

The Clinical Pathology of CHeRI: What Makes a Healthy Fawn?

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My role in CHeRI

- ▶ Dr. Katherine Sayler's MS student
- ▶ Also under advisement of Drs. Nicole Stacy and Sam Wisely
- ▶ Clinical pathology nerd
- ▶ Molecular techniques
- ▶ Database Management

Talk Outline

- ▶ Intro to clinical pathology
- ▶ Overview of clinically normal findings of farmed neonate fawns
- ▶ Conclusions
- ▶ Future directions

What is clinical pathology?



- ▶ Laboratory-based medicine
- ▶ Mix of several disciplines
 - ▶ Hematology
 - ▶ Serum biochemistry
 - ▶ Urinalysis
 - ▶ Cytology

Why do we need clinical pathology?

- ▶ Complete Blood Cell Count (CBC)/Chemistry and blood film evaluation is one of the cheapest, easiest ways to evaluate the health of an animal
- ▶ Findings typically non-specific, but can help point you in the right direction
- ▶ Acute vs. chronic conditions
- ▶ Monitoring drug therapy



Goals

- ▶ Knowledge gap about hematology in fawns within 24 hours of birth
- ▶ Establish reference intervals for normal, clinically “healthy” farmed neonate whitetails
 - ▶ Hematological values can vary according to sex, age, time of year, nutritional status, and method of collection
 - ▶ Therefore, we want values that accurately reflect the specific lifestyles and stresses of these farmed deer
- ▶ Identify hemoparasites, if present



The project/Methods

- ▶ All blood collected within 24 hours of birth from 51 fawns
- ▶ EDTA-coated blood tubes
 - ▶ Blood films made via push-smear technique
 - ▶ Rest sent off to University of Miami for CBC
- ▶ Blood film evaluation
 - ▶ Stained via Wright-Giemsa
 - ▶ WBC differential
 - ▶ RBC morphology
 - ▶ Platelet estimate
- ▶ Clot activator coated tubes spun down -> serum separated
 - ▶ Sent for biochemistry analysis at University of Miami



What are we looking at in a blood film?

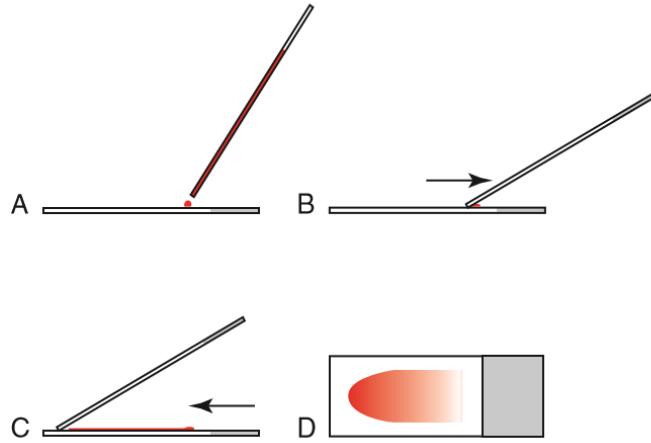


FIGURE 2-29

Patterns of slide blood film examination (*marked in white*) that may be used to improve the accuracy of differential leukocyte counts.

Harvey J. 2012. *Veterinary Hematology: A Diagnostic Guide and Color Atlas*.

- ▶ Looking at immune system cells (white cells)
 - ▶ Abnormal shapes or numbers may indicate disease
- ▶ Looking at RBC morphology
 - ▶ Abnormal shapes or numbers may indicate disease
 - ▶ May be abnormal even when animal appears healthy
- ▶ Looking for clumping of blood cells

What CBC results are normal in fawns?

