Hematology of small mammals

- Lab animals and exotic mammals
  
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The content of this presentation does not relate to any product of a commercial interest; therefore, there are no relevant financial relationship to disclose.

Blood collection

- Small sample size
  
  Small animals compared to common domestic mammals
- Collect blood in lithium heparin
  
  Used for hematology and clinical chemistries
Body size

- **Mouse**
  - Male: 20-40 gm
  - Female: 22-63 gm

- **Rat**
  - Male: 267 - 500 gm
  - Female: 225 - 325 gm

- **Hamster**
  - Male: 87 - 103 gm
  - Female: 95 - 130 gm

- **Gerbil**
  - Male: 46 - 130 gm
  - Female: 50 - 55 gm

- **Rabbit**
  - Breed variation

- **Ferret**
  - Hob: 1 - 2 kg
  - Gill: 0.6 - 1.2 kg

Blood collection

Rule-of-thumb
- 1% of body weight in healthy animal

- 25 gm mouse
  - 0.25 ml of blood
Blood collection

- If collecting blood more frequently than every 2 weeks
  - Use 0.5 % body weight each week

Blood collection in small rodents

- Jugular venipuncture
- Lateral saphenous venipuncture
- Lateral tail veins
- Ventral tail veins in rats
- Not recommended
  - Orbital venous plexus
  - Cardiocentesis

Blood collection in rabbits

- Central auricular artery
- Cephalic venipuncture
- Lateral saphenous venipuncture
- Jugular venipuncture
- Jugular/ cranial vena cava venipuncture
Hedgehog venipuncture
- Jugular or cranial vena cava
- Lateral saphenous
- Cephalic

Hematology of small mammals
- Same as common domestic mammals with minor differences
- Hemic blood cells
  - Erythrocytes
  - Leukocytes
  - Platelets

Mammalian erythrocytes
- Small compared to nucleated erythrocytes of lower vertebrates
- Biconcave discs
  - Except camelids: elliptical erythrocytes
Small non-nucleated biconcave discs

- Minimizes hemoglobin to surface distance
  - Increases delivery of oxygen to tissues
- Increases cell plasticity
  - Improves movement through blood vessels

Mammalian erythrocytes

- Hb AND PCV
  - Relatively constant among mammalian species
- Total RBC and mean cell size
  - Vary among mammalian species
  - Inverse relationship between erythrocyte size and number

Mammalian leukocytes

- Neutrophil / heterophil
- Eosinophil
- Basophil
- Lymphocyte
- Monocyte
Neutrophil/heterophil

- Neutrophil
  - Granules stain neutral with Romanowsky stains
- Heterophil (pseudoeosinophils)
  - Rabbits and some rodents
  - Granules stain eosinophilic with Romanowsky stains

Toxic changes

- Cytoplasmic basophilia
- Retained primary granules
- Cytoplasmic vacuoles
- Karyolysis

Neutrophils

- Mice
  - Often have non-lobed nuclei
- Primates
  - Nuclear lobes separated by fine filaments
Mammalian eosinophils

- Eosinophilic granules with Romanowsky stains
- Heterophil vs eosinophil
  - Tinctorial qualities of granules differ
  - Granules of eosinophils tend to be larger and more tightly packed

Mammalian basophils

- Cytoplasmic granules are strongly basophilic with Romanowsky stains

Mammalian lymphocytes

- Vary in size
- High N:C ratio
- Dense chromatin clumping
- Homogenous blue cytoplasm
Mammalian monocytes
- Largest leukocyte in blood
- Nucleus variable in shape
- Abundant blue-gray cytoplasm
- May have fine azurophilic granules
- May have vacuoles

Mice and rats
- Polychromasia is normal
- Normally lymphocytic
- Age-dependent variation in N: L ratio
  - Lymphocytes decrease with age
  - Neutrophils increase with age
- High platelet concentrations
  - > 1 million/ ul

Guinea pigs
- Larger erythrocytes than other rodents
- Normally lymphocytic
- Neutrophils often have eosinophilic granules
  - Heterophils
  - Pseudoeosinophils
Kurlof bodies
- Guinea pigs
- Single large reddish granules in lymphocytes
  - Up to 0.8 um
- Lymphocytes with Kurlof bodies can reach up to 3 to 4% of the differential
- Equivalent to large lymphocytes of other mammals
  - Natural killer cells

Hamsters, gerbils, chinchillas
- Polychromasia is common
  - 2-4%
- Howell-Jolly bodies are common
- Neutrophils of chinchillas
  - Often hyposegmented
  - Pelger-Huet anomaly of dogs

Rabbits
- Polychromasia is common
  - 2-4%
- Occasional nucleated erythrocyte and Howell-Jolly bodies
- Basophils are more common than other species
  - 5% of differential
  - Can be as high as 30%
Rabbits

- Normally lymphocytic
- Age-dependent variation in H:L ratio
  - <12 months have lower H:L ratios compared to older rabbits
- Older rabbits
  - Near equal numbers of heterophils and lymphocytes
- Leukocytosis associated with bacterial infection is rare

Ferrets

- Normally neutrophilic
- Leukocytosis associated with inflammatory disease is rare

Primates

- Neutrophils may have small granules
  - Eosinophilic in orangutans
  - Basophilic in chimpanzees