



NAVIGATING A NERD BOOK

NOVEL EDUCATIONAL RESOURCE DOCUMENT

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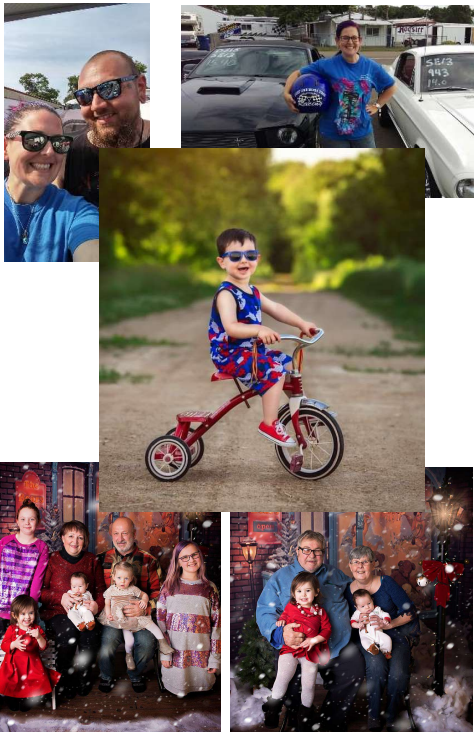
2021
SCNAVTA
advisor of the
year!

2019
MN AALAS
Technologist of
the year!

2019
MAVT
Vet Tech of
the Year!



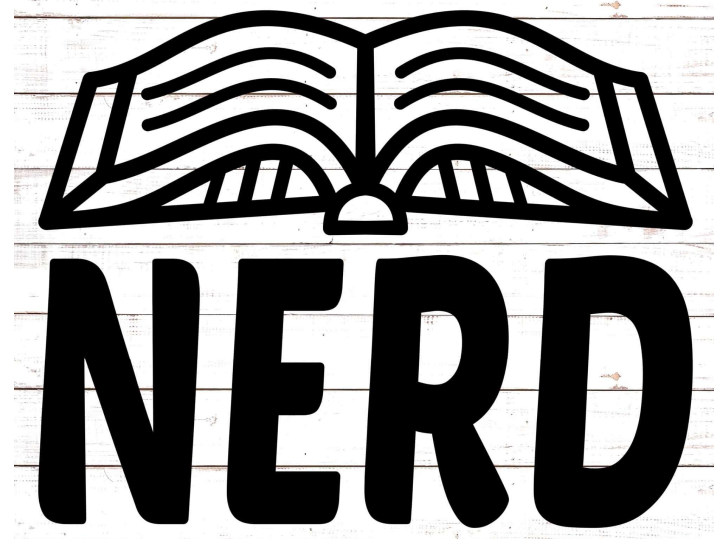
DAKOTA COUNTY
TECHNICAL COLLEGE





WHAT IS A NERD BOOK?

- Reference tool
- Help improve retention
- Useful in many classes



RUBRIC

- See hand out
- Useful for many classes
- Heavy point based ~450

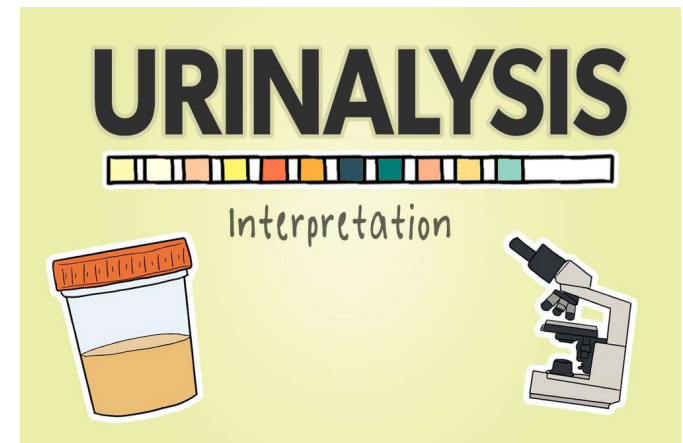
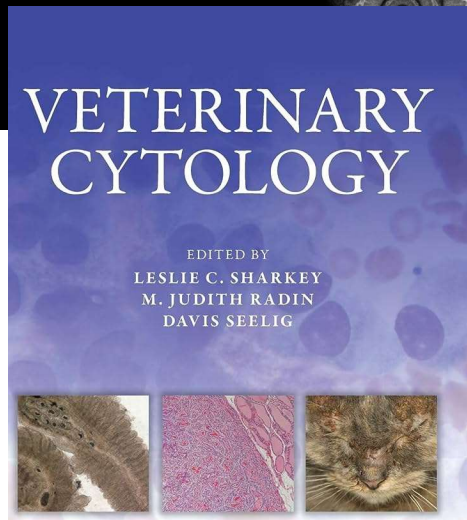
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WHAT SUBJECT MATTER IS FUNDAMENTAL FOR A NERDBOOK?



