inVue Dx analyzer uses multiple wavelengths of light and fluorescent stains to visualize cells in a three-dimensional, fluid state within a sample cartridge. The analyzer assesses multiple fields of view and uses optical characteristics and positioning of elements within the cartridge to count and identify thousands of cells, including platelets within clumps. As part of its hematology analysis, the IDEXX inVue Dx analyzer provides a confirmation or update (when indicated) of white blood cell (WBC) differential cell counts from the CBC on the IDEXX inVue Dx report. Unlike traditional 100-cell differentials, the analyzer performs a 6-part differential on 500–2,000 WBCs in the sample, providing more accurate counting of cells. In addition, the IDEXX inVue Dx analyzer provides a semiquantitative platelet estimate to provide confidence in platelet numbers even in samples with platelet clumps.

Methods, results, and discussion

Precision

Precision (standard deviation [SD]) of the IDEXX inVue Dx analyzer was assessed by repeated analysis of feline blood samples 10 times on each of 4 IDEXX inVue Dx analyzers. Nine fresh remnant feline blood samples were selected for adequate volume for repeated testing and a range of neutrophil and platelet counts. Based on the data in table 1, the IDEXX inVue Dx analyzer's precision for neutrophils and platelets were considered good for clinical use in cats.

| Parameter | Range (K/ μ L) | # Samples (9 total) | SD (K/ μ L) |
|---------------------------|--------------------|---------------------|-----------------|
| Neutrophil | | | |
| Neutropenia | < 5 | 3 | 0.15 |
| Within reference interval | 5–10 | 3 | 0.46 |
| Neutrophilia | > 10 | 3 | 0.18 |
| Platelet | | | |
| Marked thrombocytopenia | < 50 | 2 | 34.52 |
| Moderate thrombocytopenia | 50–100 | 3 | 26.31 |
| Mild thrombocytopenia | 100–150 | 2 | 55.49 |
| Adequate | > 150 | 2 | 26.30 |

Table 1. Precision for IDEXX inVue Dx mature neutrophil and platelet counts across 9 samples with a range of normal and abnormal neutrophil and platelet counts on the ProCyte Dx Hematology Analyzer. For precision testing, each sample was analyzed 10 times on each of 4 IDEXX inVue Dx analyzers.

Platelet and 6-part WBC differential performance compared to the IDEXX ProCyte Dx Hematology Analyzer

Feline EDTA whole blood samples (n = 303) were collected from 16 different sites and analyzed within 4 hours of collection on an IDEXX ProCyte Dx™ Hematology Analyzer, a CBC analyzer validated and shown to have comparable performance to reference laboratory hematology analyzers, and an IDEXX inVue Dx analyzer.² Each sample was visually evaluated for clots in the blood collection tube prior to analysis with the ProCyte Dx and IDEXX inVue Dx analyzers, and samples with obvious clots in the tube were excluded from analysis. Pearson correlation (*r* values) was used to describe the relationship between the methods when continuous concentrations were produced. Kendall's tau-b, a nonparametric measure of correlation, was used to describe the relationship between semiquantitative categories. For both correlation statistics, a value of 0 indicates no correlation and a value of 1 indicates a perfect positive correlation.

The IDEXX inVue Dx analyzer had excellent correlation with the ProCyte Dx analyzer for neutrophils, lymphocytes, monocytes, and eosinophils, in samples with and without interpretive prompts on the ProCyte Dx CBC results (*r* = 0.80–0.99, figures 1a–1e). Platelet clumping is common in cats and can result in overestimation of basophils by the ProCyte Dx analyzer (figure 1e).² When samples with ProCyte Dx interpretive prompts indicating that platelet clumping may have interfered with the WBC differential were excluded, basophil counts also have excellent correlation (*r* = 0.8) between the IDEXX inVue Dx and ProCyte Dx

analyzers. Moderate positive correlation for basophils ($r = 0.5$) was seen when samples with ProCyt Dx interpretive prompts were included. Samples with these interpretive prompts or with the characteristic dot plot changes on the ProCyt Dx results would benefit from confirmation of basophil counts by IDEXX inVue Dx analysis.

