Unusual Pet Care

VOLUME I

REVIEWED BY

PETER FISHER, DVM

- Rabbits, Ferrets, Hamsters, Rats, Gerbils, Chinchillas, Degus
- Virginia opossums, Skunks, Fennec foxes, Nonhuman primates
- Pionus parrots, Canaries, Swans, Box turtles, Leopard geckos
- Ball pythons, Chameleons, Nile monitors and Giant spiders



Rabbit Pet Care

Adapted from Exotic DVM, Volume 3.1 © Zoological Education Network, 2005

- Behavior, Sexing and reproduction
- Vital statistics, Housing, Diet
- Restraint, Blood collection
- Common d[illegible]notic potential

Teresa A. Bradley, DVM

Edited by
Peter Fisher, DVM

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Rabbits

PET APPEAL/BEHAVIOR

- Quiet animals.
- Require relatively little space.
- Engaging personalities.
- Because rabbits are most active in the morning and early evening, they are appropriate pets for people who work during the day.
- Rabbits are generally affectionate and playful and bond quickly with their owner.
- Rabbits are highly intelligent and need attention and mental stimulation to thrive.
- It is best when they are housed together as bonded pairs and trios rather than as single pets.
- Although typically not aggressive, hostile behaviors can be seen when rabbits are frightened, in pain or expressing territoriality (especially around other rabbits to which they are not bonded).

SEXING AND REPRODUCTION

- Rabbits can be sexed by applying gentle pressure above the genitalia.
- The penis will appear as a rounded protrusion with a flat end and circular hole (urethra).
- The vulva has a more slit-like appearance with a pointed protrusion.
- Neonatal and juvenile rabbits can be more difficult to sex, but after approximately 3 months of age the testes descend into hairless scrotal sacs located cranial to the penis.

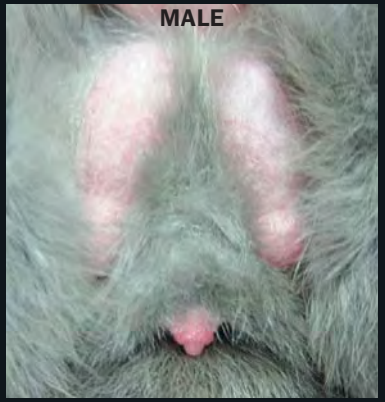


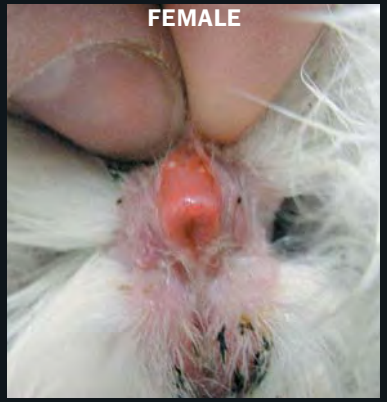
VITAL STATISTICS

Life span	6-9+ years
Body weight (breeds vary)	
Adult male	2-5 kg
Adult female	2-6 kg
Birth weight	30-80 g
Rectal temperature	101.3-104.0°F (38.5-40.0°C)
Respiratory rate	30-60 bpm
Heart rate	180-250 bpm
Blood volume	55-70 ml/kg
Food consumption	50 g/kg/day
Water consumption	50-100 ml/kg/day

Dentition	2 small peg teeth behind upper incisors, all open-rooted; incisors grow 10-12 cm/year
Dental formula	I 2/1 C 0/0 P 3/2 M 3/3
Age of sexual maturity	
Males	22-25 weeks
Females	22-25 weeks
Estrus cycle	induced ovulators
Gestation	30-33 days
Litter size	4-12 kits
Weaning	4-6 weeks

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Wire cages provide better ventilation, and feeding rabbits from an elevated box prevents contamination.

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Rabbits

- There are medical and behavioral reasons to have rabbits altered.
- Neutered male rabbits are less territorial, mark less with both urine and feces and fight less with other rabbits.
- Unspayed female rabbits tend to be more territorial, even showing aggression and irritability toward their owners when their hormones are fluctuating. Unspayed female rabbits over the age of 2 years have an extremely high rate of reproductive and mammary neoplasia.
- Rabbits should be spayed or neutered when they are approximately 4-6 months old, but older rabbits in good health are also good surgical candidates.

HOUSING

- Wire cages are preferable over aquariums, as they provide better ventilation and thereby prevent the build-up of ammonia levels.
- Cages should have narrower wire spacing on the bottom to protect feet from falling through.
- Rabbits kept in wire-bottomed cages should have a platform made of wood, cardboard or hay to protect their feet from constant wire pressure.
- Floor space should be at least three times the stretched out length of the rabbit's adult size.
- Exercise pens can be created with baby gates or standing pens (electric cords and other hazards must be removed).
- Recycled newspaper products (fiber or pellets), shredded paper towels or newspapers, straw or hay may be used as bedding materials.
- Pine and cedar chips may cause respiratory and dermatologic problems and have been associated with

elevated liver enzymes.

- Clumping clay or corncob litters should not be used, because they may be ingested and cause gastrointestinal stasis or obstruction.
- All rabbits should be allowed to exercise in a rabbit-safe area several times per week.

ENVIRONMENTAL ENRICHMENT

- Providing a variety of rabbit-safe toys will encourage exercise and decrease boredom.
- The best and safest toys are readily available and inexpensive, including paper towel/toilet paper rolls and untreated cardboard boxes. Vegetables can be hidden to allow rabbits to "forage" for food for mental stimulation.
- Sturdy hard plastic toys that are made for large birds or dogs and an untreated wood box with loose straw provide diversions. A tunnel or hidebox will simulate burrows.

DIET

- A diet consisting of only commercial pellets will often lead to overeating, diarrhea and obesity.
- Adding less digestible fiber, such as hay and leafy green vegetables, can significantly improve overall health and aid in maintaining gastrointestinal and dental health.
- **Hay:** Unlimited amounts of grass hay should be offered on a daily basis. Alfalfa is suitable for young rabbits, but adults should eat only grass hays, such as timothy, orchard grass, oat, meadow or brome hay.
- **Pellets:** An adult rabbit should be offered ¼ cup of high quality rabbit pellets per 5 lbs (2.27 kg) body weight per



Providing a variety of rabbit-safe distractions and toys will encourage exercise and decrease boredom.

D. Heishman



Straw or hay may be used as a bedding material.

D. Heishman



Unlimited amounts of grass hay should be offered on a daily basis.

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Adding less digestible fiber can significantly improve overall health and possibly increase the life span of rabbits.

D. Heishman

day. Juveniles can be fed unlimited pellets and hay with a small amount of green leafy vegetables. Timothy-based pellets are recommended for adult rabbits.

- **Vegetables:** A minimum of 1 cup of fresh vegetables (mostly green leafy vegetables) for each 4 lbs (1.81 kg) body weight should be provided daily. One or more of the following fresh vegetables should be offered twice daily:
  - Collard greens, endive, dandelion greens and flowers (no pesticides), mustard greens, parsley, snow peas, romaine lettuce (no iceberg lettuce), red or green leaf lettuce, watercress, basil, bok choy, broccoli (mostly stems and leaves), cilantro, clover, escarole, radicchio and beet, carrot and radish tops.
  - Spinach, kale, cabbage and other vegetables high in oxalates should be fed only occasionally.
- **Fruits:** Fruits should be limited to 1 Tbs or less per 5 lbs (2.27 kg) of body weight per day (none if dieting or if loose stools are a problem). High fiber fruits include apples, blueberries, melon, papaya and strawberries.
- **Water:** Fresh water should be provided daily in either easily reachable sipper bottles or sturdy crocks. Containers should be washed with hot soapy water weekly.

RESTRAINT

- A towel or bath mat should always be placed on the examination table for traction.
- Rabbits may be lifted gently, but firmly, by scooping the rear end with one hand as the rabbit is grasped behind the front legs with the other hand.
- If the rear legs are not well supported, the rabbit can break its own back or legs by kicking.

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Rabbits

- The scruff alone or ears should not be used to lift a rabbit.
- In order to take the temperature, clip the toenails or to facilitate examination of the ventrum and genitalia, the rabbit can be held in a “C” position. The rabbit is gently but firmly picked up with one hand behind the front legs, with the back positioned against the handler and the rear legs supported with the other hand.
- Covering the eyes and head with a towel may soothe an anxious rabbit.

BLOOD COLLECTION

- Venipuncture can be performed at multiple sites:
  - Lateral saphenous (author’s preference)
  - Cephalic vein
  - Jugular (under anesthesia)
  - Marginal ear vein, central ear artery (thrombosis with subsequent necrosis and sloughing may occur)

INJECTION SITES

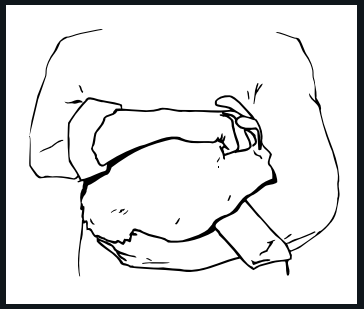
- IM - epaxial muscles, quadriceps: 0.25-1.5 ml (depending on rabbit’s size)
- SC - abundant loose skin (over shoulders is preferred): up to 100 ml at a time in larger rabbits
- IV - lateral saphenous, cephalic

THERAPEUTICS

- Drugs that should not be used in rabbits include oral penicillin, lincomycin, erythromycin, clindamycin, cephalosporins and vincomycin. Corticosteroids should be used with caution in rabbits.



The rabbit can be held in a “C” position.



To carry a rabbit, the animal’s head should be tucked into the handler’s arm and the handler’s forearms used to provide support abbit.

Adapted from photographs in Beynon PG, Cooper JE (eds): BSAVA Manual of Exotic Pets. Cheltenham, BSAVA, 1991.

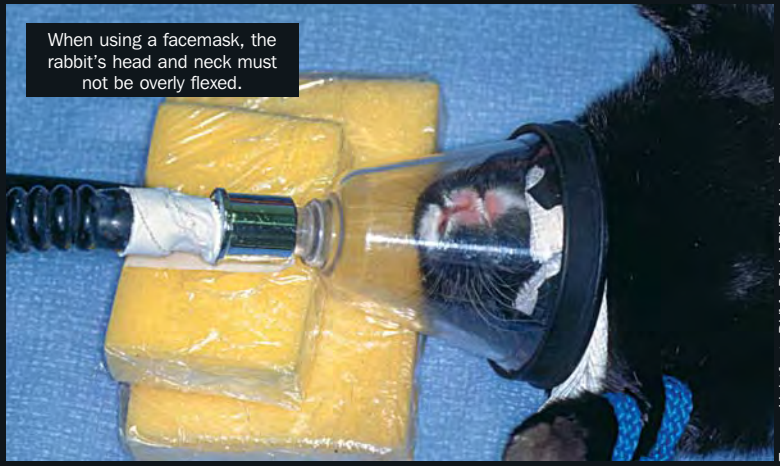
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HEMATOLOGY REFERENCE RANGES

RBC	4.0-8.0 x 10^6/µl
PCV	30-50%
WBC	5.2-12.5 x 10^3/µl
Hemoglobin	10.0-17.4 g/dl
Neutrophils	20-75%
Lymphocytes	30-85%
Eosinophils	1-4%
Monocytes	1-4%
Basophils	1-7%
Platelets	250-650 x 10^3/µl

BIOCHEMICAL REFERENCE RANGES

Total protein	5.4-8.3 g/dl
Albumin	2.4-4.6 g/dl
Glucose	75-155 g/dl
BUN	13-29 mg/dl
Creatinine	0.5-2.5 mg/dl
Sodium	131-155 mEq/L
Potassium	3.6-6.9 mEq/L
Chloride	92-112 mEq/L
Phosphorous	2.3-6.9 mg/dl
Calcium	5.6-12.5 mg/dl
ALT	14-80 U/L
AST	14-113 U/L
Alkaline phos	4-16 U/L
Cholesterol	10-80 mg/dl
Total bilirubin	0.0-0.7 mg/dl
Amylase	166.5-314.5 U/L



When using a facemask, the rabbit's head and neck must not be overly flexed.

Teresa Lightfoot, DVM, Dipl ABVP-Avian Practice



When dental disease is suspected, an oral examination should be completed under general anesthesia, such as injectable anesthetic used here

orio Capello, DVM

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ANESTHETIC CONSIDERATIONS

- Rabbits require intraoperative and postoperative analgesia.
- The head should be elevated slightly when in dorsal recumbency.
- In ventral recumbency, overflexion of the neck should be avoided to prevent restriction of the airway; instead, the head should be kept level and extended.
- A rabbit's tongue should not be pulled out of the mouth for an oral exam, intubation or dentistry in order to avoid trauma from sharp tooth edges.

MOST COMMON DISORDERS

- Gastrointestinal stasis or obstruction
- Rear limb paresis or paralysis
- *Cuterebra*
- Dental malocclusion and dental disease
- Uterine adenocarcinoma, mammary tumors
- Uterine hyperplasia
- Pseudopregnancy
- Enteritis/enterotoxemia
- Abscesses
- Skin mites (*Cheyletiella*), ear mites (*Psoroptes cuniculi*) and fleas
- Urolithiasis
- Encephalitozoonosis
- Hypercalciuria/urinary sludge
- Ulcerative pododermatitis
- Vertebral fractures
- Otitis interna and media

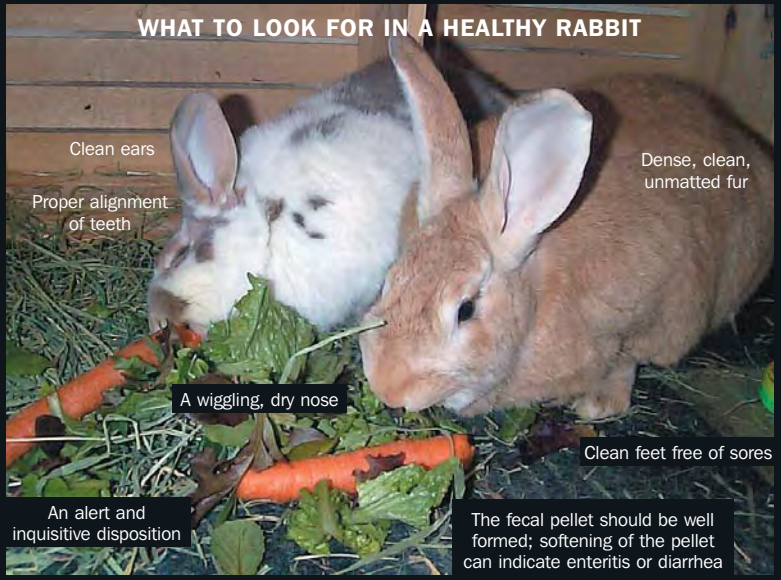
- Torticollis
- Cystitis
- Fractures
- Respiratory infections
- Pasteurellosis
- Obesity
- Heat stroke
- Diarrhea
- Moist dermatitis from perineal soiling
- Antibiotic toxicity/dysbiosis
- Renal disease

ZOONOTIC POTENTIAL

- Dermatophytosis
- Ectoparasitism
- Pasteurellosis
- Salmonellosis

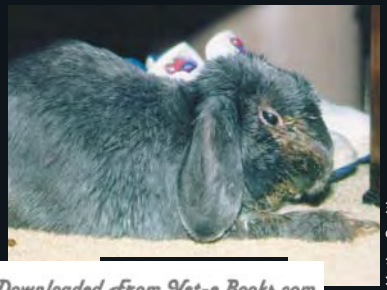
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D. Heishman

UNHEALTHY RABBITS





Kathy Smith

Rabbit with labored breathing

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Ferret Pet Care

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- Behavior, Vital statistics, Scent
- Sexing, Housing, Diet, Restraint
- Blood collection, Physical exam
- Zoonotic p[Downloaded From Vet-eBooks.com]non disorders

Kristina M. Kiefer,
and **Dan Johnson**, DVM

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Ferrets

Ferrets (*Mustela putorius furo*) belong to the family Mustelidae; their relatives include weasels, mink and otters. The ferret is suspected to have originated from the European polecat (*Mustela putorius*) or steppe polecat (*Mustela eversmannii*). They were probably domesticated for rodent and rabbit control over 1900 years ago. In the US, the ferret is used primarily as a companion animal. Regulations on ferret ownership are controversial. In some states and cities ferret ownership is illegal, and a license is required in others.

PET APPEAL/BEHAVIOR

- Joyful, interactive and entertaining.
- Mischievous thieves with intense exploratory behavior.
- Independent, rarely sit still to be cuddled or petted.
- Relatively easy to care for.
- Quiet compared to other popular companion animals.
- Sounds ferrets emit include “clucking” (giggle), hissing (exuberance, anger), squeaking (pain, surprise, fighting) and rarely, screaming (extremely frightened, pain).
- Ferrets are rarely aggressive to humans, and biting behavior is often associated with a lack of proper socialization. Time and patient socializing will usually resolve the issue.
- Ferrets are naturally curious and investigate novel items with their mouths; therefore, they should not be left unsupervised with infants or small children.
- Ferrets should not have access to other small pets, as dogs and cats are predators by nature.



VITAL STATISTICS

Lifespan		5-8 years
Body weight	Adult male	0.8-3.0 kg
	Adult female	0.7-1.2 kg
Body temperature		100-104°F (37.7-40.0°C)
Respiratory rate		33-36 bpm
Heart rate		200-255 bpm
Dental formula		I 3/3, C 1/1, P 4/3, M 1/2

Age of sexual maturity	6-12 months
Estrus cycle	Polyestrous, prolonged, induced ovulators
Gestation	42 days
Litter size	7-14
Weaning	6-8 weeks
Food consumption	20-40 g/adult/day (dry matter)

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Anal saculectomy ("descenting") is performed on most ferrets while they are very young.



MALE



FEMALE

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- Ferrets are liable to steal items and stash them in unknown or difficult-to-reach areas.
- They are particularly fond of soft rubber items, which they may tear aggressively with their teeth and ingest.

SCENT OF THE FERRET

- While the majority of ferrets in the US are descented (removal of the anal sacs) at the time of neutering, a characteristic musky odor always remains.
- Some consider anal saculectomy ("descenting") as unnecessary because anal gland secretions are not responsible for all of the ferret's musky odor.
- The sebaceous secretions of the skin produce the overall scent of the ferret and are seasonally influenced.
- Bathing a ferret provides only temporary relief. A better alternative is to regularly change the ferret's bedding.

SEXING AND REPRODUCTION

- Ferrets are easily sexed.
- Males ("hobs") can be identified by locating the preputial opening on the ventral abdomen, midway between the umbilicus and anus.
- In normal males, a distinct white line may be identified coursing along the prepuce caudally, and the os penis can be readily palpated. Testicles, if present, are located just ventral and cranial to the anus.
- Females ("jills") have a short anogenital distance, with a distinct vulva.
- Normal females have a small vulva located approximately 1 cm ventral to the anus.
- Most ferrets in the US are altered and descented before

6 weeks of age, prior to being sold as pets.

- Jills are induced ovulators with a prolonged estrus. If they do not ovulate, females will remain in estrus and may develop aplastic anemia.
- Jills must be spayed if not intended for breeding.
- Many ferret breeders and owners delay gonadectomy until their ferrets reach puberty.
- There may be a link between the age at neutering and the age of development of adrenal disease in that a lack of negative feedback from gonadal hormones, as a result of neutering, results in persistently elevated gonadotropic luteinizing hormone (LH), which may induce adrenal hyperplasia and/or neoplasia via functional LH receptors.
- An aberrant tumor suppressor gene has also been implicated in the development of adrenal hyperplasia and subsequent neoplasia.

HOUSING

- Minimum cage size should be 22 x 20 x 16 inches (55 x 50 x 40 cm) for each ferret.
- There are many cages designed for ferrets with multiple levels and constructed of galvanized metal and plastic.
- Floors made of hard plastic are easiest to clean.
- Housing and temporary housing at the veterinary clinic must be “ferret proofed” to prevent escape.
- Cage bedding (e.g., blankets, old sweatshirts) must be changed and washed regularly in order to control odor.
- Ferrets require at least a few hours of exercise outside of the cage each day.
- The less time a ferret spends outside the cage, the more space and enrichment is needed inside the cage.



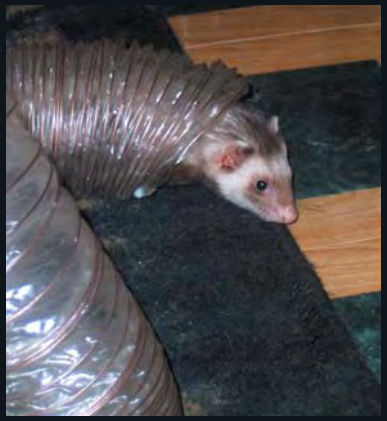
Ferrets will sleep in hammocks or in blankets.

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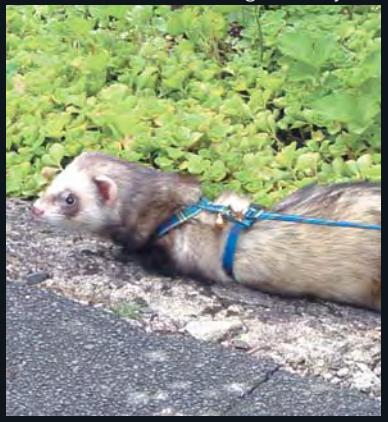
Anywhere a ferret's head can fit, the ferret is likely to follow.



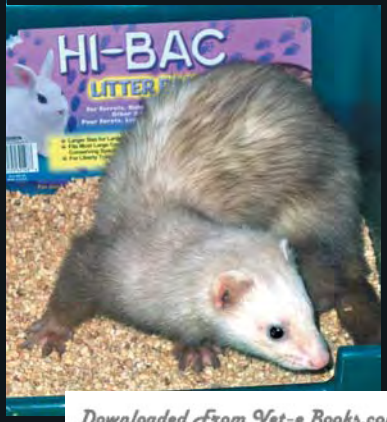
Clothes dryer exhaust tubing may provide a source of entertainment for the ferret.



Ferrets require at least a few hours of exercise outside of the cage each day.



Most ferrets can be litter box trained.



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Ferrets

- If ferrets are given free roam, anywhere that a ferret is allowed access must be "ferret proofed."
- Reclining chairs and rockers pose a danger, as the ferrets are prone to climb into the chair mechanisms.
- Given the opportunity, ferrets will venture outside or get into hidden spaces in walls and cabinets. Ductwork and small holes need to be identified and covered.
- Rooms with doors that have direct access to the outside are not ideal play areas for these animals.
- Most ferrets can be litter box trained.
- Wood shavings (not cedar) or pelleted fiber materials are the best litter material.
- Ferrets will sleep in hammocks or in blankets.
- Hard plastic tunnels and clothes dryer exhaust tubing can provide a source of entertainment for the ferret.
- Ferrets tolerate temperatures of 59-77°F (15-25°C), humidity of 45-55% and 12-16 hours of light a day.

DIET

- The ferret is an obligate carnivore with a short intestinal tract that lacks a cecum and ileocolic valve.
- GI transit time is as short as 3 hours from stomach to rectum. This rapid transit time along with the ferret's lack of intestinal brush border enzymes contribute to an inefficiency in absorption. As a result, they are not able to absorb enough calories from carbohydrates, and dairy products may cause soft stools.
- A ferret's diet should contain 30-35% animal protein and 15-20% fat and be low in fiber.
- There are many formulated, high-quality ferret diets available. These should be based on animal proteins as

the principal ingredient(s) with limited amounts of cereal grains and sugars.

- Sugary treats, such as raisins, bananas and other fruits, should be avoided.
- Free choice feeding is recommended due to the ferret's short gastrointestinal transit time and high metabolic rate.
- Unless fed very high fat foods, ferrets generally eat as much as they want without becoming obese.
- Water should be available at all times. A water bottle with a sipper tube is best, as ferrets often play with a bowl.
- Ferrets can obstruct on inappropriate food items, such as carrots and papaya.

RESTRAINT

- For maximum restraint, scruffing is best. The amount of pinch pressure used is more important than the amount of skin utilized. Scruffing works best when the body is suspended, but it is also effective in recumbency.
- Scruffing a ferret slows the heart rate and usually results in a yawn, which aids in oral examination.
- When minimal restraint is required, it is adequate for one hand to encircle the ferret's body at the level of the shoulders while suspending the animal.
- High-fat treats, such as Nutrical or Ferretone, can be used as a distraction during restraint.

BLOOD COLLECTION AND INJECTION SITES

- Larger blood volumes can be collected from the cranial vena cava, accessed at the sternal notch.
- The cephalic and saphenous veins can be used for smaller blood volumes.

Scruffing provides adequate restraint for minor procedures.





Supporting the hind legs and lower back can add additional restraint for physical exam.

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HEMATOLOGY REFERENCE RANGES	
WBC	7.0-9.2 x $10^3/\mu l$
RBC	9.3-9.69 x $10^6/\mu l$
Hct	48.4-49.8%
Hgb	16.2-16.8 g/dl
Neut	47-50%
Lymph	45-48%
Mono	1.0-1.19%
Eosin	3.0-3.5%
Baso	0-0.49
Plate	730-766 x $10^3/\mu l$

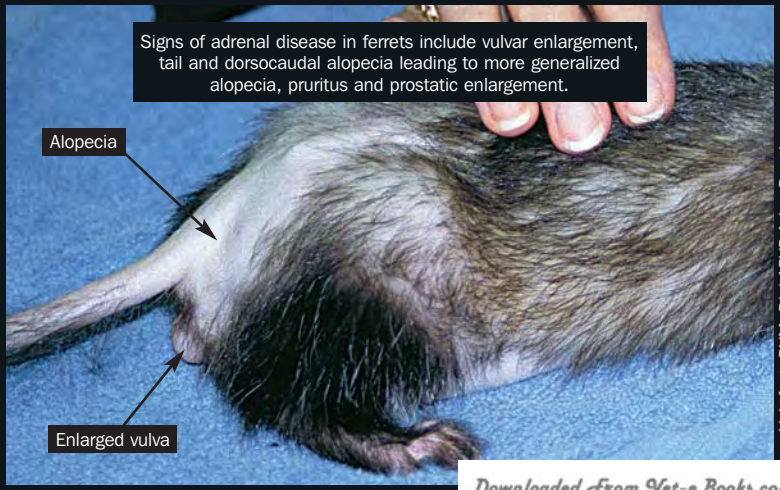
BIOCHEMISTRY REFERENCE RANGES	
Total protein	5.9-6.0 g/dl
Alb	3.4-3.5 g/dl
Glob	2.4-2.6 g/dl
Gluc	93-134 mg/dl
BUN	10-45 mg/dl
Creat	0.4-0.09 mg/dl
Ca	4.0-9.1 mg/dl
Phos	8.0-11.8 mg/dl
Na	137-162 mEq/L
K	4.2-7.7 mEq/L
Cl	102-125 mEq/L
Total bili	0.2 mg/dl
ALT	138-210 IU/L
AST	76-97 IU/L
Alk phos	31-84 IU/L
Cholesterol	158-183 mg/dl



For blood collection a 3 cc syringe with a 22 ga, ¾ inch needle is inserted through the notch formed by first rib and the manubrium and aimed caudodorsally toward the opposite hip, while maintaining negative pressure on the syringe.



Rectal prolapse is a common presentation in young ferrets with coccidia infection. Prolapse may also occur in ferrets with gastrointestinal lymphoma or proliferative bowel disease.



Signs of adrenal disease in ferrets include vulvar enlargement, tail and dorsocaudal alopecia leading to more generalized alopecia, pruritus and prostatic enlargement.

Jessa Lightfoot, DVM, Dipl ABVP-Avian Practice

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Ferrets

- IV catheters are usually placed in the cephalic vein.
- Injections may be given subcutaneously (shoulders, flanks), intravenously (cephalic or saphenous veins) and intramuscularly (quadriceps or biceps femoris).

PHYSICAL EXAMINATION

- Exams should include an evaluation of the ferret's weight, dental health and ear canals.
- The heart should be evaluated for murmurs, and any signs of alopecia noted.
- A thorough abdominal palpation and evaluation of lymph nodes is necessary to evaluate for neoplasia and other problems, especially as the ferret ages.
- An ear mite examination is performed if the ferret's status is unknown; ear mite infestations are usually subclinical.
- A fecal direct smear and flotation are recommended.
- Routine CBC and chemistry exams are recommended in middle-aged and older ferrets.
- Ferrets should be immunized against canine distemper virus (CDV) at 6, 10 and 14 weeks and boostered annually.
- Approved CDV vaccines for ferrets include Fervac-D (United Vaccine) and Purevax Ferret (Merial).
- Rabies vaccination should occur at 3 months, followed by an annual booster. Imrab (Merial) is the only approved rabies vaccine for ferrets.
- Heartworm preventive is recommended in endemic areas.

MOST COMMON DISORDERS

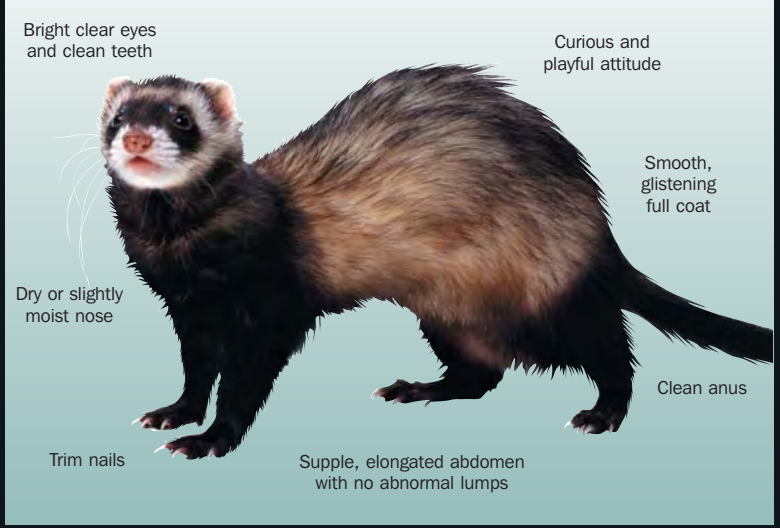
- Gastrointestinal obstruction (foreign body ingestion, trichobezoar). Young ferrets are prone to ingestion of toys, such as foam rubber and latex.

- Adrenal disease
- Traumatic injuries
- Cardiomyopathy, congestive heart failure
- Pancreatic beta cell tumors (insulinoma)
- *Helicobacter* gastroenteritis
- Inflammatory bowel disease
- Lymphoma
- Dermal mast cell tumors (behave benignly)
- Splenomegaly (usually benign)
- Coccidiosis

ZOONOTIC POTENTIAL

- *Giardia*
- *Listeria*
- *Salmonella*
- Campylobacteriosis
- *Cryptosporidium*
- Tuberculosis (*M. avium, M. bovis, M. tuberculinum*)
- Influenza virus A
- Rabies
- Ectoparasitism

WHAT TO LOOK FOR IN A HEALTHY FERRET



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Hamster Pet Care

Adapted from Exotic DVM, Volume 2.5 © Zoological Education Network, 2005

- Vital statistics, Behavior
- Sexing, Housing, Diet, Restraint
- Blood collection, Common disorders
- Injection s potential

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Hamsters

The most common hamster species maintained as a pet is the golden or Syrian hamster (*Mesocricetus auratus*). Others include the Chinese hamster (*Cricetulus griseus*) and Siberian (dwarf winter white or Djungarian) hamster (*Phodopus sungorus*). The golden hamster originates from a very limited range in the Middle East. Today captive breeding facilities supply the pet and research laboratory markets.

