



Conflict of Interest Disclosure:

I have financial interest, arrangement or affiliation with:

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IDEXX Laboratories, Inc.	Advisory Board, consultant, grant, honorarium
Merck Animal Health	Advisory Board, consultant, grant, honorarium
Pfizer	Advisory Board, consultant, grant, honorarium
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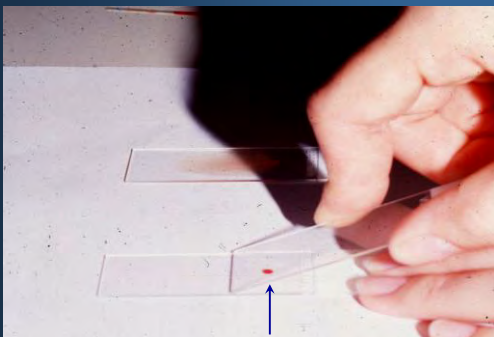
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Dot plot images are from IDEXX ProCyt Dx R ball Hematology Analyzer

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Reading Blood Films Like a Pro

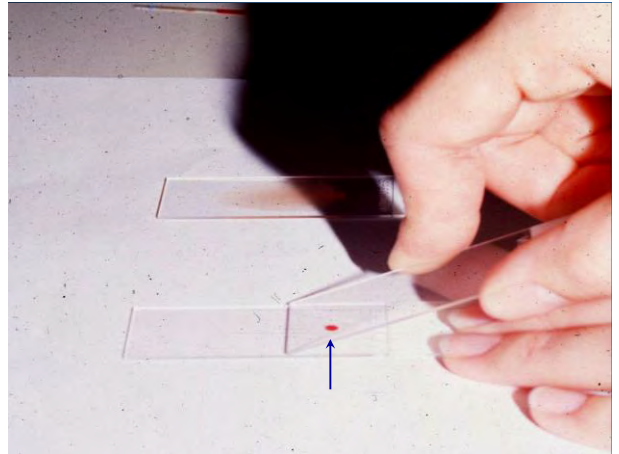


Microscopic Examination of a Blood Film

- Any quantitative abnormalities
 - RBC
 - WBC
 - Platelets
 - Dot Plots: Verified and defined with blood smear
- Evaluation of sick patients
- Quality assurance
 - Are the numerical values accurate?