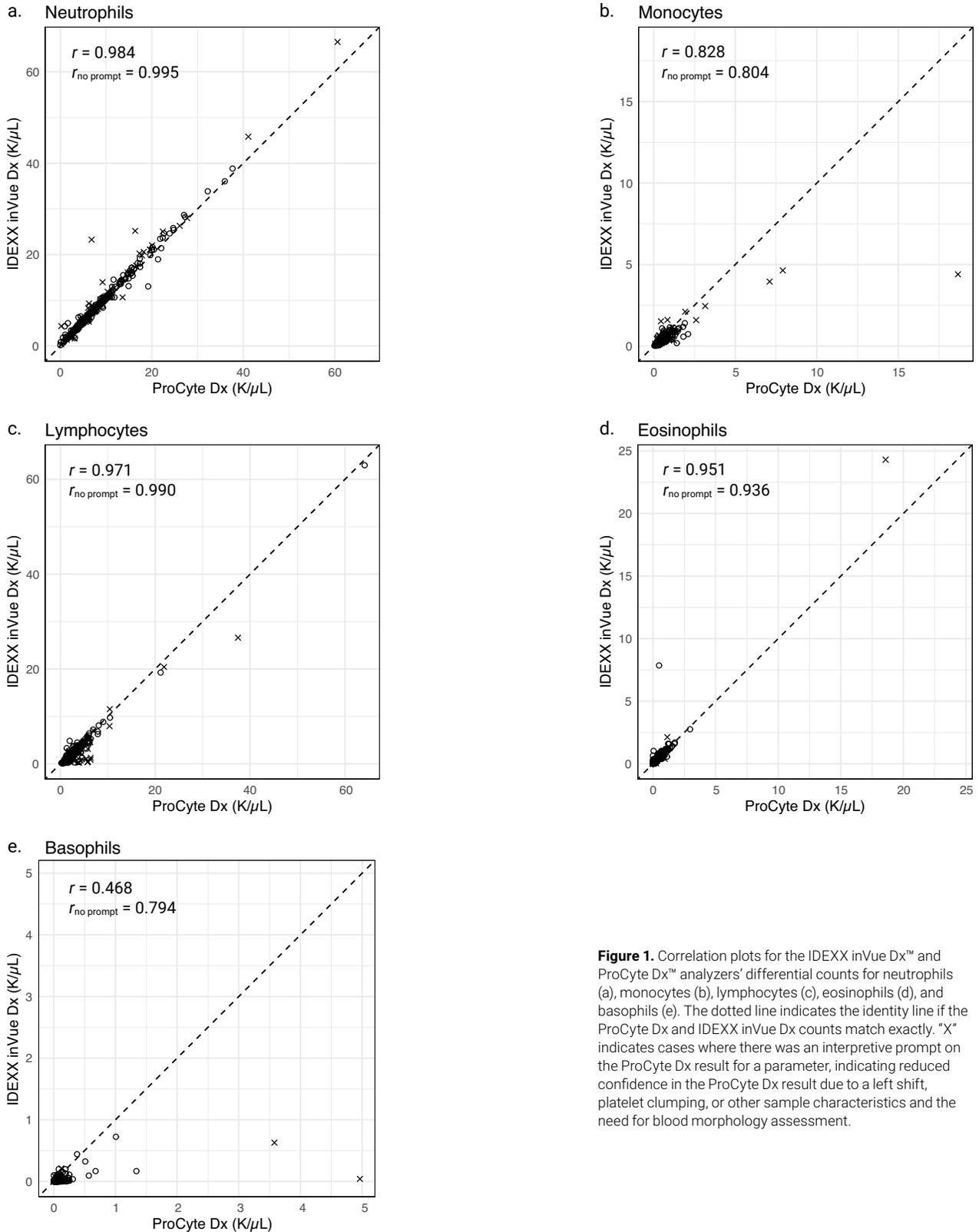
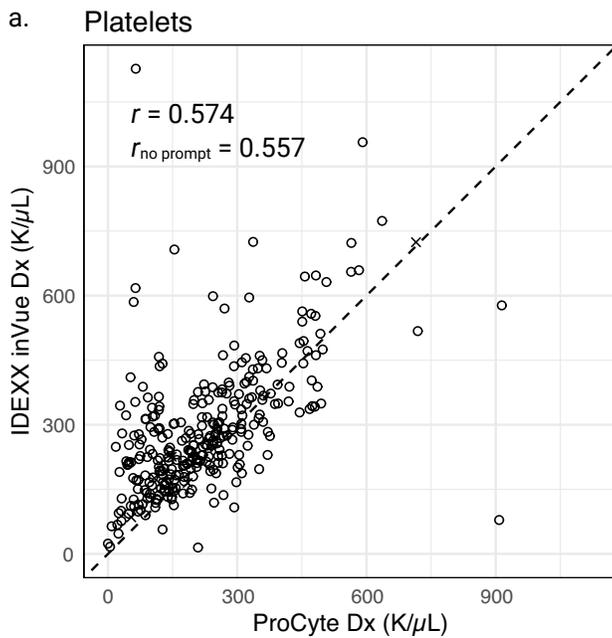