PET POTENTIAL/BEHAVIOR

- Cute pets.
- Adapt well to captivity.
- Small, do not require a lot of living space.
- Relatively inexpensive to maintain.
- Can easily become tame with frequent, gentle handling.
- Nocturnal animals.
- Will not tolerate being held still for long.
- Hamsters may bite or show aggression in response to rough handling, sudden disturbances, being around other hamsters, or when they are pregnant, lactating, ill or in pain.
- Hamsters should have a set schedule where a consistent amount of time and attention is given each day. This is especially important for maintaining tameness.
- Common household dangers include predators (dogs, cats) and inappropriate handling by small children.



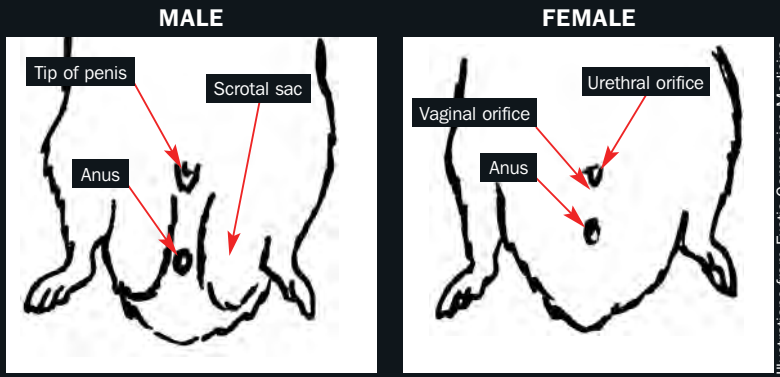
VITAL STATISTICS

Life span	maximum	3-5 years
	in captivity (avg)	1.5-2 years
Adult male body weight		80-130 g
Adult female body weight		95-150 g
Rectal body temperature		101-103°F (38-39.5°C)
Respiratory rate		35-135 bpm
Heart rate		250-500 bpm
Blood volume		78 ml/kg
Dental formula		I 1/1 C 0/0 M 3/3

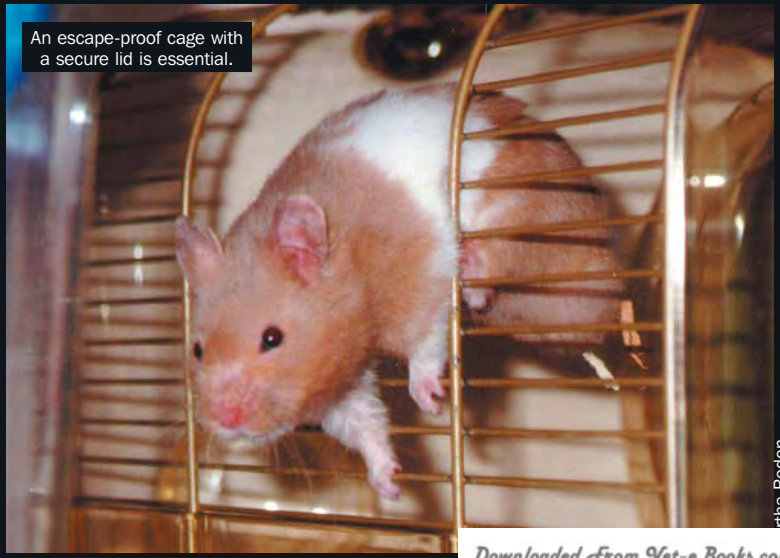
Estrus cycle length	4 days
Gestation period	15-18 days
Litter size	5-9
Birth weight	2 g
Weaning age	20-25 days
Age of sexual maturity	
Puberty - male	45-75 days
Breeding onset - male	10-14 weeks
Breeding onset - female	6-10 weeks

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Hamsters



Illustrations from Exotic Companion Medicine Handbook for Veterinarians



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SEXING

- Male hamsters have rather large scrotal sacs that give them a rounded posterior.
- Gentle pressure on the abdomen of the male hamster will cause the testicles to descend into the sacs.
- The female hamster's posterior is pointed toward the tail.
- Males have a greater anogenital distance than females, and a pointed genital papilla with a round opening.

HOUSING

- Syrian golden hamsters are solitary and should not be housed in multiples under any circumstances.
- Many golden hamsters have been injured and killed when litter mates were kept together past sexual maturity.
- Hamsters prefer bedded (litter), solid-bottom flooring to wire flooring.
- An escape-proof cage is a necessity, as hamsters can gnaw through wood, plastic and soft metals.
- A secure lid must be provided.
- At least 150 square inches of floor space are recommended.
- Solid connector tunnels provide for environmental enrichment but should be cleaned weekly.
- Preferred temperatures are 65-79°F (18-26°C) with young maintained between 71-75°F (21-24°C).
- Relative humidity should be between 40-70%.
- The enclosure should be well cleaned at least weekly to reduce odors and decrease the likelihood of respiratory or skin inflammation associated with soiled bedding.
- A hide box with deep litter for burrowing is recommended.

Hamsters

- An optimal nesting material is undyed, unscented toilet tissue.
- The hamster will instinctively manipulate toilet tissue to simulate the burrow, and it helps the hamster control local environmental temperature.
- Commercial nesting materials (commonly called fluff) are not recommended because they may lead to intestinal blockages or strangulated limbs.
- Aspen litter shavings are safe, but the oils on cedar shavings have been anecdotally associated with hair loss and respiratory disease.
- Wheat straw or pelleted, recycled newspaper products are alternative products for appropriate bedding.

ENVIRONMENTAL ENRICHMENT

- Hamsters are excellent climbers and burrowers and should be provided with safe outlets for these activities.
- They enjoy running in exercise wheels; however, in order to prevent leg injuries, only wheels with a solid running surface should be used.
- A wheel for an adult golden should be at least 8 inches in diameter.
- Wooden chew blocks are rarely effective means for keeping hamsters' teeth worn down.
- If clear plastic exercise balls are used for the hamster to explore the home safely, the covers must be secured with tape to prevent the animal's escape from the ball.
- Exposure to direct sunlight in captivity is not desirable.
- Lab blocks or chew sticks specifically designed for rodents may be recommended.



Exercise wheels should have a solid running surface.



Hamsters should be provided with safe outlets for exercise, such as climbing and burrowing.

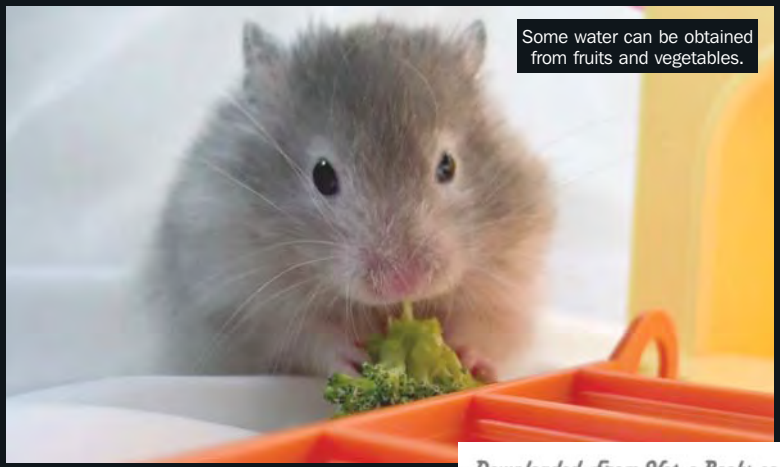
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Drinking water should be provided via sipper tubes

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Some water can be obtained from fruits and vegetables.

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DIET

- Young hamsters should be fed a pelleted diet with a minimum of 16% protein and 4-5% fat.
- Hamsters eat solid food at 7-10 days of age, so food and water must be accessible for their small size.
- Mature adults thrive on a slightly lower protein level (12-14%).
- Treats may include such items as tiny bits of apple (no seeds or skin), raisins and walnuts.
- Drinking water should be provided via sipper tubes.
- The water should be changed daily to ensure that the tube is functional and not clogged with food.
- Water can also be obtained from carrots and other fruits and vegetables.
- Obesity may result from offering fatty seed diets or feeding too many treats; this may lead to atherosclerosis.
- The food bowls should be carefully monitored to avoid mistaking seed hulls for whole seeds. Hamsters also tend to hoard food and hide it, leading to spoilage.
- Hamsters pack large quantities of food into their cheek pouches.
- Offering too much fresh produce and not enough fiber may result in diarrhea.

Hamsters

RESTRAINT

- Care must be taken to maintain control of the hamster and to prevent the handler from being bitten.
- Hamsters can be scruffed by the abundant loose skin at the nape of the neck, held in the hands (if friendly), or placed in a small container (such as a can).
- A small cloth may help restrain the rodent.

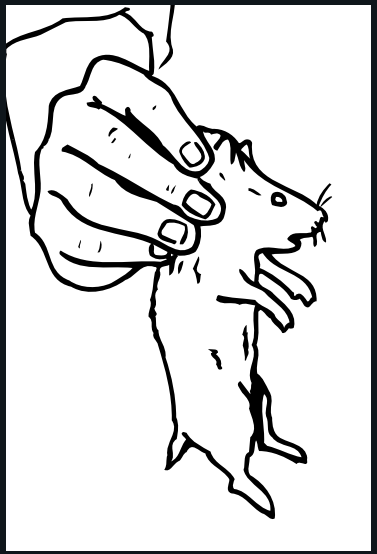
BLOOD COLLECTION

- Routine hematology testing is seldom done in hamsters due to the difficulty of obtaining a blood sample.
- In research laboratories, the following areas are utilized for blood collection: toenail clip, tail vein cut, orbital sinus bleed and cardiac puncture (the animal must be anesthetized).

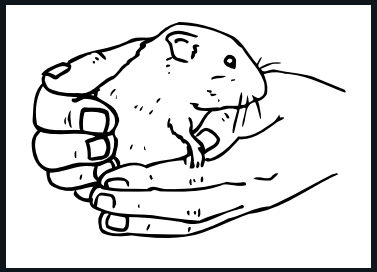
INJECTION SITES

- Intravenous: Saphenous vein - difficult, anesthesia may be required
- Intramuscular: Quadriceps, gluteals - may be hard to restrain (0.1 ml per site)
- Subcutaneous: Easy, abundant loose skin, can inject 3-5 ml
- Intraperitoneal: Can inject 3-4 ml in lower right quadrant

Scruff-of-the-neck grip for picking up and restraining a hamster.



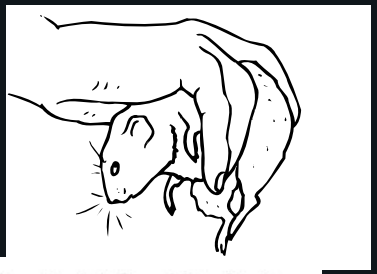
Two-handed technique for picking up and restraining a hamster.



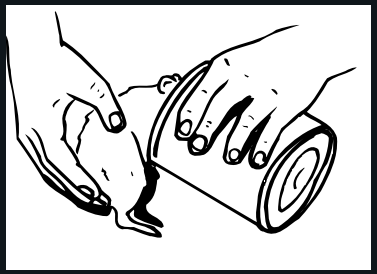


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One-handed hold for restraining a hamster. The thumb and third finger grasp the body.



Picking up and restraining a hamster with a small container.



Illustrations from Exotic Companion Medicine Handbook for Veterinarians and are adapted by permission from Hoffman RA, Robinson PF, Magalhaes H: The Golden Hamster. Ames, Iowa State University Press, 1968.

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BIOCHEMICAL REFERENCE RANGES	
Serum protein	5.9-6.5 g/dl
Albumin	2.63-4.1 g/dl
Globulin	2.7-4.2 g/dl
AG ratio	0.58-1.24
Serum glucose	60-150 g/dl
Blood urea nitrogen	10-25 mg/dl
Creatinine	0.91-0.99 mg/dl
Total bilirubin	0.25-0.6 mg/dl
Cholesterol	25-135 mg/dl
Serum calcium	5-12 mg/dl
Serum phosphate	3.4-8.2 mg/dl
Amylase	120-250 SU/dl
Alkaline phosphatase	3.2-30.5 IU/L
ALT	11.6-35.9 IU/L
AST	37.6-168 IU/L
CPK	0.5-1.9 IU/L
LDH	56-170 IU/L
Sodium	106-146 mEq/L
Potassium	4-5.9 mEq/L
Chloride	85.7-112 mEq/L

HEMATOLOGY REFERENCE RANGES	
RBC	5-10 x $10^6/\mu l$
Hematocrit	36-55%
Hemoglobin	10-16 g/dl
Leukocytes	6.3-8.9 x $10^3/\mu l$
Neutrophils	10-42%
Lymphocytes	50-95%
Eosinophils	0-4.5%
Monocytes	0-3%
Basophils	0-1%
Platelets	200-500 x $10^6/\mu l$

The typical clinical sign of "wet tail" is the liquid, yellowish diarrhea spread on and around the perineal area under the tail.

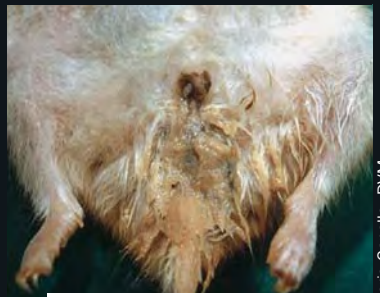


Photo courtesy of Dorio Capello, DVM

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PHYSICAL EXAMINATION

- Annual veterinary visits should include a physical exam and a review of the diet and husbandry.
- Bi-annual or quarterly examinations to assess weight, dental health, nail trimmings and overall health are recommended.

MOST COMMON DISORDERS

- Obesity/weight loss
- Diarrhea (transitory)
- Wet tail/proliferative ileitis (usually fatal)
- Bite wounds/trauma
- Dermatitis/demodectic mange
- Cutaneous lymphoma
- Hyperadrenocortism-associated alopecia
- Sendai virus infection/pneumonia
- Cilia-associated respiratory bacillus
- *Corynebacterium kutscheri*
- Malocclusion/cheek pouch impaction
- Malnutrition/starvation/dehydration
- Hairballs/foreign bodies
- *Hymenolepis* parasitism
- Septicemia or toxemia
- Chilling/overheating
- Litter abandonment/cannibalism
- Amyloidosis/protein-losing nephropathy
- Antibiotic toxicity
- Cardiomyopathy/atherosclerosis
- Neoplasia
- Rectal prolapse

- Stroke (with swift and full recovery)
- Polycystic disease
- Diabetes mellitus in Chinese hamsters

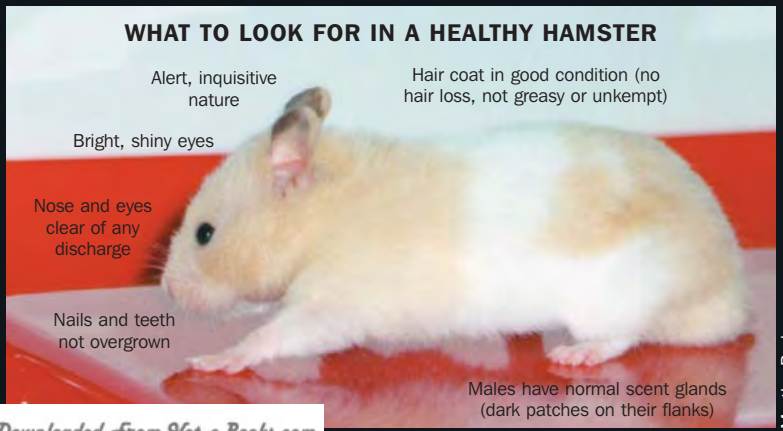
ZOONOTIC POTENTIAL

- Tularemia- *Francisella tularensis*
- Lymphocytic choriomeningitis virus (LCMV)
- Dermatophytosis (*Trichophyton mentagrophytes*, *Microsporum* spp.)
- Salmonellosis
- *Hymenolepis nana*
- Leptospirosis
- Campylobacteriosis

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FORMULARY FOR HAMSTERS	
Drug	**Dose**
Oral penicillin or cephalosporin antibiotics should be avoided (may cause entrotoxemia).	
Buprenorphine	0.05 mg/kg pre- or intra-operatively SC or IV
Ciprofloxacin	10 mg/kg PO q12h
Dexamethasone	0.1-0.6 mg/kg IM
Diazepam	3-5 mg/kg IP, IM
Doxycycline	2.5 mg/kg PO q12h
Enrofloxacin	5-10 mg/kg PO q12h
Fenbendazole	20 mg/kg PO q24h x 5 days
Isoflurane	Use to effect with oxygen; safe for hamsters
Ivermectin	200-400 mcg/kg PO, repeat in 8-10 days; for demodex repeat q5-7 days
Medetomidine	100 mcg/kg SC; light to moderate sedation
Medetomidine + ketamine	0.25 mg/kg (M) + 100 mg/kg (K) IP; surgical anesthesia
Prednisone	0.5-2.0 mg/kg PO
Trimethoprim sulfamethoxazole	15-30 mg/kg q12h



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Rat Pet Care

Adapted from Exotic DVM, Volume 1.5 © Zoological Education Network, 2005

- Anatomy, Vital statistics
- Sexing, Housing, Diet, Restraint
- Blood collection, Physical exam
- Common d[illegible]notic potential

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Rats

Pet rats are the species *Rattus norvegicus*. Common strains/variations of pet rats include albino (white) rats and hooded rats (black/white or brown/white).

PET POTENTIAL/BEHAVIOR

- Easy to care for.
- Very little odor.
- Affectionate and intelligent animals that bond quickly to their owners; rarely bite.
- Albino rats tend to be the most calm and easily handled.
- Hooded rats may be more aggressive and active.
- Basically nocturnal, but can be active during the day.
- Need at least 30 minutes each day for exercise.
- Dogs, cats, and ferrets are rats' predators.
- Often difficult to litter-train (fecal).

ANATOMY

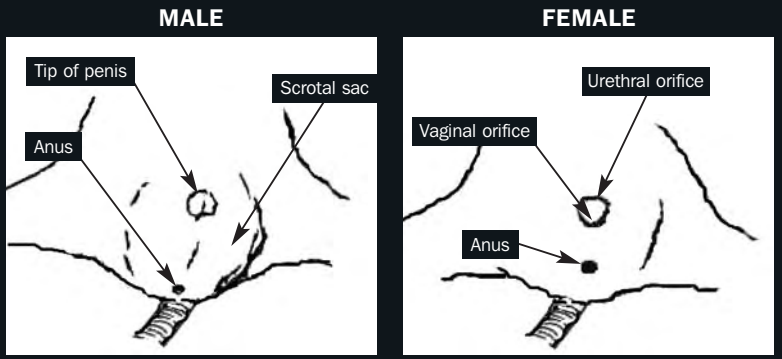
- Rats are characterized by elongated bodies, short fur, small eyes and ears and hairless tails.
- Anatomically, rats have open inguinal canals, a diffuse pancreas, a divided stomach, a large cecum and an os penis. Rats do not have gallbladders.
- Rats do not vomit due to the presence of a limiting ridge at the junction of the esophagus and stomach.
- Because rats have poor eyesight, they rely on whiskers and scent for sensory input and spatial orientation.
- Mammary gland tissue may extend from over the shoulders to the perianal region.



VITAL STATISTICS

Life span		2-4 years
Body weight	adult female	250-300 g
	adult male	450-520 g
Body temp		99.5-100.6°F (37.5-38.11°C)
Respiratory rate		70-115 bpm
Heart rate		240-450 bpm
Feces		slender, brown pellets
Dental		Incisors are open-rooted and grow continuously throughout life (elodont). Molars are closed, permanently rooted (brachyodont).
Dental formula		I 1/1 C 0/0 M 3/3
Sexual maturity		42-65 days
Estrus cycle		4-5 days; continuously polyestrous; postpartum estrus fertile (occurs within 48 hours of giving birth)
Gestation		21-23 days
Birth weight		6-13 g
Litter size		6-20
Newborns		body hair by 1 week of age and open eyes at 2 weeks
Weaning		21-42 days

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SEXING AND REPRODUCTION

- Male rats have a scrotum, making them easily differentiated from female rats.
- The anogenital distance is roughly twice as long in males as in females.
- Only female rats possess nipples.
- Rats are communal, and males and females may be combined in an uncrowded enclosure for breeding.
- If a female is not bred by 8 months of age, her pelvis will fuse and she may have difficulty giving birth later.
- Anecdotally, spaying may help to prevent mammary tumors, which are common in middle-aged to older rats.

HOUSING

- Housing should be constructed of escape-proof wire mesh with plastic or metal solid flooring and should be large enough to allow nesting, burrowing and exercise.
- Minimal enclosure size guidelines for one adult rat are 24” x 24” x 12” (61 x 61 x 30 cm).
- A secure wire screen clamped top or other roof is necessary to prevent escape.
- Ideal room temperature should be 65-80°F (18-26°C).
- Ideal humidity should be 40-70%.
- Because rats are social and need companionship, they should be maintained in same sex or altered sex groups.
- Suitable substrates include shredded paper (non-inked), recycled newspaper composite materials or pellets, hardwood chips or shavings and compressed wheat straw.
- Cedar should not be used as litter because it has been shown to affect microsomal oxidative liver enzymes.

a Tresbach

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Rats

- Bedding should be a minimum of ¼ to 1 inch deep and changed at least 1-2 times per week.
- Exercise may be provided in the form of a large exercise wheel and climbing toys.
- Housing should be cleaned weekly to minimize respiratory disease risk.

DIET

- Rats are omnivorous rodents.
- Rat/rodent pellets provide a complete diet. Recommended brands include Mazuri, ZuPreem and Oxbow Pet Products.
- Small amounts of fresh fruits, vegetables may be added.
- Seed-based diets are not recommended as they do not meet nutritional requirements and predispose to obesity.
- Adults require 5-10 g of pellets per 100 g body weight daily and 10 ml of water per 100 g body weight daily.
- Fresh water should be available at all times, ideally provided via a drinking bottle or sipper tube.
- Food consumption should be monitored when new food is offered because rats may be suspicious of new food.

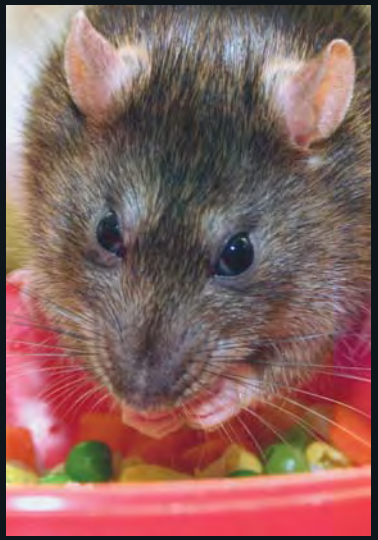
RESTRAINT

- Most rats will allow you to pick them up by placing the hand firmly over the back and rib cage.
- A rat can also be scooped up with both hands.
- The head can be restrained with the thumb and forefinger behind the jaws.
- Scruffing the loose skin at the nape of the neck can help restrain an active rat, but many rats object to this.
- Rats may bite aggressively if restrained against their will.

Toys, such as tubes, provide the rat with environmental enrichment and exercise.



Small amounts of fresh fruits and vegetables may be added to the rat's diet.



If assistance is not available, rats can be held in polythene restrainers (can be made out of a plastic bag with end cut open for air).

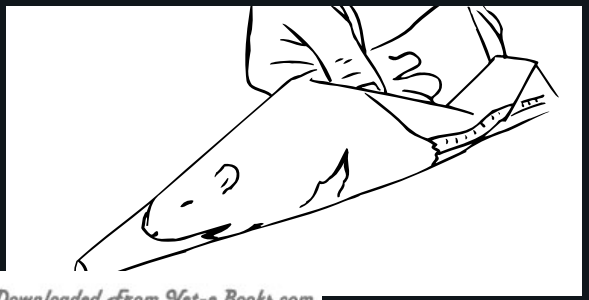
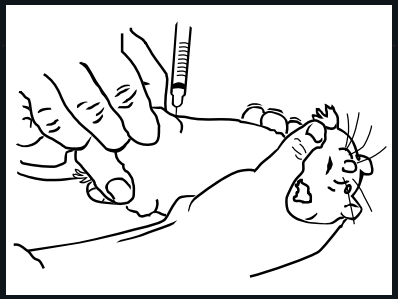


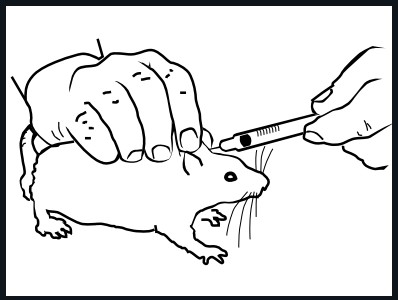
Illustration from Exotic Companion Medicine Handbook for Veterinarians
*Adapted from photograph in Beynon PG, Cooper JE (eds): *BSAVA Manual of Exotic Pets*. Cheltenham, BSAVA, 1991.

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The rat is restrained so that an assistant can inject into the quadriceps muscles.



Subcutaneous injections can easily be made into the scruff.



Illustrations from Exotic Companion Medicine Handbook for Veterinarians
*Adapted from photographs in Beynon PG, Cooper JE (eds): *BSAVA Manual of Exotic Pets*. Cheltenham, BSAVA, 1991.

HEMATOLOGIC REFERENCE RANGES

RBC	6.76-9.75 x $10^6/\mu l$
PCV	37.6-50.6%
WBC	6.6-12.6 x $10^3/\mu l$
Hemoglobin	11.5-16.1 g/dl
Neutrophils	1.77-3.38 x $10^3/\mu l$
Lymphocytes	4.78-9.12 x $10^3/\mu l$
Eosinophils	0.03-0.08 x $10^3/\mu l$
Monocytes	0.01-0.04 x $10^3/\mu l$
Basophils	0.00-0.03 x $10^3/\mu l$
Platelets	150-460 x $10^3/\mu l$

BIOCHEMICAL REFERENCE RANGES

Total protein	5.6-7.6 g/dl
Albumin	3.8-4.8 g/dl
Glucose	50-135 mg/dl
BUN	15-21 mg/dl
Creatinine	0.2-0.8 mg/dl
Sodium	143-156 mEq/L
Potassium	5.4-7 mEq/L
Chloride	100-110 mEq/L
Phosphorous	3.11-11 mg/dl
Calcium	7.2-13 mg/dl
ALT	17.5-30.2 IU/L
AST	45.7-80.8 IU/L
Alkaline phos	56.8-128 IU/L
Cholesterol	40-130 mg/dl
Total bilirubin	0.2-0.55 mg/dl
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Rats

BLOOD COLLECTION

- For blood collection, remove no more than 10% of total blood volume (1.3 ml per adult rat).
- Tuberculin syringes with 25-27 ga needles can be used to collect small amounts of blood from the lateral saphenous or lateral tail veins (superficial on either side of the tail).
- Alternatively, the ventral tail artery (ventromedial aspect of tail) can be accessed under general anesthesia.

PHYSICAL EXAMINATION

- Annual veterinary visits should include a physical exam and a review of diet and husbandry. The need for fecal analysis and blood hematology and chemistry should be discussed.
- Bi-annual or quarterly examinations to assess weight, dental health, nail trimmings and overall health are recommended.

MOST COMMON DISORDERS

- Weight loss/obesity/malnutrition
- Overcrowding/stress/suffocation
- Sudden death/trauma
- Murine respiratory mycoplasmosis - *M. pulmonis*
- Cilia-associated respiratory bacillus
- *Corynebacterium kutscheri*
- Sendai virus (most common in laboratory rats)
- Sialodacryoadenitis virus (SDV)- cervical salivary gland inflammation
- Chronic progressive nephrosis

Rats

- Overheating/chilling/heat stress
- Malocclusion/overgrown incisors
- Ectoparasitism
- Congestive heart failure
- Pituitary tumor
- Ulcerative pododermatitis
- *Hymenolepis* spp.
- Mammary tumors (fibroadenoma most common)
- Salmonellosis
- Septicemia
- Ptyalism
- Hemobartonellosis (in colonies)

ZOONOTIC POTENTIAL

- Rat bite fever - *Streptobacillus moniliformis*
- Salmonellosis
- Ectoparasitism
- Leptospirosis
- Hantaviral diseases
- Lymphocytic choriomeningitis virus (LCMV)

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Debbie Ducommun

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Gerbil Pet Care

Adapted from Exotic DVM, Volume 6.5 © Zoological Education Network, 2005

- Vital statistics, Behavior
- Sexing, Housing, Diet, Restraint
- Blood collection, Common disorders
- Injection s potential

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Gerbils

Of the numerous gerbil genera worldwide, the Mongolian gerbil (*Meriones unguiculatus*) is the prevalent pet species in the US. Mongolian gerbils are native to desert regions of Mongolia and northeastern China. All pet gerbils are captive bred for this market. Gerbils are available in a variety of color types.

PET POTENTIAL/BEHAVIOR

- Appropriate pets for beginners.
- Friendly, clean, quiet and curious pets.
- Rarely bite, easily handled.
- Produce minimal odor and waste.
- Space requirements are not excessive.
- Rarely exhibit problems in captivity.
- Active both day and night, peak activity occurs at night.
- Gerbils require at least 30 minutes a day of attention.

SEXING AND REPRODUCTION

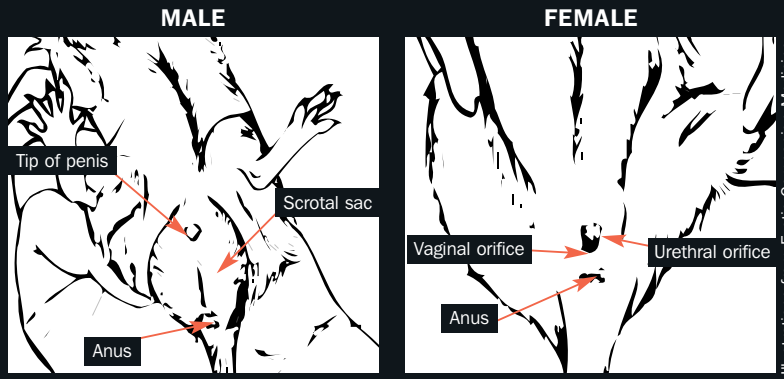
- Male gerbils have a large, dark scrotum and a longer anogenital distance than females.
- Breeding pairs tend to be monogamous and maintain lifelong relationships.
- Gerbils should be introduced before they are 8 weeks of age to reduce the risk of fighting. Adult gerbils of either sex may fight to the death if introduced as adults.
- Neutering the male can prevent overpopulation.



