

The Importance of Enrichment in Wildlife Rehabilitation (Part One)

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INTRODUCTION

Enrichment is extremely important to the welfare of animals, both those in the process of rehabilitation and permanent members of a facility. Enrichment is essential for maintenance of mental and physical well being of animals. Research has shown that active enrichment programs reduce stress and aberrant behaviors in captive animals, which benefits not only a facility's permanent residents, but in turn can promote faster healing of injured and sick patients and aid in reintroduction to the wild. Enrichment can promote natural behaviors that help acclimate rehabilitated and orphaned animals to the wild. For captive animals, enrichment can reduce stress and increase physical activity.

WHAT IS ENRICHMENT

Shepherdson (1994) defined environmental enrichment as the "concept which describes how the environments of captive animals can be changed for the benefit of inhabitants," and behavioral enrichment as "behavioral opportunities that arise or increase as a result of environmental enrichment." A good working definition of enrichment for wildlife rehabilitators is the alteration of an animal's physical environment and/or care with reference to biology, natural history, psychology, and specific history of that animal in order to provide additional opportunity and ability to participate in more natural behaviors.

Enrichment in this modern sense did not become

prevalent in animal care professions until the 1960s. Although animals had been kept in private collections since around 3000 BC and domesticated for the benefit of humanity at an even earlier date, it took publication of Ruth Harrison's *Animal Machines* (1964), a generation raised on a plethora of wildlife documentaries, and a frustrated group of developmental psychologists faced with non-human primates with floating arm syndrome to spark interest and research into what is now referred to as environmental enrichment (Young 2003).

GOALS OF ENRICHMENT

The benefits of enrichment are manifold and focus mainly on the mental and physical stimulation of an animal for its physical and psychological well-being, as well as successful reintroduction to the wild. Overall, the goals of enrichment can be summarized as: increase in diversity of behaviors, reduction of abnormal behaviors, rise in performance of species-specific behavior, promotion of positive interactions with environment, increase in ability to cope with challenges in a healthy way, reduction of stress to increase reproductive success, reduction of stress to promote health, fulfillment and education of staff and volunteers, and satisfaction and education of the public (Shepherdson 1989; Chamove and Moodie 1990; Young 2003). In order to understand why enrichment is a necessary part of wildlife rehabilitation, each of these goals and its importance to wildlife rehabilitators must be evaluated.

Increase in Diversity of Behaviors. An increase in the diversity of behaviors expressed by an animal is important, not only for those undergoing rehabilitation, but also for captive education animals. Multiplication of types of behaviors (different foraging behaviors, play behaviors, exploratory behaviors, or locomotion behaviors) exhibited by an animal

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that eventually will be released increases its ability to cope with challenges in the wild. The expression of a diversity of behaviors will also increase the mental and physical exercise any animal experiences. This benefit may be especially important for animals undergoing rehabilitation or permanent animals that need physical exertion to build strength, lose weight, increase range of motion, or simply reduce the ennui of life in a captive environment. The addition of a variety of behaviors to a display animal's repertoire can further benefit the educational experiences of the viewing public.

Reduction of Abnormal Behaviors. Any animal in a captive situation is susceptible to stereotypic or abnormal behaviors, which can include pacing, self-mutilation, head weaving, glass/cage side rubbing, aggression, apathy, prolonged infantile behavior, over-eating, refusal of food, or consumption of non-food items (Odberg 1978; Young 2003). The physical health benefits of reducing abnormal behaviors are obvious, but expulsion of these negative behaviors also promotes psychological well-being. In addition, elimination of undesirable behaviors frees time for performance of more *positive* behaviors.

Rise in Performance of Species-Specific Behavior. This benefit of enrichment is perhaps the most important for successful release of rehabilitated animals. Kleinman (1980) listed five non-genetic behaviors that were most altered by life in captivity and would hinder survival/success in the wild once reintroduction occurred: 1) inability to perform appropriate courtship and mate successfully; 2) inability to raise young; 3) inability to hunt and/or forage; 4) inability to escape predators; and, 5) loss of fear of man. All of these behaviors are inherently species-specific and are those that wildlife rehabilitators should pay close attention to when evaluating an animal for release into a natural environment. Enrichment can provide orphaned animals with the opportunity to learn, practice, and refine key skills as well as offer adult individuals the ability to maintain species-specific behaviors during time in captivity. Furthermore, promotion of species-specific behaviors in education animals provides an additional learning experience for public viewers.

