Reference Ranges

- PCV: 38-48%
  - Young birds can have lower normal PCV
- TP: 3-5g/dl
- WBC: 10,000-19,000
  - Eagles 20,000 normal
- Heterophils: 15-60%
- Eosinophils: 0-5%
  - Owls can have higher normal values
- Monocytes: 0-3%
- Lymphocytes: 18-60%
- Basophils: 0-2%

What's normal PCV & TP

Raptors	Packed Cell Volume %	Total Solids g/dl
Hawks	38-47%	3-5g/dl
Eagles	37-48%	3-5g/dl
Owls	37-50%	3.5g/dl

Mammals	Packed Cell Volume %	Total Solids g/dl
Raccoon	37-55%	6.0-7.5
Opossum	37-55%	6.0-7.5
Fox	37-55%	6.0-7.5

Turtles & Tortoise	Packed Cell Volume %	Total Solids g/dl
Common box turtle	7-35%	
Gopher tortoise	15-30%	
Sliders	16-47%	

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Test	Hawks	Eagles	Barn Owls	GHOW/ BDOW
WBC	11,000-20,000	12,000-21,000	12,000-20,000	10,000-22,000
Heterophils	35-66%	52-80%	15-50%	20-60%
Lymphocytes	19-50%	18-34%	40-70%	20-60%
Eosinophils	0-4%	0-4%	5-25%	5-30%
Monocytes	0-3%	0-3%	0-3%	0-3%
Basophils	0-2%	0-2%	0-2%	0-2%

What to rule out based on results

Packed Cell Volume %	Total Solids g/dl	Rule out/ Interpretation
Increased ⬆	Increased ⬆	Dehydrated
Increased ⬆	Normal ➡	Dehydration, protein loss
Increased ⬆	Decreased ⬇	Acute blood loss, severe dehydration with loss of protein
Normal ➡	Increased ⬆	Anemia, dehydration
Normal ➡	Normal ➡	Normal
Normal ➡	Decreased ⬇	Protein loss, decreased production (liver)
Decreased ⬇	Increased ⬆	Anemia, dehydration, chronic disease
Decreased ⬇	Normal ➡	RBC destructive disease, reduced RBC production
Decreased ⬇	Decreased ⬇	Whole blood loss, aggressive fluid therapy

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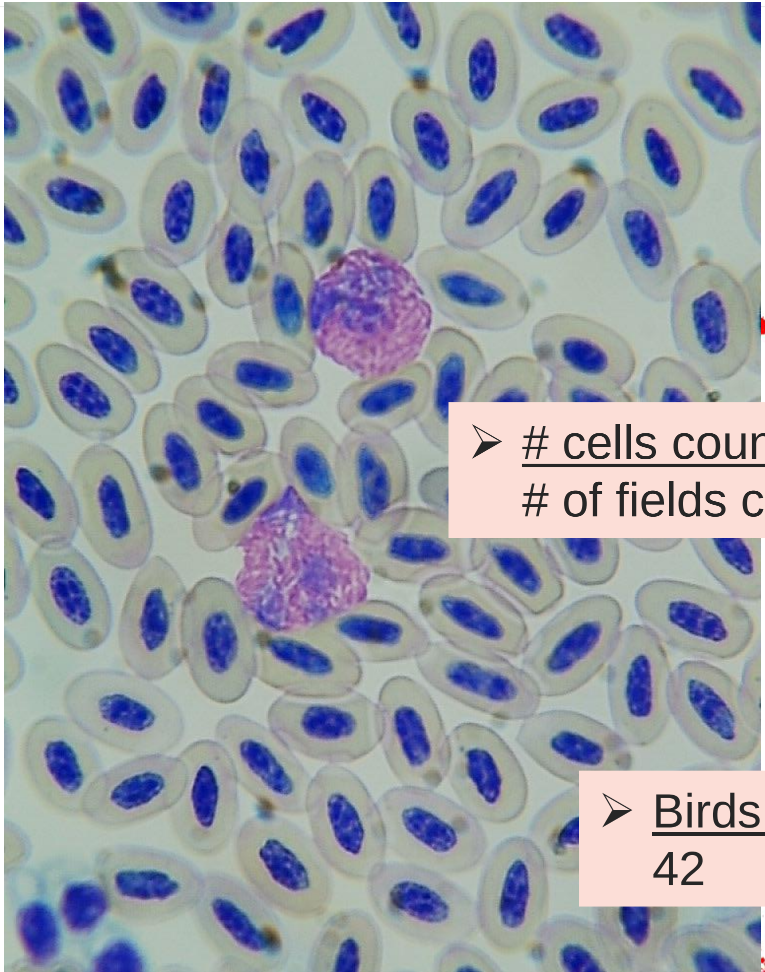
Differential/ Diagnosis	WBC	Lymphs	Hets	Eos	Monos	Baso
Dehydration	N	N	N	N	N	N
Starvation	-	-	+	N/-	N	N
Hemorrhage	N/+	N	N/+	N/+	N	n
Infection	+/-	N/-	+/-	N/+	N/+	+
Fungal	++	N/-	+	N	+	N
Parasites	+/N	+	N/+	N/+	N	N/+
Lead Toxicity	N/+	N/-	N/+	N	N	N/+
Stress	+	N/-	N/+	N	N	N

(+) increase; (-) decrease; (N) normal,
With hemorrhage and tissue trauma, the eosinophil count may be elevated
With overwhelming septicemia, the WBC and Heterophils count may decrease

