

Committed to Animal Welfare



Discussions by the Laboratory Animal
Refinement & Enrichment Forum
Volume IV

Edited by Viktor Reinhardt
Animal Welfare Institute

Committed to Animal Welfare

Discussions by the
Laboratory Animal Refinement & Enrichment Forum
Volume IV

Edited by Viktor Reinhardt
Animal Welfare Institute

Animal Welfare Institute
900 Pennsylvania Avenue, SE
Washington, DC 20003
awionline.org

Committed to Animal Welfare
Discussions by the Laboratory Animal
Refinement & Enrichment Forum, Volume IV

Edited by Viktor Reinhardt

Cover photo: Kim Carpenter
Design: Ava Rinehart and Alexandra Alberg
Copy editing: Cathy Liss and Annie Reinhardt

Copyright © 2016 Animal Welfare Institute
Printed in the United States of America

ISBN 978-0-938414-78-0
LCCN 2016945226

dedication

It is with great admiration that I
dedicate this book to Polly, who
inspires so many of us to care
for the animals in our charge with
an unconditional commitment to
their behavioral, emotional and
physical well-being.

Table of Contents

CATS AND DOGS

- 1 Environmental enrichment for cats
- 4 Handling of cats
- 7 Exercise and play for dogs
- 8 Training dogs to cooperate during procedures
- 11 Dogs wasting their food
- 12 Decreasing barking of dogs
- 14 Behavioral disorders in dogs and cats

RODENTS AND RABBITS

- 19 Trust relationship with rodents and rabbits
- 23 Handling of mice
- 25 Nesting material for mice
- 27 Identifying mice in their nest
- 30 Cold stress in mice
- 32 Food grinding in mice
- 34 Same-sex social housing of male mice
- 35 Refined caging for rats
- 37 Same-sex pairing of rats
- 38 Same-sex social housing of hamsters
- 39 Refined oral dosing of rodents
- 40 Post-surgical recovery of rodents
- 42 Housing for chinchillas

- 44 Hay for rabbits
- 46 Caging for socially housed rabbits
- 47 Same-sex social housing of mature rabbits
- 49 Dealing with an aggressive rabbit
- 49 Music enrichment for rabbits
- 50 Trimming nails of rabbits
- 51 Oral meloxicam dosing of rabbits

NON-HUMAN PRIMATES

- 53 Environmental enrichment for marmosets
- 55 Favorite treats for cynomolgus macaques
- 56 Inexpensive foraging enrichment for macaques
- 57 Produce for non-human primates
- 59 Coconuts for non-human primates
- 61 Dolls for macaques
- 62 Wheatgrass for macaques
- 64 Making use of leftover powdered chow
- 64 Paint roller enrichment for macaques
- 66 Wood enrichment for macaques
- 68 Mirror enrichment for macaques
- 68 Enrichment with stainless steel balls
- 70 Thieves by nature
- 72 What is this stuff?

- 73 Music, video and television enrichment
- 77 Water enrichment for macaques
- 78 Catching caged macaques
- 81 Working with African green monkeys (vervets)
- 83 Training African green monkeys (vervets)
- 84 Acclimating to be chair-restrained
- 85 Training macaques to test the Lixit of their cage
- 87 Pair-housing of macaques with cranial implants
- 89 Post-surgical pair-housing of macaques
- 90 Separation of paired companions
- 90 Remote video recording of caged non-human primates
- 93 Refined ECG procedure

FARM ANIMALS

- 95 Species-adequate housing and handling
- 98 Environmental enrichment for Göttinger minipigs
- 99 Rooting opportunities for pigs
- 101 Jacket acclimation for pigs

MISCELLANEOUS

- 105 Practicability of wood shaving bedding for indoor-housed animals
- 107 Cleaning up messy enrichment
- 111 Abnormal behavior—A misleading term
- 113 Fear of humans
- 122 Suffering
- 124 Choosing the correct pronouns
- 126 Minimizing noise in hallways
- 127 Ultrasound an extraneous variable
- 128 Workload—Cage changes
- 129 Implementing new environmental enrichment ideas
- 130 Monitoring social housing
- 132 We are making progress

135 REFERENCES

138 PHOTO CREDITS

139 INDEX



INTRODUCTION & ACKNOWLEDGEMENTS

The Laboratory Animal Refinement & Enrichment Forum was created in 2002 to allow individuals working with and for animals in research facilities to share personal experiences of efforts to refine traditional housing and handling practices of the animals. Comments and questions were exchanged via email. Relevant discussions were slightly edited and published in three volumes. This is the fourth volume; it includes 71 selected discussions taking place between January 2013 and January 2016. I am grateful to the 85 participants of these discussions for contributing their questions and comments:

Adrian Smith, Ali Moore, Allison Reiffer, Amanda Harsche, Amy Kilpatrick, Angelika Rehrig, Anthony Ferraro, Audrey Brown, Augusto Vitale, Autumn Sorrells, Becki Brunelli, Brianna Gaskill, Carolyn Allen, Casey Coke-Murphy, Catherine Brochu, Cynthia Santaniello, David Cawston, Erica Griffith, Evelyn Skoumbourdis, Genevieve Andrews-Kelly, Harriet Hoffman, Heidi Denman, Huw Golledge, Jacqueline Schwartz, Janneke Arts, Jacqueline Schwartz, Jeannine Cason Rodgers, Jennifer Defosses, Jennifer Deutsch, Jennifer Green, Jennifer Lofgren, Jessica Peveler, Jillann Rawlins-O'Connor, Jo Keeley, Joanna Cruden, Jürgen Seier, Kaile Bennett, Karen MacLeod, Karlina Elder, Kate Baker, Kathryn Mahoney, Kayla Shayne, Keely McGrew, Kelsey Finnie, Kelsey Neeb Lambert, Kimberly Rappaport, Kris Alaimo, Krista Beck, Kristina Carter, Kurtis Swekla, Jodi Scholz, Laura Hall, Laura Richardson, Leslie Jenkins, Lori Burgess, Lorraine Bell, Louis DiVincenti, Lydia Troc, Marcie Donnelly, Marloes Hentzen, Meagan McCallum, Meagan Shelter, Melissa Truelove, Michele Cunneen, Michelle Martin, Misty Williams-Fritze, Monica Carlson,

Natasha Down, Pascale Van Loo, Paula Austin, Polly Schultz, Rachele McAndrew, Renee Gainer, Robin Minkel, Richard Duff, Russell Yothers, Sarah Whitehead, Stacie Havens, Stefanie Nelsen, Sylvie Cloutier, Tamara Godbey, Thomas Ferrell, Toni Trahearn, Vanessa Herring, and Vera Baumans. As moderator of the forum, I have also made contributions to these discussions.

I thank the Animal Welfare Institute for its generous offer to publish this volume and make it freely available. Thanks are also due to Cathy Liss and my wife Annie for reading the final draft of the book and correcting language-related errors.

I am very grateful to Alexandra Alberg and Ava Rinehart for preparing the layout of this book and creating a very beautiful design for it. In the course of 15 years I had the privilege of working with Ava on 13 books. Ava is not only very talented and skilled in her profession, she is also gifted in creating a work environment that is efficient and, at the same time, free of stress. I always enjoyed working with you Ava; thank you!

Animal research facilities typically are strict in not allowing photos to be taken and published that depict how their animals are housed and how they are treated. The majority of the photos accompanying the text of this book, therefore, were not taken in laboratories, but rather were obtained from the public domain.

Viktor Reinhardt
Mt. Shasta, California
June 2016

Cats and Dogs

Environmental enrichment for cats

I am searching for ideas of cat enrichment; it needs to be something that can be sanitized and is non-ingestible. The market for cat enrichment in the research laboratory setting is so limited; I'm just not sure where to look.

We housed cats at my previous institution in modified NHP caging. We utilized the platforms to create hiding places and resting surfaces.

Plastic litter pans attached with zip ties served as additional platforms. Since the NHP cages attached end-to-end, we were able to hook them together the length of the room, creating lots of room for running and space for the cats to get away from group members if necessary. We also used plastic AstroTurf for scratching and as rubbing pads. The cats were a lot of fun to have in these large living quarters!





I second the zip ties idea—our cats love playing with zip ties attached to various things with a good bit of a 'tail' still on them.

We work with cats for vaccine research. All our cats are housed in groups, up to 15 animals per room. Besides scratching poles, elevated resting surfaces and typical cat toys, each group has access to a custom-made running wheel. The cats really enjoy it when they have figured out how the wheel works, and they run in it, especially when we entice them to do so with a laser pointer.

I love the cat wheel idea! Do they just figure out how to use it or is there some introduction involved?

Yes, they just figure it out by themselves how the wheel works.

Cats love to have access to elevated resting surfaces, especially high ones.

We have cats socially housed in a large room setting with perches, cardboard to rip up and various toys. We would love to use scratching posts but are trying to figure out a way to sanitize them. Does anyone have suggestions?

We use brushes to clean the scratching poles. When a pole is really dirty (lots of cat hair) we use a vacuum cleaner, or replace it with a new scratching pole. At the end of every experiment the whole room, including scratching poles, is disinfected with peracetic acid.

Our scratching poles consist of a PVC body covered with Astroturf; we simply put them through our cage washer.



