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BIOECOLOGY

The family Hyaenidae diverged from the family Viverridae 24 million years ago at the beginning of the Miocene period. The family comprises four species in three genera (Table 51-1). The spotted hyena is the most commonly encountered species in the wild; aardwolves, and striped hyenas, and brown hyenas are rarely encountered because of their smaller size, nocturnal habits, and solitary nature. Hyenas as a group communicate through vocalizations, body posture, and scent marking, the last of which is highly developed in the brown hyena and consists of two components, which dry to different colors and consistency on prominent vegetation (Figure 51-1).

Brown hyenas are nocturnal, solitary animals that travel 25 to 40 kilometers (km) per night in search of food. They live in small clans composed of several females, males, and offspring. Clans are rather female bonded, and females are believed to be related (Wiesel, personal communication). Nomadic males are believed to maintain genetic diversity by ranging across clan territories. Males and females are morphologically similar. All clan members participate in communal raising of offspring. Although they are predominantly scavengers, brown hyenas actively hunt and consume Cape fur seal pups (Arctocephalus pusillus) along the Namibian coast. In more arid areas, brown hyenas also consume plant material such as Tsama (Citrullus lanatus) and gemsbok cucumbers (Acathosicos naudiniaus). Diamond mining, vehicular trauma, and human encroachment may impact local aardwolf densities. Aardwolves are occasionally exhibited in North American zoos.

Striped hyenas are the most widely distributed hyena, preferring dense, arid, mountainous scrub woodland, and thornveld. Striped hyenas are strictly nocturnal, mostly solitary animals but have been observed in small family groups when foraging. Adult and sub-adult animals participate in caring for offspring in communal dens. Nomadic males are believed to maintain genetic diversity by ranging across clan territories. Males and females are morphologically similar. All clan members participate in communal raising of offspring. Although these hyenas are predominantly scavengers, striped hyenas actively hunt and consume flying insects, small rodents, and birds and capture larger prey such as Cape hares (Lepus capensis) and bat-eared foxes (Otocyon megalotis). Like the brown hyena, striped hyenas occasionally eat fruit, specifically the desert date (Balanites sp.). The world population is estimated at 5000 to 10,000 individuals. None of the hyena species is considered endangered or threatened.

ANATOMY

Hyenas, with the exception of the aardwolf, are powerful animals; the well-developed forelimbs, shoulders, and neck provide ample power to dismember prey animals much larger in size than themselves. The relatively weak hindlimbs sustain long distance loping, which is advantageous when hunting faster, but less so when hunting prey with endurance or distance scavenging. The jaws of the brown, spotted, and striped hyenas are very powerful, able to crush most long bones of large prey items. The brown hyena is also able to break ostrich (Struthio camelus) eggs, whereas the spotted hyena cannot. The dental formula of the hyenas is: incisors (I) 3/3, canines (C) 1/1, premolars (P) 4/3, and molars (M) 1/1, whereas that of the aardwolf which is uniquely adapted to an insect diet, is I 1/3, C1/1, P 3/2-1 and M 1/1-2. All hyenas have four digits on the forelimbs and hindlimbs, with the exception of the aardwolf, which has five digits on the forelimbs and four on the hindlimbs. The pelage is a mix of spots, stripes, and muted shades of brown and black; long and shaggy in the aardwolf, brown (Figure 51-2), and striped hyenas and short and sparse in the spotted hyena (Figure 51-3). Scent marking is the most important form of communication among hyenas. The anal glands are highly developed and large in each species and secrete a pheromone-laced sebaceous paste on prominent vegetation. Scent marking is used to define territories, signal potential mates, and identify conspecific and contraspecific individuals.