NORMALS OF ANIMALS

ANIMAL	TEMPERATURE	PULSE (Per Minute)	RESPIRATION (Per Minute)
Horse	99.5 - 101.3	28 - 40	9 - 10
Cattle	100.3 - 104	40 - 80	16 - 22
Buffalo	99 - 102	40 - 45	10 - 14
Sheep	100.4 - 103.8	70 - 90	15 - 20
Goat	101.8 - 105.4	70 - 90	20 - 25
Dog	100.4 - 102.4	60 - 100	15 - 30
Cat	100.4 - 102.4	100 - 120	20 - 30
Fowl	105 - 109.4	128 - 160	15 - 30
Camel	97.2 - 101.1	25 - 32	5 - 12



PROS VS CONS

- Personalized project
- Helpful with retention
- Can take to internship/ clinic etc.
- Student can continue to add in other classes



PROS VS CONS

- Tedious
- Students procrastinate
- Plagiarism
- A lot to grade



ASSIGNING TO STUDENTS

- Rubric 2nd week of class
- Due week 10 of semester
- Reminders



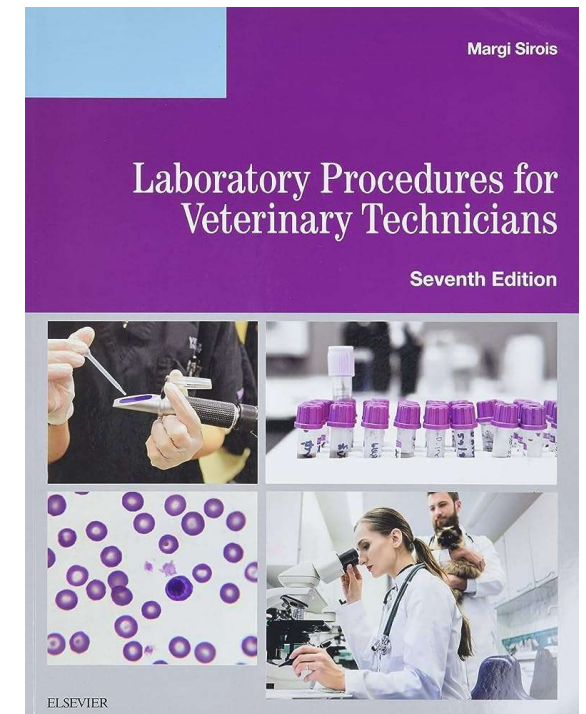
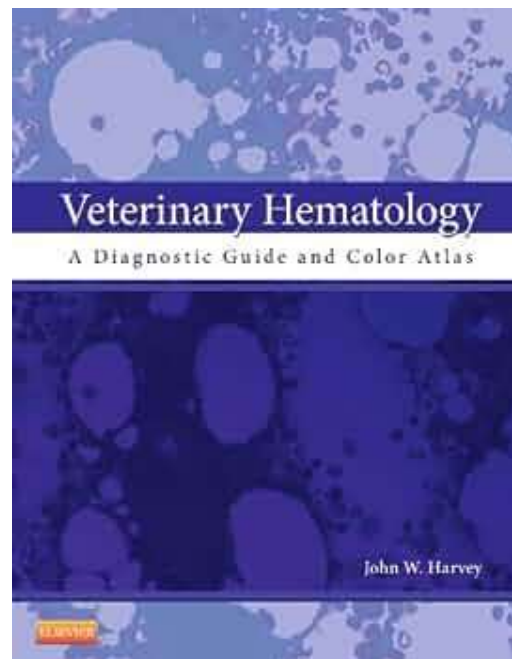
GET CREATIVE

- Allow creativity!
- Scrap book
- Typed
- Encourage them!



