Avian Haematology

David N. Phalen, DVM, PhD
Director, WHCC
University of Sydney

Why Do Haematology in Your Practice?

- Sick bird's can't wait.
- If you are experienced, you will get more from the Haemogram than you will with a report from the lab.
- May be more accurate.
- Generates income.

Blood collection sites

- Jugular – preferred most birds
- Brachial - ostriches
- Medial metatarsal – emus
- Needle size
  - 23 or less, larger birds
  - 25 gauge most birds
  - 27 small ones and Neophemas

Basics: Anticoagulants

- Direct smear: no anticoagulants
- Heparinized blood
  - None wasted
  - Fewer artefacts in blood smear
- EDTA:
  - Ok, but more artefacts
  - Lost volume
  - Long term lymphocyte drop out?
- Safe volume – 1% of bird's body weight if healthy

Packed Cell Volume (PCV)

- Don’t have to fill the tube
- Can use small tubes
- The vast majority of birds
  - 0.42-0.50
  - Slightly higher – ok
  - Lower than 0.35 anaemia in all birds
- PCV is typically lower in nestling birds (<4 weeks in larger parrots).

Changes in PCV: Decreased

- Failure of production
  - Anaemia of chronic disease
- Blood loss
  - Trauma
    - Acute vs. chronic
  - Respiratory
  - GI
- Destruction
  - Heinz body anaemia (Oil ingestion)
  - IMHA
    - IgG, IgM

Changes in PCV: Increased

- Mild increases
  - .50 - .58
  - Dehydration
  - Atheletic bird?
- Larger increases (polycythemia)
  - Respiratory disease
  - Cardiovascular disease

Estimated Total Solids

- Combination of protein and circulating fat
- Lipemia will significantly increase this value
- Normals
  - Parrots and passerines
    - 30 to 45
  - Chickens, ostriches, and waterfowl
    - 50 to 70

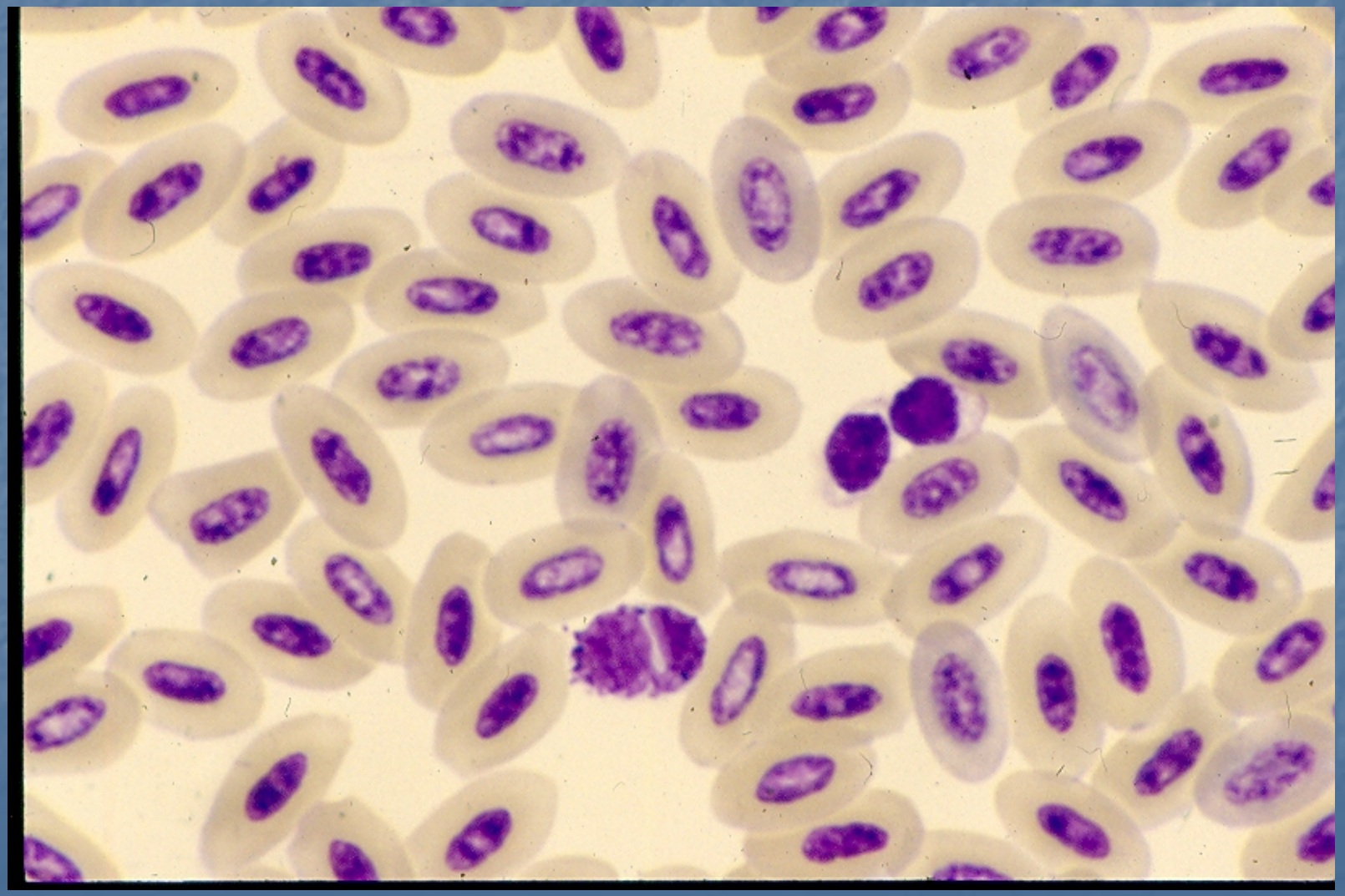
Changes in the Estimated Total Solids

- Decreased
  - Negative calorie balance
  - Blood loss
  - Protein loss from other sources?
    - GI
    - Kidney
- Increased
  - Mild increase: dehydration
  - Moderate increase or more
    - Lipemia
    - Increase in globulin fraction (Do plasma electrophoresis)

The Red Blood Cell

- Oblong, Flat, Nucleated
- Relatively uniform staining of the cytoplasm
- Often variable staining of the nucleus
- Polychromatophilic RBCs
  - Normal size to slightly larger
  - Cytoplasm is more basophilic than mature RBC's
  - Typically 5% of the cells (more than mammals)

RBCs



RBC Response to Disease

- Decreased RBC production
  - Anaemia of chronic disease or negative calorie balance
  - Little or no polychromasia

Regenerative Anaemia

- Mild: increased polychromasia
  - Minimal blood loss
  - Improved health
- Marked
  - See with significant blood loss or destruction
  - See many immature cells released into the circulation

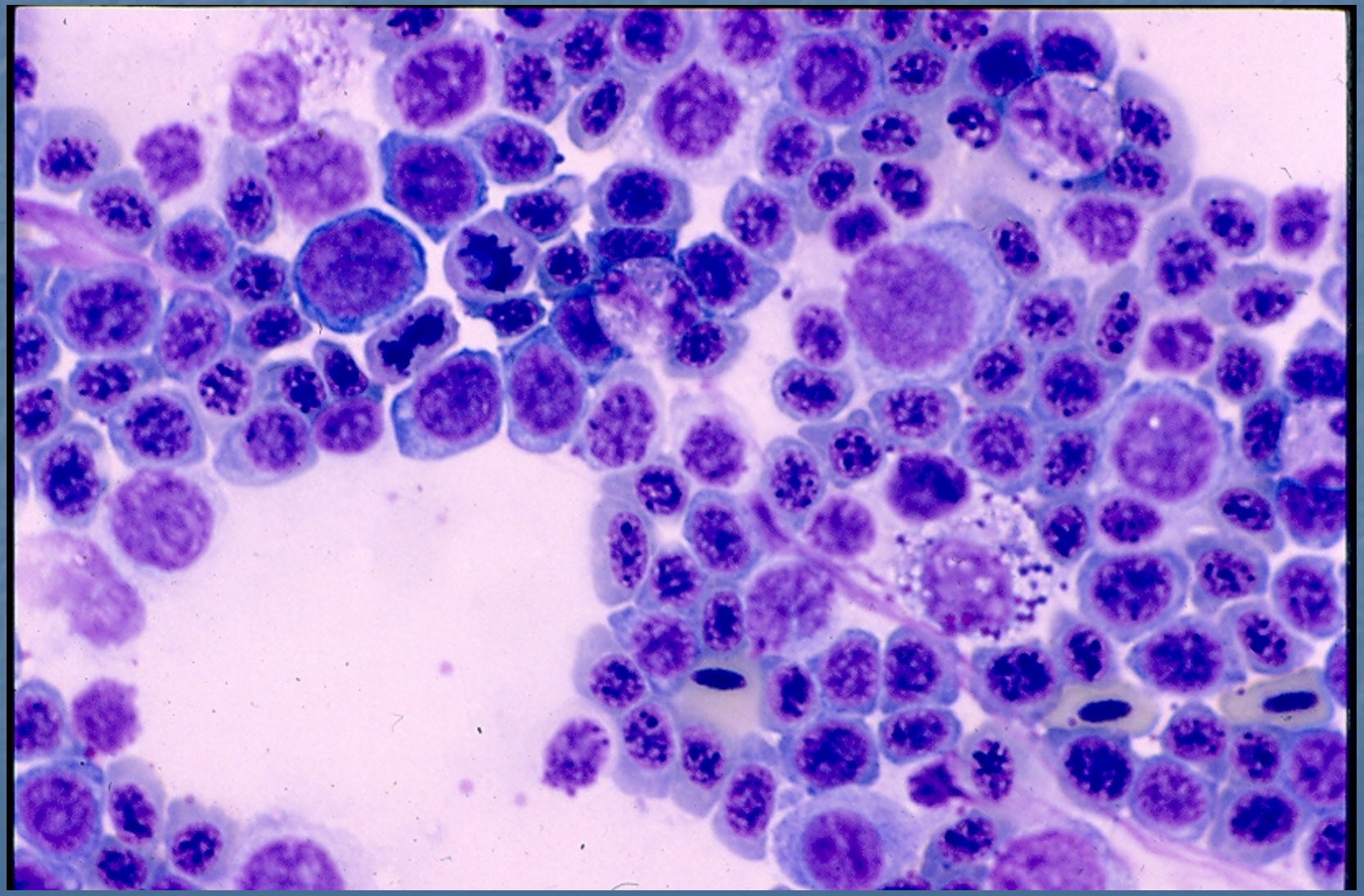
Maturation Sequence of RBC's

- Rubriblast
- Prorubricyte
- Rubricyte
- Metarubricyte
- Polychromatic RBC
- Many of these cells could be mistaken for reactive lymphocytes

Maturation Sequence

- Large round cells similar to Myeloblasts – moderately basophilic cytoplasm
- Remain round, become smaller, develop deep blue-grey cytoplasm and have a demonstrable goli complex around the nucleus.
- Finally enlarge, develop expected shape and have a transition to normal

