

The Ferret: Essentials for the Practitioner

Dr. Cathy Johnson-Delaney reviews the basics of ferret husbandry and medicine.

Speaker Bio:

Dr. Cathy Johnson-Delaney practiced avian and exotic animal medicine in the greater Puget Sound area of Washington State for over 30 years, retiring from clinical practice in 2013. Dr. Johnson-Delaney was board certified in avian and exotic companion animal medicine, and she has helped to advance the fields of exotic animal and laboratory animal medicine. She has served as President of both the Association of Avian Veterinarians and the Association of Exotic Mammal Veterinarians. Cathy was named the 2009 recipient of the Oxbow Exotic Mammal Health Award and the 2003 Exotic DVM of the Year. Cathy has presented internationally on all aspects of non-traditional companion animals, and she has also written extensively on related topics, serving as co-editor of the BSAVA Manual of Exotic Pets. She is the principal author and editor of the 2017 textbook Ferret Medicine & Surgery.

Learning Objectives:

1. Understand how feed contamination events can happen on a large or small scale.
2. Understand how contamination occurs due to formulation errors, adulteration, and natural contaminants.
3. Understand how to sample feed, provide proper legal documentation, and submit samples to a diagnostic laboratory.
4. Know what resources are available to veterinarians and horse owners in relation to feed contamination.



The Ferret: Essentials for the Practitioner

Cathy Johnson-Delaney, DVM

Objectives for this Course



1. Ferret anatomy and physiology especially major differences from dogs, cats
2. Common coat colors and patterns, including those associated with congenital deafness
3. Basic behaviors, nutrition, clinical techniques
4. Preventive health program
5. Common health disorders, diagnostics, treatment programs

References and Resources



- Unless indicated, all photos and drawings are copyrighted by C. A. Johnson-Delaney
- Ferret Medicine and Surgery, CRC Press, 2017 source of drawings.
- List of references and further reading will be provided.
- Resource recommended is membership in the Association of Exotic Mammal Veterinarians: J of Exotic Pet Med

Ferret Basics



- Domesticated species *Mustela putorius furo*; *Mustela furo*? All one blood type
- Jills, Hobs, kits; Sprites, Gibs
- 5-7 yr life span
- Highest tumor rate
- Gut transit time averages
 - 1.75 hrs, soft stool
- Still illegal in many states, or municipalities



Ferret Anatomy

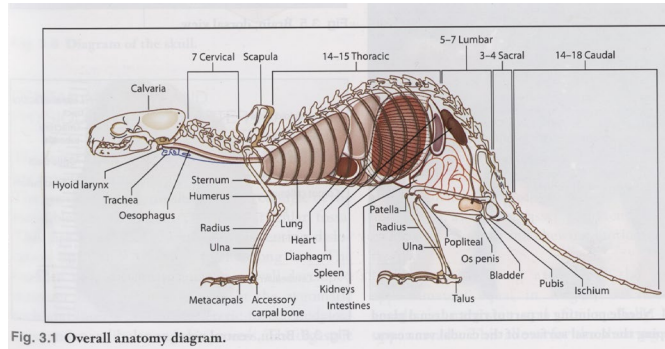


Fig. 3.1 Overall anatomy diagram.

Adrenal glands: Adrenal Disease

- All ferrets will develop some degree of adrenal disease
- Starts with neutering
- We can prevent it
- Ultrasonography

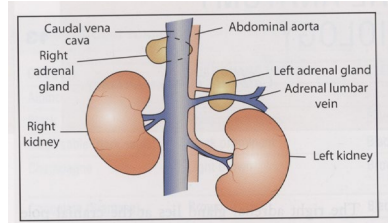


FIG. 3.2 Diagram of anatomy of adrenals and kidneys.

- Dental Formula:
- 28-30 deciduous
- I3/3: C 1/1: PM 3/3: M1 = 32.
- Rarely second Mandibular molar may be absent

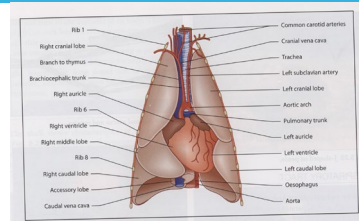


Fig. 3.31 Diagram of lungs and heart.

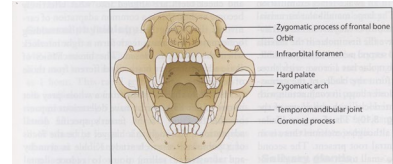


Fig. 3.8 Diagram of the skull.

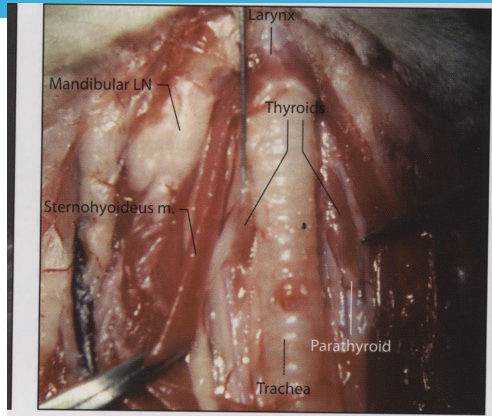
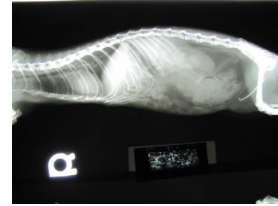
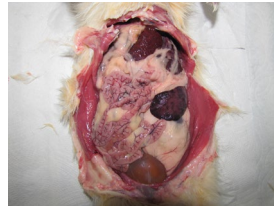


Fig. 3.36 Normal thyroids and parathyroid. LN, lymph node.