Our findings	Previously reported data in 6 month old deer (Tumbleson et al. 1970)
RBC ($\times 10^6/\mu\text{L}$) = 9.30 \pm 1.61	RBC ($\times 10^6/\mu\text{L}$) = 19.0 \pm 1.8
HCT(% vol) = 28.9 \pm 5.14	HCT(% vol) = 52.5 \pm 3.1
HB (g/dL) = 8.57 \pm 0.89	HB (g/dL) = 18.5 \pm 1.2
MCV (fL) = 31.12 \pm 1.60	MCV (fL) = 27.6 \pm 2.6
MCHC (%) = 29.65 \pm 2.90	MCHC (%) = 35.2 \pm 2.8
MCH (pg) = 9.29 \pm 1.16	MCH (pg) = 9.8 \pm 1.3
WBC ($\times 10^3/\mu\text{L}$) = 2.2 \pm 1.0	WBC ($\times 10^3/\mu\text{L}$) = 4.1 \pm 1.3

- ▶ All animals have relatively consistent findings
 - ▶ Reported values are the mean plus or minus one standard deviation

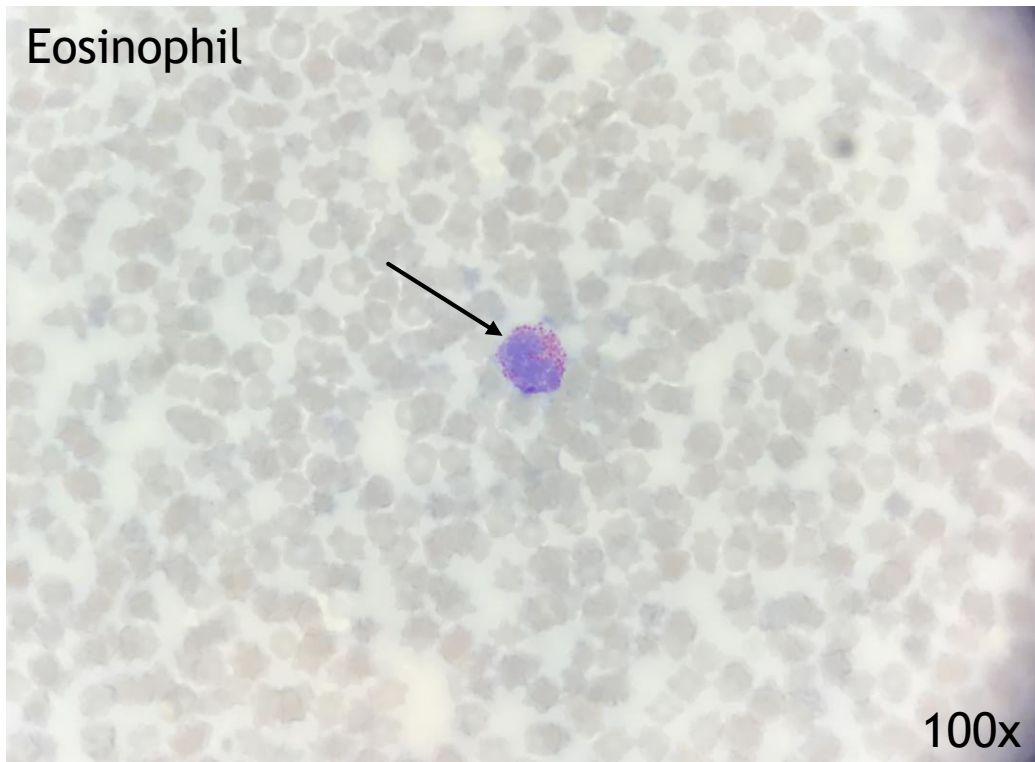
What are normal findings for a neonate on a blood film?