Figure 1. Correlation plots for the IDEXX inVue Dx™ and ProCyt Dx™ analyzers' differential counts for neutrophils (a), monocytes (b), lymphocytes (c), eosinophils (d), and basophils (e). The dotted line indicates the identity line if the ProCyt Dx and IDEXX inVue Dx counts match exactly. "X" indicates cases where there was an interpretive prompt on the ProCyt Dx result for a parameter, indicating reduced confidence in the ProCyt Dx result due to a left shift, platelet clumping, or other sample characteristics and the need for blood morphology assessment.

IDEXX inVue Dx analysis provides a semiquantitative platelet estimate, although for the purpose of this study, raw values off the analyzer were also assessed against ProCyte Dx platelet counts. There was moderate positive correlation between platelet counts on the two analyzers when either including or removing samples with ProCyte Dx “platelet clumping” interpretive prompts from analysis (figure 2a). Semiquantitative platelet assessment also showed moderate positive correlation between methods (Kendall’s tau-b = 0.43, figure 2b). Platelet estimates on glass slide blood film reviews were available for 263 samples, shown in figure 2b. In cases of discordance with

the ProCyte Dx CBC count, IDEXX inVue Dx platelet estimates were appropriately updated to a higher semiquantitative bucket based on pathologist glass slide blood film review in all but 6 cases, 2 of which pathologists denoted they were “entirely unsure” on the platelet estimate. Thus, when ProCyte Dx CBC results revealed low platelet counts, IDEXX inVue Dx analysis appropriately adjusted for platelet clumping and updated the platelet value. A platelet estimate to confirm or update a low platelet count from a CBC hematology analyzer is one of the most common reasons for blood film evaluation, now automated by the IDEXX inVue Dx analyzer.



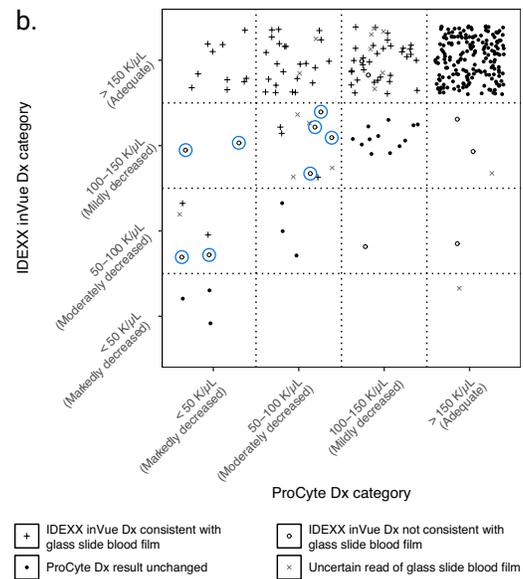
ProCyte Dx analyzer runs with an interpretive prompt indicating platelet clumps are marked by an “X.”