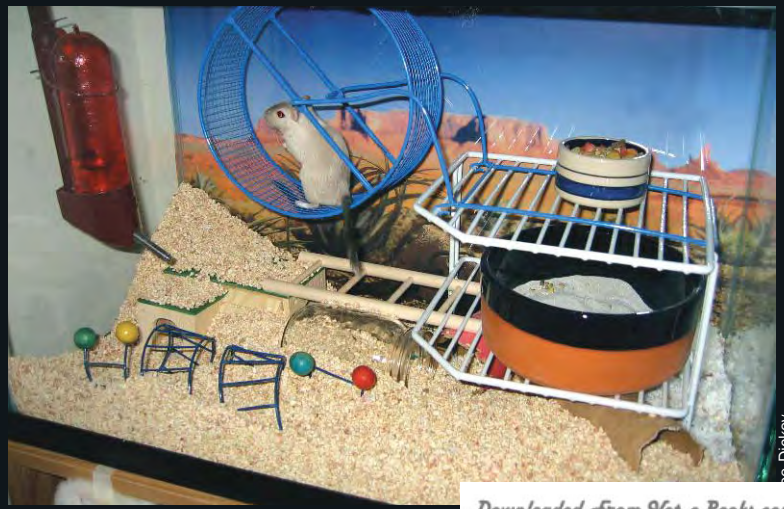
VITAL STATISTICS

Life span	maximum	5 years
	in captivity (avg)	3-5 years
Total body length (no tail)		7-15 cm
Total body weight		50-80 g (females) 80-130 g (males)
Rectal/body temperature		99-102°F (37-39°C)
Respiratory rate		90-140 bpm
Heart rate		250-500 bpm
Blood volume		6.6-7.8 ml/100 g body weight
Dental formula		I 1/1 C 0/0 M 3/3
Food consumption		5-8 g/100 g body weight/day
Water consumption		4-7+ ml/100 g body weight/day
Age of sexual maturity		65-85 days
Breeding season		year round
Gestation period		24-26 days
Litters per year		7 (avg)
Litter size		3-7 pups (5 avg)
Birth weight		2.5-3.5 g
First hair coat complete		10 days
Eyes open		16-20 days
Weaning age		21-24 days
Weaning weight		3.3-6.0 g

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Illustrations from Exotic Companion Medicine Handbook for Veterinarians



e Dickey

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Gerbils

HOUSING

- Gerbils are social animals and are best housed in pairs.
- Ensure adequate cage space to prevent fighting.
- The minimum cage size should be 36 square inches per gerbil; a pair requires a minimum of 180 square inches.
- The most popular housing for a pair of gerbils is a 10-gallon aquarium, which may house 1-3 gerbils.
- The enclosure should be escape-proof with a secure lid.
- Plexiglas enclosures designed for small rodents make adequate houses for gerbils.
- Regular weekly cleaning schedules must be maintained because this solid-sided caging (as opposed to wire) will trap ammonia from urine.
- A split tank is an ideal way to introduce gerbils to each other.
- Solid flooring is preferable to wire flooring.
- Bedding should be clean, dry, absorbent, nonabrasive and at least 2 cm deep to facilitate nesting behavior.
- Aspen wood shavings or recycled paper bedding products are acceptable substrate materials.
- Natural sunlight is beneficial to all creatures, but gerbils must not become overheated.
- An acceptable lighting schedule consists of 12-hour alternating light and dark cycles.
- Ideal environmental temperature is 60-70°F (16-21°C).
- Ideal relative humidity should not exceed 30-50%.
- Common household dangers include chewing electrical cords, children dropping or stepping on the gerbil, other pets (cats/dogs/ferrets are natural predators), eating toxic substances, gnawing inappropriate items and escaping or getting lost.

Gerbils

ENVIRONMENTAL ENRICHMENT

- Gerbils need to have safe materials for gnawing that will help wear down their continually growing incisor teeth; wooden blocks are good for this purpose.
- Exercise wheels and plastic exercise balls provide an outlet for energy.
- Gerbils like to build nests out of nesting material, especially in the winter months.

DIET

- Commercial pellet diets are available for gerbils.
- Alternatively, commercial seed mixes with a variety of seeds (minimal to no sunflower seeds) may be fed with fresh vegetables (e.g., cabbage, kale, broccoli, carrots, beets) and soaked seeds or sprouts.
- Alfalfa hay should be available for grazing and is a good calcium source for nursing females.
- Excessive consumption of sunflower seeds and other high-fat foods will lead to obesity, elevated cholesterol levels and lipemia.
- Provide fresh clean drinking water via a sipper tube.

RESTRAINT

- Gerbils should be supported on the palm of the hand while holding the tail base because they move very quickly and tend to jump.
- Avoid grasping the tip of the tail, because the skin may deglove, necessitating amputation of the tail.
- Additional restraint can be provided with an over-the-back grip where the body rests in the palm as the head is held

A bowl with a small amount of sand (not dust) should be provided for 15 minutes several times a week for sand baths.



Kylee Dickey

A hiding place or hiding box should be provided in the cage.

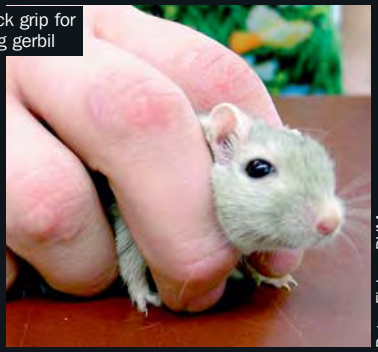


Kylee Dickey



Peter Fisher, DVM

Over-the-back grip for restraining gerbil



Peter Fisher, DVM

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HEMATOLOGY AND BIOCHEMISTRY REFERENCE RANGES

PCV	41-52% (avg 48%)
RBC	7-10 (avg 8.5) x $10^6/\mu l$ (half-life approx 10 d)
WBC	4.3-21.6 (avg 11) x $10^3/\mu l$
Neutrophils	5-34% (avg 30%)
Lymphocytes	60-95% (avg 74%)
Eosinophils	0-4%
Monocytes	0-3%
Basophils	0-1%
Platelets	400-600 x $10^3/\mu l$
Reticulocytes	21-54/1000 RBC
Hemoglobin	12.6-16.2 (avg 15) mg/dl
Serum protein	4.3-12.5 mg/dl
Albumin	1.8-5.5 mg/dl
Globulin	1.2-6.0 mg/dl
Serum glucose	50-135 mg/dl
Blood urea nitrogen	17-27 mg/dl
Creatinine	0.6-1.4 mg/dl
Total bilirubin	0.2-0.6 mg/dl
Cholesterol	90-150 mg/dl
Calcium	3.7-6.2 mg/dl
Phosphorus	3.7-7.0 mg/dl

MEDICATION AND ANESTHETIC DOSAGES

Caution: Avoid penicillin antibiotics	
Buprenorphine	0.05 mg/kg IM, SC or IV q8-12h
Ciprofloxacin/ enrofloxacin	10 mg/kg PO q12h
Dexamethasone	0.1-0.6 mg/kg IM
Diazepam	5 mg/kg IP
Doxycycline	2.5 mg/kg PO q12h
Fenbendazole	20 mg/kg PO q24h x5d
Ivermectin	0.2-0.4 mg/kg PO; repeat in 8-10 days
Ketamine	44 mg/kg IP
Ketamine + diazepam	50 mg/kg (K) + 5 mg/kg (D) IP
Ketamine + xylazine	50 mg/kg (K) + 10 mg/kg (X) IP
Oxytetracycline	20 mg/kg SC q24h; 10 mg/kg PO q8h
Prednisone	0.5-2 mg/kg PO
Trimethoprim sulfamethoxazole	15 mg/kg PO q12h
Isoflurane and sevoflurane gas anesthetics are safe for gerbils.	

gently between two fingers or by using a small cloth to aid in maintaining restraint.

BLOOD COLLECTION

- Blood collection for routine testing is seldom done in gerbils due to the difficulty of obtaining a sample.
- A 25 ga needle inserted at a 90° angle in the lateral saphenous vein, followed by blood collection in capillary tubes may be used.
- Lateral tail veins have been used to collect small samples.
- In research laboratories, blood is collected from a clipped toe nail, a nicked tail vein, the orbital sinus or by cardiac puncture.
- Cardiac puncture should be performed only on an anesthetized animal.

INJECTION SITES

- Intramuscular: Quadriceps (0.1 ml max vol)
- Subcutaneous: Scruff (2-3 ml max vol)
- Intraperitoneal: 2-3 ml max vol
- Intravenous: Saphenous vein (0.2 ml max vol)
  Lateral tail vein (0.2-0.5 ml max vol)

MOST COMMON DISORDERS

- Trauma (including tail slip)
- Malnutrition
- Rough hair coat
- Sore nose/facial eczema/nasal dermatitis
- Inherited epileptiform seizures
- Diarrhea/enteritis

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Gerbils

- Tyzzer's disease
- Malocclusion
- Periodontal disease
- Cancer/neoplasia
- Obesity
- Cystic ovaries
- Chronic interstitial nephritis

ZOONOTIC POTENTIAL

- Ectoparasitism
- Leptospirosis

PHYSICAL EXAMINATION

- Annual veterinary visits should include a physical exam and a review of diet and husbandry.
- Bi-annual or quarterly examinations to assess weight, dental health, nail trimmings and overall health are recommended.

REFERENCES

1. Johnson-Delaney C: Exotic Companion Medicine Handbook for Veterinarians. Lake Worth, Zoological Education Network, 2000, www.exoticdvm.com.
2. Quesenberry KE, Carpenter JW: Ferrets, Rabbits and Rodents - Clinical Medicine and Surgery, 2nd ed. Philadelphia, WB Saunders Co, 2004.



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Chinchilla Pet Care

Adapted from Exotic DVM, Premiere Issue © Zoological Education Network, 2005

- Vital statistics, Behavior
- Sexing, Housing, Diet, Restraint
- Common disorders, Blood collection
- Zoonotic p[illegible]ulary

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Chinchillas

Chinchillas are rodents, characterized by their large hind feet, compact bodies, soft dense fur, large eyes and ears, long whiskers, and bushy tails. *Chinchilla lanigera*, with a longer tail, is the most common pet species, while *Chinchilla brevicaudata* has a very short tail. The chinchilla's natural environment is the semi-arid rocky slopes of the Andes mountains in South America.

PET APPEAL/BEHAVIOR

- Affectionate, intelligent, charming personalities.
- Bond quickly to their owners.
- Hardy and suffer few illnesses.
- Chinchillas can make great pets, because they are easy to care for, have very little odor and rarely bite.
- Dogs, cats and ferrets are predators.
- Basically nocturnal, they may be active during the day.
- They need at least 30 min/day for exercise and play.
- They are often difficult to litter-train (fecal).

SEXING AND REPRODUCTION

- The anogenital distance in males is about twice as long as in females.
- Male chinchillas do not have a scrotum, and the testes remain primarily in the inguinal canal or abdominal cavity.
- There are two small moveable sacs next to the anus (post-anal sacs) into which the caudal epididymis can drop.
- In females, the anus is immediately caudal to the relatively large cone-shaped urethral papilla.



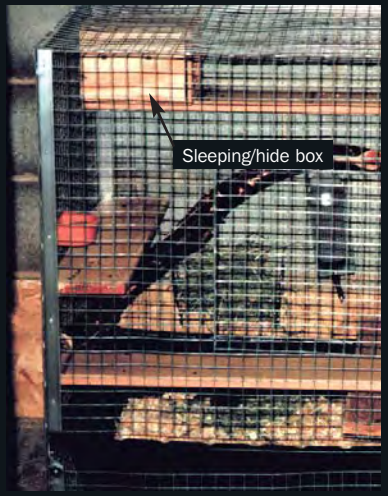
VITAL STATISTICS

Life span	9-17+ years
Body weight	
adult female	450-700 g
adult male	400-500 g
Body temp	100.5-102.2°F (38-39°C)
Rectal temp	102-103°F (38.9-39.4°C)
Respiratory rate	45-80 bpm
Heart rate	200-350 bpm
Dental	Teeth are open-rooted and grow continuously throughout life. Incisors are yellow, grow 5.5-6.5 cm (2.5-3") annually.
Dental formula	I 1/1 C 0/0 P 1/1 M 3/3
Sexual maturity	7-10 months
Estrus cycle	30-50 days, seasonally polyestrous (Nov to May); postpartum estrus fertile; spontaneous ovulation
Gestation	105-115 days
Birth weight	30-60 g
Litter	2 avg (up to 5)
Newborns	precocious, fully furred
Weaning	3-6 weeks
Feces	slender, brown pellets 2-3 mm diameter, 5-12 mm long

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Chinchillas need a sleeping/hide box to simulate hiding areas in their natural environment.



Adequate space for climbing is necessary



Chinchillas

- The female vagina is normally sealed by a membrane except during estrus (3-5 days) and parturition.
- If a female chinchilla is not bred at a young age, its pelvis will fuse and it may have difficulty giving birth later.
- An open vulva, often with visible mucus, is an external indication of estrus.

HOUSING

- House individually, in pairs or in a polygamous group with a single male and 2-4 females.
- Cage should be at least 3 x 2 x 2 feet (90 x 60 x 60 cm), constructed from wood and mesh wire.
- Use pine litter for substrate (avoid cedar, as it is toxic).
- Chinchillas need climbing areas, a dust box and a sleeping box in an upper corner.
- Dust baths help chinchillas keep clean without becoming chilled. Chinchillas should be allowed to roll in the dust material (about 2-3" [8-10 cm] deep) for 10-15 minutes several times per week.
- Temperatures higher than 82°F (28°C) can be result in heat stroke. Optimal temperature is 50-68°F (10-20°C).

DIET

- Commercial chinchilla pellets, water and unlimited timothy hay provide an adequate diet.
- Chinchillas can thrive on a mixture of grass (timothy, brome, oat) and legume (alfalfa) hays.
- Adults require 1-2 Tbs of pellets daily.
- Sugary treats, such as raisins or dried apples, and fatty foods, such as sunflower seeds or peanuts, should be avoided.

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Chinchillas

RESTRAINT

- Lift the chinchilla by supporting the body with one hand under the abdomen and hold the animal by the base of the tail close to the body with the other hand.
- The chinchilla can also be placed on the arm.
- A chinchilla should be restrained gently to avoid “fur slip.”
- Chinchillas may bite if restrained against their will.

BLOOD COLLECTION

- Blood samples can be collected from the lateral saphenous, cephalic or jugular vein; 7-10% of blood volume (0.5-0.7 ml/100 g) may be safely collected from healthy chinchillas.

INJECTION SITES

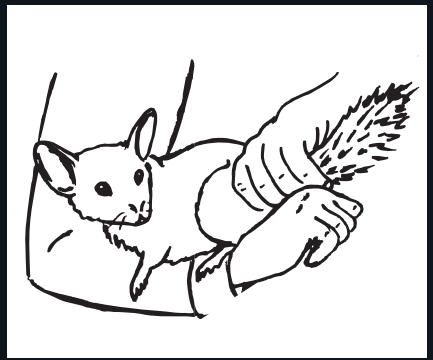
- IV: 25-28 ga needle in lateral saphenous or cephalic vein
- IM: 23-25 ga needle in quadriceps, gluteals; max. volume 0.3 ml per single site/adult
- SC: 23 ga under skin, neck or flank; be careful of “fur slip”
- IP: Hind limb should be extended with animal restrained, introduce 23 ga needle or smaller along the line of the leg into the center of the posterior quadrant of the abdomen; up to 10 ml fluid can be given.

PHYSICAL EXAMINATION

- Annual veterinary visits should include a physical exam and a review of the diet and husbandry. The need for







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From Exotic Companion Medicine Handbook

HEMATOLOGIC REFERENCE RANGES	
RBC	6-8 x 10^6/µl
PCV	27-54% (avg 38)
WBC	6-15 x 10^3/µl
Hemoglobin	8-15 g/dl
Neutrophils	40-55% (avg 43)
Lymphocytes	45-60% (avg 54)
Eosinophils	0.7% (0-9)
Monocytes	1% (0-6)
Basophils	0.6% (0-1)
Platelets	45-740 x 10^3/µl (avg 274)

BIOCHEMICAL REFERENCE RANGES	
Total protein	5-6 g/dl
Albumin	2.5-4.2 g/dl
Glucose	60-120 mg/dl
BUN	10- 25 mg/dl
Sodium	130-155 mEq/L
Potassium	5-6.5 mEq/L
Cloride	105-115 mEq/L
Phosphorous	4-8 mg/dl
Calcium	10-15 mg/dl
ALT	10-35 U/L
AST	15-45 U/L
Alkaline phos	3-12 U/L
Cholesterol	40-100 mg/dl

WHAT TO LOOK FOR IN A HEALTHY CHINCHILLA



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fecal analysis and blood hematology and chemistry should be discussed.

- Bi-annual or quarterly examinations to assess weight, dental health, nail trimmings and overall health are recommended.

MOST COMMON DISORDERS

- Dermatophytosis
- Trauma (broken bones, bite wounds)
- Diarrhea/constipation
- Respiratory disorders
- Eye irritation/conjunctivitis
- Convulsions/encephalitis/lead poisoning
- Malocclusion/molar spurs
- Penile hair rings in males/paraphimosis
- “Fur-barbering” from stress
- Heat stroke
- Esophageal choke
- GI stasis/bloat
- Cardiomyopathy
- Rectal prolapse
- Giardiasis

ZOONOTIC POTENTIAL

- *Listeria monocytogenes*
- Lymphocytic choriomeningitis virus (LCMV)
- Dermatophytosis
- *Baylisascaris procyonis*

FORMULARY FOR CHINCHILLAS AND DEGUS

DRUG	DOSAGE
Acepromazine	0.5-1.0 mg/kg IM
Acetylsalicylic acid	100-200 mg/kg PO q6-8h PRN
Amikacin	2 mg/kg q8h IM, SC, IV
Amitraz (Mitaban®)	Make up as per package directions
Amoxycillin	DO NOT USE
Ampicillin	DO NOT USE
Atropine	0.05 mg/kg IM or SC
Calcium (EDTA) disodium versenate	30 mg/kg SC q12h
Carbaryl 5% powder	Dust lightly once weekly
Cephalosporin	25-100 mg/kg PO q6h; note: injectable suspension may be too thick for a 23-25 gauge needle
Chloramphenicol palmitate	30-50 mg/kg q12h PO; 10 mg/30 ml drinking water
Chloramphenicol succinate	50 mg/kg q12h IM, SC
Chlortetracycline	50 mg/kg q12h PO
Dexamethasone	0.5-2.0 mg/kg IV, IP, IM, SC
Diazepam	1-2 mg/kg IP, IM
Doxapram	2-5 mg/kg IV
Doxycycline	2.5 mg/kg q12h PO
Enrofloxacin	5-10 mg/kg q12h PO, SC, IM
Fenbendazole	20 mg/kg PO q24h x 5d
Furosemide	5-10 mg/kg q12h
Gentamicin	2 mg/kg q8h IM, SC, IV
Griseofulvin	25 mg/kg PO q24h x x 2d28-40d
Isoflurane	To effect

DRUG	DOSAGE
Ivermectin	(0.2 mg/kg) 200-400 µg/kg PO; repeat in 7-14d
Ketamine	44 mg/kg IP
Ketamine + acepromazine	40 mg/kg (K) IM + 0.5 mg/kg (A)
Ketamine + diazepam	20-40 mg/kg (K) IM + 1.0-2.0 mg/kg (D)
Ketamine + xylazine	35 mg/kg (K) + 5 mg/kg IP (X)
Meperidine	10-20 mg/kg q6h IM, SC
Metoclopramide HCl	0.5 mg/kg q8h SC
Neomycin	15 mg/kg q12h PO
Orthocide antifungal powder	Mix in dust bath @ 1 tsp/2 c dust
Oxytetracycline	50 mg/kg q12h PO; 1 mg/ml drinking water
Oxytocin	0.2-3.0 IU/kg SC, IM, IV
Pentobarbital	30 mg/kg IV; 35-40 IP
Piperazine adipate	0.5 g/kg/d x 2d
Piperazine citrate	100 mg/kg/d x 2d or 2-5 mg/ml drinking water x 7d, off 7d, repeat
Praziquantel	5-10 mg/kg IM, SC, PO; repeat in 10d
Prednisone	0.5-2.0 mg/kg PO, SC, IM
Procaine penicillin G	DO NOT USE
Sulfamethazine	1 mg/ml drinking water
Tetracycline	50 mg/kg q12h PO; 0.3-2.0 mg/ml drinking water
Thiabendazole	50-100 mg/kg PO x 5d
Tresaderm®	1 drop each ear, massage in, swab out (q24h x 3-5d)
Trimethoprim sulfadiazine	30 mg/kg q12h SC, IM
Vitamin B_1	1 mg/kg feed; 0.02-0.2 ml/kg SC, IM
Vitamin K_1	1-10 mg/kg as needed, IM

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2. Hillyer EV, Quesenberry KE: Ferrets, Rabbits and Rodents - Clinical Medicine and Surgery. Philadelphia, WB Saunders Co, 1997.
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Degu Pet Care

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- Anatomy, Vital statistics, Behavior
- Sexing, Housing, Diet, Restraint
- Common disorders, Blood collection
- Injection s potential

Dan Johnson, DVM

Edited by
Peter Fisher, DVM

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Degus

The degu (*Octodon degus*) is native to the western foothills of the Andes. Degus are rodents belonging to the suborder Hystricognathi ("porcupine-like rodents") based upon jaw musculature and skull structure. They belong to the family Octodontidae. Octodon refers to the "figure 8" shape of their cheek teeth. Other names for the degu include brush-tailed rat and trumpet-tailed rat.

PET POTENTIAL/BEHAVIOR

- Social animals.
- Enjoy human attention.
- Long-lived.
- Have a low incidence of disease.
- Degus are diurnal and do not hibernate.
- They are highly social and communicate via vocalizations and postures.
- Degus are coprophagic.
- If degus are not given social interaction and physical stimuli, they may become aggressive or self mutilate.
- Fighting is rare even when new introductions occur.
- They dig elaborate burrows.

ANATOMY/PHYSIOLOGY

- Degus resemble large gerbils and are dark grayish-brown with a dark brush on the tip of the tail.
- Their pupils are elliptical.
- Their urine is normally yellow and thick.



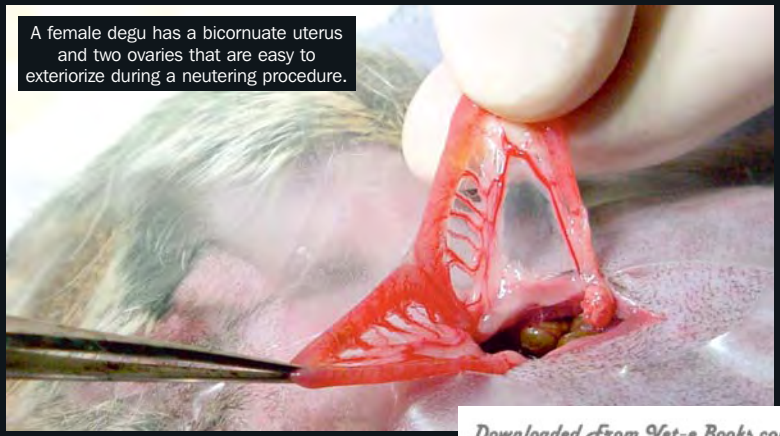
VITAL STATISTICS

Lifespan	maximum	10 years
	avg in captivity	5-8 years
Body length		12.5-19.5 cm
Tail length		10.5-16.5 cm
Body weight		170-300 g
Normal body temperature		101.8ºF (37.9ºC)
Dental formula		I 1/1, C 0/0, P 1/1, M 3/3

Age of sexual maturity	3-4 months
Breeding season (captive)	year-round
Gestation	87-93 days
Litter size	1-10 pups (6-7 avg)
Weaning	4-6 weeks
Litters per year	2-3

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A female degu has a bicornuate uterus and two ovaries that are easy to exteriorize during a neutering procedure.

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Degus

- Degus are hind-gut fermenters and have a functioning cecum.
- Their adrenal glands are relatively large.

SEXING AND REPRODUCTION

- The anogenital distance of the male is approximately double that of the female.
- The prepuce resembles a clitoris but is several times larger.
- The penis can be exteriorized by moving the prepuce proximally.
- The testicles of the male are intraabdominal; there is no scrotum.
- A female degu has 8 mammary glands: 3 pair lateral thoracic and 1 pair inguinal.
- A female degu has a bicornuate uterus and two ovaries that are easy to exteriorize during a neutering procedure.
- To reduce the incidence of pregnancy toxemia (similar to guinea pigs) and dystocia, breeding should begin when the female is 4-9 months of age and body weight is below 250 g.
- Degus are induced ovulators.
- Early during pregnancy, the vaginal membrane reopens and a red discharge is produced. This “red ring” should be used as an early indicator of pregnancy. It is best to avoid palpation to confirm pregnancy.
- In spite of their long gestation, degus are not born as fully developed as one would expect.

Degus

HOUSING

- Degus should be provided with a large cage containing shelves, branches, a running wheel and plenty of room to exercise.
- Wood shavings, recycled paper products and hay are all suitable bedding materials.
- A dust bath should be provided as for chinchillas to help degus keep clean without becoming chilled. Degus should be allowed to roll in the dust material (about 2-3" deep) for 10-15 minutes several times per week.
- At least two degus should be housed together.
- Overheating should be avoided.

DIET

- The diet in the wild includes a wide variety of plants, roots, seeds, fruit and livestock droppings.
- A successful captive diet consists of a mixture of rodent blocks and guinea pig chow along with grass hay.
- Carrots, sweet potatoes, other vegetables, seeds and peanuts may be given as treats.
- Foods containing sugar (e.g., fruits, raisins, breakfast cereal, honey treat sticks) should be avoided. Note that most pelleted feeds contain molasses, which is used as a binder. Starchy foods may also predispose to gastro-enteritis.
- Water bottles or sipper tubes should be cleaned frequently.

An adequate cage for two degus includes shelves and branches for climbing and a nest box.



www.degus.org

HEMATOLOGIC REFERENCE RANGES	
WBC	3-8 x $10^3/\mu l$
RBC	7-8 x $10^6/\mu l$
Hgb	11-12 g/dl
Hct	27-40%
Neut	0.8-5.5 x $10^3/\mu l$
Lymph	1.2-4.2 x$10^3/\mu l$
Mono	0.07-0.16 x $10^3/\mu l$
Eos	0.13-0.62 x $10^3/\mu l$
Baso	0.03-0.16 x $10^3/\mu l$
Plate	435-475 x $10^3/\mu l$
ISIS reference ranges, 1999	

Dust baths help degus keep clean without becoming chilled.



www.degus.org

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The encircling grip is used for restraint.

If picked up improperly by the tail, a degu may spin, resulting in a degloving injury that requires amputation.




Venipuncture is possible via the cranial vena cava

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Degus

RESTRAINT

- Degus may be scooped up with two hands and scruffed or held in an encircling grip for examination.
- Grasping by the tail should be avoided, as tail degloving easily occurs.
- Alternatively, degus readily learn to step into a net.

BLOOD COLLECTION AND INJECTION SITES

- Venipuncture is possible via the cranial vena cava.
- IV: 25 g or 28 g in lateral saphenous, cephalic
- IM: quadriceps, gluteal muscles: 23-25 g needle, max volume 0.2-0.3 ml single site/adult
- SC: 2-3 ml under skin of neck or flank.

FORMULARY

- See Chinchillas section, page 6.

PHYSICAL EXAMINATION

- Annual veterinary visits should include a physical exam and a review of diet and husbandry. The need for fecal analysis and blood hematology and chemistry should be discussed.
- Bi-annual or quarterly examinations to assess weight, dental health, nail trimmings and overall health are recommended.

MOST COMMON DISORDERS

- Diabetes mellitus
- Cataracts
- Fatty liver disease associated with pregnancy and diabetes
- Dental disease

Degus

- Diarrhea, GI stasis with bloat, colic
- Neoplasia
- Tail degloving
- Breeding problems
- Rare parasites; *Giardia* found in a lab colony
- Susceptibility to bacteria such as *Pseudomonas* sp.

ZOONOTIC POTENTIAL

- *Linguatula serrata* (sinus worm)
- *Echinococcus granulosus*
- *Trypanosoma cruzi*
- *Giardia*
- *Salmonella*
- Dermatophytosis

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The "figure 8" shape of a degu's cheek teeth is shown.



Degus have 5 toes on each foot, but the pollex on both forelimbs is greatly reduced.





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Virginia Opossum Pet Care

Adapted from Exotic DVM, Volume 6.6 © Zoological Education Network, 2005

- Behavior, Vital statistics, Sexing
- Housing, Diet, Restraint, Formulary
- Common disorders, Blood collection
- Injection s potential

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Cathy A. Johnson-Delaney, DVM, Dipl ABVP-Avian Practice

Edited by **Peter Fisher**, DVM

Virginia Opossums

The Virginia opossum (*Didelphis virginiana*) is the only native marsupial of North America. (New World "possums" are properly called "opossums"; Old World "possums" are "possums"). Some states and municipalities prohibit ownership of native or wildlife species, and local or state regulatory agencies should be consulted for information on proper permits. The private practitioner interested in working with Virginia opossums is referred to the National Opossum Society (NOS), www.opossum.org.

PET POTENTIAL/BEHAVIOR

- Quiet; usually gentle and non-aggressive.
- Startle easily.
- Can learn to urinate/defecate on newspapers in designated areas.
- Can be trained to come when called.
- Will cuddle and curl up in one's lap.
- Opossums found as infants (furred) can be successfully hand raised and bonded to their human caretakers.
- If the intention is to release the animal after raising it, handling should be kept to a minimum.
- Opossums are solitary animals that do not usually interact with other pets.
- The Virginia opossum is nocturnal but may adjust somewhat to a human schedule.
- Adults may use the tail to carry bundles of leaves or bedding material.
- Opossums can climb trees and dig under fences.

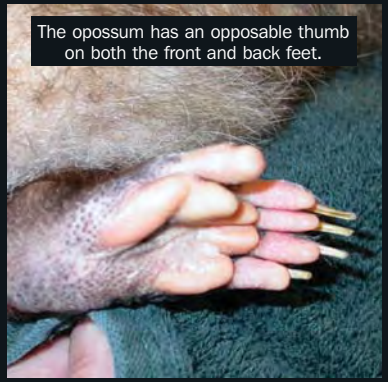


VITAL STATISTICS

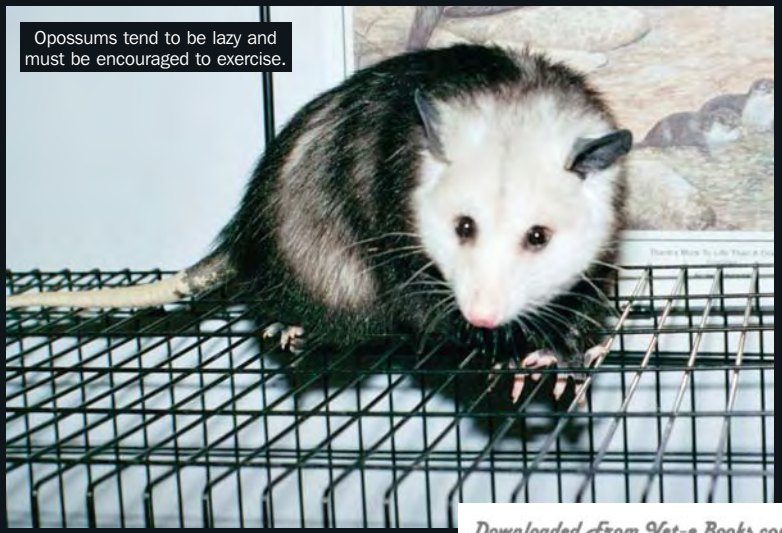
Life span	Captivity avg	7 years
	Free ranging avg	2 years
Body weight	Adult females	2 kg
	Adult males	4-5 kg
Body length (including tail):		Approx 91 cm
Cloacal body temperature:		90-95°F (32.2-35.0°C)
Blood volume		5.7% of body weight
Heart rate		70-100 bpm
Respiratory rate		25-40 bpm
Dental formula		I 5/4, M 1/1, P 3/3, M 4/4
Water consumption/day		100-150 ml
Food consumption/day		150-200 g
Environmental temperature		50-86°F (10-30°C)
Ideal relative humidity		> 58%

Puberty		6-8 months
Sexual maturity		12 months
Breeding season	Early spring	6-7 weeks
	Early summer	1-2 months
Estrus		Polyestrous 23- to 28-day cycle Estrus lasts 1-2 days
Ovulation		Spontaneous
Litters per year		1-2
Gestation period		12-13 days
Litter size		8-20
Birth weight		Approx 2 g
Vibrissae appear		34 days
Eyes open		56-64 days
Weaning age		10-12 weeks
Milk composition		86% water, 4.7% fat, 4% protein, 4.5% sugar

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The opossum has an opposable thumb on both the front and back feet.