- ▶ Performed on 48 of the neonates
- ▶ No hemoparasites seen - and confirmed by PCR
 - ▶ Piroplasmids: *Theileria* and *Babesia*
- ▶ Compared to adults, findings consistent with regenerative anemia
 - ▶ Mild anisocytosis, mild hypochromasia, mild polychromasia, mild poikilocytosis
 - ▶ Anisocytosis: Variation in red blood cell size
 - ▶ Hypochromasia: Red cells with decreased hemoglobin and increased central pallor
 - ▶ Polychromasia: Presence of polychromatophils in the blood
 - ▶ Poikilocytosis: Abnormal shapes of red blood cells

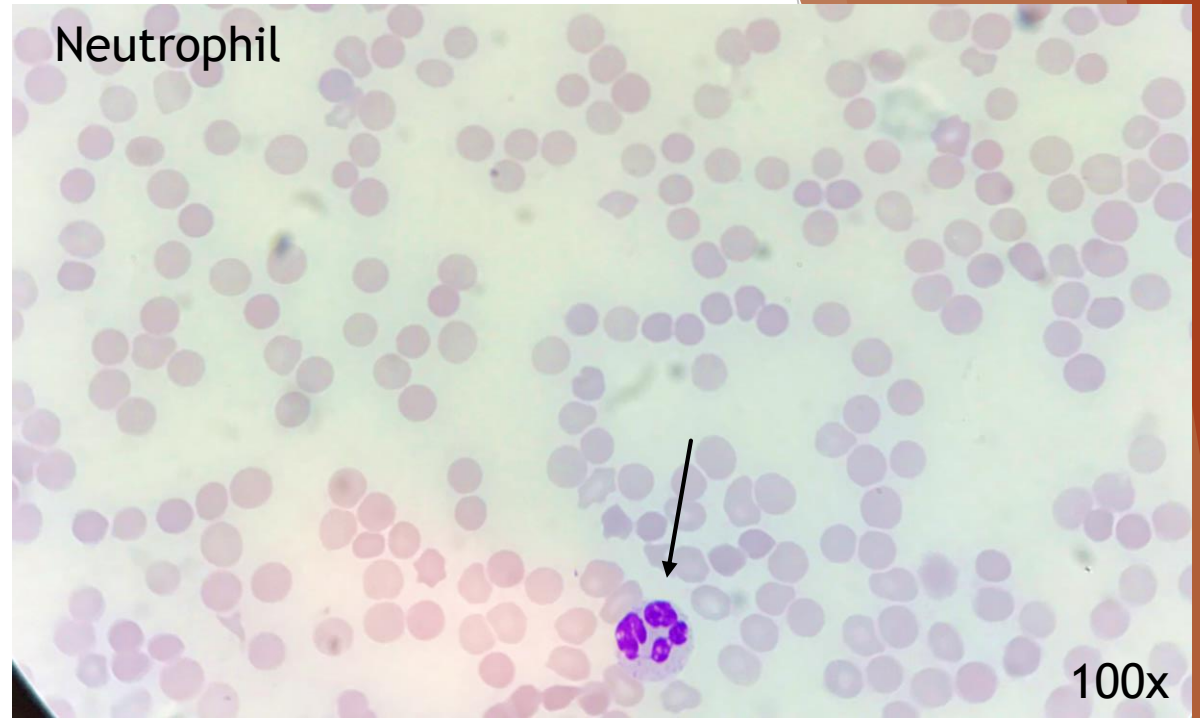
Findings completely normal in neonates



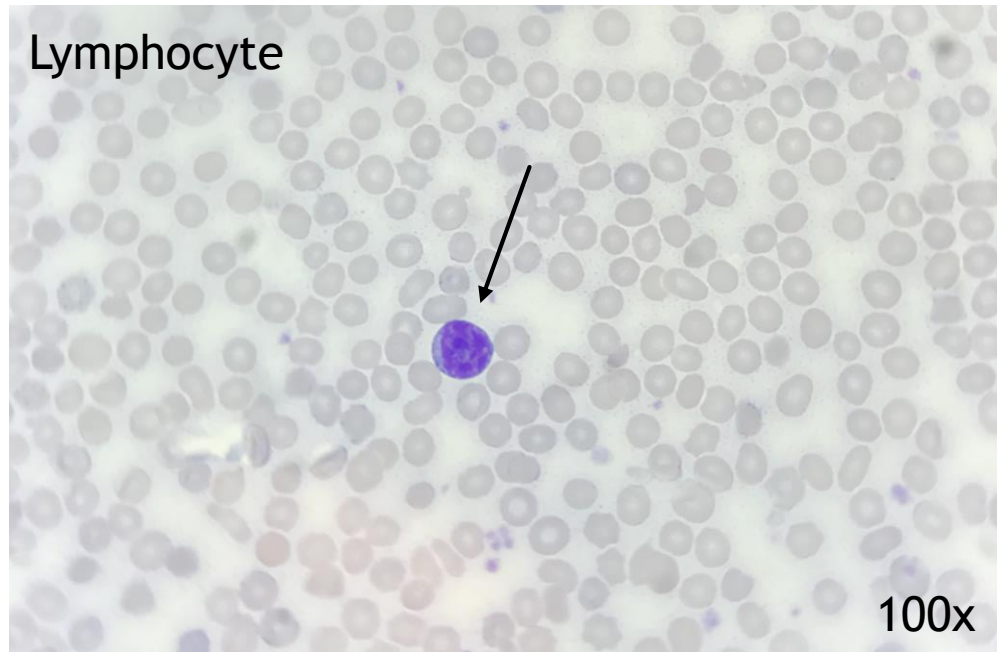
Eosinophil



Neutrophil



Lymphocyte



WBC Morphology

Normal morphology
across species and
between neonates and
adults

Differential WBC Counts

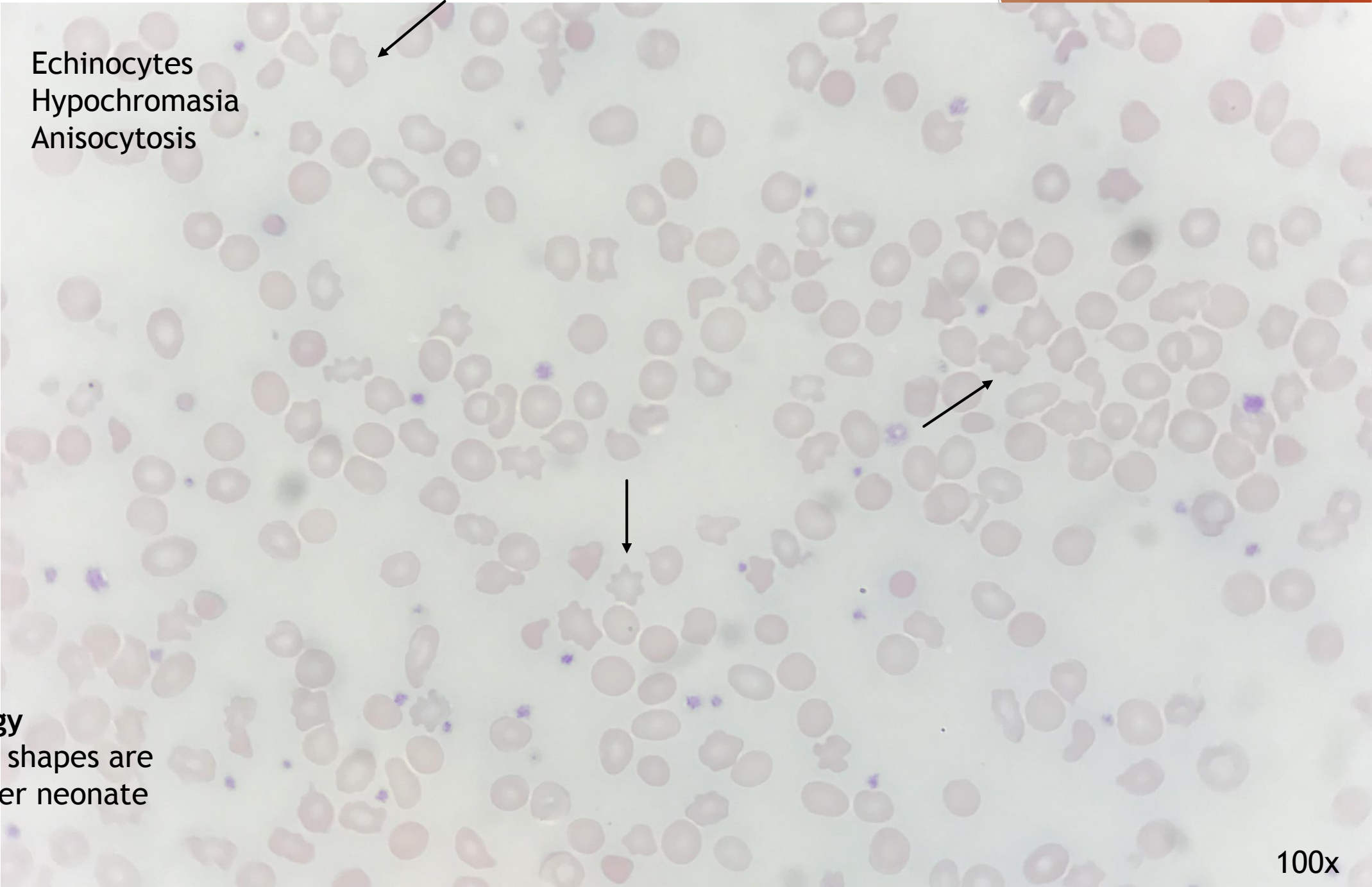
Neutrophils ($\times 10^3/\mu\text{L}$) = 1.63 \pm 0.95

