Behavior of Exotic Pets
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Edited by

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Finally here is a reference book for all of us who, for one reason or another, wish to educate ourselves about species, other than dogs and cats, that find their way, as pets, into our homes, or those of our friends or our clients. The appeal of so-called exotic pets runs the gamut of birds that talk to us, to those that represent an appealing sample of real nature, to those that might set us apart from our friends and neighbors. Of course, the term exotic pets is actually a misnomer; parrots, ferrets, gerbils, rats, chinchillas, and the like are abundant in nature whereas the Beagle, Black Lab, or Siamese is nowhere to be found outside our homes. Exotic pets are “exotic” because we know little about them as members of households. This is where this book offers so much valuable information; exotic pets will become less exotic, at least in terms of helping us provide the best environment, care, and medical–behavioral oversight.

For the 17 species or groups of species covered, there is a fairly uniform style in first discussing the natural history of the species in the wild, including communication, diet, reproduction, and parental care. In all chapters there is a section on prevention of problem behaviors, and when appropriate, evaluation, and treatment of behavior problems. Chapters are written by authorities on the species covered with welcome oversight by the editor to assure uniformity in chapter style; I found this particularly appealing for dealing with so many diverse species. When considering exotic pets ranging from parrots to canaries, snakes, lizards, guinea pigs, and llamas, coming up with meaningful universal principles of behavior modification, pharmacology, and welfare has to be challenging, but in the last three chapters this material is masterfully handled. Here is a text that one can turn to as a reference on a particular pet species or as a background for exotic pets in general.

In virtually all chapters there is something to say about the uniqueness of the pet discussed. Setting the tone for the style of coverage, the chapter on parrots and other psittacines spends more than half of the chapter on parrots in nature. Many readers will find it interesting that parrot mimicry vocalizations actually have an adaptive role in allowing the vocalizer to scare away predators by mimicking mobbing birds or by mimicking a predator to protect territory from conspecifics. In our homes parrots are preadapted to mimic us, even if the conversation is a bit one-sided. Feather picking or plucking, arguably the most important problem behavior in these birds as pets, is discussed in detail.

The chapter on passerines, your basic canary or zebra finch, also provides a great overview of these birds in nature. Fortunately, caregivers of pet passerines are generally spared the visual trauma of plucked-out feathers; other problems, aggression and lack of song are dealt with. While canaries and finches are pretty problem free, the chapter is a great source for understanding where these common pets fit in nature.

Snakes are masterfully handled in a chapter that, again, goes into basic behaviors that are important to understand in adopting a snake into an urban setting. The authors remind us that as the essence of the caduceus, snakes are a symbol of healing. Paradoxically, they can also symbolize the introduction of evil. Whatever a person’s orientation, snakes obviously make a great pet for those who learn about their biology and normal behavior in nature. The authors provide an insight into the unique sensory capacities of snakes, especially the vomeronasal organ, the use of which is the key to understanding tongue flicking. The culinary orientation of feeding in snakes, as in eating a whole mouse, is explained along with avoiding problems and the necessity of a postprandial hot spot to help in digestion. If you, or a client, plan to adopt a snake, be sure to read this chapter.

A turtle, tortoise, or terrapin would seem like a very easy pet to keep. But do not let the slow movement or seemingly immortal life-span—often surpassing that of humans—fool you. They are, according to the authors, the most high maintenance of all reptiles. Reading this chapter is essential to know what you, or your client, are getting into. These tortoises and turtles are filled with scent glands—along the carapace, along the chin, and in the cloaca—something you might not expect, but then, when you think of it, how else are such slow-moving males and females going to get together. A long section on husbandry in this chapter is necessary because poor husbandry is the primary factor in illness.

Lizards are another group of potential pet species where, in nature, chemosensory information plays a critical role. The vomeronasal organs are essential for chemoreception,
as are an array of specialized organs for dispensing chemical scents. Much of the discussion is devoted to husbandry, and wisely so. These creatures require considerable knowledge of species-specific requirements; in fact, most behavior problems stem from inappropriate husbandry.

The chapter on ferrets says straight on that “ferret” in Latin means “little thief.” Despite this untrustworthy name, these are quite popular pets. One appeal is their tendency to dance or play, especially when excited. Another plus is their ease in litter box training. With ferret behavior problems one can use some of the behavior modification approaches commonly used with dogs and cats.

Rabbits, believe it or not, are among the most popular urban mammalian house pets after dogs and cats. The author of this chapter gives us an overview of the origin of the rabbit as a pet and source of food, going back 3000 years to the time of the Phoenicians. Several behavioral traits of wild rabbits help in understanding their odd bits of behavior as a pet; engaging in urine spraying, coprophagy, and nursing young only once or, at the most, twice a day.

Guinea pigs as the prototypical pocket pet have been around for centuries, going back 3000 years to the Central Andean native Americans. Like other chapters this one is filled with interesting insights into their natural behavior. If the behavioral image of a guinea pig is one of tranquility, this is not far off. The guinea pig makes for a relatively easy-to-care-for pet, and this chapter provides the essentials for creating a welcoming home.

No other species kept as a pet is represented in such a broad spectrum of human activities as the mouse. Intimately associated with hominid dwellings around the time that modern humans evolved, over 200,000 years ago, the mouse is now known for its role as a favorite pocket pet, a persistent pest in our attics and walls, and as the mainstay of modern medical–biological research. Whether one is a laboratory investigator, a family veterinarian treating murine pocket pets, or just interested in understanding a bit of the wild fauna living in our neighborhoods, this chapter will enrich your understanding of the mouse.