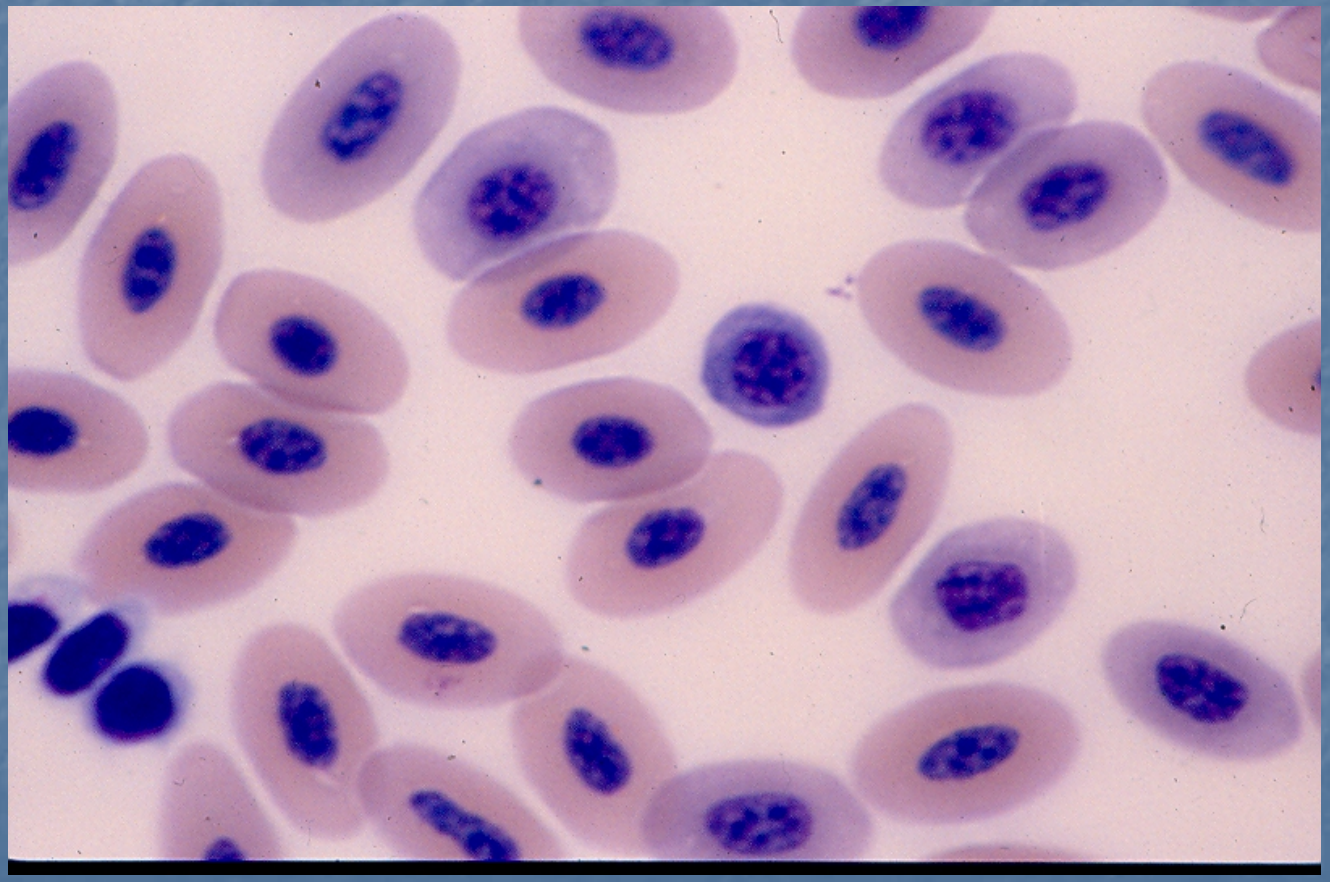
Bone Marrow

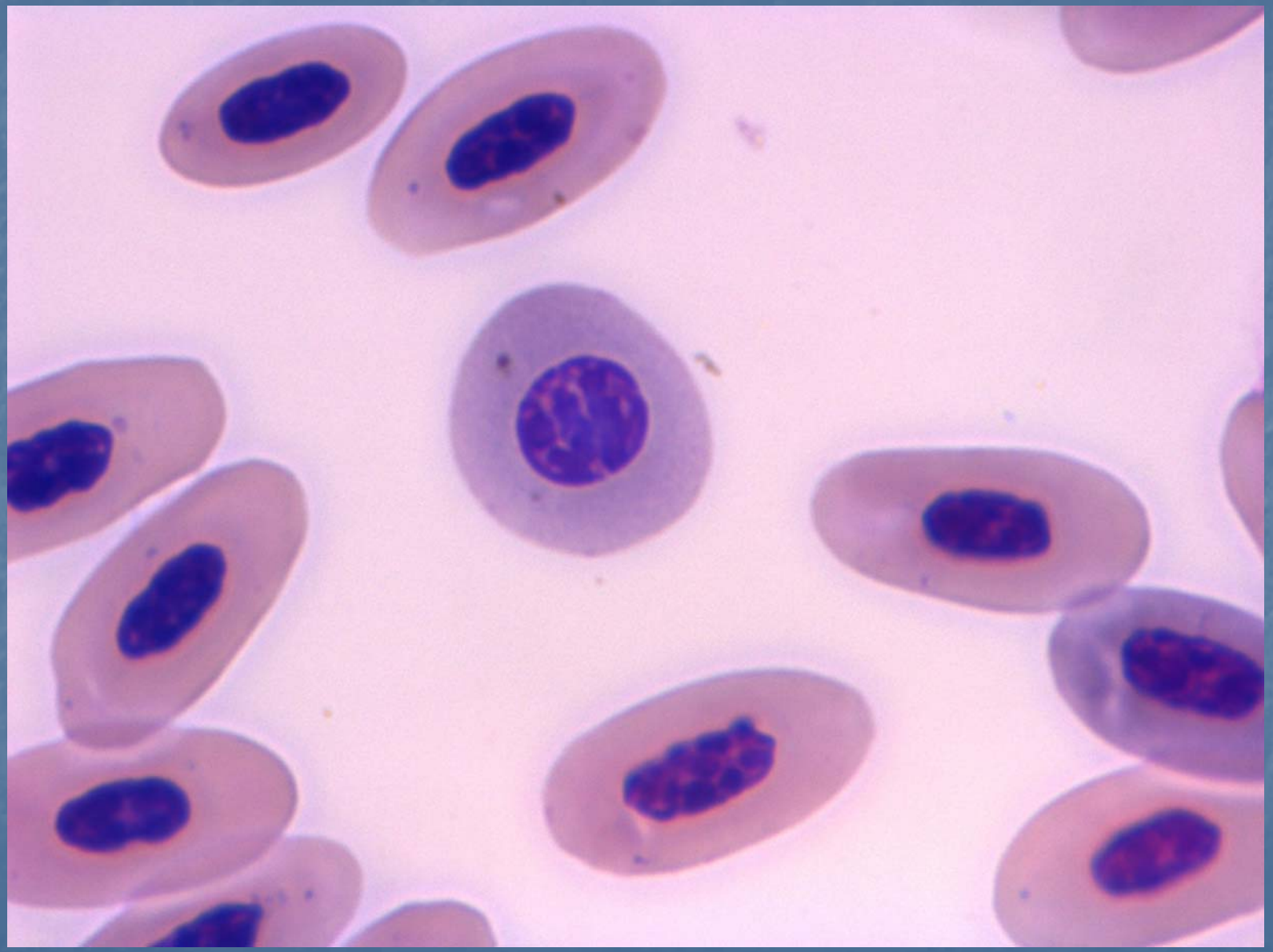


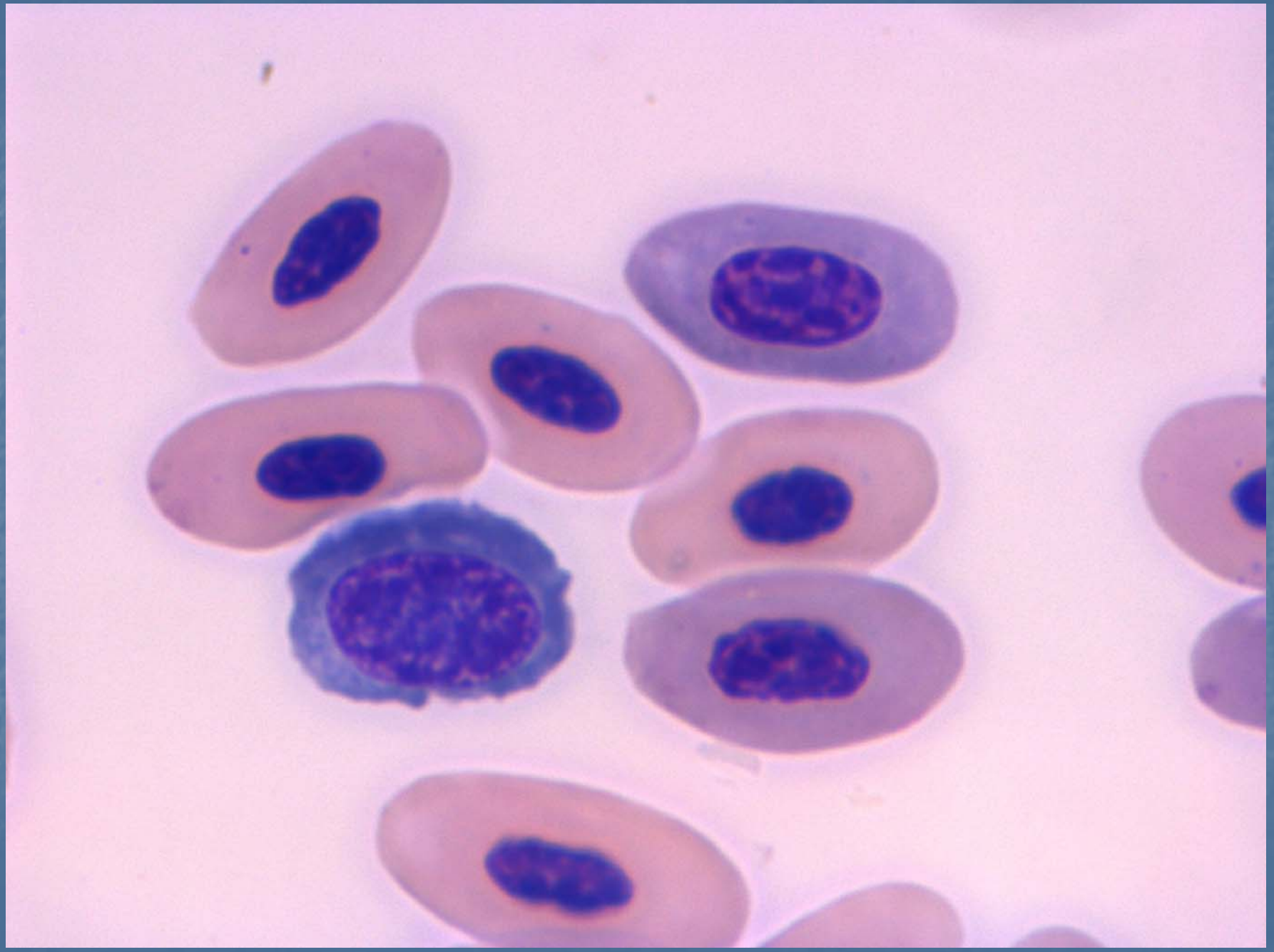
Haemorrhage

- Single event
  - Rapid influx of immature cells (within 2 days)
  - Return to normal PCV within 7 to 10 days
- Chronic
  - May get iron deficiency anaemia
  - Moth eaten cytoplasm
  - Poor staining
  - Abnormal shape of cell and more variations in the nucleus