Promotion of Positive Interactions with the Environment. The use of enrichment to increase an animal's constructive and healthy interaction with its physical and social environment is integral in successful rehabilitation of wildlife. This will enable any

animal to interact with its captive environment in as stress-free a manner as possible and will reduce injury to the animal and cage mates resulting from inappropriate interactions. Enrichment also prepares animals undergoing rehabilitation for release into natural physical and social environments.

Increase in Ability to Cope with Challenges in a Healthy Way. There are two types of stress an animal may experience when confronted with a novel situation: distress or eustress. Eustress is good stress and permits the animal to manage a stressful situation adaptively, whereas distress is negative stress and impedes the animal's ability to handle stressful situations. By providing enrichment to animals undergoing rehabilitation, caregivers can introduce them to and/or maintain their interaction with novel and challenging environments, thus promoting a eustressful reaction rather than a distressful reaction upon release. Animals held in a permanent captive state can also benefit from a healthy reaction to stressful situations as their surroundings and/or care regimes are susceptible to variation based on staff changes, husbandry improvements, weather conditions, transfer to other facilities and/or enclosures, and shifting composition of cage mates.

Reduction of Stress to Increase Reproductive Success and Promote Health. Many wildlife rehabilitators actively engage in captive breeding programs to strengthen wild populations of certain species. Negative stress can directly interfere with success in courtship, mating, production of young, and rearing young. Animals that experience less distress as a result of enriched environments demonstrate greater reproductive success (Bell and Adams 1998). Social enrichment is critical to the success of captive breeding programs. Some species need critical group sizes below which they will not breed. Social and non-social types of enrichment aid in stabilizing social groups, reducing aggression, and increasing positive social behaviors, which can all lead to an increase in reproductive output (Young 2003).

Reduction of distress can also lead to faster healing times and a more complete recuperation for animals undergoing rehabilitation or injured/sick education animals. Distressed animals also exhibit a higher risk of disease transfer among populations. By incorporating enrichment into the husbandry of rehabilitating and permanent animals, the overall disease transmission between animals can be reduced.

Fulfillment and Education of Staff and

Volunteers. Enrichment programs are beneficial, not only for animals, but also for the staff/volunteers that are planning, preparing, and providing enrichment. In this author's experience, volunteer keepers frequently comment on how much fun they have preparing enrichment items and how exciting it is to see animals' different reactions to enrichment. In addition to the variation enrichment programs instill in caregivers' routines, enrichment programs can empower volunteers and/or employees through the opportunities available for taking on a variety of responsibilities related to the implementation of enrichment protocols. The improved animal welfare observed by staff and volunteer keepers has the added benefit of longer retention times and attraction of highly motivated caregivers.

Satisfaction and Education of Public. For those with captive animals on public display and/or those who rely heavily on public donations for financial support, enrichment programs can bolster public opinion and increase donations.

Reade and Waran (1996) performed a survey of zoo visitors in the United Kingdom and found that 90 percent of those surveyed expected environmental enrichment and animal welfare to be one of the top priorities of the zoo and expected to see evidence of enrichment during their visit. Enriched environments can also provide an educational opportunity for the public, offering lessons on an animal's natural habitat and species-specific behaviors expressed in that natural habitat. For these reasons, enrichment provides not only an additional means to increase public financial support, but also a method to strengthen the message of conservation and respect for the natural environment and its inhabitants.

RESEARCH

Most studies performed to substantiate the positive effects of enrichment have been done in zoo, laboratory, and farm settings and can be divided into the following four categories: veterinary, behavioral, physiological, and neurological. These findings support the use of enrichment to improve the mental and physical health of a wide variety of animals in captive situations and shed light on potential benefits of enrichment for animals in wildlife rehabilitation establishments.

