Low-Stress Medication Techniques in Birds and Small Mammals

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KEYWORDS

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KEY POINTS

- Forceful, coercive, and fear-evoking treatment methods can be behavioral harmful to the patient as well as result in lower prognosis and impaired clinical outcome.
- Many medical behaviors can be trained using science-based methods, often quickly and effectively, in a veterinary practice setting.
- Keys to implementation of low-stress medication techniques in practice require the ability to recognize fear and to use desensitization and counterconditioning and the use of versatility, adjusting methods to best fit the behavioral and medical needs of the patient at hand.
- Medication can be optimally delivered through the use of food vehicles and via operantly trained medication/treatment behaviors.
- Selective and appropriate use of conscious sedation and even general anesthesia may be appropriate in select cases at key times, but these pharmacologic interventions rarely should become the sole methods for maintaining long-term treatment or execution of medical procedures.

Video content accompanies this article at http://www.vetexotic.theclinics.com/.

INTRODUCTION

Low-stress medication techniques are an important component of ethical and effective treatment. Paired with the medical details of patient management, by balancing medication techniques, success can be greatly enhanced. Low-stress medication

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techniques require careful assessment of body language, at times may use strategic and appropriate use of anxiolytics to facilitate some medical procedures, and often use the regular implementation of target training as a gateway to other trained medical behaviors as well as enrichment. The neurobiological aspects of the stages of memory formation, and how these stages may be influenced by stress and some therapeutics, are explored.

CAPTURE AND RESTRAINT

Many case reports, veterinary textbook references, conference proceedings, and discussions describe techniques and treatments used to provide medical care for birds using the term "capture and restraint," or fail to describe the methods used and assess their behavioral outcome on the patient. Loosely, "capture and restraint" often includes combinations of techniques that include physically overpowering the bird, sneaking up on or surprising the bird, or other means to quickly get the bird restrained and get the task at hand done. In addition, videos of these methods and techniques, good and bad, live in perpetuity on YouTube and other sources, are repeated, and are even referenced in current presentations. Conversely, medication techniques may also not even be described at all in scientific studies, case reports, or other descriptions of procedures requiring therapeutic administrations. These realities, in turn, can result in further confusion and misunderstanding about the "controversial" views on the topic.

Similar issues are encountered in small mammals because veterinarians are often trained to handle and restrain these animals using "traditional methods," such as applied in laboratory animals. Moreover, animals are often chased in their cage before being grabbed quickly and forcefully and held in the air with their feet off the ground. This activity in itself is likely innately aversive to the animal because it mimics the chase-and-capture action of a predator. However, additional stress and anxiety may result because of the aversive nature of the treatment that is being administered, especially if the procedure is recurring on a daily or twice-daily basis. As a result, it is not surprising that a large number of animals will show fear behaviors or resistance when being handled. For example, surveys among rabbit owners have shown that around 60% of rabbits will struggle if lifted or demonstrate fear-related aggression upon being approached.[1–4]

> *By restraining pets in a forceful, crude or unskilled manner, you could be breaking your promise to do no harm. Such handling can make pets behaviorally worse and even lead to aggression and, ultimately, euthanasia.*
>
> *—Dr Sophia Yin*

This quote really applies to how veterinary professionals interact with pets in all aspects of veterinary medicine, not only restraint.

Outdated methods or techniques that are not evaluated for effectiveness on all aspects, above and beyond outcome alone, typically overlook some of the more important ethical considerations and best practices for pet birds and small mammals. When veterinarians and health care personnel did not look back and critically evaluate the outcomes of restraint and medication methods, most people were quick but incorrect to pronounce those methods effective. This is especially true in parrots as an example, as their intelligence and learning capacity was often discounted. In reality, these "successes" were in fact often quite far from their ideal or intended mark. The adverse effects of our own failure to appreciate learned fear in the development of and shaping of behaviors during in-patient treatment and clinical procedures are immense. Inadvertent, unrecognized, or unaltered use of stressful or fear-

evoking treatments can lead to significant adverse consequences. These perceived acute and chronic stressful situations can adversely affect the immediate and longer-term outcomes of an examination, a specific procedure or surgical event, patient-healing capacity, and the long-term quality of life of the animal. In addition, the observed changes to the pet's behavior can easily adversely affect a client's desire to return for further care or even annual wellness evaluations. Misconceptions about the use of training methods in birds and small mammals have to some degree become included as part of routine veterinary aspects of patient care.[5] Because welfare and the nature of learned experiences are considered more a part of veterinary health care, balanced behavioral science and these modern myths have become combined in in-patient management plans and have become included as part of outcome assessments. Fragments of popular pseudoscience, mixed and blended with more current scientific information in the same discussion, presentation, or publication, can become challenging for even the most critical veterinary minds struggling to separate fact from fiction pertinent to their patient's care decisions. Conflict, confusion, and variable levels of understanding and assessments of outcomes of treatment effectiveness abound. There is enough scientific evidence that the use of force-, coercion-, and "capture"-oriented methods and positive punishment or negative reinforcement as the primary means with which to guide behavior, more than ever before, are increasingly less appropriate for most of the animals in our stewardship and care.[6,7]

Low-stress techniques also do not have the same problems associated with forceful treatment, such as increased learned fear-eliciting stimuli, increased learned aggression, increased risks to the bird and handlers, increased risk of problems during medical procedures, and increased difficulty interpreting some laboratory diagnostics due to iatrogenic and stress-influenced changes. Low-stress handling techniques are time-effective and can directly enhance the comfort of the avian and small mammal patient in daily clinical practice. These basic skills and techniques are essential not only to avoid the old "capture and restraint" methods and their adverse consequences but also to enable veterinarians and technicians to be more ethical and effective in their health care delivery for companion birds and small mammals and to enable training of medical behaviors in the present and the future. In the practice setting, encouraging staff to take low-stress medicating into their own hands helps empower staff and share what they learn with other coworkers and ultimately clients. In the examination room and with hospitalized patients, it is easy to adjust timing, scheduling, and service prices to benefit the patient and the veterinary practice.

The training of medical behaviors is becoming increasingly more common in zoologic institutions.[7] Nevertheless, training birds and small mammals to cooperate in their own medical care unfortunately still is a comparatively new, but key aspect of treatment (**Box 1**). Methods should be focused on positive reinforcement and should be a component of most treatment plans, almost regardless of the nature of the problem or problems being addressed. Trainable medical behaviors for birds include standing on scales, allowing restraint in a towel, being comfortable with a tactile examination, voluntarily presenting feet for nail trims, voluntary participation in venipuncture, medical treatment plans, and more.[8] Trainable behaviors for small mammals include, for example, crating, being picked up and handled (or stepping voluntarily onto the hand), toweling, standing still and allowing an examination to be performed, targeting (eg, to direct the animal to get onto and off of a scale, coming out of a cage), administering medication (topical, oral, parenteral), and voluntarily undergoing grooming procedures (eg, nail trimming, brushing) (Videos 1–4).[9]

Box 1
Benefits of training health care behaviors in birds and exotic small mammals

- Creates a patient that willingly participates in health care procedures, significantly reducing stress on the patient, the veterinary staff, and the caregiver.
- Reduces patient aggressive behavior toward the veterinary staff or caregiver.
- Preempts the need for heavy-handed or chemical restraint.
- Increases behavioral resiliency when it is necessary to expose the animal to an aversive experience. Animals will "bounce back" more easily.
- Builds a relationship of trust between caregiver and animal, reducing the animal's anxiety and fear in its daily life.
- Creates empowering problem-solving opportunities for the animal, resulting in behavioral enrichment and an increase in the animal's behavioral repertoire.