RESOURCES

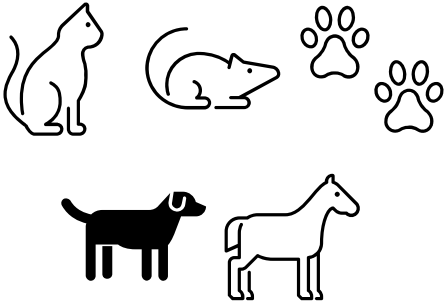
- Textbooks
- Eclinpath.com
- Class power points
- Reputable sources



EXAMPLE



Lindsey's Nerd book Lab II



Red Blood Cells

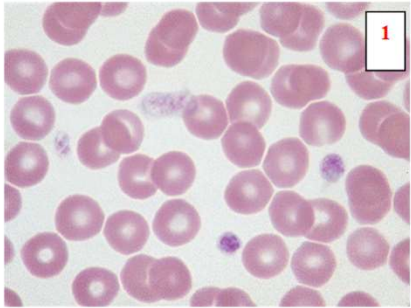


Figure 1 Canine Red Blood Cell

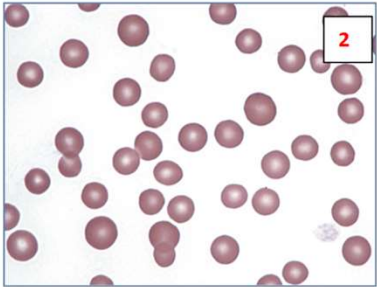


Figure 2 Feline Red Blood Cell



3

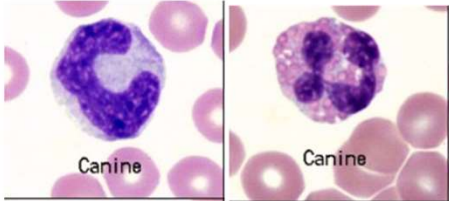


Figure 1 Canine Monocyte Figure 2 Canine Eosinophil

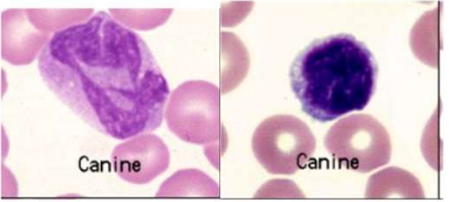


Figure 3 Canine Basophil Figure 4 Canine Lymphocyte

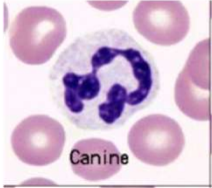


Figure 5 Canine Neutrophil

Different types of blood cells



Erythrocytes: The canine **erythrocyte** in health is a relatively large, uniform, biconcave disc. This is reflected in the Wright's stained blood film as a cell with an area of central pallor. ⁽³⁾

Neutrophils: Neutrophils are the predominant circulating WBCs in dogs, cats, and horses. Mature neutrophils, called segmented neutrophils, are about 12 µm in diameter and are characterized by a segmented nucleus that often has three to five lobes. ⁽⁴⁾

Eosinophils: In general, nuclei of mature **eosinophils** are shorter and less segmented than neutrophil nuclei and the cytoplasm, if visible, is pale blue. Marked variation in granule size, number and shape occurs within and between individuals of any breed. A specific and predictable morphologic variant of the eosinophil is seen in Greyhounds, other sighthounds (eg, Whippets, Deerhounds) and in some Golden Retrievers. ⁽³⁾

Basophils: Canine **basophils** are difficult to recognize since many do not have readily apparent granules. This is because the granules are a pale lavender versus purple. The major identifying features of canine basophils are the long and

folded nucleus, described as "ribbon-like", and the unusual gray to lavender hue of the cytoplasm. ⁽³⁾

Lymphocytes: Most of the **lymphocytes** that circulate in healthy dogs, cats, camelids and horses are small (mature) cells that have round nuclei with smooth, dense chromatin and a small rim of light blue cytoplasm. ⁽³⁾

Sizing of lymphocytes	
Lymphocyte size	Nucleus size in relation to a neutrophil
Small	Nucleus of lymphocyte can fit inside a neutrophil
Intermediate	Nucleus of lymphocyte is the same size as a neutrophil
Large	Neutrophil can fit inside the nucleus.