The direct physical health improvements that can result from an enriched environment include the following: reduced pathogen transfer, increased immune response, improved overall health, decreased incidence

of body sores, prevention of certain oral and gingival health problems, reduced ulceration of the stomach, and increased body weight from consumption of the same amount of food (Manosevitz and Joel 1973; Manosevitz and Pryor 1975; Schapiro and Kessel 1993; Van de Weerd et al 1997; Flint and Murray 2001; Baer 1998; Young 2003; Coe et al 1987; Kingston and Hoffman-Goetz 1996; Capitano and Lerche 1998; Kuhnen 1999; Kelly et al 2000; Schapiro et al 2000; Corruccini and Beecher 1982; Fitch and Fagan 1982; Pare and Kluczynski 1997).

Some physical benefits are specific to growth stages of an animal and can be essential for rehabilitators who raise orphaned or captive-bred individuals. For instance, Cheal et al (1986) found that enriched environments facilitated adolescent development of gerbils. Other benefits are extremely important for faster and more complete rehabilitation of injured animals. A plethora of research has been performed on gerbils, rats, and mice to understand brain injuries. The results of these studies are applicable to cases of head trauma presented to wildlife rehabilitators. The use of enrichment has been found to reduce cellular recovery time in cases of brain damage (Schrott et al 1992; Hannigan et al 1993; Gomez-Pinilla et al 1998; Torasdotter et al 1998; Dahlqvist et al 1999; Dahlqvist et al 2000; Farrell et al 2001), to increase recovery of cognitive function after cerebral deterioration (Hamm et al 1996; Fernandez-Teruel et al 1997; Soffie et al 1999; Young et al 1999; Biernaskie and Corbett 2001; Passineau et al 2001) and to increase recovery of motor ability following brain damage (Johansson 1996; Borlongan 2000).

Many of the researched advantages of enrichment lead to both physical and mental improvements in the life of captive-held animals. Enriched environments have been shown to reduce stereotypies (Carlstead et al 1991; O'Neill et al 1991; Markowitz et al 1995; Baker 1997; Brent and Belik 1997; Lidfors 1997; Wurbel et al 1998; Callard et al 2000; Hansen and Berthelsen 2000; Grindrod and Cleaver 2001; Henderson and Waran 2001), reduce self-injury and injury to cage mates (Norgaardnielsen et al 1993; Holmes et al 1995; Bubier 1996; van Hoek and King 1997; Sherwin et al 1999; de Jong et al 2000a; Martrenchar et al 2001); decrease aggressive behavior (Brent and Eichberg 1991; Estep and Baker 1991; Zimmermann and Feistner 1996; O'Connell and Beattie 1999; Beattie et al 2000a; Beattie et al 2000b; Patton et al 2001), and increase the amount of space in an enclosure that an animal will use (Lutz and Novak 1995; Williams et al 1996; Young 2003). The direct effects enrichment programs have on the type

and quality of behaviors animals engage in is important to note as these changes can increase success of an animal released into a wild environment as well as benefit the mental and physical state of a permanent resident animal. Enriched environments can lead to creation of more natural time budgets (Molzen and French 1989; Young et al 1994; Beattie et al 1996; Winskill et al 1996; O'Connor 2000); increase the diversity of behaviors exhibited (Shepherdson et al 1993; Ludes-Fraulob and Anderson 1999); increase desirable behaviors such as play, locomotion, foraging, and exploration (Hubrecht 1993; Arey and Maw 1995; Cardiff 1996; Van Waas and Soffie 1996; de Monte and LePape 1997; Ings et al 1997; Platt and Novak 1997; Fischbacher and Schmid 1999; Masefield 1999; Kells et al 2001); and reduce the animal's general level of fear through introduction of novelty (Young 2003).

Some of the neurological effects enrichment has shown in laboratory animals are beneficial to wildlife rehabilitators seeking to release animals that are highly adaptable to new, wild environments and suitably outfitted to prosper within those environments. Enriched surroundings increased learning ability in mice and rats (Olsson et al 1995; Passig et al 1996; Gomez-Pinilla et al 1998; Tees 1999; Ickes et al 2000; Duffy et al 2001; Tang et al 2001; Williams et al 2001); increased spatial (in rats) and non-spatial (in mice and rats) memory (Escorihuela et al 1995; Gagne et al 1998; Woodcock and Richardson 2000; Hoplight et al 2001); improved visual perception in mice (Prusky et al 2000); and enhanced social cognition and other forms of cognition in owl monkeys (*Aotus trivirgatus boliviensis*), rats, and squirrel monkeys (*Saimiri* spp.) (Xerri et al 1996; Pham et al 1999).