The common rat, that has become a favorite pet of elementary classrooms, a common inhabitant of household attics and a staple of laboratory research in studies of general biology, is commonly known as the Norway rat. Another quirk of scientific nomenclature is that Rattus norvegicus did not originate in Norway, but rather in the plains of northern China. Learn more about this bit of natural history, along with a thorough review of the rat’s well-known biology and behavior in this chapter. In fact, so much is known that the authors provide a table of online resources of rat biology and behavior. There is much in this chapter that should be of value to classroom teachers as well as parents who wish to take advantage of the pet rat as a bridge for teaching introductory biology.

Gerbils have the well-deserved reputation of being an adorable pocket pet, although the pocket is probably the least suitable housing for this exotic pet. Under problem behaviors, which are relatively minor, the authors remind us that gerbils are escape artists. Here is a pet where seizures are fairly common; interestingly, early handling seems to prevent most seizures. Adopters of gerbils will find the natural history and general biology well worth reading.

Hamsters, which are becoming an increasingly popular pet, are represented by primarily four species. Managing pet hamsters is made easier by reading this chapter to learn about some unique aspects of hamster behavior as well as their intriguing natural history. Maternal infanticide and cannibalism, common in pet hamsters, and probably normal in the wild hamster, might be disconcerting to the unsuspecting adopter, especially children. The authors discuss ways to reduce this behavior, and other problems, through appropriate management.

One of the most recently introduced exotic pets is the chinchilla, a native of the Andean mountains. In fact, the domestication of this pet is thought to have started in the 1920s in California, catching on as a pet in the 1960s. While growing in numbers as a pet in urban settings, chinchillas are classified as endangered in the wild state. In reading this chapter one gets the feeling that of the small pets, chinchillas take the most thought and planning to avoid problems.

Of the several species of prairie dogs, the black-tailed is the standard pet. Almost all pets are captured from wild so here is one exotic pet that has had no selective breeding, making it truly a wild type. According to the authors, if captured when young and given lots of gentle handling, they seem to imprint onto their caregivers. And they are easily housetrained. The leading behavior problem seems to be chewing: electrical cords, precious wood sculptures, rugs, window screens, furniture, and the like. The home needs to be prairie-dog proofed.

As exotic as a camellid might seem to be as a pet, actual domestication of camelds began some 4000–5000 years ago from native species in the Andes. An interesting bit of camellid history is that old world camels are actually new camelds, having evolved from the older camelds in the new world thanks to courageous animals crossing the Bering Land Bridge a few million years ago. While the most popular camellid pet is the llama, the authors cover the behavior and biology of all the domesticated camellid species. This chapter, like all chapters in this book, provides the essentials needed for adequate husbandry and management.

One has to believe that those who keep hedgehogs appreciate having a truly unusual pet; certainly the spiny pelage is not what you think of as pet-able. But these pets, once habituated, and provided with the appropriate home, are friendly, entertaining, and educational. They are easily tamed to ride around in your hand and sit beside you. The spines are only for self-defense, especially when they...
roll into a spiny ball. Here is another pet that has not been domesticated by selective breeding; all pets are captured from the wild. For those interested in a hedgehog, this chapter has the essential information needed to make both the pet and the caregiver happy.

About the only type of pet not mentioned in the above discussion is a marsupial. The role of a marsupial pet is beautifully fulfilled by the sugar glider, coming to us from Australia. The pet is so named because the webbing between their fore and hind limbs that allows them to glide from tree branches down a hundred feet or more to lower branches. And they love sugary sweet sap and nectar of the trees in Australia where they originated. Like some of the other newer pets, sugar gliders are naturally friendly when habituated; they have not been domesticated by selective breeding. The author provides a complete description of

the necessary husbandry and three-dimensional enclosure needed for a pet that finds it natural to scurry, jump, and glide through its environment.

In closing here is a volume that veterinarians attending to family pets or zoo animals, animal behaviorists, pet store managers, and, of course, exotic pet caregivers will find useful. The species covered are those that can be amicably maintained in a home or paddock. Those that should not be kept as pets—monkeys, chimpanzees, wolves, cheetah, and the like—are left out.

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I realize that I am not being very creative or original when I say that a project of this sort could never have been accomplished without the encouragement, assistance, and support of many, many people. I want to thank all of the editors at Wiley-Blackwell who worked with me on this project. I am especially grateful to Katy Loftus for her patience and for always being so gracious about answering my numerous questions.

Identifying authors for a project of this type was a challenging endeavor. I am very proud of and grateful for the hard work and dedication to the project that was shown by this diverse group of scientists. This book could not possibly contain the depth and breadth of knowledge that it holds without them, and I am forever indebted to each and every one of them.

At risk of this sounding like an Oscar acceptance speech, I feel that it is only fair that I acknowledge the pioneering group of individuals who, if not for them, our specialty college, the American College of Veterinary Behaviorists would not even exist. We owe an enormous debt to these eight people; R.K. Anderson, Bonnie Beaver, Sharon Crowell-Davis, Benjamin Hart, Katherine Houpt, Elizabeth Shull, Victoria Voith, and Thomas Wolfe, who worked so hard to lay a foundation that allowed many such as myself to pursue advanced studies in the field of behavior. Thanks to their dedication and hard work, this field and the interest in it continues to grow. In addition, several of these people and others have served a very important role in mentoring me and encouraging me over the years. Bonnie Beaver, Karen Overall, and Peter Neville were some of the first behaviorists whom I met. I am extremely grateful for their encouragement and support of my interest in behavior. Their passion for the field has served as a constant source of inspiration for me. I also owe a great debt to Ben Hart for accepting me into his residency program and then serving as such a kind and patient mentor.