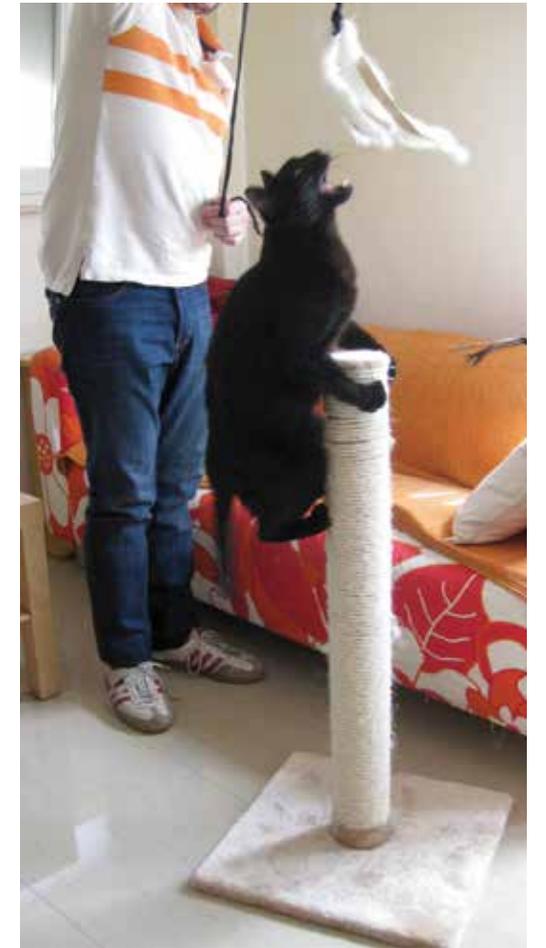
It is my experience that cats who are alone in a cage are not easily enticed to play with enrichment gadgets beyond a brief phase of initial exploration, perhaps even play. Do any of you have experience with self-made or commercial toys that elicit play behavior in single-housed cats beyond the novelty effect?

I work with singly caged cats in a shelter and can say, a plastic ball containing a bell is NEVER ignored and is always revisited. The cats go ga-ga for it! Little cloth toys filled with cotton and a touch of catnip are also big favorites.

Our cats enjoy playing with the small plastic balls containing a little bell. We also make use of zip ties as enrichment. The zip ties are attached to the cage doors and/or the top of the cages and engage the cats whenever they touch the free ends. I have found that my ID badge attached to an extendable neck lanyard is a huge attraction for our single-caged cats. I swing the badge over the cage door, moving it back and forth or dropping it down on the cage floor and moving it up again; the cats don't get tired chasing the prey through their cage!

This is also my experience: Any type of movable toy is very attractive for single-caged cats as long as a human is involved in moving it around!

Once you stop playing with the cat, the toy loses its attraction. The time the human caretaker interacts with the single-caged cat is probably the most effective environmental enrichment option. The single-caged cat does deserve it!





Handling of cats

It is my experience that it takes quite a bit of patience and compassion to gain the trust of a cat who had limited positive contact with humans. In order to be at ease, a cat seems to have a strong need to feel free and have control over interactions with a human.

How do you go about minimizing stress and distress during handling procedures in new cats who have arrived at your facility and you are in charge of them?

It has been a very long time since we have housed cats, but getting them used to me was always a must. Restraint is often one of the hardest things to accomplish with a cat. The moment a cat finds herself too restrained, the harder it is to work with her. Getting to know your patient along with lots

of gentle handling and patient conditioning to the restraint method helps greatly to reduce or avoid stress for both the cat and yourself; it also minimizes the risk that the cat resorts to overt self-defensive aggression.

I agree, a cat typically resists the moment she feels over-restrained. Most cats have a kind of free spirit, so they need to have the feeling of NOT being controlled in order to be/remain at ease with a given situation. When you give a cat enough space/freedom, you can very often do with her what needs to be done, under the condition that she really trusts you.

I had the luxury of being able to spend a good bit of time with cats. Typically what I'd do is go into the rooms in the afternoon

and just sit on the floor and let the cats come to me. I'd do this every day and as they got more comfortable with me I'd start doing small things like picking them up, combing them, cleaning their ears, checking their teeth, etc. When it came time for me to restrain them for a procedure, it was just another day and nothing for any of us to be worried about.

A lot of stress can be completely avoided when you are well familiar with the cat's body language and cues so that you can see when she is frightened of you and when she is completely relaxed with you. If you find yourself having to apply more and more restraint, then it's time to take a step back and let the cat (and the human handler) calm down.

I've never had any really bad cats, but I did have one very skittish cat who needed a food reward to help offset the trauma of a blood draw.

That you never had a 'bad' cat speaks for you as much as for the cats!

I've worked with cats in specialty medicine for years. To work with a cat is more of an agreement between the two of you: You are working together, but it's primarily on the cat's terms. Some of them HATE being scruffed and will never forgive you for it. They pretty much all feel that way about muzzles. Once you've ticked them off, they tend to hold a VERY long grudge.

Yes, that is also my experience! When you have made a mistake, the cat will remember and will not forgive you for a very long time.

Leather gloves are a waste of time, you can't feel what you're doing and cats can bite through them anyway.

Towels are your best friend.

Avoid sudden movements and don't be hesitant. For example, you want to lay the towel over them slowly, and confidently; not toss it over them and jump back!

Tapping the nose during any procedures is a common form of distraction, but I find that it just pisses them off. It's better to scratch their nose/ears and rub their foreheads. Keeping a soft, light and calm tone of voice is helpful when dealing with cats. Believe it or not, I've found that they like singing softly—opera mostly.

If the cat is actually food motivated, treats are useful when you intend to handle her.





When you can get cats to do something on their own terms, that's always better than trying to coax, or even force them to do it. I can't tell you how many times I've walked up on someone trying to grab a cat out of her cage for several minutes and then, finally got the idea of letting the cat do it on her terms: The person just held the carrier up to the opening of the cage and watched the cat walk into it without any ado.

Thank you for sharing this excellent advice. Yes, all animals—not only cats—are great teachers to cultivate more patience and develop more respect for their need to have basic control in the interaction with you.

Suppose you are working with a cat who trusts you. How do you go about taking a blood sample from such a cat or giving her an injection without triggering stress or distress reactions?

I worked with several different cats on a daily basis. One of the biggest things that cats hate is restraint. The minute you put a cat into a restraint hold, the cat typically gets upset.

Usually, I am able to hold the cat's head in a position that I can obtain a blood sample from the jugular without a second person restraining the cat. The cats do not show any signs of stress and the samples collected are great! If I do have an aggressive cat who needs to be restrained, I use a 'cat bag' or wrap the cat in a towel (almost like a kitty burrito) along with a cat muzzle. This method gives the cat a sense of security, which is likely to reduce stress, and I can take a blood sample from the jugular vein. I have come across a few cats who were so intractable that anesthesia was the only option to get a blood sample from them.

Assuming you do have the time to gain the trust of the cats in your charge, how do you go about keeping this trust during and after procedures that are potentially fear provoking (e.g., injection or blood collection) for the individual cat? Are patience and food treats enough?

I spend time rewarding them with positive physical contact and play. Head rubbing (or head butting if they are the affectionate sorts) and a favored feather or string toy help to relieve anxiety; none of them seem to hold a grudge about sample collection procedures. For the one who is skittish, I take extra time giving her food treats and combing her; being gently combed has a very calming effect on any cat who trusts you.

Exercise and play for dogs

Do you have an exercise-and-play program for the dogs at your facility?

Our dogs get exercised in pairs or groups when they get along well with each other, alone when they don't get along with other dogs, in a designated room at least 30 minutes a week. Usually, one or several techs stay in the room with the dogs and often play with them.

We also allow our dogs to exercise and play alone or with other dogs in a designated area, with at least one technician being in the same room. The amount of time spent in the exercise and play area is very flexible and depends on the availability of staff and willingness of staff to spend some time with the dogs.

I work in a high-paced CRO [Clinical Research Organization]; we have a designated canine playroom that we refer

to as 'ZenPen.' Our dogs have ZenPen-time for 30 minutes, at least once a week. We can have 2-8 compatible dogs out for playtime. We move our dogs in a cart, or 'Beagle Bus.' Currently our vet techs manage the exercise-play program for our dogs, but they are not solely dedicated to just this. Occasionally we have volunteers from other non-animal departments join us, which is fantastic.

At my old job we had 15 to 20 beagles. Because we were small enough, I would let all the girls out into the hallway while I cleaned their rooms in the course of the morning. Later we would do the same for the boys. The dogs absolutely loved coming out to run up and down the hallway, play with each other and check what I was doing. On certain days when we were relatively slow, I would let them out again in the afternoon and sit and play with them. They sure were spoiled! Man, I loved that job!





We have an exercise program for our dogs, but I firmly believe it's as good as it is only because I have one of the world's best dog caretakers at my facility. She manages to run our dogs for at least 30-60 minutes per day. The dogs come out in compatible pairs/groups of the same gender in the room. Once the pens are cleaned, games are played, or special run-time-only toys are used. If the rest of us have extra time during the day, we'll pull the pups out for play as well. Nothing is better than taking a tennis ball to a lab hound when you're having an otherwise lousy day!

Training dogs to cooperate during procedures

There is little, if any, published information on training dogs to cooperate during research-related procedures. It is easy to train monkeys to cooperate; it should be even easier to train dogs, as they are truly domesticated animals and trust humans quite spontaneously.

Is there anyone on our forum working with dogs who have learned to actively cooperate during blood collection? Did the animals learn to cooperate through habituation or formal training? Who trained the animals?

