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# The Domestic Ferret: A Guide for the Veterinary Practitioner

K. C. Cornish, BA, DVM\*  
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## Natural History

The domestic ferret (*Mustela putorius furo*) is a small, elongated, lithe carnivore. It belongs to the Mustelidae family, along with the skunk, badger, and mink. Its domestication from the wild European polecat dates back to the 4th century B.C. when it was used for rodent and snake control, and later, for rabbit hunting.<sup>1</sup> It has been raised in captivity for centuries, and selectively bred for productivity and desirable behavioral traits. The domestic ferret was first imported to the U.S. about 1875. Unlike its relatives, it is not a wild animal. It has survived for centuries only in captivity. This animal should not be confused with the endangered black-footed ferret (*Mustela nigripes*) that is native to the U.S.

Currently, there are approximately 100,000 households keeping ferrets as pets in the U.S., as compared to only about 14,000 five years ago.<sup>2</sup> As such, having at least one active ferret client in any given practice is fast becoming the rule rather than the exception.

The ferret is also used extensively as a research animal. Currently about 6,000 are purchased for this purpose yearly.<sup>3</sup> As a laboratory animal, the ferret has been used experimentally in reproductive endocrinology and physiology, pharmacology, virology, teratology, and fetal alcohol syndrome studies.<sup>4</sup>

There are two varieties of the domestic ferret. The fitch, also referred to as the wild type, polecat, or common ferret, is a buff color with a black mask, limbs, and tail. It is born silver-gray, and becomes a milk chocolate brown by the time it

is weaned. The albino, or English, variety is born snow white with pink eyes, but its coat tends to yellow with age due to sebaceous gland secretions. The albino and its color mutants, the silver mitt, silver, and Siamese, are recessive to the fitch coloration.<sup>5</sup>

## Behavior

The ferret tends to have a friendly personality. Its innate playfulness and curiosity make it a fun pet. The ferret can find its way into surprisingly "inaccessible" places. It has retained some of its wild relatives' instinct to exploit existing tunnels or burrows, and will explore any dark recess in the home. For this reason, if the caretaker intends to allow the ferret free run of the house, measures will have to be taken to "ferret-proof" most of it (e.g.: plug holes in the backs of appliances, repair holes in upholstered furniture, and secure closet doors).

The ferret is not strictly nocturnal, so it readily adapts to its caretaker's daily schedule. It has fastidious toilet habits, similar to a cat, making it relatively easy to litter train. It has no innate fear of man, cats, or dogs,<sup>4</sup> and can be mixed with other pets. This is easily done if the pets are introduced when young, but can be done with adult animals if judicious supervision is practiced initially. A ferret will ferociously defend itself if cornered, even against the largest dogs. Its aggressive display is very impressive. The amount and quality of human contact directly affect the ferret's attitude and temperament as a pet.

The ferret's jaw and neck structure, teeth, and claws are well adapted to its wild ancestors' carnivorous lifestyle. A tenacious biting grip is combined with a side-to-side ripping and tearing motion. It is best to discourage any activity that might lead to such behavior in the future, either in its character or in play. Handlers should avoid play activity with the ferret which involves the biting of fingers, and "tug-of-war" with objects

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that could be considered extensions of the hand. Any biting behavior should be met by a swift, light thump on the lower jaw, and a loud, curt "NO!" Reprimanding by hitting on the nose or skull should be discouraged due to the potential traumatic nerve and vascular damage.

Caution should be exercised, as with any pet, in allowing young children to play with ferrets. Ferrets have relatively poor visual acuity and/or depth perception, and a child's quick movements are easily misinterpreted as threatening, with young skin being easily torn by small, sharp teeth. A ferret should never be allowed to run free in a house where children are left unattended, and any interaction should be monitored under close supervision. In this way, tragic consequences can be avoided.

### Physical Characteristics

The ferret has an elongated, supple body, short powerful legs with non-retractable claws, and a long tail. Males, called "hobs," weigh three to six pounds (1350-2700 g), and females, called "jills," weigh one to two pounds (450-900 g), but both go through marked seasonal weight fluctuations of 30% to 40% due to the accumulation and loss of subcutaneous fat in the fall and spring, respectively. An adult will measure 17 to 22 inches (44-56 cm), from the nose to the tip of the tail.<sup>6</sup>

The ferret lacks a cecum, seminal vesicles and a prostate and bulbourethral glands. It has a unique large intestine in that there is no gross anatomical separation from the ileum. It appears as one long undifferentiated tube. There is, however, a functional separation.<sup>5</sup> In common with all mustelids, and most carnivores, the ferret possesses paired anal sacs. These open at four and eight-o'clock positions at the mucocutaneous junction of the anus. The sacs store the potent secretions of the perianal glandular complexes. Another feature, unique to the ferret, is the replacement of paired carotid arteries with a single, central ascending artery.<sup>5</sup> It is thought that this is a functional adaptation to maintain adequate cerebral blood flow while turning its head 180 degrees in maneuvering through tunnels! The ferret's respiratory system is also adapted to tunnel life. Its chest walls are extremely compliant, and its total respiratory capacity and inspiratory reserve are very large for its body size. The ferret's vertebral formula is: C7, T14, L6, S3, Cd14-18.<sup>6</sup> It has 14 pairs of ribs. Males have a relatively large os penis with an upturned tip. The permanent dental formula is: 213/3, C1/1, P4/3, M1/2), and supernumerary incisors are common.<sup>6</sup>

The ferret lacks any well developed sweat gland complexes. Its main method of heat exchange is via respiration. Consequently, the ferret is prone to heat prostration as ambient temperatures approach 90 °F (32 °C).<sup>6</sup>

A normal, healthy ferret will often present a cardiac silhouette that could be misinterpreted radiographically as having a dilated left ventricle.<sup>6</sup> As a pet, a ferret can be expected to live at least 5 to 6 years, and ages of 8 to 10 years are not uncommon.