Scrotal sac in the male


Opossums tend to be lazy and must be encouraged to exercise.

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Virginia Opossums

- Opossums can make four vocalizations—hiss, screech, growl or click—which may be used in aggressive actions.
- When threatened, the opossum may hiss and then freeze in position with its mouth slightly open showing the teeth.
- It can go limp and feign death (“playing ‘possum”).
- Most opossums urinate/defecate when initially picked up.
- Anal sacs are present in both sexes and secrete a greenish-colored fluid.

SEXING AND REPRODUCTION

- Being a marsupial, the female opossum has a pouch and marsupial pelvic bones. The vagina is forked, and there are two separate uterine horns.
- The male has a forked glans penis, posterior to the scrotum. The scrotal sac is pendulous on a long stalk.
- Pet opossums should be spayed or neutered.
- Male castration is performed by incising at the base of the scrotal “stalk,” ligating vasculature and suturing skin with a subcuticular absorbable suture.
- Excess scrotal tissue may need to be ablated with castration.
- In males, neutering decreases scent marking and odor.
- In females, spaying decreases the likelihood of chronic urogenital tract infections.
- Ovariohysterectomy may incorporate the lateral vagina, but care must be taken to separate the ureters that loop between the central and lateral vaginas.

HOUSING

- Pairs or individual opossums may be housed in caging 18” x 30” (45 x 75 cm) with a sloping roof 32” (80 cm)

at the highest point and 14” (35 cm) at the lowest.
- Adults may fight if the quarters are too small.
- Large groups may be housed in yards measuring 100 feet x 150 feet.
- Standard caging for rabbits with a solid floor may be used.
- Appropriate bedding includes recycled newspaper that has been shredded or pelleted.
- A nest box 12” x 18” x 16” (30 x 45 x 40 cm) should be provided and can be attached to the outside of the cage.
- Environmental temperature ranges of 50-86°F (10-30°C) are acceptable, with 72°F (22°C) being ideal.
- The environmental humidity should be greater than 58%.
- The cage must be kept clean and dry to prevent foot problems.

DIET

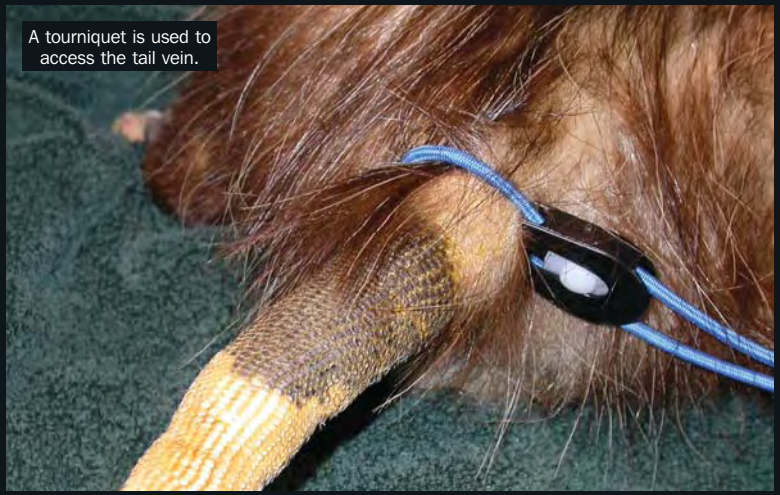
- The diet eaten by free-ranging Virginia opossums is truly omnivorous: green and yellow vegetables, grass, fruit, carrion, snails, slugs, worms, insects, rats, mice, snakes, amphibians, eggs and fish.
- In captivity, they can be fed a varied diet that includes quality dog and/or cat foods, vegetables, fruits, an occasional egg, live foods (such as crickets, mealworms) and yogurt.
- Opossums, being marsupials, have a lower physiologic metabolic rate.
- Obesity is common and sufficient exercise is necessary.
- Depending on the diet fed, a general mineral/vitamin supplement may be needed.
- Dry food fed only as meals (not free choice) may aid dental health.



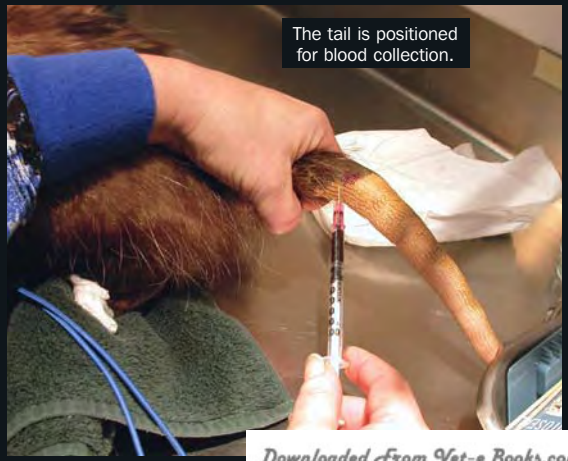


To prevent obesity, dry food may need to be limited and fed as meals rather than ad lib.

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A tourniquet is used to access the tail vein.



The tail is positioned for blood collection.

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Virginia Opossums

- Diet formulations have been developed for different life stages (www.opossum.org).
- Commercial dry hedgehog diet (Mazuri® Insectivore diet) can be used in place of dry dog/cat food to aid in control of obesity, but feeding trials have not been performed.
- Suggested Diet #1: Commercial dry cat food ad lib supplemented daily with low calorie canned dog food and banana, potato and apple sprinkled with calcium carbonate.
- Suggested Diet #2: Commercial dry dog food ad lib supplemented with low calorie canned dog food and fruit and vegetables sprinkled with calcium carbonate.
- Fresh water should be available at all times.

RESTRAINT

- Control can be maintained by using a cat restraint bag or wrapping the opossum as a “burrito” in a towel.

BLOOD COLLECTION

- The lateral tail vein may be accessed for blood collection in younger animals without scarred tails.
- There are also ventral veins on either side of the coccygeal artery.
- A 20- to 22-gauge needle without a syringe should be inserted blindly into the ventral aspect of the tail and the blood allowed to flow.
- Pressure must be applied for several minutes to prevent hematoma formation.
- The cephalic and a tibial (saphenous) vein can also be accessed.
- Pouch veins can be used in the female.

Virginia Opossums

INJECTION SITES

- Intramuscular: Gluteals in rear leg, triceps in front leg
- Subcutaneous: Intrascapular, flank area
- Intravenous: Injections can be given in pouch veins or the lateral tail vein.
- Intraosseous: Catheters can be placed in the femur as in other mammals.

MOST COMMON DISORDERS

- "Crusty ear" (ear mange often with secondary bacterial infection)
- Cardiac disease (streptococcal endocarditis, dilative and hypertrophic cardiomyopathies, heartworms - *Dirofilaria*)
- Metabolic bone disease
- Septicemia (esp. rescued "pouch" babies)
- Necrotizing fasciitis (streptococcal infections)
- Bronchopneumonia (*Bordetella bronchiseptica*, *Pasteurella multocida*)
- Endoparasites (intestinal, respiratory tract nematodes)
- Ectoparasites (fleas, ticks, mites)
- Obesity
- Malnutrition
- Urogenital tract infections, chronic nephritis

MEDICATION AND ANESTHETIC DOSAGES

Drug	Route	Dosage	Comments
Alfaxalone-alfadolone acetate	IV	0.1-0.2 ml/kg; 15 mg/kg	Immobilization, Sedation
	IM	0.25-0.5 ml/kg	
Aspirin	PO	18 mg/kg q72-96h	Cardiac disease
Atropine	IM, IV, SC	0.02-0.04 mg/kg	Control bradycardia and salivation during sedation
Butorphanol	IM, SC, PO	0.1-0.5 mg/kg q6-8h PRN	Analgesic
Cisapride	PO, IM	0.25 mg/kg q8-24h	GI motility enhancer
Dexamethasone	IV, IM, SC	0.2 mg/kg q12-24h	Antiinflammatory
Diazepam	IM, PO, IV	0.5-2.0 mg/kg	Calming, Higher dosages IV for seizures
Digoxin	PO	0.0011-0.0012 mg/kg q24h	Cardiac disease, Monitor like cat
Enalapril	PO	0.22-0.44 mg/kg q24h	Cardiac disease, Monitor like cat
Enrofloxacin	PO, IM, SC	2.5-5 mg/kg q12-24h	Antibiotic, May cause tissue necrosis SC, IM
Flunixin meglumine	SC, IM	0.1-1 mg/kg q12-24h	NSAID, Short term use only
Furosemide	SC, IM, PO	1-5 mg/kg q6-12h	Diuretic
Gentamicin	SC, IM, IV	1.5-2.5 mg/kg q12h	Antibiotic, Fluid support necessary
Glycopyrrolate	IM, IV, SC	0.01-0.02 mg/kg	Control bradycardia and salivation during sedation
Griseofulvin	PO	20 mg/kg q24h x 30-60d	Antidermatophyte, *Trichophyton* spp.
Ketamine	IM	30-50 mg/kg	Immobilization
Ketamine + medetomidine	IM	2-3 mg/kg (K) + 0.05-0.1 mg/kg (M)	Immobilization, Reverse meditomidine with atipamezole 0.05-0.4 mg/kg IM
L-carnitine	PO	100 mg/kg q12h	Cardiac disease
Meloxicam	PO, SC	0.2 mg/kg q24h	NSAID, Analgesic
Metoclopramide	IV, IM, SC, PO	0.05-0.1 mg/kg q6-12h PRN	GI motility enhancer
Piperazine	PO	100 mg/kg	Anthelmintic
Prednisolone	IM, SC, PO	0.1-0.2 mg/kg q24h	Corticosteroid
Propranolol	PO	0.55-1.10 mg/kg q12-24h	Cardiac disease, Monitor like cat
Sulfadimethoxine	PO	5-10 mg/kg q12-24h	Antibiotic, Keep well hydrated
Trimethoprim/sulfa	PO	10-20 mg/kg q12-24h	Antibiotic, Keep well hydrated
Vitamin B complex	IM	0.01-0.02 ml/kg	Vitamin
Vitamin E	PO	25 mg/animal/day	Vitamin
Vitamin K	SC	2 mg/kg q24-72h	Adjunctive therapy for cardiac, liver disease

Virginia opossums ... arnivore guidelines for antibiotic choice.
Dosages are anecc

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Shown is a severe case of osteodystrophy in a Virginia opossum.



HEMATOLOGIC REFERENCE RANGES

Parameter	A*	B*
RBC ($10^6/\mu l$)	3.3-5.9	3.4-6.5
PVC (%)	28-47	33-51
Hgb (g%; g/dl)	8.3-16.2	11.7-17.9
MCV (μm^3)	64.7-102.9	73-113
MCH (pg)	22.5-35.9	24.4-39.5
MCHC (g/dl)	28-43	32.7-40.0
WBC ($10^3/\mu l$)	14.0-22.9	3.9-12.6
Neut (%)	12-67	11-48
Lymph (%)	13.0-67.5	26-82
Mono (%)	0-2	0-8
Baso (%)	0-2	0-3
Eosin (%)	2-15	6-17

*A. Wallach & Boever
B. Ness

BIOCHEMICAL REFERENCE RANGES

Parameter	A*	B*
Total protein (g/dl)	5.6-8.0	3.8-7.2
Albumin (g/dl)	0.2-0.9	0.3-4.9
Globulin (g%)	3.7-7.1	—
BUN (mg/dl)	23-60	23-38
Creatinine (mg/dl)	—	0.4-7.3
Glucose (mg/dl)	99-145	64-130
Uric acid (mg%)	0.9-2.2	—
Total bilirubin (mg/dl)	0.3-0.8	0.1-0.8
Cholesterol (mEq/L)	80-151	85-203
Calcium (mg/dl)	9.6-11.2	9.7
Phosphorus (mg/dl)	4.6-8.2	2.1-7.7
Alk phos (IU/L)	—	137
SGOT (AST) (Ku)(IU/L)	250	339
ALT (IU/L)	—	68
Na (mEq/L)	143-155	101-129
K (m		

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ZOONOTIC POTENTIAL

- Virginia opossums may be carriers of *Leptospira* spp., *Francisella tularensis* (tularemia), *Erysipelothrix rhusiopathiae, Trypanosoma* cruzi (Chagas' disease), *Sarcoptes scabiei, Trichophyton* spp., *Mycobacterium* spp. and rabies (rare).
- Stools should be handled cautiously and examined frequently for protozoa.
- *Salmonella* spp. have been recovered from clinically normal animals.

OTHER CONSIDERATIONS

- Sarcosporidiosis: The Virginia opossum serves as the definitive host for *Sarcocystis falcatula* and *Sarcocystis neurona*. *S. falcatula* is a major pathogen to birds. In highly susceptible avian species (Old World psittacines) infection most often results in peracute death from severe lung congestion. *S. neurona* is a major pathogen to horses (equine protozoal myeloencephalitis). Infectious sporocysts of both parasites are shed by the Virginia opossum. Flies and cockroaches may serve as vectors.

ANNUAL VETERINARY VISIT

- Physical examination
- Diet and husbandry review
- Dental, oral examination
- Fecal (normal feces resemble cat feces; flotation, direct smear, sedimentation for parasites, protozoa)
- CBC/chemistry panel
- Radiographs to assess bone density, cardiac size

- Additional tests: cultures (pouch, any exudates or discharges), biopsy (masses, dermal lesions), skin scrapings ectoparasite examination, ECG, echocardiography

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Survey radiographs of a healthy 6-month-old female Virginia opossum.





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Skunk Pet Care

Adapted from Exotic DVM, Volume 5.1 © Zoological Education Network, 2005

- Behavior, Sexing, Vital statistics
- Housing, Diet, Restraint
- Blood collection, Common disorders
- Zoonotic p[illegible]nations

Marc H. Kramer, DVM
Angela Lennox, DVM,
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Edited by
Peter Fisher, DVM

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Skunks

Eleven different species of skunks belong to the Mephitidae family. The striped skunk, *Mephitis mephitis,* is the species most commonly kept as a companion animal in the US. Free-ranging skunks are well recognized for spraying a foul-smelling secretion from their scent glands as a defense mechanism, but captive-bred pet skunks are typically descented at a young age. State and local authorities may have specific regulations, licensing requirements or even prohibitions regarding skunk ownership. Go to www.aspenskunk.org to see individual state requirements.

PET POTENTIAL/BEHAVIOR

- They are playful animals and require abundant socializing time.
- Although nocturnal by nature, skunks can adjust to a partially diurnal lifestyle.
- Threat displays include stomping the front feet and raising the tail.
- Proper socialization, gentle handling and neutering or spaying a pet skunk will reduce the incidence of biting.
- Adopting free-ranging skunks as pets is not advisable.
- With maturity many skunks become less social and more aggressive and may not make good pets.

SEXING

- In males, the testicles are positioned close to the anus, and the penis is located on the ventral abdomen.



Marc H. Kramer

VITAL STATISTICS

Average life span	8-10 years	Estrus	monestrous
Average body weight	2-4 kg (7-10 lbs)	Breeding cycle	Mating in Feb/March; single litter in early May
Total length tail length	21-32 inches (50-80 cm) 7-16 inches (18-40 cm)	Gestation period	62-66 days (delayed implantation)
Body temperature	97-98°F (36-37°C)	Litter size	6-7
Heart rate	140-190 bpm	Birth weight	1 oz
Urine pH	6.0	Eyes open (pupils)	3-4 weeks
Dental formula	I 3/3, C 1/1, P 3/3, M 1/1	Lactation	4-6 weeks
Sexual maturity	1 year	Weaning	7-8 weeks

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Skunks

- Contrary to popular belief, skunks cannot be sexed by the characteristics of their striping pattern.
- Skunks should be neutered prior to 6 months of age to reduce aggression and prevent complications secondary to extended estrus in females.

HOUSING

- Minimum cage size should be 36 x 24 x 24 inches (90 x 60 x 60 cm) per skunk.
- An indoor adult pet skunk does not need to be confined to an enclosure.
- Young skunks may need to be confined when unsupervised, and their enclosure should be spacious, sturdy and durable to prevent escape.
- A sleeping quarter den allows the skunk to feel secure.
- The den may consist of a cardboard box or large plastic shelter, such as a dog carrier, and should contain cloth blankets, sheets or other bedding material that can be removed and washed frequently.
- Skunks may be destructive; they climb and open cabinets, dig at carpeting and steal objects, so their environment should be modified accordingly.
- The home environment must be “skunk-proofed” by installing child-proof locks on cabinets, securing vents through which the skunk could escape, removing potted plants, poisons, chemicals, electrical cords and fragile or expensive household items from the animal’s reach.
- Skunks should be provided with a place and opportunity to dig or they may become frustrated.
- A young skunk can be trained to use a litter box.

Skunks

ENVIRONMENTAL ENRICHMENT

- Foraging provides exercise and environmental enrichment. Hard food can be hidden throughout the enclosure, in a litter box filled with vermiculite, or wrapped in newspaper.
- Toys that are disposable or easily cleaned should be provided. Examples of safe chewable toys include ping-pong balls, tennis balls, brown paper bags, cardboard boxes and old socks tied in knots.

DIET

- Free-ranging skunks are omnivorous with a diet consisting of whole prey, insects and some fruit and vegetable matter.
- In zoos, skunk diets vary from commercial carnivore and insectivore diets to natural diets consisting of items such as mice, rats, day-old chicks and live insects. Most zoos also supplement with varied amounts of vegetables/fruits.
- As obesity is extremely common in captive pet skunks, many skunk interest groups have proposed diets consisting of mostly vegetables and other items, such as cottage cheese, yogurt, wheat germ. However, an increase in dietary-related disease, such as metabolic bone disease, has been seen with these types of diets.
- The Standardized Animal Care Guidelines for Mustelidae[1] recommend the following diet for captive skunks:
  - Premium dog food (PMI Nutrition International, Brentwood, MO): 37%
  - Canned cat food (Old Mother Hubbard, Lowell, MA): 37%

Skunks may use litter boxes for waste or sleep.



www.skunkhaven.net

A sleeping quarter den allows the skunk to feel secure.



www.skunkhaven.net

Skunks may use hammocks for sleep.



www.skunkhaven.net

Extremely overweight skunk (40 lbs)

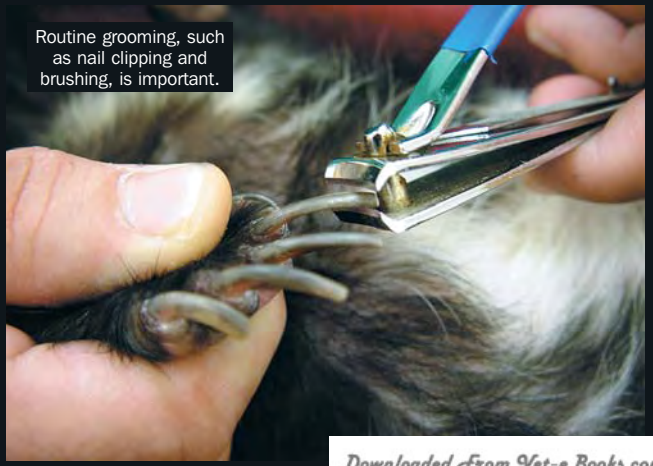


www.skunkhaven.net

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Dog bones and tartar-controlling treats are useful for keeping skunks' teeth clean.



Routine grooming, such as nail clipping and brushing, is important.

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- Fruits: 23%
- Other (insects, treats): 3%

- Considering the natural diet of wild skunks, acceptable additions may include commercial insectivore and omnivore diets.
- A number of manufacturers offer commercial skunk diets. While dietary composition may appear adequate, the authors have been unable to find any manufacturers that have conducted dietary trials on these products.
- Techniques to reduce the risk of obesity include reducing food volume, increasing exercise and offering food as forage to encourage skunks to expend energy searching for food.
- Skunks should have access to a water bottle or a sturdy, spill-proof bowl of water at all times.

MAINTENANCE

- Occasional bathing with a gentle shampoo may be beneficial.
- Routine grooming, such as nail clipping and brushing, is important.
- Regular dental care should be introduced at an early age and may provide benefits similar to those in dogs. Specialty pet toothpastes or gels can be applied with a soft toothbrush or cotton-tipped applicator.
- Toys and hard foods should be provided daily for chewing.

RESTRAINT

- Skunks may be grasped by the scruff with the right hand while the left hand extends the rear legs and tail. When

scruffing, be sure to also support the hindquarters.

- Skunks frequently attempt to bite when they are being restrained.
- Care must be taken to avoid bite wounds. Skunks that bite humans are treated as rabies suspects regardless of vaccination status, and health regulatory agencies often require euthanasia and rabies testing.
- Tranquilization (ketamine 11 mg/kg) is often advisable to facilitate a thorough, physical examination and sample collection, especially when handling very large or aggressive skunks.

BLOOD COLLECTION

- The preferred location for collecting a large blood sample from an unanesthetized skunk is the jugular vein.
- Cephalic veins may be used to obtain smaller samples.
- Blood can be collected from the cranial vena cava via the sternal notch approach.

ANESTHESIA

- Isoflurane or sevoflurane is administered via face mask or with an induction chamber. Intubation is relatively easy to perform.

MOST COMMON DISORDERS

- Malnutrition (obesity, metabolic bone disease)
- Hepatic lipidosis
- Dental disease
- Gastrointestinal parasites (roundworms [*Baylisascaris columnaris*], tapeworms)



Venipuncture can be performed from the cranial *vena cava* using the sternal notch approach.

Frank Krupka, DVM



The preferred location for collecting a large blood sample from an unanesthetized skunk is the jugular vein.

Frank Krupka, DVM

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BIOCHEMICAL REFERENCE RANGES*

Glucose	80-118 mg/dl
BUN	14.5-29.0 mg/dl
Creatinine	0.46-0.82 mg/dl
Total protein	5.9-8.0 g/dl
Albumin	2.7-3.7 g/dl
Total bilirubin	0.05-0.21 mg/dl
Alk phos	4.0-94 IU/L
ALT	28-266 IU/L
AST	55-155 IU/L
Cholesterol	105-171 mg/dl
Calcium	8.65-10.55 mg/dl
Phosphorus	3.6-7.0 mg/dl
Sodium	147-157 mEq/L
Potassium	4.5-5.5 mEq/L
Chloride	107-125 mEq/L
Globulin	2.87-4.67 g/dl

*Based on a study by Frank Krupka, DVM, Avon Lakes, OH, of 39 domestic skunks assessed to be normal on physical examination. Samples were submitted to Antech Diagnostic Laboratory (www.antechdiagnostics.com).

PARASITICIDES

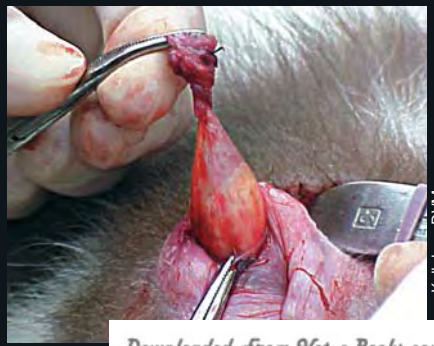
Fenbendazole	50 mg/kg/day PO x 5d
Piperazine	110 mg/kg PO, repeat in 14d
Mebendazole	5-10 mg/kg
Pyrantel pamoate	4.4 mg/kg PO, repeat in 14d

DESCENTING SKUNKS

- Guidelines should be followed from Fowler ME (ed): Zoo and Wildlife Medicine 2nd ed. WB Saunders Co, 1986, pp 807-809.
- This procedure should be done outdoors.
- Descenting should be done at as early an age as possible, because the larger the skunk, the larger the sacs.



Susan Kelleher, DVM



Susan Kelleher, DVM

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Skunks

- Ectoparasites (lice)
- Abscesses
- Cardiomyopathy
- Dermatitis
- Gastroenteritis
- Canine distemper
- Rectal prolapse in juveniles
- Seizures in juveniles (possibly related to hypocalcemia or hypoglycemia)
- Aleutian disease virus (ADV)

ZOONOTIC POTENTIAL

- Rabies
- *Baylisascaris procyonis, B. columnaris*

VACCINATIONS

- Exact vaccine requirements for pet skunks are unknown.
- Skunks are susceptible to canine distemper and rabies virus, and cases of clinical canine distemper have been reported.
- The Standardized Animal Care Guidelines for Mustelidae recommend that skunk vaccine protocols include canine distemper, feline panleukopenia, canine adenovirus, leptospira Bacterin C1 and rabies.
- Live and modified live distemper vaccines have been associated with rare vaccine-induced distemper.
- Distemper vaccines of mink or ferret origin should never be used in Mustelidae.
- Recombinant rabies and distemper vaccines (Merial, Inc., Athens, GA) are recommended for use in skunks.

- Studies on infectious diseases in wild animals indicate skunks are susceptible to canine adenovirus, and nearly all mammals are susceptible to leptospirosis.
- Researchers suspect skunks may be susceptible to feline panleukopenia.

FORMULARY

- Dosages for antimicrobials, parasiticides, fluids, cardiovascular medications and analgesics are commonly based on those used for dogs or ferrets.
- For other medications used to treat adult skunks, the clinician is advised to extrapolate dosages from those used with cats.

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Fennec Fox
Pet Care

Adapted from Exotic DVM, Volume 5.4 © Zoological Education Network, 2005

- Behavior, Anatomy, Vital statistics
- Sexing, Housing, Diet, Anesthesia
- Physical Exam, Common disorders
- Blood coll[illegible]c potential

Dan Johnson, DVM

Edited by
Peter Fisher, DVM

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Fennec Foxes

The fennec foxes (*Vulpes zerda*) are in the Order Carnivora, the family Canidae and the genus *Vulpes* (with the red fox, Arctic fox and 9 other species). Fennecs are found in the Sahara desert region of North Africa from Morocco and Niger to Egypt and Sudan. Fennec foxes are listed in Appendix II of CITES and are considered threatened in the wild.

PET POTENTIAL/BEHAVIOR

- Clean, have no odor and are relatively easy to care for.
- Engaging, social animals.
- Fennecs may require several hours of play time/exercise with the owner and are not considered a "lap pet."
- Fennecs are fastidious.
- Fennecs live in colonies of up to 10 individuals.
- When approached by someone, a fennec will normally cower, lay on its side, yelp, and wag its tail in a typical canine greeting display.
- When fennecs are content, purring may be observed.
- They can be taught to fetch, which can be a means of providing exercise.

ANATOMY AND PHYSIOLOGY

- The fennec fox is the smallest wild canid.
- It has the largest ears relative to body size in the dog family, measuring up to 6 inches (15 cm) in length.
- A heavily furred tail helps the fennec change direction quickly and keep it warm when it curls up to sleep.
- A fennec fox has the same dental formula as a dog.



VITAL STATISTICS

Body height (at the shoulder)	8 inches (20 cm)
Average body weight	2-3 lbs (1.0-1.5 kg)
Average life span	12-16 years
Normal body temperature	100.8°F (38.2°C)
Dental formula	I 3/3, C 1/1, PM 4/4, M 2/3
Respiratory rate (at rest)	23 bpm
Heart rate (at rest)	118 bpm
Sexual maturity	9-11 months
Breeding season	January/February
Gestation	49-63 days (51 avg)
Litter size	2-5

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"Love handles:" dorsolateral alopecia may appear on the vixen around the time of breeding.

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Fennec Foxes

- The pads of the feet are covered with fur, protecting them from heat and enabling the fennec to run in loose sand.
- Fennecs have exceedingly large tympanic bullae, emphasizing their dependence on hearing for predation.
- The fennec radiates body heat by dilating blood vessels in its feet and its large, vascular ears.
- The tapetum lucidum is well developed and the pupil is elliptical and vertically slit. Both characteristics are typical of nocturnal predators that hunt on a horizontal plane.
- Compared with other vulpines, the canines of fennec foxes are smaller, and their teeth are sharply cuspidate.

SEXING AND REPRODUCTION

- Fennecs are easy to sex; they have reproductive anatomy typical of canines.
- Fennecs are unusual among wild canids in that the female is seasonally polyestrous.
- Breeding pairs are monogamous and will peacefully coexist year round.
- Males urine-mark their territory during breeding season.
- Fennecs become very nervous and aggressive during breeding and rearing.
- To prevent neonatal deaths, disturbances should be avoided until the kits reach 3-4 weeks of age.
- In practice, kits are sometimes pulled at 10-12 days and hand-raised on a fox milk replacer such as Day One® Formula 35/32 (www.foxvalleynutrition.com).
- For hand-raised kits, solid food may be introduced at about 1 month, and weaning may occur as early as 6 weeks.

Fennec Foxes

HOUSING

- A ferret enclosure with shelves makes a suitable cage.
- Fennecs should be kenneled while unsupervised.
- Fennec foxes can easily climb out of fenced enclosures; therefore, the enclosure should be designed so the occupants cannot dig out or otherwise escape.
- Dusty cage substrates should be avoided.
- The enclosure should be placed in a low humidity, well-ventilated environment.
- Free-ranging fennecs practice site-specific defecation and, therefore, can be litter box trained.
- Because of their digging habits, a covered litter box is recommended. Regular clay litter is preferable.
- Fennecs can be leash- or harness-trained but can easily escape from either if startled; a crate is preferable.
- While fennecs are primarily nocturnal, they also enjoy basking in the sun.
- Fennec foxes will shiver when the ambient temperature drops below 68°F (20°C).

DIET

- The diet of free-ranging fennecs includes plant material, fruits, small rodents (gerbils, jerboas), birds, eggs, lizards and insects (locusts). Plant roots are a source of water.
- In captivity, the staple diet should be a completely formulated diet, such as high-quality dog or cat food.
- Mazuri Exotic Canine Diet® (www.mazuri.com) is widely used for this species.
- The diet may be supplemented with vegetables, fruits, rodents, eggs, crickets and mealworms if necessary.



Fennecs can easily climb out of fenced enclosures if not properly secured.

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Blood is sampled from the cephalic vein.



A fennec fox is given a physical exam.



HEMATOLOGIC REFERENCE RANGES	
WBC	2.6-12.45 x $10^3/\mu l$*
RBC	5.7-10.5 x $10^6/\mu l$*
Hct	34-59%*
Hgb	10.4-21.1 g/dl*
Segs	1.439-5.958 x $10^3/\mu l$
Lymph	0.6-8.217 x $10^3/\mu l$*
Mono	0.026-0.557 x $10^3/\mu l$*
Eosin	0.078-1.161 x $10^3/\mu l$*
Baso	0-0.092 x $10^3/\mu l$†
Plate	210-866 x $10^3/\mu l$†

* Houston Zoological Gardens, 2002
† ISIS Reference Values, 1999

BIOCHEMICAL REFERENCE RANGES	
Total protein	4.2-7.4 g/dl†
Albumin	2.1-4.5 g/dl†
Glucose	88-188 mg/dl*
BUN	11-31 mg/dl*
Creatinine	0.4-0.9 mg/dl*
Glob	1.4-4.2 g/dl†
Potassium	3.1-6.9 mEq/L†
Chloride	102-126 mEq/L†
Phosphorous	1.6-9.3 mg/dl†
Calcium	8.4-11.0 mg/dl*
ALT	35-162 IU/L*
AST	33-150 IU/L*
Alkaline phos	16-142 IU/L*
Cholesterol	10-80 mg/dl
Total bilirubin	0.1-0.3 mg/dl*
CK	

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Fennec Foxes

- Raw meat may be added for variety; raw meat must be handled with care to avoid bacterial growth.
- Feeding raw meat without bone/calcium supplementation may result in nutritional secondary hyperparathyroidism.
- Nebraska Bird of Prey Diet® (www.nebraskabrand.com) contains supplements and is used for this purpose.
- Fresh water should be provided at all times.