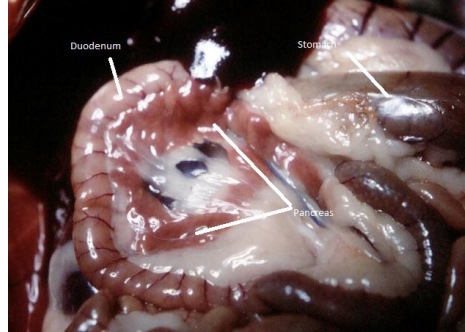
Spleen

- Enlarges with sedation, anesthesia
- May take up to 35% of blood volume
- Need to tell radiologist if splenomegaly before anesthesia
- Tends to enlarge and lose elasticity as age



Pancreas

- C shaped
- Ultrasonography to see it; position ferret dorsal recumbency - difficult if normal
- Lymph nodes



Physiological Highlights



- Small intestine 5X length ferret body
- (cat: 8-10X)
- Vagal and sacral innervation.
- Spontaneously active even under anesthesia
- Motility moderated by atropine
- Stomach spontaneously produces acids and proteolytic enzymes, histamine

Physiological Highlights

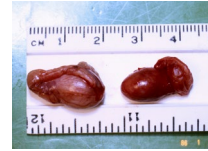


- For surgeries, only fast 2-3 hours
- Check for hypoglycemia (<60 mg/dL after 2 hours needs screening for insulinoma and other disease problems)
- Have a gallbladder, can have choleliths
- Entire gut secretes cholecystokinin
- Cannot distinguish jejunal/ileal segments
- No cecum, no ileocolic junction
- Retroperistalsis (emesis) begins in the colon

Physiological Parameters



- HR: 200-400 beats/min
- Blood volume: 5-7% of body weight
- Blood pressure non-sedated: 140-164 mmHg systolic
- Large anal glands: most have them removed at early spay/neuter. Still can have odor!



Ferret Basics



- Sleep a lot! Hammocks favored
- Play hard!
- Defecate/urinate in corners



Ferret Basics



- Sable & Albino: Basic colors
- Coat varies seasonally, with age

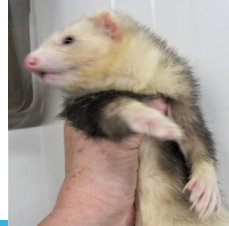


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Congenital Deafness



- Wardenburg's syndrome
- All Blaze, Pandas
- Some DEW or albino, some silver aging to white may also be deaf



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Ferret Basics



- Siamese: Brown guard hairs
- Also called “Chocolate”



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Ferret Basics



- Silver mitt, Dark or Black-eyed white, Cinnamon, Silver, Champagne, Roan, etc.
- Very Social Animals!



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Ferret Behavior



- Confine when unattended for their safety!
- Ferret will nap until released
- Ferrets can be active at any time. Generally adopt activity pattern of owners
- Vocalizations: chuckles, giggles when playing. Soft “phaser” sound when fussing, irritated, playing. Squeal if injured, in pain.
- Nightmares: may groan, squeal
- Deaf ferrets squeal – very distinctive

Ferret Behavior: Biting, Nipping



- Absolutely not tolerated!
- Rules similar to those of training puppies, kittens. All members of the household use same technique consistently for reinforcement.
- Do not allow “licks”. They precede nips. (lick, nip, chomp and latch on)
- Immediately scruff and disengage. Eye contact, verbal emphatic “No bite!” If ferret not paying attention, brief dominance upon the floor position.
- TIME OUT!

Litter Box Training



- Train easily to a corner box or papers, but may need reminders all of its life.
- “Urge” strikes quickly, ferrets don’t plan ahead, easily distracted by play.
- Introduce ferret to a corner box (with pre-placed feces, or put the box where the ferret has already chosen). Set ferret in, coach verbally.

Litter Box Training



- Key is accessibility. If there is a corner box, the ferret will use it, otherwise it will just use the corner.
- Start with a small play area with box. As the ferret learns “where” the box is, gradually increase the play area.
- Ferrets like clean boxes: dispose of feces and wet litter frequently (often several times a day)

Diet and Nutrition



- Johnson-Delaney, CA. Ferret nutrition. *Vet Clin Exotic Anim*, 2014, 17(3); 449-470
- Ferret Diets: high in protein, fat. Very low fiber. Must be high quality animal-derived protein, fat. Can't absorb calories from carbohydrates: short digestive tract, simple gut flora.
- Cannot digest raisins, fruits, vegetables.
- Are diets with indigestible carbs right for ferrets?
- Sugars, fats stimulate acid reflux



Diet Conversion



- From Cat/Dog Food to Ferret Food
- Pulverize current diet to approximate size of ferret food. (you may need to do the same to the ferret food)
- Gradually mix in the FF so the ferret doesn't notice the food change. Start with 90% previous diet, 10% ferret diet
- Over 2-3 weeks increase the proportion of the FF until you reach 100%

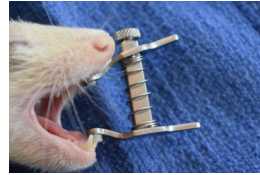
Ferrets in Your Clinic



- Susceptible to canine distemper
- Dogs can kill
- Ferrets may attack birds, small mammals
- Escape proof caging
- Small equipment: laryngoscope #1 blade, endotracheal tubes 2.0, 2.5, 3.0 uncuffed, 3.5 cuffed
- Designated potty corner