Adapted from Brown S. Small mammal training in the veterinary practice. Vet Clin North Am Exot Anim Pract 2012;15:471; with permission.

THE ABCs OF DESCRIBING BEHAVIOR

The simplest manner of describing an initial evaluation of a behavior is through the use of the ABC's of behavior.[10,11]

The letters stand for the 3 elements of a simplified behavioral "equation," which includes the *Antecedents*, *Behavior*, and *Consequences*. With this simple descriptive and analytical strategy, we seek to identify through careful observation the events and conditions that occur before a specific behavior: *Antecedents*, as well as identifying the results that follow the *Behavior*: its *Consequence*s. When paired with keen observation skills and creative problem-solving abilities, the ABCs help clarify the way in which the basic components of behavior are interrelated. It is this clarity that leads to important insights and more effective teaching or training strategies. The ABCs can also be used to help identify problem situations and consequences that also have a formative role in some behaviors. By describing a behavior in the context that it is occurring, one is more optimally positioned to describe problem behavioral situations and therefore has more opportunity to alter them. There are 6 steps to analyzing and using the ABCs in a behavior-change strategy: (1) describe the target behavior in clear and observable terms; (2) describe the antecedent events that occur and conditions that exist immediately before the behavior happens; (3) describe the consequences that immediately follow the behavior; (4) examine the antecedents, the behavior, and the consequence in sequence; (5) devise new antecedents and/or consequences to teach new behaviors or change existing ones; (6) evaluate the outcome.

The ABCs are used to enable critical employment of operant behavior changes with the learner and can be put in better context with the use of paradigms of reinforcement and punishment (**Table 1**).

Table 1
Basic paradigms of reinforcement and punishment

	Operant Response Increases	Operant Response Decreases
Stimulus presentation	Positive reinforcement (R+)	Positive punishment (P+)
Stimulus removal	Negative reinforcement (R−)	Negative punishment (P−)

Reading from the left, if a stimulus is being presented to the learner, this is represented as a positive. Then, evaluating the frequency or probable frequency of the behavioral consequence of this presented stimulus, one can assess if the stimulus is functioning as a positive reinforcer (R+), or a positive punisher (P+). If the behavior increases, the introduced stimulus is functioning as a reinforcer, and if the behavior decreases, the introduced stimulus is a punisher. If a stimulus is being removed from the learner as a result of its behavior, it is represented as a negative. Based on the observed frequency or probable frequency of the behavioral consequence of this removed stimulus, we can also assess whether the stimulus is functioning as a negative reinforcer (R−), or a negative punisher (P−).

In a review article of 17 different studies on the effects of training dogs, it was concluded that using aversive training methods (positive punishment and negative reinforcement) can jeopardize both the physical and the mental health of dogs. Although positive punishment could be effective, there was no evidence that it was more effective than positive reinforcement, and more potential that it could be less effective.[12]

BODY LANGUAGE: WHAT IT IS AND WHAT IT IS NOT

In order to effectively train and guide behaviors, clear descriptions of what is seen are important. When describing any behavior, it is important to describe observable actions (ie, what we see and can be seen easily by others). What body language and observed behavior are not are labels. These types of labeled descriptors often have different meanings to different people. For example, an "aggressive" bird may look like a bird slamming its toys around the cage to one person, but to another person "aggressive" may look like a lunging, biting bird. The same applies to a "territorial" rabbit, which can be used as a label to describe a rabbit scent-marking and spraying while roaming freely through the house, a rabbit grunting, lunging, or biting upon being approached by a human handler while in its enclosure, or a rabbit that will fight with other rabbits with which it is housed. Another common label that is used in popular practice is the "hormonal" label, which may be used to justify treatment without a clear description of what behavior or behaviors are being observed. Similarly, people may refer to a "depressed" animal, which needs to be petted constantly to be "happy." "Happy" and "depressed" can have many different meanings to different people, yet they are very commonly used as explanations for why an animal behaves the way that it does. One seeks to describe the animal's personality (the veterinary staff might say, "That's just how the animal is!") or its state of mind, but these labels rarely, if ever, can be objectively and accurately assessed. As a result, these can easily predispose veterinarians to incomplete, imbalanced, and sometimes less comprehensive treatment strategies, rather than to help design a concrete behavior-modification plan that would be considered the best treatment practice for the patient before them. Without taking time to paint a clear picture of an animal's behavior, veterinarians can sometimes be a greater hindrance than help for the patients and clients. As such, veterinarians are encouraged to describe the actual behavior, something the animal is doing, that can be measured, observed, and repeated, as well as the conditions under which it occurs, because these descriptors provide the best indicators for what is going on and why, thereby rendering it more likely to design a concrete behavior-modification plan that will result in the desired behavioral changes.

IDENTIFY FEAR AND EMPLOY DESENSITIZATION AND COUNTERCONDITIONING

Desensitization and counterconditioning are both techniques that can be used to address elicited fear responses in patients. Desensitization is the process of

incrementally exposing the animal to the aversive stimulus without crossing the threshold, causing the animal to show any fear response. Desensitization and counterconditioning are focused on altering respondent behavior and are very effective especially when used together. Careful observation of the animal's body language is crucial, because it is the animal's "comfort" level that decides whether to decrease proximity to the aversive stimulus. For example, a bird may show an elicited fear response (eg, increased respiratory rate when observed from a distance, screaming, flattening of the feathers against the body; **Table 2**) upon being presented with a towel at close proximity, for example, when the towel is brought within 8 feet of the bird. However, the same bird may be preening when the towel is presented at a far enough distance, for example, within 10 feet of it. Based on these observations, we know that 10 feet would be an appropriate distance to start, because the bird is displaying "calm" body language by preening. Small approximations are subsequently used to bring the towel closer to the bird without it demonstrating fear or escape behavior, the size of the approximation being dependent on the bird and its response. Aside from objects, desensitization can also be applied to potentially aversive sounds (eg, clipping of nails or noise of a nebulizer), for which the animal may be gradually desensitized by keeping the animal at a distance and slowly increasing proximity to the noise-producing object, and/or starting with the sound at a low frequency or short duration (eg, one clip, turning on the nebulizer for 1 second) and gradually increasing the frequency or duration. Alternatively, the sound can be recorded and initially played at a soft intensity followed by a slow increase of the intensity, while ensuring that the animal is displaying calm behavior before continuing to the next approximation (and taking a step back when a fear response is elicited; see **Table 2**). Once the animal is desensitized to the sound or object and displays calm behavior in proximity of the object, the next step would be to gradually desensitize to the touch of the towel, nail clippers, or the face mask, and so forth.

Counterconditioning focuses on pairing a desired or appetitive stimulus with the aversive stimulus (the undesirable stimulus that the animal avoids and causes a fear response) to change the stimulus from aversive to valued. The appetitive stimulus should elicit a stronger response from the animal than the aversive stimulus. In the previous example, if a bird shows elicited fear of the towel, and if we know that this individual bird enjoys peanuts and scrambled eggs, we can pair the appetitive response from eating the food with the towel, thereby overriding the fear response. The same pairing would be possible for an aversive sound, for example, if a rabbit shows a fear response (eg, ears flattened against the body) upon hearing the nail clippers, and we know that this rabbit highly favors banana, we can present this food item to the rabbit while simultaneously exposing the rabbit to the sound of the nail clippers. Many birds and small mammals have several food items that may be used as a reward during counterconditioning (**Figs. 1** and **2**, **Table 3** also supplies examples). Reserve the animal's favorite, that is, a very highly valued food item, for this exercise. In the aforementioned example, if when the towel is presented, the bird will not eat the peanut, then it may be wise to try a different food. If the bird readily eats scrambled eggs when the towel is presented, we know we have a food item that is high enough value to outweigh the aversiveness of the towel in the manner it is being presented. It is fair to assume that an animal that is stressed or does no' feel "safe" will not eat treats. Slowly, the end result is an animal that does not show a fear response when it is confronted with the aversive stimulus (ie, the towel or sound of the nail clippers in the aforementioned examples) because it was successfully paired with the appetitive response of eating its favored treats (ie, the scrambled eggs in the case of the bird or the strawberries and bananas in the case of the rabbit).