ANESTHESIA

- A useful anesthesia protocol includes induction with ketamine (5.5 mg/kg) and diazepam (0.28 mg/kg) followed by isoflurane for maintenance.

BLOOD COLLECTION

- Veins most suitable for blood collection are the jugular, cephalic and lateral saphenous.
- Canine restraint methods are used.

PHYSICAL EXAM/PREVENTIVE CARE

- Physical exam should include a fecal exam for internal parasites and a discussion of diet and husbandry.
- Rabies vaccination (IMRAB®* - Merial) is not legally recognized, but it will protect foxes and the public.
- Canine distemper virus, canine parvovirus and canine hepatitis virus vaccination (Recombitek-C4®* - Merial)
- Flea control (Advantage®* - Bayer)
- Canine heartworm preventive

**All vaccinations and medications are extra-label use*

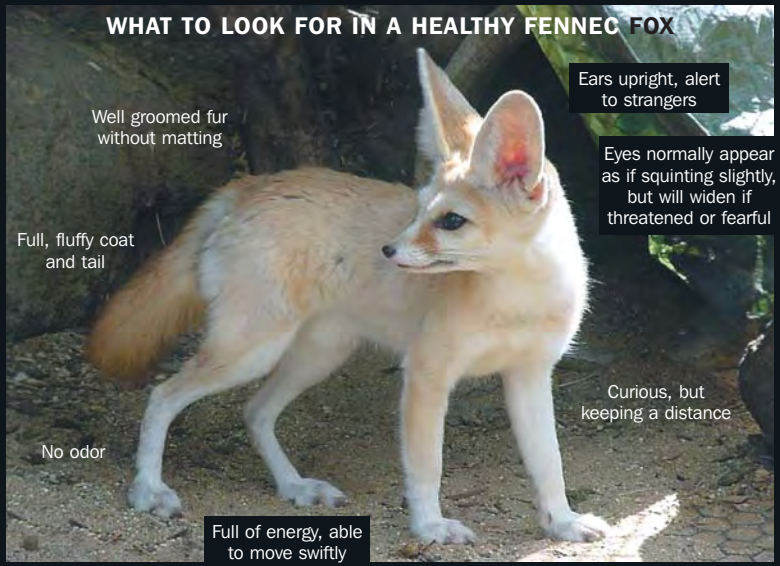
Fennec Foxes

MOST COMMON DISORDERS

- Trauma (bite wounds)
- Neonatal death (nervous mothering)
- Neoplasia
- Renal disease (nephritis)
- Liver disease (hepatitis, neoplasia)
- Cardiomyopathy
- Pneumonia
- Dermatopathies (dermatophytes, mites, otitis)
- Fleas
- Conjunctivitis
- Corneal lesions (foreign body)
- Glaucoma
- Histoplasmosis
- Intestinal parasites

ZOONOTIC POTENTIAL

- Tuberculosis
- Rabies
- Leishmaniasis



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Nonhuman Primates
Pet Care

Adapted from Exotic DVM, Volume 4.5 © Zoological Education Network, 2005

- Behavior, Housing, Diet
- Common disorders, Vaccinations
- Zoonotic potential, Physical exam
- Dental exa

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Cathy A. Johnson-Delaney, DVM, Dipl ABVP-Avian Practice

Edited by **Peter Fisher**, DVM

Nonhuman Primates

Regulations concerning privately-owned primates: Foreign Quarantine Regulation 42 (CFR Part 71.53, implemented by CDC), Animal Welfare Act (implemented by USDA) USFW, CITIES, IATA and local animal control regulations

PET POTENTIAL/BEHAVIOR

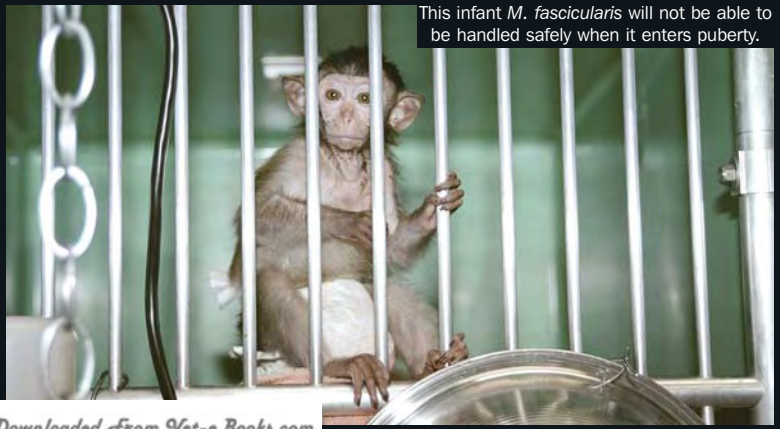
- Nonhuman primates (NHP) make unsuitable pets and are one of the most difficult animals presented to the small animal practitioner.
- The practitioner must not only be familiar with the dietary, husbandry, regulatory, psychological and health care needs of the particular species presented, but also must have a thorough background in zoonoses and public health risks to be able to educate the owner as well as to protect staff, other clients and patients.
- The Animal Welfare Act defines guidelines for caging, sanitation, general husbandry, diet, veterinary care and psychological well-being of nonhuman primates, including mandatory socialization with other primates.
- Malnutrition and stereotypical behaviors are frequent problems presented to the practitioner.
- Macaques should never be kept as pets.

HOUSING

- Optimal caging should be specifically designed for NHPs; it should be strong, escape-proof and easy to clean.
- Habitats should provide hiding places, perches and for many, nest boxes.

NONHUMAN PRIMATES POTENTIALLY SEEN IN PRACTICE

Scientific Name	Common Name
Lemur, Eulemur sp.	Lemurs
Galago, Otolemur sp.	Bushbabies
Cebus sp.	Capuchins
Saimiri sp.	Squirrel monkeys
Callithrix sp.	Marmosets
Saguinus sp.	Tamarins
Ateles sp.	Spider monkeys
Aotus sp.	Owl monkeys, dourocoulis
Macaca fascicularis	Java, crab-eating, cynomolgus macaque
Macaca fuscata	Snow monkey, Japanese macaque
Macaca mulatta	Rhesus macaque
Cercopithecus, Chlorocebus sp.	African green monkey, vervet, guenon
Papio sp.	Baboons
Colobus guereza	Black and white colobus
Hylobates sp.	Gibbons
Pan troglodytes	Chimpanzee



This infant *M. fascicularis* will not be able to be handled safely when it enters puberty.

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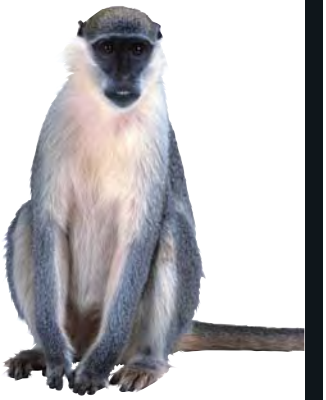
Capuchin



Chimpanzee



Vervet



Baboon



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Nonhuman Primates

- Most NHPs should be kept fairly warm (65-80°F [18-26°C]) with humidity ranging between 55-70%, although many New World monkeys require 70-80% humidity.
- A squeeze back cage is desirable, and an owner should be encouraged to have at least a small squeeze cage to use as a hospital cage in an emergency situation.
- A transfer box with a guillotine-type door, rather than the conventional kennel carrier for dogs, is recommended.
- Environmental enrichment facilitates adequate exercise and allows for socialization with other primates.

DIET

- There are many commercial diets (Mazuri® Primate Diet, www.mazuri.com) available that may be minimally supplemented with fresh produce or specialized foods such as nectars, gums or live insects.
- Diets have been formulated for the major orders: New World formulas, Old World formulas, Marmoset jelly (gum replacement) and Leaf-eater diet (*Colobus*, langurs).
- Commercial formulations should form the basis of the diet and, in most cases, be 80-90% of the daily intake.
- Offering human foods to the NHP is not recommended.
- All NHPs require vitamin C supplementation at a dosage of at least 1-4 mg/kg body weight daily. Either vitamin C chewable tablets or fresh fruit are recommended.
- Although primate chows contain supplemental vitamin C, most have a shelf life of only 90 days.
- New World primates require vitamin D_3, while Old World primates can metabolize vitamin D_2. The majority of commercial diets made for NHPs contain vitamin D_3.
- Most adult primates consume 3-5% of their body weight

daily; however, many waste a great deal of food, and a greater quantity of food may need to be offered, preferably divided into 2-3 meals per day.

- Animals currently eating only table foods may be converted to commercial chows by soaking the biscuits in juice or milk or by pulverizing the biscuit and mixing it with table foods. The biscuit amount are gradually increased.
- Offering food only twice daily and removing uneaten portions with no between-meal snacks will expedite diet conversion by ensuring that the animal is hungry when the proper food is presented.
- Fresh water should be available at all times.

PHYSICAL EXAMINATION

- History (review diet, husbandry, reproductive patterns and behavioral observations)
- Physical examination (including dental and weight)
- CBC, serum chemistries, serology
- Fecal wet mount/flotation to check for parasites; fecal/rectal culture
- TB testing

DENTAL EXAMINATION

- The dental examination should include evaluation of all teeth, periodontal and gingival assessment performed with a dental probe, dental radiographs, scaling of calculus followed by polishing of tooth surfaces, and fluoride treatment to repair and strengthen the enamel.
- Caries, gingivitis, periodontitis and dental abscesses present as they do in other species.

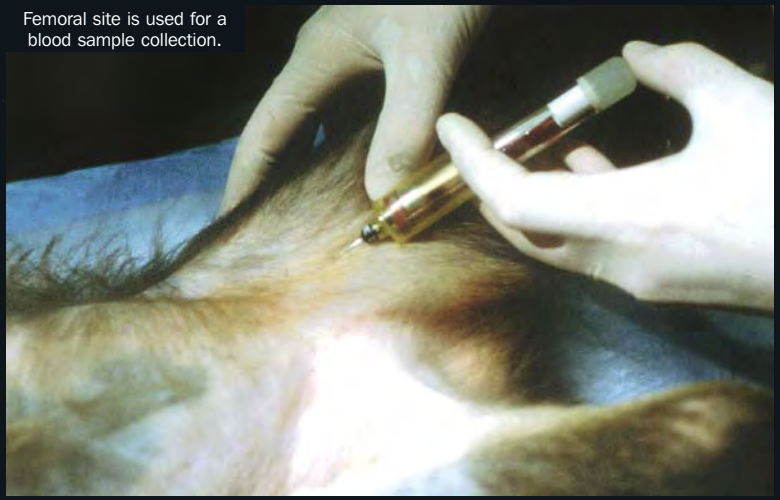


Squirrel monkey in squeeze-cage at a clinic.

SOME ETIOLOGIES OF DIARRHEA

Bacterial	Parasitic	Viral	Other
▶ *Campylobacter* sp. ▶ *Shigella* sp. ▶ *Salmonella* sp. ▶ *E. coli* (β-hemolytic with endotoxins) ▶ *Yersinia* sp. ▶ Flora imbalance/ bacterial overgrowth ▶ Clostridial entero-	▶ *Strongyloides* sp. ▶ *Oesophagostomum* sp. ▶ Pinworms (*Enterobius* sp.) ▶ *Trichuris hominis* ▶ *Entamoeba histolytica* ▶ *Balantidium* sp. ▶ *Giardia* ▶ *ium*	▶ Reovirus ▶ Rotavirus ▶ Retroviruses causing lymphadenopathies within the GI tract ▶ Hepatitis A (rarely)	▶ Inflammatory bowel disease ▶ Diverticulosis ▶ Food allergies (gluten or lactose intolerance) ▶ Stress-induced hypermotility ▶ Malabsorptive pancreatic conditions

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Femoral site is used for a blood sample collection.

VACCINATIONS (All Extra-label Use)

Vaccine	Species	Frequency
Trivalent oral poliovirus	Great apes	Follow human pediatric per vaccine
Tetanus	All species (except *Callitrichidae* – do risk assessment)	2,4,6,18 months of age; repeat at 4-6 years of age, then every 10 years; also if injured per human recommendations
Measles	All species	15 months of age, repeat at 10 years of age
Rabies	All, if housed outdoors, endemic area	Unproven with killed small animal vaccines or with human diploid. Titer levels may be helpful.

Vaccines: human ones are obtained through your local human pharmacy or pediatrician contacts. Consult current PDR for brand names.

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Nonhuman Primates

SEDATIVES USED TO ENABLE EXAMINATION

- Ketamine hydrochloride (5-10 mg/kg IM) or Telazol® (2-6 mg/kg IM)
- Atropine sulfate (0.02-0.04 mg/kg IM) to prevent hypersalivation
- Inhalant anesthetic (isoflurane/sevoflurane) if longer or deeper sedation is required. Isoflurane may be delivered via endotracheal tube or mask (for short-term, non-oral).

MOST COMMON DISORDERS

- Gastroenteritis (see box, at right)
- Tuberculosis (TB)
- Periodontal disease
- Vitamin D_3, vitamin C deficiency
- Obesity
- Trauma due to fighting
- Hyperthermia
- Fungal diseases
- Lentiviruses
- Retroviruses
- Parasites
- Anemia

ZOONOTIC POTENTIAL

- Care must be taken during oral examination and dental procedures to protect the clinical staff from potential zoonoses, most notably B virus (Cercopithecine herpesvirus 1, Herpes B), especially in macaques.
- B virus (Cercopithecine herpesvirus 1) is carried only by *Macaca* sp. (macaques) and has been isolated from many macaques, such as *M. fascicularis, M. mulatta, M.*

nemestrina, M. arctoides, M. nigra and *M. fuscata*.

- Infection with B virus is usually subclinical or may cause minimal oral ulcers in macaques.
- All pet macaques should be serologically tested for B virus and always examined closely for mucosal ulcers.
- NHPs with B virus lesions are shedding the virus and pose a risk to humans. B viral infection may cause a fatal encephalitis in a human. Shedding is intermittent, and cultures of the conjunctival sacs and buccal surface should be taken if there has been a bite or scratch.
- The human should follow recommendations for a 15-minute scrub of a wound. A swab should also be submitted for viral culture, and a serum sample should be collected for antibody titer (ELISA and IFA). All samples (human and monkey) should be submitted to the NIH B virus laboratory for testing (Viral Immunology Center, Atlanta, GA, 404-651-0808, www.gsu.edu/bvirus).
- Other notable zoonoses include; salmonellosis, campylobacteriosis, shigellosis, giardiasis, tuberculosis, monkeypox and cryptosporidiosis.

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TUBERCULOSIS (TB) TESTING

For all primates (although many species of New World monkeys are more resistant to infection)

- Sites: Alternating eyelids or abdominal site just off umbilicus (must be palpated daily to read)
- OT (mammalian tuberculin) - 0.1 ml intradermally via a 25- to 27-ga tuberculin needle and syringe
- Read: 24, 48 and 72 hours
- Negative: no bruising, erythema or swelling at the injection site; no palpable induration if abdominal site is used
- Positive: erythema and/or edema persisting at the injection site for 48 hours or longer. A suspicious test should be repeated 7 days later in the opposite eyelid or at the abdominal site.





Swelling is apparent if you look at the aperture of the eye.

If an animal clearly tests positive, public health officials should be consulted, and all humans who have been in contact with the animal should be tested immediately. Although chest radiographs of the monkey may be helpful, palpable femoral lymph nodes, intra-abdominal lymphadenopathy and/or splenomegaly may be more conclusive. At this time, treatment of the NHP is not recommended because of the public health danger and potential resistance to medications.

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Pionus Parrot
Pet Care

Adapted from Exotic DVM, Volume 3.2 © Zoological Education Network, 2005

- Vital statistics, Behavior
- Sexing, Housing, Diet
- Blood collection and injection sites
- Common d[illegible]notic Potential

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Pionus Parrots

Although free-ranging pionus parrots are found in plentiful numbers in Mexico, Central America and South America, for the pet market they are captive-bred in aviaries. The blue-headed (*Pionus menstruus*), white-crowned or white-capped (*P. senilis*) and Maximilian's or scaly-headed (*P. maximiliani*) are the most common pionus species, with bronze-winged (*P. chalcopterus*) and dusky (*P. fuscus*) close behind.

PET POTENTIAL/BEHAVIOR

- Relatively small parrots.
- Calm, gentle dispositions.
- Not as noisy as larger parrots.
- May not seek or accept much handling or cuddling.
- Independent, but do like to be with their owners.
- Maximilian's believed to be the most calm and easy-going pionus species, while the white-capped may be more feisty and single owner-oriented.
- Capable of making loud vocalizations, especially in the early morning and late afternoon.
- Pionus are considered intelligent birds that have some ability to mimic words and sounds; however, they may speak in an exceptionally soft voice.
- Males are believed to be more vocal than females.
- Although generally sweet by nature, some individuals may be aggressive.
- When a pionus is feeling feisty, it will "strut," fanning its tail feathers and raising the head feathers as it slowly stalks back and forth; it may bite if approached.



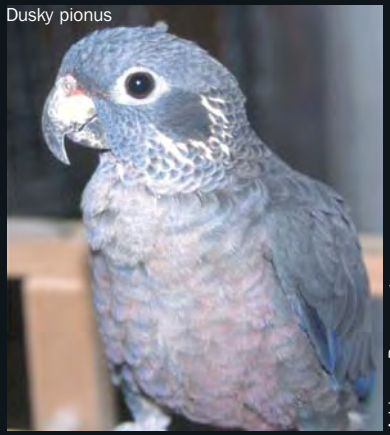
Greg J. Harrison, DVM, Dipl Emeritus ABVP-Avian, Dipl ECAMS

VITAL STATISTICS

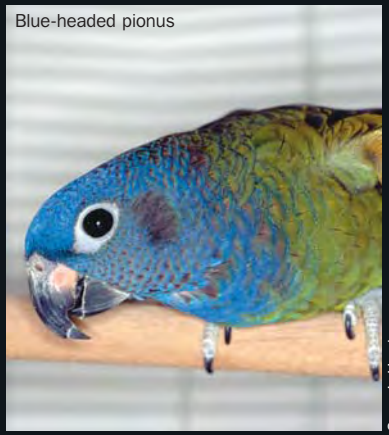
Life span	maximum	25-30 years
	avg in captivity	6-10 years
Body length white-crowned and dusky	11-11.5 inches (28-29 cm)	9.5 inches (24 cm)
Body weight		180-255 g

Age of sexual maturity	1.5-4.0 years; breed 1-2 times per year
Clutch size	3-4 avg
Incubation	26 days avg
Weaning	9-10 weeks avg

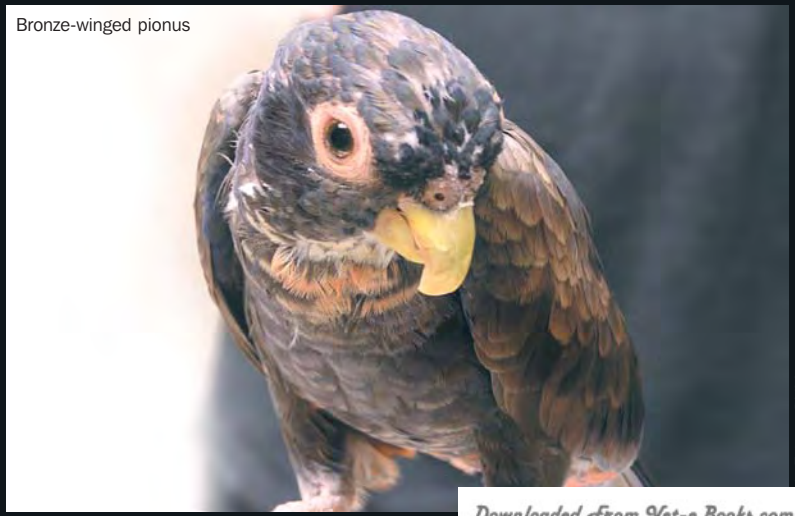
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Dusky pionus

Adrienne Rappaport


Blue-headed pionus

Greg J. Harrison


Bronze-winged pionus

Cindy Fulton, DVM

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Pionus Parrots

- The breeding season may alter the personality of a pet bird, making it a little more aggressive than it would be at other times of the year.
- A bird protecting its mate (real or perceived) may bite.
- Like all parrots, pionus are messy and tend to fling food and other items out of their cage.
- Excessive screaming, feather plucking and poor appetite may be signs of a stressed or poorly socialized bird.
- Unique among parrots, when pionus individuals are alarmed, frightened or upset, they exhibit behaviors that may be misinterpreted as clinical signs of respiratory disease: wheezing, rattling, low growling, hyperventilating and labored breathing. These signs disappear when the bird once again feels secure.
- Pionus parrots also have a distinctive musky odor, which is generally most evident during the breeding season.
- It is recommended that the owner provide a consistent amount of interaction and enrichment time.
- Physical enrichments include increased physical complexity within the cage. Foraging enrichments require the parrots to chew and sort through, open, and/or manipulate objects to get to food.
- Pionus should be encouraged to interact with people to reduce the possibility of possessive attachment.
- To maximize socialization, the bird should be exposed to many new stimuli when it is young.

SEXING

- Pionus are monomorphic so sexing must be determined via endoscopy (preferred if breeding) or DNA sexing.

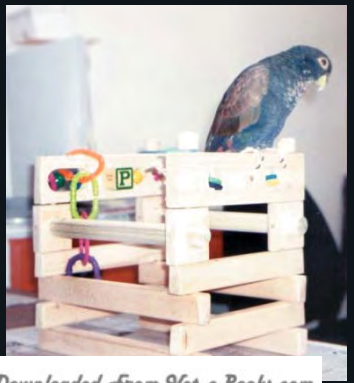
- The distinctive coloration of each species is not fully appreciated until adulthood.

HOUSING

- The enclosure should be as large as possible — minimum of 20 x 24 x 40 inches (50 x 60 x 100 cm) — with enough space for the bird to freely flap its wings.
- Bar spacing should be 7/8" (2.2 cm) for most pionus species. Small birds, such as duskies and white-caps, should have no more than 3/4" (1.8 cm) space between bars to prevent the bird's head from becoming stuck.
- Newspaper is a suitable substrate in the cage tray so the droppings may be monitored.
- Wood and rope-type toys provide proper outlets for their energy and curiosity.
- A variety of toys, including foraging or puzzle toys, will improve environmental enrichment.
- Abundant branches and extra wood for chewing should be added to the enclosure.
- Free-flying pionus should be protected from common household dangers: glass windows and doors, mirrors and glass-fronted picture frames (if frightened, the bird may fly into the reflection); open doors, ceiling fans, hot cooking oils/pots and pans, open containers of water (toilets), toxic houseplants, dogs, cats, children.
- Caged pionus should be protected from potential toxins: cigarette smoke, overheated nonstick (polytetrafluro-ethylene-coated) cookware, chocolate, avocado, salt, alcohol, pesticides, toxic fumes, easily dismantled toys, sources of lead or zinc, sandpaper-covered perches.



Adrienne Rappaport



Adrienne Rappaport



Adrienne Rappaport

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HEMATOLOGY REFERENCE RANGES

WBC	4.0-11.5 x $10^3/\mu l$
RBC	2.4-4.0 x $10^3/\mu l$
Hct	35-47%
Hemoglobin	11-16 g/dl
MCV	85-210 fl
MCH	26-54 pg
MCHC	24-31 g/dl
Heterophils	50-75%
Eosinophils	0-2%
Basophils	0-1%
Monocytes	0-2%
Lymphocytes	25-45%

BIOCHEMICAL REFERENCE RANGES

AST	150-365 U/L
Calcium	7.0-13.5 mg/dl
Cholesterol	130-295 mg/dl
Creatinine	0.1-0.4 mg/dl
Glucose	125-300 mg/dl
Phosphorous	2.9-6.6 mg/dl
Potassium	3.5-4.6 mmol/L
Sodium	145-155 mmol/L
Total protein	3.2-4.6 g/dl
Uric acid	3.5-10 mg/dl

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DIET

- Numerous high quality formulated diets are commercially available and should make up 80% of the bird's diet.
- Diet may be supplemented with high vitamin A-containing dark green or dark orange-colored vegetables, such as carrots, sweet potatoes, pumpkin, yellow squash, escarole, collards and parsley, or fruits, such as cantaloupe, apricots and papaya.
- Seeds and table foods should be avoided or severely limited in order to prevent the incidence of atherosclerosis and fatty liver disease.
- Grit is not necessary.
- Because birds are sensitive to pesticides and other chemicals, organic products should be considered.
- Drinking water may be provided in an open dish or a sipper tube. Water should be changed daily.
- Pionus like to dunk their food and make "soup" in their water bowls, so the water must be changed as often as necessary to keep it fresh. Or, the food and water may be placed at opposite ends of the cage.

BLOOD COLLECTION AND INJECTION SITES

- Right jugular vein
- IM - pectoral muscles
- IV - right jugular vein
- SC - between shoulders, inguinal region

MOST COMMON DISORDERS

- Obesity/malnutrition
- Bacterial infections
- Aspergillosis

- Chlamydiosis
- Young birds purchased unweaned or from questionable sources may be at risk for other contagious diseases, such as polyomavirus.

ZOONOTIC POTENTIAL

- Chlamydiosis
- Tuberculosis (*Mycobacterium avium, Mycobacterium genovense* most common)
- Campylobacteriosis
- Colibacillosis
- Salmonellosis
- Allergic alveolitis
- Avian influenza
- Newcastle disease (paramyxovirus 1)

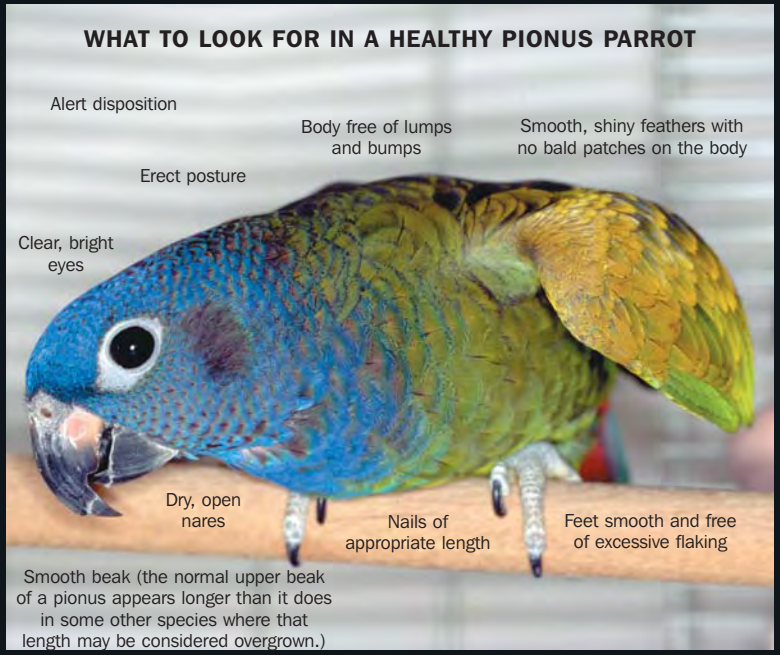
MAINTENANCE

- Frequent baths, showers or misting are recommended.*
- Some clipping of the wing feathers may be recommended to limit flying ability, altitude and speed.

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*AVIx - www.avi-x.com



The pionus parrot may be used as a model for other psittacines for many husbandry issues.

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Canary Pet Care

Adapted from Exotic DVM, Volume 7.1 © Zoological Education Network, 2005

- Vital statistics, Behavior, Sexing
- Housing, Diet, Physical examination
- Sample collection, Injection sites
- Common d[illegible]notic potential

Peter Coutteel, DVM

Edited by
Peter Fisher, DVM

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Canaries

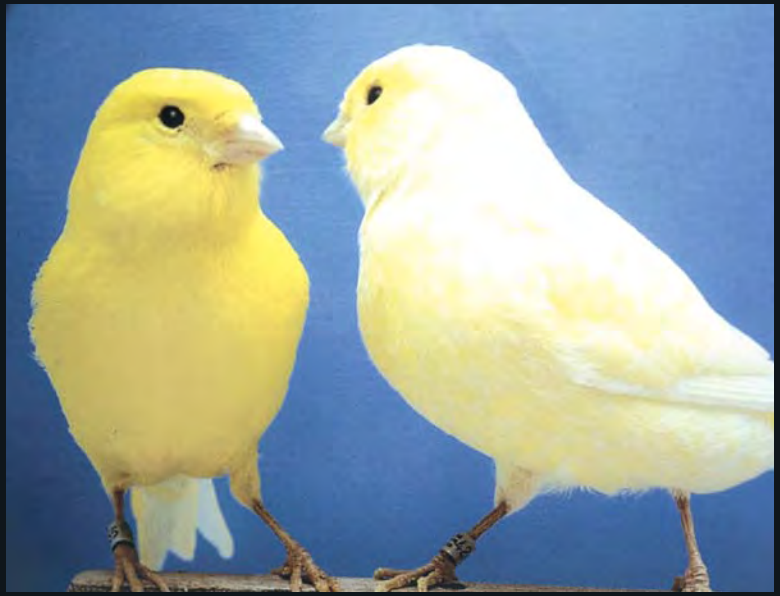
Spanish monks in monasteries on the Canary Islands first started breeding canaries (*Serinus canarius*) as far back as 1402. Today's canary fanciers pursue a wide range of activities, including preserving old and rare breeds as well as breeding new color mutations.

PET POTENTIAL/BEHAVIOR

- Tidy, nondestructive.
- Relatively easy to care for.
- Require a minimum of space.
- Not considered social birds.
- Considered "skittish," they will fly away when approached.
- Color variations, size, shape characteristics and feather traits are the basis of their appeal.
- Canaries may not be ideal pets for children because they do not like to be handled.
- Appreciated most for their pleasant melodious song.

SEXING AND REPRODUCTION

- The caudal end of each ductus deferens in males forms a mass called the seminal glomerulus. During the breeding season, the seminal glomeruli push the cloacal wall into a "cloacal promontory."
- Females have a flatter vent.
- Males are more vocal and usually sing best in the spring in response to an endogenous surge of testosterone.
- A photoperiod of at least 14-15 hours of light is necessary to initiate breeding behavior.



VITAL STATISTICS

Life span	avg captive	5-9 years
	maximum	25 years
Body length		4-7 inches (11-18 cm)
Body weight		12-30 g
Body temperature		105.8°F (41°C)
Water consumption		200-300 ml/kg BW/day
Food consumption		Up to 30% BW/day

Heart rate	Resting	265-325 bpm
	Restraint	400-600 bpm
Respiratory rate	Resting	60-80 bpm
	Restraint	80-120 bpm
Age of sexual maturity		5-8 months
Eggs per clutch		4-7
Incubation		12-14 days
Fledging		11-17 days

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Breeding cage separates youngsters from the breeding pair.



Young canaries are placed in an exercise flight with multiple perches to reduce the incidence of aggressive picking.



An indoor breeding facility for color canaries provides outside hanging nest boxes.



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Canaries

HOUSING

- One bird kept as a single pet will be content.
- Males must be housed separately from other males to prevent fighting, but they may be kept within visual or auditory range to stimulate singing.
- Group housing for mixed ages and sexes will work only if the cage has sufficient perches and feeding stations.
- Housing for a pet canary should be indoors or protected by mosquito screening if placed outdoors.
- The cage size should be at least 10 x 10 x 18 inches (25 x 25 x 46 cm) or 20 x 16 x 16 inches (50 x 50 x 40 cm).
- The cage setup should be clean, secure, safe and easy to service.
- Suitable substrates include newspaper, butcher paper and plain brown paper.
- One should avoid using pressure-treated wood, cedar or redwood cage substrates as well as synthetic fibrous nesting material or fine thread in the nest box.
- Natural materials are preferred for lining nests: sisal (from *Agave* cactus), cotton fibers, moss or jute.
- Ideal environmental temperature is greater than 59°F (15°C); ideal relative humidity is 60-80%.