Several of my dear friends and colleagues provided valuable assistance by reading chapter drafts and giving constructive criticism. The book is definitely better for their contributions and I thank them for their time, as well as their friendship: Laurie Bergman, Lore Haug, Heather Mohan-Gibbons, Paul Gibbons, Lisa Nelson, Lynn Seibert, and Fon Chang.

Kristin Gieseker and Catherine Kelley both generously opened their homes to me and allowed me to photograph their pets. I also want to thank Millie Sanders with the Texas Ferret Lovers Rescue, who allowed us to intrude on her and her ferrets, and take pictures.

I also want to take this opportunity to acknowledge my husband Michael for his many photographic contributions, to this book, as well as many of my other previous projects. He never ceases to offer encouragement and support, no matter how much these projects distract me from “family time.” I truly could not have done this without him!
I admit that much of what I have managed to accomplish so far in life is simply due to the fact that I had the immense good fortune to be born to two people who believed that one of the most valuable things they could give their children was a good education. They saw to it that not only was the good education received in school, but that it was given at home as well. My parents made a point of introducing my brother and me to the natural world and all of its wonders. Thanks to them, I learned to love and respect all living things, not just those typically considered lovable. I owe more than I can ever repay for their constant love, encouragement, and support. Thus, it is to my parents, Gloria and Edward Vaughn, that I dedicate this book, with much love and gratitude.
Introduction

Currently, there are over 9000 documented species of birds living on Earth. Birds are among the most popular companion animals in the United States. Psittacine birds, in particular, are appealing companions because of their social behavior, exotic plumage, and vocal mimicry ability. There are over 300 different species of birds in the order Psittaciformes living in various parts of the world. They are found mainly in tropical and sub-tropical forests located in Central and South America, Australia, Southern Asia, New Guinea, New Zealand, and Central Africa, occupying habitats ranging from grasslands to mountain ranges to arid plains. The percentage of households in the United States keeping pet birds was estimated to be 3.9% in 2007, with the total number of pet birds estimated to be 11,199,000.

Common characteristics of psittacine birds are hooked beaks with a downward curved upper maxilla that fits over an upward curved lower mandible and a thick, muscular tongue. They have a zygodactyl toe arrangement, with the second and third toes projecting forward and the fourth toe and hallux projecting backward. These specialized feet allow them to maintain a good grip on branches and enable them to hang upside down or sideways. While climbing, psittacine birds use both their feet and beak for grasping.

The order Psittaciformes includes the families Loriidae, Cacatuidae, and Psittacidae. The birds belonging to this order are more commonly referred to as psittacines. The family Cacatuidae includes all cockatoo species and the cockatiel. The family Loriidae includes the lories and loriikeets. The family Psittacidae includes Amazons (Amazona spp.), pionus parrots (Pionus spp.), macaws (Ara, Cyanopsitta, and Anodorhynchus spp.), conures (Aratinga, Cyanoliseus, and Pyrrhura spp.), rosellas (Platycercus spp.), budgerigars (Melopsittacus spp.), grass parakeets (Neophema spp.), African gray parrots (Psittacus spp.), Cape, Jardine’s, Ruppell’s, Meyer’s parrots (Poicephalus spp.), lovebirds (Agapornis spp.), hanging parrots (Loriculus spp.), ring-necked parakeets (Psittacula spp.), and fig parrots (Opospitta and Psittaculirostris spp.).

Psittacine birds are highly social. In their natural habitats, they typically live in large social groups with complex intraspecific interactions. Their daily activity patterns include flying, foraging, resting, and self-maintenance, as well as interactions with other members of the group. In captive settings, it is not uncommon for psittacine birds to develop abnormal behaviors. In order to provide suitable captive environments and effectively manage undesirable behaviors of captive pet birds, there must first be an understanding of natural psittacine behavior.

Flock behavior

Psittacine birds form complex social groups called flocks. Flocking serves to reduce predation pressure, facilitate cooperative foraging, improve reproductive success, and strengthen territorial defense. Birds travel to different areas to locate adequate food, and flocking increases the efficiency of food-searching activities. Flocking provides security for group members and allows them to forage more efficiently.
efficiently in a shorter amount of time. There is increased safety within a large flock such that individuals located in the center of the group are less likely to fall victim to predators.³

Flock size can vary depending on the availability of certain resources, such as food or nesting sites. Species that rely on small clumped food sources, such as fruit trees, tend to live in small diurnal feeding flocks. Galah cockatoos (Cacatua roseicapilla) and budgerigars (Melopsittacus undulatus) utilize widely dispersed food resources and typically form larger flocks.⁴ A large roosting flock will often separate into smaller foraging flocks during the day. This may be a strategy adapted to minimize intraspecies competition for food.⁵

The parrots’ day consists of a cyclic pattern of flying, vocalizing, foraging for food, resting, grooming, and social interactions.⁶,⁷ Most flocks are active soon after sunrise, but tend to decrease their activities during the warmer periods of the day.⁶ In the evening with decreased light available for foraging, birds engage in intraspecies social activities and focus on predator avoidance.⁸

**Flock hierarchy**

Within any complex social group, a system must evolve that enables flock members to determine allocation of resources and coexist with minimal aggression. Overt aggression directed at members of the flock would interfere with flock activities and increase the risk of injury and mortality within the flock. The formation of a dominance hierarchy promotes stable, predictable interactions between flock members. A dominance relationship is said to exist when a consistent pattern of dominance–submissive postural signaling occurs between two individuals within the group. The higher-ranking individual will exhibit assertive behavior toward the subordinate, and the subordinate will passively defer, reducing the incidence of overt aggression. Dominant (assertive) or submissive (subordinate) behavioral responses are determined by the outcomes of previous interactions between the individuals involved.⁵ Once a dominance relationship has developed, it functions to decrease aggressive encounters between flock members, reducing competition and conferring priority of access to limited resources to higher-ranking individuals. The following behaviors were exhibited by assertive members of a cockatiel flock: turn threat, beak gape, peck threat, beak spar, peck, wing flapping, side approach, slow advance, and rushing and flight approach.⁹ Birds exhibiting submissive or appeasement behaviors typically crouch, fluff their feathers, wag their heads, lift a foot, or avoid assertive flock members.³