Table 2
Common behavioral indicators of fear in birds and small mammals

	Freeze Response (Fright)	Flight Response: Escape and Avoidance Behaviors	Fight-Response: Defensive of Fear-Related Aggression (Usually Last Resort for Prey Species When Cornered)	Other Remarks
Birds	Flattening of feathers Muscle tensing Body still and tensed Hunched/crouched posture Vision oriented toward the threat, following its every movement	Leaning backwards Flying or running away from the perceived threat Shelter-seeking behaviors, for example, hiding in a corner or underneath an object Wing flapping Falling from perch Struggling and wing flapping while being caught or restrained Screaming (high-pitched vocalizations)	Eye pinning Feathers either fluffed or flattened against the body Lying on back, kicking with feet Tail fanning Lunging forward with beak Biting (often short, quick bite) Screaming (high-pitched vocalizations)	Sounds produced can vary per species
Rabbits	Eyes wide open and unblinking, into the eye socket Ears initially pointed forward, then laid back flat against body	Running away from the perceived threat Shelter-seeking behaviors, for example, by hiding in a corner or underneath furniture Guinea pigs, rats, and hamsters: repeated nudging of and digging in cage bedding, trying to bury itself in it Struggling and scratching or kicking while caught or being restrained Running away from perceived threat, shelter-seeking behaviors	Body leaning backwards, with the weight placed on in back legs Lunging forward with head and front feet toward the perceived threat Growling, grunting Biting	Eyes can either bulge slightly or be retracted in the eye socket Position of the ears can be more difficult to observe in lop-eared rabbits
Lip-licking	Body still and tensed (freeze response), body flattened to the ground, oriented toward the threat; foot thumping, but no other movements			
Guinea pigs	Eyes wide open (white of the eye may be visible), lowered head and ears, head stretched forward Shivering		Growling, teeth chattering Lunging and biting (rarely)	

(*continued on next page*)

Table 2
(*continued*)

	Freeze Response (Fright)	Flight Response: Escape and Avoidance Behaviors	Fight-Response: Defensive of Fear-Related Aggression (Usually Last Resort for Prey Species When Cornered)	Other Remarks
	Muscle tensing, stiffening of front legs Standing tall or sitting still, frozen, feigning death Body often oriented toward the perceived threat Growling, shrieking, whining			
Chinchillas	Stiff body with weight in hind legs, or standing upright Ears forward or flattened on the back Sitting still, with body Directed toward perceived threat		Teeth chattering, barking, screaming, grunting, whistling Urine spraying Lunging, biting	
Rats	Piloerection Standing on hind legs, slapping tail Body tensed and still, lowered to the ground and oriented toward the threat Defecating and urinating		Flip onto back with mouth open, ears flattened against head High-pitched squeal, low-pitched squeak, hissing, teeth chattering Revealing lower teeth Lunging and biting	
Hamsters	Body stiffness, standing upright, flattened to the ground, washing face continuously Defecating and urinating		Flip onto back with mouth open, ears flattened against head Screaming, tooth clicking Revealing teeth Lunging and biting	
Ferrets	Piloerection on tail and sometimes body Standing still, with arched back; body tensed and oriented toward the perceived threat Anal gland expression		Hissing, huffing, screaming Backing up with mouth open Flip onto back with mouth open Lunging and biting	Note that backing up with mouth open can also be observed during play

Note: In all species, these behavioral responses are often accompanied by sympathetic responses (eg, increase in heart rate, respiratory rate, blood pressure).
Data from Refs.[13–17]

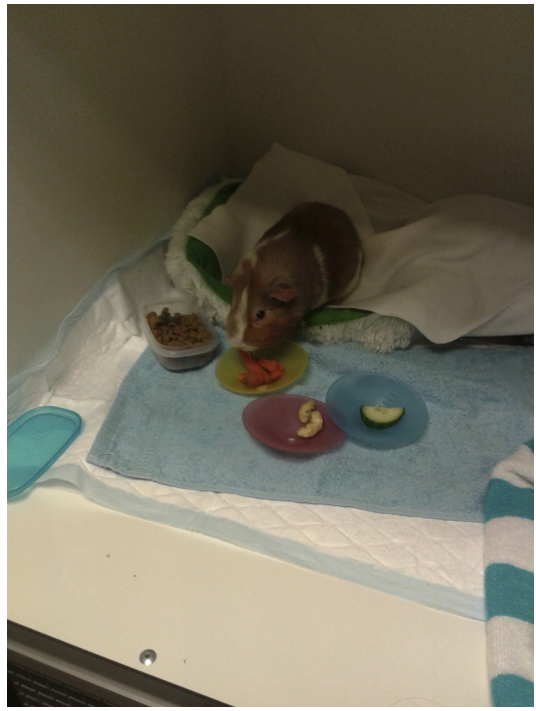

Fig. 1. To identify which food items are favorites, preference tests can be performed. Here, a Guinea pig is allowed to select which food items (carrot, banana, cucumber, pellets) it prefers to eat. The most favored item can subsequently be used in training sessions.

Desensitization and counterconditioning work very well together by combining the pairing of stimuli from counterconditioning at each approximation used with desensitization. In the aforementioned examples, the towel would be brought close to the bird or a single sound of the nail clippers would be produced in proximity of the rabbit, and if no fear response or escape behavior were shown, small pieces of food (scrambled egg or banana, respectively) would be offered. Each successful approximation of decreased distance between the towel and bird (or increased frequency of the nail clipper sound produced in proximity of the rabbit) is reinforced with a positive stimulus, which makes the appetitive stimulus dependent (contingent) on the behavior.[11,14–20]

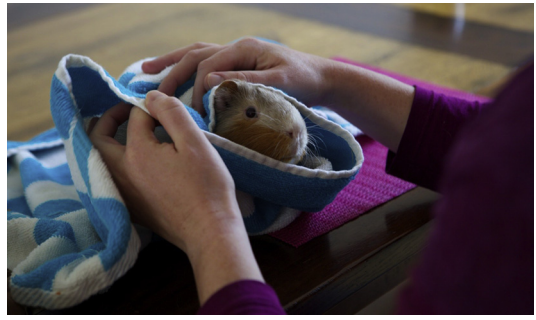

Fig. 2. Towel training in a guinea pig (*Cavia porcellus*).