ENVIRONMENTAL ENRICHMENT

- Canaries spend a great deal of their time eating and flying from perch to perch, and multiple, small-diameter, fresh, nontoxic, pesticide-free branches are necessary.
- Canaries enjoy taking a daily bath; a bathing area should be available away from the feeding area.
- During the breeding season, nest pans made of plastic, stone, wood or wire with holes should be provided.

Canaries

- If there is a continuous source of stress in the canary's environment, the bird's feathers will not molt properly.

DIET

- Canaries are primarily seed-eating birds; however, a diet consisting of only seeds may lead to nutritional deficiencies.
- The recommended captive diet consists of high-quality, toxin-free, canary-specific formulated foods with limited offerings of finely chopped vegetables and fruits and fresh, pesticide-free seed mixtures as treats. This diet reduces the incidence of obesity and cardiac disease.
- Soluble "grit," such as cuttlefish bone (*Sepia* spp.), oyster shell, limestone (calcium carbonate), marble (crystalline limestone) or gypsum (calcium sulfate), offers a good calcium source and is usually completely digested.
- Vitamin/mineral supplements should be applied to moist food rather than added to seeds or drinking water.
- During reproduction and molting, a high-protein commercial or homemade "egg food" may be offered in limited quantities.
- Clean, fresh water must be provided daily.

PHYSICAL EXAMINATION

- An annual veterinary visit should consist of a discussion of any history of illness, physical examination, a CBC, fecal examination (wet mount, flotation) and an examination for parasites of the feathers with magnification and the trachea via transillumination with a penlight.
- The bird should be weighed in a paper box, bag or pan with a lid.

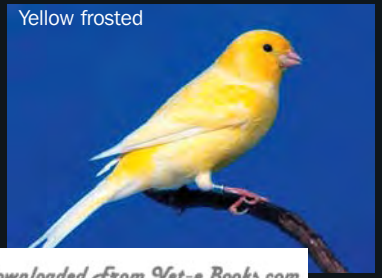
SOME COMMON CANARY VARIATIONS













Common canary variations photos provided courtesy of Johan Van der Maelen

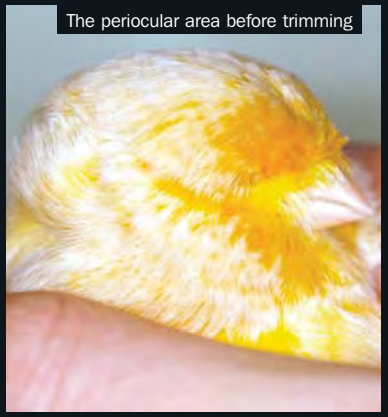
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FEATHER TRIMMING

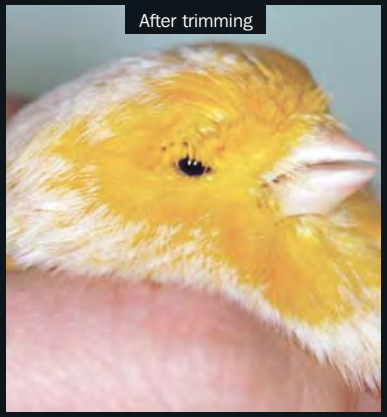
In heavily feathered birds, it is necessary to trim some feathers prior to the breeding season.



Trimming around the vent



The periocular area before trimming



After trimming

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Canaries

- Feathers: state of the molt, presence of any external parasites, broken feathers and feather discoloration
- Wings and legs: skeletal deformities, fractures, irritation or constriction from leg band, lacerations or feather cysts
- Feet and toes: hyperkeratosis, pox lesions and signs of pododermatitis
- Respiratory sounds: crackles, wheezes, sneezing, moist clicks, increased respiratory effort
- Eyes, ears and nares: exudate, crusts, pox lesions, cataracts or sinusitis
- Oral mucosa and tongue: whitish plaques may indicate candidiasis, bacterial infection or trichomoniasis.
- Keel (part the feathers): straight keel, evaluate the pectoral muscles for mass, color (pallor may indicate anemia) and the presence of fat.
- Skin: dehydration makes the skin appear red. Red factor canaries may have a normal red coloration due to ß-carotene and canthaxanthine in the food.
- Abdomen (part the feathers): enlarged liver, dilatation of the GI tract, ascites and urine in the cloaca.
- Overgrown nails should be trimmed.

SAMPLE COLLECTION

- Fecal examination: A direct wet mount of fresh, warm stool for *Cochlosoma, Giardia*, *Candida, Macrorhabdus* (avian gastric yeast), bacteria, plant material, chitin skeletons, urates and powder down feathers.
- Crop swabs: A crop swab can be obtained by using a cotton-tipped applicator moistened in saline or by flushing 0.2 ml saline into the crop (using a syringe and small feeding needle) then applying gentle negative

pressure. A warm wet mount can reveal the presence of *Trichomonas, Candida, Macrorhabdus* or bacteria.

- Bacteriology: Samples for bacteriology may include feces, a cloacal swab, nasal discharge or a skin swab.

VACCINATION

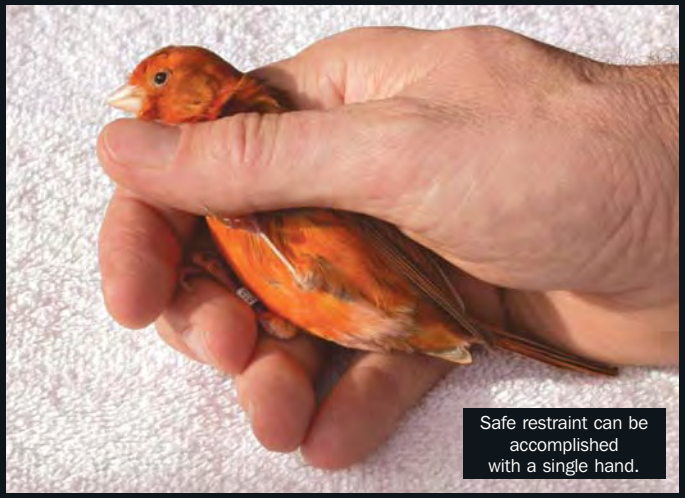
- The wing web is the site for administering pox vaccine in canaries and closely-related birds (Poulvac® P-Canary by Fort Dodge Laboratories is available in Europe; Poximune C® MLV Canary Pox Vaccine by Biomune in the US).
- The vaccination site is checked after 8-10 days; a white spot at the site indicates a successful "take," and the bird should be protected for 6 months.

BLOOD COLLECTION

- The right jugular vein is the best site for blood collection.
- The medial metatarsal vein or cutaneous basilic vein often provides inadequate sample volumes, although a skin-prick technique accessing the above sites or the external thoracic vein can be used to obtain a drop of blood for microscopic evaluation.
- One should avoid creating a hematoma, as it may result in significant extravascular blood loss.
- Numbers of lymphocytes, the predominant leukocyte, tend to increase in stress-related conditions.

INJECTION SITES/THERAPEUTIC ROUTES

- IV: Right jugular vein; maximum IV bolus of fluid is 0.5 ml administered very slowly.
- IO: Use a 26-ga needle as a cannula.
- IM: Use a 25-ga needle in the cranial third of the



Safe restraint can be accomplished with a single hand.



The right jugular vein in a canary is used for blood sampling.

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REFERENCE RANGES

BIOCHEMISTRY	
Alk phos (U/L)	20-135*
ALT (U/L)	5-11*
AST (SGOT) (U/L)	145-345*
Amylase (U/L)	190-485*
AP (IU/L)	146-379**
BUN (mg/dl)	3-5*
Ca (mg/dl)	5.5-13.5*
Chol (mg/dl)	150-400*
Creat (mg/dl)	0.1-0.4*
CO_2 (mmol/L)	14-26*
CPK (U/L)	55-350*
GGT (U/L)	1-14*
Glu (mg/dl)	205-435*
LDH (U/L)	120-450*
Lipase (U/L)	29-255*
Phos (mg/dl)	2.9-4.9*
P (mmol/L)	0.52-1.81**
K (mmol/L)	2.2-4.5*
Na (mmol/L)	135-165*
Total bili (mg/dl)	0-0.1*
Total protein (g/dl)	2.8-4.5*
Triglycerides(mg/dl)	60-265*
Uric acid (mg/dl)	4-12*
Bile acids (μmol/L)	23-90*
T_4 (μg/dl)	0.3-1.8*
Pre-albumin (g/dl)	0.35-0.98*
Albumin (g/dl)	0.81-1.23*
Alpha-1 (g/dl)	0.08-0.16*
Alpha-2 (g/dl)	0.05-0.22*
Beta (g/dl)	0.3-0.71*
Gamma (g/dl)	0.16-0.63*
A/G ratio	1.3-4.5*

HEMATOLOGY	
WBC x $10^3/\mu$l	4-9*
RBC x $10^6/\mu$l	2.5-3.8*
PCV (%)	45-60**
Hct (%)	40-49*
Hets (%)	50-80*
Eos (%)	0-2*
Baso (%)	0-1*
Monos (%)	0-1*
Lymphs (%)	20-45*

*University of Miami, Avian and Wildlife Laboratory.
**Altman RB, et al.[4]

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pectoral muscles; apply negative pressure prior to injecting; apply pressure after injection to reduce risk of intramuscular hemorrhage.

- SC: Use 27-30 ga needle; fluids administered via this route may not be absorbed if the bird is moderately dehydrated or hypothermic.
- Tube feeding: Gavage 0.1-0.5 ml q4h if the crop is empty, often in combination with medication.
- Oral: Suspensions may be given using a blunt cannula.

MOST COMMON DISORDERS

- Acute dyspnea (inhaled seed)
- Arthropods (air sac mites, feather mites, scaly mites)
- Bacterial infections/septicemia
- Baldness or other feather abnormalities
- Infection with *Campylobacter fetus* subsp. *jejuni*
- Canary poxvirus infection
- Cataracts
- Circovirus infection (“black spot” disease) in hatchlings and nestlings
- Coccidiosis (*Isospora canaria, Atoxoplasma serini, Cryptosporidium*)
- Colisepticemia
- Constricted feet and digits (leg band too small, thread or small linear foreign body), hyperkeratosis (older birds), wart-like skin masses (“tasselfoot”) from papillomavirus
- Egg binding
- *Enterococcus faecalis* associated with chronic tracheitis and dyspnea
- Feather cysts
- GI flagellates (*Cochlosoma, Trichomonas, Giardia*)

- Internal parasite infections (cestodes in the family Anoplocephalidae)
- Mycotic infections (candidiasis, macrorhabdosis, dermatomycosis, aspergillosis)
- Nutritional problems
- Obesity, fatty tumors
- Salmonellosis
- Toxicosis from inhaled toxins
- Trauma (wing and lower leg fractures)
- Yersiniosis (*Y. pseudotuberculosis*)

ZOONOTIC POTENTIAL

- Chlamydiosis
- Tuberculosis (*Mycobacterium avium, Mycobacterium genovense* most common)
- Colibacillosis
- Salmonellosis
- Allergic alveolitis

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WHAT TO LOOK FOR IN A HEALTHY CANARY



The canary may be used as a model for other passerines for many husbandry issues.

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Swan Pet Care

Adapted from Exotic DVM, Volume 2.1, © Zoological Education Network, 2005

- Behavior, Anatomy, Vital statistics
- Sexing, Housing, Diet, Restraint
- Blood collection, Common disorders
- Physical e[boilerplate: Downloaded From Vet-eBooks.com] potential

Gwen Flinchum, DVM

Edited by
Peter Fisher, DVM

Swans

Swans are the largest waterfowl belonging to the family Anatidae of the order Anseriformes. Of the 7 swan species in the world, several are indigenous to every continent except Africa and Antarctica. The mute swan (*Cygnus olor*) is probably the species most commonly seen in veterinary practices. Others include the black swan (*Cygnus atratus*), trumpeter swan (*Cygnus buccinator*), black-necked swan (*Cygnus melancoryphys*), tundra (whistling or bewick's) swan (*Cygnus columbianus*), whooper swan (*Cygnus cygnus*) and coscoroba swan (*Coscoroba coscoroba*). Because of their beauty and majestic appearance, they are popular ornamental birds on lakes and ponds.

BEHAVIOR

- Docile; prefer to keep to themselves.
- Can become quite aggressive, especially during breeding season and while nesting.
- When faced with an undesirable situation, they prefer to flee to the water.

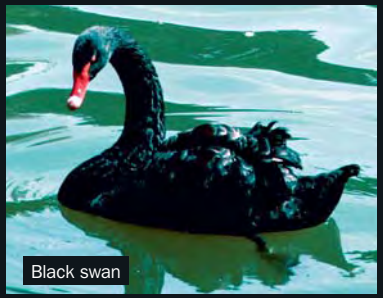
ANATOMY

- Short legs and webbed toes make them excellent swimmers, but clumsy runners on land.
- The feathers of swans are compact and waterproof.
- A thick layer of down lies underneath the surface feathers and provides insulation.
- A swan will be flightless during its annual wing molt (3-4 weeks) because its flight feathers shed simultaneously.



Mute swan





Black swan



Trumpeter swan

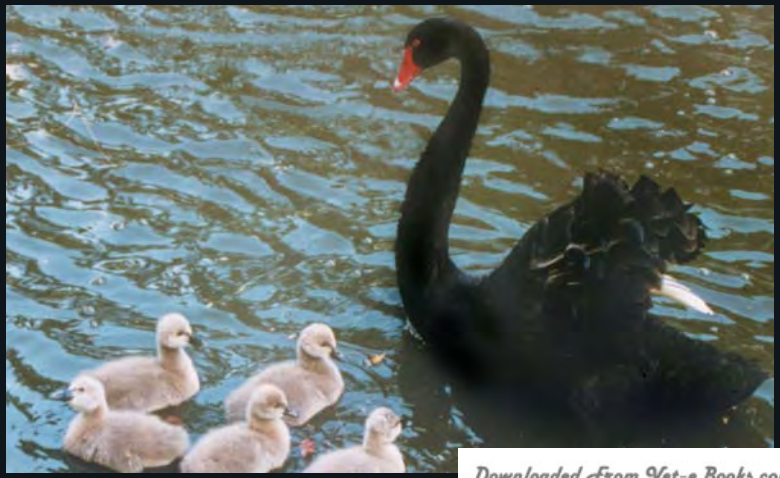
VITAL STATISTICS

Lifespan	maximum	>25 years
	average in captivity	5-6 years
Body length		up to 59" (150 cm)
Body weight		
	mute, trumpeter, whooper swans	9-12 kg
	black, tundra swans	5-7 kg
	black-necked, coscoroba swans	3.8-5.4 kg
Age of sexual maturity		18 months to 3 years (varies with species)
Incubation		29-36 days
Clutch size		3-8 eggs

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Swans prefer to build huge nests in bushy or wooded areas that are somewhat secluded.



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SEXING AND REPRODUCTION

- Sexing is best done at a very early age by manually everting the cloaca to visualize the phallus in males.
- Males have an erectile penis covered with keratinized papillae.
- Male adults are called cobs, female adults are called pens, and young swans are called cygnets.
- Swans are generally monogamous and pair-bond for life.
- Swans prefer to build huge nests in bushy or wooded areas that are somewhat secluded.
- Cygnets learn to eat by themselves because from the time they are hatched, the parents do not feed them.
- Both parents care for the young, and cygnets are frequently seen riding on a parent's back in the water.

HOUSING

- Most swans are easily kept in large, open areas with ponds or streams.
- They should have enough landscape to provide areas for privacy, nesting, and some shade.
- Pond islands will help increase privacy and decrease vulnerability to predation.
- Swans should not be kept on hard surfaces such as concrete, because this may damage their feet and increase the possibility of bumblefoot.
- Good water quality is essential.
- A constant supply of fresh water can be achieved by using underwater filter systems with high water flow rate.
- A depth of 3-4 feet of water is usually adequate for swans.

Swans

- Swans tend to be territorial; thus, overcrowding or mixing several species is not desirable.
- As a general rule, swans are best kept as a single pair in a pen with a small pool.
- Larger groups do best in open areas with a lake.

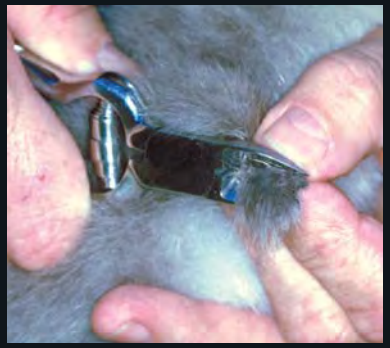
DIET

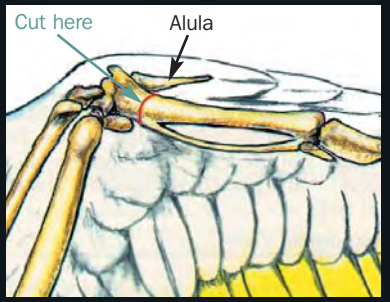
- Swans are filter-feeders and have specialized mouth parts to help them eat.
- Besides serrated beaks, they also have highly sensitive, fleshy tongues that contain spiny projections.
- Free-ranging swans feed on a variety of food items including grass, seeds, and aquatic vegetation.
- In captivity, they should be fed a commercial food especially formulated for waterfowl.
- Corn or greens, such as lettuce, should be limited.
- A commercial diet is made by Mazuri (www.mazuri.com) in separate breeder, starter, and maintenance formulas.

RESTRAINT

- The face and eyes of handlers should be protected from possible injury from spurs (cocks) or beaks. The swan's primary defenses are scratching with toenails, pinching with bills and striking with wings.
- Nets may be used to catch waterfowl.
- A wrap with Velcro straps may be used to encircle wings.
- A swan can be restrained by placing it under one arm and pressing it gently against one's body.
- Birds can be calmed by placing a loose-fitting lightweight cotton sock over the head to reduce vision.







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PINIONING

- Pinioning of cygnets should be performed around 2-4 days of age.
- Pinioning of older birds is not recommended due to the well-established blood supply in the wing, resulting in a higher incidence of excessive blood loss, secondary infection, stress and death.
- The alula is identified as a landmark, and metacarpals III and IV are cut with a sterile clippers.
- The alula remains in position and helps protect the tissue exposed by cutting the bones.

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Swans are best restrained by holding the bird under an arm with the head facing backwards and feet tucked up under the swan's body.



Blood can be easily collected from the median metatarsal vein

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Swans

BLOOD COLLECTION

- Blood can easily be collected without anesthesia and with minimal restraint from the median metatarsal vein.
- Collection from the wing vein is not recommended, because the swan's massive wing strength can result in a greater possibility of injury to the handler.

PHYSICAL EXAMINATION

- Swans should be examined once annually. The exam should include a fecal direct and fecal Gram's stain, a foot examination and body weight.
- *Clostridium* is frequently seen on Gram's stains and is not a problem in swans unless clinical signs are present.
- Pulse and respiration rates are not good indicators of disease, because they vary so widely.

MOST COMMON DISORDERS

- Bumblefoot
- Frostbite (feet)
- Angel wing (drooped wing, flipped wing)
- Lead/heavy metal poisoning
- Malnutrition
- Retained yolk sac (babies)
- Amyloidosis
- Aspergillosis

ZOONOTIC POTENTIAL

- Colibacillosis (*Escherichia coli*)
- Erysipelas (*Erysipelothrix insidiosa*)
- Tuberculosis (*Mycobacterium avium*)

Swans

- Salmonellosis (*Salmonella pullorum*)
- Chlamydiosis (*Chlamydophila psittaci*)
- Pasteurellosis (*Pasteurella multocida*)
- Listeriosis (*Listeria monocytogenes*)
- Q fever (*Coxiella burnetti*)
- Candidiasis (*Candida albicans*)
- Toxoplasmosis (*Toxoplasma gondii*)
- Sacrosporidiosis (*Sarcocystis lindemanni*)
- Acariasis (lice, mites)
- Sparganosis (*Diphylobothrium* spp., *Spirometra* spp.)
- Cercarial dermatitis (*Schistosoma* spp.)
- Eosinophilic allergic alveolitis (danders)

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ACKNOWLEDGEMENTS

Special thanks to Bill and Honey Dobyns for black swan photos.

HEMATOLOGIC REFERENCE RANGES*

	International SI units	Conventional US units
RBC	1.9-2.9 x 10^{12}/L	1.9-2.9 x 10^{6}/µL
PCV	0.32-0.5 L/L	32-50%
Hb	110-165 g/L	11.0-16.5 g/dL
MCH	52.9-65.5 pg	52.9-65.5 pg
MCHC	290-365 g/L	29.0-36.5 g/dL
WBC	6.3-22 x 10^{9}/L	6.3-22 x 10^{3}/µL
Heterophils	3.3-14.7 x 10^{9}/L	3.3-14.7 x 10^{3}/µL
Lymphocytes	0.9-9.8 x 10^{9}/L	0.9-9.8 x 10^{3}/µL
Monocytes	0.05-1.4 x 10^{9}/L	0.05-1.4 x 10^{3}/µL
Eosinophils	0.1-3.5 x 10^{9}/L	0.1-3.5 x 10^{3}/µL
Basophils	0-0.8 x 10^{9}/L	0-0.8 x 10^{3}/µL

* Values in International SI units reproduced from the Manual of Raptors, Pigeons & Waterfowl with the permission of the BSAVA.

BIOCHEMISTRY REFERENCE RANGES*

	International SI units	Conventional US units
Total protein	35.5-54.5 g/L	3.6-5.4 g/dL
Albumin	12-21.5 g/L	1.2-2.2 g/dL
Globulin	23-35.5 g/L	2.3-3.6 g/dL
A:G ratio	0.4-0.7	0.4-0.7
Uric acid	0.126-0.700 mmol/L	2.1-11.8 mg/dL
ALT (SGPT)	10-59 U/L	10-59 U/L
GGT	4-26 U/L	4-26 U/L
AST (SGOT)	17-112 U/L	17-112 U/L
CK	124-894 U/L	124-894 U/L
LDH	165-724 U/L	165-724 U/L
Glucose	6.2-12.6 mmol/L	112-230 mg/dL
Cholesterol	3.0-7.8 mmol/L	115-300 mg/dL
Inorganic phosphorus	0.7-2.4 mmol/L	2.2-7.4 mg/dL
Calcium	2.2-2.9 mmol/L	8.8-11.6 mg/dL
Sodium	132-150 mmol/L	132-150 mEq/L
Potassium	3-5 mmol/L	3-5 mEq/L

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Box Turtle Pet Care

Adapted from Exotic DVM, Volume 1.2 and Volume 6.1 © Zoological Education Network, 2005

- Vital statistics, Sexing, Housing
- Temperature, Lighting, Diet
- Blood collection, Fluid therapy
- Common c sical exam

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Roger Klingenberg, DVM,
Sandy Barnett and
Brent R. Whitaker,
MS, DVM

Edited by
and **Peter Fisher**, DVM

Box Turtles

Two species and six subspecies of the North American box turtle (*Terrapene carolina, T. ornata*) occur in the pet trade. These turtles are primarily terrestrial with fixed home ranges. Hunting and foraging occur primarily in the mornings and late afternoons during hot weather. Box turtles hibernate during the winter except in the southerly portion of their range. Most Asian box turtles (distantly related to North American species) are semi-aquatic.

PET POTENTIAL/BEHAVIOR

- Relatively small size and attractive.
- Responsive to owners; will accept food fed by hand.
- Shy (at least initially), mildly social animals, but do well living alone in captivity.
- Long-lived if properly cared for.

SEXING

- The tail of the male is often longer and wider at the base than in the female.
- The cloaca of the male is more caudal (further from the shell and closer to the tip of the tail) than the female's when compared with the rear edge of the plastron.
- Males often have a concavity in the caudal half of the plastron.
- The iris of the mature male is frequently red, while in the female it is usually brown, yellowish brown or auburn.
- Females typically have a higher-domed carapace.



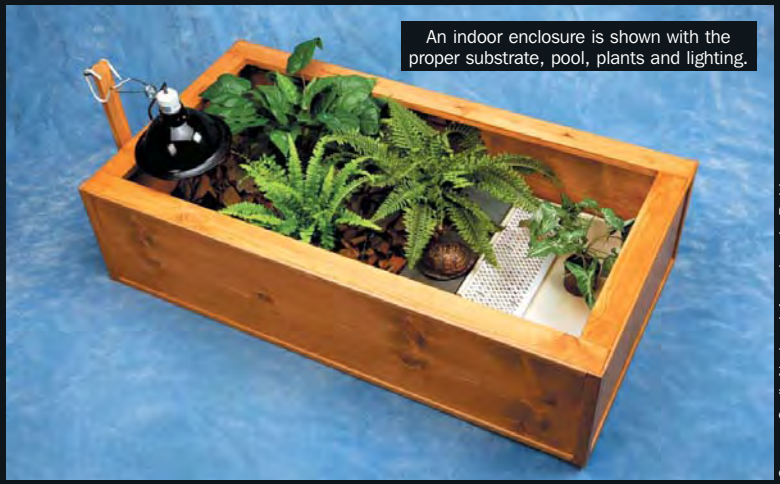
VITAL STATISTICS

Life span	Free-ranging	under 50 years
	Average captive	20+ years
Body weight		200-600 g
Shell length		3.5-8.4 inches (9-21 cm)
Diet		omnivorous
Sexual maturity	males	4-6 years
	females	5-7 years
Breeding season		spring/early summer
Clutch size		2-7 eggs; avg 4-5
Incubation period		50-90 days

The red color of the iris in this western box turtle denotes a male.



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An indoor enclosure is shown with the proper substrate, pool, plants and lighting.

George Grall, National Aquarium in Baltimore



An outdoor pen shows a shallow pool. The remainder of the pen (not shown) provides a well vegetated, shady retreat for the turtles.

Colin Barnett

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Box Turtles

HOUSING

- Indoor enclosures should be at least 48 x 24 x 15 inches (120 x 60 x 38 cm) for one adult box turtle.
- Males and females should be housed separately.
- Where the climate is appropriate it is better to house box turtles outdoors.
- Enclosure walls should be a minimum of 12-15" (30-40 cm) high to prevent escape from climbing walls.
- If housed outdoors, walls should have an inside lip at the top and extend at least 15" (38 cm) above the ground and at least 10" (25 cm) into the ground to prevent escape (turtles are capable of climbing over or digging under a fence).
- Finely shredded hardwood mulch or high quality loam compost are appropriate substrates.
- Hardwood leaves, rehydrated sphagnum moss or rehydrated coconut shell is recommended to increase moisture. Substrate moisture content is very important in the health of a box turtle.
- Live or silk plants and smooth pieces of wood should be added for a retreat from overexposure to ultraviolet light and for environmental enrichment.
- Providing opportunities for exercise and a substrate (3-4" deep) for digging will help maintain the turtle's health.

TEMPERATURE

- Daytime background temperatures should be 72-75°F (22-24°C) and several degrees cooler at night.
- A daytime basking area heated from above by a radiant heat source or lamp (85-88°F [29-31°C]) is essential.

Box Turtles

- Access to sun for basking is ideal.
- An under-tank heater designed for reptile enclosures should be used in a different area from the basking site.

LIGHTING

- A diurnal cycle of 12-14 hours of light and 10-12 hours of dark is ideal.
- UVB full spectrum lighting must be provided 10-14 hours per day with bulbs replaced every 9-12 months.
- When outdoors, a hollowed log, slanted board or heavy vegetation will protect from excessive direct sunlight.

WATER

- Box turtles must have daily access to water for drinking, soaking and eliminating wastes.
- Fresh water should be provided in a shallow container no deeper than ¼ the shell height (many are weak swimmers).
- Because turtles tend to defecate in water, fastidious cleaning of water containers is essential.
- Most Asian box turtles do best in semi-aquatic habitats. The terrestrial keeled box turtle is the exception.

DIET

- Box turtles are omnivorous, and opportunity often dictates what they eat in the wild.
- High quality, pesticide-free vegetable and animal sources of food should be provided.
- Vegetables should be finely diced and mixed together to prevent selective feeding.

Box turtles are omnivorous; however, western box turtles are more insectivorous than eastern box turtles



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MEAL 1

Ingredients (per turtle):

- Rehydrate 1 Tbs of dry "Turtle Brittle" (www.enasco.com), a fish/meat/grain-based chow, in 2 tsp of water.
- Add ½ Tbs of a hard squash from List A.
- Add ½ Tbs of a vegetable from List B.
- Add ½ Tbs of a leafy green from List C.
- Add ½ Tbs of a fruit from List D.
- Several times a month add 1 tsp of crumbled, hard-boiled egg.
- Mix all of the above ingredients together well so the turtle is less likely to focus on a single food item.
- Top with a few berries from List E.
- Top with 1-2 freshly killed crickets or mealworms.
- Dust the entire meal very lightly with pure calcium carbonate (sold as a supplement for humans; the pills must be crushed) or finely crushed cuttlebone (about 85% calcium carbonate)

MEAL 2

(per turtle):

- Serve as every third meal for eastern box turtles
- Serve as every other meal for ornate box turtles

Feed to satiation:

- Pesticide-free slugs
- Terrestrial snails
- Grubs
- Earthworms
- Beetles
- Sow bugs
- Crickets (cultured crickets should be gut-loaded with high calcium cricket diet for at least 2 days before use)
- Grasshoppers
- Preying mantids (remove pincers)
- Katydids

Feed occasionally:

- Mealworms
- Super mealworms (*Zophobas* beetle larvae)
- Pre-killed pinkie mice

Foods to include in vegetable portion of box turtle diet

List A	List B	List C	List D	List E
Grated and very finely diced ▪ Acorn squash ▪ Butternut squash ▪ Pumpkin ▪ Winter squash	Very finely diced ▪ Sweet potatoes ▪ Carrots ▪ Red/orange bell peppers ▪ Okra ▪ *Opuntia* cactus pad (no spines)	Very finely diced ▪ Clover and blossoms ▪ Collard greens ▪ Dandelions (all parts) ▪ Endive ▪ Escarole ▪ Romaine ▪ Watercress	Very finely diced ▪ Apples ▪ Apricots ▪ Figs ▪ Grapes ▪ Mango ▪ Melon ▪ Oranges ▪ Papayas ▪ Peaches ▪ Tomatoes	▪ Blackberries ▪ Blueberries ▪ Elderberries ▪ Gooseberries ▪ Raspberries ▪ Wild strawberries

This list is far from complete, but represents a reasonable variety of commonly available foodstuffs that are palatable and nutritious. Try to vary which items are used from each list.
Be sure that any field-collected foodstuff has not been exposed

Barnett SL, Whitaker BR: Indoor Care of North America Box Turtles. Exotic DVM 6(1):23-29, 2004.

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- All insects should be lightly dusted with a phosphorus-free calcium power every other meal, and a high quality multivitamin supplement once a week.
- Hatchlings and juvenile turtles should be fed daily. A blender may be used to dice their food especially finely to ease ingestion.
- When box turtles reach adulthood it is practical to feed them only once every other day.
- Turtles should be fed in the morning.
- Mature turtles will eat pinkies, and Asian turtles enjoy chopped goldfish, which should be offered occasionally.
- Foods should be offered on flat rocks or a plastic lid to prevent substrate ingestion. Each animal should be provided its own food dish.
- Leftovers should be removed to prevent spoilage.
- Free-roaming animals are at great risk from dietary indiscretion.

RESTRAINT

- Box turtles rarely need significant restraint during exam.
- Cranial exam is easier with an assistant restraining the forelimb from behind.
- Once presented, the head is controlled with the thumb and forefinger.
- Place thumb under carapace and the middle fingers on the other side midway on the carapace; be prepared for a pinch.
- If poked or prodded, they usually do not retreat into their shell but may occasionally bite or pinch an unwary finger between the carapace and plastron as it slams shut.