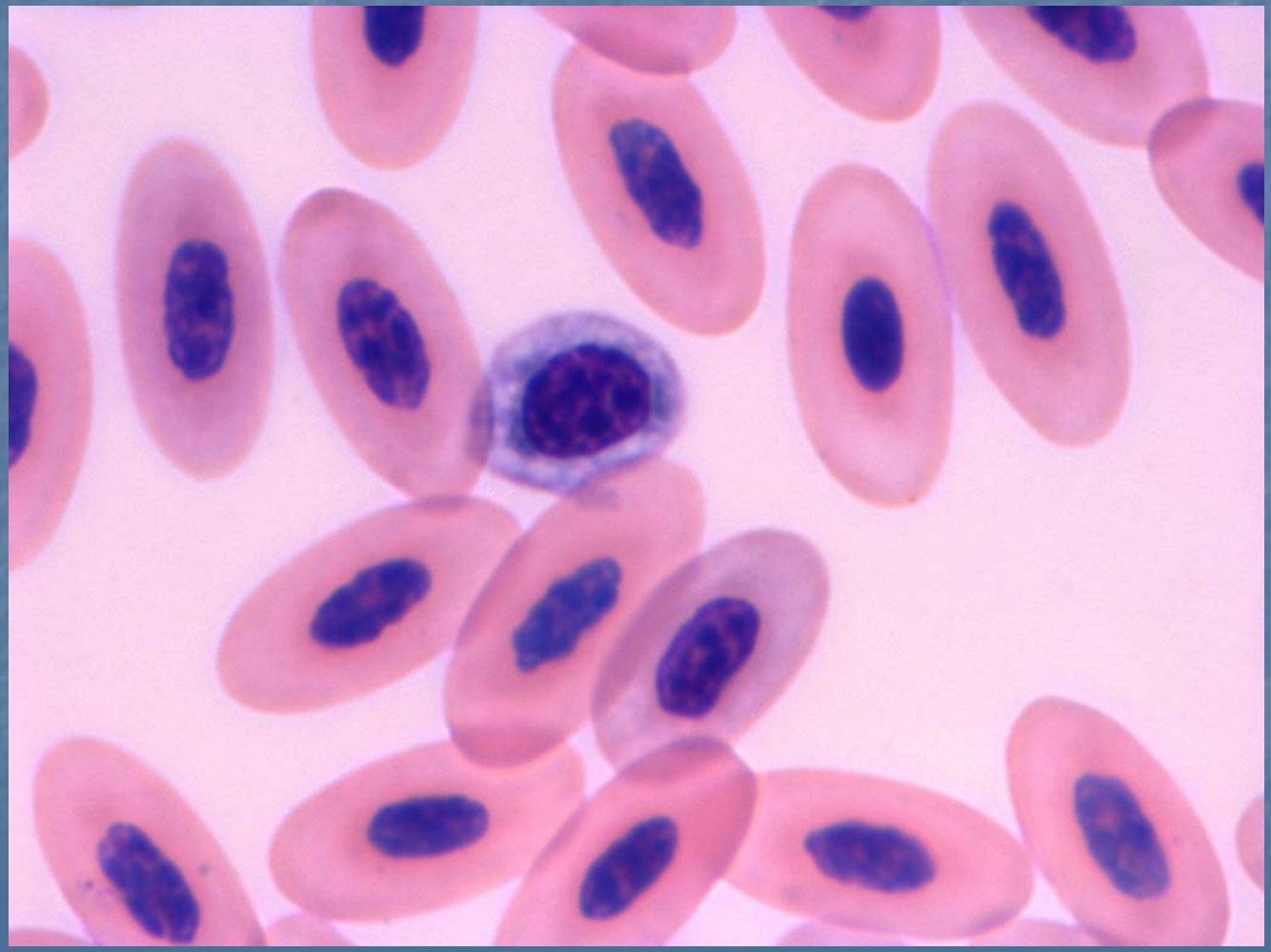
Regenerative Response: Mild Blood Loss







Chronic Blood Loss

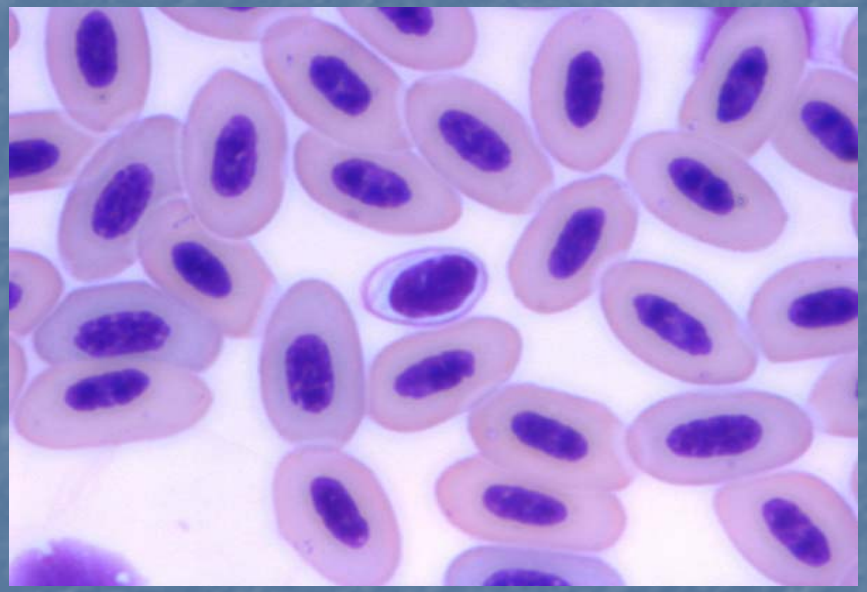


Regenerative Response Immune-mediated Haemolytic Anaemia

- One case
  - Spherocytes
  - Marked polychromasia
  - Biliverdinuria
- Second case
  - Cold agglutination
  - Marked polychromasia
  - Biliverdinuria

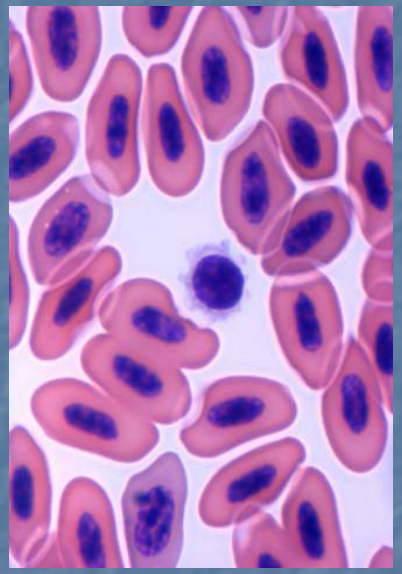
Thrombocytes

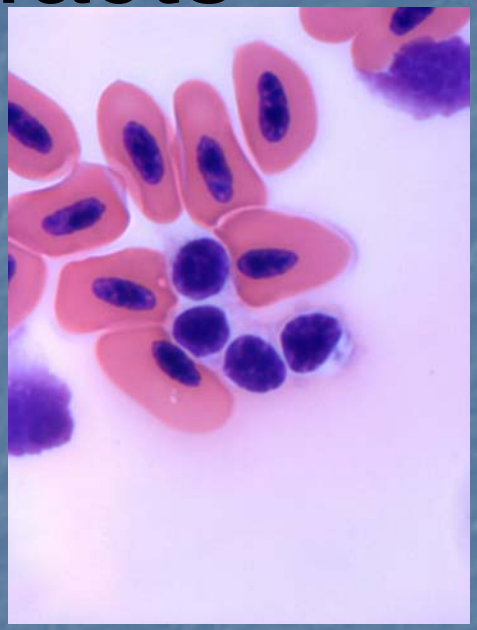
- Smaller than RBCs
- Off centered nucleus
- Clear cytoplasm
- +/- granules

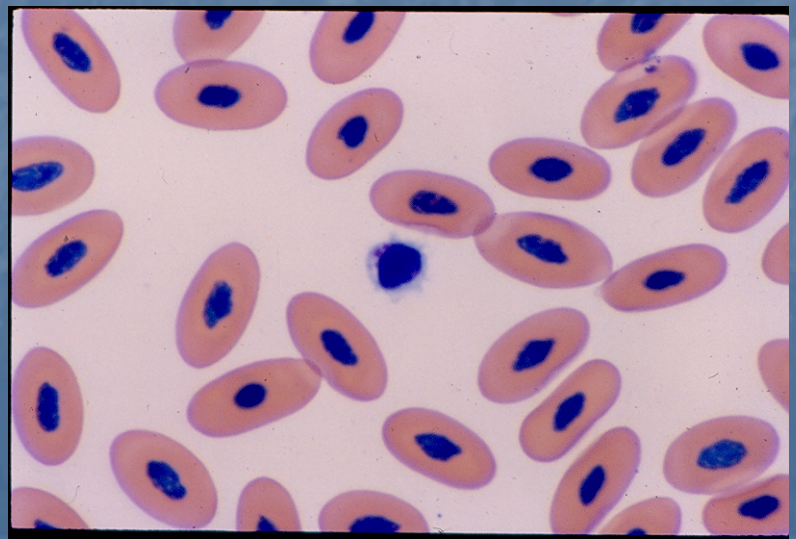


Thrombocytes: Artifacts

- Round up
  - Can look like small lymphocytes
- Send out small fine processes
- Clump

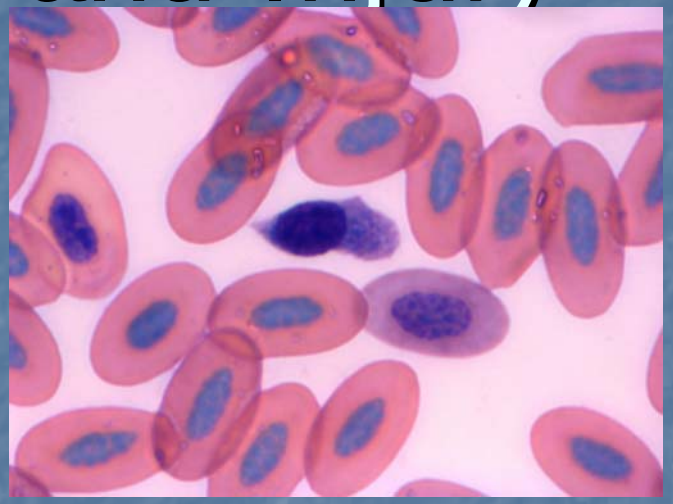


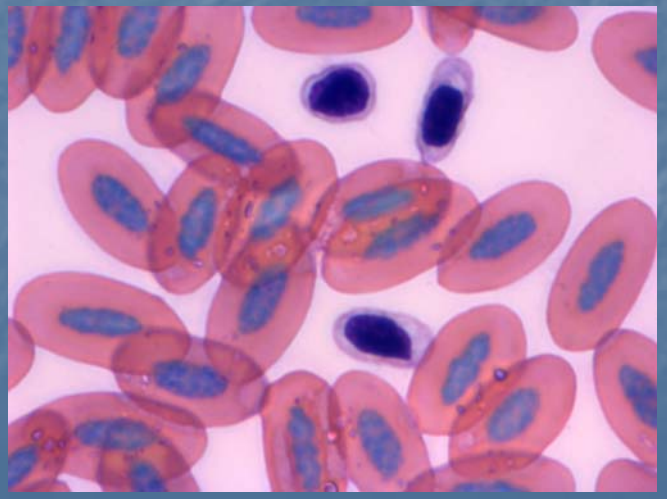




Thrombocytes and Injury

- Thrombocytopenia (DIC)
  - Septic bird
  - Birds with APV
- Immature cells in the circulation
  - Crushing injuries





Leukogram

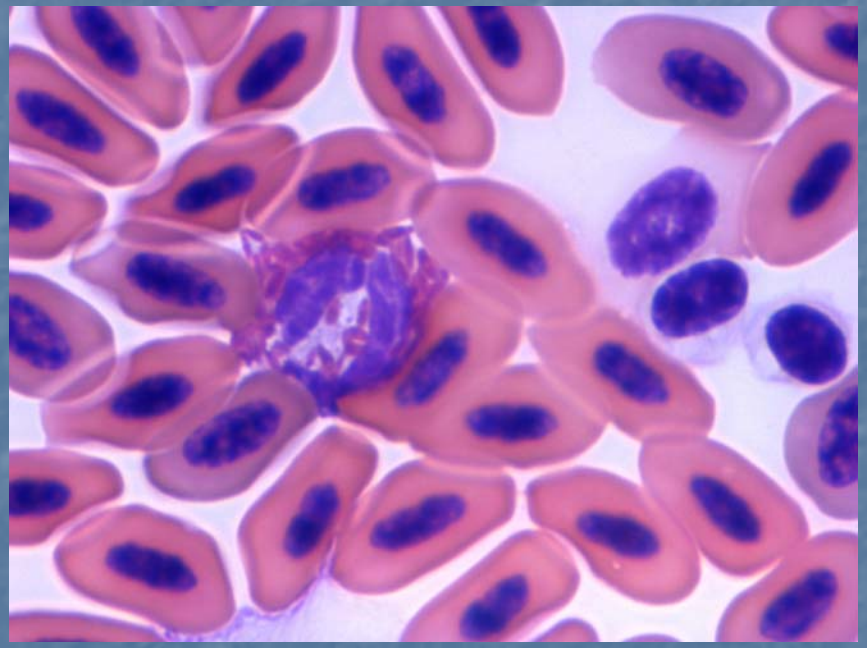
- Granulocytes
  - Heterophils
  - Eosinophils
  - Basophils
- Mononuclear cells
  - Lymphocytes
  - Monocytes

Counting Leukocytes

- Natt and Herrick's
- Eosinophil Unopette
  - Only counts heterophils and eosinophils