Table 3
Food items that can be used as reinforcers during training for birds and small mammals[a]

Birds	• Dried or fresh fruit, cut into smaller pieces (grapes, apple, banana) • Nuts: shelled, unsalted, and cut into smaller pieces (for example, almonds, pine nuts, palm nuts, macadamia nuts) • Sunflower or safflower seeds, cereals and grains, dried peppers • Treat foods • Other highly favored food items often include foods for human consumption (eg, cheese, cooked pasta, peanut butter, bread, popcorn)
Herbivorous small mammals (eg, rabbits, guinea pigs, chinchillas)	• High-fiber pellets • Fresh greens and vegetables (eg, [dried] parsnip, [dried] cucumber carrot) • Canned unsweetened pumpkin or squash, unsweetened fruit juice, unsweetened vegetable juice • Grains (whole oats, barley, plain popcorn) • Dried fruit with no added sugar (dried mango and papaya) or fresh fruit (eg, apple, banana) • Treat foods • Fruit or vegetable baby food puree
Small rodents (hamsters, mice, gerbils, rats)	• Pelleted rodent food broken into tiny pieces • Unsalted raw seeds or nuts and grains (as listed for rabbits) • Unsweetened fresh or dried fruit, herbs, or vegetables (eg, coconut flakes, dried white man's foot or dandelion leaves) • Liquid foods, such as those described for rabbits, yoghurt (eg, coconut flavored) • Fresh or dried mealworms of appropriate size • Treat foods and other highly favored food items, such as mentioned for birds (eg, cooked pasta) • Fruit or vegetable baby food puree
Ferrets and other carnivorous species	• Dried ferret food that is slightly moistened to facilitate chewing • Cooked meat (eg, chicken, turkey, organ meat) or eggs • Fatty acid supplement in small squeeze bottle or syringe or presented on a spoon (maximum ½ teaspoon a day per ferret) • All-meat baby food on a spoon or tongue depressor or in a syringe (diluted with water or meat broth) • Liquid recovery diets (eg, Convalescence support [Royal Canin], Emeraid Carnivore [Lafeber Company], Critical Care for Carnivores [Oxbow])

[a] Up to the daily limit.
Adapted from Brown S. Small mammal training in the veterinary practice. Vet Clin North Am Exot Anim Pract 2012;15:478; with permission.

A video example of desensitization and counterconditioning can be found at https://youtu.be/wm3tWFmWa0c.

THE APPROPRIATE USE OF CONSCIOUS SEDATION

Where indicated, conscious sedation or even general anesthesia should be considered in particularly stressed or fearful patients. Although these maneuvers can be very effective, they should not be uniformly used in all patients and should not be viewed as a means with which to avoid the need for low-stress handling methods. The choice to use conscious sedation or general anesthesia may also depend on the frequency with which the procedure needs to be repeated. For treatments that

are common and frequently recurring, it might be beneficial to train; for those that only occur incidentally, training may be less important, and low-stress methods possibly aided with the use of sedation or anesthesia may be more appropriate.

Midazolam 0.5 to 1 mg/kg intramuscularly (IM), paired with butorphanol 1 to 2 mg/kg IM, can produce effective conscious sedation for many, but not all, companion bird species, and midazolam 2 mg/kg intranasally can also be used where appropriate.[21–24] Similarly, benzodiazepines (eg, midazolam 0.2–0.5 mg/kg) can be used, with or without butorphanol (dose 0.1–1 mg/kg), in small mammals. When injecting these medicaments, the subcutaneous route is preferred over the IM route because it produces equivalent effects, but is far less likely to cause discomfort (and thereby fear or resistance) to the animal.[25,26]

The advantages that conscious sedation offers include minimal cardiopulmonary effects and the potential for an amnesia effect as is described in humans.[27] If training of medical behaviors is a goal of the treatment plan, however, these same sedatives may be less appropriate. However, benzodiazepines, including midazolam, are not analgesics. Although sometimes referred to as "sedated" with isoflurane, volatile anesthetics are not sedatives and render the patient entirely unconscious. Even though volatile anesthetics offer a relatively wide margin of safety, they are not benign and can produce apnea and hypotension, especially at the higher concentrations required when used as sole agents. In addition, the process of mask induction can be quite stressful and fear-evoking for both birds and small mammals, and undesired learned fear responses still may be generated.[28] Although the task at hand may be able to be accomplished, the greater goal of minimizing fear and stress and facilitating learned cooperative interaction between the animal and staff is reduced.

MEDICATION TRAINING

Birds and small mammals can be taught numerous medical behaviors using target training. By this method, the animal can be taught that if it "targets" (touches with a body part, eg, its beak or nose) an object (such as a chopstick, or closed hand), it will receive a favorable outcome, that is, positive reinforcement. Target training is used very commonly to train a large number of animal species, particularly in zoos. Target training can be used to train birds to do anything from play basketball, allow IM injections, to enter and exit the carrier. Similarly, target training can be used in small mammals to teach them to get onto and off of a scale voluntarily, stand still while being treated/examined, or enter or exit a carrier or its enclosure. Using small approximations and the individual strength of different reinforcers, new behaviors can be created. A reinforcer is any consequence that increases the strength or frequency of the behavior. A very simple example of target training is when teaching a bird, rabbit, ferret, or rodent to take medication directly from a syringe. Initially, the animal is reinforced just for touching the tip of the syringe: the owner holds the syringe up to the animal's beak or mouth (antecedent); the animal touches the tip of the syringe with its beak or mouth (behavior); owner gives the animal a treat (consequence). Assuming that treat provided (eg, millet, fruit, piece of meat; see **Table 3**) is a reinforcer for this individual animal, it can be predicted that the animal will continue to touch the target to get a nibble of millet or a piece of fruit or meat. Approximations are small steps taken to get to an end behavior. Each approximation should be repeated a few times or until the animal is comfortable before progressing to the next step. One can guess that the animal understands what is being asked when it can perform the desired behavior readily/without hesitation.

It may be helpful to list out the desired approximations before starting medication training with an animal so that you have a reminder of how you would like the training to progress. Although writing out a shaping plan may help with organization, keep open to

the idea that there are several different ways to teach a behavior and the plan may need to be changed as it progresses. The learner, the bird, rabbit, ferret, or rodent, should control how quickly you progress to the next approximation, how small or large you break up the approximations, and whether you need to go back to the drawing board to make a new shaping plan.[29] Ideally, training sessions are kept short, giving the teacher time to review progress and adjust the shaping plan, and to make any needed changes to the environment, type of reinforcer, and so forth. For the purpose of training and shaping medical behaviors, many times these initial steps can be trialed while the patient is hospitalized. Short training sessions, 1 to 3 minutes for example, are recommended. Short sessions are easier to keep the animal engaged. If the animal loses interest before this time frame, end the session and try again later. Alternatively, some animals may prefer to train for hours. Keeping the sessions brief builds excitement for the next training session.

There are many reasons an animal may choose not to engage in a training session. For example, motivation may be low because the animal is already satiated or becoming satiated during the session. In birds, the following signs may indicate a satiated animal: rubbing or cleaning the beak on the perch, tucking the head back to preen, beak grinding. Satiated ferrets will often start licking their lips and rub their face against the floor or a cloth or other item, whereas resting and grooming behavior (eg, washing of the face and body) can be seen in all small mammal species. Animals might also fail to interact in a training session when it is unsure what you are asking of it (ie, does not understand how to get reinforcement). In this situation, try asking for a previously completed approximation to maintain interest while you assess the need to change the shaping plan (Are smaller steps needed? What might be unclear to the animal?). Check the environment for fear-evoking stimuli or other potential barriers to the learning experience. Check the patient's body language for clues to what signals may be missed. An animal that does no't feel safe is not likely to accept reinforcement of any kind, eat, or engage in a training session. Similarly, the animal may be distracted because of training sessions taking to long. It is therefore recommended to keep training sessions short to ensure an optimal attention span. Dependent on the species and engagement of the individual, durations of training sessions may vary from 1-3 minutes to periods of 10 to 20 minutes. Inclusion of short breaks, in which the animal is allowed to do something else (eg, play with a toy or other type of enrichment) can also help to keep it engaged longer.