We get our dogs from a breeder who habituates the animals to common procedures when they are still puppies. We continue to work with them for bleeds; to 'train' them, they are usually restrained by a second person until they learn the

routine. After just a few sessions, many of these beagles will actually put their necks up for you when they are placed on a table. We have a guy who knows the dogs very, very well; he can just put his pinky finger on the dog's neck to keep him still while he draws the blood. We bring the dogs out of the kennels and do the blood collection in the anteroom, as they are very excited in the kennel and tend to run around and get all the other dogs going; in the anteroom it's quieter and we don't have to kneel down—it's a bit more comfortable standing up. I find these dogs are also excellent for nail trimming; far better than my own dog! Typically, I put the beagle in my lap and trim all nails with no restraint other than to keep the animal from falling off my lap.

I trained beagles to present their front paw for cephalic bleeding. A small swipe of peanut butter on my finger served as a reward, coupled with playtime on the floor following their cooperation. I did not need a second person to hold the dog during this cephalic bleeding, but as per our SOPs [Standard Operating Procedures] we were required to have a second person present whenever a dog was treated on an exam table. The second person puts her hands reassuringly on the dog for safety reason.

Dogs are easy to train because they are so eager to please us!

It is my experience that purpose-bred beagles are very compliant. They almost spontaneously cooperate with procedures, like blood draws; only minimal restraint is required. The dogs need no training other than a few seconds of petting before they cooperate without further ado. I can usually obtain blood samples alone. The dogs tend to object much more to the restraint than to the actual procedure—be it blood collection, rectal temperature, nail trimming or ear

cleaning. Therefore, I think there is much more value in spending a few minutes with the dogs and making sure that they feel at ease rather than applying physical restraint that might not be necessary but is likely to distress the animals.

I want to underscore the importance of your observation regarding restraint. What applies for dogs, applies probably to most species found in the research lab setting: Even after a dog, a rat, a guinea pig, a rabbit, a monkey, a cat, a pig, a sheep or a cow has gained trust in the handler, a potentially painful/uncomfortable procedure will be accepted much more readily when no or only minimal restraint is involved. It is my experience that the animals lose their trust in me the moment I restrain them, but they readily hold still during a harmless procedure if they have the space to move away, out of my reach.

When I started working with laboratory-housed dogs, I was surprised at the lack of information on how to train dogs to cooperate with procedures. I train beagles



to cooperate with procedures using positive reinforcement training and desensitization. The dogs are trained to sit while on the procedure table and to cooperate during restraint, blood collection, oral dosing and other procedures.

It is my experience that dogs very often freeze during procedures but that this is mistaken for a sign of their cooperation.

Not only dogs but many other species, including humans, freeze in terrifying situations. A creature who freezes may, indeed, give the impression that he is cooperating when being handled or moved; but this kind of passive cooperation does not mean that the individual is not experiencing physiological stress and possibly extreme emotional distress. You would not like this to happen with an animal during a presumed harmless research-related or husbandry-related procedure.

I find purpose-bred beagles to be extremely submissive. Sometimes this is an obstacle with adopting them out after study, as they often have very noticeable anxiety issues. I'm guessing they are specifically bred for



this trait; it certainly does make them quite compliant for procedures. The beagles we get often just lie down when we are doing neuro exams and testing their proprioception. Instead of correcting their foot they just lie down, LOL! I agree that they freeze and cooperate, but they are not actually desensitized to the experience. I think desensitizing would still be very valuable for their benefit. Desensitizing with positive reinforcement training (PRT) is useful for our convenience in getting the job done, but it is also very much about the dogs and their quality of life. I would love to see PRT implemented not only for non-human primates but also for dogs.

Beagles of various strains exhibit a freeze response to stressful situations; it is sometimes unintentionally encouraged because of a perceived ease of handling a dog who freezes, in comparison to a dog who behaves excitedly. That's perhaps why it is seen more frequently in these dogs. It may even have been selected as a desirable trait.

I have seen the freezing behavior only in beagles, and more specifically beagles from a particular vendor. There was one female who accidentally became pregnant at our facility. All the puppies showed this freezing behavior. One of the runts was rejected by mom immediately; I had to bottle feed the pup from day one. I brought the pup home and she has been a member of our household for over two years. The thing I noticed about the freezing behavior is that she only does it when she has to do something she does not want to do. It's like she is saying, "You're not my boss!" For example, when I want her to go to bed, she will just lie on her side and act paralyzed. If you tell her to move out of the way so you

can get to the front door, she does the same thing. You could push her all around the room with your foot and she will just play dead. If you could see her, I think you would agree that it is not submission but opposition that she is displaying. It really is quite funny. She probably thinks, if she looks all sad and pitiful you won't make her do what you want her to do.

I had a cat who used to do this. I called it the *passive resistance move*. Seems more like a spoiled behavior than a genetic trait.

Our spoiled beagle does it in a less dramatic fashion. She just sits on the couch and wags her tail and gives sad puppy dog eyes; difficult to get her to move when she is in this mood.



Dogs wasting their food

We have three hounds who dig out all of their food; since they are housed in a raised run, the food falls underneath, out of reach for them. Has anyone had experience with a similar scenario and found a trick to make the dogs eat their food directly from the feeder without wasting it? Today I changed the dogs' feeders from bowls to J-feeders; they got food three times and each time they dug the food out. Now, either they really hate the food or we haven't found the correct feeder! I thought about trying a larger pan and zip-tying it to the corner of the pen; they will probably continue to dig. I don't think I will get my wish and get them in a run that is flat on the floor with shavings. So, I'm up for some suggestions, please!

You may need to design your own feeders.

What could be the ethological reason for dogs (and also for cats) to have such a strong urge to get their food OFF the bowl/plate or OUT of the feeder before processing and consuming it?

This seems like a stretch but I know coyotes will take food from a wolf kill and consume it a short distance away. Maybe subordinate dogs do that as well.

Your hypothesis does not seem a stretch to me. Securing a share of a kill and consuming it at a distance away from other group members may well be an instinctive response that minimizes food competition; this would be particularly important for subordinate members of the group. In the scenario that we are discussing, flipping a bowl filled with

food and consuming the food away from the bowl would be a normal, dog-specific behavior pattern.

It would be interesting to observe a group of dogs who are fed at the same time in the same enclosure and see if high-ranking dogs are less inclined to drag food away from its source than low ranking dogs.

My rescued lab beagle always took one kibble at a time out of her bowl and ate it on the carpet when she first came home. I know of another beagle from our facility who was adopted and who showed the very same behavior in her new home. Once settled in their new living quarters both dogs started to eat their food directly from their bowls rather than carrying it away and then consuming it. Perhaps they realized that there is no dominant food competitor around, so it was safe to eat the food at its source.



Our daughter's dog also takes food from his dish piece by piece and carries it to the carpet where he eats it. He does that even though there is no other dog in the house.

This suggests that dragging or carrying food away from its source may indeed be a biologically programmed canine behavior.

Decreasing barking of dogs

Based on your own experience, what are practical and effective options to decrease the barking of dogs?

We purchased the Canine Lullaby CDs and I feel that they have definitely reduced the barking in my dog rooms. Be careful though, while doing playtime with the pups, I have found myself so relaxed that I nearly fell asleep!

Awesome!

We have two types of housing for our dogs. Standard cages in which we can pair-house the animals, and EU [European] housing in which we can group-house them. Our

dogs in the EU housing arrangement bark significantly less than the ones in the [US] standard-cage housing arrangement. Our EU housing units are transparent, so the dogs can see what is happening around them. Each unit is equipped with a platform; the dogs seem to enjoy jumping on it and checking what is going on at the front of the room; they also spend much time resting on the platform.

We recently installed new kennels for our dogs. Each kennel has a little raised porch so the dogs can see who's coming into their room. This has made a big difference; our dogs are now much quieter than in the old standard caging.

Yes, dogs want to see what's going on in their territory. They are less excitable and bark much less when they can access a raised structure from which they can see who is entering their room and what is going on in the room. For that reason alone, raised platforms or benches should be standard furniture in all primary enclosures of dogs.

I have used clicker training to reduce barking in the dog-shelter environment. It's like magic! This technique was developed by Karen Pryor. Here is the text of her free Click for Care™ instruction sheet:

Preparation

- › Hang a small envelope of kibble or treats and a clicker outside of each enclosure. Or have kennel employees wear clickers on their wrists or belts.
- › Ask anyone who is frequently in the kennel area to use the following clicker procedures:

Steps

1. If a dog is barking, approach the dog, wait until the barking stops even for a split second, click, treat, and move on. Or ...
2. If a dog is barking persistently, don't look at it; instead, click and treat the dog's quiet neighbors, just once, and move on.
3. If a barking dog stops when he sees you coming, click and toss treat. Wait a few beats, watching the dog. Click and treat, again.
4. Mark kennels of persistent barkers with a colored tag or ribbon; ask staff to click and treat any periods of quiet from those dogs.
5. Click persistent barkers for any of the following behaviors: looking away, lying down, backing away from gate.
6. Be patient. Habitual barkers may get worse, temporarily, before they give in

and offer silence as the new way to get attention.

7. In traditionally noisy moments, such as mealtime, click quiet dogs before feeding. Feed barkers last, and only after a click.