REPRODUCTION

Hyena reproduction relies on complex social structures. Specific reproductive data are provided in Table 51-2. Dystocia has been documented in captive spotted hyenas, all of which were surgically corrected. Other reproductive tract abnormalities are not reported in the literature but likely are similar to the problems in domestic dogs and cats.
Hyenas are intelligent, destructive animals that need secure caging. The nocturnal, secretive nature of hyenas presents unique challenges for exhibit in captivity. The complex social structure of the spotted and brown hyena dictates that these animals be housed in compatible groups. All hyenas should be provided with adequate space, dens, and stimulating enrichment to prevent stereotypical behavior; they should be given opportunities to participate in training programs, which have been developed for captive spotted hyenas in a number of institutions. Captive hyenas fare well on commercial meat-based diets supplemented with nutritionally sound dog food and large bones. Aardwolves have been maintained on ground meat, milk, eggs, and supplemental vitamins but may benefit from specialized insectivore diets.

**HUSBANDRY**

**TABLE 51-1**

| Common Name   | Scientific Name | Adult Weight (kilograms) | Current Distribution                |
|---------------|-----------------|--------------------------|------------------------------------|
| Brown hyena   | *Hyena brunnea* | 34–43                    | Arid areas of Southern Africa      |
| Spotted hyena | *Crocuta crocuta* | 40–90                    | Sub-Saharan Africa                 |
| Aardwolf      | *Proteles cristatus* | 9–14                    | Eastern and Southern Africa        |
| Striped hyena | *Hyaena hyaena*  | 25–55                    | Northern, Eastern, and Western Africa; portions of Central and Southern Asia |

**TABLE 51-2**

| Parameter          | Aardwolf | Spotted Hyena | Brown Hyena | Striped Hyena |
|--------------------|----------|---------------|-------------|---------------|
| Sexual maturity    | Unknown  | 2–3 years     | 2–3 years   | 2–3 years     |
| Seasonality        | Unknown  | Year-round    | Year-round  | Year-round    |
| Gestation          | 90–110 days | 110 days     | 92–100 days | 88–92 days    |
| Litter size        | 1–5      | 1–3           | 1–5         | 1–5           |
| Weaning age        | 6 weeks  | 6 months–1 year | 3–4 months | 3–4 months    |

**FIGURE 51-1** Two-toned paste mark of the brown hyena (*Hyena brunnea*).

**FIGURE 51-2** A brown hyena (*Hyena brunnea*) in Namibia. This animal fed through the night and into the early morning hours, which is unusual for this nocturnal animal.

**FIGURE 51-3** A female spotted hyena (*Crocuta crocuta*). Note the shorter pelage compared with that of the brown hyena.

**RESTRAINT**

All species of hyena require chemical restraint for examination. In general, remote delivery systems work well, although smaller
individuals may be hand-injected through the use of a standard restraint device. The drugs of choice when immobilizing hyenas are listed in Table 51-3.4,7,10,14,15,20 Hyenas should be administered injections into the shoulders, forelimbs, or neck, whenever possible.

**Field Immobilization of the Brown Hyena in Southern Namibia**

Field immobilization techniques for the brown hyena are rarely reported in the literature.15 A working knowledge of the natural history and behavior of this animal facilitates its successful capture. The brown hyena is a nocturnal, silent, solitary forager.15 However, large carcasses attract several hyenas. As opposed to the spotted hyena, brown hyenas generally feed singly, rather than in groups, even on larger carcasses. Individuals wait in the distance until the conspecific finishes (Wiesel, personal communication). In most instances, black-backed jackals (*Canis mesomelas*) arrive at the bait first; vocalization of larger groups of jackals may attract hyenas to the site. Jackals will commonly signal a hyena’s approach by nervously looking in the direction of the hyena.