Dental Equipment:



Ferrets in Your Clinic



- Staff Training
- ExoticsCon
- J Exotic Pet Medicine
- Association of Exotic Mammal Veterinarians – Client education material
- LafeberVet
- Exotic DVM Forum www.exoticdvm.com
- Vet Clin Exotic Animal Practice

Precautions



- Highly susceptible to human influenza, COVID
- Animal model for influenza and COVID
- We usually can't tell a cold from influenza
- Flu vaccine and COVID vaccine for all humans working with ferrets
- N/K 95 masks, gloves
- No one ill should be working with the ferrets.
- We know ferrets have same symptoms with influenza and COVID that we do AND that they can spread it to other ferrets. Influenza can go to people, not sure yet if they can pass COVID.

Restraint

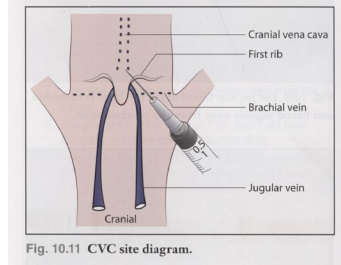
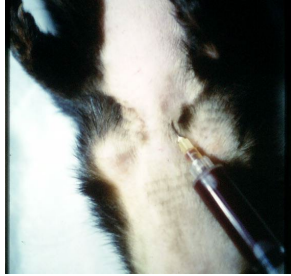


- Scruffing - they go limp, yawn
- Wrap in a towel
- Hold in your lap with a bribe
- Chemical: many combinations - may need for imaging, blood draws, dental exam, etc.
 - Butorphanol 0.2 mg/kg plus Midazolam 0.2 mg/kg SC

Restraint



- Sternal notch blood draw - Cranial Vena Cava



Vascular Access



- Use 22-23 ga needle
- Also cephalic, saphenous, jugular, tail
- Catheter usually in cephalic
- Ferrets don't bother bandages

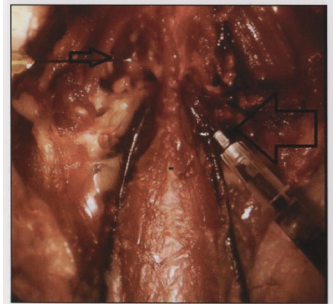


Fig. 10.12 The dissected anatomy for the CVC site.
Small arrow is the first rib, large arrow is the site of entry.

Injection Sites



- Subcutaneous: scapular or flank. Scapular/neck area very thick skin so flank easier.
- Intramuscular: anterior thigh, epaxial
- Intravenous: cephalic, saphenous, jugular (consider catheter, vascular access port)
- Intraosseous: place in femur as is done in other small mammals.

Fluid Therapy



- Base on 50-100 mL/kg/day and adjust
- LRS, Normosol, Dextrose in Water, Saline
- May add dextrose if ferret becomes hypoglycemic
- SC: Flank using butterfly catheter easiest



Oral Medications



- Best if can mix with Nutrical or a little VetOmega or salmon oil and have the ferret lick off a spoon
- Scruff
- Directly deliver into the mouth
- Follow with a treat or lick of A/D etc.
- Remember: Ferrets are used as vomiting models. Very good at spitting things out.



Veterinary Visits



- Vaccination schedule
 - Canine distemper ending at 12-14 weeks of age; then annual (?) – Run titers
 - Rabies at 6 months, then annual (regs)
- Annual examination until 3 years, then consider twice yearly
 - May time a visit to “puberty” even for early spay/neuters.....current research findings.
- Fecal parasite check: coccidia*
- Heartworm in endemic area
- Deslorelin implant

Veterinary Exam



- Ear mites – *Otodectes cynotis*
 - Chronic problem – see pigmentation
 - May be fairly ivermectin resistant
 - Multiple treatments, bath next day
 - All pets in the household

- Fleas: All mammals in house!!!!!!
 - Revolution; Advantage; Program; Frontline
 - Small cat dosages or partial cat dosages
 - May also help with ear mites
 - Premise control: vacuum, spray access areas

- Heartworm in endemic areas – test and treat



Veterinary Exam



- Dental cleaning

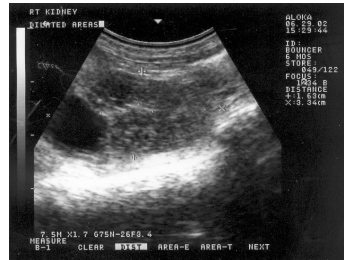
- Scale
- Polish
- Fluoride
- Home prophylaxis with CET malt flavor hydrolyzing toothpaste on a cotton swab at least weekly
- OraVet tooth sealant and home follow-up



Veterinary Exam



- Age 3 and older: geriatric
- CBC, chemistries – baseline
- Hormone panel – UT (sex steroids)
- Radiographs
- Ultrasound
 - Echocardiography
- ECG
- Urinalysis
- Replacement of implant



Preventive Plan - Imaging



- Radiology - same positioning as dogs, cats
- Do need sedation to get positioning
- Contrast studies: barium, renograffin
- Ultrasonography
 - POCUS
 - AFAST/TFAST
 - Echocardiography
 - All males: check prostate!
- CT
- MRI

Canine Distemper



- Ferrets sold through pet stores had 1 vaccination at 5 weeks of age. Mink vaccine.
- Early signs similar to influenza.
- Segmenting of the fur shows up first. Soiled perineal areas often seen. Pigmentation around anus.
- Only later does “classic conjunctivitis, photophobia, chin rash”, and pneumonia show up.