The individuals with higher rank may benefit from preferred access to food resources, roosting sites, nests, and mating opportunities.³ Hardy noted that aggression occurred more frequently during feeding, bathing, or seeking roosting sites.⁶ Seibert and Crowell-Davis found that higher-ranking males in a captive flock of cockatiels had greater access to mates and preferred nest boxes.⁹ They also noted that males were more aggressive than females, and females were more aggressive toward other females than males. While dominance relationships are critical to flock success and stability, the existence of cross-species dominance relationships has not been investigated.

**Diet**

In the wild, parrot diets are dependent upon the environment. Parrots are opportunistic foragers that primarily consume fruits, nuts, and seeds.⁷,¹⁰,¹¹ They have high-energy requirements due to their foraging and reproductive efforts. They may occasionally ingest insects while consuming their staple diets. Keas (Nestor nobalis) inhabiting the alpine region of New Zealand are the only parrots known to be omnivorous. Their diet includes plants, seeds, fruits, insects, and carrion.¹²,¹³ Lories and lorikeets have special dietary requirements. In their natural setting, lories and lorikeets feed on fruits, seeds, blossoms, buds, and berries; they also have a specialized tongue that allows them to collect pollen and nectar from flowers.¹⁴

Parrots will include seasonally available items in their diets. Scarlet macaws have been observed feeding on seeds, fruits, leaves, flowers, and bark from 43 different plant species in Costa Rica. Some of the food items are non-native plants introduced in the local area for agricultural purposes.¹¹,¹⁴

**Reproduction**

Male birds display certain ritualized behaviors during courtship. Male budgerigars display head bobbing during courtship.¹⁵ Other psittacine courtship behaviors consist of bowing, head pumping, hopping, wing flicking, flapping, tail wagging, and strutting.¹⁶ Male cockatoos may erect the crest feathers during a courtship display, along with opening the wings and spreading the tail feathers. When the cockatoo crest is erected during times of non-breeding, it may be an indication of excitement or arousal. Psittacine birds also use vocalizations specific to courtship. Budgerigars sing a warble song to synchronize reproductive behavior between the breeding pair. Male budgerigars have been found to warble at a higher rate than females.⁴

There are many reproductive systems used by avian species. The type of system used is dependent on ecological and social factors.¹ To briefly summarize, the different systems are:

- **Polyandry**—A female forms pair bonds with multiple males. Both females and males provide parental care.
- **Polygynandry**—Males and females both pair with multiple partners. They form a communal nest and all individuals participate in raising the offspring.
• Polygyny—A male breeds with multiple females. The female is responsible for raising the offspring. The male may not provide any parental care.
• Monogamy—A single male and single female form a pair bond for breeding and raising the offspring through the season. This is one of the most common mating systems in the avian world.

Within a monogamous reproductive system, several different breeding strategies can be employed to ensure the survival of offspring.

• Territorial breeding—A pair defends an established territory that contains the nesting site, or food and other resources.
• Colonial breeding—All mating pairs position their nests in a colony. This strategy is chosen when there are limited nesting sites near a food resource. Cooperative defense against predators is a key characteristic of colonial breeding.
• Cooperative breeding—The breeding pair has helpers, who may be individuals from their previous brood, who assist in feeding and protecting the offspring.

Pair bonding

Pair bonding is defined as a mutual attachment between a male and a female for the purpose of reproduction. Members of a bonded pair show preferential affiliative behaviors toward their mate, characterized by allopreening, beak touching, and allofeeding. Bonded pairs will often mutually exclude other individuals from these interactions. Males have been known to regurgitate to their partners as part of their courtship, but this behavior may also function to strengthen and maintain the pair bond. Bonded pairs have also been observed to engage in aggressive behavior in defense or support of the mate.

Allopreening usually occurs between breeding pairs or preferred associates and provides mutual benefits to the performer and recipient. The preening is often directed to the head and areas of the body that the recipient cannot easily reach. For a bonded pair, the physical interaction of allopreening serves to strengthen their relationship. Allopreening occurs most frequently when pair bonds are first formed or after the pair has been separated. Solicitation of allopreening, with feathers fluffed and head bowed or withdrawn, can also be used for appeasement in the event of an aggressive act.

Monogamy is the formation of a pair bond that lasts through the breeding season. Parrots that form serial monogamous bonds may remain with one partner throughout the breeding season but may take part in extra-pair copulations. After the breeding season, some pairs may stay together throughout the year. More experienced pairs typically have a higher reproductive success than newly formed pairs. Budgerigars often maintain the same pair bond from one breeding season to the next, whereas green-rumped parrotlets (Forpus passerinus) frequently have different mates from season to season. Certain species of parrots have adapted to different social systems at different times of the year. They may pair bond during the breeding season, then form family groups when their chicks become fledglings.

Nesting

During the breeding season, parrots nest in tree cavities. While they do not create holes in trees, they can and do modify the cavity or entrance by chewing with their beaks. Most parrots have individual nests that they defend against intruders and predators.

Some species, such as the monk parakeet, engage in communal nesting. They are colonial breeders and are the only parrots that build nests. Each pair has a separate entrance into the nest. It is not uncommon for monk parakeet breeders to have a helper.