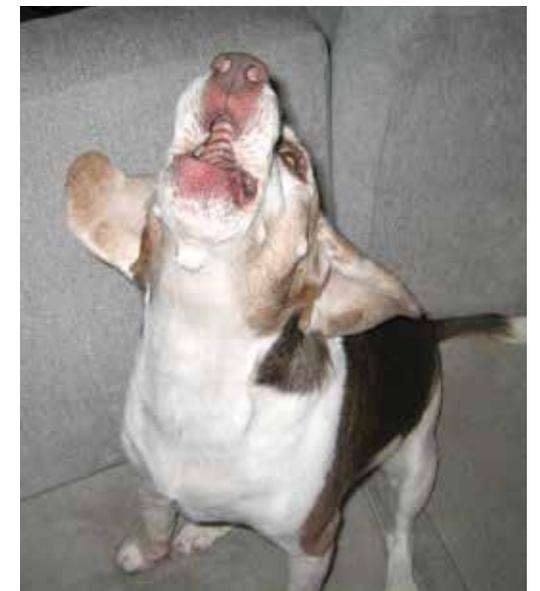
Ask staff to click occasionally for quiet on an irregular basis; unpredictable clicks and treats will maintain behavior strongly.

We had an amazing caretaker who applied this clicker training and achieved a most remarkable difference in the dogs' barking habit!

At my previous facility, we combined two basic rules:

1. Only open the door when the room is quiet.
2. If the dogs bark, shut the door and wait—yes, looooooots of waiting in the beginning! Once you are able to enter and shut the door, and all the dogs sit and are quiet you go to each dog, click and hand-reward the behavior with a treat.

A number of great behavior interns conditioned our dogs to these rules. You were able to enter a room without a deafening din of barks and the whole kennel of hound mixes would greet you with wagging tails. What a difference!



Behavioral disorders in dogs and cats

Based on your own experience and observations, would you agree that behavioral pathologies, including stereotypical locomotion, are an important animal welfare issue in caged dogs and cats?

The stereotypical behavior of a dog, running back and forth and leaping at each end of his cage or jumping so high and hard he hits his head on the top of cage, was brought to our attention by the USDA inspector. He wanted to know if there was something being done with the animal to alleviate these repetitive and tense behavioral expressions. I can only use common sense to reason why a confined dog would behave in this manner; I believe that the situation is an important welfare issue.

Caged dogs show such stereotypical movement patterns not only because they are extremely bored but also because they are biologically programmed to exercise, which they cannot do in a species-typical manner; there is just not enough room for it, so they do what they can: run the given short distance back and forth, run in small circles or jump up against the wall of their kennel over and over again. This is a normal behavioral reaction to abnormal living quarters.

If we have a dog as you have described, we will place a baby camera in the room and watch from outside to see if the dog continues to circle and run back and forth with no one in the room. If the dog settles down, his running back and forth could be simply an expression of his excitement/joy when somebody is around; we would

describe this as a temporary, normal excitement reaction in the dog's records.

If the dog continues frantically moving around even though nobody is in the room, we would be concerned and document this as stereotypy in his record. Inspectors are pleased when they can check these records and see that we are monitoring our dogs' behavior.

At a previous job, we also used video monitors to find out if a conspicuous activity, such as repeatedly jumping up on a platform, was an expression of excitement because a person is in the room, or if it was a stereotypic behavior reflecting a welfare issue. These rather inexpensive baby monitors worked really well. They allowed us to keep important behavioral information in the individual dog's records.

I think it's fair to let the dogs out of their kennels and run in pairs or trios while you hose their kennels; not only can they exercise but they also stay dry. Dogs have a lot of energy and need to expend it or they resort to stereotypically exercising in the given, very limited space. It's a natural reaction!

We had dogs circling in their cage or jumping at the back wall of their cage over and over again. After much pleading, I was allowed to let the dogs run around and play on the room floor; they absolutely loved it! I was not surprised when I noticed a remarkable decrease of stereotypical activities after the dogs were given the opportunity to exercise and play.

This is also my experience. After we started exercising our dogs on a regular basis, the circling and barking decreased notably when we entered their rooms.

We have also seen a remarkable decrease in stereotypies of our dogs who get regular play and exercise time on the floor of their room with other dogs. These animals tend to bark less and rest more, and do not display the pacing or circling in their home cages.

We have initiated a play room for our canines; it's so great! The techs rotate all our dogs in pairs or small groups through the play room where they can run freely and play with each other and interact with the techs.

I have to say, though, it is very difficult to get staff to participate in any extra interaction with the canines outside of assigned duties. When I worked with dogs, I tried to start up a volunteer canine enrichment program where people would sign up to exercise and train the dogs during breaks or any extra time they had. It was, to say the least, a failure. A myriad of reasons were given but I think it boiled down to the simple fact that it wasn't part of the job description or daily tasks. Unless and until it is written as a part of the necessary husbandry tasks, extra time

investment on behalf of the dogs—however much we know they need it—is hard to maintain long-term.

This is also my experience. Most people are not willing to put in a little bit of extra time to play with the dogs in their charge and let them exercise and to clean up afterwards. Since it isn't required, let alone enforced, it is looked down upon as a waste of time.

I would run into similar problems of lack of willingness or lack of time, so I asked vet tech interns or vet externs to spend time visiting, exercising and training the dogs. It has been documented in the professional literature that "human contact is the single most consistent and important factor in encouraging dogs to be active" in an otherwise unstimulating environment (Hughes et al., 1989).

We have a dog play room set up two days a week for the chemists who make the compounds. I have been surprised by the number of chemists signing up every week to come over to spend time with the dogs even though this is not part of their jobs. They say it's a stress relief for them to sit on the floor with the dogs, pet them, play with them and let them run around.





When I first started working with our cats, they were all kept in small USDA regulation-sized cages. The cats gave the impression of being very agitated; they vocalized and paced back and forth or in circles most of the time and vigorously and repetitively pawed (to get out!). Fortunately we were able to build a large enclosure for them where they could eventually all be housed together. This large enclosure has scratching areas, raised platforms, lots of toys, places to cuddle and places to hide. The change in the cats' housing condition resulted in a significant decrease in stereotypies and agitated vocalization.



Rodents and Rabbits

Trust relationship with rodents and rabbits

We have discussed on numerous occasions how easy and desirable it is to establish a mutual trust relationship with non-human primates in the research lab setting. Is it possible, and does it have any value when we establish such a relationship also with rodents and rabbits?

I would have to say yes, it has all the value in the world.

Once, I was treating a mouse for a long-term eye problem. He was not fond of the cleaning with saline at first but with lots of time, patience and gentle handling I gained his trust and he finally decided to just sit in





my hand and let me clean his eye without any restraint; he would even tilt his head toward the Q-tip. Getting his eye cleaned by me may have caused some relief of discomfort. I think he had learned through experience that I was not going to hurt him, but rather was doing something that actually was good for him, so he felt assured and at ease while I treated his eye.

Thanks for sharing this beautiful story; it is a great example of the often untouched potential of mutual trust. The absence of fear, along with good intentions, is probably the key for developing such a trust relationship with rodents, rabbits or with any other animals—including humans.

I have established a trust relationship with a few rats over the years, especially my sentinel rats. When it's time to change their cage or when I visit them, they willingly climb up on my hand to have a little outing. While I put the polishing touches on the room, like cleaning the floors, etc., they get to ride around on my shoulders. They really seem to like this attention and to climb on me; I

have no doubt that they are not afraid of me but trust me in the same way as I trust them. It never happened that one of the rats in my care exhibited overt aggression against me.

During my senior year of college, I opted to do an animal behavior study. I was given a mentor and a senior thesis project that came along with a group of 12 female Long Evans rats. I was told upon their arrival that I should handle them daily until they grew comfortable with me. As soon as they landed, I made an appearance and began to 'play' with the rats after a quick info session with the mentoring professor. After just a couple of sessions, I fell in love with the little darlings and rather than simply just handle them, allowed them to run through my shirt sleeves, sit on my head, sniff my ears, etc. I remember two of my clinical psychology profs coming in during such a 'play session' and, after one of the girls popped out of my shirt sleeve to say hello, said aloud, "Well, looks like we've lost this one to the critters. Look how happy they both are!" Needless to say, the rats and I developed not only an affectionate, but a mutual trust relationship. The girls never tried to bite me, probably because they knew I

would never do them any harm. I worked with them on almost a daily basis and found their personalities quite enamoring! They loved treats such as Froot Loops (everyone had a different color preference, of course!), little squares of Hershey Bars, and pieces of popcorn—all of which I enjoyed watching them consume with delight. Eventually, I became known around the psych building as 'The Rat Queen' because any time I left the main lab for a quick check-in with the mentoring professor, I had a rat riding on my shoulder.

Even though the project had some rough edges, and my relationship with the professor wasn't all that wonderful, I knew this type of work was something I should pursue. After all, where else was I going to be able to play with rats and get paid to do so?! To this day, even after my many years of large animal work, I still love walking into a rat room and having everyone stand up to say hello. It will always make my day!

Those rather amazing rat-story contributions to our current discussion makes you wonder if it is ethically really acceptable to exclude rats from legal animal welfare regulations by simply not considering them as *animals* (Animal Welfare Regulations, 2013).

Rabbits are so easily stressed! Developing a trust relationship with them is extremely important when you have to work with them. The process from when they arrive to when they're ready to be handled involves a lot of patience and comforting interactions. After a few weeks of positive interactions, I've had a couple of rabbits who run up to me and lick me whenever I come into their room. These rabbits have learned that they can trust me and they will remain calm during almost any handling and treatment procedure. Some

of our technicians have developed amazing trust relationships with the rabbits in their charge. The techs actually get the rabbits to lie on their backs in baby bouncer chairs for things like nail trims! I guess it's comfortable enough so that the rabbits don't really mind.