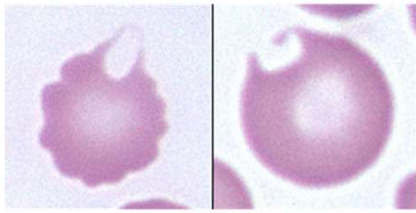
⁽³⁾

Monocytes: They are often larger than neutrophils and are usually the largest leukocyte, but there are no consistent species differences. The nucleus can be round to kidney-shaped to pseudo-lobulated (can mimic a neutrophil). It can even occasionally be band-shaped, especially in dogs, and may be confused with band neutrophils. However, the chromatin of **monocytes** is less dense than neutrophils, and is described as lacey to slightly clumped. ⁽³⁾

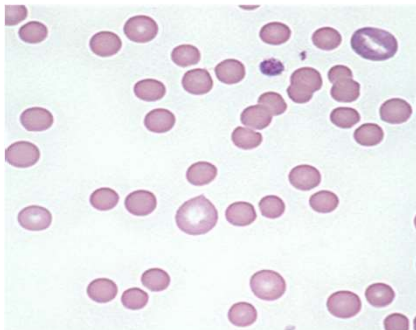
EXAMPLE



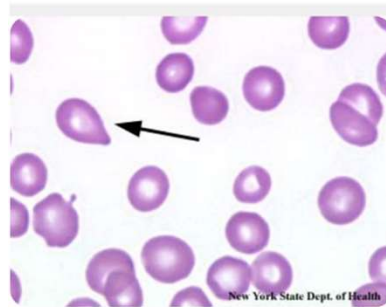
Keratocytes – Commonly referred to as helmet cells, blister cells, or bite cells. This cell may appear to contain a vacuole. (5)



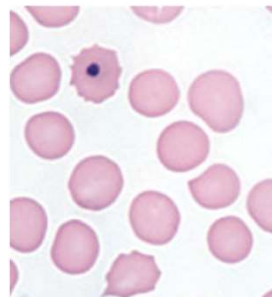
Spherocytes – Darkly staining RBCs with reduced or no central pallor. Spherocytes are not easily detected in species other than dogs. (5)



Dacryocytes – Teardrop-shaped cells that are seen with myelofibrosis and certain other myeloproliferative diseases. (5)



Howell-Jolly Bodies – Basophilic nuclear remnants that are seen in young erythrocytes during the response to anemia. (5)



EXAMPLE

EXAMPLE

Exotic & Avian Blood Cells

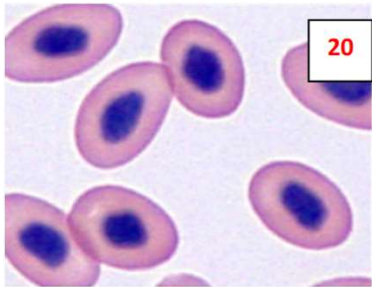
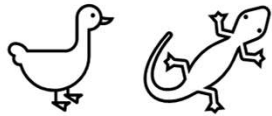