Pink cockatoos (Cacatua leadbeateri) sometimes displace Galah cockatoos (Eolophus roseicapillus) from their nests after eggs have been laid. The pink cockatoos may raise Galah cockatoos along with their own young. Galahs raised by pink cockatoos produce contact calls of pink cockatoos and associate with the foster species, even when exposed to their own species.

Parental care

Hatching occurs asynchronously. In some clutches, the eldest can be several days older than the youngest hatched. Newly hatched psittacines are altricial, meaning that they are born naked, blind, weak, and helpless. They are unable to maintain their body temperature and rely upon the parents to keep them warm. Chicks are completely dependent upon the parents for food and protection from predators until they fledge and leave the nest. Due to the huge parental investments required for reproductive success, psittacine parents often engage in cooperative biparental care of offspring. Males often provide for the female and the chicks. In some species of cockatoos, the males have been observed to assist with incubation of eggs. As the chicks develop, the parent’s nest attendance declines.

Social interactions with the parents and clutch mates are necessary for vocal learning and social development. Budgerigars raised in isolated groups can eventually learn normal behavior and vocalizations once they rejoin a flock. However, individual chicks raised in total isolation continued to display aberrant behaviors even after exposure to other birds.

Different species engage in a variety of parental care strategies. Meyer’s parrots (Poicephalus meyeri), and several other psittacine species, place their juveniles together in
a communal nursery area. Parents continue to care for their own fledglings, and fledglings recognize and respond to contact calls from their own parents.

Once old enough to leave the nest, juvenile parrots form large foraging groups. Young psittacine birds have been observed to engage in different forms of group play. They beak wrestle, push each other with their feet or chase each other on foot or in flight. Some juvenile keas exhibit object play with a stone, stick, or any small object that they can grasp and toss in the air.

**Vocal communication**

Avian vocal communications are comprised of different types of calls (short, innate, stereotyped vocalizations), and songs (longer complex vocalizations that are learned) used to convey specific messages. Parrots use contact calls for flock members, alarm calls for predators, flight calls, calls to indicate that food has been located, and more. Other vocalizations are used to indicate particular social relationships within the species or to identify potential mates. Psittacine birds are generally silent during the day while they are feeding. Vocalizations are associated with roosting and flying from foraging sites.

Vocal mimicry is an innate part of a bird’s vocal development. It enables juveniles to learn the calls and songs required for communication with flock mates. While songbirds have critical periods for song learning, psittacine birds exhibit vocal plasticity in which they can learn new vocalizations throughout their lifetime. Adult budgerigars can learn and imitate complex sounds.

Vocal mimicry can be utilized in predator defense, and nest and territory defense. When there is a threat to a nest or an individual, the threatened individual can give the mobbing call of another species. Birds of the other species will be attracted to the call and mob the predator. If an intruder approaches a nest or territory, the threatened individual can mimic the call of a predator and frighten the intruder.

A study by Masin, Massa, and Bottoni on fledgling Meyer’s parrots showed that young chicks exhibit vocal learning while they are in the nest. By the time of weaning, the chicks exhibited 100% similarity with the father’s vocalizations. Chicks raised without vocal context sing, the chicks exhibited 100% similarity with the father’s vocalizations. Chicks raised without vocal context are used different contact calls for different social companions.

Vocal mimicry and plasticity enable juveniles to learn the calls and songs required for communication with other flock members. Juveniles mimic adults and learn from auditory feedback of their own calls. Amazon parrots roost in communal groups each night comprising 50–200 birds. Each group has its own dialect, and flock members only respond to calls within their own dialect. Juveniles must learn this dialect before dispersal in order to interact with members of its flock.

Vocal plasticity also allows adult parrots to learn vocalizations that help maintain bonds within a flock, which is particularly relevant for species in which individuals change flocks several times in their lifetime, such as the Galahs. Psittacine birds can selectively learn to mimic the vocalizations of the individuals with whom they are closely bonded.

The range of hearing for psittacine birds includes frequencies from 1 kHz up to 4 kHz. Budgerigars have the ability to discriminate and remember complex vocalizations that occur in the range in which they hear best. Auditory feedback is important for young birds to learn the appropriate songs. If budgerigars are deafened, they vocalize less and have contact calls that differ from the calls of normal siblings. Adult birds also need auditory feedback in order to maintain the learned songs.

**Non-vocal communication**

Non-vocal communication consists of signals and displays. A signal is a behavior that changes the behavior of the recipient in a manner that benefits the sender. A display is a ritualized signal that conveys a specific message to the recipient. Displays are used by psittacine birds during courtship rituals.

Plumage and color also play a role in communication. Bird vision is considered tetrachromatic because they can visualize both near ultraviolet (UVA) and ultraviolet (UV) wavelengths. They have the ability to see UV wavelengths because they possess a UV-sensitive cone in their retina. Parrots can also see fluorescence, which occurs when short wavelength light is absorbed and re-emitted. When the light is re-emitted, it occurs in longer wavelengths. Certain Australian parrots, such as certain cockatoos, rosellas, blue-winged parrots, and budgerigars, have been found to possess a yellow fluorescent pigment in their feathers undetectable to the human eye.

Budgerigars are sexually dimorphic parrots that live in the arid regions of Australia. Several studies that involved altering the fluorescence of male budgerigars demonstrated that alterations in reflectance in the UVA waveband affected female choice of mates. Budgerigars also possess fluorescent yellow plumage in contrast with UV reflecting blue plumage on their heads, which is used during courtship displays. Hausmann et al. examined 108 species of birds and found that significantly more UV reflective plumage is found in body regions associated with active courtship display. In parrots, there are twice as many
species with fluorescent plumage in areas used for courtship displays, than non-displayed areas on their body.