Camouflage, a low-profile silhouette, and absolute stillness are required for success of immobilization of hyenas. Use of advanced lighting, in the form of infrared technology, facilitates darting. Commercially available remote delivery systems work well, and dart placement is paramount to success. A well-placed dart in the neck or shoulder affords consistent success. A combination of ketamine (2–3 milligrams per kilogram [mg/kg]) with medetomidine (0.035–0.045 mg/kg) is effective within 3 minutes and causes recumbency of the animal within 7 minutes on average.22 This combination provides rapid smooth induction, good muscle relaxation, stable heart rate and rhythm, slight to moderate pytalism, and 40 to 50 minutes of stable anesthesia. Pulse oximetry trends are undetectable initially (Figure 51-4) but elevate to the mid-90th percentile 20 to 30 minutes after induction without supplementary oxygen;22 although supplemental oxygen is advisable, if available. Regurgitation is common upon reversal in field situations; this is likely caused by ingestion of bait just prior to immobilization. Application of a bland ophthalmic ointment protects the eyes during times of blowing sand and debris. Covering the eyes and placing plugs in the ear canal also assists in providing consistent recumbency (Figure 51-5). On occasion, an anesthetized hyena may require 30 to 40 mg of supplemental ketamine administered intramuscularly to facilitate completion of medical procedures. Reversal is achieved with atipamezole at five times the dose of medetomidine. Atipamezole given intramuscularly produces reliable recovery within 3 to 10 minutes. Blepharospasm, followed by purposeful movement of the head and cervical spine, is an indication of impending recovery. In general, the hyena ambulates away with mild ataxia, which rapidly resolves to normal ambulation within an additional 3 to 5 minutes. It is important to wait at least

![A female brown hyena (Hyaena brunnea) anesthetized with ketamine and medetomidine. Note the low pulse oximetry reading.](image)

![An anesthetized female brown hyena (Hyaena brunnea). Note the substrate barrier and covered eyes. The animal also has aural plugs to decrease auditory stimulation.](image)

### TABLE 51-3

| Species            | Immobilizing Agent       | Dosage (mg/kg) | Reversal Agent (mg/kg, IM) |
|--------------------|--------------------------|----------------|---------------------------|
| All                | Tiletamine/zolazepam     | 5              | None                      |
| All                | Ketamine/xylazine        | 8–10/0.5–1.0   | Yohimbine 0.11–125        |
| Aardwolf           | Ketamine/acepromazine    | 15/0.3         | None                      |
| Spotted hyena      | Etorphine/xylazine       | 0.05/0.63      | Naltrexone 100 mg per 1 mg etorphine and Yohimbine 0.125 |
|                    | Ketamine/xylazine        | 13.2/6.3       | Tolazine 3.7 or yohimbine 0.125 |
| Brown hyena        | Ketamine/medetomidine*   | 2–3/0.035–0.045| Atipamezole 5x mg amount of medetomidine |
|                    | Ketamine                 | 15             | None                      |

*Field immobilization agents in the author’s experience.

**IM**, Intramuscularly; **mg/kg**, milligram per kilogram.
TABLE 51-4
Select Hematologic Reference Values for Hyaenidae

| Parameter                              | Aardwolf | Spotted Hyena | Striped Hyena |
|----------------------------------------|----------|---------------|---------------|
| Packed cell volume %                   | 21.8–55.8 (42.4) | 29.9–64.1 (42.3) | 27.0–57.6 (41.0) |
| Red blood cell x 10^6/microliter (µL)  | 4.95–10.62 (7.84) | 5.08–9.83 (7.56) | 4.35–9.77 (7.06) |
| Hemoglobin, gram per deciliter (g/dL)  | 7.8–18.7 (13.8) | 6.3–18.5 (14.0) | (– (13.6) |
| Mean corpuscular volume, µ (fL)        | 45.3–64.3 (55.0) | 46.3–63.9 (56.8) | (– (57.7) |
| Mean corpuscular hemoglobin, picogram (pg) | 15.0–20.8 (17.9) | 15.7–21.4 (18.8) | – (19.6) |
| Mean corpuscular hemoglobin concentration (g/dL) | 28.1–36.4 (32.5) | 29.7–37.3 (33.2) | 30.1–40.5 (33.5) |
| Leukocytes x 10^6/µL                   | 2.35–13.11 (8.21) | 6.28–19.59 (11.98) | 5.30–15.34 (10.52) |
| Neutrophils x 10^6/µL                 | 1.40–8.75 (5.30) | 3.71–15.29 (8.62) | 3.00–11.65 (7.50) |
| Band neutrophils x 10^6               | 0.00–0.07 (0.04) | 0.03–0.14 (0.06) | 0.00–0.50 (0.14) |
| Lymphocytes x 10^6/µL                 | 0.01–3.79 (2.08) | 0.59–6.35 (2.45) | 0.00–4.31 (2.19) |
| Eosinophils x 10^6/µL                 | 0–537 (238) | 0–1684 (667) | – |
| Monocytes x 10^6/µL                   | 0–806 (369) | 79–1550 (483) | 0–1179 (484) |
| Basophils x 10^6/µL                   | – (163) | 0–285 (42) | – |
| Platelets x 10^6/µL                   | – (222) | 72–466 (267) | – |