Canine Distemper



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Vaccine Schedule



- Kit: 10, 13, 16 wks of age or 11, 14, 17 wks
- Adult: Boost annually or take titer and adjust schedule accordingly.
- If an adult is presented with unknown history, do series of 2 vaccines, 2-3 weeks apart. We found 1 is not adequate.
- Give diphenhydramine 15-30 minutes prior, have owners wait 30 minutes post vaccination

Common Clinical Presentations



- Sick Ferret Syndrome
 - Weight loss, tarry stool, excessive salivation or swallowing a lot
 - Anorectic, dehydrated, tremor, glassy eyes
 - Exercise intolerance, collapse
 - Weight loss
 - Hypoglycemic
- Gastrointestinal
- Tumors
- Seizures/CNS signs
- Cyanotic (blue) mucus membranes or very pale
- Respiratory distress
- Trauma
- Ectoparasites (earmites, fleas)
- Signs of Pain



Contagious Diseases



- Earmites: ectoparasite
- Fleas: ectoparasite
- ECE: coronavirus
- Coccidia: endoparasite - protozoal
- Helicobacter: spirochete bacteria
- Influenza: human virus
- Canine distemper: parainfluenza virus
- Bacterial diarrheas: E.coli, Campylobacter, Shigella, Salmonella, etc.
- Bordetella (youngsters): bacteria, respiratory

Methods of Transmission

- Direct contact
- Fecal-Oral (shared litter boxes, water bottles, food dishes, sleeping cloth)
- Aerosol



Gastrointestinal Disease



- Ulceration
- Foreign bodies
- Helicobacter
- Campylobacter, Clostridium, Giardia
- Coccidia
- Enteric Coronavirus (FeECV)
- Inflammatory bowel disease
- Intestinal lymphoma
- Most common symptom: diarrhea – doesn't let you know what is going on



Cardiopulmonary

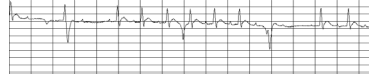



- Almost all ferrets develop some form heart disease
- Dilated, hypertrophic, restrictive
- Arrhythmias very common: I-III heart block
- Cardiac insufficiency - ferret will walk a bit, and then “pelt, speed bump” then get up again.


Cardiopulmonary



- Echocardiography
- Electrocardiography
- Auscultation (electronic with trace)
 - Doppler, blood pressure
- Radiographs



Honey's Heart on Feb 28 

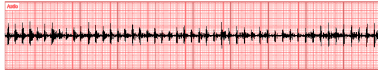


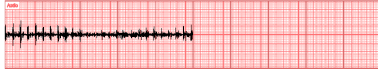
Eko [View Audio Data >](#)

Honey
Patient ID: Honey
Age: | DOB: |
Description: None

Date Recorded: 2021-02-28 08:30:34 (UTC)
Recorded By: Cathy Johnson-Delaney
Heart Rate: |

Area: Other
Position:
Posture: |





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Neoplasia

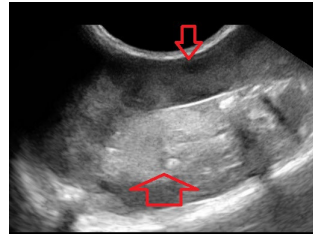


- Dermatologic
- Extremely Common
- They are not all mast cell tumors!
- You can't tell what they are until you send them in for histopathology.
- Chordomas - radiograph, surgery, can be anywhere on spine although usually on tail.



Neoplasia

- Lymphoma
- Localized
- Disseminated
- Peripheral blood may not be diagnostic
- Fine needle aspirate of lymph node - may miss it - better to take a whole affected node.
- Juvenile onset seems more aggressive



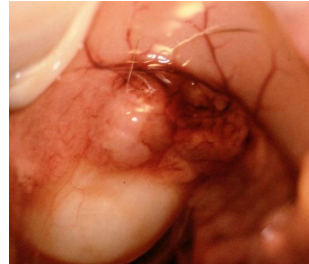
● Adrenal Disease

- Prevent with deslorelin implants for life
- Treat with leuprolide acetate depot 30 day and deslorelin
- Surgery if tumors large, compressing other organs, causing pain



- Islet Cell Disease -
Insulinoma, Islet Cell
Carcinoma

- Hypoglycemia leading to collapse, seizures
- Treatment: diazoxide, prednisone, frequent feeding, surgery



Musculoskeletal



- Disseminated Idiopathic Myositis/Myofasciitis
- Characterized: high fever, high WBC, pain etc.
 - Is treatable although may take months. Recent publications usually say “fatal”
 - Dr. Katrina Ramsell’s protocol
- Cytoxan is the key drug.
- 10 mg/kg at 10, 11 or 12 days. If they start to decline, they may need it sooner, so it should be done when they need it.
- With that dose, usually within 48-72 h they start to get better.
- Don’t wait up to 4 weeks – do it sooner.
- Do it as needed. Check the WBC then dose if that WBC is elevated.
- Dr. Ramsell uses the injectable Cytoxan as it is safer and more controlled. Put in a “hump” of SC fluids, and make sure there is no fluid leak. Then inject the Cytoxan into that fluid hump. Hold injection site so no leakage.