BLOOD COLLECTION

- Recalcitrant individuals may require minor sedation for successful blood draws.
- The most common sites are the dorsal tail vein (dorsal venous sinus), jugular vein, subcarapacial (subvertebral) sinus, brachial venous plexus and occipital sinus.

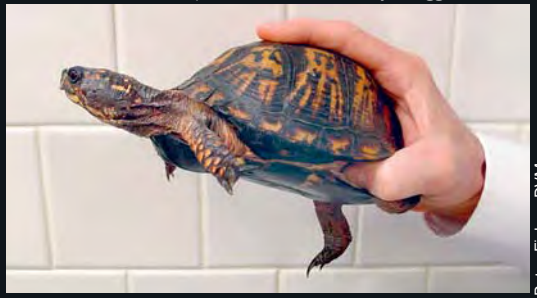
FLUID THERAPY

- Oral: esophagostomy tube or oral speculum 25-35 ml/kg/day divided in 2-3 treatments.
- Subcutaneous: in the loose skin of the front or rear legs near the shell margin.
- Intracoelomic: needle inserted in prefemoral fossa and parallel to plastron.
- Intraosseus: tibia or medullary cavity of the plastro-carapacial bridge. Secure with tissue glue and tape.

PHYSICAL EXAMINATION

- The first visit should consist of a complete physical examination including full captive history and baseline weight.
- Take a case history of the client's husbandry protocol, including diet, housing, temperature, humidity and lighting.
- A fecal examination (direct and flotation) should be performed to rule-out protozoan and nematode infections.
- A thorough examination of the skin and all accessible recesses will reveal ectoparasites (bots, ticks), signs of trauma, or bacterial or fungal infections.

Alternatively, box turtles may be restrained by holding at the rear end of the carapace, but the turtle may struggle.



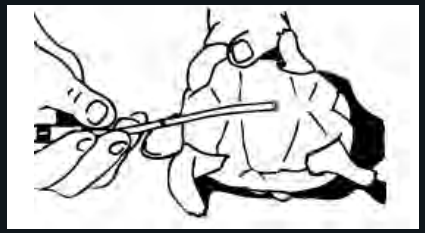
Peter Fisher, DVM

HEMATOLOGIC/ BIOCHEMISTRY REFERENCE RANGES

RBC	2.35-7.55 x $10^6/\mu L$
PCV	27-38%
WBC	6-15 x $10^3/\mu L$
Hbg	5.9 g/dl
Total protein	4.5 g/dl
Glucose	22-36 mg/dl
Uric acid	2.1-10.0 mg/dl
Na	130 mEq/L
K	4.7 mEq/L
Mg	3.5 mEq/L
Cl	108 mEq/L
Phos	1-5 mg/dl
Ca	7.5-11.8

Values vary with sampling site, ambient temperature, gender, stress, seasonality and laboratory used. Clinicians are encouraged to use a laboratory familiar with reptilian blood

The length of stomach tube for oral dosing is measured and marked. The tortoise is held upright to allow the esophagus to straighten out for insertion of the tube.



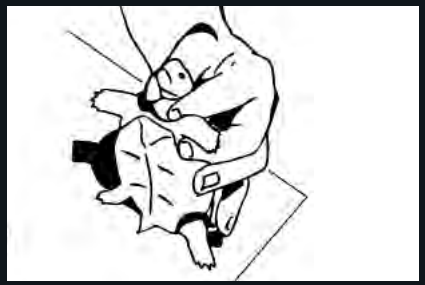


Illustration from Exotic Companion Medicine Handbook

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Excessively long nails and an overgrown beak are frequently seen in box turtles with inappropriate husbandry.





The natural habitat of the western box turtle shows that they prosper in very harsh conditions. Hiding in burrows, bushes or logs protects them from withering daytime heat.



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Box Turtles

- Special attention should be given to ocular discharge and a bubbly respiratory discharge (may indicate vitamin A deficiency often complicated by secondary bacterial problems), which is a common presenting syndrome.

MOST COMMON DISORDERS

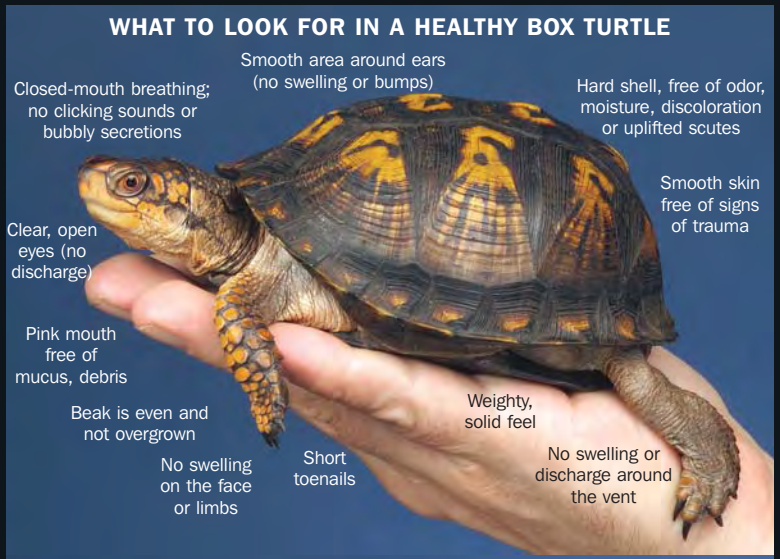
- Malnutrition
- Dehydration
- Bacterial infections/septicemia
- Ocular signs/discharges (may be related to vitamin A deficiency)
- Upper respiratory problems (may be related to vitamin A deficiency, poor husbandry and bacterial infection)
- Parasitism, both internal and external
- Metabolic bone disease (soft shell, overgrown beak, pyramiding of scutes, muscular weakness and an alteration in carapace conformation)
- Abscesses (especially aural abscesses)
- Trauma (shell damage, fractures, wounds, burns)
- Fungal infection of shell (may be dry or wet; affected area of shell is soft or crumbly, has odor, collapses, turns color)
- Beak deformities
- Swollen eyes (caused by excessively dry environment)

ZOONOTIC POTENTIAL

- Like all reptiles, box turtles may be *Salmonella* sp. carriers. Hand washing and good hygiene after handling are essential.

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George Grall, © National Aquarium in Baltimore

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Leopard Gecko Pet Care

Adapted from Exotic DVM Volume 4.1 © Zoological Education Network, 2005

- Behavior, Anatomy, Vital statistics
- Sexing, Housing, Diet, Restraint
- Physical exam, Blood collection
- Common d[illegible]notic potential

Marc Kramer, DVM

Edited by
Peter Fisher, DVM

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Leopard Geckos

Leopard geckos (*Eublepharis macularius*) are native to the deserts and dry rocky plains of Afghanistan, India and Pakistan. Leopard geckos are now well established in captivity following decades of large-scale commercial propagation.

PET POTENTIAL/BEHAVIOR

- Gentle lizards.
- Hardy, long-lived.
- Easy maintenance.
- Moderate size, attractive appearance.
- Nocturnal.

ANATOMY

- Unlike many other geckos, leopard geckos possess movable eyelids.
- Leopard geckos lack the adhesive lamellae on their feet that enable many other geckos to cling to glass or walls. Instead, on each digit is a small claw, suiting them well to a terrestrial lifestyle.

SEXING

- As juveniles, there is little visual difference between male and female leopard geckos.
- The sex of the gecko can be predicted based on the temperature at which it was incubated as an egg.
- In temperatures from 78-82ºF (25-28ºC), the great majority of hatchlings will be female; from 85-87ºF



VITAL STATISTICS

Lifespan		30 years
	avg	10-15 years
Body length		7-10 inches (15-25 cm)
Body weight	avg	45-60 g
	maximum	100 g
Ambient temperature		
	daytime	75-80ºF (24-26ºC)
	nighttime	65-75ºF (18-24ºC)
	optimum	84-88ºF (29-31ºC)
Age of sexual maturity		10 months
Clutch size		2
Breeding season		January-September
Number of eggs laid per year		6-16
Incubator temperature		78-92ºF (25-33ºC)
Incubator relative humidity		75-100%
Incubation period		6-15 weeks

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Note the V-shaped row of enlarged pre-anal pores, which produce a waxy secretion, and the prominent hemipenal bulges in the male.



Females lack prominent pre-anal pores, having only very small pre-anal pits. Hemipenal swellings are absent.



Aquariums emphasizing horizontal space work well as enclosures.

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(29-31ºC) there will be fairly equal ratios of males and females; and around 90ºF (32ºC), one can expect mostly males.

- As adults, males have a V-shaped row of enlarged pre-anal pores along their inner thighs, whereas females have only small pre-anal pits.
- Males also have paired hemipenal swellings at the base of the tail, which females lack.
- Males are slightly more heavy-bodied and robust with a broader head and thicker neck than females.

HOUSING

- Quarantine new geckos in a separate area of the house for at least 30 days.
- Leopard geckos can be housed in groups provided there is only one adult male per enclosure, as males are highly territorial and aggressive when mature.
- Standard 10-gallon (or larger) aquariums work well as enclosures.
- Cage size should be at least 36” x 15” x 12” (90 x 38 x 30 cm); a cage height of at least 6” (15 cm) is recommended for a group of 2-3 animals.
- The cage should have a screen top for adequate ventilation.
- Acceptable substrates include paper towels, newspaper, orchid bark or fine sand (controversial).
- Coarse sand, corncob, walnut shell and/or sand-like calcium ground litter should be avoided as substrates, as they have been implicated in gastrointestinal impactions.
- Feces should be removed regularly and substrate replaced as necessary.

Leopard Geckos

- Geckos should be prevented from free roam of the house and exposure to cats, dogs, or other predators.
- A moist hide box filled with damp sphagnum moss, cypress mulch, or vermiculite is especially important for both security and proper shedding.
- It is important to mist the hide box substrate daily, which promotes normal skin shedding.
- The shelter should be cleaned and the vermiculite or moss changed weekly.
- While these animals are well adapted to a dry climate, the lack of a moderately humid shelter will make a leopard gecko prone to dysecdysis.
- A common shedding problem is retention of skin around the toes with subsequent avascular necrosis and loss of the distal phalanges.

HEATING AND LIGHTING

- Leopard geckos fare best at temperatures in the mid-80s°F (30°C).
- A gradient of temperatures should be available in the enclosure, from 70ºF (21°C) on the cool end to 84-88°F (29-31°C) on the warm end.
- Heat should be provided by a heat pad, heat tape or basking light.
- Hot rocks or direct contact with heating elements or light sources should be avoided.
- UVB or other supplemental lighting is not essential to these primarily nocturnal lizards but can be used.
- A reduction in light intensity within the vivarium may be used to encourage diurnal activity.



A moist hide box is important for both security and proper shedding.



Skin shedding occurs at regular intervals, and leopard geckos generally consume the shed skin.

Skin retention around the toes is common in geckos that are not provided with a moist shelter.

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Orchid bark is a good choice for a substrate



Clean fresh water should be provided in a shallow container.

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Leopard Geckos

DIET

- Leopard geckos feed primarily on live moving insect prey.
- Commercial diets are available, including dried or canned insects and frozen prepared meats.
- Leopard geckos need to be conditioned to feed on non-living food sources, and some may be hesitant.
- An appropriate diet may consist of commercially-raised crickets with smaller numbers of silkworms, roaches, mealworms (*Tenebrio* sp.), superworms (*Zophobas* sp.), waxworms and other live insects.
- Large leopard geckos will also consume baby “pinkie” mice and other lizards, but these food items are not required.
- Prey items should be fed a high quality diet (“gut-loaded”) for at least 24 hours prior to using.
- Live prey may be offered in shallow containers, which will prevent mealworms from burrowing, reduce cricket dispersal and reduce accidental ingestion of substrate.
- Appropriate-sized prey items should be offered every 1-2 days for juveniles and 2-3 times a week for adults.
- Crickets should be no bigger than half the size of the gecko’s head.
- Feed no more than the animal will consume within 15 minutes, which usually amounts to 4-6 food items.
- Beware that hungry juveniles housed together may nip toes or tail tips off their cage mates.
- Clean fresh water should be provided in a shallow container and changed daily.

Leopard Geckos

SUPPLEMENTATION

- A jar lid full of calcium powder should be available at all times and will particularly benefit breeding females.
- While vitamin and mineral supplementation is controversial, leopard geckos will tolerate a wide range of supplementation regimens.
- Dusting prey items with a calcium supplement is probably beneficial. Prey are dusted daily for juveniles and every 2-3 feedings for adults.

RESTRAINT

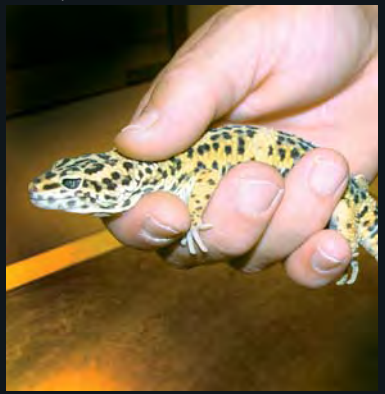
- A leopard gecko should not be caught or lifted by the tail; its body must be fully supported.
- Leopard geckos have the capability of autotomy, or self-amputation of the tail, which they will often execute when restrained or stressed excessively.
- A lost tail will take several months to grow back, and a regenerated tail is not as aesthetically pleasing as the original.

PHYSICAL EXAMINATION

- Physical examination should include sexing, husbandry review (diet, sanitation, humidity delivery), zoonosis discussion, handling (nail trimming or soft claws), skin evaluation, weight/growth, fecal flotation and direct smear, vent/choanal culture and sensitivity (good indication of normal flora).
- Normal feces are dark and firm and are deposited in one corner of an enclosure (defecatorium). Sticky, soft, or excessively malodorous urofeces may indicate a gastrointestinal disorder.

Gentle restraint should be used to examine leopard geckos, being careful not to apply excessive pressure to the tail.







Normal leopard gecko droppings consist of prominent white urates with dark feces.

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FORMULARY OF COMMONLY USED DRUGS

Drug	Dose
Enrofloxacin*	5-10 mg/kg PO, IM q24h
Trimethoprim/sulfa	15-30 mg/kg PO, SC, IM q24-48h
Metronidazole	20-50 mg/kg PO q24-48h
Piperacillin	50-200 mg/kg SC, IM q24-48h
Ceftazidime	20 mg/kg SC, IM q24-72h
Amikacin	2.5-5 mg/kg IM q24-72h
Fenbendazole	25-50 mg/kg, PO q24h x 3-5 d, then repeat cycle PRN
Sulfadimethoxine	50 mg/kg PO q24h x 3-5 d, then q2d PRN
Ivermectin	0.2 mg/kg PO, SC, IM once, repeat in 2 weeks

*Repeated IM administration may result in tissue necrosis or sterile abscesses. Should be used only for initiating therapy.



Induction of inhalant anesthesia should be accomplished without excessive restraint. A large plastic mask is suitable.

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- Depending on health, CBC and chemistries may be warranted (especially blood calcium and phosphorous).
- Radiographs may be used to diagnose bone disease, ingestion of substrates, metabolic calcification and egg retention.

ANESTHESIA

- Sedation using isoflurane is recommended for improved restraint, to prevent autotomy and to obtain a cleaner and more accurate blood sample.
- A small induction chamber (mask, clear plastic bag or small plastic container) is filled with 5% isoflurane and the gecko is left undisturbed for 10-20 minutes or until its righting reflexes are lost.

BLOOD COLLECTION

- Blood collection from leopard geckos is challenging because excessive immobilization for venipuncture may cause them to drop their tails.
- Blood collection sites include the ventral abdominal vein, ventral tail vein or cardiac puncture.

Leopard Geckos

MOST COMMON DISORDERS

- Intestinal parasites
- Metabolic bone disease
- Egg binding
- Gastroenteritis/diarrhea
- Sand impactions
- Shedding problems
- Loss of digits
- Tail loss
- Stomatitis
- Respiratory infections
- Rectal or hemipenal prolapse
- Poor aim when catching prey

ZOONOTIC POTENTIAL

- *Salmonella*
- *Aeromonas*
- *Campylobacter*
- *Erysipelothrix rhusiopathiae*
- *Mycobacterium*
- *Candida*
- *Trichosporon*

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A light can be shone in the ear for easy visualization of the tympanic membrane.



Juveniles have a banded black and yellow pattern, with stronger contrasts and brighter colors than adults.



WHAT TO LOOK FOR IN A HEALTHY LEOPARD GECKO



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Old World Chameleon Pet Care

Adapted from Exotic DVM Volume 3.6 © Zoological Education Network 2005

- Vital statistics, Sexing, Housing
- Temperature, Lighting, Humidity
- Diet, Restraint, Anesthesia
- Blood coll[Downloaded From Vet-eBooks.com]n disorders

Rob L. Coke, DVM

Edited by
Peter Fisher, DVM

Old World Chameleons

Free-ranging Old World chameleons (Chamaeleonidae) live in Africa, southern Europe, the Near East, Middle East, Sri Lanka and India. Over 150 species and 180 subspecies of chameleons have been described; about half of these are located on Madagascar. All Old World chameleon species are classified as threatened (Level II CITES). The most commonly kept species are veiled chameleons (*Chamaeleo calyptratus*), panther chameleons (*Furcifer pardalis*) and Jackson's chameleons (*Chamaeleo* [Trioceros] *jacksonii*).

PET POTENTIAL

- They are appealing as pets because of their unique appearance and biological characteristics.
- Meller's chameleons (*Chamaeleo* [Trioceros] *melleri*) are not recommended for beginners due to high mortality following importation.
- Large species: Parson's, Meller's, Veiled, Panther.
- Medium species: Jackson's, Carpet, Fischer's, Flap-necked, Senegal.
- Small species: Chameleons in the *Brookesia* genus.

ANATOMY

- Eyes are independently rotating turrets that can move 180° in the horizontal plane and 80° in the vertical plane.
- The chameleon has a modified hyoid bone (entoglossal process) that acts as a firing pin for the accordion-folded tongue, which can project toward its prey.



VITAL STATISTICS

Body length	
Large species	12-24" (30-60 cm)
Medium species	6-12" (10-30 cm)
Small species	<6" (<15 cm)
Average lifespan in captivity	
Male	4-6 years
Female	2-3 years
Maximum lifespan (veiled chameleon and Parson's chameleon)	>10 years
Age of sexual maturity	4-8 months
Breeding season	Year round
Livebearers (*C. jacksonii*) gestation period	30 days
Clutch size	2-60

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An adult female ambanja blue panther chameleon displays sexual receptivity colors (left) and gravid colors (right).



Chameleons may be housed in outside enclosures.



A chameleon enclosure needs several trees, plants, branches, or even rope to provide optimal climbing areas and protection.



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Old World Chameleons

- Best known for their ability to change the color of their skin. The stimulus for color change is directed by neuro-hormonal influences such as light intensity, temperature, autonomic nervous system and endocrine hormone levels.
- Another unique feature is the chameleon's syndactyl (fused) digits that form zygodactyl (arch-like) feet, allowing for a better grip on branches.

SEXING AND REPRODUCTION

- Many species of chameleons are sexually dimorphic as adults.
- Male chameleons are generally larger and more colorful.
- Hemipenal bulges are often visible on the ventral surface of the tail base in males.
- Many species of males have horns and other skull projections to aid in territorial displays or combat.
- Female chameleons are usually smaller and have less ornate skin patterns during non-breeding seasons.
- Some female chameleons display colorful skin patterns that rival their male counterparts when they are gravid.
- It is common for female chameleons to lay eggs, regardless of whether they are exposed to a male.
- If a female develops eggs, a deep container with a laying substrate such as moistened sand, vermiculite or potting soil, should be provided. Alternatively, the female may periodically be placed in a "laying chamber" of sand.

HOUSING

- Housing size (length x width x height)
  - Large chameleon (12-24" [30-60 cm] length): 2 x 2 x 4 feet (60 x 60 x 120 cm)

Old World Chameleons

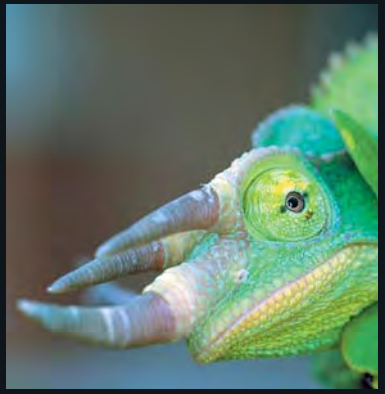
- Medium chameleon (6-12” [15-30 cm] length): 1.5 x 1.5 x 2.5 feet (45 x 45 x 75 cm)
- Small chameleon (<6” [<15 cm] length): 1 x 1 x 2 feet (30 x 30 x 60 cm)

- Free-ranging chameleons are usually territorial and prefer to live separately.
- To avoid stress and predisposition to illness in captivity, two or more chameleons should not be housed in the same enclosure or within visual range.
- Glass or plastic aquariums are not recommended because the internal reflection from glass may stress these solitary reptiles, and the ventilation is not sufficient to prevent eye, skin or respiratory infection.
- The ideal enclosure is constructed from plastic-coated wire mesh (½ x ½ inches or ½ x 1 inches [1.2 x 2.4 cm]) with wood or metal framing. The large mesh provides good ventilation and protection.
- Aluminum window screening should be avoided for adult chameleons due to the potential risk of damage to claws or toes.
- The enclosure bottom may be covered with indoor/outdoor carpeting but should be free of other substrate to prevent accidental ingestion and subsequent impaction of the chameleon’s gastrointestinal system.
- Several trees, plants, branches or even rope should be added to the enclosure to provide optimal climbing areas.
- Easy access to water, food and basking sites should be available.

An adult male veiled chameleon in normal coloration.



An adult male Jackson’s chameleon in normal coloration.



An adult female Meller’s chameleon.



An adult male ambanja blue panther chameleon exhibits normal coloration.



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A PVC-coated wire cage with proper lighting can be used to temporarily house hospitalized patients.



A chameleon enclosure with an automatic watering system provides daily “rains” for water access.



A basic nutritious diet may consist of gut-loaded crickets, mealworms, superworms, waxworms and flies.



r Fisher, DVM

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Old World Chameleons

TEMPERATURE

- The tolerated ambient temperatures for lowland chameleon species range from 65-95°F (18-35°C).
- Montane species need cooler temperatures.
- A temperature drop of 10-15°F (6-9°C) at night is ideal.
- A basking spot should provide a 5-10°F (3-6°C) increase in temperature and may be provided with a spotlight placed above the enclosure.
- The temperature gradients may be monitored with a digital indoor/outdoor thermometer and a remote sensor probe on the side of the cage.

LIGHTING

- Chameleons need access to unfiltered sunlight for at least several hours a week.
- A full-spectrum, daylight fluorescent light that emits UV-A and UV-B radiation for lighting and an incandescent light bulb (60-100 watt) for the basking site should be included for indoor cages.

WATER/HUMIDITY

- Free-ranging chameleons drink morning dewdrops and raindrops that collect on leaves or surfaces. The best way to provide this natural means of a water source is to mist or spray the cage plants 2-4 times a day.
- Alternatives for dispensing water include: medical IV bag set to a slow drip, plastic cup with a pinhole in the bottom, or commercial reptile water drippers.
- Humidity levels should be 40-90%. Humidity can be enhanced with a humidifier or greenhouse misting system.

Old World Chameleons

DIET

- Chameleons are primarily insectivores.
- Juvenile chameleons need to be fed daily; adults can be fed 3-4 times per week.
- A basic nutritious diet may consist of gut-loaded crickets, mealworms, superworms, waxworms and flies.
- Wild insects such as grasshoppers and butterflies may be fed periodically.
- Prey should be placed in a deep-sided container or jar to prevent escape.
- A branch should be added near the food container so that the chameleon has easy access to the food.
- Prey insects may also be coated with supplements containing calcium and other nutrients; however, if the food items are gut-loaded properly, supplementation should be used sparingly in adults (e.g., 1x/week for males; 1-2x/week for females).
- Supplementation of every feeding or every other feeding is recommended for juveniles.

RESTRAINT

- For proper restraint of a chameleon, the thumb and index finger are placed behind the eyes to hold the head, and the palm is placed over the chameleon's back. The other hand may be placed underneath the chameleon to allow the feet to grip.
- Alternatively, the chameleon can perch on a wooden dowel for examination.



Marc H. Kramer, DVM

Proper restraint of a chameleon



Blood collection in the chameleon from the ventral tail vein



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Multiple oral and lingual abscesses are shown in a veiled chameleon.



A subcutaneous nematode was found in a wild-caught panther chameleon.



A 2-year-old veiled chameleon exhibits severe metabolic bone disease.



A severe mandibular abscess and osteomyelitis in a panther chameleon.

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ANESTHESIA

- For short medical procedures, general anesthesia with propofol (5-10 mg/kg IV) provides smooth induction and rapid recovery.
- Propofol may be administered in the ventral tail vein or via an intrasseous catheter in the femur.
- Isoflurane administered via an endotracheal tube or facemask can be used in conjunction with propofol induction for longer procedures, such as a celiotomy.

BLOOD COLLECTION

- The best site for blood collection in the chameleon is the ventral tail vein.
- An alternative site, the ventral abdominal vein, can be difficult to locate in small chameleons.

INJECTION SITES

- Intramuscular: Triceps and femoral muscle groups
- Subcutaneous: Area over scapula, paralumbar region
- Intraperitoneal: Area cranial to hind legs
- Intravenous: Ventral tail vein

MOST COMMON DISORDERS

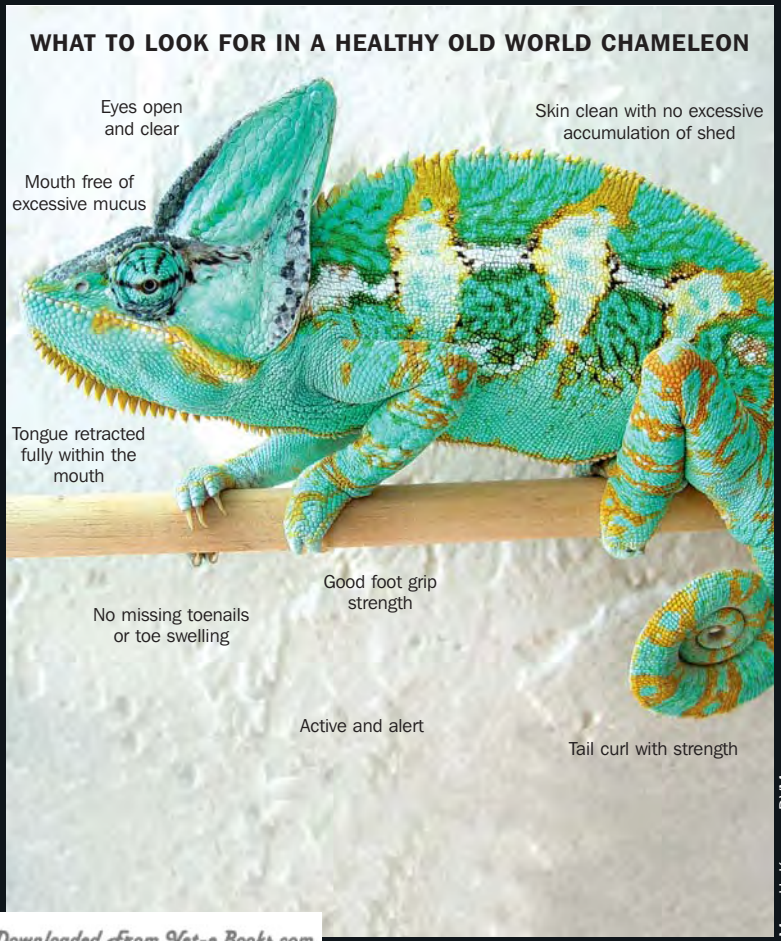
- Parasites
- Dystocia
- Nutritional secondary hyperparathyroidism (metabolic bone disease)
- Stomatitis
- Periocular swelling
- Anorexia

ZOONOTIC POTENTIAL

- *Salmonella*
- *Aeromonas*
- *Campylobacter*
- *Enterobacter*
- *Erysipelothrix rhusiopathiae*
- *Mycobacterium* sp.
- *Zygomycosis*
- *Candida*

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Marc H. Kramer, DVM

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Nile Monitor
Pet Care

Adapted from Exotic DVM, Volume 4.2 © Zoological Education Network, 2005

- Vital statistics, Behavior, Sexing
- Housing, Temperature and light
- Diet, Water, Common disorders
- Restraint, [illegible]n

Philippe de Vosjoli
Mark Mitchell, DVM, PhD

Edited by
Peter Fisher, DVM

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Nile Monitors

PET POTENTIAL/BEHAVIOR

- Nile monitors (*Varanus niloticus*) might present at a veterinary practice in the hands of teenagers, first-time reptile owners and unwitting amateurs.
- Not suitable for pets; potentially dangerous.
- Alert and intelligent.
- Grow quickly from charmer to liability. Nile monitors will grow 200-300 times birth weight (30 g to 9 kg).
- Best kept in the hands of experienced, responsible and dedicated keepers.
- Females raised since hatching may be tame when kept in large front-opening cages.
- In contrast, males generally display a much higher level of responsiveness and curiosity, but tame less readily.
- Veterinarians may notice 3 types of defensive behaviors — most can lead to serious injury: tail whipping often in reaction to being kept in cages that are too small (causing welts, hematomas, injuries to the face and eyes, possibly concussions); clawing (causing shallow to deep lacerations and punctures that often become infected); and biting (causing lacerations and puncture wounds that tend to become infected).
- Nile monitors may also defensively defecate or flee.
- Nile monitors will move back and forth in enclosure to raise and lower body temperature in response to internal physiologic cues.



VITAL STATISTICS

Adult body length	
Male	5-6 feet (1.5-1.8 m)
Females	3.5-4.5 feet (1-1.35 m)
Adult body weight	8-20 lbs (3.6-9.0 kg) (exceptional cases have been noted up to 40 lbs [18 kg])
Lifespan	
Free-ranging avg	8 years (because of hunting)
In captivity avg	5-12 years
Maximum	10-20 years
Age of sexual maturity	2-3 years
Breeding season	Variable (Aug-Jan)
Clutch size	10-63
Hatchling length	12 inches (30 cm)
Hatchling weight	30 g
Preferred optimum temperature zone	78-87°F (25-30°C)
Ambient basking temperature (distance of 6")	88-100°F (31-38°C)

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Nile Monitors

SEXING

- Sexing is difficult in juveniles.
- Males may evert their hemipenes during handling or defecation.