Figure 2. Correlation between the IDEXX inVue Dx™ and ProCyte Dx™ analyzers for discrete (a) and semiquantitative (b) platelet reporting.

IDEXX inVue Dx analyzer performance compared to pathologist manual WBC differentials

6-part WBC differential

The IDEXX inVue Dx analyzer provides updated WBC differentials if it detects a clinically significant change in cell counts from the CBC, such as when immature neutrophils and platelet clumping are present. To evaluate the ability of the IDEXX inVue Dx analyzer to update differentials, 263 of the 303 samples described above underwent pathologist blood film review. Samples were stained with modified Wright-Giesma stain (Aerospray™ 7120 Hematology Slide Stainer/Cytocentrifuge, ELITechGroup Inc.) and scanned on a digital slide scanner (MoticEasyScan™ One, software version 1.0.7.50 or 1.0.6.49, Motic Digital Pathology). The IDEXX inVue Dx analyzer was compared to traditional blood films by calculating an average



In 263 cases where the IDEXX inVue Dx, ProCyte Dx, and glass slide blood film analyses were available, IDEXX inVue Dx platelet estimates were appropriately updated to a higher semiquantitative bucket in all but 6 cases, 2 of which had an uncertain platelet estimate on blood film review. In the circled cases, pathologist blood film review revealed “likely adequate platelets with clumping,” creating uncertainty in the exact manual quantification of platelets due to clumping.

of 3 manual 6-part, 200-cell WBC differentials performed by board-certified pathologists.

Correlation between IDEXX inVue Dx results and average expert manual 200-cell differential are shown in figures 3a–3d. Correlation of mature neutrophils, lymphocytes, and eosinophils remained excellent ($r > 0.9$); monocytes were strong ($r = 0.6$); and basophils were moderate ($r = 0.4$). Manual and IDEXX inVue Dx correlation of immature neutrophils was fair ($r = 0.3$) (figure 3d). Abnormal cells, like immature neutrophils, have subjective variability in manual counts even with expert observers. Additionally, for cell types present in low numbers, including immature neutrophils and basophils, the higher number of cells evaluated in the IDEXX inVue Dx differential can provide higher confidence in the results. Finally, the IDEXX inVue Dx analyzer performed well in identifying other nucleated cells ($r = 0.95$).