As stated previously, there are numerous possible paths to get the desired behavior. Dependent in part on the already learned behaviors of the patient and its level of fearfulness, there may be different starting points for planned approximations. A few examples for medication training in birds and small mammals are provided, including different approximation paths that can be used to achieve the desired target behavior.

Shaping plan: learning a bird to accept medication from a syringe

Shaping Plan A

1. Bird drinks medication from syringe without restraint
2. Bird touches syringe to receive reinforcement
3. Bird touches syringe filled with water to receive reinforcement
4. Bird touch syringe with drop of water at the end to receive reinforcement
5. Bird drinks small amount of water from syringe to receive reinforcement
6. Bird touches syringe filled with medication to receive reinforcement
7. Bird drinks small amount of medication from syringe to receive reinforcement

Shaping Plan B

1. Bird drinks medication from syringe without restraint
2. Bird looks at syringe to receive reinforcement
3. Bird touches syringe to receive reinforcement
4. Bird bites syringe to receive reinforcement
5. Bird bites syringe filled with water to receive reinforcement
6. Bird bites syringe with drop of water at the end to receive reinforcement
7. Bird bites syringe filled with juice to receive reinforcement
8. Bird bites syringe with drop of juice at the end to receive reinforcement
9. Bird drinks small amount of water from the syringe to receive reinforcement
10. Bird drinks small amount of juice from the syringe to receive reinforcement
11. Bird drinks small amount of juice mixed with medicine to receive reinforcement

Shaping plan: toweling and using a face mask to anesthetize a guinea pig that routinely needs gas anesthesia for a dental examination and correction

Behavior 1: accept toweling (see Fig. 1)

Start with towel at the distance of approximately 1 m; guinea pig looks at the towel and displays calm behavior to receive reinforcement

Slight (eg, 10 cm) decrease of distance between towel and guinea pig, calm behavior displayed to receive reinforcement

Gradual decrease in distance; calm behavior displayed to receive reinforcement; repeat step until distance between towel and guinea pig has minimized

Place towel on the table near the guinea pig; look at towel to receive reinforcement (while maintaining calm behavior)

Guinea pig touches the towel with its nose to receive reinforcement

Guinea pig touches towel for longer periods to receive reinforcement

Guinea pig steps on towel to receive reinforcement

Guinea pig stands on towel for longer time to receive reinforcement

Guinea pig stands still while towel is lifted slightly to receive reinforcement

Guinea pig stands still while towel is gradually lifted higher to receive reinforcement

Guinea pig stands still while towel is gradually held above its head to receive reinforcement

Guinea pig stands still while towel is held above its head and lowered slightly so that a piece of towel touches its back shortly to receive reinforcement

Guinea pig stands still while towel is held above its head and lowered slightly so that a piece of towel touches its back for longer periods of time to receive reinforcement

Guinea pig stands still while towel is gently dropped over it for short period to receive reinforcement

Guinea pig stands still while towel is placed over it for longer periods to receive reinforcement

Guinea pig held in towel by hand while remaining calm to receive reinforcement (initially only for a short second, then gradually increase the duration)

Behavior 2: accepting facemask

Present the facemask at a large enough distance to not elicit a fear response and gradually decrease the distance while reinforcing calm behavior (as described for the towel) until the distance between the facemask and guinea pig has minimized

Guinea pig looks at the facemask to receive reinforcement

Guinea pig moves toward facemask to receive reinforcement

Guinea pig touches the facemask with its nose to receive reinforcement

Guinea pig touches the facemask with its nose while the facemask is held in correct position to receive reinforcement

Guinea pig touches the facemask with its nose while facemask is held in position for longer duration to receive reinforcement

Once a reinforcer and a delivery method have been established, begin targeting to the syringe. Reinforcement may be given for any interaction with the syringe to start, including biting. There are a few ways to address "attacking" (biting/lunging) at the syringe. Biting the syringe is interacting with the syringe and close to the goal behavior of drinking medication from the syringe, so one way to address this is to reinforce it! By capturing a behavior, we reinforce a behavior the animal is already offering. Think of taking a photograph of the behavior. This photograph is what you choose to reinforce. Any behavior reinforced is a behavior that is likely to be repeated, giving you more opportunities to reinforce biting the syringe and build your shaping plan from that point. Another option is to mark and reinforce when the animal is reaching to bite the syringe, so it may help to hold the syringe slightly out of reach. After reinforcing the behavior of reaching for the syringe, shape touching the syringe by offering the syringe closer (Fig. 3). Aside from medication training, target training is an important exercise in communication and strengthening the bond that can be started with clients during new pet/client examinations and wellness checks. Target training has multiple other practical applications in teaching animals to go into their carriers, for towel training, and for several medical uses, and is very useful when working with "aggressive" animals. Essentially, target training is the perfect way to start integrating training into the examination rooms, by making veterinarian visits fun for your patients and clients.

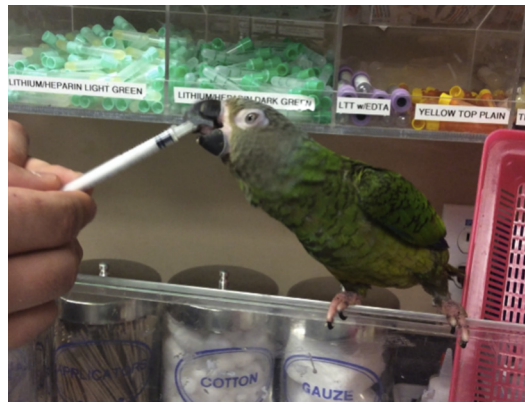

Fig. 3. Dusky-headed conure (*Aratinga wedellii*) demonstrating willingness to participate in drinking medication by leaning toward the syringe with open beak.

Links to step-by-step videos to help clarify the in-house use of approximations for medication training are available for viewing at https://youtu.be/3RufY4U_bnM.

FOOD VEHICLES

We all wish on occasion that medication administration could be as simple as stuffing a pill in a piece of cheese for a dog, but even that may not be as straightforward as we hope. After considering the health status of the animal and other factors, the decision to give medication in food is up to you and the pet owner. If the patient is a suitable candidate for receiving medication in food, this may be a minimally stressful method of delivery. The best food vehicle is small enough to encourage rapid consumption, but large enough to hide the taste of the medication, and most importantly, is a food item that is very high value for the animal. Food that mixes easily or acts as an absorbent, like bread, scrambled eggs, oatmeal, peanut butter, or pastries, generally works well with liquid medication (**Fig. 4**). For ferrets, you may consider including pate as a food vehicle. If the animal likes a juice, applesauce, or yogurt, you can mix these easily with the medication and offer in a spoon or bowl, whichever the animal prefers. With the help of a compounding pharmacy, medication can be made at a higher concentration, resulting in a smaller volume to put in food. However, medication at a higher concentration may have a stronger flavor, which might be harder to disguise in food. It may also be possible to hide medication by injecting it or hiding it in a small piece of fruit (eg, grape, banana) or a prey animal that is being fed to predators (birds of