HOUSING

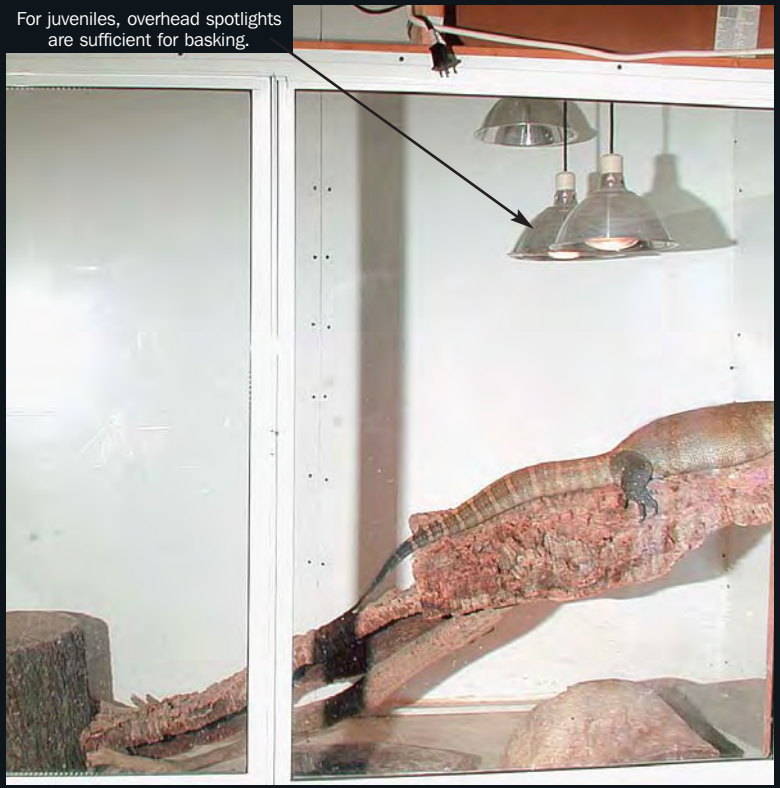
- Hatchlings can start off in tanks 3' (1 m) long with secure screen tops.
- After 6 months, they need enclosures of at least 4' x 2' (1.2 x 0.6 m).
- Adults (2-3 years old) require an enclosure the size of a small room, at least 12' x 4' (3.6 x 1.2 m) for monitors under 48" in length and at least 15' X 5' (4.5 x 1.5 m) for specimens exceeding 48" (120 cm).
- Juvenile monitors should be provided with shelters into which they can curl their entire body.
- Adults should be offered as spacious an enclosure as feasible that allows opportunities to climb and explore.
- Raised structures, such as thick logs or cork bark rounds, are used as basking sites.
- Multiple basking sites will encourage the lizard to move within an enclosure when seeking thermoregulation.
- Monitors may choose to sleep in their shelter, on tree branches or in their water container.
- Flat rocks should be placed alongside the water container to wear down nails as the lizards enter and exit the water.
- To accommodate high levels of activity and digging, the best substrates are mixes of peatmoss-based potting soil, ground fir bark and sand, with some coarser material such as a fine grade ground limestone to help wear nails.

This substrate allows the digits to remain in a normal position rather than twist to the side, as found in large monitors kept on solid flooring.

- Newspaper should be used only with young animals, especially prior to worming; it fails to provide a proper texture for adults.
- If tractable, monitors can be allowed to roam in a "reptile-proofed" exercise room.

TEMPERATURE AND LIGHT

- Extra light and heat are required for monitors of all ages. Lights should be turned on 12-14 hours a day.
- The temperature measured 6 inches under the basking site should be 88-100°F (31-38°C), not to exceed 105°F (40°C).
- For thermoregulation, part of the habitat should be 5-10°F (3-6°C) cooler.
- As for most amphibious monitors, the Nile's activity temperature is relatively low, about 90°F (32°C).
- For juveniles, overhead spotlights are sufficient for basking.
- For monitors over 30" (75 cm) in length, a combination of large reptile heat pads and at least 2 spotlights, or 1 spotlight and 1 infrared ceramic incandescent heat bulb over one or more basking sites are needed. These may be controlled by rheostats or thermostats.
- Alternatively, an area can be provided where Nile monitors can bask in unfiltered sunlight (through a welded wire screen-covered window or in an outdoor plastic-coated welded wire cage during the summer).
- Monitors may benefit from exposure to a UV-B source.



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Kevin Wright, DVM



An obese savannah monitor (*Varanus exantematicus*)

Stephen Hernandez-Divers, BVetMed, CBiol, MIBiol, DZooMed, DipECZM, DipECVS, Dipl ACZM

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Nile Monitors

DIET

- Juveniles can be fed mainly on crickets gut-loaded and coated lightly with a multivitamin/calcium/vitamin D_3 supplement. Mealworms and locusts may also be offered as well as a weekly pinkie mouse.
- For older juveniles, king/super mealworms can substitute for crickets, and larger mice can be offered.
- However, unlike broad-snouted monitors, the narrow-snouted Nile monitor should be fed only relatively small vertebrates (body width < 2/3 the monitor's head width).
- Monitors over 3 feet (1 m) long will continue to enjoy king/super mealworms, but the bulk of their diet should be filled by a ground meat mix.
- Lean ground turkey supplemented with calcium carbonate and a complement of vitamins and minerals is an appropriate diet. The turkey is either cooked or frozen for a month to reduce risks of *Salmonella*.
- Commercial meat-based carnivore diets may also be fed.
- Adult Niles fare best if fed measured portions; excess food may lead to obesity in adults.
- For adults, feed an amount roughly equal to the volume of the monitor's head every 2 days.

WATER

- For small individuals, reptile water dishes, dog bowls and plastic storage containers may suffice.
- For adults, plastic cement mixing tubs or plastic "kiddie" pools large enough for complete immersion are required.
- Monitors may defecate in a water container if kept singly.

Nile Monitors

RESTRAINT

- Nile monitors are strong creatures and, once past 3' (1 m) in length, may require 2-3 people to secure.
- Leather gloves and goggles should be worn and towels used to provide protection from clawing and tail lashing.
- A tame Nile monitor may present few problems with handling, especially if examined at an owner's home.
- Many monitors panic when taken from their habitat and transported to a veterinary clinic.

BLOOD COLLECTION AND ANESTHESIA

- Ventral coccygeal vein or jugular vein
- Propofol at 8-10 mg/kg IV or Telazol at 3-5 mg/kg IM then intubation and maintenance with isoflurane or sevoflurane

MOST COMMON DISORDERS

- Stomatitis/rostral abrasions from running into walls
- Abscesses: oral, digit, tail
- Foreign body ingestion
- Secondary nutritional hyperparathyroidism in juveniles fed inappropriate insect diet without supplementation
- Renal disease from oversupplementation
- Obesity
- Dystocia and prefollicular stasis

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Tail whipping is the main defense of Nile monitors. In adults, the tail is an awesome and frightening weapon.



Abnormal position of monitor's digits from housing on solid flooring.

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Ball Python Pet Care

Adapted from Exotic DVM, Volume 2.4 © Zoological Education Network, 2005

- Vital statistics, Behavior, Sexing
- Housing, Temperature, Humidity
- Diet, Anesthesia, Blood collection
- Common d[illegible]notic potential

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Ball Pythons

The ball python (*Python regius*), or royal python, is an attractive and gentle snake native to western and west-central Africa. These nocturnal pythons prefer mixed grassland and trees (savannah) as their habitat. When they are frightened they coil up into a ball; thus, the name "ball python." Free-ranging ball pythons are considered a threatened species.

PET POTENTIAL/BEHAVIOR

- Generally prefer to be left alone; shy and docile.
- Small; typically reach 4 feet (120 cm) in length.
- May grow 1 foot (30 cm) per year during the first 3 years
- Crepuscular; active at dawn and dusk.
- Inexperienced python owners must be prepared for potential feeding problems and internal and/or external parasite problems.
- Ball pythons are notorious for not eating and may go for extended periods (sometimes over a year) without eating.
- Health problems may occur secondary to chronic anorexia.
- A newly purchased snake should be left alone in its enclosure for 1-2 weeks to acclimate to its new home.
- Avoid any interactions until it is accustomed to its cage and is eating, then gentle handling may begin.
- A frightened snake may lash with its tail, hiss, or in rare cases, bite.
- Many reptiles are potential carriers of *Salmonella* and owners should use common sense in their personal hygiene when handling ball pythons.
- Ball pythons are nocturnal; therefore, the best time to



Stephen Hernandez-Divers, BVetMed, CBiol, MIBiol, DZooMed, MRCVS, Dipl ACZM

VITAL STATISTICS

Life span	maximum	30-40 years
	avg captive	20-30 years
Body length (adults)		36-48 inches (90-120 cm)
Body weight		Age/length dependent
Sexual maturity		3-5 years
Gestation/incubation		90 days

Incubator temperature	86-89.6°F (30-32°C)
Ambient daytime temperature	80-85°F (26-29°C)
Ambient nighttime temperature	Not <75°F (24°C)
Basking area temperature	90-94°F (32-34°C)
Incubator relative humidity	80-100%
Humidity	50-80%

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tt Stahl, DVM

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interact with the snake is during the evening hours when it is more active.

SEXING

- Ball pythons are difficult to sex visually, but are easy to sex via a probe.
- The males have thicker tails, and the anal spurs are longer and more curved.
- Females have a probe depth of 2-4 subcaudal scales and males have hemipenes with a probe depth of 6-10 subcaudal scales.

HOUSING

- Standard aquariums work well as enclosures.

Ideal Size:

- Hatchling: 10 gal tank (20” x 10” [50 x 25 cm])
- Adult: 20-30 gal tank (36” x 12” [90 x 31 cm])

- Snakes must be able to stretch out in an environment that encourages exercise.
- The cage should have a screen top for adequate ventilation. Tops should be secure and escape proof.
- Sliding doors should be secure and raised on a plinth to prevent waste accumulation.
- A dark hiding box is mandatory for a sense of security and a place to rest during daylight hours.
- The lids of glass and plastic vivaria must be at least 50% mesh to provide adequate ventilation.
- Suitable substrates should be easy to clean and include newspaper, paper towels, indoor-outdoor carpet, Astroturf®.
- Unsuitable substrates are corncob, wood chips/shavings,

gravel, dirt, rocks or other substances that could be ingested and cause blockage of the digestive tract.

- Cypress mulch may be used as a substrate for adults but must be kept free of moisture and fecal/urinary contamination and changed frequently.
- Some ball pythons will not eat unless they are able to burrow.
- Ball pythons do not require sources of UV light in their enclosure because they are nocturnal and obtain vitamin D_3 in their diet.
- A climbing branch or two should be provided. Artificial greenery adds a nice touch as well as a sense of visual security for the snake.

TEMPERATURE

- Ambient air temperature should be provided throughout the enclosure.
- Proper temperature regulation is the most important aspect in maintaining a healthy snake.
- The enclosure must be kept between 80-85°F (26-29°C) during the day, with a basking area kept at 90-94°F (32-34°C). At night, the air temperature should not fall below 75°F (24°C).
- Room temperature is not adequate for the digestive process and health of the snake.
- Heating may be provided by special reptile heating pads or tape or with overhead ceramic heaters in porcelain reflector hoods, screened off or placed to avoid direct contact with the snake. Thermostat control is ideal.
- A barrier should be provided between the snake and any heating elements or hot surfaces.



Proper humidity levels help to ensure successful sheds for the snake.

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Frozen mice are available in many pet shops.

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Ball Pythons

- Two thermometers are needed for the cage: one 1” (2.5 cm) above the floor in the general enclosure area and another near the basking site.
- The use of “hot rocks” in the snake’s enclosure is a leading cause of thermal burns and should be avoided.

HUMIDITY

- Proper humidity levels help to ensure successful sheds.
- The ideal humidity of the enclosure is between 60-80%.
- An alternative is to provide a shedding box (e.g., Tupperware® container with moistened sphagnum moss or terry cloth towels and the two opposite corners cut out for entry and exit). The snake can be trained to use this box for shedding. A box with moistened sphagnum moss may also serve as an egg-laying site.
- Fresh water must be provided at all times in a water bowl that is large enough for the snake to soak in. The water should be changed when soiled.

DIET

- Ball pythons are fed at night.
- Young snakes (2-3 years of age and 18-36 inches long) should be fed every 7-10 days; older snakes should be fed every 2-3 weeks.
- A prey item appropriate to the size of the snake should be fed at each meal.
- Ball pythons are constrictors — they coil around their prey and suffocate it.
- Only stunned or prekilled prey should be offered to avoid severe injury to the snake.

Ball Pythons

- Gerbils are the initial prey of choice, although dark-colored mice or hamsters might work as prey in a reluctant eater.
- Some snakes do not recognize red-eyed white mice as a food item.
- Rubbing mice with a gerbil can impart the scent of the gerbil to the mouse and aid in converting the snake to a mouse diet.
- Frozen mice are available in many pet shops.
- As the snake gets larger, small rats are ideal.

RESTRAINT/TRANSPORT

- Support must be given at two points on snake's body.
- If aggressive, hold the snake securely behind the head and support body.
- A pillowcase is suitable for transport.

BLOOD COLLECTION

- Cardiac puncture is the standard and preferred method. The heart is located 25-35% of the distance from the snout.
- The heart is palpated and immobilized between the thumb and forefinger. Advance the needle at 45° in a craniodorsal direction into the apex of the beating ventricle. Maintain digital pressure for 30-60 seconds following blood draw.
- The caudal vein may be accessed caudal to the cloaca, between 25-50% down the tail. Angle the needle 45-60° along the ventral midline. Avoid the paired hemipenes in males and the paired cloacal musk glands in females.



Scott Stahl, DVM

Support at two points on snake's body.



For radiographs, the snake may be restrained in a radiolucent container. The x-ray cassette is placed under the patient.

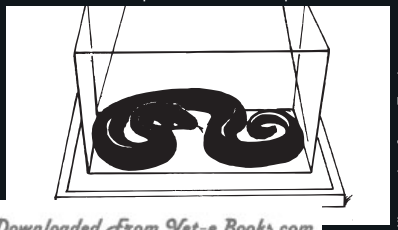


Illustration from Exotic Companion Medicine Handbook for Veterinarians

HEMATOLOGY REFERENCE RANGES	
RBC (x 10^6)	1.0-2.5
Hct (g%)	20-30
WBC (x 10^3)	6-12
Lymphocytes	44-61%
Heterophils	26-55%
Eosinophils	0-4%
Basophils	0-4%
Monocytes	0-3%

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Albino ball python

Steve Osborn

Pinworms are associated with rectal irritation, rectal prolapses and gastrointestinal impactions.



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Ball Pythons

ANESTHESIA

- When needed, preanesthetic rehydration is ideal.
- Consider preemptive analgesia with meloxicam (0.1 mg/kg IM) or butorphanol (1-2 mg/kg IM).
- One of three methods may be used for anesthesia:
  - Induction with 5 mg/kg IM Telazol® or 20-30 mg/kg IM ketamine and then intubation and maintenance with isoflurane or sevoflurane. Monitor with pulse oximeter.
  - Induction with 5 mg/kg IV propofol and then maintenance with isoflurane or sevoflurane. Monitor with pulse oximeter.
  - Cardiac catheterization and propofol titration (5-10 mg/kg). Monitor with pulse oximeter.

MOST COMMON DISORDERS

- Anorexia
- Endoparasitism
- Necrotizing dermatitis
- Respiratory disease
- Stomatitis (mouth rot)
- Ectoparasitism (mites and ticks)
- Dysecdysis (retained skin shed, retained eye spectacles)
- Obstipation/constipation
- Dystocia/retained eggs
- Bite wounds from prey
- Inclusion body disease
- Rectal/colon or uterine prolapse
- Spinal fractures/trauma/thermal burns

ZOONOTIC POTENTIAL

- *Salmonella*
- *Aeromonas*
- *Campylobacter*
- *Enterobacter*
- *Erysipelothrix rhusiopathiae*
- *Mycobacterium* sp.
- *Zygomycosis*
- *Candida*
- Pentastomiasis

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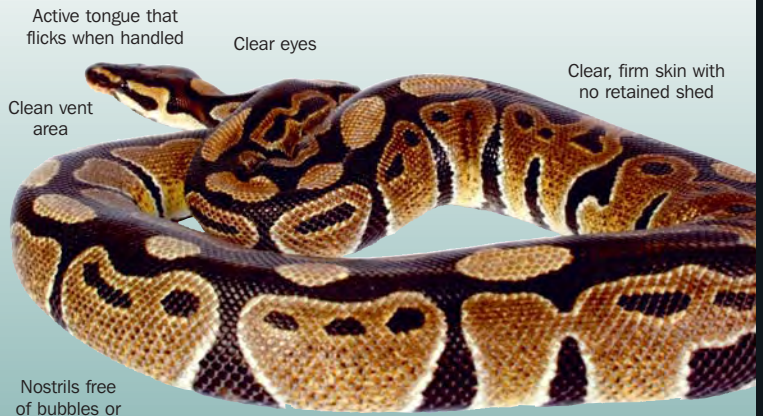
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THERAPY ADMINISTRATION

- A volume of therapeutic agent less than 1 ml can be administered orally in the back of the oropharynx with a ball-tipped feeding needle.
- If a volume over 1 ml is administered, a lubricated red rubber urethral tube passed several inches deep into the esophagus works well.



WHAT TO LOOK FOR IN A HEALTHY BALL PYTHON



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Giant Spider Pet Care

Adapted from Exotic DVM, Volume 5.6, © Zoological Education Network, 2005

- Pet potential, Sexing, Housing
- Diet, Restraint and transport, Molt
- Common disorders, Physical exam
- Hemolymp

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Giant Spiders

Giant spiders, commonly called tarantulas, are arthropods belonging to the Arachnid class, Araneae order, Mygalomorph suborder and Theraphosidae family. *Brachypelma* sp., *Aphonopelma pallidum* and *A. albiceps* are part of CITES Appendix II.

PET POTENTIAL

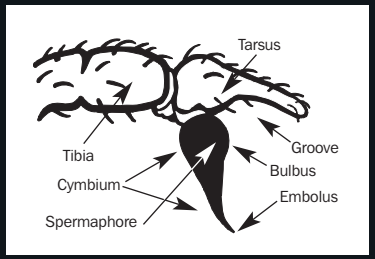
- Attractive due to graceful movements and bright colors.
- Easily managed with proper species husbandry information.
- Relatively tame and solitary animals.
- Recommended species for the beginner include: *B. smithi* (red knee), *B. albopilosum* (curly hair), *B. vagans* (red rump), *Grammostola rosea* (Chile rose), *A. avicularia* (pink toe), *P. cambridgei* (Trinidad chevron).
- Not suitable pets for children.
- Giant spiders should not be handled.
- A few genera (not of the Theraphosidae family) have lethal venom (e.g., *Atrax* spp., *Phoneutria* spp.)
- All adults can impart extremely painful bites with subsequent allergic reactions that may be serious. New World species possess urticating bristles/setae.
- The average lifespan in captivity is 18-20 years for females and 2-3 years for males after their ultimate molt.

SEXING

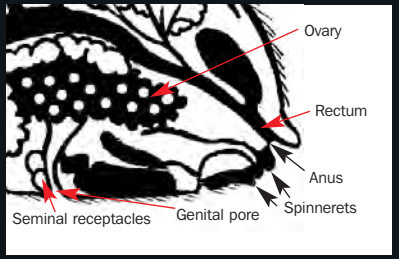
- Sexing a spider is possible by examining the inside portion of the molt.
- Adult females have a spermatheca, a sexual organ that stores the sperm, situated between the lungs.



MALE



FEMALE



Internal anatomy of a female

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MEXICAN RED KNEE *(Brachypelma smithi)*



ORIGIN	Central Mexican Pacific Coast
HABITAT	Semi-desert terrestrial, burrowing
CAPTIVE HOUSING	Medium-sized tank with a substrate of slightly moist compost is recommended for this typical terrestrial burrowing species. Include cork bark or half a flowerpot for hiding and an open water dish.
TEMPERATURE	70-80°F (21-27°C)
HUMIDITY	Approx. 60%
ADULT SIZE	Up to 6" (15 cm) legspan
BEHAVIOR	Popular because of bright coloring, beauty and docile nature. Adapts well to captivity. Slow growing. Can easily live in excess of 20 years. These spiders spend long periods sitting motionless in one place.
CAUTIONS	May bite

CHILEAN ROSE *(Grammostola rosea)*



ORIGIN	Chile
HABITAT	Scrubland areas, grounddweller, burrowing
CAPTIVE HOUSING	Medium-sized tank with a substrate of slightly moist compost is recommended for this typical terrestrial burrowing species.
TEMPERATURE	75-80°F (24-26°C)
HUMIDITY	Approx. 60%
ADULT SIZE	Up to 6" (15 cm) legspan
BEHAVIOR	Popular because of beauty and docile nature. Originally the two color forms (normal and red) of *G. rosea* were considered different species, *G. spatulata* and *G. cala*, but now both are classified as color variants of *G. rosea*. An extremely hardy species that is somewhat slow-growing yet long-lived.
CAUTIONS	May bite

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BRAZILIAN BLACK *(Grammostola pulchra)*



ORIGIN	Brazil
HABITAT	Tropical forests; terrestrial
CAPTIVE HOUSING	Medium-sized tank with a substrate of slightly moist compost is recommended for this typical terrestrial burrowing species. Will adapt to artificial burrow.
TEMPERATURE	75-80°F (24-26°C)
HUMIDITY	Approx. 60-65%
ADULT SIZE	Up to 7” (18 cm) legspan
BEHAVIOR	Popular because of beauty, docile nature and slow movement
CAUTIONS	May bite; is able to flick urticating hairs but rarely does

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BRAZILIAN SALMON PINK *(L. parahybana)*



ORIGIN	Brazil
HABITAT	Tropical rain forest, terrestrial, burrowing
CAPTIVE HOUSING	Medium-sized tank with a substrate of slightly moist compost is recommended for this typical terrestrial burrowing species. Provide cork bark or half a flowerpot for hiding and an open water dish. A deeper substrate will allow the spider to burrow.
TEMPERATURE	70-80°F (21-27°C)
HUMIDITY	Approx. 65%
ADULT SIZE	Up to 8” (20 cm) legspan
BEHAVIOR	Not known to be aggressive, but can be a little skittish. Adapts well to captivity.
CAUTIONS	May bite

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BRAZILIAN BLACK AND WHITE *(Nhandu coloratovillosus)*



ORIGIN	Brazil
HABITAT	Terrestrial
CAPTIVE HOUSING	Medium-sized tank with a substrate of slightly moist compost is recommended for this typical terrestrial burrowing species.
TEMPERATURE	75-80°F (24-26°C)
HUMIDITY	Approx. 60-70%
ADULT SIZE	Up to 7” (18 cm) legspan
BEHAVIOR	Slightly skittish and feisty
CAUTIONS	May bite; will flick urticating hairs without much provocation

BRAZILIAN WHITE KNEE OR WHITE BANDED
(Acanthoscurria geniculata)



ORIGIN	Brazil
HABITAT	Terrestrial
CAPTIVE HOUSING	Medium-sized tank with a substrate of slightly moist compost is recommended for this typical terrestrial burrowing species.
TEMPERATURE	75-80°F (24-26°C)
HUMIDITY	Approx. 60-65%
ADULT SIZE	Up to 8” (20 cm) legspan
BEHAVIOR	Fairly hardy in captivity and able to withstand lower humidity than most other South American species. Growth is rapid in the early stages, slowing as the spider matures.
CAUTIONS	Can be a defensive spider; will bite or readily flick urticating hairs.

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Giant Spiders

- Adult males show very small structures called emboli located on the underside of the distal pedipalps.
- Males are usually smaller and some have spurs/hooks on the tibia of leg i (see page 2 for identification).
- For most species, the age of sexual maturity is 2-3 years.

HOUSING

- Tarantulas must be housed in secure enclosures to simulate the appropriate environment and prevent escape.
- The size of the enclosure depends on the species. Tree, running and burrowing spiders need larger enclosures.
- Spiderlings can be housed in groups only for the first few weeks after emerging from the egg sac, while adults must be housed alone due to their potential cannibalism.
- To set up an ornamental vivarium, a glass tank with a sliding screen on the front or top is the best choice.
- For tropical species, most of the ventilation holes on the sides should be closed to maintain humidity.
- Homemade enclosures or plastic vivariums are acceptable for housing spiders during hospitalization. Glass or plastic jars with a few ventilation holes in the cover and a damp paper as bedding are also suitable.
- Peatmoss is the recommended substrate, but it may be prone to fungal and bacterial infection from organic waste, and frequent cleaning is necessary.
- Damp fine vermiculite may be used as an alternative substrate, but it is not suitable for burrowing.
- Artificial burrows should be provided for burrowing spiders.
- Driftwood, orchid bark and rocks are suitable as perches or shelters, as is a flowerpot turned on its side.
- For tropical or rain forest tarantulas, potted plants may be

GOLIATH BIRD EATER *(Theraphosa blondi)*



ORIGIN	Northern South America
HABITAT	Rain forests
CAPTIVE HOUSING	The goliath requires a large enclosure. A retreat in the form of cork bark or half a flower pot is necessary. High humidity is essential but the substrate should be allowed to dry out occasionally. A large open water dish is required. The enclosure should not be too high as these spiders like to wander, and a fall can prove fatal. Care should be taken when cleaning as the hairs can cause a severe reaction.
TEMPERATURE	75-80°F (24-26°C)
HUMIDITY	Approx. 60-70%
ADULT SIZE	Up to 12” (30 cm) legspan
BEHAVIOR	*T. blondi*, the largest species, grows up to 115 g and is a fast-growing, ravenous feeder.
	ful urticating hairs and may bite.

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CURLY HAIR *(Brachypelma albopilosum)*



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ORIGIN	Honduras, Nicaragua and Costa Rica
HABITAT	Tropical forest, burrowing
CAPTIVE HOUSING	Typical terrestrial set up. Provide retreat in the form of half a flower pot or piece of cork bark. Rarely digs deep burrows in captivity.
TEMPERATURE	75-80°F (24-26°C)
HUMIDITY	Approx. 60%
ADULT SIZE	Up to 6" (15 cm) legspan
BEHAVIOR	Popular because of docile nature; considered an ideal beginners' species. Grow rapidly and are long-lived captives.
CAUTIONS	May bite

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introduced to make the vivarium more attractive.
- Indirect natural sunlight from a window is sufficient for tarantulas; additional lighting or UVB lamps are not recommended.
- Heat may be provided by heating cables connected to a thermostat and placed under half the tank.
- Heat lamps are not recommended as a heat source because they frequently reduce the necessary humidity.
- A water dish should be added to the enclosure to maintain the required humidity, which is essential for a proper molt.

DIET

- Tarantulas are predators; usually feeding only on live prey.
- Variety in the diet may be the best for a healthy spider.
- The size of the prey should be 1/3-1/4 the length of the spider's body.
- Uneaten prey should be removed to reduce waste and to prevent the prey from biting or injuring the spider.
- Feed only healthy prey.
- Spiderlings should be feed daily or every 2 days with small fruit insects/flies (*Drosophila* spp.).
- Adults should be fed weekly from prey including African cockroaches, crickets (*Acheta domestica, Gryllus bimaculatus, Grillus assimilis*), grasshoppers (*Locusta migratoria, Schistocerca gregaria*), mealworms (*Tenebrio molitor*), super/king worms (*Zophobas morio*), wax moth larvae (*Galleria melonella*), earthworms and pinkies. Some genera prefer to prey upon lizards.
- Feeding high-energy food and vitamin/mineral supplements to prey may be beneficial (gut loading).

Giant Spiders

RESTRAINT AND TRANSPORT

- A gauze sling, positioned at the pedicel and loosely looped to allow a finger to immobilize the caudal caphalothorax/cranial abdomen, may be used for restraint.
- Tarantulas should be handled as little as possible and only for a short period.
- To avoid a fall or escape, it is advisable to examine the spider over a basin on the table.
- Special tools or ornamental fish nets may be used to lift giant spiders, unless the animal is tame enough to be restrained gently with the thumb and the middle finger applied between the cephalothorax and abdomen.
- All giant spiders are capable of hurting the handler.
- All species are venomous and can give potentially nasty bites or flick very painful urticating hairs from their abdomen (using their hind legs) that may cause allergic reactions.
- Use caution during the examination to avoid damaging a leg and to prevent the animal from falling.
- The ventral portion of the spider can be observed by viewing it from the bottom of a transparent container in which it has been placed to prevent escape.
- The best way to transport a tarantula is to place it in a small plastic terrarium with damp paper on the bottom, which keeps it safe and prevents escape.
- In colder weather keep the spider warm by placing the transport jar in a bag with a heating pad or plastic bottle filled with warm water.

HEMOLYMPH TRANSFUSION

- A break in the exoskeleton with sudden lymph loss

The best way to capture a tarantula

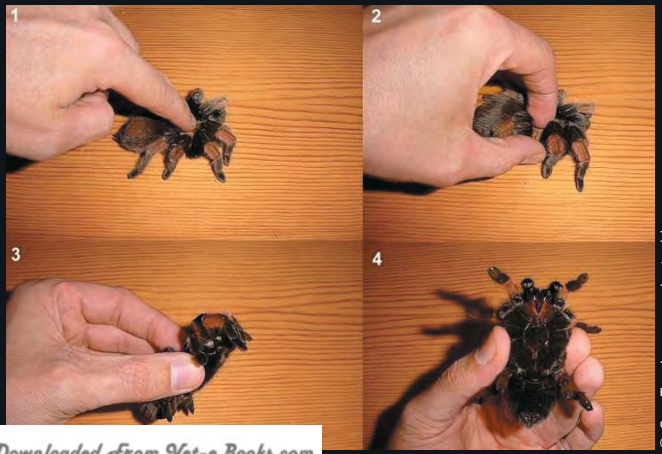


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Tarantula restraint for hemolymph transfusion



A 4-step method to capture and restrain a tarantula.



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Tarantula showing signs of dehydration



Hemolymph transfusion



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HEMOLYMPH COLLECTION

- The giant spider is anesthetized with 3% isoflurane.
- The site of puncture for hemolymph collection is the dorsal abdomen where the needle can access the heart.
- This is a very safe procedure and may also be useful for detection of bacterial infections.
- After the fluid is collected, gentle pressure must be applied to the site.
- If the hemolymph does not stop draining from the puncture, a drop of tissue glue should be applied.



Raffaele Melidone, DVM

Raffaele Melidone, DVM

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causes a rapid deterioration in the internal pressure and consequent serious shock.

- Rehydration is possible by placing the spider in a shallow water dish; however, it may drown if the booklungs are submerged.
- Hemolymph transfusion provides the best opportunity to counteract shock, dehydration and hemolymph loss.
- The transfusion procedure is relatively easy to perform.
- The insertion of an IV cannula into the spider's heart will allow the patient to successfully transfuse/rehydrate over 2-4 consecutive days without repeated injections.
- A 26-ga IV cannula should be inserted into the cardiac sinus ("heart") at a 30° angle to perform the procedure properly, quickly and with minimal risk for the patient.

MOLT

- In their first 2-3 years of life, giant spiders molt every 1-3 months, depending on the species, age, humidity and availability and quality of food.
- After that growth period, molts occur less often, from every 6-7 months to once annually. Terrestrial spiders molt less frequently than arboreal species.
- The spider should not be disturbed during the molt as it is fragile.
- Spiders may get a bald spot on abdomen prior to shed.
- During the molt, the spider is fairly immobile for 24-48 hours; they flip over on their backs and slowly emerge.

PHYSICAL EXAM

- History (housing, microclimate, diet, molts, behavior).
- Ophthalmic magnifying loupes should be used. Note the

turgidity of the opistosoma (abdomen), which must be lifted from the ground for examination, correct position of the limbs and presence of ectoparasites (mainly mites).

- Fecal testing should be done, if possible.

COMMON DISORDERS

- Anorexia
- Alopecia (focal or generalized)
- Molting problems
- Wounds
- Lethargy
- Incoordination
- Dehydration
- Ectoparasites/endoparasites
- Injuries, such as falls, burns, detachment of limb segments and rodent bites
- Practical therapies for emergency situations include administration of hypotonic fluids, parenteral or oral antibiotics and topical ointments as well as suppression of any lymph loss, mainly from a ruptured abdomen or loss of limb (possibly using tissue glue [smaller injuries], candle wax, corn starch or talcum powder).

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B. auratum showing premature molt problems



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B. vagans with major nematode worm infection



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Grammostola rosea was presented because of a mouse bite. Note the collapsed abdomen



Haplopelma sp. with severe book lung mold infection



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