Slide Preparation

- Small drop of blood
- Push Smear
- Quick drying to reduce artifacts
- Staining



Hematology Stains

- Three-step staining set
–Diff Quik®
- New Methylene Blue

Diff Quik® Stain

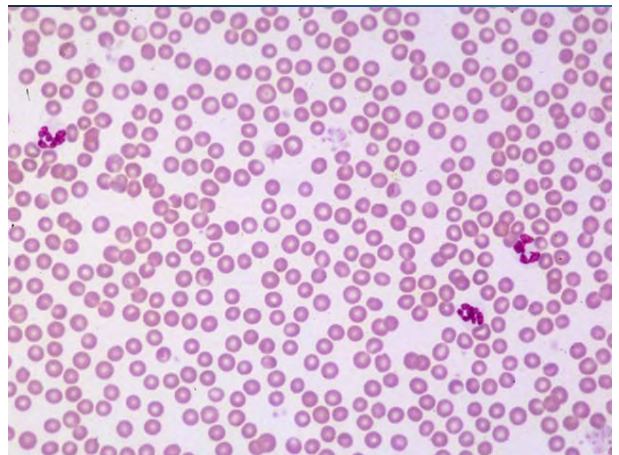


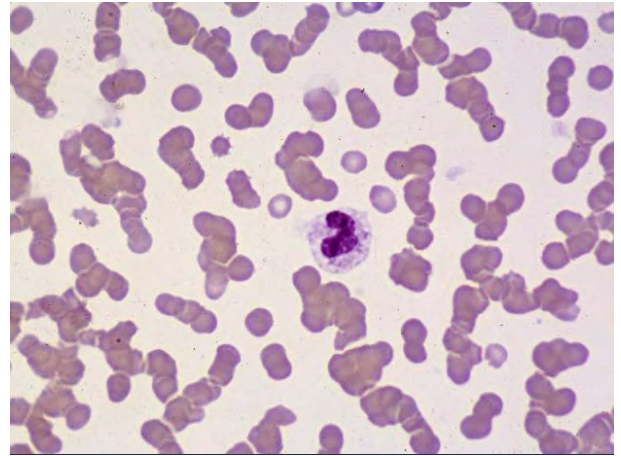
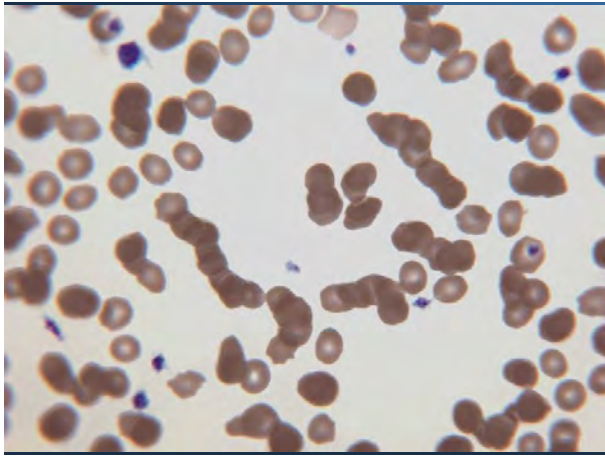
Procedure for Blood Film Evaluation

- Scan slide at 20x magnification
 - Predominant leukocyte
 - Erythrocyte arrangements
 - Platelet clumps
 - Abnormal cells
 - Nucleated red blood cells (NRBC)
 - Reactive, left-shifted, neoplastic
- Erythrocyte morphology (100x)
- Platelet numbers and morphology (100x)
- Leukocyte numbers and morphology (100x)

Erythrocyte Evaluation 100x Oil Objective

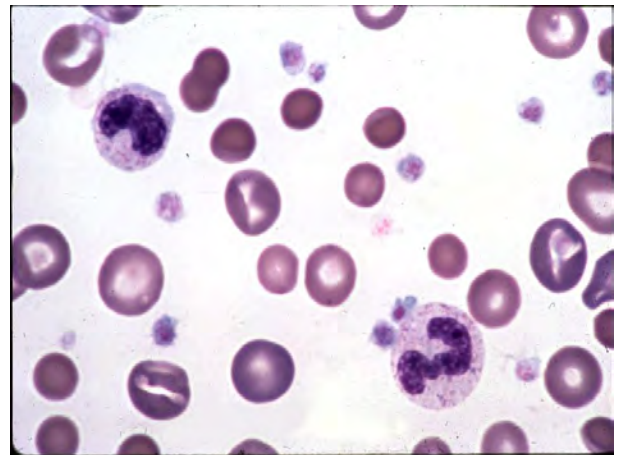
- Erythrocyte morphology
 - Changes in size, shape, or color
- Evaluation for presence of hemoparasites