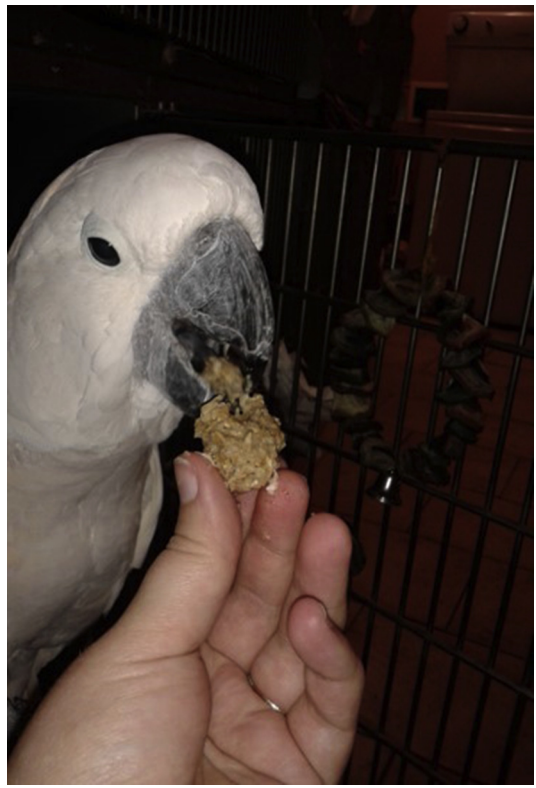

Fig. 4. Moluccan cockatoo (*Cacatua moluccensis*) eating oatmeal mixed with medication.

prey, ferrets). Similarly, for medicating poultry or waterfowl, a pill can be hidden in their favorite treat, like what is often done for medicating dogs. Grapes, cheese, tomatoes, and bread seem to work well for this, depending on what the bird prefers. If trying a new food, offer it first without medication to see if the animal will eat it. Ideally, the food has a very high value for the animal, which can take some trial and error to discover. When offering new foods, try several to see what the animal likes. Many tame birds and some small mammals like rats are highly interested in food that comes off our plate, which we can use to our advantage. Birds especially that are over threshold outside of the cage are not likely to eat or try new foods. For these birds, offer a variety of food to sample in the cage and come back in a few hours to see what the favorites were. The purpose of delivering medication in food is as a less stressful method, not to trick our animals into taking medication. If the flavor of the medication is too strong or apparent and/or the food vehicle not appealing enough to the animal, it might refuse to eat the food. Withholding the animal's normal diet until the medication is eaten rarely works in the authors' experience. Occasionally, an animal will taste medication in its favorite foods, resulting in it refusing to eat not only the food vehicle but also other treats/food offered outside of the normal diet. In this situation, even for animals that do not tolerate handling well, it is best to move to a different technique, like target training for medication.

TEACHING ANIMALS TO TAKE MEDICATION FROM A SYRINGE

Teaching an animal to drink medication from the syringe is an option that should be strongly considered for aggressive or fearful individuals because there is no restraint necessary. Although we can help our animals acclimate to a towel or handling, in many situations it is much more reinforcing to provide the opportunity for the animal to take part in its training, giving it control over the outcome, and then to restrain them or wrap them in the towel for medication.

Mixing medication with juice or another (semi)liquid substance (eg, recovery or critical care formula) may help your patient's willingness to drink a foul-tasting medication. Offer the juice or liquid substance to the animal first in a bowl or spoon to see if it likes the taste. For an animal that does not like the taste of the liquid, you may be making more work for yourself by teaching it to drink 2 foul-tasting liquids AND increasing the total volume you are asking it to drink from the syringe. Teaching an animal to drink from a syringe works well for any animal, regardless of whether it is "tame" or not by teaching the animal how to target to the syringe through cage bars while it is inside the cage (Fig. 5). First ensure that you have a reinforcer and a way to deliver the

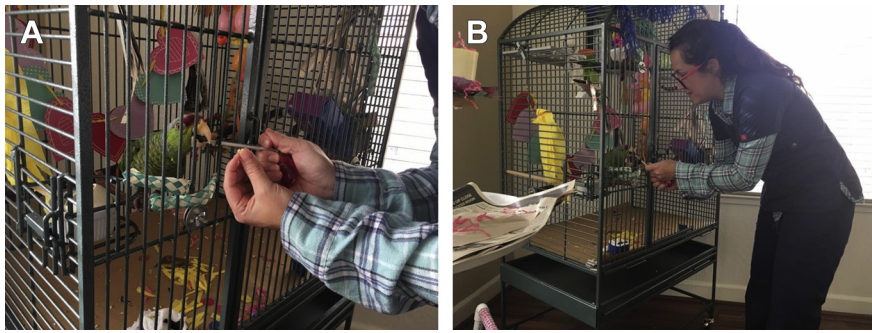

Fig. 5. (*A, B*) Lilac-crowned Amazon parrot (*Amazona finschi*) learning to target to the syringe through the cage bars.

reinforcer. Depending on the animal's response (is it showing escape/avoidance behaviors, is it lunging/trying to bite), you may need to be creative with how you deliver reinforcement. For example, a bird that flees to the opposite side of the cage when you hold up your hand might not be willing to take a treat from the hand. Offing a treat from a spoon may add distance between the bird and your hand and lessen anxiety should proximity to your hand be fear evoking. For smaller birds, offer a bite from an entire millet sprig, rather than a bite from a tiny piece in your hands. Another option is to fasten a "treat bowl" in the cage, which is a bowl that only holds treats. With some practice, using a treat bowl should feel safe for both human and bird. Remember that both teacher and student have a reinforcement history, and although one may have learned to avoid hands, the other may have learned to avoid beaks. It is important to take both into consideration for a successful shaping plan. By using a specific bowl and location in the cage, we teach the bird that there is a preferred place to perch, essentially teaching them to station for training (**Fig. 6**). Similar methods can be applied to small mammal species as well to teach them to accept medication from a syringe.

IN-PATIENT MANAGEMENT

Patients who are hospitalized or boarding are in an excellent position to begin medication training. Owners of animals that may require long-term medication often can recognize the merits of the ability to treat the animal without restraint, as a happy alternative to, for example, wrangling their bird, rabbit, or ferret in the towel. Compliance with treatment plans can be greatly enhanced. Also, it seems that a surprising number of clients are interested in beginning medication training *before* their pet even needs it! This framework can be facilitated with young animals while still in the appropriate socialization window or with adult animals just the same.

Particularly in birds, boarding patients for the purpose of training can enlist help with "problem" behaviors like lunging, training step-up behaviors, and especially medication training, just to name a few. There does not always have to be a behavior problem to go the extra mile with training. Medication training can easily be incorporated into daily treatments and documented on the patient's chart to note progress. Adjustments can be made to fees and treatment sheets to ensure time with technicians, according to what works best for your hospital. Hospitalized and boarding patients are also a

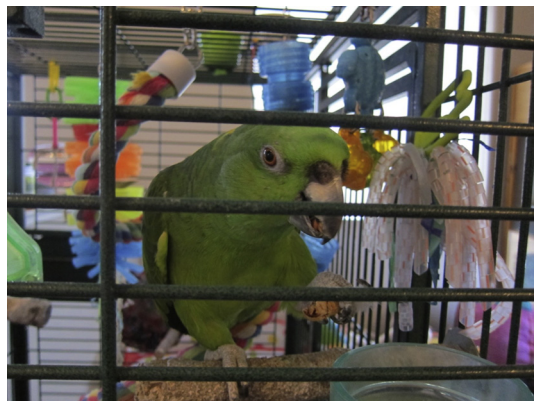

Fig. 6. Birds that cannot easily or safely come out of the cage, like this yellow-naped Amazon parrot (*Amazona auropalliata*), can be taught to station at a designated perch where training sessions occur. This helps set the stage for training lessons: When you come to this perch, we have a training session, that is, there are multiple opportunities for reinforcement.

great learning opportunity for the rest of the hospital staff. Including staff with the training and behavioral plan for patients opens the stage for them to ask questions and practice, which will ultimately allow them to help educate clients.