Heterophil

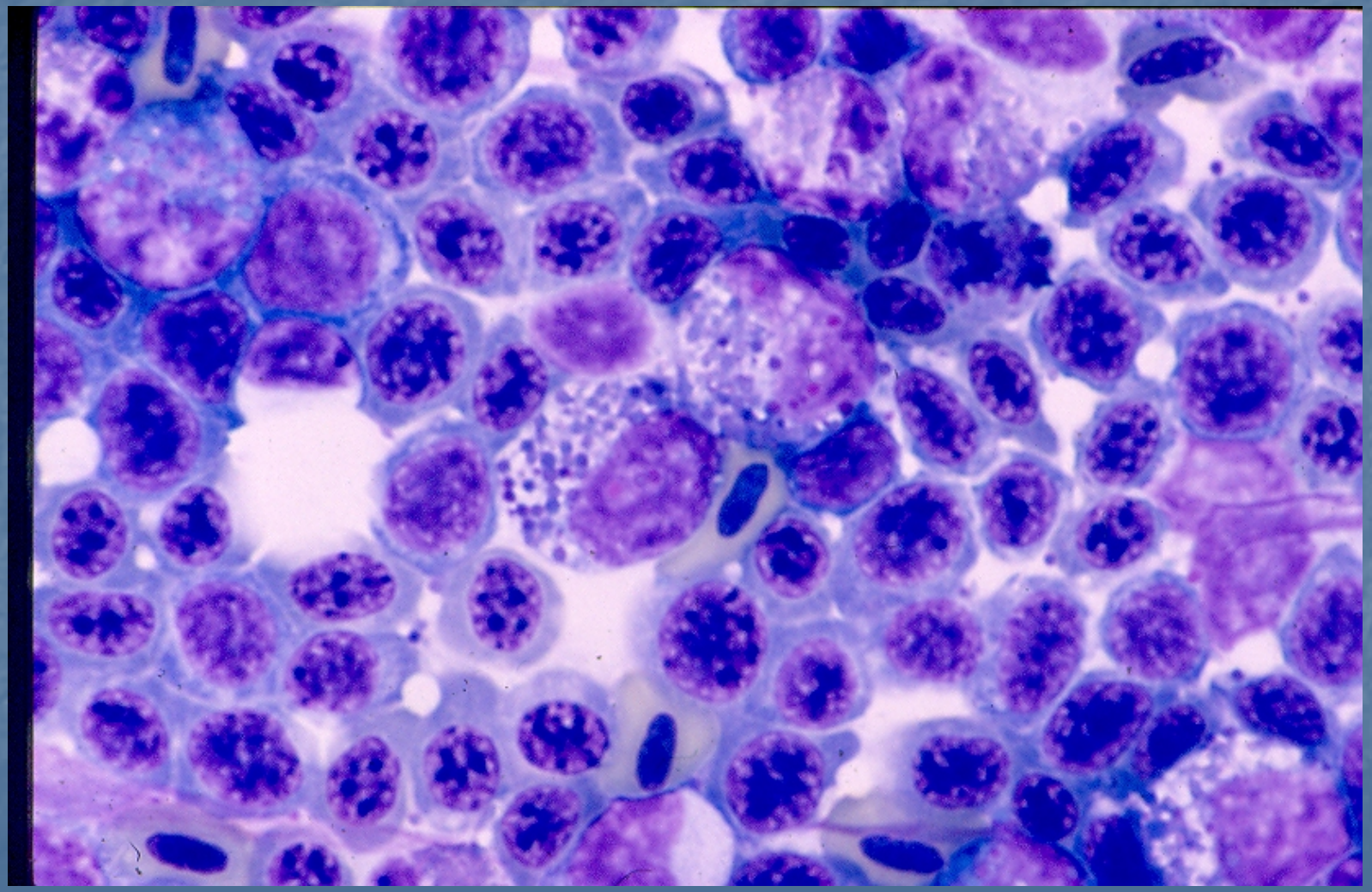
- Segmented nucleus
- Fusiform granules
- Approximately 50% of the total WBCs
- Normal range
  - 2,000 to 10,000 per ul
  - Will depend on species
  - Waterfowl, chickens, emus and ostriches
  - Vs. smaller species



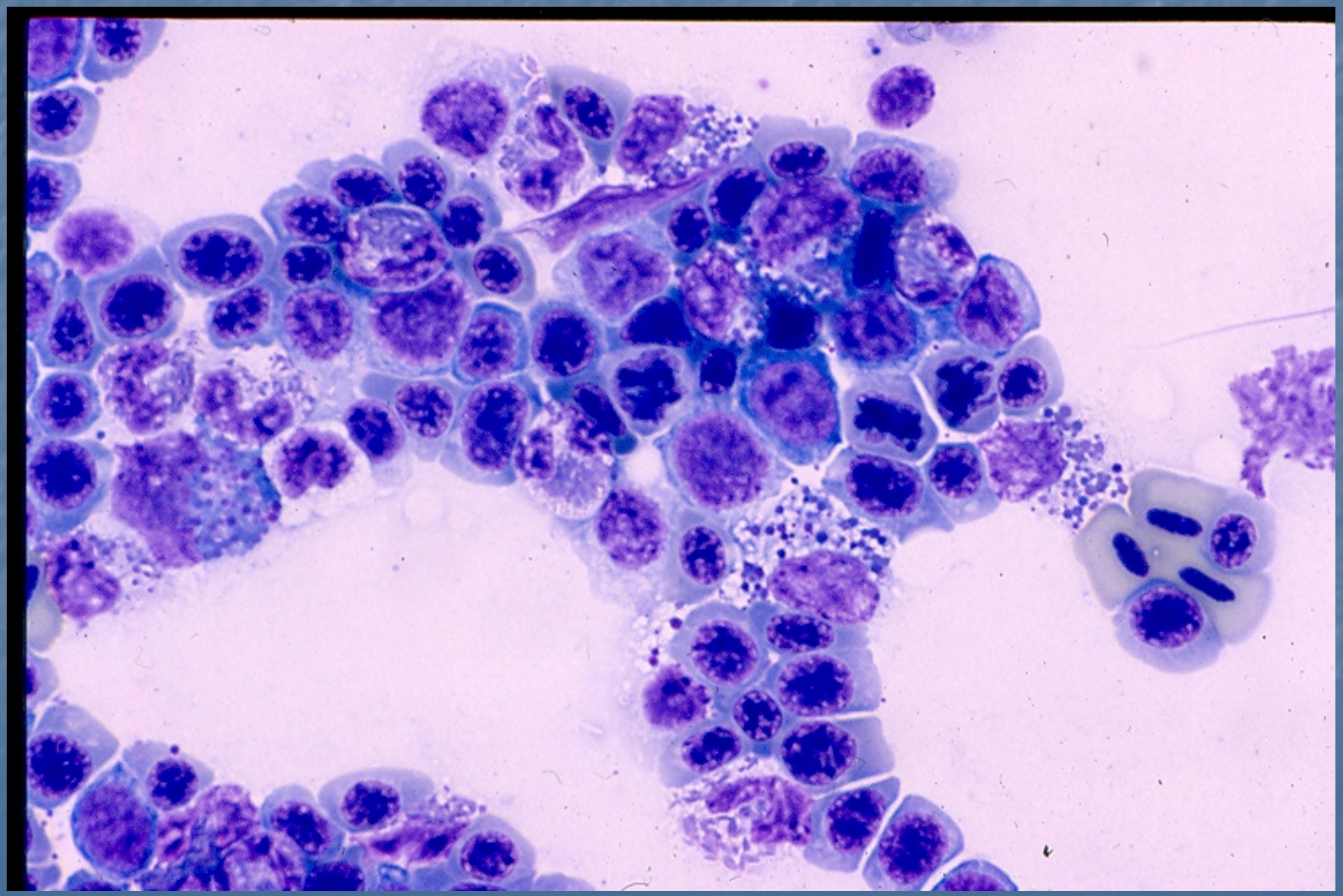
Heterophil Maturation

- Myeloblast
  - Large round cell
  - Dispersed chromatin
  - Nucleus in not segmented
  - Substantial blue cytoplasm
- Promyelocyte
  - Unsegmented nucleus
  - Purple round granules
- Myelocytes
  - Unsegmented nucleus
  - Purple and red round granules
- Metamyelocyte
  - Unsegmented nucleus
  - Red round granules
- Band
  - Segmenting nucleus
  - Red fusiform granules

Bone Marrow



Bone Marrow



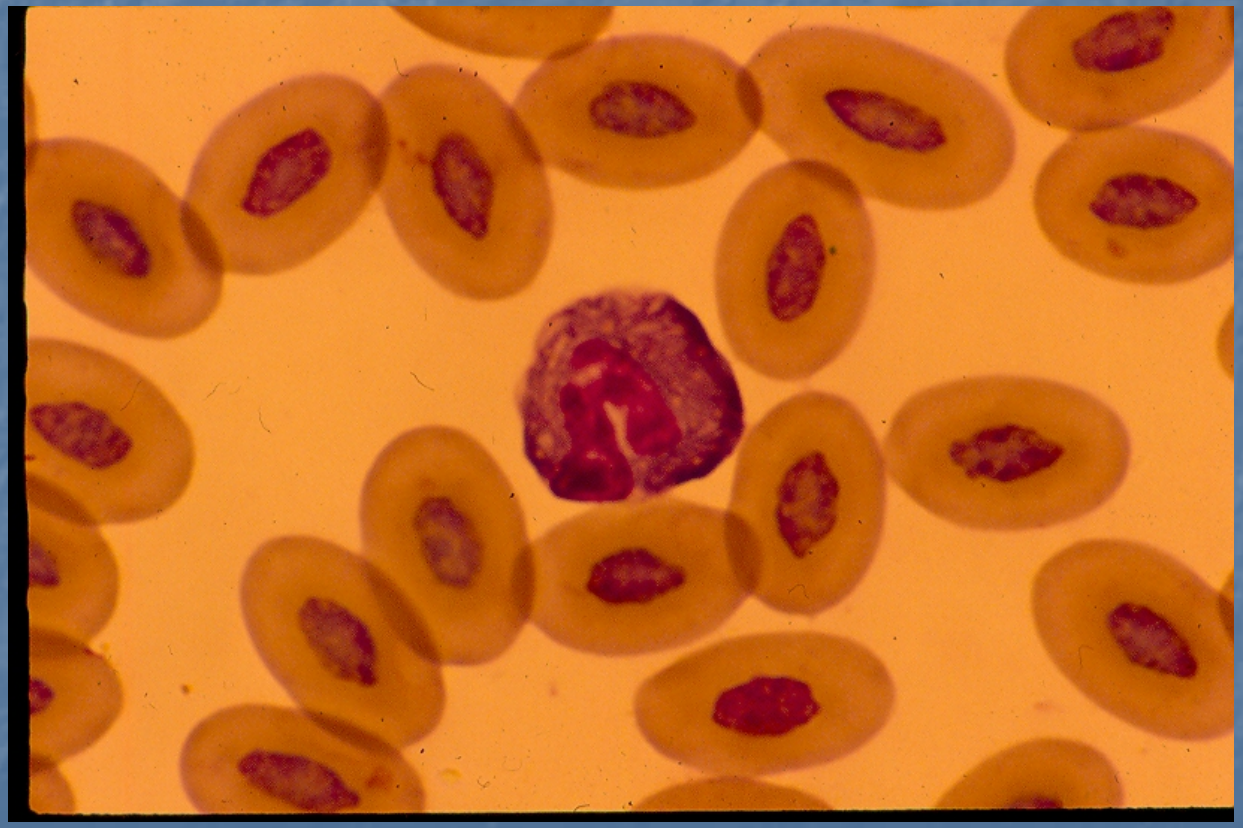
Heterophil and Disease

- Stress
  - Increase, sometimes a marked increase, in heterophil count
  - Simultaneous drop in lymphocytes
- Infection/inflammation
  - Increase if not septic
  - Often huge increase with aspergillosis, psittacosis, and avian tuberculosis