### Nutritional and Environmental Requirements

A ferret makes a friendly, inquisitive, and quiet pet. It does have a range of vocalizations that it uses on occasion. It will often make a little grunting noise, similar to a guinea pig, when running and playing. If annoyed, it may hiss. If provoked to an aggressive display, it may make a loud bark, similar to a pika. The ferret chuckles quietly during coitus.<sup>5</sup>

The ferret's pelage changes color very little, if at all, through the year. It normally sheds its winter coat as it loses its fat layer in the spring.

Tables 1, 2, 3, and 4, give the normal hematological, serum chemistry, urinalysis, and physiological values, respectively. The ferret has a relatively high hematocrit compared to the cat and dog. Its blood must be spun longer to avoid artificially high values due to the negligible erythrocyte sedimentation rate.<sup>5</sup> The blood volume of a ferret is between five and seven percent of its body weight. Estrous females tend to have lower platelet and leukocyte counts. The normal heart rate is approximately 250 beats per minute, with ECG measurements similar to normal feline values.<sup>6</sup> Heart and respiratory rates and body temperature all commonly rise during a routine physical exam. For instance, the normal rectal temperature of 101 to 102.5 °F may temporarily be elevated to 104 °F. Proteinuria is a common finding, especially in the male. This may be due to relatively high systolic blood pressure.<sup>5</sup> The male's normally dark urine may also cause false positive readings for ketonuria when urinalysis reagent strips are used.<sup>5</sup> Traces of blood in the urine of estrous females is a common finding.

A question that needs to be addressed with every client relates to the pet's diet. The nutritional requirements for the domestic ferret are assumed to be similar to the mink and cat, with protein, 25-32% and 28%, and fat, 6-20% and 9%, requirements, respectively.<sup>6</sup> Several commercial wet mink diets are available, and a mink rancher in the region should be consulted for

**Table 1**  
**Hematological Values for the Domestic Ferret (mean/range)<sup>a</sup>**

	<u>Fitch<sup>3,7,8</sup></u>	<u>Albino<sup>5,9</sup></u>	<u>Fitch, estrous female<sup>8</sup></u>
RBC's (10 <sup>6</sup> /mm <sup>3</sup> )	8.5/8.1-8.8	9.2/6.8-12.2	6.0/1.8-9.1
Hemoglobin(g/dL)	15.5/12.0-17.4	17.0/14.0-18.0	12.1/4.0-18.0
Hematocrit(%)	46.4/42-51	52.3/42-61	36.0/13-53
Total Protein(g/dL)	5.9/5.3-7.2	6.0/5.1-7.4	6.1/5.4-6.9
Leukocytes(/mm <sup>3</sup> )	7900/6000-8100	10100/4000-19000	3800/1800-5800
Differential(%)			
Neutrophils	34/12-78	58/11-84	34.2/9-81
Band Cells	1.3/0-4.2	—	0.2/0-1.4
Lymphocytes	53.3/45-66	34.5/12-54	63.3/29-84
Eosinophils	3.3/0-9	2.5/0-7	1.2/0-5.5
Monocytes	5.2/0-8.2	4.4/0-9	1.0/0-3.8
Basophils	0.7/0-2.9	0.1/0-2	0.1/0-1.1
Reticulocytes(%)	0.5/0.4-0.6	4.6/1-14	1.0/2-2.6
Platelets(10 <sup>3</sup> /mm <sup>3</sup> )	820/760-871	499/297-910	154/3.5-506

a) Statistical analysis of reported values.

**Table 2**  
**Serum Chemistry Values for the Domestic Ferret (mean/range)<sup>a</sup>**

	<u>Fitch<sup>3,7</sup></u>	<u>Albino<sup>3,5</sup></u>
Glucose(mg/dL)	101/62-134	136/94-207
BUN(mg/dL)	29/12-43	22/10-45
Albumin(gm/dL)	3.7/3.3-4.1	3.2/2.3-3.8
ALP(IU/L)	53/30-120	23/9-84
AST(IU/L)	—	65/28-120
ALT(IU/L)	172/82-289	—
SDH(IU/L)	3.4/0.2-11.2	—
T. Bilirubin(mg/dL)	—	<1.0
Cholesterol(mg/dL)	—	165/64-296
Creatinine(mg/dL)	0.4/0.2-0.6	0.6/0.4-0.9
Sodium(mmol/L)	152/146-160	148/137-162
Potassium(mmol/L)	4.9/4.3-5.3	5.9/4.5-7.7
Chloride(mmol/L)	116/102-121	116/106-125
Calcium(mg/dL)	9.2/8.6-10.5	9.2/8.0-11.8
Phosphorus(mg/dL)	6.5/5.6-8.7	5.9/4.0-9.1

a) Statistical analysis of reported values.