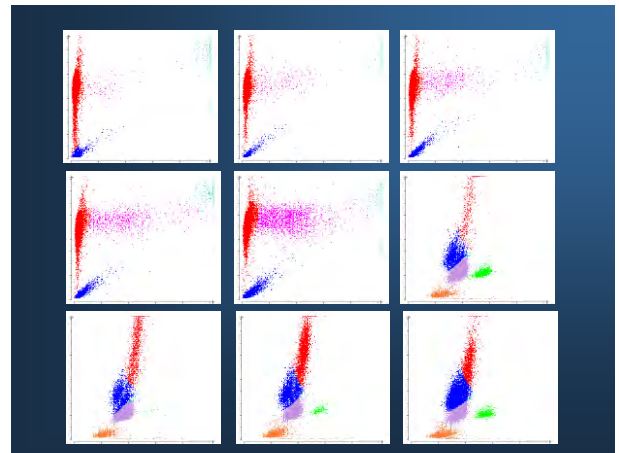
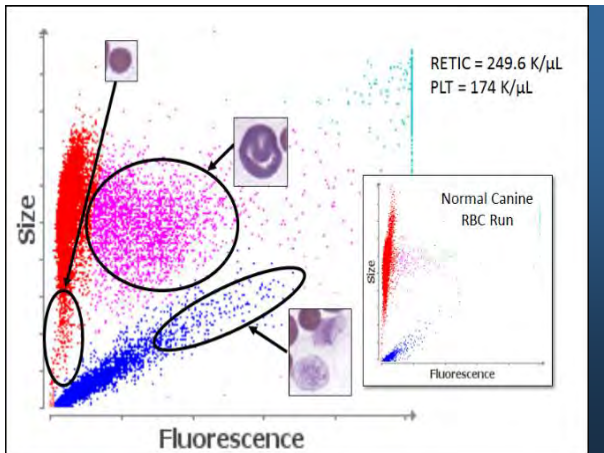
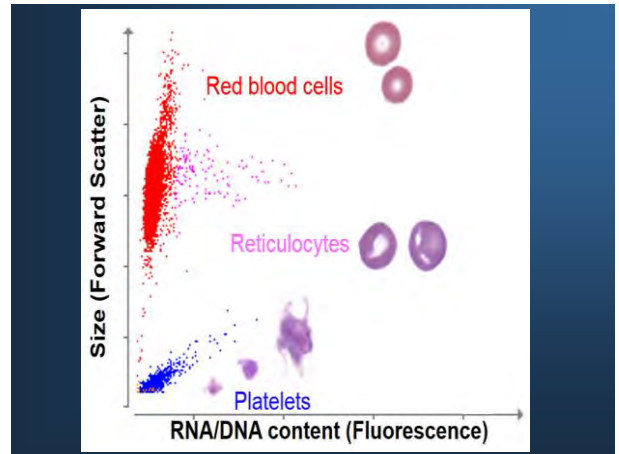
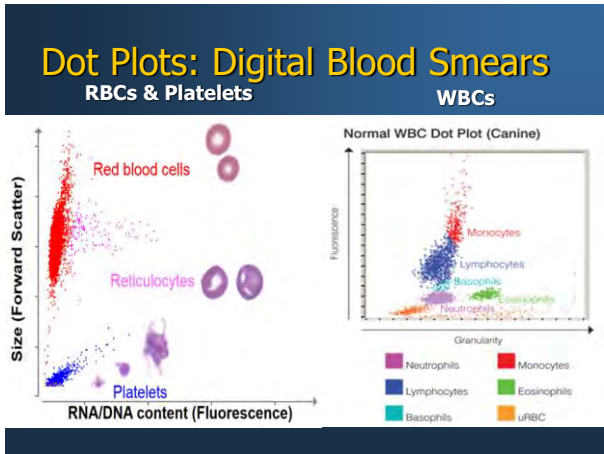




The Saline Test

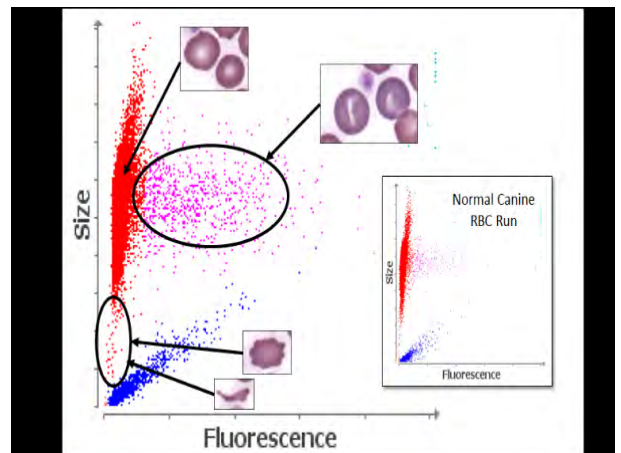
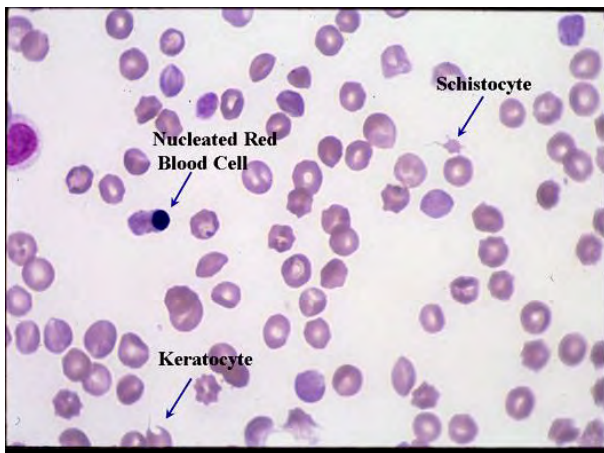
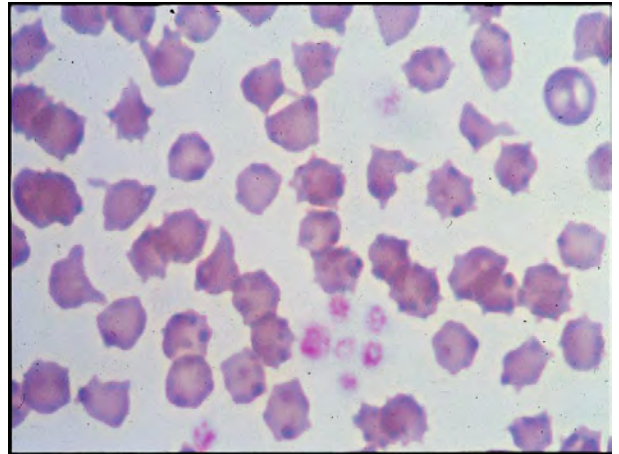
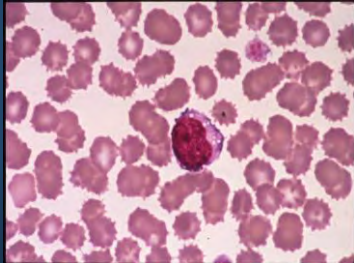
- Distinguishes rouleaux from agglutination
- One drop of patient blood and 1 ml saline
- Examine as unstained, wet-prep on 20X with low light