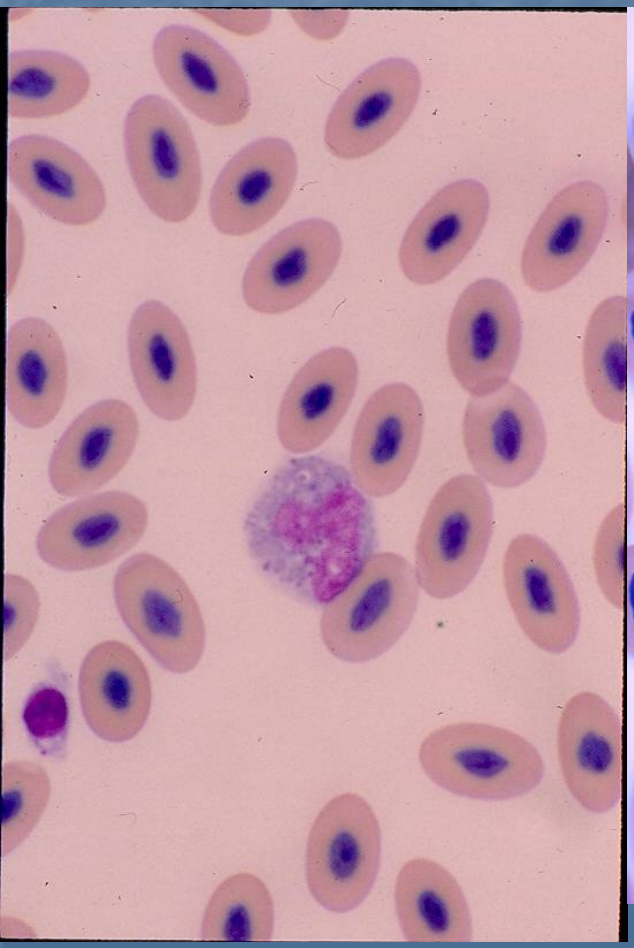
Severe Infection

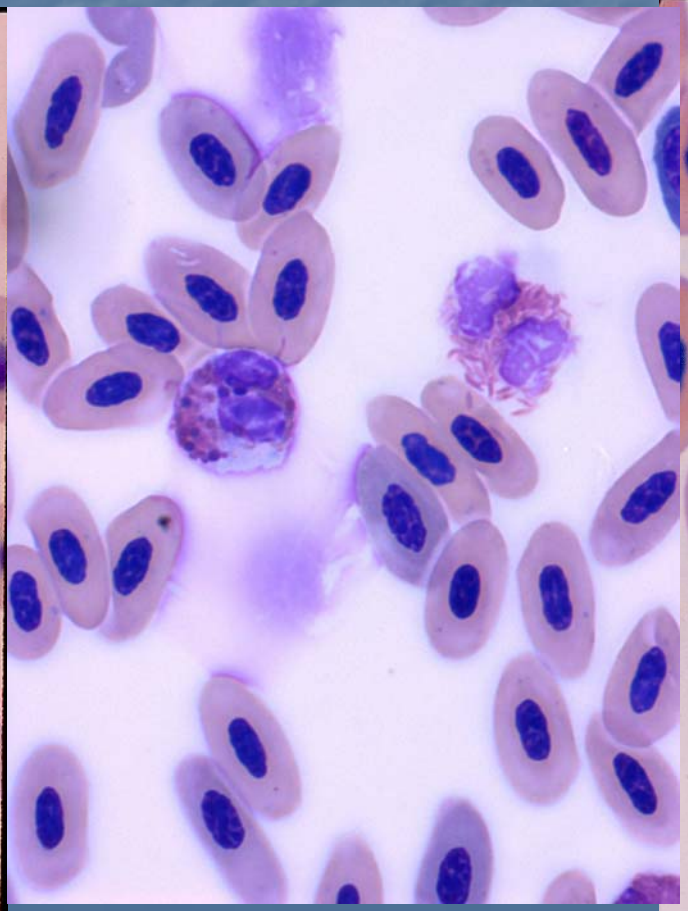
- Left shift
  - Bands
- Degenerative left shift
  - Metamyelocytes and earlier
  - Low WBC
- Toxic changes
  - Asynchronous maturation of nucleus and granules