Would you mind describing what your acclimation program looks like?

There isn't much of a set program per se. I pretty much just do it on my own. That the rabbits can't be used for any research for several days is the only official condition of the acclimation protocol.

I work with them every morning, just using a soft voice (sometimes singing); slow, steady movements; allowing them to explore me. They are usually bug-eyed and nervous at first; gradually, they come around to get close and smell me, and then allow me to



gently touch their nose. After a couple of days, I can pet their backs, but they're very tense about it. After the first week, most of the rabbits will allow me to pet them on their backs without being tense; they are now relaxed when I am with them. I talk to them with a soothing voice; they seem to like it when I sing pieces of opera

By week two some of the rabbits will hop up to me and put their nose down to let me pet them. Some of them want to lick, lick, lick. They can be very cute!

There are always a few who don't quite get past just letting me pet them, but they're fairly calm for handling, which includes mainly PO meds, IM injections for sedation and eye drops.

I attended a training session in a research lab a few years ago. In each rabbit room, they

had an exercise pen. Rabbits were allowed to exercise singly or in pairs. The technicians were asked to sit in the pen and interact with the rabbits by throwing toys for them to fetch or petting them. And yes, to my surprise, rabbits run after their toys! They throw the toy in the air and they jump all around the pen; it was so great! I did not know rabbits were like that. In my numerous years in a private clinic with pet rabbits, I never saw rabbits so cheerful, calm and cooperative with people as in the research lab.

My point is that maybe the trusting relationship that formed during those playful and positive interactions accounted for the calmness and absence of fear shown by these animals. No doubt, they trusted their handlers! Maybe exercise and positive interaction should be an intrinsic part of the acclimation program.



Handling of mice

Mice—unlike rats—have a hard time getting used to being handled. In your experience, what is the most mouse-friendly, low-stress way of picking up a mouse, performing an IP injection and returning her back to the home cage?

There isn't a truly mouse-friendly way of doing this procedure; mice just don't like to be restrained, and they can't be blamed for that! I will say that scruffing them gently but securely the first time and then performing the injection quickly as well as correctly is very helpful. Have all that is necessary ready to go so that, once the mouse is restrained, the procedure can be completed swiftly. The less time the mouse is restrained the better.

Yes, mice don't like restraint at all. In order to give a mouse an injection, I gently pick her up by the very base of her tail, place her on a bar lid (not my arm so I don't get a bite), very gently put some pressure on the tail so the mouse grabs the bars and I can scruff her, and hold the tail with my

pinkie finger. I have the mouse now firmly but gently restrained in my hand, give the injection quickly and safely and place the mouse back into her home cage without any delay.

It's my feeling that, once you can do this procedure swiftly and correctly, the mouse is not really affected by it.

I agree, the best way to decrease handling stress is to have your act together and conduct a procedure (such as an IP injection) as quickly and smoothly as possible.

Yes, mice don't like to be restrained ... for very good reason! I have yet to find a mouse who really is stress-free when I handle her. It seems to be an instinctive reaction of mice to immediately squirm and try to get away, even in a gentle yet secure scruff. The less time restrained the better, so I always try to have everything ready before I give the injection. This way, the amount of time, and hence the magnitude of stress, is reduced as much as possible.

When a mouse is handled without being physically restrained, she does not give the impression of being stressed. For example, when I merely pick up a mouse, a firm grasp at the base of the tail, allowing the mouse to hold on to my fingers or sit on my hand does not appear to stress her.

In my experience, the way a mouse is scruffed plays an important role in her stress response to manual restraint.

Many people scruff a rodent—for example, a mouse—by lifting a skin fold that is parallel to the animal's long axis. This will automatically put pressure on the throat, giving the animal the feeling of being suffocated, which of course intensifies fear dramatically.

A better way, in my view, is to scruff the mouse using a skin fold that goes at 90 degrees to her long axis. This doesn't put pressure on the throat and avoids the animal getting unduly stressed while being handled.

I like your technique! This is how we hold our rats for oral dosing: kind of off to the side. They really don't struggle. I'll have to try it with mice.

Have any of you tested the handling method described by Hurst & West (2010) in the biomedical research setting? When you pick up a mouse using a tunnel, or when you pick up a mouse by cupping her in your hands, do you have the impression that the animal is less distressed (shows fewer signs of anxiety) when you then perform an intraperitoneal injection?

I do cup the mice in my hand when I move them to a clean cage, and never get a bite; the mice seem relaxed in my cupped hand, certainly not stressed.

Over the years, we've had the occasional trainer and/or vet suggesting we always handle the mice with two hands—cup them—or lift them in a tunnel or igloo. Unfortunately, like it or not, time is a factor here. It is simply not practical to handle mice in any of these ways to complete cage changing without increasing staff numbers or extending the change period far beyond the desirable limit. I think it is clear that the mice would prefer not to be handled at all and, as such, the kindest thing is probably to transfer them as quickly as possible by the base of the tail to the next cage.

I am not quite sure that a mouse who is picked up by the tail actually ever acclimates to this situation. After all, that's how a mouse is picked up by a raptor or by a cat. But it's true that the picked-up mouse is not struggling but gives the impression of being a lifeless prey hanging in the fangs of the predator. Being caught by the predator puts the mouse in a state of stupor (not fully conscious), which probably buffers the agony associated with being subsequently killed. I have rescued quite a number of mice and chipmunks that our cat brought in the house. These captured little rodents are limp in the fangs of the cat; once I get them (our cat is pretty cooperative with this) in my cupped hands they seem dead but, fortunately, in almost every case come back to life in a rather short time so that I can release them back in the yard and ... off they run for cover.

In my experience, mice still act crazy when you first start picking them up with a tube or cupped hands because they don't know what's happening. However, they quickly acclimate, and I think it's worth spending this little extra time. Even for myself, it is sometimes easy to forget and quickly grab

a mouse by the tail (for cage change). So, I think part of the value of handling via tube and cupped hands is that it forces the handler to slow down and be more aware that mice are sentient creatures rather than work tools. That attitude, I believe, plays its own role in decreasing handling stress.

It increases, at the same time, the scientific reliability of data that are collected from the mice. A little bit of compassion along with some extra time for the mouse benefits not only the research endeavor but also the ethical well-being of the person who handles the mouse.

Nesting material for mice

I am in the process of testing the usefulness of new nesting material with a small group of mice (25 cages). The material is known by various names depending on where it is purchased: Crink-I'Nest, Eco-Bedding, Enviro-dri. I've had a few questions pop up during this trial and was hoping someone on the forum had experience on a larger scale with this type of nesting material.

How much material is typically used per cage? The mice should be able to build a nice comfy nest without filling the whole shoe box cage. We have tried a golf ball-size amount, but some of the nests built have been rather large, making it difficult for staff to view the animals. I personally love the large nests, but I can understand the concern from the staff as it pertains to time constraints during animal checks. I'm hoping for that happy medium.

Also, has anyone used this product type with breeding mice or nude strains? Any issues with the folds of paper and young pups—paper sticking to them, paper cuts, etc?

We have been using Enviro-dri. This material allows the mice to build proper nests, but it makes it a bit difficult to properly check the mice—a minor trade off. Building a nest is, I think, the most important thing to most



mice; it probably buffers a lot of stress resulting from their captive environment. Good nesting material is very important stuff if you are a mouse!

Porter & Lane-Petter (1965) reported 50 years ago that pre-weaning mortality is significantly lower when mice can build a nest with shredded paper versus when they are kept on sterile woodchip bedding. Roper (1973) confirmed the importance of nesting material a few years later by demonstrating that female mice will work by lever-pressing to gain access to nesting material.



I like the Nest Scoring Chart from one of our suppliers. It grades nests from 1-5, with 5 being a full dome-shaped nest. This is what a mouse nest should look like; our mice need about 7-8 grams of Enviro-dri to build it.

We have had no issues with paper cuts or pups stuck to paper. I care for three ventilated racks and have not encountered any problems.

When we tested with an automated, computerized choice test, the preference of BALB/c and C57BL/6 mice for different nesting material, including Enviro-dri, we found a clear preference for intact soft paper tissues and paper towels; Enviro-dri did not score that well. It turned out that the mice prefer to shred paper themselves instead of using pre-shredded paper (Van de Weerd et al., 1997).

We strictly use Nestlets. I found that if given enough of them, the BALB/c mice will build a very nice nest, even the group-housed males. The C57BL/6 mice, on the other hand, just shred the material up and scatter it about the cage, making a kind of sleeping mound.

We have also found that C57BL/6 mice aren't the best nest builders if given

something too complicated. Enviro-dri is easy for them to work with.

The reason that you see different types of nest building is that C57BL/6 and BALB/c mice stem from different ancestors. C57BL/6 mice are burrowers who are not making beautiful nests, but elaborate burrows. BALB/c mice are surface nesters who have to make good nests to protect themselves. They make nice bowl-shaped nests when they are provided with the right material.

Do you have a citation for the different types of building? I've heard this before but haven't been able to find a reference describing it.

It was described by Van Oortmerssen (1971) and by Lee (1973).

We did a few studies on different types of materials for mice and found the Enviro-dri/ Crink-I'Nest paper was the best material for ALL mice to build with. C57BL/6 mice seem to have difficulty with the processing part of nest building. If something is too compressed they don't know what to do with it. BALB/c mice are awesome builders, so you can give them anything. Since thermal stress was one of the main reasons we were investigating

nesting materials—and we wanted them to build a warm nest quickly—we went forward using Enviro-dri in our research.