From Teare JA, ed: 2013, Proteles cristata, Crocuta crocuta, Hyaena hyaena, No selection by gender. All ages combined. Standard International Units. 2013 CD.html in ISIS Physiological Reference Intervals for Captive Wildlife: A CD-ROM Resource., International Species Information System, Bloomington, MN.

Values listed as reference intervals with mean listed in parentheses.

TABLE 51-5
Select Biochemical Values for Hyaenidae

| Parameter                                              | Aardwolf | Spotted Hyena | Striped Hyena | Brown Hyena |
|--------------------------------------------------------|----------|---------------|---------------|-------------|
| Total protein, gram per deciliter (g/dL)               | 4.4–7.0 (5.7) | 5.7–8.4 (6.8) | – (6.0) | 5.8 + 0.6 (3.5–7.0) |
| Albumin (g/dL)                                         | 2.0–3.7 (2.9) | 1.9–3.4 (2.6) | – (2.4) | 2.6 + 0.4 (1.5–3.3) |
| Globulin (g/dL)                                        | 1.6–3.9 (2.8) | 2.9–5.7 (4.1) | – (3.6) | 3.3 + 0.5 (1.7–4.4) |
| Total bilirubin, milligram per deciliter (mg/dL)       | 0.1–0.9 (0.3) | 0.0–0.4 (0.2) | – (0.2) | 0.1 + 0.1 (0.0–0.4) |
| Direct bilirubin (mg/dL)                               | 0.0–0.2 (0.0) | 0.0–0.2 (0.0) | – (0.0) | 0.0 + 0.0 (0.0–0.2) |
| Indirect bilirubin (mg/dL)                             | – (0.1) | 0.0–0.3 (0.1) | – (0.0) | 0.0 + 0.0 (0.0–0.3) |
| Aspartate aminotransferase, international unit per liter (IU/L) | 14–151 (89) | 51–139 (87) | 32–108 (73) | 44 + 34 (10–145) |
| Alanine aminotransferase (IU/L)                        | 45–247 (115) | 50–206 (105) | – (49) | 29 + 22 (8–103) |
| Alkaline phosphatase (IU/L)                            | 0–32 (14) | 13–75 (32) | 0–86 (37) | 96 + 56 (22–245) |
| Glucose (mg/dL)                                        | 57–181 (108) | 67–262 (143) | 34–192 (116) | 87 + 43 (3–172) |
| Cholesterol (mg/dL)                                    | 82–365 (233) | 103–355 (220) | 125–327 (231) | 207 + 90 (73–356) |
| Urea nitrogen (mg/dL)                                  | 14–48 (28) | 15–43 (25) | 13–29 (21) | 35 + 11 (18–66) |
| Creatinine (mg/dL)                                     | 0.6–2.2 (1.4) | 0.8–2.4 (1.5) | 0.4–1.7 (1.1) | 1.0 + 0.2 (0.4–1.4) |
| Calcium (mg/dL)                                        | 8.5–11.6 (9.8) | 8.6–11.8 (10.1) | 8.8–11.6 (10.2) | 9.3 + 1.5 (5.1–11.0) |
| Phosphorous (mg/dL)                                    | 2.8–10.4 (5.2) | 2.1–6.4 (3.6) | – (4.8) | 5.3 + 1.2 (2.1–7.8) |
| Sodium, milliequivalent per liter (mEq/L)              | 135–152 (144) | 131–155 (145) | – (146) | 145 + 13.5 (76–154) |
| Chloride (mEq/L)                                       | 100–118 (109) | 103–127 (115) | – (116) | 110 + 11.9 (53–124) |
| Potassium (mEq/L)                                      | 3.7–5.9 (4.9) | 3.9–5.3 (4.5) | – (4.3) | 4.5 + 0.5 (2.5–5.3) |