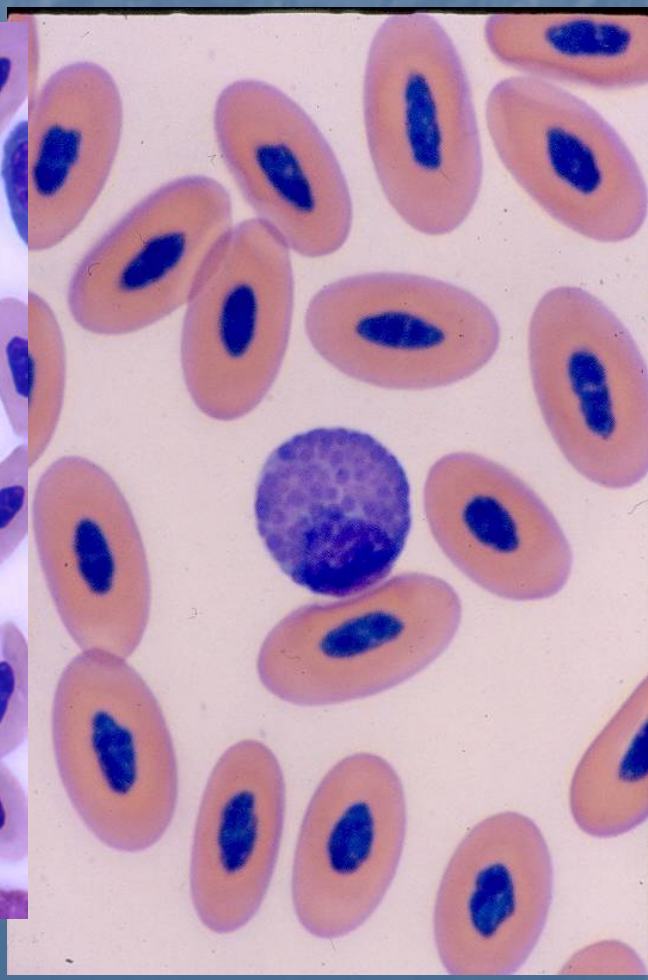
Band



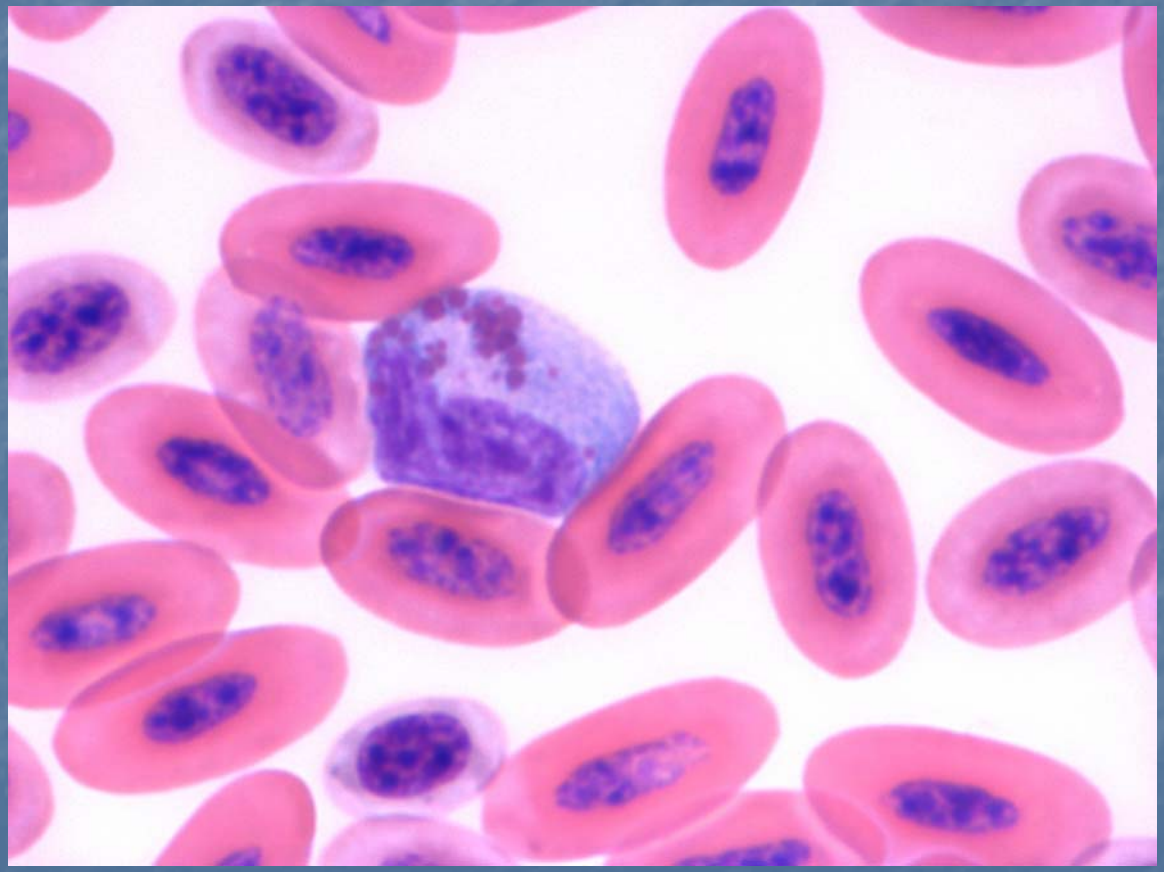
Promyelocyte, Myelocyte Metamyelocyte



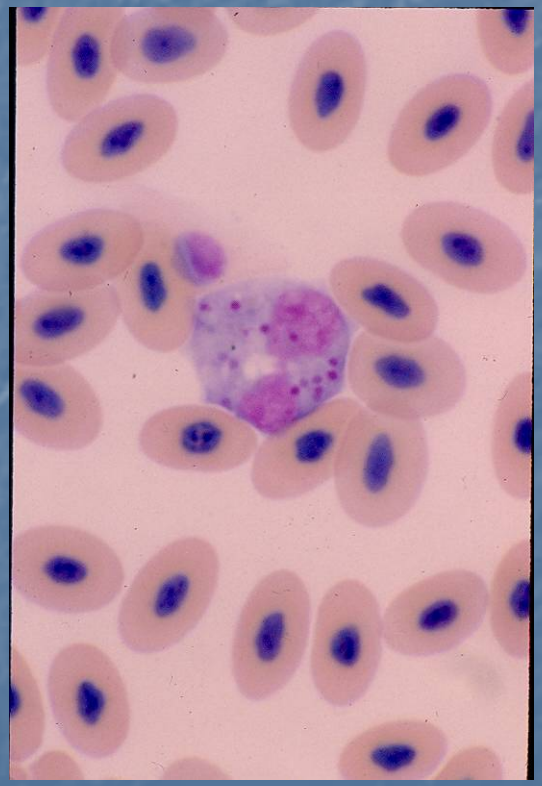


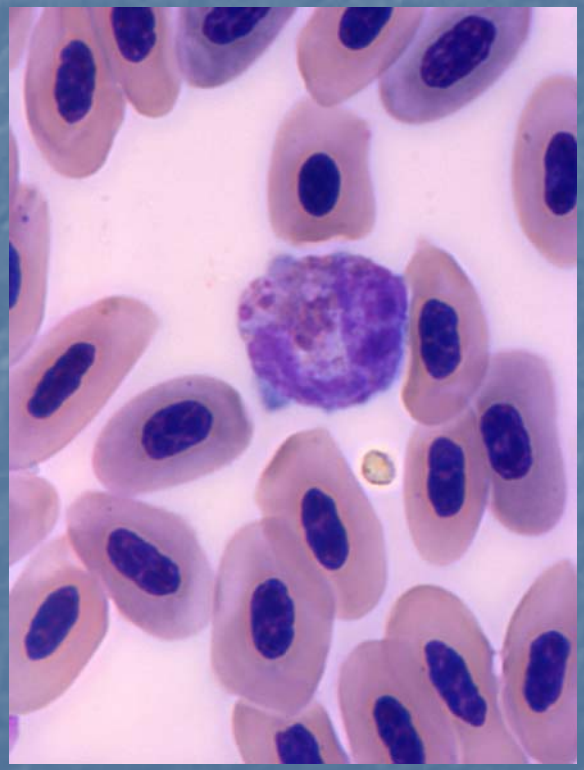


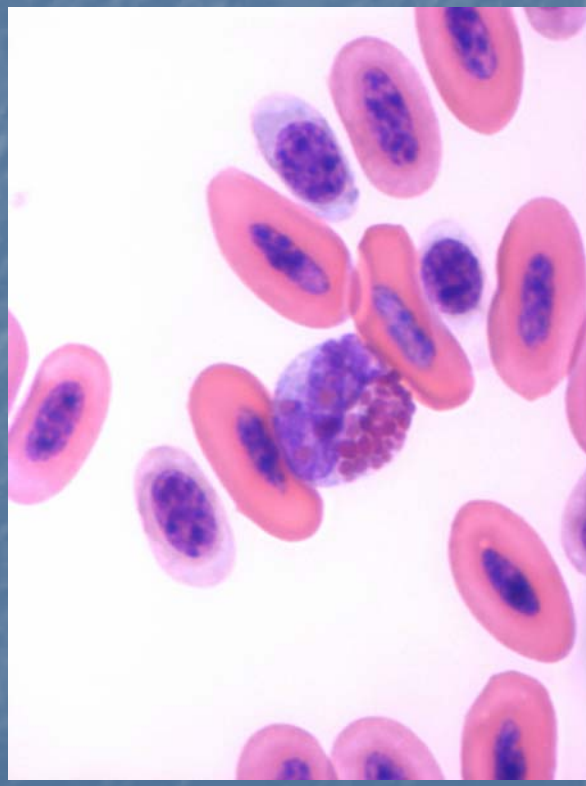
Metamyelocyte



Toxic Changes



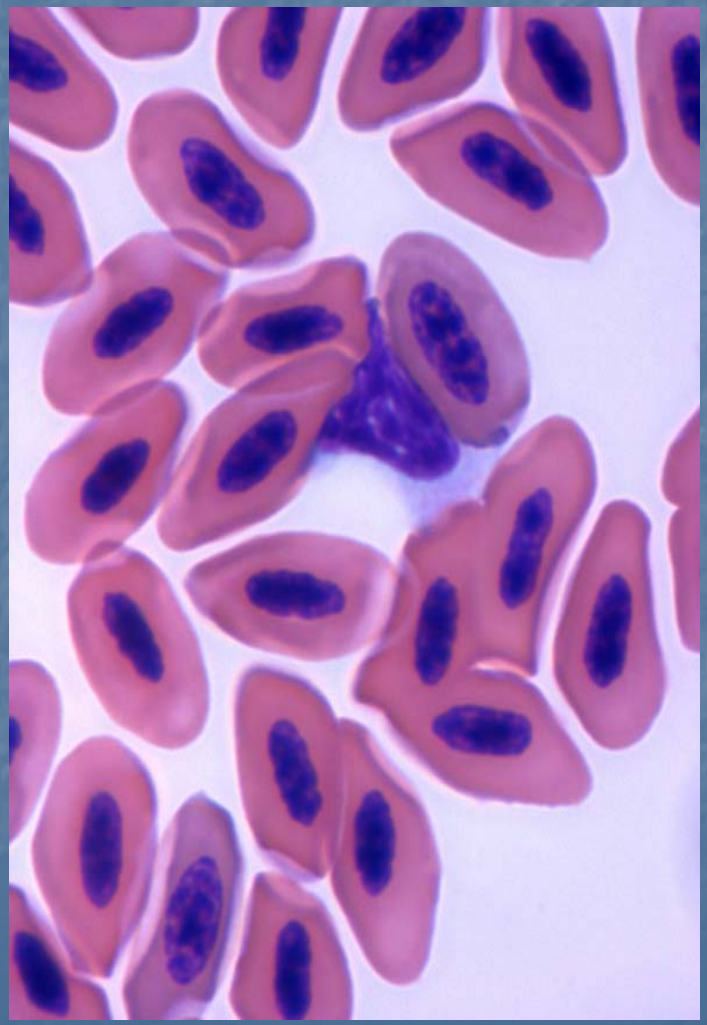


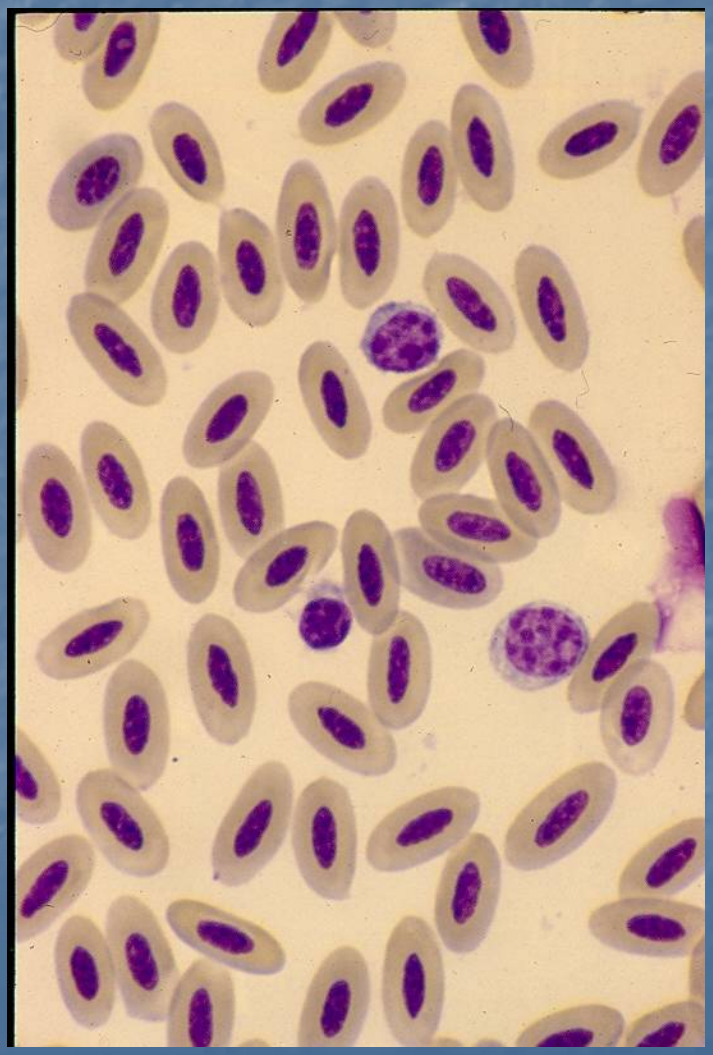


Lymphocytes and Monocytes

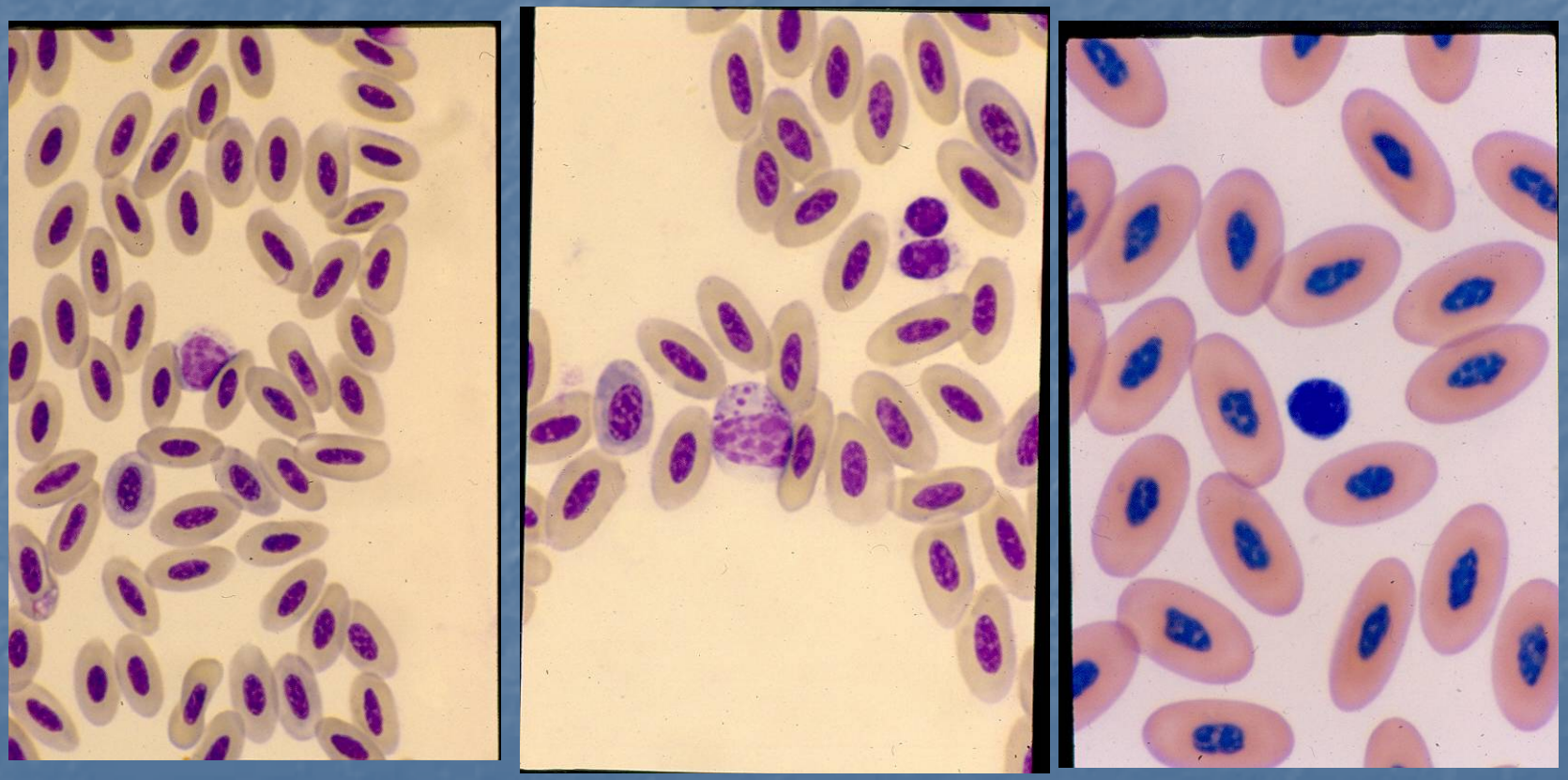
- Lymphocytes
  - Size – smaller
  - Shape
    - Round or polygonal
  - Nucleus
    - Central
    - Condensed chromatin
  - Cytoplasm
    - Less
    - Light blue and wispy
- Monocytes
  - Size – larger
  - Shape-round
  - Nucleus
    - Off centre
    - Less condensed chromatin (topographical map)
  - Cytoplasm
    - Less
    - Busier