Figure 1 Avian Heterophil

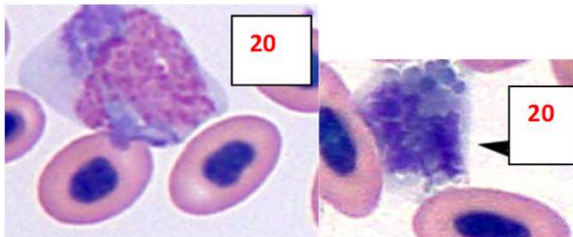


Figure 2 Avian Monocyte

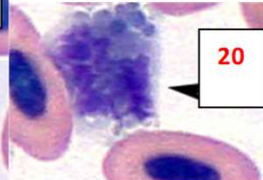


Figure 3 Avian Eosinophil

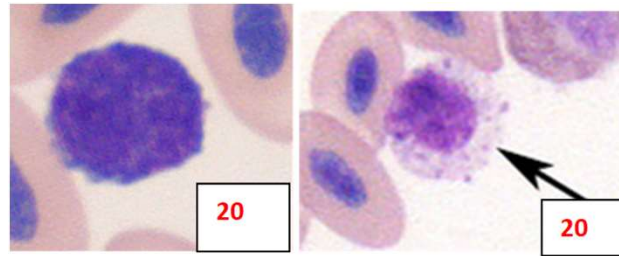


Figure 1 Avian Lymphocyte

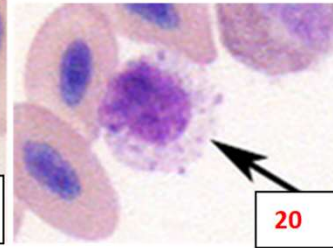


Figure 2 Avian Basophil

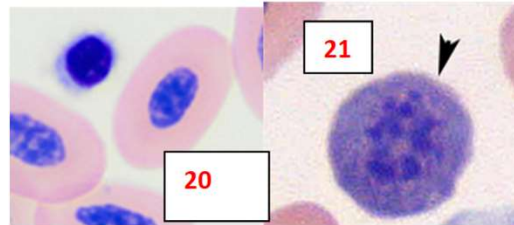


Figure 3 Avian Thrombocyte Figure 4 Immature Avian RBC



Avian **erythrocytes** are larger than mammals but smaller than reptiles with lower hemoglobin due to nucleated red blood cells. Avians have a different respiratory system that lets them transport oxygen efficiently without needing enucleated blood cells. (56)

Math Formulas ⁽⁵⁶⁾

Mean Corpuscular Volume (MCV) –

$PCV \times 10 \div RBCs$ (units fl)

Mean Corpuscular Hemoglobin (MCH) –

$Hgb \times 10 \div RBCs$ (units pg)

Mean Corpuscular Hemoglobin Concentrations

$(Hgb \div PCV) \times 100$ (units g/dL)

$Hgb = PCV \div 3$ (units g/dL)

$PCV = Hgb \times 3$ (units %)

RBC Est. = $PCV \div 6 \times 1,000,000$ (units est. RCB/uL)

WBC Est. = count 10 fields, take average, then multiply by 2,000 (units est. WBC/uL)

Platelet Est. = count 10 fields, take the average, multiply by 15,000. (units est. platelet/uL)

What is a hemocytometer? ⁽²⁵⁾

A hemocytometer is a specialized slide used for cell counting with a microscope. There are several types of hemocytometer, all with different counting grids. The most commonly used is the *'Improved Neubauer' chamber*.

The Improved Neubauer has an H-shaped indent at the center of the slide that separates the space into two counting chambers. Grids are engraved onto the surface to make cell counting easier and more precise.



How to Use the Hemocytometer

1. Clean the hemocytometer and the cover glass with ethanol. Ensure the ethanol evaporates completely so it does not affect your cells.
2. Place the cover glass on top of the hemocytometer's chambers to stop your sample from evaporating.
3. Load 10 μ l of your stained sample into one or both counting chambers with a micropipette. Capillary action ensures even distribution of the suspension within the chamber.
4. Place the hemocytometer under the microscope.
5. Adjust the microscope's focus until you can clearly see the cells.

EXAMPLE



The Main Electrolytes:



Sodium (Na) – Plays a major role in the pH regulation of urine and acid-base balances. **Hypernatremia** (water deprivation, hyperventilation, osmotic diuresis) refers to elevated blood levels of sodium while **hyponatremia** (GI disorders, Ketonuria, CHF) is decreased blood level of sodium. (5)



Potassium (K) – This electrolyte is important for normal muscular function, respiration, cardiac function, nerve impulse transmission, and carbohydrate metabolism. Elevated potassium can cause **hyperkalemia** (metabolic acidosis, renal insufficiency, urinary tract obstruction). Decreased levels of potassium can cause **hypokalemia** (anorexia, ketonuria, diuresis). (5)