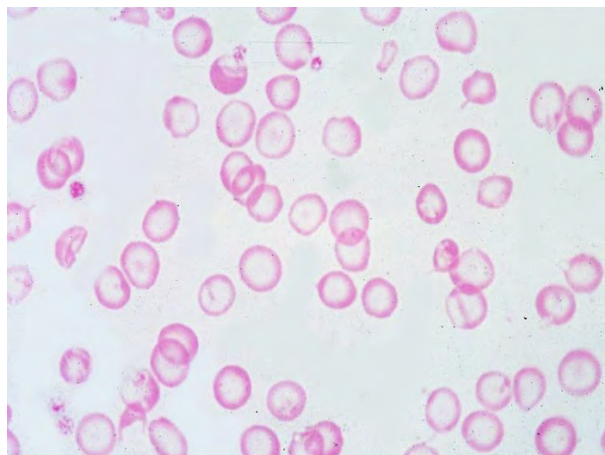
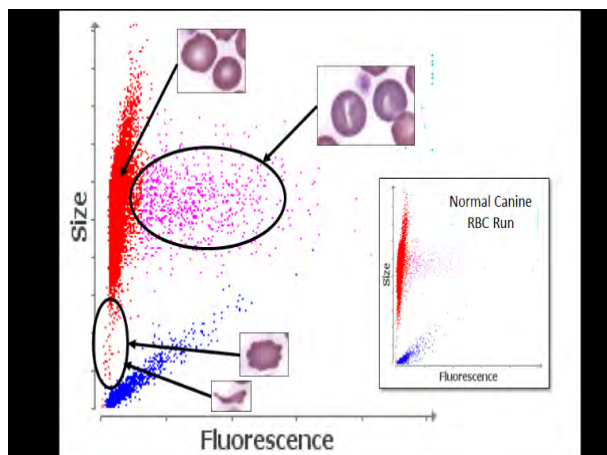
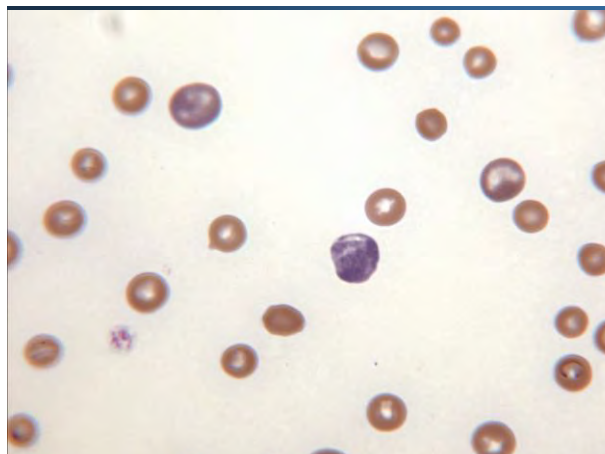
Changes in Shape