**Table 3**  
**Urinalysis Results for the Domestic Ferret (male/female<sup>5</sup>)**

(based on 24 hr samples)

Volume(ml/24hr)	26/28
Sodium(mmol/24hr)	1.9/1.5
Potassium(mmol/24hr)	2.9/2.1
Chloride(mmol/24hr)	2.4/1.9
pH	6.5-7.5
Protein(mg/dL)	7-33/0-32

Table 4

Physiological Data for the Domestic Ferret<sup>5</sup>

Heart Rate (mean/range)	250/224-387 per min.
Respiratory Rate	33-36 per min.
Body Temperature	100.8-102.5 F°/38.2-39.2 C°
Systolic Blood Pressure(awake)	
male/female	161/133 mmHg
Blood Pressure(anesthetized)	
male/female	140/110 mmHg
Lifespan (pet)	8-10 years

sources. These diets are usually a fish base, and consist of 35% protein, 30% fat, and 5-6% ash.<sup>10</sup> They must be refrigerated, and are extremely malodorous.

The ferret tends to eat to its caloric requirements. While this may be convenient in allowing ad libitum feeding, it can lead to a wasting syndrome. This problem can develop in any ferret being fed high calorie cat or dog food which fails to satisfy the daily protein requirement. Clinical signs of this syndrome can manifest in any system requiring protein for its development and/or maintenance. Chronic weight loss, neurological deficits such as blindness, skin abnormalities, and poor reproductive performance, are examples.

A good, readily available food that satisfies the ferret's basic nutritional needs is a dry kitten chow. Adult cat foods should be supplemented with small amounts (10-20% of the total diet) of cooked meats. Fiber is only marginally digested by the ferret, and should be avoided (eg.: low quality pet foods high in cereals, popcorn, and high fiber fruits and vegetables). Small amounts (3-4 ml/day) of milk can be used to supplement calcium, but may result in loose stools. Cod liver oil (3-5 drops/day) can be fed if the ferret's coat becomes dry. If large amounts of horse meat are being fed, vitamin E (10 mg/day) should be supplemented to prevent the development of steatitis.<sup>3</sup> While feeding a well-balanced, free-choice diet is possible, there are some benefits to dividing a ferret's daily intake into two or three meals. This affords the caretaker a regular opportunity to monitor the ferret's general health, reinforces the caretaker/pet relationship, and provides a potential training aid. Fresh water should be available at all times, and rodent mineral licks can be used to supplement the diet if desired.

Because the ferret is prone to heat prostration, care must be given to providing well ventilated housing out of direct sunlight and away from heat sources. Cat and rabbit cages with secure doors and narrow bar spaces, or heavy wire mesh make good quarters.<sup>11</sup> The floor spaces must be wide enough to allow feces to fall through, yet narrow enough for the ferret to walk on. Half inch spacings are usually sufficient. The floor space must be large enough to allow for a den, eating area, and dunging area if the ferret is to be confined to the cage for any length of time. Although not too adept at climbing, a ferret enjoys it, so the cage doesn't have to be restricted to a single level. For instance, three staggered levels within a two and a half to three foot tall cage can be designed to accommodate a lower litter area, and upper sleeping and eating areas. This type of design provides a built-in exercise routine for the pet.

The ferret should be housed individually or in sexually distinct, if intact, groups. Hobs may be kept together from September through February, but the incidence of aggression will increase as the rut approaches. Estrous jills intended for breeding should not be housed together, nor with females mated in the past five days, since their play may induce ovulation and pseudopregnancy.<sup>5</sup>

### Reproduction

The ferret becomes sexually mature at 8 to 12 months of age, usually in the spring following its birth. The female is seasonally polyestrous with induced ovulation. Her normal breeding season begins in March and extends into August. The season is triggered by increasing photoperiod. This lends itself, if desired, to manipulation using controlled lighting techniques. Increasing

daylight length not only triggers estrus, it induces male spermatogenesis. The hob's potential breeding season begins and ends earlier than the jill's, starting in December and extending into July. This is thought to be a functional adaptation to allow time for adequate sperm maturation and fertility.<sup>5</sup> During this period the testes descend from their quiescent position in the subcutaneous anterior inguinal region into the scrotum. The fertility of both sexes decreases after three to four years.