Lymphocytes

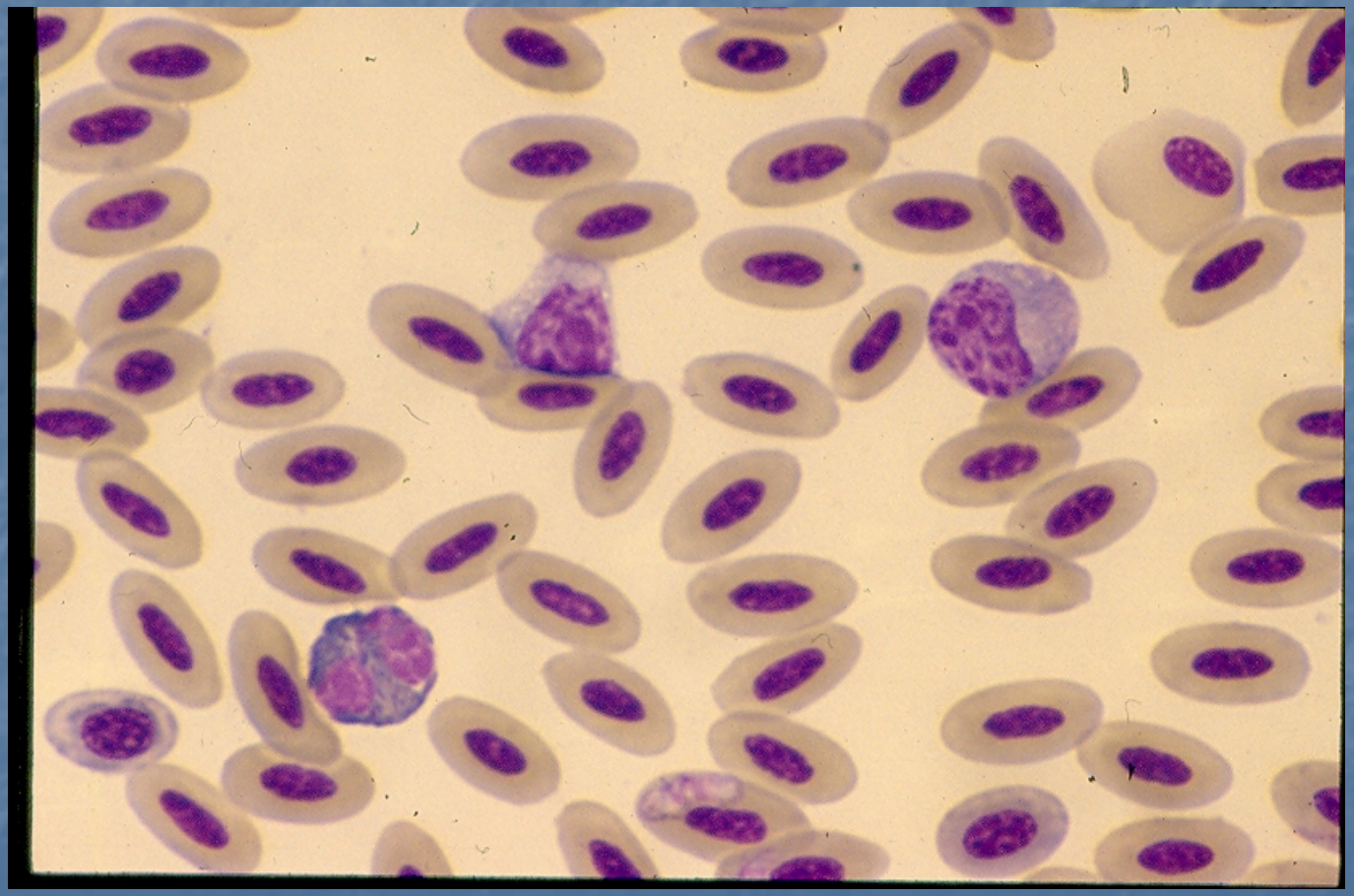




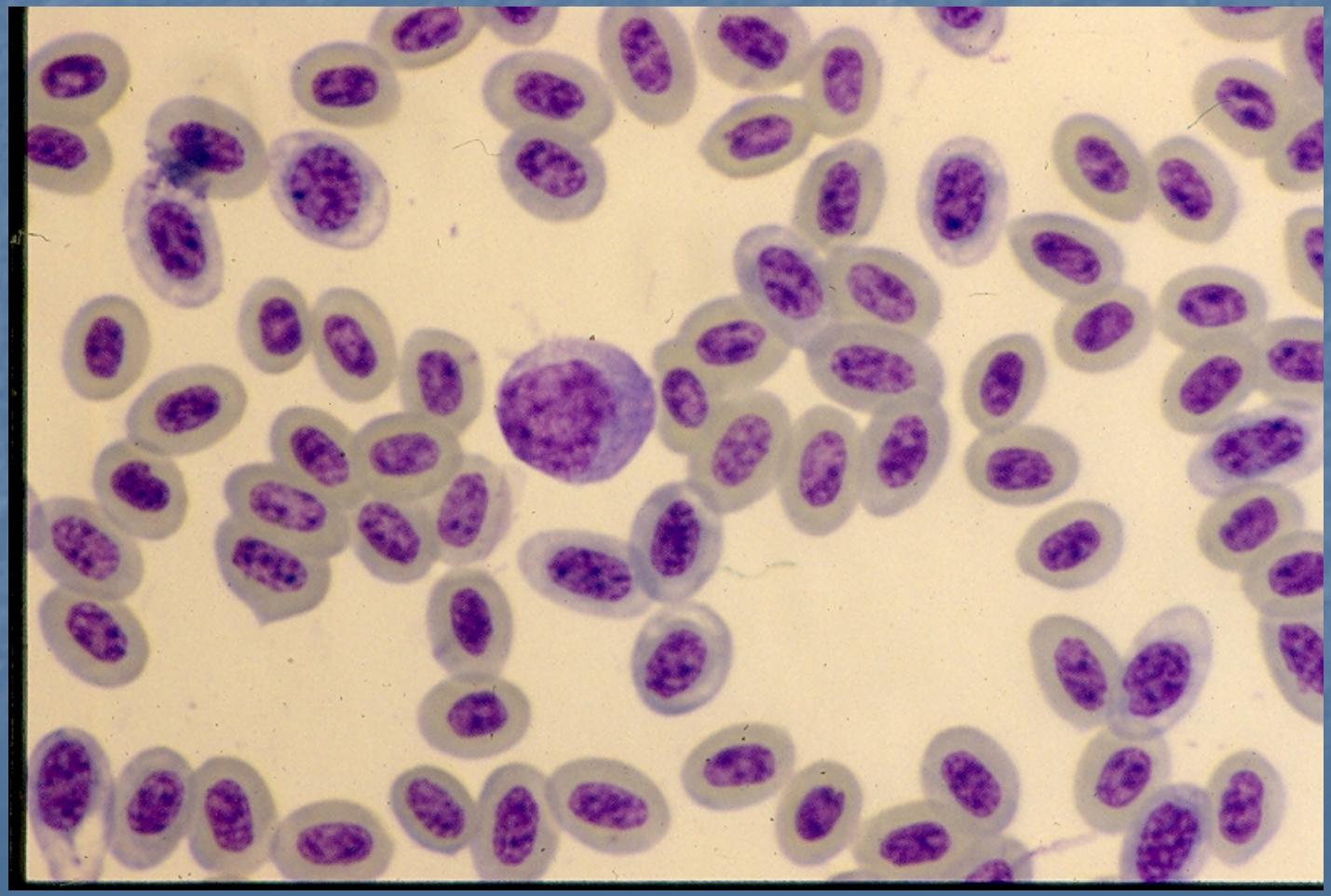
Lymphocytes



Lymphocyte and Monocyte



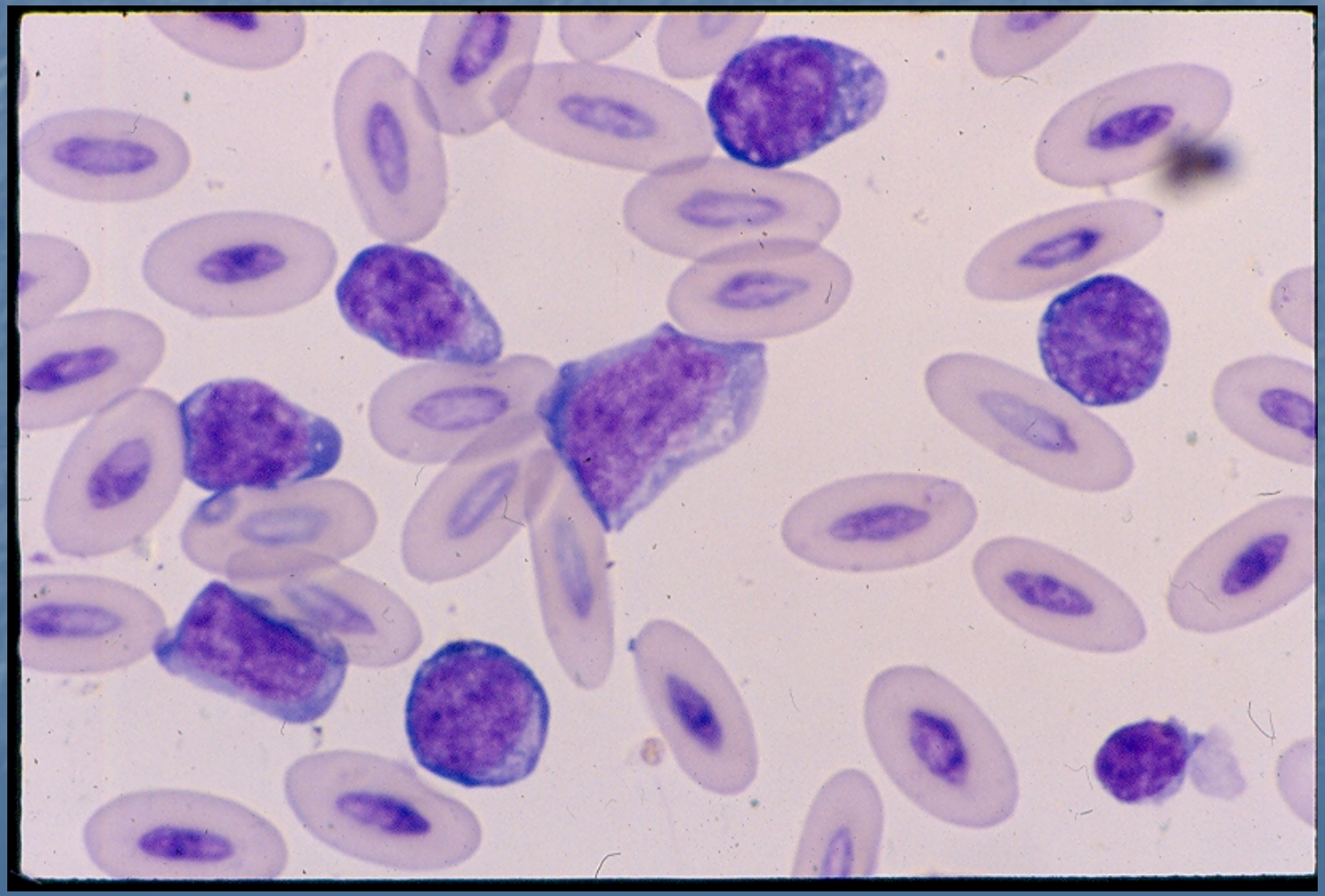
Monocyte



Lymphocyte and Disease

- Lymphopenia
  - Part of generalized leucopenia
  - Stress response
- Lymphocytosis
  - Often accompanies increases in heterophil count
  - Neoplastic cells
- Reactive lymphocytes
  - Enlarge, more euchromatin, more cytoplasm with increased blue staining