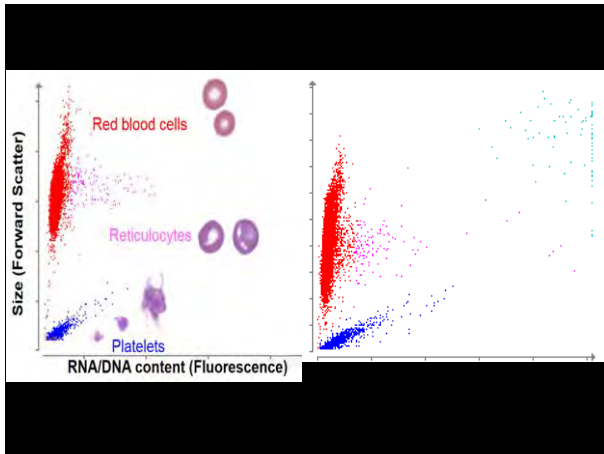
- Nonpathological
 - crenation
- Pathological
 - Polychroms.
 - Acanthocytes
 - Schistocytes
 - Keratocytes
 - Spherocytes



Changes in Color

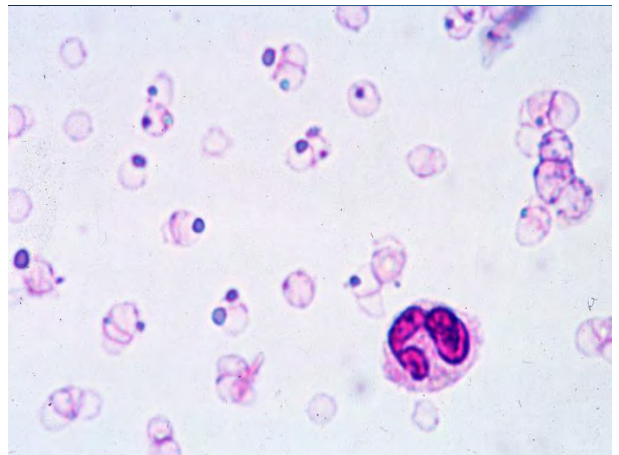
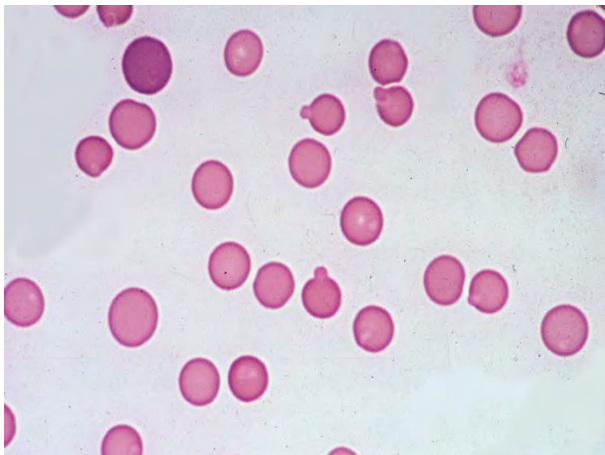
- Related to amount of hemoglobin in the cell
- Two changes recognized
 - Polychromasia
 - Hypochromasia

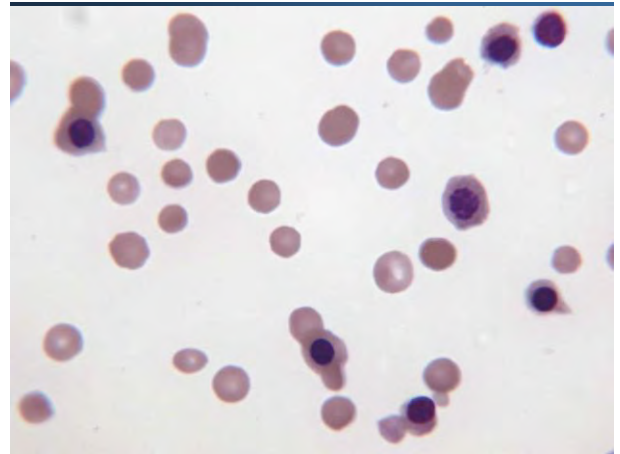
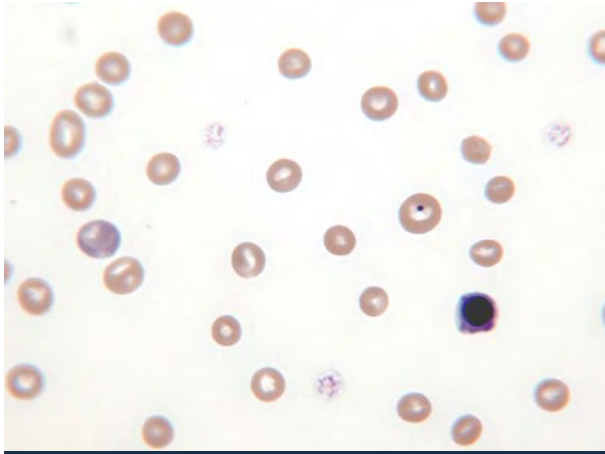