During estrus, the jill's vulva swells to its full size of one to two cm in diameter over about a one month period. She will remain in a state of constant estrus for up to 120 days if not bred. Prolonged estrus is characterized by weight loss and aplastic anemia. Complications of this condition account for the belief that an unmated jill will "pine away and die" unless something is done to induce ovulation. Once ovulation is induced, the vulva should regress to normal dimensions over a two to three week period.<sup>5</sup>

Mating should be initiated on the fourteenth day following the onset of vulvar swelling. The jill should be taken to the male's cage. Ferret mating behavior is very involved and often violent, lasting from one to three hours. The hob is generally aggressive towards the jill, and a lot of jumping, rolling, and vocalization occurs. Eventually, he grasps the jill by the nape of the neck, and drags her around, for up to an hour, until she is limp. At this point, intromission is attempted. Hobs are not known for their skill in this aspect of mating. After intromission is achieved, the pair lay locked together, side-by-side, for one half to three hours. This is thought to be a functional adaptation, since reflex ovulation is stimulated by coital excitation. The hob should be removed after mating to reduce the trauma suffered by the female. Breeding on consecutive days will increase the conception rate and litter size.<sup>5</sup> The jill should be examined one week post-breeding. At this time, the vulva should be flaccid and markedly smaller if ovulation has occurred. If the vulva is unchanged in character, the jill should be re-bred. Should a mating be nonfertile, the jill will go through a 40 to 42 day pseudopregnancy.<sup>5</sup>

The ferret's gestation length is 42 days, with less variation than the cat or dog. The jill appears visibly pregnant at 30 days, but is palpably pregnant as early as 14 days of gestation. She should be isolated in a quiet, individual cage two weeks prior to her due date. Keeping her quiet, and continuing to do so through the first week post-partum, will decrease her irritability and the in-

cidence of cannibalism. During this time she will make a nest using available bedding and her own fur.<sup>5</sup>

The ferret averages about eight kits per litter. A jill can raise more kits than she has nipples if she is a good milker. The kits are born hairless and blind, weigh about 10 grams, and have a large fat pad on the dorsum of their neck. Initially, they use their forelegs almost exclusively. They grow rapidly, having fur at two days of age, and a fluffy coat by two weeks. Their eyes and ears begin to open at 28 days, and are completely open by 37 days. Deciduous teeth erupt at about 14 days of age. Permanent canines appear at 47 to 52 days, and deciduous canines are shed at 56 to 70 days. Neonates will begin to show an interest in solid food at three weeks of age. They should be weaned and continent at four to five weeks. While nursing, the jill stimulates urination and defecation in the kits by licking their urogenital regions.<sup>5</sup>

In some lines of ferrets, there is a significant mortality rate among neonates. Infanticide and agalactia (often with a nutritional component) account for the largest percentage of these deaths. Cannibalism is normally a minor problem in the general population, but even normal jills and kits will consume a dead litter member. The incidence can be reduced by providing a clean, dry, warm, quiet environment, and a well-balanced diet with fresh water. Occasionally, a jill will accidentally dismember a kit during normal activity in the nest. Spontaneous congenital malformations occur at a rate of about three percent in the general population. A jill will often instinctively cull malformed or weak kits.

The jill's full reproductive cycle, from the onset of proestrus to weaning, is 14 weeks so two potentially fertile matings per year are possible. She will return to estrus about two weeks post-weaning (six to eight weeks post-partum), or in the next season, depending on the timing of the first mating.<sup>5</sup>

### Handling

Upon presentation to the practitioner, it is best to let the owner extract the ferret from its cage and place it on the exam table. Allow the animal several minutes to acclimate to its new surroundings. During this time a history can be taken, and general health and disposition evaluated. It doesn't take too long before any short-lived anxiety is overcome by the ferret's natural curiosity. Initially, the use of light leather gloves is only prudent, especially if the patient's disposition is unknown. The key to handling a ferret is employ-

ing slow, deliberate movements at all times. The object is not only to avoid being bitten, but to avoid the expression of the anal sacs. Warning signs of a potentially fractious constitution including arching of the back, lowering of the head, and a fluffed out, twitching tail.<sup>12</sup>

While a ferret should never be lifted by the tail, this appendage can be used to gain control of the patient. While gently applying caudal traction to the tail, the ferret will try to pull forward, allowing the upper torso to be grasped.<sup>13</sup> Unlike cats, a ferret won't tolerate simultaneous traction on its nape and rear legs. Two hands are usually required for manual restraint, one to control the head and forelegs, and one to support the rear-quarters. Two things, short of resorting to chemical restraint, can be tried to calm an unruly ferret. Placing the patient in dorsal recumbancy may allow for noninvasive physical exam procedures. Gently placing a towel over the patient's head may further aid the endeavor. Suspending the ferret by the nape of the neck has a sedating effect on all but the most fractious, and can be used in taking a rectal temperature.

Drugs used for chemical restraint are given in Table 5. Ketamine hydrochloride, at a dose of 25 mg/kg, in combination with xylazine, at a dose of 2 mg/kg, given intramuscularly in the same syringe is the recommended anesthetic protocol. It provides an acceptable level of analgesia and muscle relaxation, sufficient duration of action for routine procedures (15-30 min.), and a smooth recovery.<sup>15</sup> Should the need arise, atropine can be given in an attempt to at least partially reverse any xylazine-induced arrhythmias. Some method of warming the anesthetized ferret should always be employed.

Subcutaneous and intramuscular injections can be given as in other small animals, with due regard for the thicker subcutaneous fat layer. A ferret will resist most manipulation attempts of the rear legs, so injection into the neck or lumbar regions is usually better tolerated. Due to the difficulty in locating suitable vessels and the size factor, intravenous injections in the unanesthetized patient is not recommended.