Lymphocytes ($\times 10^3/\mu\text{L}$) = 0.59 \pm 0.34

Eosinophils ($\times 10^3/\mu\text{L}$) = 0.03 \pm 0.04

Monocytes ($\times 10^3/\mu\text{L}$) = 0.01 \pm 0.03

Basophils ($\times 10^3/\mu\text{L}$) = 0.00 \pm 0.00



Echinocytes
Hypochromasia
Anisocytosis

RBC Morphology
Highly variable shapes are
common in other neonate
ruminants

100x

Keratocytes

RBC Morphology

Highly variable shapes are common in other neonate ruminants

100x



Schistocytes

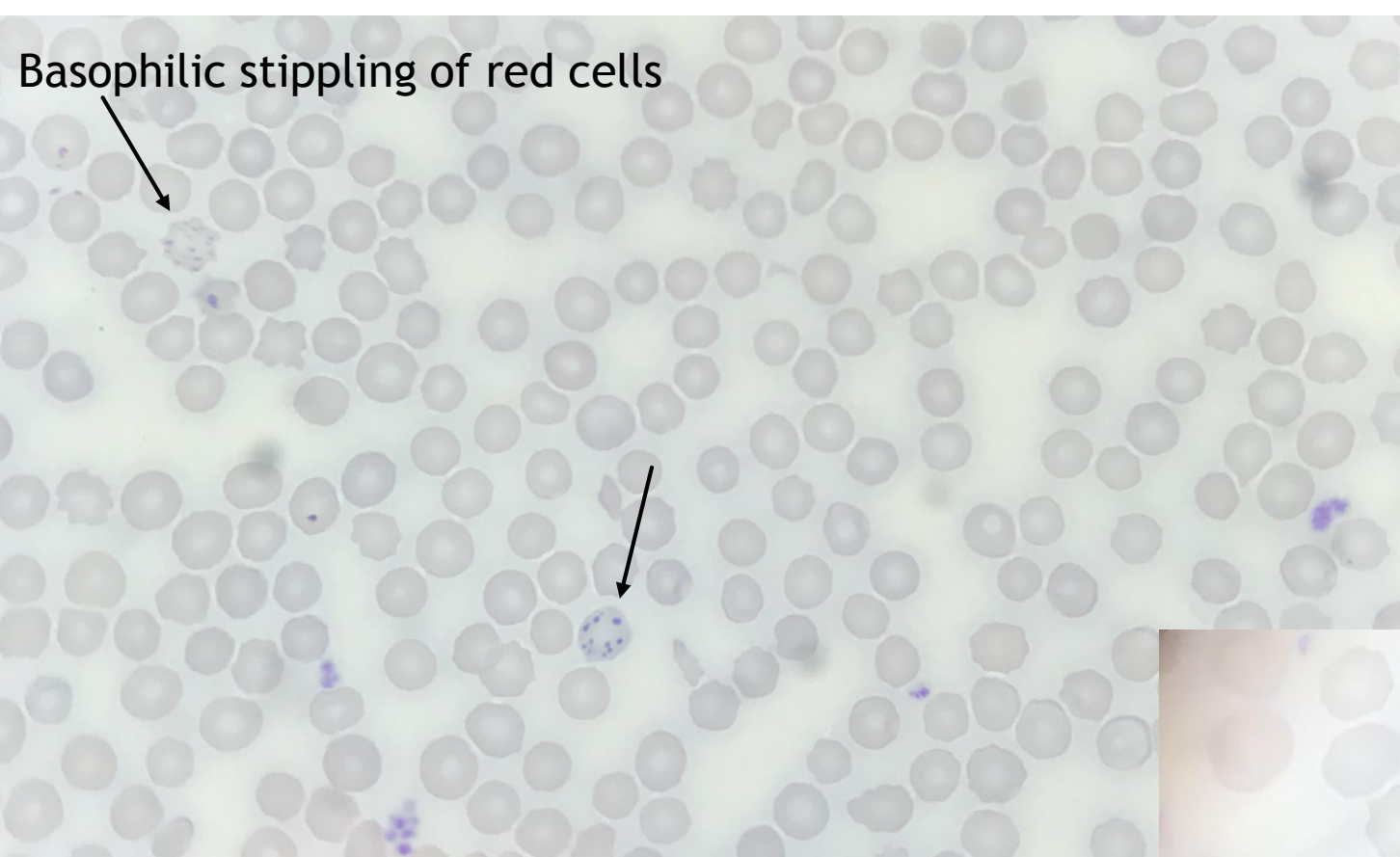


RBC Morphology

Highly variable shapes are common in other neonate ruminants

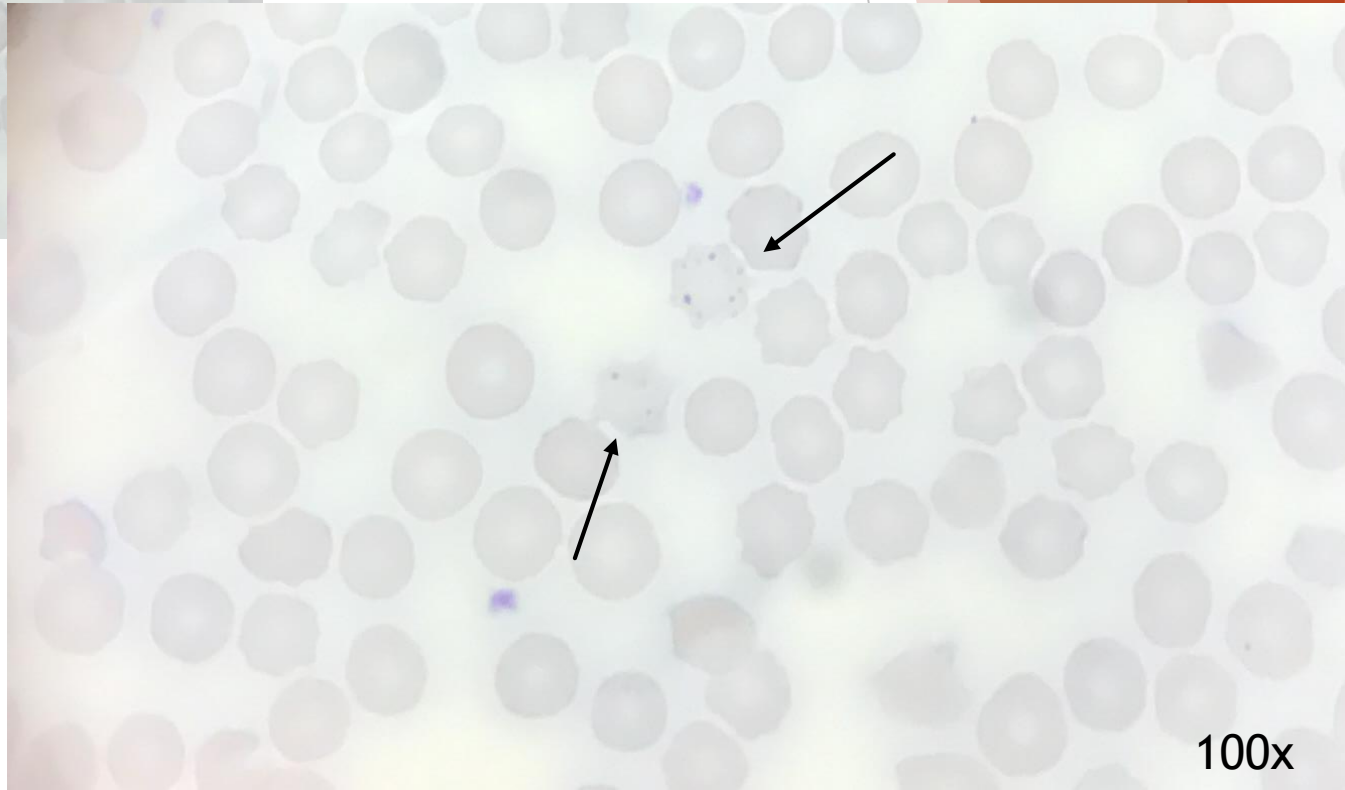
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Basophilic stippling of red cells