Erythrocyte Inclusions

- Stain precipitation
- Drying artifacts
- Hemoglobin abnormalities
- Erythrocyte nuclear material



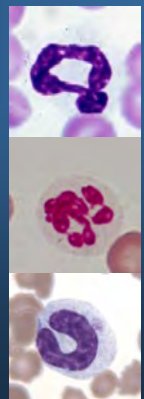


Leukocyte Evaluation

- Estimation of leukocyte numbers
 - (# per 100x field) x (10,000 cells/ul)
- Differential cell count
- Morphologic changes in leukocytes
 - Toxicity
 - Reactivity
 - Parasites
 - Neoplastic changes

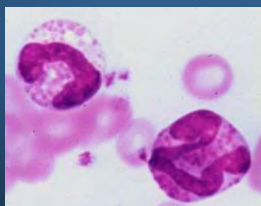
Neutrophils

- Predominant leukocyte in dog and cat
- Indicators of inflammatory/infectious disease
 - Corticosteroid induced stress leukogram
- Left-shifting
 - Degree indicates magnitude of disease process
 - Degenerative vs. regenerative

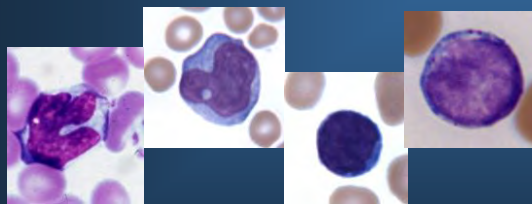


Eosinophils and Basophils

- Neoplasia
- Allergic / hypersen.