Perhaps the most important finding on the effects of enrichment is its influence on plasma cortisol levels in animals. Cortisol is a chemical produced by the body in response to a stressful and/or exciting situation. The presence of cortisol stimulates the liver to release energy reserves that allow the animal to respond physically to a situation. A majority of physiological studies have shown that the presence of enrichment statistically reduces plasma cortisol levels in a wide variety of animals (Carlstead et al 1993; Schapiro and Kessel 1993; Pedersen 1996; McGreevy and Nicol 1998; Boinski et al 1999a; Boinski et al 1999b; Ahola et al 2000; de Jong et al 2000b; de Groot et al 2000; Roy et al 2001). This reduction in cortisol level demonstrates the decreased stress that an animal is experiencing in the enriched environment in comparison to the stress the animal experiences in a non-enriched environment under otherwise similar circumstances. As previously mentioned; a reduction in the level of

an animal's distress results in an increased immune system response, decreased disease transmission, faster healing time, higher quality of mental and physical development, and increased reproductive success.

EVALUATION

In order to reap the multitude of benefits enrichment provides to a wildlife rehabilitator, one must first establish what type(s) of enrichment is going to be provided and how to provide that enrichment. The first step toward making these decisions is to establish the goals of enrichment. For wildlife rehabilitators, the different kinds of goals for different sets of animals can be summed up in three, overlapping categories: 1) Fixing abnormal behaviors (usually for longer-term rehabilitation, permanent display/educational residents, or feeder animals); 2) Fostering or maintaining behaviors that will aid in successful survival and reproduction of an animal in the wild (focused on animals undergoing rehabilitation or captive-bred individuals intended for wild release); and 3) Expression of species-specific behaviors for improvement of the physical and mental health of an animal (applicable for any category of animal).

In the case of attempting to eradicate abnormal behaviors, it is important to follow the steps below.

1. Ensure that the behavior is actually *abnormal*. Some behaviors are obvious in their abnormality, such as pacing or self-mutilation. However, some *undesirable* behaviors are not necessarily atypical for any given species. For example, an opossum on public display sleeps for seven out of the eight hours it is supposed to be serving its educational role. Virginia opossums (*Didelphis virginiana*) are normally nocturnal, so the seemingly excessive sleeping habits of the publicly-displayed marsupial are not abnormal and do not need to be *fixed*.
2. Observe the animal! When is it performing the behavior? Directly before a scheduled feeding time? When the public is observing the animal? After the animal has consumed its daily diet? After the animal has completed a training session? Try to observe a pattern and timing in the animal's abnormal behavior.
3. Look at the animal's individual history. When did the animal begin exhibiting abnormal behavior? Was a cage mate recently removed or added? Has the animal's exhibit been altered in some way? Has the animal's diet, feeding regime, or any other aspect of care been altered? Does the animal have a history of performing this or other abnormal

behaviors? Performing an assessment of behavior and delving into the history of a particular animal may seem like a waste of time that could be spent reversing the abnormal behavior, especially in cases of self-mutilation or unusually high aggression. However, without understanding the pattern and potential causes of abnormal behaviors, attempts to fix problems may prove to be worthless shots in the dark and may waste more time than actions taken based on careful observations and a review of individual histories. Knowing the animal's history and being familiar with its behavior will also prove useful for the next step in eradicating abnormal behavior.