We use 6-7 grams of the Enviro-dri paper material per cage. We have placed little plastic bags filled with this amount throughout the facilities for people to use as a reference.

In a study looking at how much material we should recommend for different temperatures we found that, in general, C57BL/6, BALB/c, and CD-1 mice need at least 8-10 grams to build a nest that provides them a thermal benefit. Your mice with 6-7 grams of Enviro-dri are probably still cold in the nest they have built with this quantity of paper material! Since one of the goals of enrichment is to provide control over a stressor—such as temperature—I push very hard to get people to furnish the cages of their mice with enough nesting material so that the animals have a chance to keep warm.

We've used Enviro-dri for nude mice as well and have found improvements in

breeding with no increases in eye lesions (Gaskill et al., 2013). Not surprisingly, we have even seen breeding performance improvements in normal mice—C57BL/6, BALB/c, and CD-1 mice—as well.

Do you have any problems with flooded cages for the mice on ventilated racks? Our mice tend to make a large nest with Nestlets near or against the water Lixit and sometimes cages get flooded.

I find there is less risk of flooding with the Enviro-dri than with Nestlets. When we used Nestlets we only were allowed to give half of one, so the nest was not that big and flooding was less likely to happen.

With a half Nestlet, mice are unlikely to be able to build a nest that suits their thermoregulatory needs.

A half Nestlet is far from enough! If one intends to give only a half Nestlet per mouse, other additional nesting material is required so that the mouse can build a reasonable nest.

Identifying mice in their nest

When you work with mice, do you find that the routine health checks are less reliable when the animals are provisioned:

(a) with nesting material versus

(b) no nesting material?

If you do, what kind of nesting material do the mice in your care get?

The health checks are reliable when you don't fill up the whole cage with nesting material. One or two soft paper tissues or a yellow translucent tube with one paper tissue

are enough for mice to build a suitable nest, yet remain visible.

Building a proper nest already is a good indicator that the mice feel well. This does not mean that mice who don't build a nest are not healthy. There seem to be strain related differences in nest building and preferences for nesting materials. Some strain-sex-age combinations just won't build nests. We had good results with soft paper tissues for some strains and a piece

(approximately 10 cm) of flax rope in other strains. The amount of nesting material should be limited to a handful, so the mice will stay visible.

The mice get Enrich-o’Cobs at our facility; they build nice nests and we have very little trouble with observations. After cage change the mice go right for the twisties and start building again!

Our mice get one Nestlet per cage; they make a great nest with it but all mice in it are visible. We also give them transparent shelters in which they can hide and build nests while remaining clearly visible for health checks.

I take care of about 1,500 ventilated cages. Our mice get Nestlets and I like to see big nests. I do not find a large nest an added burden at all. If the mouse has a nice large nest, I can move the whole thing intact with little disruption to the animals. If I need to observe the animals I just pull out the cage a bit and look from underneath. If I see movement, then I assume all is well. They get a close health check during the cage change. I can also observe newborn litters with little disruption.

I’m also really glad you mentioned observing mice from the bottom of the cage. We do that too! It’s very easy to see if a new litter is in the cage or to count feet from the bottom.

Our mice construct nice nests with Enviro-dri but it is very hard to see them when they don’t want to be seen. We don’t have the time to put every box in the transfer station and do health checks, but I try to look at other signs in the cage that something might be wrong. A mouse by herself outside the

nest is usually sick or she could be bullied; the situation warrants a closer look. If a nest is not made, a thorough examination may be required and, of course, if any signs of blood are noted there is most likely a problem that needs to be addressed immediately.

Nesting material is a difficult topic because if you don’t give enough for a proper nest (strain sometimes determines what is proper) then what is the point? A nest that does not do what the mouse needs—seclusion and thermoregulation—can sometimes be more stressful to the mouse than no nest at all. Most mice like to hide and be concealed from what is in their environment, especially from techs who are disturbing them in order to have a look; the mice don’t know that it’s for their own benefit. It is a balancing act that is hard to get my head around most days—what is better for the mouse (the proper nest) or what is better for me, which is to see them and be assured that they are all okay.

You don’t want to see the mice when they have a big nest. Mice who are ill or in pain do not engage in nest building. Therefore you can use the nest as an indicator of how the mice are feeling that day.

We also use Enviro-dri. Yes, it is difficult to see the mice but they seem to like the material and build fabulous nests with it. Even our most difficult breeders tend to be better parents. We plan to switch our entire facility over to the Enviropak, which consists of premeasured Enviro-dri in a tea bag-looking packet.

I agree, Enviro-dri is tough to work with for health checks; we only use it for our nude mice. We tried out those bags you mention, but found that many of our mice would just

chew a hole in the bag and crawl in! Then it was mouse-in-a-bag, which was pretty much impossible for health checks! LOL!

We also had a few mice who would chew a hole and then move into the little bag. That’s the fun of enrichment, right? The animal has more control over the environment.

It has been our experience that if you can see the mice cage-side, they likely are not able to make a nest of sufficient quality to be protected from cold stress.

We’ve evaluated 4 and 8 grams of Enviro-dri, 4 and 8 grams of Carefresh bedding, huts, and Nestlets; the only nesting material that improved feed efficiency was the 8 grams of Enviro-dri.

We also did an epidemiological study evaluating our ability to recognize sick mice in the presence and absence of nesting material. After collecting over 1,000 clinical cases, equally split between cages with versus without nesting, we found that we were just as likely to identify sick or moribund mice whether or not nesting material was present in the cage. With nesting material in the cage, we were not missing animals in need of immediate veterinary attention during cage-side health checks. In fact, we had fewer false positive cases—mice who appeared sick to husbandry staff due to being hunched and scruffy but upon veterinary exam were healthy—in cages with nesting material. We think that the cold stress resulting from no access to a proper nest can make mice appear sick when, in fact, they are just feeling uncomfortably cold.

It may be time to start rethinking what it is we need to see during a cage-side exam. Perhaps not seeing the mice because they are all in a well-built nest can be taken as a sign that we have healthy animals.

I do not think the nest-limited viewing is an issue. A well-constructed nest with all the mice snuggled in it tells me that the mice of this cage are most likely all healthy; a sick animal is typically kicked out of the nest and is easily detected during the health check.

Burlingame & Lofgren (2014) analyzed 800 ATRs (Animal Team Reports) and found that the provision of nesting material did not result in an inability to identify sick mice and, therefore, did not cause an increased incidence of mice found dead or moribund.

All of our mice are provided with Enviro-dri no matter the study design. Enviro-dri has been proven to be one of the best and one of the most preferred nesting materials for our mice. At each Clinical Sign Observation (CSO), we instruct the technicians to lift a part of the nest if mice can’t be seen cage-side. Of course, it takes a little bit more time for the techs to perform their CSOs, but I strongly believe it is best for the science. We should keep in mind that we do not offer nests to mice only as a way of environmental enrichment. We offer them nests because it is part of their physiological needs. It has been documented that mice not provided with a nest suffer from thermal stress and that this thermal stress has an important impact on their metabolism and physiology (Gaskill et al., 2009; Gaskill et al., 2013). So in my opinion, providing nesting might be a little bit more costly in terms of technician time, but it surely fosters better science. Therefore, everybody wins! And as for disrupting the nest at CSOs, it does not seem to be a problem for the mice. I consider it as a kind of environmental enrichment. It gives them an extra challenge to rebuild it at their convenience.



The idea is not my own, but we have started providing nesting material to a room of breeders and being okay with not laying eyes on them every day. I had to convince our husbandry staff not to ‘earthquake’ the cages so they could look at all the mice in the

cage during sporadic health checks. It turns out that these mice seem to be arguably happier, plus they are better breeders (cf., Porter & Lane-Petter, 1965; Gaskill et al., 2011; Jackson et al., 2015)—their purpose! I began tracking numbers of animals ‘found dead’ before switching to increased nesting material and can say that the rates have not gone up. Despite being ‘out of sight’ most of the time, these mice are thriving and do not seem to be missing any extra attention or special vet care.

We started this refinement attempt in one small breeder room only. Incremental improvements are sometimes the best way to make people comfortable with scary new things.

Yes! We call that ‘no sudden movements!’ at my job.

Cold stress in mice

The ventilation arrangement of individually ventilated cages (IVCs) bears the risk of imposing chronic cold stress on the caged mice—a welfare concern and an extraneous variable—unless the animals have the option of avoiding exposure to the artificial current of air. Mice don’t like to be constantly exposed to a strong air stream, so they build their nests away from it, even if it implies away from the relative dark and undisturbed rear section of their cage (Scales & McDonald, 2011).

What are, in your experience and observations, practicable and safe options for protecting rodents living in IVCs from cold stress?

For mice, I will say definitely nesting, nesting, nesting and more nesting!

“Although mice avoid IVC in preference testing, they show no aversion when provided additional nesting material or if the cage is not ventilated” (David et al., 2013).

The most effective way to protect the mice from cold stress is making sure they have enough of the proper substrate to build a dome-type nest. This probably takes several different nesting materials that can be woven together to construct a well-insulated nest. I also think a solid shelter is a protective option and feel that both a



shelter and nesting material are necessary for the mice to achieve species-adequate thermoregulation.

Nesting material does not bear the risk of triggering flooding?