Chloride (Cl) – Chloride is important for maintenance of water distribution, osmotic pressure, and the normal cation/anion ratio. (5)



Magnesium (Mg) – This electrolyte is found in all body tissues and more than 50% is found in the bones. Mg activates enzyme systems and is involved in the production

and decomposition of acetylcholine. Cattle and sheep are the only domestic animals that show clinical signs related to magnesium deficiencies. (5)



Calcium (Ca) – More than 99% of calcium in the body is found in the bones. The remaining 1% (or less) functions to maintain neuromuscular excitability and tone, the maintenance of activity for various enzymes, blood coagulation and more. Ca concentrations are usually inversely related with inorganic phosphorus concentrations, meaning if calcium concentrations rise phosphorus concentrations will fall. (5)



Phosphorus – 80% of phosphorus is found in the bones while the other 20% functions as energy storage, release, transfer, involvement in carbohydrate metabolism, and composition of nucleic acids and phospholipids. (5)

EXAMPLE

Analyte	Units	Canine	Feline	Equine	Bovine
Sodium	mEq/L	143-150	149-158	134-142	134-144
Potassium	mEq/L	4.1-5.4	3.8-5.5	2.4-4.8	4.0-5.9
Chloride	mEq/L	106-114	111-124	95-104	92-99
Calcium	mg/dL	9.4-11.1	9.0-11.3	10.8-12.9	8.9-10.9
Phosphate	mg/dL	2.7-5.4	2.6-5.5	2.1-4.7	4.1-7.3
Magnesium	mEq/L	1.5-2.1	1.7-2.2	1.2-1.9	1.6-2.5

(27)

Ehrlichia canis



• **Vector:** *Rhipicephalus sanguineus*,
Dermacentor variabilis.

• **Cells:** Monocytes, macrophages, lymphocytes. Morulae rarely seen in infected dogs and usually only in acute infection.

• **Clinical signs:** Fever, lethargy, anorexia, excess hemorrhage (attributed to platelet dysfunction as well as thrombocytopenia – thrombocytopenia is usually not severe enough to induce hemorrhage alone – platelet counts are usually moderately decreased, i.e. 50-150,000/uL). Some dogs have neurologic disease and may have increased numbers of granular lymphocytes in their cerebrospinal fluid (this finding is not specific for this organism).

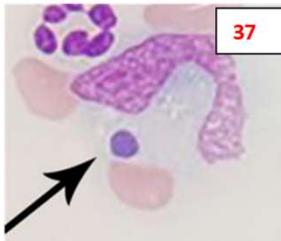


Figure 1 *Ehrlichia canis*



Figure 1 Heartworm



Dogs in the low-risk category would ideally fulfill the following conditions: young, with no clinical signs, normal thoracic radiographs, a low level of circulating antigen or a negative antigen test with circulating microfilariae, no worms visualized by echocardiography, no concurrent disease, and with owners capable of completely restricting exercise. ⁽³⁸⁾



Dogs at high risk of thromboembolic complications include those with signs related to HW infection (eg, coughing, dyspnea, ascites), abnormal thoracic radiographs, high level of circulating antigen, worms

EXAMPLE

Sediment in urine ⁽⁴³⁾



White Blood Cells - White blood cells (WBC) are reported semi-quantitatively as the number seen per high power field (HPF) using the high dry objective (40x). Less than 5 WBC/HPF is commonly accepted as normal (however, it is unclear on where this number was derived from and in a clean urine [e.g. minimal hematuria, cystocentesis collection, <5 WBC/HPF could very well be abnormal]). Greater numbers (pyuria) generally indicate the presence of an inflammatory process somewhere along the course of the urinary tract (or urogenital tract in voided specimens).

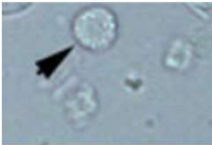


Figure 1 White Blood Cell



Red Blood Cells - Red blood cells (RBC) are reported semi-quantitatively as number seen per high power field (HPF). Increased red blood cells in urine is termed hematuria, which can be due to hemorrhage (e.g. idiopathic renal hematuria in young large breed dogs, hemorrhagic cystitis in horses or hemorrhage due to inflammation, necrosis, trauma, or neoplasia somewhere along the urinary

tract (or urogenital tract in voided specimens). The hemorrhage can originate from anywhere in the urinary tract, as well as the genital tract (in voided or catheterized specimens).