FINDING TIME

Perhaps the most challenging part of integrating training and low-stress methods into daily practice is competing with a busy schedule and time constraints. Training sessions should be short, 1 to 3 minutes ideally, which can make planning time during the work day a bit easier to manage. Longer training sessions may overwhelm, frustrate, and cause the patient to lose interest. For hospitals that have very busy treatment areas, use an empty examination room and place on the appointment schedule. Time will need to be set aside for client communication, which can be scheduled during the patient discharge. Visual aids, such as handouts and videos, may make this process easier for the clients to adjust to and help with time management.

EXAMINATION ROOM AND OUTPATIENT MANAGEMENT

Examination room setup can be easily tailored to meet the needs of the patients. Items like appropriate-sized perches for birds, or boxes, towels, or blankets for small mammals to hide in, and a room with minimal (visual, olfactory, and auditory) distractions will help patients feel comfortable. Any supplies you may need for the examination, training, or test sample collection should be stored in the examination room to minimize the amount of time the animal needs to be restrained. A variety of treats and training supplies like target sticks and a clicker can easily be stored in the examination room. Although it can be tricky storing properly sized items for various sizes and species of animals (perches, scales, towels/blankets/mats, hiding boxes, toys, treats), having these items readily available cuts down on restraint time and stress, which is important for both birds and small mammals. While handling, ensure that the animal is restrained as loosely as possible, and, especially in rabbits and rodents, allow the hind feet to have contact with a solid, nonslippery surface (bathmats usually work well for this purpose). Flooding, where an animal is restrained too long or excessively, which then causes the animal to not struggle anymore, should be avoided if at all possible for ethical and humane reasons.

In the examination room, it is not difficult to find a client who wants to make giving oral medication easier. It is also not difficult to find a client who wants to put their animal back in the cage without the animal attempting to bite, struggle, or escape. Who wouldn't want that? For most veterinary practices, *time* is the biggest obstacle to helping clients with their behavior questions and dilemmas. After addressing the primary reason for the examination, there may be hardly any time to delve into low-stress medicating let alone questions about the pet's behavior. Another complicating factor is that there are so many variations of behavior problems and questions, a short question may have a mile-long answer! Or even worse, several answers! For example, questions about how to give medication from a syringe may entail several different techniques, explanations of positive reinforcement, and successive approximations. It may also include less forceful handling and toweling methods. Delegate these tasks to your staff. Just like many tasks in the veterinary practice setting, educating clients about behavior and low-stress medicating is not a one-person job! By using regular, staff-wide continuing education, a more uniform practice team can be developed. The more advanced training opportunities that a veterinary practice staff has had the ability to pursue and put to work, the better the collaborative power the practice has to effect favorable change for their clients and patients. **Box 2** provides training opportunities and other great resources about behavior and training.

Box 2
Behavior and training resources

Veterinary Specialty Groups

- American College of Veterinary Behaviorists http://www.dacvb.org/
- American College of Animal Welfare http://www.acaw.org/
- European College of Animal Welfare and Behavioural Medicine www.ecawbm.com
- International Society for Applied Ethology www.isae.org

Behavior Associations

- Animal Behavior Management Alliance (ABMA) www.theabma.org
- Animal Behavior Society www.animalbehaviorsociety.org
- American Veterinary Society of Animal Behavior (AVSAB) www.avsabonline.org
- International Association of Animal Behavior Consultants (IAABC) www.iaabc.org

Exotic Animal Behavior/Training texts and videos

- Bunny Training 101 (Video). Heidenreich B. 2011. www.bunnytraining.com
- Exotic Pet Behavior: Birds, Reptiles, and Small Mammals. Bradley Bays T, Lightfoot T, Mayer J. Saunders Elsevier; 2006.
- Behavior of Exotic Pets. Tynes V, editor. Wiley Blackwell; 2010.
- Manual of Parrot Behavior. Luescher AU. Blackwell Publishing; 2006.
- Parrot training. Heidenreich B. http://www.goodbirdinc.com/

Web sites

- www.behaviorworks.org
- www.bunnytraining.com
- www.clickertraining.com
- www.drsophiayin.com
- www.kenramireztraining.com
- www.medicalcenterforbirds.com/training.pml

Adapted from Brown S. Small mammal training in the veterinary practice. Vet Clin North Am Exot Anim Pract 2012;15:472; with permission.

Although there are several different approaches and changes that can be made to accommodate necessary time for behavior talk with clients, it is important to find what works best for *your* hospital. Behavior questionnaires for clients are easily available and can be adapted to fit your client needs. Handouts can be a great way to provide clients with information and give "homework" between visits. Follow-up is important and can be accomplished via recheck examinations, technician appointments, telephone calls, or e-mail. Most importantly, however, is that follow-up is not dismissed, and that the behavioral health and welfare of the patient remain the focus, above and beyond the mere medical model of the current problem of concern.

FORAGING AND ENRICHMENT

Foraging is a necessary form of enrichment, especially for animals in captivity. Applied optimally, foraging can be used as a means of enrichment to redirect an animal's attention and behavior, as a part of a DS/CC (desensitization/counterconditioning) plan, to avoid the need for use of restraint collars and to avoid the need for some medical treatments to suppress undesired behaviors (particularly in birds). Foraging functions as a means with which to enrich the welfare of the animals themselves. Working for food by means of searching through boxes, toys, or puzzles, and shredding or chewing through paper or cardboard are great ways to keep your bird, rodent, and rabbit patients busy (**Figs. 7** and **8**). For ferrets, provision of a "foraging mat" or puzzle feeders and toys similar to those used in cats and dogs will work great too. Many animals will need to be taught these very natural behaviors, because they are not innate and are oftentimes very limited in the lifestyles of many companion animals. The need for training natural behaviors may be particularly the case when some natural chewing behaviors are considered a nuisance by the pet owner and discouraged. Beginning

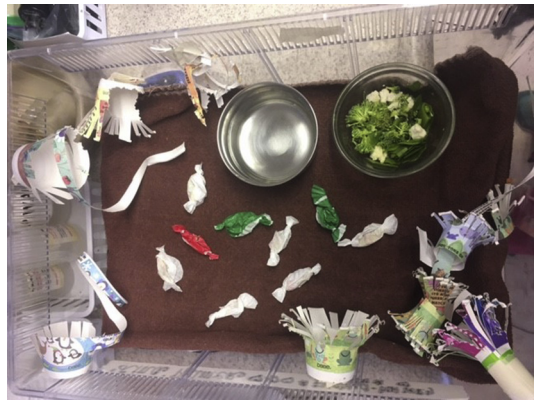

Fig. 7. Example of foraging for food in a hospital isolette for a small bird, which includes paper cups for shredding and food wrapped in paper for foraging.

foraging behaviors and shredding can be taught by demonstration in the examination room and continued at home (Fig. 9). These food acquisition activities can range from very simple hidden treats in half-covered bowls, wrapping food in pieces of paper, or hanging it at a more difficult to reach location (particularly for rabbits and rodents) to very complex puzzles and time-consuming boxes to untie or open for parrots. By increasing foraging in daily activities, oftentimes undesired behaviors can be eliminated or lessened, and quality of life can be enhanced. Enrichment and foraging are skills that can easily be developed in many settings while a patient is hospitalized and then transferred as a value-added skill set directed toward longer-term lifestyle changes at home. These enrichments are best viewed as lifelong lesson plans, and veterinarians can deliver their best impact by following through with patients and their stewards, coaching both from the side and tailoring recommendations to best fit patient needs.