Birds may have adapted the use of UV signals for many reasons. It can be used to signal over short distances. Birds can signal with less risk of being exposed to mammalian predators since most predatory species cannot perceive UV light. UV signals contrast sharply against foliage. They may also be an indication of good health since they are created by feather microstructure rather than pigmentation. The UV signals are also iridescent which may help to augment courtship displays.

**Diagnosis and treatment of common behavior problems of psittacine birds**

Complaints about behavior can arise when pet birds struggle to cope with inappropriate environmental conditions, when social interactions are poor in quantity or quality, or when caregivers misconstrue normal parrot behaviors. Early adverse experiences can also influence later behavior, particularly those that occur during sensitive developmental periods. Conditions associated with some captive breeding programs, such as early separation from clutch mates, maternal and paternal separation, hand weaning practices, and inadequate socialization, can have long-term consequences on coping styles, neuroendocrine responses to stress, neural circuitry, and social competence. The impressive cognitive capabilities of parrots may also be a factor in the development of behavior problems, because of the lack of adequate intellectual and occupational challenges in captive environments.

Many parrots are kept as single-housed birds, making the human caregiver the sole target of social contact. Problem behaviors reported by owners of psittacine companion parrots include aggression and biting, feather picking and self-inflicted injuries, social avoidance of family members, excessive vocalization, destructive behavior, fears and phobias, inappropriate sexual behaviors, overeating, and failure to accept new diets.

**Behavioral evaluation**

The diagnosis of a primary behavioral problem requires establishing a doctor–patient–client relationship, obtaining a thorough behavioral history, performing a physical examination and appropriate diagnostic testing, evaluating the nutritional status of the bird, evaluating the environment, and observing the behavior of the bird within the environment, including interactions with caregivers and family members. Important historical information that should be collected during a behavioral evaluation is listed in Table 1.1.

Behavior symptoms include feather picking, mutilation, screaming, aggression, and avoidance behaviors. Symptoms should not be mistaken for diagnoses. A list of differential diagnoses should be developed based on diagnostic testing and the behavioral history. Specific information about the behavioral complaint or complaints should include a detailed description or videotape of the behavior, age of onset and any particular events associated with the onset of the behavior, temporal or seasonal patterns, and an estimated or recorded frequency of the behavior. It is also important to determine if the behavior is more likely to occur in the presence of particular individuals, or in specific locations. The caregivers’ response to the behavior and the outcomes of previous interventions should be detailed. For aggression complaints, document who (the victim), where (the location), and what (the specific behaviors of the bird) for each episode, as well as the outcome of each episode.

**General treatment considerations**

**Environment**

The environment should, to the extent possible, allow for the expression of species-typical natural behaviors, and accommodate the natural time budgets for these activities. Attention to foraging opportunities, sleep patterns, physical activities, and social interactions is important in the treatment of behavioral disorders in birds.

The majority of psittacine birds kept as pets are from tropical to semi-tropical regions where the typical photoperiod would include approximately 12 hours of light and 12 hours of dark. Sleep and rest occupy the majority of the 24-hour time period when time budgets are measured in the wild. Budgerigars studied under conditions of constant illumination spent an average of 38% of a 24-hour period in sleep states. Half-moon conures (Aratinga canicularis) under similar experimental conditions spent 57% of the 24-hour period sleeping or drowsing.
Sleep is essential for mental and physical health. Sleep deprivation has been suspected as a risk factor for increased reproductive activities, fears or anxiety, stereotypies, and aggression or irritability. A minimum of 12 hours of uninterrupted sleep in a quiet, dark area away from household activities is recommended for any bird that is presented for behavioral abnormalities.

Foraging activities and food handling occupy a significant proportion of a parrot's waking hours. When pet birds are fed pelleted or seed diets ad libitum from a dish, the time budget required for feeding activities is drastically altered. This has been postulated to contribute to the development of abnormal behaviors. In a study of wild crimson rosellas, young birds spent an average of 67% of their active time in foraging and feeding activities. In captivity, a variety of feeding techniques can be used to encourage foraging, or food searching, such as placing non-perishable foods in multiple locations around the cage or mixing non-edible items with the food (Figure 1.1). Placing food on clean areas of the cage floor and adding branches, leaves, or shavings is another option. Foraging devices and puzzle feeders are commercially available or can be easily constructed. Attention to safety, as well as adequate nutrition, is important when incorporating foraging enrichment strategies.

In addition to food-oriented activities, additional strategies can be used to address deficiencies in the captive environment. Captive environments are rarely able to accommodate all species-typical activities (reproductive behavior, flight, flock interactions), but substitutions can focus on providing acceptable alternative activities to occupy the time budget. For any problem parrot, recommendations should focus on creating appropriate intellectual stimulation (training opportunities), providing exercise (flying, flapping, swinging, running, climbing), beak activity (chew toys, branches) (Figure 1.2), and positive social interactions. Effects of social enrichment were documented in a laboratory study involving orange-winged Amazon parrots. Isosexual pair housing of young Amazon parrots resulted in greater use of enrichments, fewer bouts of prolonged screaming, less time spent preening, and less inactive time, than singly housed control birds.

Behavior modification

Behavior modification uses operant conditioning techniques to strengthen the occurrence of desirable behaviors and diminish the occurrence of undesirable behaviors. With operant conditioning, behaviors are goal-directed and controlled by their consequences, or controlling stimuli. Operant conditioning paradigms can involve positive reinforcement, negative punishment, positive punishment, and
negative reinforcement. For a detailed discussion of the meaning of these terms and their application, see Chapter 18.