4. Consult your veterinarian. Sometimes an abnormal behavior is the result of a physiological problem. An animal may become overly aggressive to cage mates and caretakers because of vision loss. Fungal or parasitic infestations may cause animals to feather-pluck or gnaw off fur. Observations and understanding of the animal's individual history will be extremely helpful for the veterinarian in making a diagnosis.
5. Identify the cause of abnormal behavior and take steps to address the problem and eliminate the behavior. Accounting for the underlying cause in order to stop abnormal behaviors may take multiple tries, so the sooner the process is started, the better. Try to encourage behaviors that are incompatible with the abnormal behavior that is being eradicated. The encouragement of more natural, species-specific behaviors and/or fulfillment of species- or individual-specific social requirements often aids in the elimination of abnormal behaviors. Whatever option that is chosen to fix the problem should be tailored to the underlying cause of the unusual behavior and the individual animal expressing this behavior.

Consider the following scenario: A wildlife rehabilitator is presented with a turkey vulture (*Cathartes aura*) that has recently been judged non-releasable and is a good candidate for an education bird. However, after a few weeks in its new enclosure, the vulture begins to pluck feathers until its chest is nearly bald. If the bird is not observed, its personal history not investigated, or a veterinarian is not consulted, the rehabilitator may simply try to distract the turkey vulture from self-mutilation by throwing in a bunch of dog toys and hanging some parrot toys around the enclosure. However, the rehabilitator has not eliminated the underlying cause of the behavior, so the feather-pluck-

ing continues until the beautiful education vulture is completely bald-chested. The rehabilitator has wasted not only time and energy, but also money. If the rehabilitator carefully watched the turkey vulture, it would be noted that feather plucking occurs throughout the day, without any connection to feeding times or interaction with caretakers or the public. When looking into the history of the vulture, the rehabilitator finds that it came into the wildlife rehabilitation center as an adult with a broken shoulder and, while undergoing rehabilitation, was housed with two other turkey vultures and did not exhibit any unusual behaviors. The vulture also did not begin feather-plucking until a few weeks after introduction to the new enclosure (which has not been altered since arrival). The bird's diet and feeding regime remained the same. After consultation with a veterinarian, the rehabilitator learns the animal does not have any physiological problems that may be to blame for its condition. Since the abnormal behavior is not linked to anything in the turkey vulture's current location, present schedule, or overall care, the rehabilitator tries to find another difference between its feather-plucking state now and its previous non-feather-plucking set-up: *social interactions!* In the former captive setting, the animal had the company of two other turkey vultures. In order to provide this turkey vulture with social enrichment one of the following options can be chosen: housing it with other turkey vultures or appropriate raptors, providing training sessions for a social outlet, or providing a mirror or view of other turkey vultures. Once one of these options has been employed, the education bird ceases plucking and its chest feathers grow in fully.

Some other useful tips to remember when addressing abnormal behaviors are noted below.

1. Try to catch problems at an early stage and take action quickly to eradicate abnormal behavior. The longer the behavior continues, the less the chance that enrichment will be effective in combating it and the greater the chance that the behavior will become a permanent part of the animal's repertoire. Cooper and Nicol (1991) found that bank voles (*Clethrionomys glareolus*), which had developed an abnormal repetitive somersaulting behavior in a non-enriched environment, preferred barren environments to enriched environments in the future because non-enriched habitats permitted easier somersaulting.
2. There are no simple solutions. The path of a pacing animal can be blocked with a physical object to try to prevent the animal from pacing. A bandage can be wrapped around the area on

a coyote's (*Canis latrans*) limb that is repetitively gnawed. However, the underlying causes of the behaviors still exist in both cases, so when the physical barrier to the abnormal behavior is removed, the behavior will return. In fact, abnormal behaviors will likely return in different forms even in the presence of an intended deterrent.

3. It is always easier to prevent a problem than fix it after the fact. By providing an animal with a diverse array of environmental and behavioral enrichment and fulfilling its species-specific requirements, it may be possible to prevent the start of abnormal behaviors.

When using enrichment to foster or maintain behaviors that will aid in the successful survival and reproduction of an animal in the wild or to motivate expression of species-specific behaviors for the improvement of the physical and mental health of an animal, the focus is on the species and individual animal level. Use the following points as a guide to keep the goal in focus while devising plans for enrichment.

Look at the Natural History of the Species Involved.