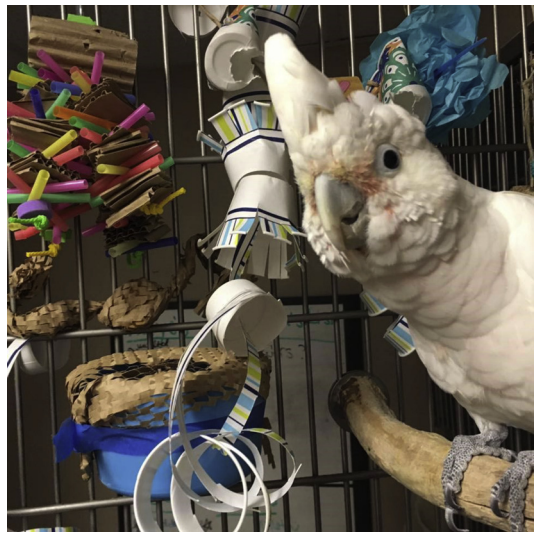

Fig. 8. Goffin's cockatoo (*Cacatua goffini*) pictured in his hospital cage with food hidden in paper cups, packaging paper, and a paper-covered food dish.

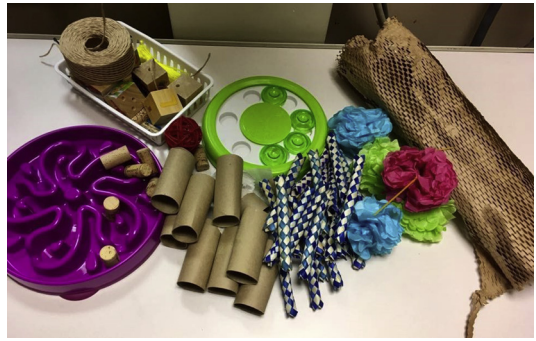

Fig. 9. Example of some different foraging supplies kept at the veterinary hospital.

THE POTENTIAL FOR INFLUENCE OF DRUG THERAPIES ON MEMORY AND LEARNING

Some treatments that patients receive as well as treatment methods can also influence memory and learning. There are some endocrine and drug-related influences on learning and memory retention, outside of a reinforcing consequence alone. For example, several studies have shown that psychological stress (eg, predator exposure) impairs spatial memory in rats.[30–32] Gonadal sex hormones can also affect memory and learning, as demonstrated in rats, in which acquisition, consolidation, and retrieval of inhibitory avoidance learning and memory were found to be impaired following intrahippocampal injections of testosterone.[33] Similarly, domestic chicks pretreated with testosterone, or treated within 30 minutes after exposure, were less able to retain aversion-trained stimuli. Without evidence from juvenile and adult birds to the same effect, it is not yet possible to conclude that such effects exist as a result of manipulation of gonadal steroids within physiologic ranges.[34] Estradiol plays a necessary role in auditory processing and memory of zebra finches (*Poephila guttata*). Estradiol depletion negatively affected the neuronal memory for vocalizations in that species, lending additional support that sex steroids have a role in memory and memory processing.[35] There are other endocrine influences on the development of long-term memory. Day-old chicks trained on a single-trial passive discrimination-avoidance task showed improved long-term memory with weakly reinforced tasks, when treated with noradrenaline, corticotropin, and vasopressin in close proximity to the training trial. The net effect mimicked the outcome of strongly reinforced learning and of retaining the weakly reinforced tasks.[36] There is a phase of memory in the day-old chick that is susceptible to interference by drugs affecting noradrenergic processes. The intermediate phase of memory processing of day-old chicks, to passive discrimination-avoidance tasks, was inhibited by the subcutaneous administration of propranolol. This effect was seen in chicks with strongly reinforced training, and with weakly reinforced training presented twice or coupled with a selected dose of the stress-related hormone corticotropin.[37]

Although the concept of a stress-free learning environment seems good, stress to a certain degree can facilitate memory and learning. In mice, corticotropin-releasing factor and acute stress were found to facilitate long-term potentiation of the hippocampus and enhance context-dependent fear conditioning.[38] Long-term memory for a passive avoidance task in day-old chicks has been shown to depend upon an action of the adrenal steroid corticosterone through specific receptors in a brain region, and corticosteroid synthesis inhibitors can inhibit long-term memory formation for passive avoidance tasks in day-old chicks.[39] Corticosteroid synthesis inhibitors were shown to impair long-term memory for a passive avoidance task in day-old chicks.[40]

Passive avoidance training results in increased cell proliferation in day-old chicks in areas of the brain known to be loci of memory formation.[41] Of course, not all levels of stress are necessarily a good thing. Stress functions to facilitate the consolidation of contextual fear memory. In rats, midazolam attenuated the stress-induced promotion of fear memory formation.[42] What this may mean, in practical applications, is that the appropriate and timely use of benzodiazepines may be important but not necessarily a requisite, along the long-term course and goal of not requiring continual use in patient treatment and management, in order to help avoid the development of learned fear in patients. Behavioral assessment and enrichment, combined with the physiologic and neurobiological aspects of learning, remain key. Short-term enrichment of housing conditions in chickens has been shown to have favorable, immediate effects on chickens by reducing behaviors that are likely to reflect fearfulness and by favorably affecting learning performance. This effect did not translate to long-term retention, however. In essence, a low-stress hospital environment, with strategic enrichment used, can help reduce perceived stress and can function to enhance operant conditioning of therapeutic procedures and treatments.[43]

Three memory developmental stages are known in birds and mammals: 2 short term and 1 long term. There is a long-term, antibiotic-sensitive, and likely protein synthesis–dependent stage of memory development.[44] Passive avoidance training memory was shown to be inhibited by the use of intracranial chloramphenicol.[45] Similarly, amnestic effects have been observed from antibiotic use in mammals.[46] Cyclooxygenases are induced during training, and cyclooxygenase products are of importance in memory formation of the chick.[47] Intracerebral injections of the cyclooxygenase inhibitors indomethacin, naproxen, and ibuprofen caused amnestic effects at all concentrations tested when injected either before (in chicks) or after training (in rats).[48,49]

Dopamine modulation of late-memory formation may be attenuated by haloperidol.[50] This attenuation of late memory does not necessarily imply that learning is critically impaired in patients being treated with haloperidol. In cases where feather-plucking sulfur-crested cockatoos (*Cacatua galerita*) were being treated medically (haloperidol), and with socialization, training, and feeding enrichment, the most successful treatments included the training sessions. These sessions provided much needed social attention as well as mental stimulation.[51] Desensitization, counterconditioning, enrichment, and pharmacologic intervention can be combined in case management. In a case report of a cockatiel with a history of repetitive chewing of the third digit of the right foot, the hypothesized causes of the behavior were presumed to be multifactorial, involving neurochemical changes, learning or owner reinforcement, and anxiety-induced displacement activity. Case management components that led to resolution of the problem included antecedent arrangement strategies (removal of stimuli that were associated with an increase in the problem behavior), enrichment (altered and enhanced social interactions with the stewards of the bird in the home), removal of hypothesized reinforcements for the problem behavior (successful attention acquisition), and reinforcement of alternative behaviors (counterconditioning) paired with desensitization. Fluoxetine was prescribed at 1 mg/kg orally every 24 hours as a pharmacologic intervention intended to aid in downsizing impulse control concerns. Enrichment of alternative behaviors and cessation of the problem behavior were accomplished over 1 month, and fluoxetine was reduced in dose and ultimately discontinued by 5 months.[52] Although some drugs can certainly have influence on the perception of stress and learning, there is even stronger support that with a balance of appropriate medication choices, training, enrichment, and socialization, there is an excellent opportunity for most effective and least intrusive treatment strategies to be formulated and implemented.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at https://doi.org/10.1016/j.cvex.2018.01.016.

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