Desensitization, counter-conditioning, and flooding are all techniques commonly used to modify behavior. These techniques, their advantages and disadvantages, and instructions for their application are covered in detail in Chapter 18.

Training parrots to understand and comply with simple requests (commands) can build confidence, reduce fear, and facilitate predictable interactions between bird and human. Commands can be practical (step up, stay, quiet), or promote physical activity (dance, swing, turn around), and will serve to increase the caregiver’s ability to communicate effectively and predictably with the parrot, and allow for the intellectual stimulation associated with learning new commands.

Pharmacotherapy
Pharmacological treatment options for behavioral disorders in birds are detailed in Chapter 19. Medication can be used to prevent self-harm, improve quality of life, or facilitate responses to the behavior modification plan.

Fears and phobias
Fear responses in psittacine birds involve characteristic vocalizations, defensive postures, avoidance, escape attempts, frantic behavior, displacement behaviors, and aggression. A variety of factors contributes to fear responses in psittacine birds. Parrots are prey species, many of which do not have long histories of domestication, and some of which suffer from socialization or developmental deficits. Housing conditions, environmental stressors, and sleep deprivation can also contribute to fear responses.

The effects of environmental enrichment on fear responses to novel objects in orange-winged Amazons (Amazona amazonica) were evaluated. Physical enrichments included swinging ladders and spiral boings. Foraging enrichments included fruit cages, toy boxes, and treat baskets. Parrots housed in enriched environments were significantly less fearful of novel objects compared to parrots housed in barren environments.

The effects of rearing conditions on the development of fear were studied in Nanday conure chicks (Nandayus nenday). Four different treatment groups were raised in either enriched environments (with other chicks, soft toys, and sensory stimulation) or restricted environments, and were either exposed to early handling or were not handled beyond the feeding routine. Both handling and environmental enrichment were found to significantly reduce fear of novel objects.

Treatment of fears and phobias involves identifying sources of fear, and removing or minimizing contact. Frightened birds should be removed from high traffic areas and allowed to explore new objects and places on their own schedule. A sleeping cage that allows for security and uninterrupted sleep can be vital for fearful parrots.

Caregivers should avoid reinforcing (giving excessive verbal comfort or attention to) behaviors consistent with fear. Positive reinforcement training should focus on building confidence through acquisition of new commands and skills.

Gradual desensitization can be used when the stimuli that elicit fear or anxiety can be identified and manipulated for controlled exposures. Fear can result from a variety of stimuli, many of which may not be apparent to the human caregivers. Fear can also occur as a result of interactions or associations with humans. In a case report of a Goffins cockatoo (Cacatua goffiniana) diagnosed with a conditioned fear response of the primary caregiver, desensitization and counter-conditioning were used successfully to improve the relationship and reduce the fear. Anti-anxiety medications can be used in severe cases of fear or phobias, but limited data is available regarding efficacy and safety.

Feather plucking and self-mutilation
Feather picking may not be the most prevalent behavior problem affecting companion psittacine birds, but it is the most common complaint for which the veterinarian is consulted. The plumage serves multiple functions, including flight, insulation, protection from physical trauma, protection from UV radiation, waterproofing, and visual communication. After foraging, grooming occupies the largest amount of a wild bird’s time budget. Self-preening and allopreening (preening of another individual) function to maintain feather condition, provide comfort or de-arousal, and strengthen social bonds.

Feather picking disorder, or behavioral feather picking, is characterized by self-initiated feather removal or damage, and/or self-inflicted damage to soft tissues, in the absence of an identifiable primary medical explanation (Figures 1.3 and 1.4). In addition to aesthetic consequences, feather chewing or plucking can result in abnormal feather development, hemorrhage from damaged blood feathers, follicular damage, discomfort, and loss of insulation. Consequences of soft tissue mutilation might include hemorrhage, secondary infections, and penetration of body cavities.

A variety of medical differentials or risk factors should be investigated including organopathies, infectious diseases, internal and external parasites, seasonal hormonal changes, dermatological conditions, toxin exposures, malnutrition, food sensitivities, conditions causing pain or discomfort, and neoplasia. In a review of dermatohistopathology findings for 408 feather picking and self-mutilating birds, paired biopsies from affected and non-affected skin were evaluated. Inflammatory skin disease was diagnosed based on the histological presence of inflammation in both
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affected and unaffected skin samples. Macaw species and Amazon species were most likely to be diagnosed with inflammatory disease. Traumatic skin disease was diagnosed by the absence of inflammation at both affected and unaffected biopsy sites. Traumatic skin disease was reported in cockatoos and African gray parrots. Traumatic skin disease and inflammatory skin disease were reported with approximately equal frequencies in conures, eclectus parrots, Quaker parrots, cockatiels, and caiques.

There are many suggested risk factors for feather picking disorder, but none scientifically proven to cause feather picking in pet birds. Possible environmental factors include inadequate bathing, mechanical injury or skin irritation, poor air quality, toxin exposure, abrupt changes, and sleep deprivation. Possible behavioral risk factors include lack of stimulation, lack of control or unpredictability, lack of foraging opportunities, confinement, crowding, social incompatibility, and social isolation. Individual factors include chronic hormone induction, species, gender, neurotransmitter abnormalities, and individual differences in coping styles. A single retrospective study has identified several significant risk factors for feather picking in pet parrots: species (African gray parrots), gender (female), and lack of play behavior. Additional species predispositions have been reported based on clinical impressions, including conure, macaw, and cockatoo species.

Treatment considerations should include attention to nutrition, general health, social interactions, photoperiod, housing, and air quality, and control of reproductive behaviors. Special attention should be given to foraging enrichment and stress reduction. Foraging and physical enrichments were shown to prevent and improve feather picking behavior in laboratory-housed orange-winged Amazon parrots and in African gray parrots. Additional species predispositions have been reported based on clinical impressions, including conure, macaw, and cockatoo species.