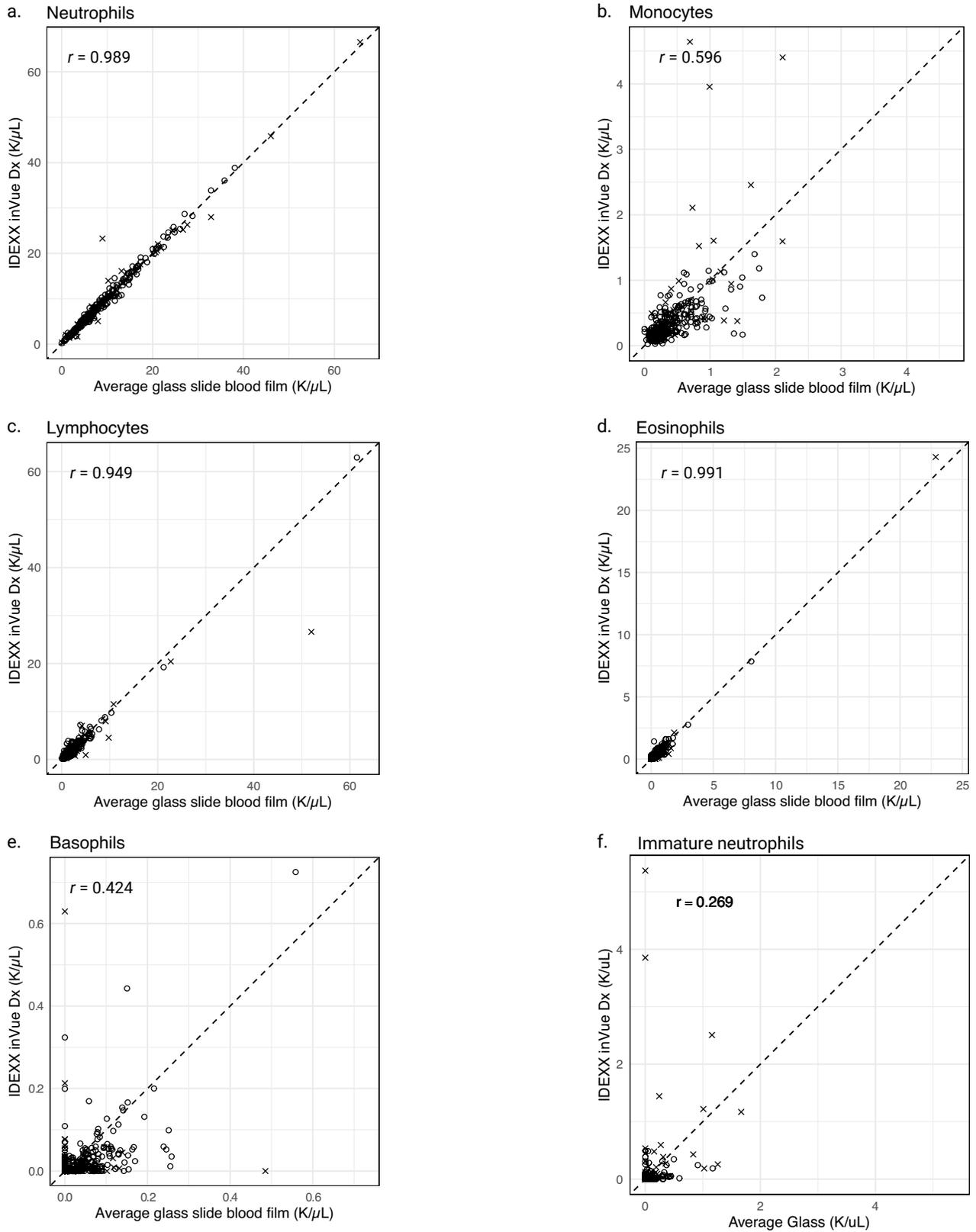


Figure 3. Correlation plots for the IDEXX inVue Dx™ analyzer’s differential counts to expert manual differentials for neutrophils (a), monocytes (b), lymphocytes (c), eosinophils (d), basophils (e), and immature neutrophils (f). Manual counts were averaged across 3 board-certified pathologist blood film reviews consisting of 200-cell 6-part differential counts. The dotted line indicates the identity line if the manual and IDEXX inVue Dx differential counts matched exactly. “X” indicates cases that had an interpretive prompt on ProCyte Dx™ analysis, prompting blood morphology assessment.

Conclusion

The IDEXX inVue Dx™ Cellular Analyzer performs blood morphology analysis in cats using its computational power and deep-learning models to produce automated, accurate, algorithm-aided pathology results. The analyzer demonstrates excellent correlation to ProCyte Dx automated hematology results and pathologist blood film interpretation when needed to assess morphologic changes within feline blood

samples. In clinically unwell patients, and in those whose CBC results from the ProCyte Dx™ or ProCyte One™ hematology analyzer suggest the need for morphologic assessment, such as abnormal cell counts, atypical dot plots, or analyzer messages indicating morphologic changes, the IDEXX inVue Dx Cellular Analyzer provides valuable information that complements the CBC and helps guide diagnostic and treatment decisions.

References

1. Schaefer D. Hematology of cats. In: *Schalm's Veterinary Hematology*. 7th ed. John Wiley & Sons, 2022;983–992.
2. Goldmann F, Bauer N, Moritz A. Evaluation of the IDEXX ProCyte Dx analyzer for dogs and cats compared to the Siemens ADVIA 2120 and manual differential. *Comp Clin Pathol*. 2014;23(2):283–296. doi:10.1007/s00580-012-1608-1