Normal Urine Information



- Yellow, clear, strong odor, concentrated (>1.035)
- pH 6.0-7.5 but varies with diet. Lower pH on good ferret food
- 24 hr volume (mL): 24.93 +/- 14.31 (range of 8-48 in males, 8-140 in females)
- Protein (mg/dL) 7-33 males, 0-32 females
- Catheterization in males: use 3.5 Fr red, stylet. Urethral opening is on side. J-hook baculum

Urogenital Disease



- Males: dysuria, stranguria, hematuria, preputial changes, complete obstruction:
 - Prostatic disease
 - Part of adrenal complex
 - Treat with GnRH analogue (Lupron, Deslorelin) and local hormone blockers such as finasteride, bicalutamide, etc.
 - May need to drain cysts, surgically marsupialize cysts

Urogenital Disease



- Urolithiasis
- A problem with grain-free diets with peas, legumes, chickpeas within the first 4-6 ingredients
- Cysteine urolithiasis
- Research ongoing, not all ferrets get them, but I stop feeding grain-free with peas, etc.
- Probably genetic predisposition

Cysteine Urolithiasis



- Ferret presented being fed grain-free with peas, radiograph them. May not be symptomatic – yet.
- We are finding it in almost every ferret on grain-free/pea, but not all are symptomatic, so we don't know true incidence.
- Stay tuned.



Ferret References and Resources



- List is being provided.
- Also listed is vaccine reaction protocol and my nutraceutical formulations as adjunctive therapy primarily for cardiac and geriatric ferrets. And Dr. Ramsell's protocol for DIM
- Questions?
- CAJDDVM@HOTMAIL.COM
- www.exoticdvm.com



Thank you for choosing Vetcetera!

Cathy Johnson-Delaney, DVM

References, Resources and Further Reading

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2022

Cathy A. Johnson-Delaney, DVM

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Canine Distemper Treatment Protocol

- Broad spectrum antibiotics
- Vitamin A 50,000 IU IM q 24 h SID x 2 days
- Vitamin C 250 mg IV q 24 h X 3 days
- Hyperimmune serum against CDV: 1 mL IV
- Vaccination (only effective if done early after infection)
- Interferon 60-120 units SC q 24h
- Meloxicam 0.2 mg/kg PO q 24h
- Famotidine 2.5 mg/ferret PO or SC q 24h
- Diphenhydramine 0.5-2.0 mg/kg IM, IV, PO q 8-12h prn
- Buprenorphine 0.01-0.5 mg/kg IV, IM, SC q 8-12 h if painful
- Supportive and symptomatic treatment (nutritional, fluid, bronchodilators, nebulization, etc.)

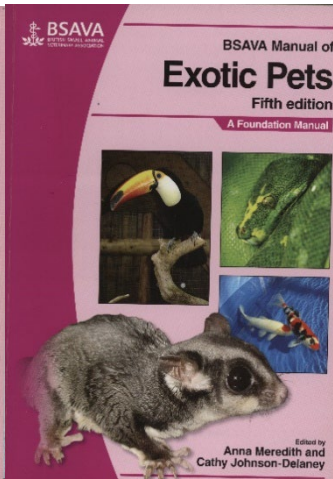
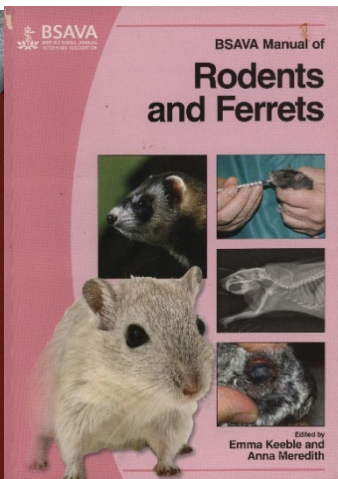
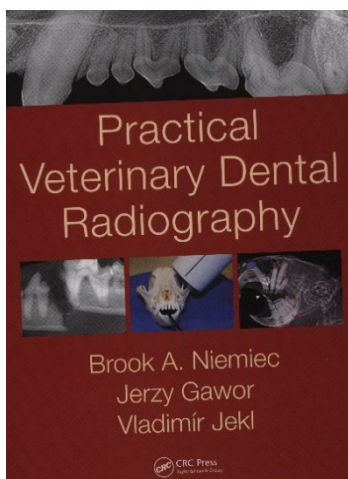
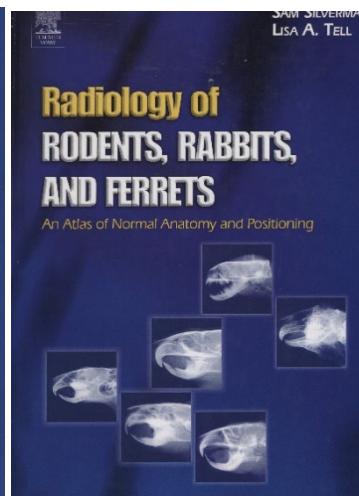
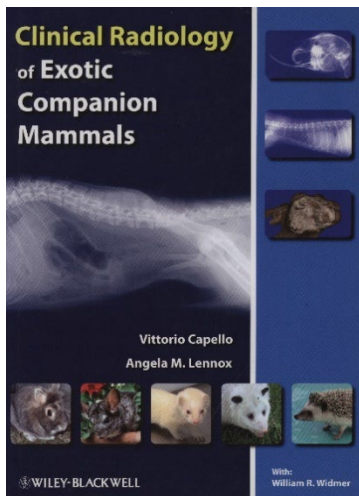
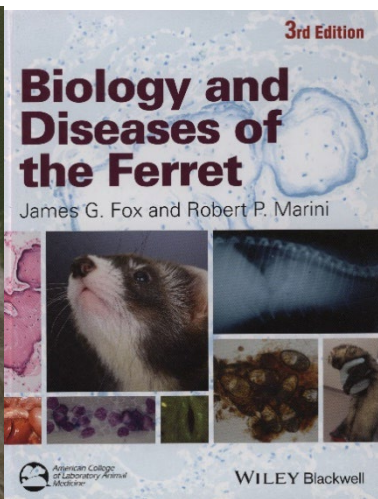
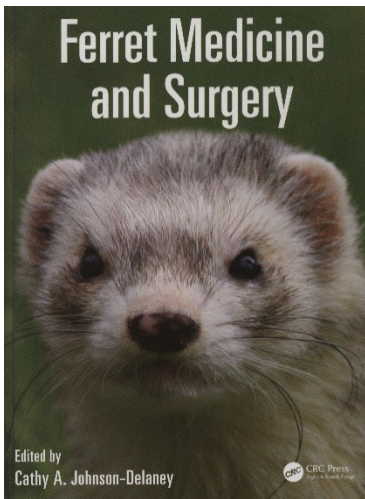
Ferret Vaccine Reaction Protocol