Neurochemical abnormalities should be considered, particularly in cases of chronic feather picking. Feather picking disorder has been compared to trichotillomania, an impulse control disorder of humans. Medications used to treat compulsive or impulsive behavioral disorders in other species may be helpful in treating persistent feather picking or self-mutilation problems in psittacine birds. Selective serotonin reuptake inhibitors are the treatment of choice based on treatment responses in a variety of species. Successful adjunctive use of medication for the treatment of feather picking has been reported using fluoxetine, paroxetine, clomipramine, naltrexone, gabapentin, amitriptyline, and haloperidol. Hormone therapies may also prove useful. Pharmacological interventions are described in detail in Chapter 19.

Reproductive behavior problems

The onset of puberty, ranging from 6 months to 6 years depending on the species, may be associated with a variety of behavioral complaints. Behavior problems associated with hormonal changes may include screaming, or frequent contact calling, aggression or territorial defense of cage and nesting sites, intolerance of handling, irritability, favoring one person, sexual displays, frequent regurgitation, panting, and masturbation.

While species differences exist, typical environmental cues that trigger reproductive behaviors include changes in day length, temperature, or rainfall, the presence of nesting sites, and the presence of potential mates. Caregivers that stroke their birds over the back or tail can also stimulate sexual behavior and should be advised to discontinue any forms of handling that stimulate the bird. Seasonal variations in temperature, photoperiod, and food supply
are typically absent in captive environments, which can result in chronic hormone stimulation. Persistent sexual behaviors in pet psittacine birds create challenges for behavioral management as well as physical health. Potential medical concerns for females include dystocia, cloacal prolapse, pathologic fractures, and coelomitis. In male birds, orchitis and cloacal prolapse are possible. General treatment recommendations should include decreasing the photoperiod, providing more dark time, removing potential or perceived nesting areas, and reducing the fat content of the diet. Hormone therapy, such as leuprolide acetate, may also be indicated. However, species differences in sensitivity to leuprolide acetate are possible as well as variations in effects based on the timing of administration during the reproductive cycle.

**Aggression**

The postulated causes of human-directed aggression (lunging, charging, pecking or striking, or biting) in psittacine birds include play and exploration, instrumental or conditioned aggression, territoriality, fear, mate-related and sexually induced aggression, and redirected aggression.

**Play and exploration**

Parrots use their beaks like hands to explore the environment. Juveniles of several psittacine species have been observed to engage in social play in the wild. Play behaviors included clawing, play biting, and mock fighting. Treatment of play aggression includes provision of chew toys, regular opportunities for appropriate play and interactions, and positive reinforcement (rewards) for appropriate play behavior. Corrections for play biting are often unsuccessful. Caregivers should be instructed to discontinue interactions if mouthing becomes excessive.

**Fear aggression**

Fearful behavior in psittacine birds may involve aggression if the bird is otherwise unable to extricate itself from the stressful situation. Caged birds that are unable to fly or prevented from escaping may choose aggression when flight or avoidance is not an option. Caregivers should receive instructions about how to recognize postures that are consistent with fear, and how to avoid eliciting these responses. Safety considerations are important for both the caregiver and the bird. Forcing unpleasant exposures is seldom helpful and tends to worsen fear responses and aggressive behaviors. Desensitization and counter-conditioning is often successful in cases of fear aggression.

**Instrumental or learned aggression**

For birds that do not desire to interact (to be petted or handled at particular times or by particular individuals), biting is often a highly effective means of avoiding contact. If the bird can successfully use aggression to avoid certain activities, then negative reinforcement of aggression is possible. Caregivers should respect the preferences of the bird regarding interactions and avoid activities that elicit aggressive responses. Birds can be taught with positive reinforcement to comply with caregiver requests.

**Territorial aggression**

Many avian species establish, maintain, and protect access to particular areas in their natural habitats. Aggression may be directed against any intruder, regardless of familiarity. The bird is often normal and friendly when taken away from the vicinity of the cage. Treatment will require that the cage be moved away from high traffic areas to reduce the incidence of territorial displays. Otherwise, negative reinforcement of aggressive displays can influence the severity of the problem. The bird can be taught to step up on a hand-held perch, rather than a hand, to allow removal from the cage.

Gradual desensitization and counter-conditioning for approaches to the territory (cage) can be effective. The bird is allowed to have a special treat or offered verbal praise as individuals gradually approach the cage area from a comfortable distance. If the bird shows signs of defensive behaviors, the approacher stops and resumes once the bird has settled. Alternatively, the caregiver can work with the bird in a neutral area at a comfortable distance from the cage, and then gradually move the training sessions closer to the cage.

**Sexual aggression**

Lack of suitable conspecific mates and seasonal hormonal changes can result in sexual behaviors directed at a preferred human. Sexual behaviors may involve a combination of the following: regurgitation, masturbation, excessive contact seeking, guarding, and aggression directed at other individuals when the preferred individual is present. Problem onset may coincide with the species’ natural breeding season, with lengthening daylight, or at random times when conditions support breeding behavior (households with unnatural photoperiods, presence of breeding birds, and stimulation of the bird by the caregiver).

Treatment suggestions include allowing non-preferred family members to participate in feeding and maintenance care when possible and avoiding any forms of handling that stimulate the bird to engage in sexual behaviors. Gradual desensitization and counter-conditioning for approaches to the bird when it is with its preferred person or in the nesting area can be attempted.

Hormonally mediated behaviors can be extremely frustrating for caregivers. Hormone therapies can be used to facilitate behavior modification by minimizing sexual and