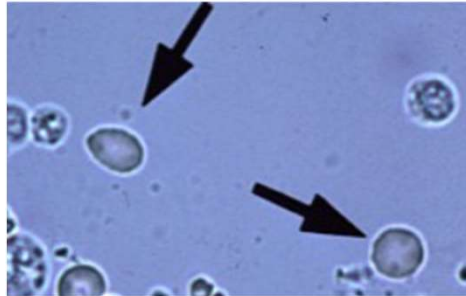


Figure 1 Canine RBC in fresh urine



Epithelial Cells - Epithelial cells are subjectively semi-quantified in urine (usually under low power using the 10x objective) as: none seen, few, moderate, many. It is difficult to distinguish small transitional epithelial cells from WBCs and renal tubular epithelial cells from transitional epithelial cells. Thus, all non-squamous cells in urine are considered to be of transitional origin.

EXAMPLE



Ammonium Biurate - Ammonium urate (or biurate) crystals generally appear as brown or yellow-brown spherical bodies with irregular protrusions (“thorn-apples”). In some urine samples, they do not have irregular protrusions but have smooth borders and can resemble calcium carbonate (although these do not occur in the urine from dogs and cats). They have been seen in animals on chemotherapy with increased uric acid production. They can be seen in urine from normal Dalmatians, English Bulldogs and Black Russian terriers, due to a defect in a putative urate transporter.

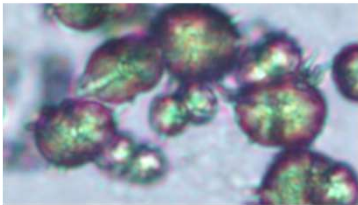


Figure 1 Ammonium Biurate



Cystine - Cystine crystals are flat colorless plates and have a characteristic hexagonal shape with equal or unequal sides. Cystine crystalluria or urolithiasis is an indication of cystinuria, which is an inborn error of metabolism involving defective renal tubular reabsorption of certain amino acids including cystine. Sex-linked inheritance

is suspected since male dogs are almost exclusively affected. Many breeds, as well as mongrels, have been reported affected. Renal function otherwise appears to be normal and, aside from a tendency to form uroliths, the defect is without serious consequence.

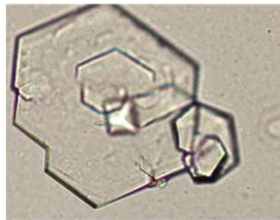


Figure 1 Cystine



Leucine & Tyrosine: Leucine are round to oval yellowish-brown crystals with circular striations on their edges (given them a somewhat crimped outline) whereas tyrosine are colorless thin needle-like crystals in bundles and can be mistaken for other needle-like crystals. Both occur in acid urine. Leucine and tyrosine have been identified in humans with liver disease but they have not been identified in animals with liver disease.

EXAMPLE

Vaginal Cytology



51

- ⊖ Moisten a cotton-tipped swab with saline.
- ⊖ Gently part the vulvar lips and insert the swab at the dorsal commissure of the vulva.
- ⊖ Advance the swab dorsally and angle slightly cranially until the swab goes over the ischial arch, then advance slightly cranially.
- ⊖ Gently roll the swab against the dorsal vaginal surface, then pull it straight out.
- ⊖ Roll the swab on a glass slide, allow to air dry, and stain with Diff-Quick or Wright-Giemsa stain.