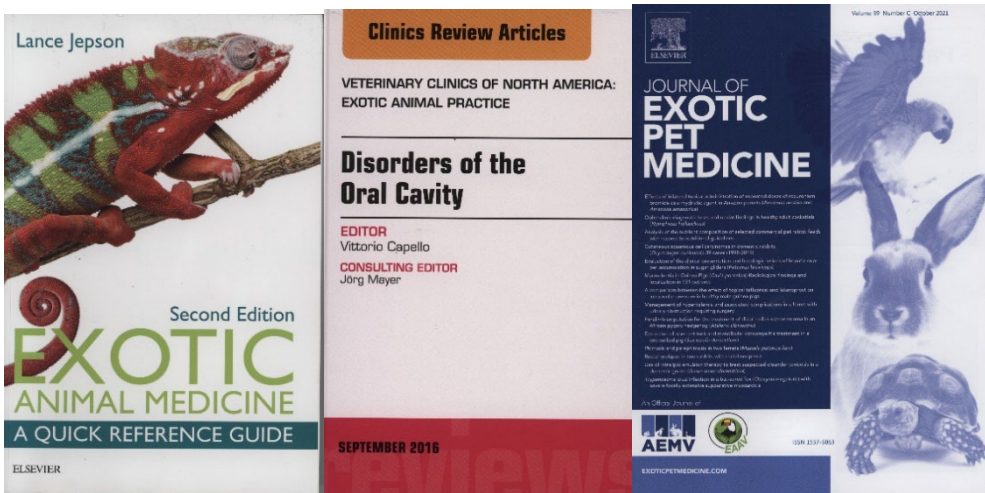
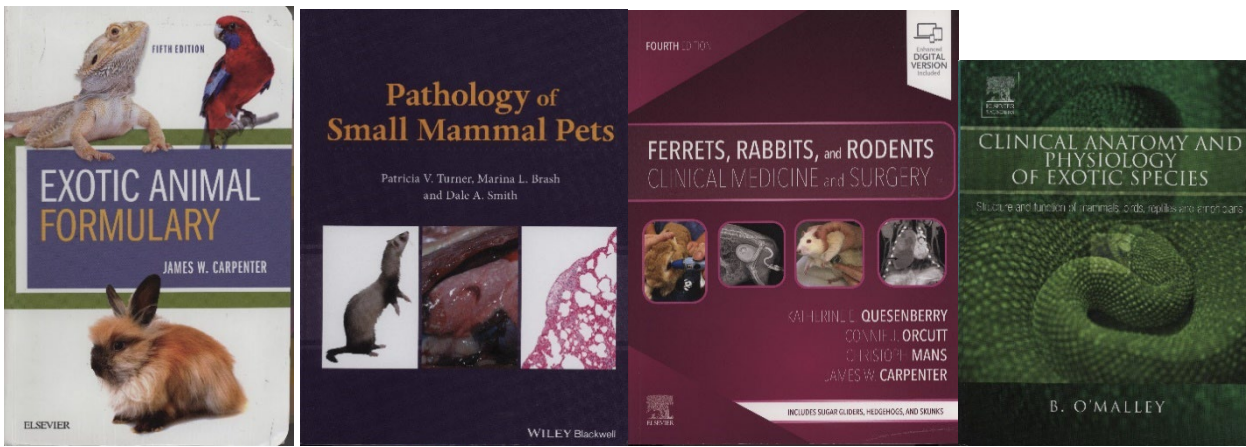
- I.M. diphenhydramine 5 mg (50 mg/mL; 0.1 mL most ferrets). If under 800 grams, give 0.08 mL
- If retching, vomiting, give 0.1 mL metoclopramide I.M. (5 mg/mL)
- Famotidine 2.5 mg I.M. or S.C. (0.25 mL of 10 mg/mL)
- Oxygen if dyspnea. Watch for vomiting and keep from aspirating
- Crystalloid fluids 10-20 mL plus 1 mL 50% dextrose S.C.
- If reaction is continuing, put an additional 5 mg diphenhydramine in fluid pocket
- If hemorrhage give 0.5 mL vitamin K (half in I.M., half in S.C.)
- If still retching, bleeding, flushing after 10-15 minutes for above treatment to work, give 0.5 - 1 mg I.M. dexamethasone
- If still dyspneic, laryngeal swelling, respiratory problems: give dopram (1-5 mg/mL I.M.), epinephrine (0.02 mg/kg I.M., I.T., I.V., S.C.), aminophylline (5 mg/kg I.M., I.V.) or terbutaline (2.5-5 mg/kg P.O.)
- If necessary to stop reaction: I.V. dexamethasone, diphenhydramine, additional symptomatic medications
- I.V. or Intra-rectal diazepam if seizing (1-2 mg/kg)