I have used a variety of nesting materials and really have only seen flooding due to Nestlets—not often mind you, but I have seen it. The mice stuff it through the back of the shoebox into the space around the Lixit. Most of the time our mice use the Nestlet to build their nest inside their little hut, but every once in a while you get a mouse who just likes to stuff the material into the Lixit. For this reason I always pop into all the mouse rooms first thing in the morning just to make sure no one is swimming. When you see the mice swimming once, you never want them to have to go through that again. I have luckily always gotten to the flooded boxes in time to not lose any mice.

I usually recommend 8-10 grams of the crinkled paper nesting material (Enviro-dri). It seems to be the best material I’ve come across so far that even poor nest builders can use. We have implemented the crinkled paper in a few housing systems (automatic watering and bottles) and have not encountered any flooding issues; when this material gets wet it does not stick to the Lixit or sipper but disintegrates and falls away from the drinker.

We keep our mice warm via a combination of Nestlet, Enviro-dri and—most importantly—cage mates. Our mice cannot be housed individually unless necessary for medical or behavioral (e.g., barbering, social incompatibility) reasons. The nest material does not affect the water sipper in our IVCs as the mice tend to form their nests at the front of the cage, away from the air and auto-water supply.

Food grinding in mice

Based on your own observations, why do you think that some mice engage in excessive food grinding? According to your own experience, what is your recommendation for addressing this problem, or perhaps you don't regard it as a problem?

The only real problem this behavior presents is having to change the cage more often. At our facility, we typically see this in CD-1s/ICRs although, on occasion, mice of pretty much any strain will engage in this behavior. We have tried several methods to deal with it, to no avail: increased bedding, increased nesting, chew toys, bamboo tunnels, running wheels, different food, HydroGel, and increased foraging opportunities. I should mention that the room environment of our mice is always kept consistently within normal ranges. We have noticed a possible correlation with construction noise but I have my doubts, as the increase in grinding at that time seems minimal.

We give excessively grinding mice extra food and change their cages twice as often as usual. Who knows, maybe they want a fresh clean apartment sooner and this is their way of forcing our hand.

Our mice show increased food crumbling behavior during high air humidity conditions. They are kept in a relatively old building that does not allow us to regulate air humidity with precision. It could be that our mice engage in more food grinding when their food gets relatively soft, hence easier to process. Maybe it's an innate response to gather all the food that is available; you never know, there may be a harsh winter to follow.

We don't give our mice extra enrichment with the hope of controlling the excessive food grinding but change the cage more often; once the air humidity lowers this behavior disappears.

There is a great paper out in which the authors—I can't remember their names—found that the food grinding of mice is correlated with increased air humidity and/or softness of the chow/biscuits.

I would make sure that air humidity in the food room is within limits and that feed bins are always closed tightly.

The article you are referring to is by Nelson & Dysko (2006), who note that “neither of the enrichment tools (Gumabones or a cellulose/corn cob mixture) improved food-chewing behavior. As the humidity decreased over the 3-wk period, so did the abnormal behavior, regardless of the enrichment status of the cage.”

We have a small number of food chewers—notably, all in the same room. As of now, it appears to be seasonal for our mice. They shredded their food all summer long, but come fall, the behavior stopped. During the shredding time, we gave them Shepherd Shacks to see if that would help, but the added shelter didn't have an effect on the behavior. It also doesn't appear to have any correlation with housing status (single versus social) or mouse strain; certain animals simply love to shred their whole food ration, very quickly. It will be interesting to see if the behavior starts up again next summer.

At my last facility we had mice excessively grinding their food also in a seasonal pattern; we tried pretty much every environmental enrichment option on the market. Nothing we tried helped with any of our strains! We were finally able to control the behavior by autoclaving the food for the rooms of the worst food grinding offenders. That pretty much stopped it in these rooms.

With our specific subset of mice food grinding has been an ongoing issue, regardless of season or humidity. Our food is already autoclaved, and that doesn't slow them down one bit.

We operate under the theory that excessive food grinding occurs when a strain of mice is experiencing an overexpression of the third of four distinct foraging behavior segments that make up the complete foraging process in all species. ALL animals must: 1. Locate food; 2. Obtain the food; 3. Process the food; 4. Ingest the food. For each of these four steps, the animal is instinctively programmed to spend a certain amount of energy and time before taking the next step. In the laboratory environment, not much energy and very little time is required for a mouse to process her food—step 3 is under-expressed; when the mouse has finished processing her food ration, she still has an instinctive drive to continue: she gets stuck in a behavioral loop and goes on grinding more pellets without actually consuming the food.

The way we've attempted to address this problem (with mixed, and not yet quantified results) is to add seeds to the diet, which require more processing efforts and more processing time.

I very much like your ethological explanation of this behavioral phenomenon; it applies

probably to all under-expressed behaviors and behavior segments not only in mice but in animals/humans in general. It is the root cause of stereotypical activities.

Quite a number of our mice also engage in excessive food grinding. It's not humidity for us, as humidity is very strictly controlled in the animal rooms. Our food pellets are hard and pre-autoclaved. We've noticed it's gotten worse after we switched from expanded to extruded diet which, if anything, is harder. The pellet crumbles are causing a lot of problems with dust in our IVC cages. The mice just sit up by the bottom of the food hoppers and chew away! I do think maybe it really is a stereotypical behavior.



Same-sex social housing of male mice



Male mice are often housed alone in toxicity studies. Typically such mice are relatively aggressive and not so easy to handle. Are there practical and safe options for housing male mice in pairs or in compatible groups during long-term studies?

If you have experience with this housing arrangement, do you find that male mice are easier to handle when they are kept in compatible pairs or groups versus alone?

Your first question was the subject of my thesis (Van Loo et al., 2001). My findings can be summed up in the following recommendations:

- › House males in small stable groups of three mice. More individuals in a group increases the chance of aggression exponentially, fewer individuals (i.e., pairs) increases the chance of one animal being bullied without the opportunity of getting social support from another submissive animal.

- › Transfer nesting material but NOT bedding material during cage cleaning. Nesting material is kept clean from urine and contains aggression inhibiting pheromones from the plantar glands in the paws; urine, on the other hand, contains aggression-eliciting pheromones.
- › Keep disturbances to a minimum. Each disturbance may elicit aggression between males, and once it has started in a cage, it is usually not easy to control. Although some disturbances may be unavoidable during a study, you may think of solutions such as combining handling procedures with cage cleaning.
- › Use enrichment that can keep the mice busy (e.g., nesting material) and does not allow for territorial defense of specific areas of the cage (e.g., rigid shelter).
- › It is important to keep in mind that some male mice may develop pathological aggression. These animals are best kept alone or with sterilized females.

We have many cages of socially housed male mice who are usually fine together.

I do find that it is easier to work with socially housed males than with individually housed ones. When they are kept alone, male mice tend to be rather jumpy.

It is my experience that group-housed male mice are relatively easy to handle and will let me pick them up by wrapping my hand around their body; no single-housed mouse has ever let me do this! Goes to show the importance of trying everything possible to keep them with a cage mate!

Refined caging for rats

We have a project coming up where the investigator is willing to let us try out different styles of housing for rats. It is my plan to provide the animals with more space by interconnecting two standard cages. I wonder if the rats would prefer a deep layer of bedding in which they can burrow over elevated structures on which they can rest/sleep.

We cut half of the bottom out of a large rat polycarb cage and stack that into an intact cage. The wire lid then fits on top with food and water just like a standard cage, only it is much taller. The rats use the bottom cage to sleep and hide and enjoy climbing onto the top cage. When using this arrangement, you have to be cautious to file the cut edge of the top cage, as the heavier rats could injure their feet on the sharp edges.

We also have a project with rats in ferret-style cages with hanging hammocks, ladders, blankets, etc. The rats climb very readily, shred the blankets and sleep under them either on the ground or in the hammocks. Climbing really seems to be their thing. In another project, rats have access to deep soil in a ferret-style cage. The animals make burrows and, when frightened, head into them.

There has been a study done on lab rats released into a semi-natural outdoor pen (Berdoy, 2003). One of the first things the rats do is dig an elaborate burrow system. I believe this is a behavioral drive that is even stronger for rats than for mice. The problem is that providing a burrowing space is not easily achieved in the laboratory, since

it's so hard to clean. I do think rats would benefit from structural complexity such as a two-level cage. This would be more practical than providing them with a sufficient amount of burrowing substrate.

Will the rats of the upcoming project be group-housed or singly housed? What type of bedding substrate will you use? Will you provide environmental enrichment?

The plan is to pair-house retired breeder female rats; I hope that increased space, especially if we have two connected standard cages, will lower the chance of fighting.

We use PVC tubing for enrichment; I am also looking into gnawing blocks and Nylabones.



I'd definitely include items the two rats can manipulate, as well as some form of nesting material. They may not create a properly constructed nest with it—as mice would do; rats typically just make sort of a mashed down cup-like structure of the material. You may want to consider a flat, raised platform that they can climb and lounge on. I've also seen rats make use of a hammock-style sleeping area, similar to what you might provide for ferrets. If you furnish the cage with a raised resting area, make sure it is large enough so that both rats can share it simultaneously if they wish.

Rats use platforms for climbing and jumping and as shelter underneath. They also use

nesting material but—unlike mice—they first have to learn from their mother how to build a nest with it (Van Loo & Baumans, 2004).