*From Teare JA, ed: 2013, Proteles cristata, Crocuta crocuta, Hyaena hyaena, No selection by gender. All ages combined. Standard International Units. 2013 CD.html in ISIS Physiological Reference Intervals for Captive Wildlife: A CD-ROM Resource., International Species Information System, Bloomington, MN.

Values listed as Reference Intervals with mean listed in parentheses.

†Wild normals N = 30. Values listed as mean +/- standard deviation with minimum and maximum values listed in parentheses.

MEDICAL CONDITIONS

Infectious diseases of concern in hyenas are few. Rabies has been documented in wild spotted hyenas, but not in brown hyenas, possibly because of their solitary nature. Canine distemper virus (CDV) has been documented in asymptomatic and symptomatic wild spotted hyenas; the symptoms were associated with an outbreak
in African lions. Animals exhibited epiphora and nasal discharge, hematochezia, ataxia, lethargy, and respiratory distress. Feline calicivirus, feline herpesvirus, canine parvovirus or feline panleukopenia, feline immunodeficiency virus, and feline coronavirus were detected in wild spotted hyenas in the Masai Mara of Kenya over an 8-year period. In a serosurvey of 30 brown hyenas in Namibia from 1997 to 2010, 43% of adult hyenas were seropositive for CDV, as opposed to none of the sub-adults. Additional sampling for canine parvovirus, feline panleukopenia virus, rabies, Ehrlichia canis, and Neorickettsia risticii were negative in these same animals. Fecal direct flotation for ova and parasite examination of numerous stool samples collected from latrines and individual wild brown hyenas in 2011 were surprisingly scant; only one sub-adult demonstrated infection with low levels of coccidia. Numerous ectoparasites and endoparasites of Hyaenidae have been reported in the literature, and captive individuals should be screened and treated routinely for clinical parasitism. Cardiomyopathy caused by Trypanosoma cruzi has been documented in an aardwolf. Dirofilaria sp. parasites have not been reported in the literature. Intraspecific aggression, resulting in traumatic induced wounds are common in hyenas and occasionally need medical care. Hyenas are well known for ingestion of foreign bodies, so appropriate measures should be taken to prevent ingestion. Pacing on hard substrates predispose to ulceration of digital pads, so appropriate substrate and proper management should be provided to prevent stereotypical behaviors leading to this condition.

**DIAGNOSTIC SAMPLING AND TREATMENT**

Techniques for diagnostic sampling are identical to those performed in domestic dogs and cats. Reference values for select hematologic and biochemical values are presented in Tables 51-4 and 51-5. Treatment with pharmaceutical agents is extrapolated from that for domestic dogs and cats. No drugs or pharmaco-kinetically studied medications have been approved for use in Hyaenidae.

**PREVENTIVE CARE**

On the basis of the apparent susceptibility of hyenas to CDV, it may be advisable to vaccinate hyenas against canine distemper using a recombinant canarypox vectored or killed vaccine. Although exposure to canid and felid viruses is prevalent in wild populations of spotted hyenas, clinical disease has not been documented. Rabies vaccination with a killed product may be advisable in endemic areas. Rabies has been documented in wild spotted hyenas.

Routine examination is advisable to include specific evaluation of dental arcades; hyenas routinely damage their teeth (Figure 51-6), although infections are rare.

**PEDIATRICS**

Hand rearing of cubs is occasionally necessary and has been achieved by using commercially available kitten formulas. Hand-reared animals are tractable and nonaggressive, although removing food or enrichment from an individual is not advisable. Vaccination schedules generally follow those for domestic dogs and cats at 2, 3, and 4 months of age, using the canine distemper and rabies vaccines mentioned earlier. One author advises the use of killed canine parvovirus vaccination.

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