Dr. Ramsell's Treatment Protocol for Disseminated Idiopathic Myofasciitis

- Cytoxan is the key drug.
- 10 mg/kg at 10, 11 or 12 days. If they start to decline, they may need it sooner, so it should be done when they need it.
- With that dose, usually within 48-72 h they start to get better.
- Don't wait up to 4 weeks - do it sooner.
- Do it as needed. Check the WBC then dose if that WBC is elevated.
- Dr. Ramsell uses the injectable Cytoxan as it is safer and more controlled. Put in a "hump" of SC fluids, and make sure there is no fluid leak. Then inject the Cytoxan into that fluid hump. Hold injection site so no leakage.

Recommended books and journals if you work with ferrets:





Selected recent references:

AU: Larrat S, Summa N.
 TI: Ferret Behavior Medicine.
 SO: Vet Clin North Am Exot Anim Pract;(2021);24;1:37-51.

AU: Johnson-Delaney, CA
 TI: Geriatric Ferrets.
 SO: Vet Clin North Am Exot Anim Pract (2020);23;3: 549-566.

AU: Johnson-Delaney, CA
 TI: Anatomy and disorders of the oral cavity of ferrets and other exotic companion carnivores.
 SO: Vet Clin North Am Exot Anim Pract (2016); 19(3): 901-928

TI: SEDATIVE AND CARDIORESPIRATORY EFFECTS OF INTRAMUSCULAR ALFAXALONE AND BUTORPHANOL AT TWO DOSAGES IN FERRETS (MUSTELA PUTORIUS FURO).
 SO: J Zoo Wildl Med;(2021);51;4:841-847.

AU: Joanna K. Webb, DVM, Jennifer E. Graham, DVM, Kristine E. Burgess, DVM, Natalie Antinoff, Dip.ABVP(Avian)
 TI: Presentation and survival time of domestic ferrets (Mustela putorius furo) with lymphoma treated with single- and multi agent protocols: 44 cases
 SO: J Exot Pet Med;(2019);31;1:64-67

AU: Pierfrancesco Boa, Claudio Tagliavia, et al

TI: Comparative characterization of the prostate gland in intact, and surgically and chemically neutered ferrets

SO: J Exot Pet Med;(2019);31;1:68-74

SU: Keywords: Prostate Ferret Deslorelin Exotic small mammal Anatomy Histology

AU: Karra N. Pierce,DVM, Samuel Lee,DVM, et al

TI: Hyperglycemic hyperosmolar syndrome in a domestic ferret (*Mustela putorius furo*) following a partial pancreatectomy

SO: J Exot Pet Med;(2020);34;1:15-17

AU: Carolyn Tai, BS, CVT, VTS (ECC) et al

TI: Novel placement of an omobrachial vein catheter in a ferret (*Mustela putorius furo*)

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AU: Cazzini P, Watson MK, Gottdenker N, Mayer J, Reavill D, Fox JG, Parry N, Sakamoto K.

TI: Proposed grading scheme for inflammatory bowel disease in ferrets and correlation with clinical signs.

SO: J Vet Diagn Invest;(2020);32;1:17-24.

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TI: Persistent infection and pancytopenia associated with ferret systemic coronaviral disease in a domestic ferret.

SO: J Vet Diagn Invest;(2020);32;4:616-620.

AU: Eryn Hanak, DVM, Nicola Di Girolamo, DMV, MSc (EBHC), GP Cert (ExAP), PhD, DipECZM, Udaya DeSilva, BVSc, MS, PhD, et al

TI: Composition of Ferret Uroliths in North America and Europe: 1055 Cases (2010-2018) (Session #2918)

SO: Proc Exoticscon;(2019);2019;0:403

AU: Myrna KE, Girolamo ND.

TI: Ocular Examination and Corneal Surface Disease in the Ferret.

SO: Vet Clin North Am Exot Anim Pract;(2019);22;1:27-33.

AU: Julia E. Katzenbach, DVM, Luke A. Wittenburg, DVM, PhD, Sandra I. Allweiler, DVM, Daniel L. Gustafson, PhD, and Matthew S. Johnston, VMD

TI: PHARMACOKINETICS OF SINGLE-DOSE BUPRENORPHINE, BUTORPHANOL, AND HYDROMORPHONE IN THE DOMESTIC FERRET (*MUSTELA PUTORIUS FURO*)

SO: J Exot Pet Med;(2018);27;2:95-102

AU: Laura Vilalta, DVM , Antonio MelTndez-Lazo, DVM, Dip. ECVCP , et al

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SO: J Exot Pet Med;(2017);26;2:143

AU: Webb J, Graham J, Fordham M, DeCubellis J, Buckley F, Hobbs J, Berent A, Weisse C.

TI: Diagnosis and treatment of esophageal foreign body or stricture in three ferrets (*Mustela putorius furo*).

SO: J Am Vet Med Assoc;(2017);251;4:451-457.

AU: Schoemaker NJ.

TI: Ferret Oncology: Diseases, Diagnostics, and Therapeutics.
SO: Vet Clin North Am Exot Anim Pract;(2017);20;1:183-208.