Audubon

How to do WBC count

- Get stained slide focused on 10x and find a thinner cell area on the slide. Microscope condenser should be up and iris should be open to allow more light.
- Focus on to 40x and look at the feathered edge (mono layer). The cells should be slightly touching but not overlapping.
- Count all WBCs you see in a minimum of 8 fields
  - A field is the view with in the microscope
  - Make sure you do not overlap fields while counting
  - Do not count WBCs in fields that are to thick or thin (stay in mono layer)

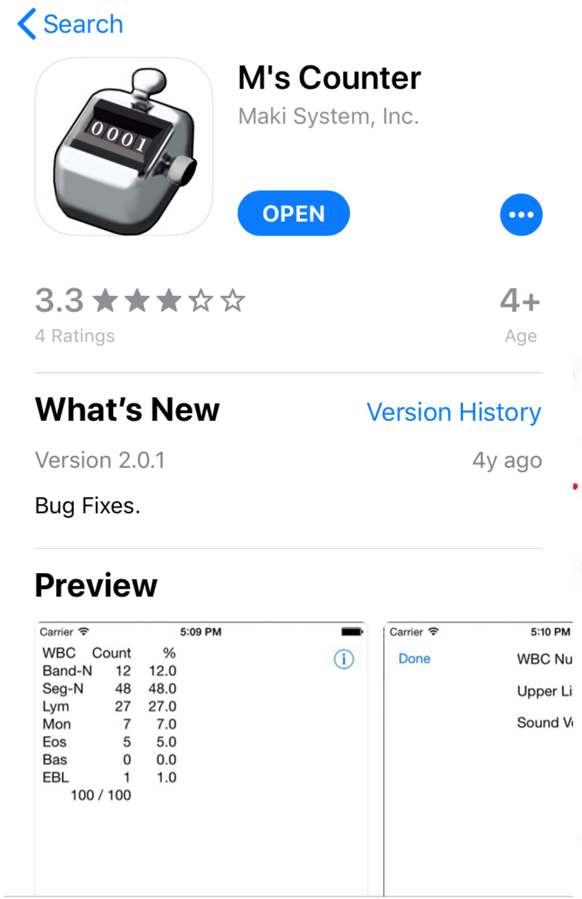


- The picture to the left shows a good mono layer with 2 WBCs
- After counting fields (8) add all of the cells counted by field together and divide by number of fields counted (8), then multiply by 2,000 for an uncorrected WBC

$$\frac{\#\text{ cells counted (in 8 fields)}}{\#\text{ of fields counted (8)}} \times 2{,}000 = \text{Uncorrected WBC count}$$

- For a corrected WBC take PCV and divide by 42 then multiply by the uncorrected WBC

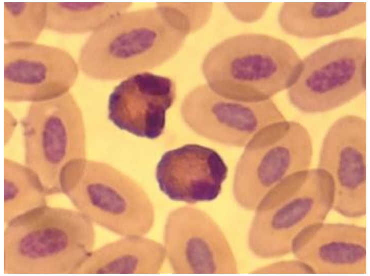
$$\frac{\text{Birds PCV}}{42} \times \text{Uncorrected WBC count} = \text{Corrected WBC}$$



How to do WBC differential

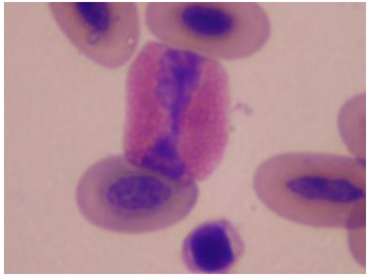
- Change microscope to 100x (use oil) and count 100 WBCs.
- You can keep track of different type of cells using a cell counters or apps found on cell phones
- Evaluate WBCs: Are cells broken, toxic?
- Look for blood parasites while doing differential and tally # found
  - 5 or under = neg
  - 1-19 = 1+
  - 2-29 = 2+…..

White Blood Cell Differential



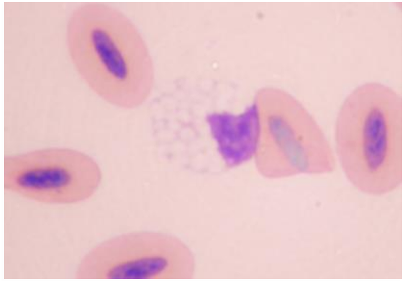
Rod shaped granules, purple

Heterophil



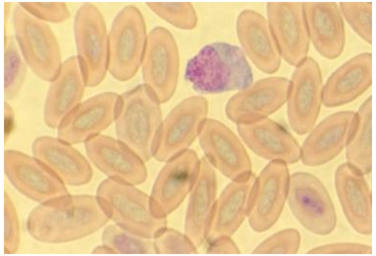
Round shaped granules, pink

Eosinophil



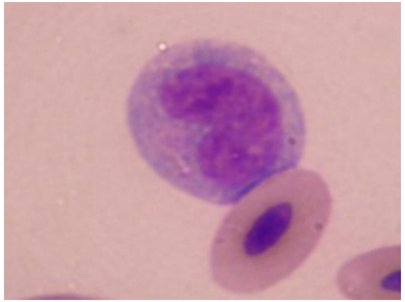
Rarely seen, have clear granules

Basophil



More nucleus to cytoplasm, smaller

Lymphocyte



More cytoplasm to nucleus, larger, may have vacuoles

Monocyte