What behaviors are expressed for how long, when, and by whom? What behaviors does this species typically exhibit in the wild? What are the components of these behaviors? Many behaviors can be divided into sub-categories that can each be a focus of an enrichment item. For instance, hunting can be separated into: 1) prey location using olfactory, visual, tactile, and/or auditory signals; 2) prey stalking; 3) prey chasing; 4) prey capture; and, 5) killing of prey. Each of these five components, all, or a combination, can be the goal of an enrichment device.

In what dimension does the behavior take place? Behaviors show variations in time and space as well as variations in 3-dimensional and 2-dimensional planes. A woodpecker hunts grubs up and down a tree, in and out of holes in the tree's bark. A bat whirls around in all planes when attempting to catch a fleeing moth.

For how long does the animal exhibit the behavior? Does the animal sleep for half an hour a day or 20 hours a day? Does it hunt once a week or ten times a day? What is the duration of the hunt and its various components? How often and for what duration is foraging observed? Is duration of behavior dependent on the size, distribution, and/or type of food for which they are foraging or hunting?

When do they exhibit the behavior? At what time during the day or year is the behavior expressed? Does the behavioral repertoire demonstrate seasonal variations or changes based on breeding condition, light cycles, temperature, humidity, or age of the individual? Is the animal diurnal, nocturnal, crepuscular, etc? If behavior is a social one, in what concentration of males to females or juveniles to adults is the behavior expressed?

Which members of the species are involved in the behavior and in what manner are they involved? Are there age and/or sex differences in expression of the behavior? Are individuals of a species social or asocial? If they are social, in what concentration of males to females, juveniles to adults, and at what times of day/year are they social? Is there participation in solitary or group foraging? Understanding age and sex differences in behavior is critical to determining appropriate enrichment. A juvenile mallard (*Anas platyrhynchos*) of either sex or an adult female mallard should receive a mirror for social enrichment. However, adult male mallards may severely injure themselves if provided with a mirror for enrichment, especially during breeding season, as a result of their high level of aggression towards other adult male mallards (Figure 1).

As a wildlife rehabilitator reviews the natural history of a species, the positive behaviors necessary for mental and physical exercise, reduction of stress, increasing positive social relationships, and fostering and/or maintaining skills crucial for an animal's success in the wild become apparent. In general, these behaviors can be summarized into the following seven groups that necessarily overlap: exploratory behavior (aids in the search for food, mates, nesting material, shelter, etc.); play (helps animals learn effective ways for interacting with their environment and other animals in that environment); food finding and processing behaviors (foraging and/or hunting); locomotion (imperative for physical fitness, foraging/hunting, predator avoidance, conspecific avoidance, etc.); anti-predator and conspecific avoidance behaviors (including any activity that protects against predation and/or conspecific aggression: hiding, playing dead, fleeing, etc.); hygienic behaviors (grooming, wallowing, preening, etc.); and positive social interactions for social species (consisting of courtship, breeding, care of young, group foraging, allopreening/allogrooming, etc.) (Young 2003).



Figure 1. Mallard ducklings exhibit reduced stress when housed with other ducklings and when exposed to reflected images in a mirror. However, an adult male mallard in breeding season may attack other male mallards, including its reflection in a mirror, risking damage to itself and cage mates.

Look at the Specific Animal(s) in Question.

What sex and age is the animal? Does this status affect expression of the desired behavior in any way? As reviewed above, many behaviors differ in expression based on the age and sex of the individuals exhibiting them.

Is the animal disabled in some way? This can be a temporary disability, like a broken wing, or a permanent disability, such as partial wing amputation. How will this disability affect the expression of the desired behavior and/or the design of enrichment used to motivate the desired behavior? If one wants to use enrichment to elicit exploratory behavior in an opossum that is nearly blind, hiding scented objects will be more effective than hiding objects that have no distinctive scent.

What are the diet requirements or restrictions of the animal? Is the animal diabetic, underweight, or obese? This determination will affect what types of food-based enrichment can be used.