AU: Huynh M, Chassang L, Zoller G.
TI: Evidence-Based Advances in Ferret Medicine.
SO: Vet Clin North Am Exot Anim Pract;(2017);20;3:773-803.

SU: Kristin M. Sinclair, DVM, Dip. ABVP (Avian), Chrissy Eckstrand, DVM, Peter F. Moore, BVSc, PhD, and Michelle G. Hawkins, VMD, Dip. ABVP (Avian)
TI: AEMV Forum: Epitheliotropic Gastrointestinal T-Cell Lymphoma With Concurrent Insulinoma and Adrenocortical Carcinoma in a Domestic Ferret (*Mustela putorius furo*)
SO: J Exot Pet Med;(2016);25;1:34

AU: Laura Vilalta, DVM, Yvonne Espada, DVM, PhD, Natalia Majó, DVM, PhD, Dip. ECVP, and Jaime Martorell, DVM, PhD, Dip. ECZM (Small mammal)
TI: Liver Lobe Torsion in a Domestic Ferret (*Mustela putorius furo*)
SO: J Exot Pet Med;(2016);25;4:321

AU: Watson MK, Cazzini P, Mayer J, Gottdenker N, Reavill D, Parry N, Fox JG, Sakamoto K.
TI: Histology and immunohistochemistry of severe inflammatory bowel disease versus lymphoma in the ferret (*Mustela putorius furo*).
SO: J Vet Diagn Invest;(2016);28;3:198-206.

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SO: J Vet Dent;(2016);33;2:108-111

AU: Long H, di Girolamo N, Selleri P, Palmieri C.
TI: Polyostotic Lymphoma in a Ferret (*Mustela putorius furo*).
SO: J Comp Pathol;(2016);154;4:341-344.

AU: Debbi Walcker, Vondelle McLaughlin, Kevin Farlee, Cathy Johnson-Delaney, DVM
TI: Surviving Canine Distemper at a Ferret Shelter
SO: Proc Exoticscon;(2015);2015;0:361

AU: Dario d'Ovidio, DrMedVet , ECZM (Small Mammal), Raffaele Melidone, DrMedVet, Dip. ACVP, Giacomo Rossi, DrMedVet, Dip. ECZM (Wildlife Population Health), et al
TI: Multiple Congenital Malformations in a Ferret (*Mustela putorius furo*)
SO: J Exot Pet Med;(2015);24;1:92-97

AU: Sarrah W. Kaye, DVM , Robert J. Ossiboff, DVM, PhD, Dip. ACVP , Brendan Noonan, DVM , et al
TI: Biliary Coccidiosis Associated With Immunosuppressive Treatment of Pure Red Cell Aplasia in an Adult Ferret (*Mustela putorius furo*)
SO: J Exot Pet Med;(2015);24;2:215-222

AU: Carlos Martínez, Mikel Sabater, Jacobo Giner, Minh Huynh
TI: Spontaneous Primary Hypoparathyroidism in A Ferret (*Mustela Putorius Furo*)
SO: J Exot Pet Med;(2015);24;3:333-339

AU: Monica C. Overman
TI: A Review of Ferret Toxicoses
SO: J Exot Pet Med;(2015);24;4:398-402

AU: Brianne E. Phillips, Craig A. Harms, Kristen M. Messenger
TI: Oral Transmucosal Detomidine Gel for the Sedation of the Domestic Ferret (*Mustela putorius furo*)
SO: J Exot Pet Med;(2015);24;4:446-454

AU: Jones KL, Granger LA, Kearney MT, da Cunha AF, Cutler DC, Shapiro ME, Tully TN, Shiomitsu K.
TI: Evaluation of a ferret-specific formula for determining body surface area to improve chemotherapeutic dosing.
SO: Am J Vet Res;(2015);76;2:142-148.

AU: Bennett KR, Gaunt MC, Parker DL.
TI: Constant rate infusion of glucagon as an emergency treatment for hypoglycemia in a domestic ferret (*Mustela putorius furo*).
SO: J Am Vet Med Assoc;(2015);246;4:451-484.

AU: Smith SA, Zimmerman K, Moore DM.
TI: Hematology of the domestic ferret (*Mustela putorius furo*).
SO: Vet Clin North Am Exot Anim Pract;(2015);18;1:1-8.

AU: Harris LM.
TI: Ferret wellness management and environmental enrichment.
SO: Vet Clin North Am Exot Anim Pract;(2015);18;2:233-244.

AU: Frohlich JR, Donovan TA.
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SO: J Vet Diagn Invest;(2015);27;5:656-659

AU: Huynh M, Guillaumot P, Hernandez J, Ragetly G.
TI: Gall bladder rupture associated with cholecystitis in a domestic ferret (*Mustela putorius*).
SO: J Small Anim Pract;(2014);55;9:479-482.

AU: Johnson-Delaney CA.
TI: Ferret nutrition.
SO: Vet Clin North Am Exot Anim Pract;(2014);17;3:449-470.

Nutraceuticals/Herbal Formulation

Cardiac Formula:

1000 mg L-carnitine

1000 mg taurine

1000 mg CoQ10

40 IU vitamin E

Add to 30 mL of VetOmega (balanced omega 3-6-9). Stir, do not shake. Keep refrigerated. Dosage 0.5-1 mL/ferret per day

Vet Omega: info@vetomega.com 512-809-8389

Additional Resources:

Association of Exotic Mammal Veterinarians: www.aemv.org

Exotic DVM Forum: www.exoticdvm.com