- Addison's
- Parasitism

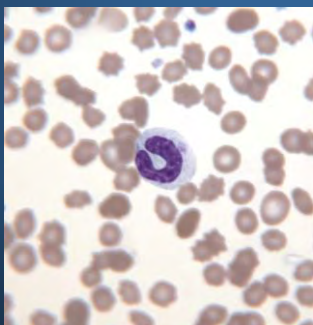


Monocytes and Lymphocytes



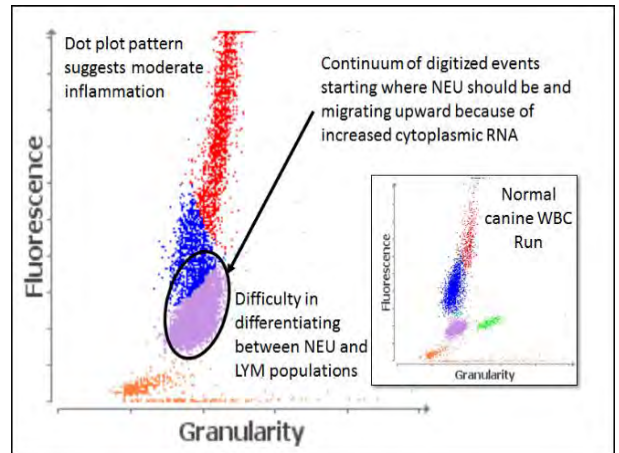
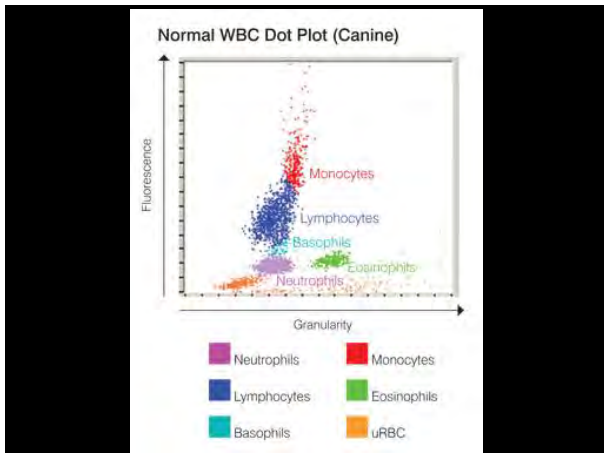
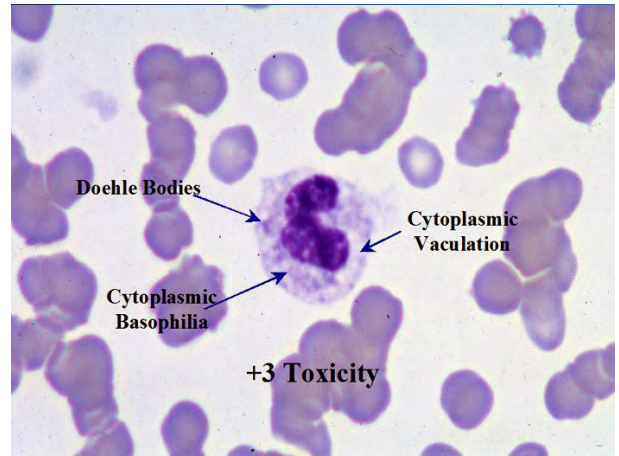
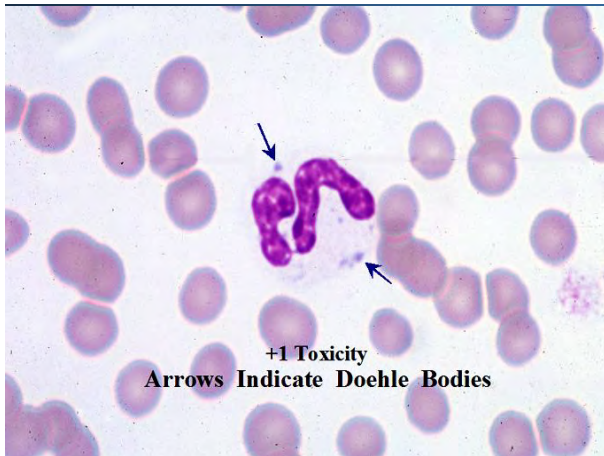
Left-Shifting

- Response to increased demands for neutrophils in peripheral tissues
- Regenerative, degenerative and transitional shifts



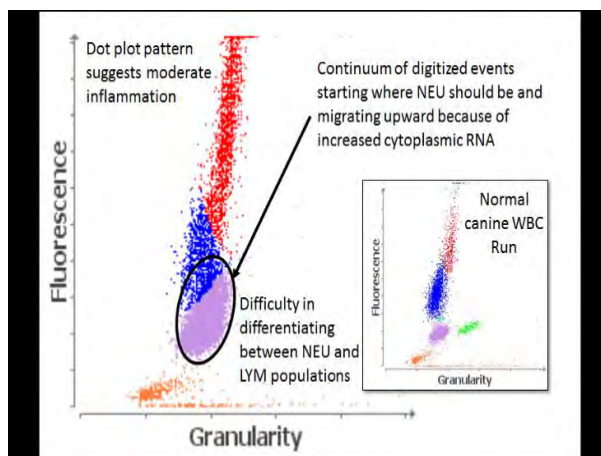
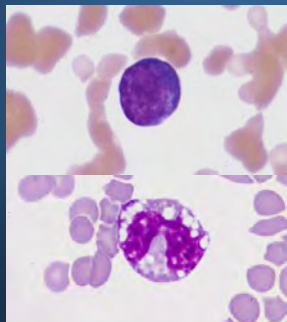
Toxic Changes

- Developmental abnormality seen only in the neutrophil cell line
 - Cytoplasmic changes
- Different from degenerative changes
 - Nuclear changes
- Typically associated with infectious diseases or exposure to endogenous or exogenous toxins
- Variable stages of severity
 - +1, +2, +3, +4