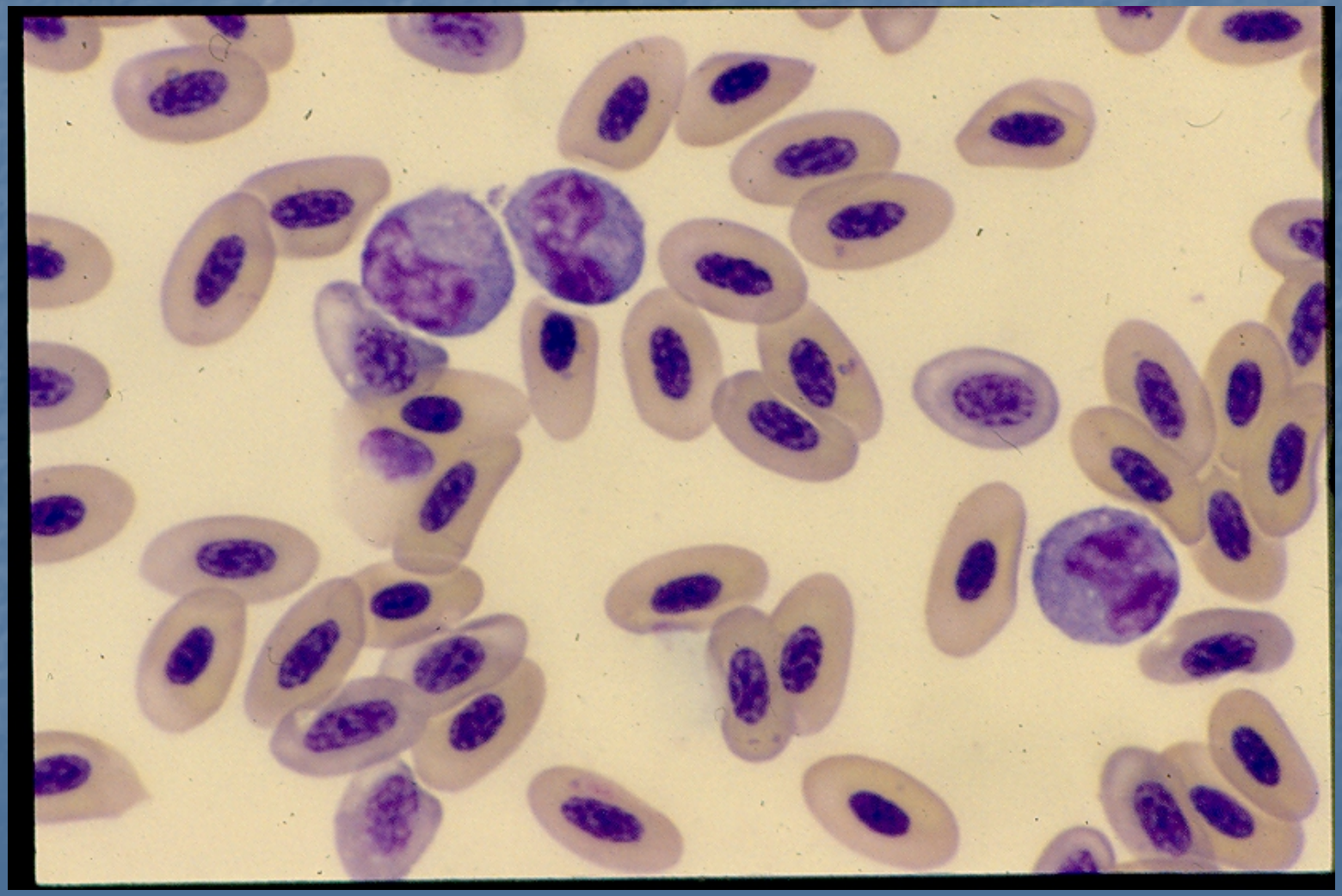
Leukemia: Muscovy Duck



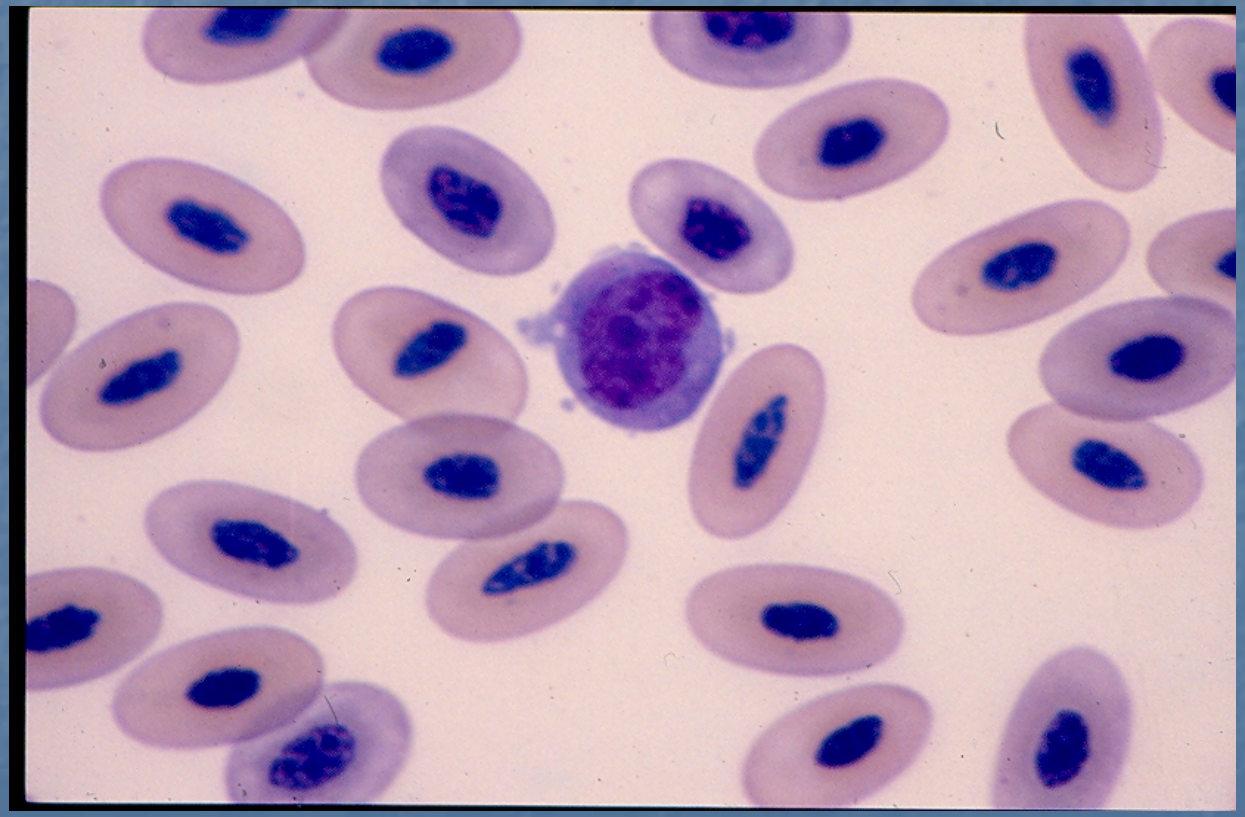
Monocytes and Disease

- Monocytosis
  - > 1,500 to 2,000 cells/ul
- Occurs in chronic inflammatory diseases
  - Psittacosis
  - Aspergillosis
  - Avian TB
  - Ventriculitis

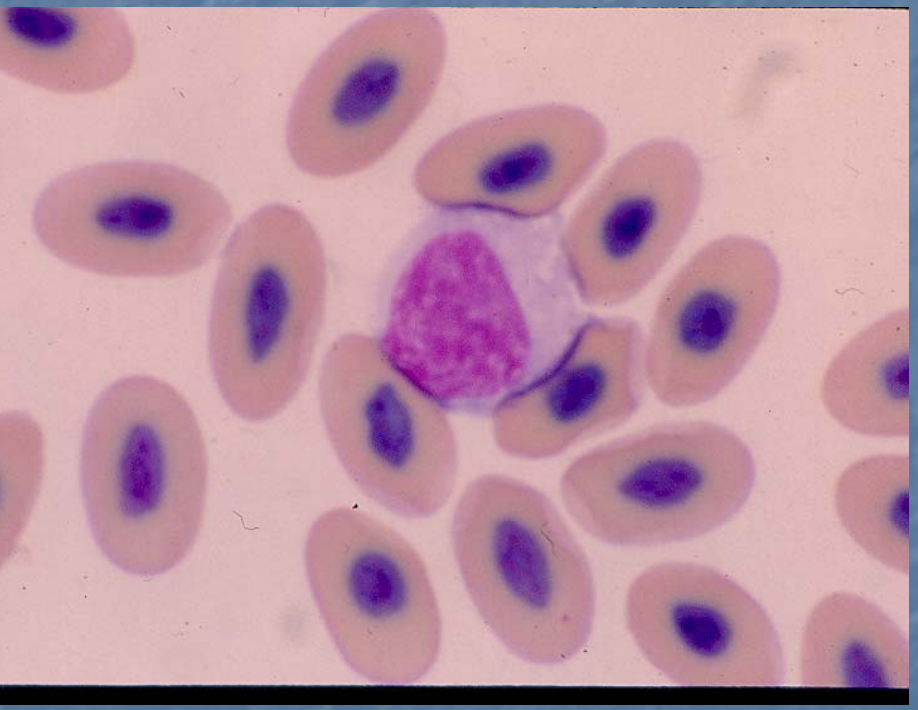
Moncytosis

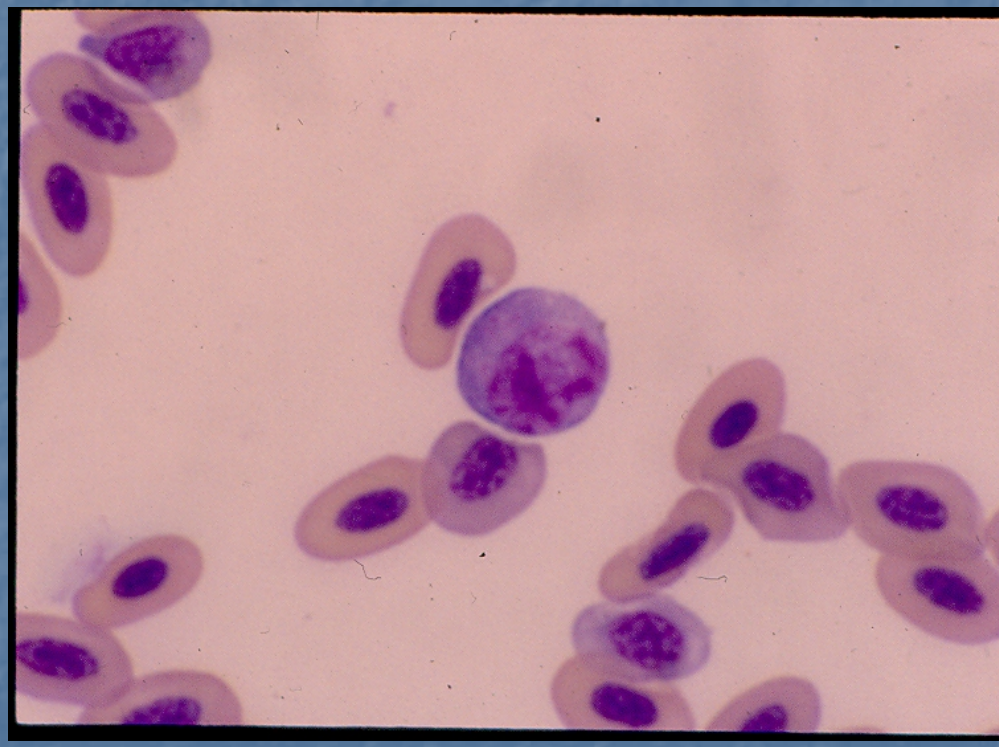


Reactive Monocyte



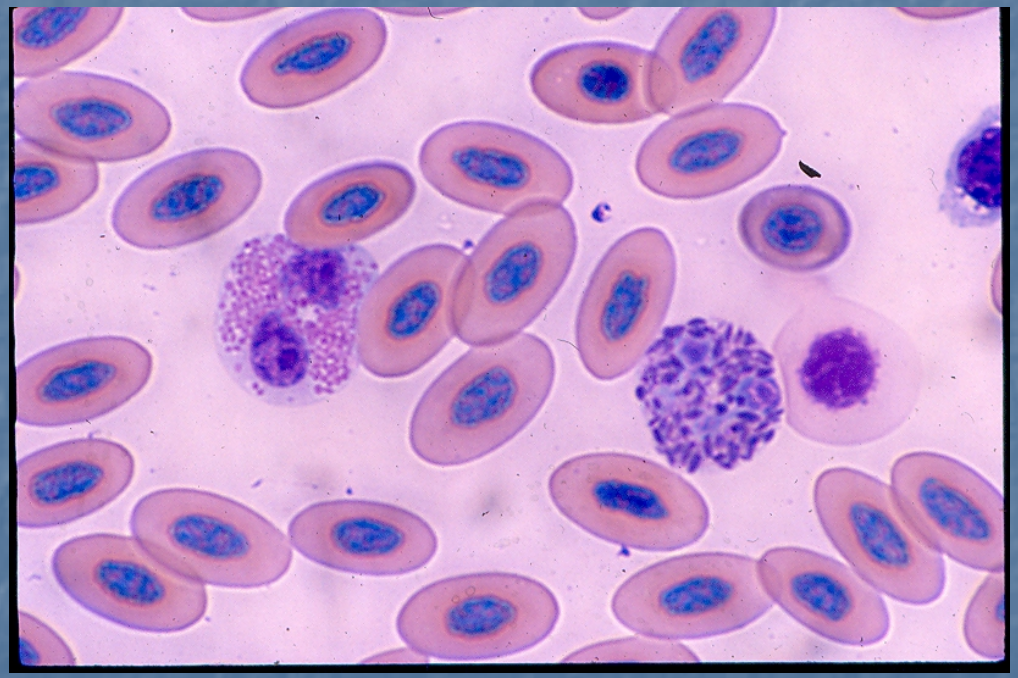
Reactive Monocytes





Eosinophils

- Segmented nucleus
- Round densely packed granules
- Brighter red than heterophil granules



Eosinophils

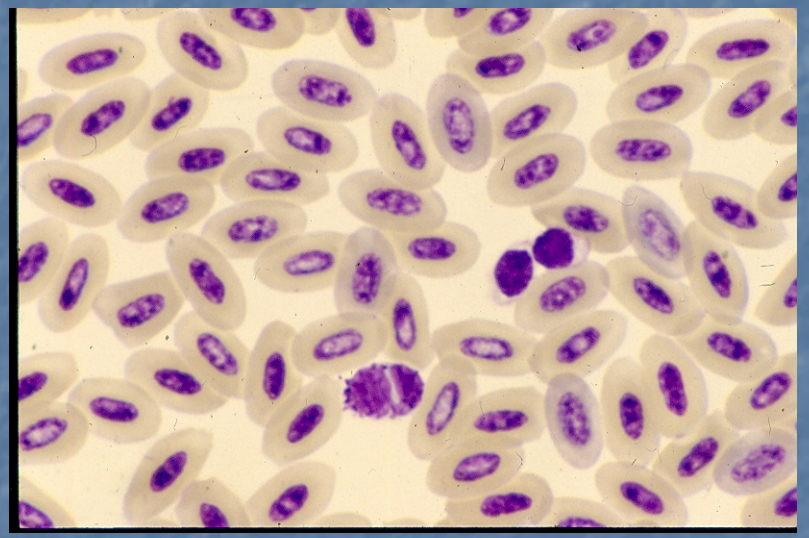
- Normal
  - Parrots – very few to none
  - In some birds of prey, up to 2,000 cells/ul is normal
- In small birds (canaries, finches and budgerigars) slight increases may be significant
- Very high counts seen in
  - An emu with cutaneous mites
  - Currawongs with leucocytozoon infection

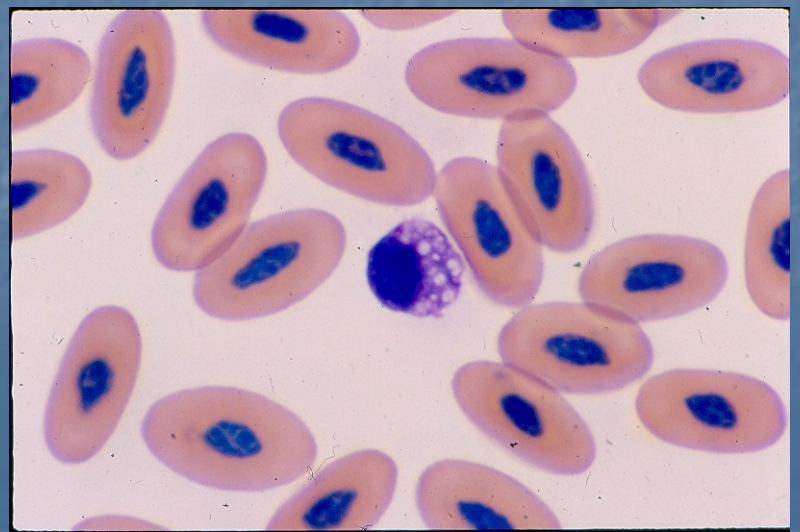
Basophhils

- Generally a round nucleus
- Dark purple granules – Geimsa stain
- Empty vacuoles – Diff Quick

Basophils

- Most birds very few
- Higher numbers (<1000/ul) in conures
- Elevations associated with disease in small birds including canaries, finches, budgerigars, and lovebirds.





Thank You For Your Attention