Blood collection from an alert and responsive ferret is difficult. While toenail clipping yields less

Table 5  
Drugs used for Chemical Restraint, Sedation, and Anesthesia  
in the Domestic Ferret<sup>5</sup>

<u>Drug</u>	<u>Dosage</u>	<u>Route</u>
Sedatives		
Acepromazine	0.2-0.5 mg/kg	IM, SQ
Xylazine	1.0 mg/kg	IM, SQ
Ketamine	10-20 mg/kg	IM
Preanesthetics		
Atropine	0.05 mg/kg	IM, SQ
Acepromazine	0.1-0.25 mg/kg	IM, SQ
Anesthetics		
Ketamine (alone)	20-30 mg/kg	IM
Urethane	1.5 mg/kg	IP
Ketamine and Acepromazine	20-35 mg/kg + 1-4 mg/kg	IM, SQ
Ketamine and Xylazine	20-30 mg/kg + 1-4 mg/kg	SQ
Ketamine and Diazepam	25 mg/kg + 2 mg/kg	IM
Pentobarbital	30-35 mg/kg	IP
Halothane		mask, endotracheal tube
Methoxyflurane		mask, endotracheal tube
Analgesics		
Aspirin	200 mg/kg	PO
Phenylbutazone	100 mg/kg	PO
Meperidine	4 mg/kg	IM

than 0.5 ml of blood, this is often enough for a hematocrit, total protein, and, maybe, a complete blood count and smear. If the ferret is tractable, ventral tail or jugular venapuncture with the animal in dorsal recumbancy may be attempted.<sup>9</sup> Suspension by the nape of the neck may facilitate a sample from the ventral tail vein on the more active patients. Small gauge needles and patience on the part of the patient and the clinician are necessary for successful venapuncture.

Blood can be collected from the anesthetized patient using a retro-orbital technique. One to three ml of venous blood can be collected safely from a young, 100-300 gm, ferret. From the adult ferret, 600-2000 gm, 5 to 10 ml of blood can be collected without adverse side-effects.<sup>14</sup> With the ferret in dorsal recumbancy, a heparinized capillary tube (broken to produce a cutting edge) is introduced into the medial canthus, and directed caudomedially into the retro-orbital venous plexus located at the back of the orbit. The blood is allowed to flow into the desired blood tube(s). Pressure from the retro-orbital fat and the eyeball provide hemostasis. While this is a relatively safe procedure, practice on laboratory animals or terminal patients is recommended to become proficient at this technique.

Cardiac puncture is used extensively in laboratory situations on anesthetized ferrets, but carries added risks to the patient. Cut-downs may be used to gain better access to the jugular vein or femoral artery. The cephalic and saphenous veins may also be suitable on larger patients.

Euthanasia can be achieved by administering a barbiturate overdose. Injection of the selected solution into the caudolateral peritoneal cavity produces a smooth, relatively rapid transition. Intracardiac injection has a more rapid effect, but administration usually meets more patient resistance.

### Diseases and Vaccinations

Canine distemper virus (CDV) infection is one of the most common and devastating infectious diseases affecting the domestic ferret. The ferret will begin to show clinical signs of the infection seven to nine days after contact with the infected animal (dog or ferret). A mucopurulent ocular discharge is often the presenting complaint. Accompanying this may be anorexia, fever up to 105° F, nasal discharge, and other ocular manifestations (blepharitis, keratoconjunctivitis sicca, or corneal ulceration). Two to three days after the onset of the ocular signs, cutaneous rashes begin to break out on the chin, inguinal region,

and foot pads. These can develop further into pruritic secondary pyodermas, and footpad hyperkeratosis. Pneumonia and diarrhea may also be present, and the anus characteristically protrudes.<sup>16</sup> Should the ferret survive this catarrhal phase, the disease progresses into a neurologic syndrome characterized by hyperexcitability, muscle tremors, convulsions, and coma.<sup>17</sup> Mortality is virtually 100%. A ferret will usually succumb within one week (2-35 days) after the onset of clinical signs. Euthanasia is an acceptable alternative to symptomatic care, especially if the patient could potentially infect other ferrets.

Prophylactic vaccination against CDV should be highly recommended. Table 6 gives a schedule for vaccination of the pet ferret. Modified live vaccine of chick embryo tissue culture origin<sup>b</sup> should be given intramuscularly or subcutaneously at 7 to 10 weeks of age (4-7 weeks if the dam is unvaccinated).<sup>16</sup> The initial vaccination should be followed by a booster two weeks later, again at one year, and then every three years. This type of vaccine, using the standard canine dose, is safe and effective. Pregnant jills can be vaccinated without side effects. Care should be taken to avoid the use of canine or ferret cell culture propagated vaccine, as these may revert to virulence within the ferret. Killed vaccine provides only short term and questionable protection. While the use of the common multivalent canine vaccines may be dictated by availability and economics, this practice isn't recommended.