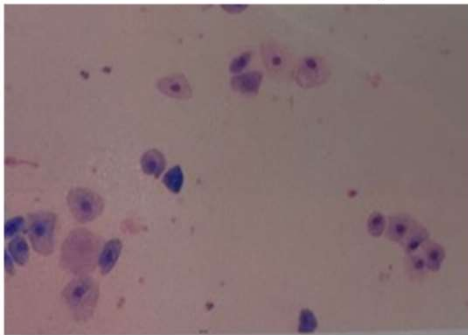


Figure 1 Proestrus in a bitch

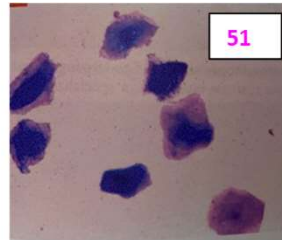


Figure 1 Estrus

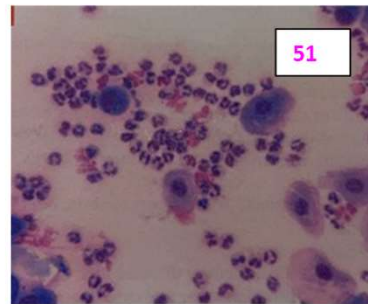


Figure 2 Diestrus

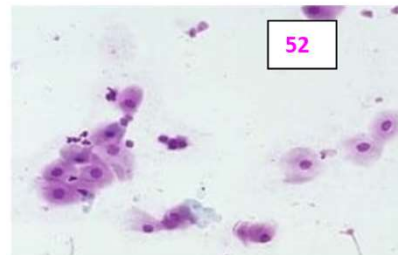


Figure 3 Anestrus

EXAMPLE

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EXAMPLE

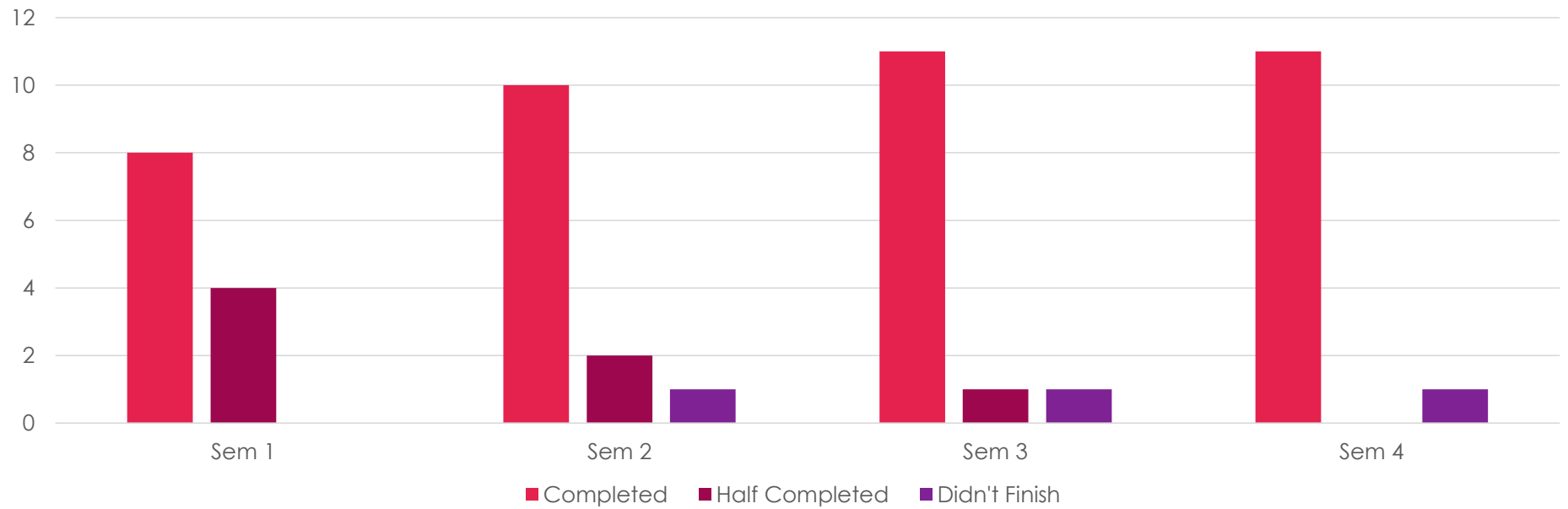
STUDENT FEED BACK

- “I use it in my clinic daily!” Baily R.
- “Worth the effort.” Grant P.
- “I continue to add to mine!” Ace K.
- “I’m glad I finished it!” Ariel D.
- I should have started it sooner!” Brian T.



STATISTICS

Completion of Nerdbook



QUESTIONS

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