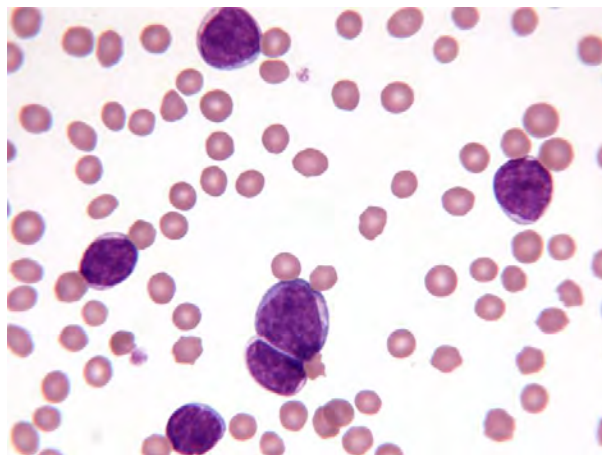
Reactive Lymphocytes & Monocytes

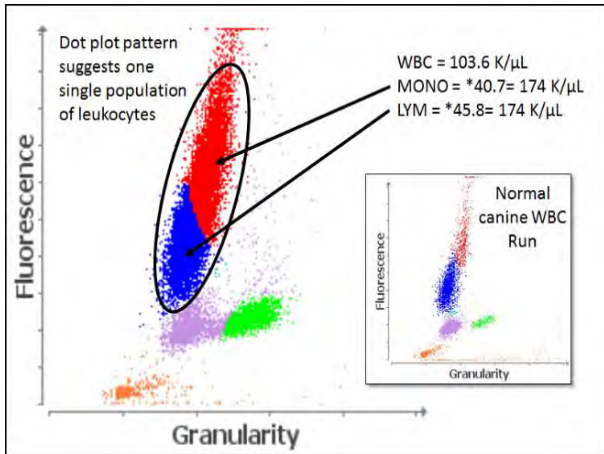
- Increased cytoplasmic basophilia
 - Monocytes & lymphocytes
- Cytoplasmic vacuolation
 - Monocytes



Neoplastic Cells

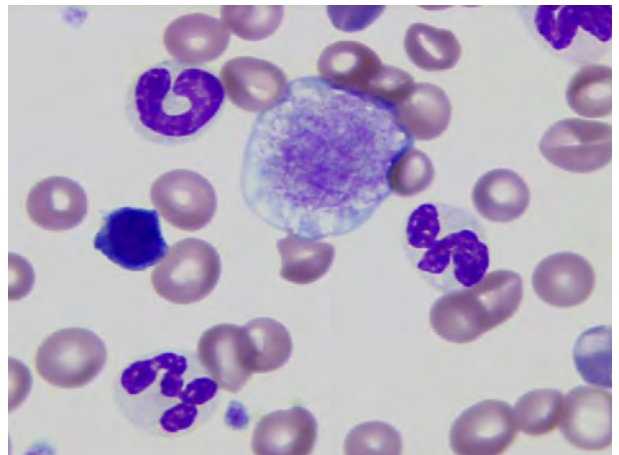
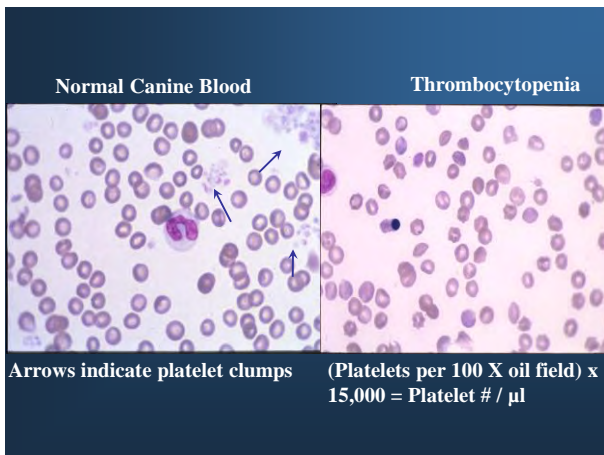
- Non-hematopoietic cells in circulation
 - Mast cells
- Hematopoietic cells
 - 3 or more times the size of erythrocytes
 - Increased cytoplasmic basophilia
 - Diffuse chromatin pattern in nuclei
 - Other anaplastic features (nucleoli)
 - Lymphoproliferative vs. myeloproliferative





Platelet Evaluation

- Scan slide for platelet clumps
- Estimation of platelet numbers
 - Dogs (# per 100x field) x (15,000 cells/ μ L)
 - Cats (# per 100x field) x (20,000 cells/ μ L)
- Platelet size
 - Megaplatelets
- Parasite
 - *Anaplasma platys*



Summary

- The systematic evaluation of a blood film is the most important part of the hemogram
- Estimates of the complete blood count can be quickly obtained from the blood film
- The morphological evaluation of blood cells can yield clinically important information that cannot be obtained by any other laboratory testing