The routine vaccination of a ferret against rabies isn't recommended, sanctioned, or approved by the American Veterinary Medical Association at this time. The ferret is very susceptible to the virus, and capable of transmitting it however, so the potential for exposure should be determined for each patient, and acted on accordingly. Only four cases of ferret rabies have been reported in the United States since 1954, and at least one of these may have been due to the use of a modified live vaccine.<sup>18</sup> Diagnosis, at this time, can only be done by the post mortum analysis of the brain. If vaccination is opted for, a killed vaccine of murine origin<sup>c</sup> should be used annually, beginning at three months of age.<sup>6</sup>

The ferret is susceptible to several strains of human influenza virus. The clinical signs resemble

b) Fromm D™, Fromm Laboratories, Grafton, WI 53024.

c) Trimune,® Fort Dodge Laboratories, Inc., Fort Dodge, IA 50501.

Table 6

Schedule of Vaccination and Routine Prophylactic Care for the Pet Ferret<sup>5</sup>

<u>age</u>	<u>plan</u>
7-10 weeks (4-7 wk if dam unvacc.)	1st CDV vacc. <sup>a</sup> ; fecal
9-12 weeks	2nd CDV vacc. <sup>a</sup> ; fecal
3 months	rabies vacc. <sup>b</sup>
6-8 months	neuter; descent; fecal
1 year	CDV booster (triennial) <sup>a</sup> ; rabies booster (annual) <sup>b</sup>

a) modified live vaccine of chick embryo tissue culture origin.

b) killed vaccine of murine origin.

the early manifestations of CDV infection, however, the animal usually recovers in two to three days if provided with a warm, dry environment and rest. Symptomatic therapy may also alleviate some of the clinical signs. Ferrets are also infected by the virus causing Aleutian disease in mink, but the infection is usually subclinical. Some animals may develop hypergammaglobulinemia, become emaciated, have black tarry feces, and eventually die, but this is rare. The ferret is also experimentally susceptible to pseudorabies and infectious bovine rhinotracheitis.<sup>1</sup>

The ferret is not susceptible to canine hepatitis, mink virus enteritis, feline panleukopenia, feline rhinotracheitis, or feline calicivirus, and canine parvovirus infection has not been reported.<sup>6</sup> Vaccination against these diseases is unwarranted. Clinically normal, feline leukemia virus positive ferrets have been identified. It is believed that the ferret may have its own innocuous retrovirus that produces a false positive FeLV assay.

The ferret is very susceptible to type C botulism, and is moderately susceptible to types A and B. Signs of muscle incoordination and stiffness begin within 12 to 96 hours of ingestion of the contaminated food, and it usually will die of anoxia due to respiratory paralysis. This disease is most common in commercial ranches where wet-mix feed is being fed. Vaccination at weaning with type C botulism toxoid will protect a ferret for about a year. A pet being fed fresh food daily need not be vaccinated.<sup>5</sup>

Avian, bovine, and human strains of *Mycobacterium tuberculosis* readily infect the ferret, with primary predilection sites being the alimentary tract and the abdominal lymph nodes. Infection leads to a wasting away syndrome and often some

degree of paralysis.<sup>6</sup> Tuberculosis should be suspected if a ferret's mesenteric lymph nodes are palpably enlarged.

Staphylococcal and Streptococcal infections are common during the breeding season due to the ferret's intense mating behavior. The female can be severely traumatized by the male. Vulvar irritation during estrus may also lead to secondary infection. *Streptococcus zooepidemicus* can cause pneumonia and mastitis, and *Staphylococcus intermedius* is a common cause of mastitis. These infections can be treated as in the dog or cat. If streptomycin is the drug selected for treatment, care should be taken to keep the total dose given over a 12 hour period under 50 mg. Similarly, toxicity has been reported with the use of sulfaquinoxaline.<sup>3</sup>

Oral Salmonella infections in the normally resistant ferret may cause abortion if the infective dose is large enough or accompanied by sufficient stress.

*Campylobacter fetus* subsp. *jejuni* can cause a proliferative colitis in the ferret.<sup>19</sup> Clinical signs include anorexia, dehydration, green mucohemorrhagic feces, and rectal prolapse. Supportive therapy is usually unsuccessful, but fluids and broad spectrum antibiotics may be tried. This particular agent may also be the cause of a warm weather-associated enteritis with acute and chronic fatal manifestations. Neomycin, at 10 to 20 mg/kg, has been tried with some success in this disease.<sup>6</sup>

The ferret shares many of the parasites common to dogs and cats. *Sarcoptes scabiei* infestations usually manifest clinically as scabby, swollen feet with loose claws. Treatment consists of sulfur ointments or lime and sulfur dips (30-32% cal-

cium polysulfide). Pruritus can be reduced with prednisone, at a dose of 2 mg/kg.<sup>3</sup> Ringworm, usually *Microsporum canis*, is readily contracted, usually from cats. This can be treated orally using griseofulvin, at 25 mg/kg.<sup>1</sup> Fleas (*Ctenocephalides sp.*), ear mites (*Otodectes cynotis*), ticks, and lice are treated similarly to cats. Cat protocols of therapy may also be used for *Toxoplasma gondii*, *Giardia spp.*, *Filaroides spp.*, *Toxascaris leonina*, *Actinomyces spp.*, *Cryptococcus neoformans*, and for several species of coccidia and tapeworm infections of the ferret. Dichlorvos is effective in clearing a worm problem. It can be used at a dose of 25 to 35 mg/kg orally, in divided doses on consecutive days. Mebendazol, at 15 mg/kg, will also, in addition to most nematodes, eliminate most tapeworms.<sup>17</sup>