What is the history of the animal in captivity? Has the animal recently arrived from the wild? If so, the animal may be easily stressed by the presence of people or unnatural objects, noises, smells, etc. In this case, enrichment that does not require caregivers to be in the presence of the animal for an extended period

of time (e.g., hanging only one string of nuts for one minute versus ten strings of nuts for ten minutes) and incorporates attributes more natural to the animal's prior habitat will be best. If the animal has been in captivity for an extended period of time, has it become habituated to people, noise, unnatural objects, etc? Has it had opportunity to practice species-specific behaviors in captivity? Has the animal been in an enriched or a non-enriched environment? If an animal has previously been in an environment without stimulation or is naturally neophobic (fearful of new things or experiences) as many birds are, providing a lot of environmental and/or behavioral

enrichment suddenly may distress an animal. In this situation, it is preferable to move forward with a slow introduction of enrichment and gradually build up in the diversity and amount of enrichment based on the reaction of the target animal.

Brainstorm with Others. Take advantage of the experience of others. Once the desired behavior(s) has been determined for a particular animal, investigation should be done on enrichment methods employed by other wildlife rehabilitators, zookeepers, farm workers, laboratory animal caregivers, animal trainers, and domestic pet owners to encourage similar behaviors. Techniques can always be customized for a specific species and individual animal of concern, but it is extremely helpful to learn from the mistakes and successes of others. Discussion of an enrichment plan with as many individuals as possible should take place. The more people with different perspectives that evaluate a scheme, the better the chances that problems will be discovered and fixed early in the process, decreasing wastes of time, energy, and finances, and ensuring a safer and more satisfying experience for the animal receiving enrichment. Online chat rooms established to discuss enrichment protocols and animal welfare are great resources as are the many animal-related scientific journals, zoological websites, and laboratory and farm animal organizations.

A veterinarian is another essential consultant on any enrichment project. Veterinarians can help to review overall plans from a safety perspective and provide advice on potential discrepancies in prescribed diets or physical capabilities of certain animals with regard to the intended enrichment. Mechanical engineers are also a great resource when designing enrichment devices. Many of these professionals love the challenge and novelty of these projects and will volunteer their time, talents, and resources to aid in animal welfare efforts.

Ensure the Safety of Enrichment. Make sure the enrichment is safe for the target animal, cage mates, and caregivers! Ensure that there is no possible way for the animal to injure itself or others with the enrichment or the presentation of the enrichment. It is imperative to review not only the enrichment item, but also the method and location of attachment used for the item. Avoid objects that have sharp or pointed edges; have parts that can be easily broken, dismantled, and/or ingested; are made of toxic materials; are not thermally neutral (i.e., absorb heat from an animal's body); or have potential traps or entanglements for digits, limbs, or other body parts. If re-using an item for enrichment, ensure that the device can be fully sanitized to limit the potential for disease transfer among individuals.

If plants or derivatives of any vegetation are used, familiarity with the hazardous potentials of the items is essential. Buy a poisonous plant identification guide and consult botanists whenever necessary. Although a particular plant may not be poisonous, ensure that the physical attributes are not harmful. Thorns, spines, and prickles all hold potential for anything from minor irritations to fatal injury for animals. Burrs can compromise the hygiene of an animal or entangle smaller victims. Wild birds sometimes become trapped in burrs of burdock while feeding on this plant and die as a result of starvation, dehydration, or severe injuries from escape attempts.

Do not use enrichment devices that will restrict the ability of staff or volunteers to care for an animal. Ensure that enrichment does not block a caregiver's access to or view of an animal. Similarly, do not employ enrichment that will compromise the safety of the caregiver. Evaluate the contact a caregiver must have to an animal and its enclosure in order to set up and/or maintain enrichment and assess the access caregivers will have to exits once enrichment is employed. Be sure enrichment does not impede the cleaning of an area of the enclosure or an animal's ability to use its enclosure to the full extent.

Some additional questions to keep in mind when planning an enrichment item for long-term use are: Is the item of the simplest design possible? The simpler a device is in design, the easier it will be to fix when it breaks. Is the device easy to maintain? Is the item and/or its parts cost-effective? Is the item tough and durable? Is the object able to withstand prolonged exposure to UV light, water, and thermal extremes? Is the item cleaning-chemical-proof and of a texture that is able to be cleaned (i.e., nonporous)? Is the enrichment easy to use? If the item is difficult to employ, it is likely that caregivers will shy away from its use, especially in a long-term situation.

(to be continued)

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