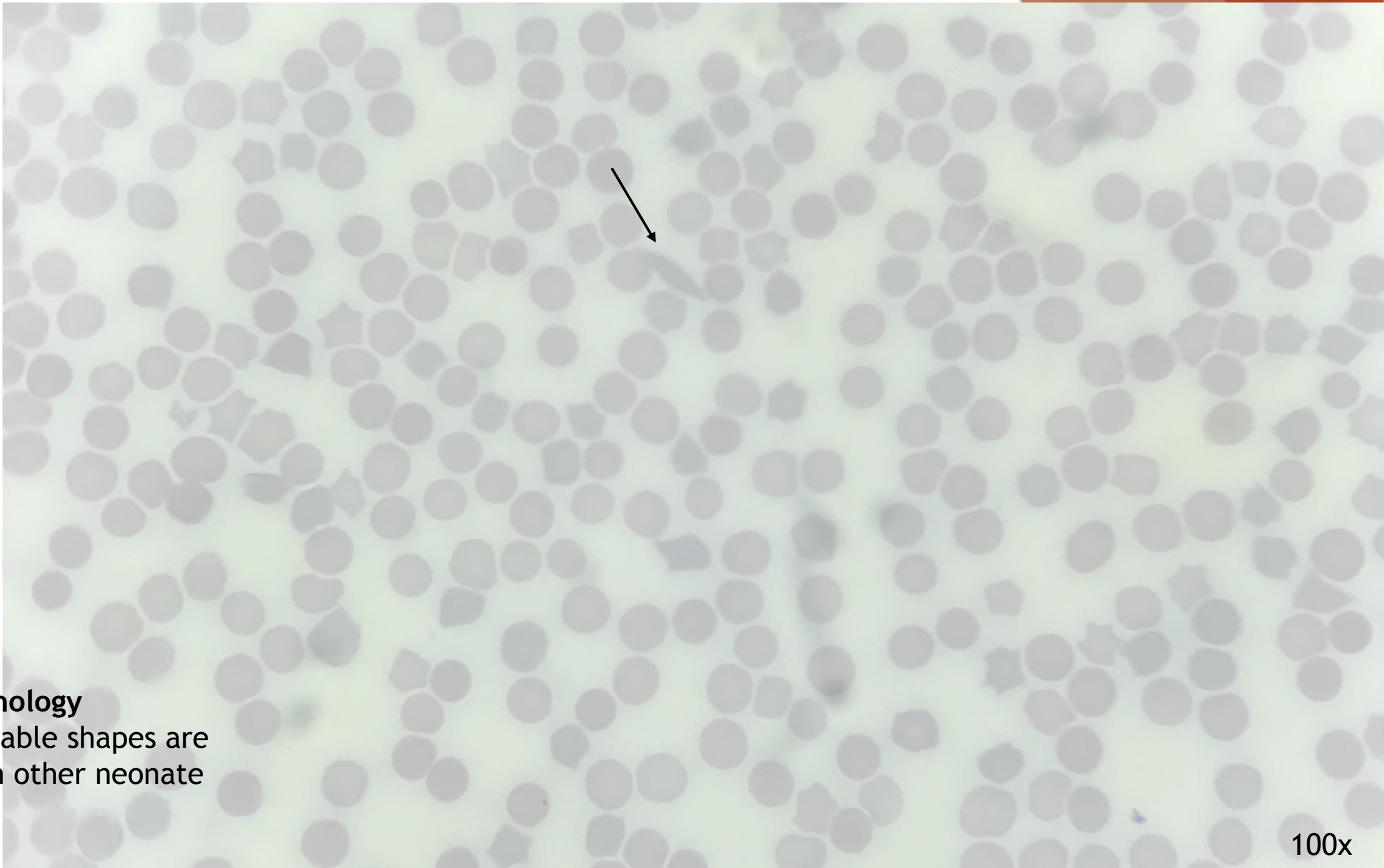
RBC Morphology

Highly variable shapes are common in other neonate ruminants



100x

Drepanocytes



RBC Morphology

Highly variable shapes are common in other neonate ruminants

100x

What chemistry results are normal in fawns?

Our Chem Panel values

Glucose (mg/dL)= 97.76 +/- 20.59

BUN (mg/dL)= 17.37 +/- 5.05

Creatinine (mg/dL)= 1.13 +/- 0.36

BUN/Crea = 15.73 +/- 3.77

Calcium (mg/dL)= 9.66 +/- 0.53

Phosphorus (mg/dL)= 9.77 +/- 1.38

Total Protein (g/dL)= 5.72 +/- 1.13

ALT (U/L) = 40.65 +/- 9.82

- ▶ Previously reported chemistry reference values only reported for adults
- ▶ Neonate values seem to be similar to adults
- ▶ Why evaluate these?
 - ▶ When we understand what's normal, we can identify what is abnormal
 - ▶ These analytes can indicate diseases with certain organs

Conclusions

- ▶ Farmed neonate fawns have distinct CBC/Chem values
- ▶ No hemoparasites are vertically transmitted
- ▶ Neonate fawns display a variety of RBC morphologies, which is clinically “healthy” for them:
 - ▶ Anisocytosis
 - ▶ Hypochromasia
 - ▶ Polychromasia
 - ▶ Poikilocytosis
- ▶ Takeaway Message: This is the first time we’ve defined what is normal in farmed neonate whitetail blood. You can’t find this in any textbook!

Why is this important?

- ▶ This has never previously been described for neonate whitetails
- ▶ Understanding what is normal in these fawns allows for rapid identification of what is abnormal
- ▶ Improve diagnostic capabilities
- ▶ May be able to identify individuals that are at-risk for decreased survival



Future Directions

- ▶ Spend another fawning season to increase sample size
- ▶ Collating the CBC/Chem data with maternal antibody levels to identify if these serve as predictors for fawn survivorship
- ▶ Multivariate regression analysis to identify risk factors for EHDV positivity
- ▶ Develop additional diagnostic tests for passive transfer evaluation

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