*Dirofilaria immitis* infection has been reported in the ferret.<sup>20</sup> Of course, this is most common when the ferret has access to the outdoors. The ferret has very little ability to tolerate the presence of the adult parasites in the heart. Only two or three adult heartworms are necessary to severely compromise the cardiopulmonary system of a ferret. Diethylcarbamazine liquid in the ferret's food can be used prophylactically at a daily dose of 1.25 to 2.5 mg/lb.<sup>17</sup> Ivermectin, at 1 mg/kg, is effective in killing the adult parasites.<sup>3</sup>

Estrus-associated bone marrow depression is a major health concern for the female ferret. Being an induced ovulator, a jill will remain in heat for up to 120 days if ovulation does not occur. This is a potentially life threatening situation and should not be allowed to happen if possible. Under the influence of high levels of estrogen, the estrous jill can develop a severe anemia. She is also prone to malaise, weight loss, vulvar trauma, and increased susceptibility to uterine infections.<sup>22</sup> The presenting clinical signs include pale mucous membranes, bilaterally symmetrical alopecia of the ventral abdomen and tail, melena, petechial and ecchymotic hemorrhages, anorexia, and depression. It is usually subclinical until the packed cell volume (PCV) falls below 20% and/or the platelet count falls below 50,000 per microliter. The high levels of estrogen depress bone marrow function, resulting in a pancytopenia. Anemia and secondary infections are common. There is a greater than 50% occurrence rate in intact, nonbred jills during the months of April through July, and a 40% mortality rate among those affected. Most will present with a PCV of less than 10%, and have fewer than 20,000 platelets per microliter.<sup>5</sup> Treatment at this

point is rarely successful. Ovariohysterectomy, serial blood transfusions (10 ml each), anabolic steroids, vitamins, and forced or intravenous feeding may save an occasional patient.<sup>23</sup> Hemorrhagic anemia due to thrombocytopenia is the common cause of death.

There are four options to prevent this syndrome. As stated previously, it should be strongly recommended that any female not intended for breeding be spayed prior to her first heat cycle. If this choice is not made, the syndrome can be prevented by allowing her to be bred by a vasectomized hob, or by the use of exogenous hormones. Human Chorionic Gonadotropin (HCG) can be used to induce ovulation and, thereby, terminate estrus. Administering 100 IU of HCG subcutaneously after the 10th day of observed heat is usually sufficient to cause the jill to cycle out of heat in 20 to 25 days. She should then remain anestrous for 45 to 50 days. The HCG injection can be repeated after one week if the estral swelling of the vulva hasn't started to regress.<sup>5</sup> The use of megestrol acetate to delay or prevent estrous greatly increases the risk of pyometra, and should be avoided.<sup>6</sup>

Gestating or lactating jills are prone to several nutritionally associated conditions. Eclampsogenic toxemia can occur a few days pre-whelping, and can result in the death of the fetuses and the jill. Adding uncooked liver to supplement 5 to 10% of the diet will reduce the incidence. Nursing sickness usually occurs at weaning, often in late June. The jill becomes anorexic, weak, and incoordinated, and may die. Adding table salt to the jill's ration (0.05%) from May to mid-July helps in preventing this condition.<sup>1</sup>

Ferret hair loss is a common complaint. Most cases are of undetermined etiology, but usually respond to the addition of small amounts of uncooked liver (5-10% total diet). A history of a diet consisting of greater than 10% raw chicken egg whites indicates a biotin deficiency. Removal of the eggs from the diet and the addition of liver should resolve the condition.<sup>3</sup>

Urolithiasis is not uncommon in the ferret, and resembles the feline syndrome clinically, and similar treatment regimes should be implemented.<sup>5</sup> An obstruction often lodges at the proximal os penis.

Zinc poisoning has been reported in the ferret. This can occur when the ferret is fed directly on galvanized cage floors. Signs noted may be muscle tremors, lethargy, and uremia.<sup>5</sup>

Congenital malformations have been reported to manifest as anencephaly, neuroschisis, gas-

troschisis, cryptorchidism, amelia, corneal dermoids, and cataracts, among others.<sup>1,3,5,6</sup>

Many spontaneous neoplastic processes are described for the domestic ferret. Of these, ovarian leiomyomas, ovarian smooth muscle hyperplasia, ovarian thecomas, and pancreatic adenocarcinomas are considered incidental post-mortem findings.<sup>5</sup>

Other health considerations, such as anal gland impaction and dental tartar, parallel those of the dog and cat. Diagnosis and treatment can, for the most part, be extrapolated from these species.

### Neutering and Descending

Neutering should be recommended for any pet ferret not intended for breeding. The male can be castrated after six months of age. This will decrease aggressiveness to some degree. The testes are present in the scrotum only during the breeding season. Castration can be performed during the off-season, but the procedure is more involved, and post-operative recovery is not as rapid. A prescrotal, closed orchietomy technique is recommended. This method, incidentally, results in less overall trauma to the perineum should anal sac extirpation be performed at the same time. Females can be spayed after six months of age. The same techniques used for feline ovariohysterectomy can be employed. It should be emphasized that any female not intended for breeding should be neutered. The procedure will prolong her healthy life expectancy, and make her a more enjoyable year-round pet.

The ferret can be descended at the same time it is neutered. This will decrease its characteristic odor substantially, but the owner should be informed that some of the muskiness will remain due to the presence of residual perineal sebaceous and apocrine glands, and cutaneous sebaceous glands. Output from these sources is higher in the hob, and will be reduced with castration. Extirpation involves grasping each duct with a mosquito forceps and dissecting three to four millimeters through the surrounding glandular complex to the fascial plane immediately adjacent to each sac. Carefully following this fascial plane, using blunt dissection, allows the removal of each sac with a minimum of hemorrhage or damage to the internal and external anal sphincters. The anal sacs are 15 to 20 mm long. It is very desirable to employ extreme patience in the dissection technique to avoid rupturing a sac. If a sac should rupture during the procedure, its complete extraction is still possible as long as the fascial plane is maintained (the surgeon will probably have to fin-

ish the procedure alone at this point). Sutures and infused antibiotics are usually unnecessary. An important post-operative complication is rectal prolapse and/or fecal incontinence due to excessive trauma to the anal sphincter muscles.<sup>21</sup> Bathing with a mild soap every three to four weeks will further aid in reducing a ferret's inherent musky odor.

The domestic ferret is a small pet that is rapidly rising in popularity in the U.S. With a little adaptation of conventional small animal medicine and surgery, and attention to a few unique details, the practitioner should be able to administer to the medical needs of this inquisitive little fellow.

### REFERENCES

1. Ryland LM, Gorham JR: The ferret and its diseases. *JAVMA*. 173(9)1154-1157. 1978.
2. Petzke D: The pet of the year. *Wall Street Journal*. 4-4-1986. pp. 1,9.
3. Holmes DD: *Clinical Laboratory Animal Medicine, an Introduction*. Ames, IA: ISU Press. pp. 59-66. 1984.
4. Rabe A, Haddad R, Dumas R: Behavior and neurobehavioral teratology using the ferret. *Lab An Sci*. 35(3)256-264. 1985.
5. Moody KD, Bowman TA, Lang CM: Laboratory management of the ferret for biomedical research. *Lab An Sci*. 35(3) 272-279. 1985.
6. Ryland LM, Bernard SL, Gorham JR: A clinical guide to the pet ferret. *Comp Cont Ed Prac Vet*. 5(1)25-34. 1983.
7. Lee EJ, Moore WE, Fryer HC, Minocha HC: Haematological and serum chemistry profiles of the ferret (*Mustela putorius furo*). *Lab An Sci*. (16)133-137. 1982.
8. Sherril A, Gorham J: Bone marrow hypoplasia associated with estrus in ferrets. *Lab An Sci*. 35(3)280-286. 1985.
9. Wechsler SJ: Blood collection techniques and normal values for ferrets, rabbits, and rodents, a review. *Vet Med Small An Clin*. 78(5)713-717. 1983.
10. Yost S, Limberg B, Kimbrough D: *What's a Ferret?* Colorado Ferrets, Inc. 1977.
11. Carpenter JW, Hillman CN: Husbandry, reproduction, and veterinary care of captive ferrets. *Am Assoc Zoo Vet*. pp. 36-45. 1978.
12. Lewington JH: Handling ferrets (correspondence). *Vet Rec*. 112(26)616. 1983.
13. Feller DL, Benson GJ: Manual restraint of the ferret. *Vet Med Small An Clin*. 75(4)690-693. 1980.
14. Fox JG, Hewes K, Niemi SM: Retro-orbital technique for blood collection from the ferret (*Mustela putorius furo*). *Lab An Sci*. 34(2)198-199. 1984.

15. Moreland AF, Glasser C: Evaluation of ketamine, ketamine-xylazine, and ketamine-diazepam anesthesia in the ferret. *Lab An Sci.* 35(3)287-290. 1985.
16. Davidson M: Canine distemper virus infection in the domestic ferret. *Comp Cont Ed Prac Vet.* 8(7)448-453. 1986.
17. Thatcher E: Veterinary care of ferrets, raccoons, and skunks. *ISU Vet.* (1)27-36. 1980.
18. Groseclose S, Horman JT: Pet ferrets require special safety considerations. *Norden News.* Winter/Spring pp. 16-17. 1986.
19. Fox JG, Curry C, Leathers CW: Proliferative colitis in a pet ferret. *JAVMA.* 189(11)1475-1476. 1986.
20. Moreland AF, Battles AH, Nease JH: *Dirofilaria immitis* in a ferret. *JAVMA.* 188(8)864. 1986.
21. Creed JE, Kainer RA: Surgical extirpation and related anatomy of anal sacs of the ferret. *JAVMA.* 179(6)575-577. 1981.
22. Cooper JE: Oestrus-associated anaemia in the ferret. *Vet Rec.* 117(16)395-396. 1985.
23. Ryland LM: Remission of estrus-associated anemia following ovariohysterectomy and multiple blood transfusions in a ferret. *JAVMA.* 181(8)820-822. 1982.