We suspend PVC tubes from the cage tops; the rats always sleep in those raised shelters rather than on the floor of the cage. Some cages are equipped with a raised shelf, and again the rats are usually found resting on the shelf rather than on the floor. Rats seem to prefer to rest well above the ground level of their enclosure.

We purchased a bunch of rat lofts for our sentinels; they love them. I would often find two individuals squished together, relaxing on the little platform. Too cute!



Same-sex pairing of rats

Do you have any experience in re-housing rats who end up alone due to the death of cage mates? Is it better to leave the rat singly housed than pair her with an unfamiliar rat? I tend to believe pairing is best, but I am looking for practical evidence that demonstrates this.

In a small standard-size cage, a rat is probably better off alone than with another unfamiliar rat because two rats would not have enough space to respect each other's individual space requirements, especially in the beginning when the two have to sort out who is dominant and who has to submit to the other.

All our rats are housed in 210-square-inch solid-bottom polycarbonate cages equipped with two sippers, several chewing objects, a hiding tunnel and lots of bedding. Do you think this might be enough?

I would think it's worth a try. Make sure to offer two sleeping huts at first and scatter some food enrichment in the bedding so that the two rats have a lot to do when first introduced to each other.

We re-pair male Sprague Dawley rats after they recover sufficiently from surgery—sometimes with a previous cage mate, other times with an unfamiliar rat. Typically, the re-pairing creates no problems and the rats get along with each other very well. It happened only once or twice that we had to separate a new pair due to fighting.

We had a few single-caged rats who showed signs of over-grooming or barbering. Re-pairing them with another

cage companion significantly improved the behavioral problem.

How do you proceed when you want to safely pair two unfamiliar rats?

The vet staff here do the pairings of single rats. They usually choose another rat of about the same size and age as the single rat, introduce the two in a clean cage with clean toys, observe them for a while to make sure that they get along well with each other and finally label the cage as a 'new pair' so the techs can then continue to monitor the new cage mates who typically work out without any issues.

My experience is that adolescent rats will not fight at all. Young adult rats are unlikely to fight as long as they have not had sexual experience. There is little risk that female rats will fight with each other, unless they have pups. Adult male rats are best paired in a clean cage that is unfamiliar to both of them; they usually get along well with each other when they are paired.





Same-sex social housing of hamsters

Does anyone keep hamsters in a group or in pairs, males or females? I would guess if they were kept together from a young age they might be okay for a while. Is a small group better than a pair for dispersing aggression and keeping them compatible?

It is my experience that pair-housed females get along with each other reasonably well until the age of about 8-12 months. At this age, the females tend to get more and more engaged in fighting. When this happens while the study is continuing, we separate the pair.

Arnold & Estep (1990) tested 3-month-old male hamsters and found that the animals show a strong preference for being with other males (groups of four males) even though injurious fighting occurred occasionally. Arnold & Gillaspay (1994) made similar findings in female hamsters; obviously, “hamsters do not prefer being housed individually.”

Our hamsters arrive at 4-5 weeks of age. We keep them as isosexual pairs or groups with very few issues related to overt aggression.

Cage mates stay together for six to twelve weeks in research protocols followed by approximately five months in teaching protocols.

Placing food (pellets and sunflower seeds) on the bottom of the cage and plenty of nesting material—we use Enviro-dri and paper towels—along with shelters such as glove boxes or needle boxes definitely helps to keep peace between companions. At cage change we do hear a few squeaks and see some wrestling, which typically has no injurious consequences.

It is my experience that hamsters get along with each other better when they live in groups rather than pairs. Serious fighting is very rare in groups but it does occur occasionally and without any noticeable warning signs in pairs.

How many hamsters do you keep in a group?

When the hamsters are sexually mature, we keep 5-8 animals, when they are immature up to 11 animals in a group.

Refined oral dosing of rodents

When mixed with the right decoy (e.g., juice, yogurt, coffee) many drugs can be administered on a spoon to non-human primates. This method circumvents stress/distress associated with oral gavage.

Have any of you tried this kind of user-friendly trick with rodents?

When I was in small-animal practice, some clients sent me pictures of their rats licking compounded and flavored medications from a syringe. Apparently the rats would even get excited for their daily or twice daily dose of antibiotics and come running to the cage door when it was medication time. It is probably just a question of getting the right flavoring to hide the bitterness of the drug.

I had a dwarf hamster as a pet many years ago; he took cherry-flavored tetracycline from the spoon without any ado.

Let me attach a photo that prompted my question; the photo is from Flickr Creative Commons and has the caption: Balboa gets his meds.



I believe not only primates are good candidates to learn how to avoid stress associated with procedures, but rodents also have this potential.

I recently was looking into research in this area to see if anyone had published findings on this kind of refinement. The only study I found was in the last issue of *Laboratory Animals* (Corbett et al., 2012). I find this topic extremely important since we often don't know the extent stress from enforced dosing has on the science we are trying to conduct.

Thanks for pointing out Corbett's article. The authors integrated oral medications with a sugar-cookie dough ball (~4 g). This method has worked consistently to deliver the medication (complete ingestion) in four different strains of rats, with reliabilities ranging from 98.6% to 100%.

I was wondering what flavors mice would like?

We use condensed milk to administer drugs orally to mice. They learn to like the milk-medication cocktail within two days.

Mice looooooove bacon, and oatmeal.

They like lard very much. We melt lard, add the medicine, mix it thoroughly, put it in a syringe, let it get stiff, take it out and cut it in small slices. A bit labor intensive but it works very well; the mice love these 'treats.'

Post-surgical recovery of rodents

It has been my experience that rodents are typically transferred into a new, clean cage after experimental surgery. If I were a mouse or a rat, I would feel pretty disturbed or even distressed in such a scenario, and I would think that I would recover from surgery and the post-surgical stress quicker if I would be surrounded by the familiar scents of my own nest/cage.

What speaks against allowing rodents to recover from experimental surgeries in their familiar olfactory home environment?

I certainly would want to wake up in a familiar environment. I have had several surgeries over the years and it is quite disturbing to wake up where you can't remember being! If it is stressful to me—and I can rationalize it—how must a rat, mouse or guinea pig feel?

Jirkof et al. (2013) observed that female C57BL/6J mice are significantly less inclined to burrow, were significantly more agitated and significantly more restless when they recover from surgery in a new clean cage versus in their familiar home cage, suggesting that “transport to a new and clean cage might be an additional stressor after an exhausting event and may affect recovery.”

There is no good reason for not transferring at least a little bit of the familiar nesting material—a piece of the Nestlet or a piece of the paper tissue—of the home cage to the new, clean cage to provide the recovering rodent a familiar, comforting scent in an otherwise strange, presumably fear-inducing environment.

I must admit, I have always returned post-op rodents to a clean cage but this was to reduce the chance of infection. The idea of transferring their Nestlet to the new cage so they have familiar scent is, indeed, appealing.

New, clean cages are mandated for rodents post-surgery because the research staff doing the experimental surgery would very likely put the animals back into the very dirty or wet home cage. Using a new cage is a guarantee that chances of post-surgical infections are minimal. Instructing the research staff to move a pinch of dirty nesting material from the old cage to the clean new cage would probably not have the desired effect.

Are any of you working at a facility where some of the familiar nesting material is transferred to the new cage in which rodents recover after surgery? Adding a little bit of the animals' familiar nest scent to the clean recovery cage is unlikely to jeopardize the research, but would it be too much to ask for in a busy work environment?

No, I think it would be very little to ask for, and it seems like a sound idea.

Our institutional survival surgery policy states that “rodents should be returned to clean cages with fresh bedding to prevent fecal contamination of the fresh surgical incision.” This makes sense and is a very common practice.

I believe most people, being uncertain exactly how contaminated old bedding/ nesting material might be, simply omit transferring nesting to the new cage. I can't

say I'm surprised, but it would be nice to have a better understanding of how contaminated old nesting might be as, if the risk is negligible, transferring relatively clean nesting would be an excellent practice due to the fact that most post-surgical rodents are slow to build a new nest to aid in thermoregulation; if they could recover in their own already-made nest, it would certainly speed their recovery. Would be a win-win!

A one-day-old nest will not be soiled, as rodents keep their nests clean and urinate and defecate somewhere else!

We clean cages one day before surgery. After surgery, we let the rodent fully wake up alone in a warmed clean cage and then return the animal back to his or her home cage with the familiar cage mates.

The clean cage in which the animal regains consciousness after surgery is provided with some nesting material of the one-day-old familiar nest of the home cage so that the animal is surrounded by familiar odors while waking up.

We let our mice and rats recover from surgery in their own cages whenever possible. This means that the animals recover in their home environment where they not only are surrounded by familiar scents but also receive the social, stress-buffering support of their familiar cage companions. To reduce the risk of suture biting by cage mates, we either use intradermal suture or metal suture clips.

What is your opinion on social housing of rodents post-op? I want to try to push for housing them together right away after surgery as a routine practice; this may be an uphill battle, so hearing from other institutions that do not routinely separate

rodents post-op would be very helpful.

The stress-buffering of the presence of a familiar companion has been demonstrated in rats (Davitz & Mason, 1955), mice (Goldsmith et al., 1978) and guinea pigs (Sachser et al., 1998).

I always keep pair-housed rodents together after one of the companions has gone through an experimental surgery. It has been my experience that sutures often get chewed—whether it's self-chewing or buddy-chewing is another question—so I either bury sutures or use wound clips without any issues.

Like you, we either use surgical staples when the wound is in an area where the staples don't hamper the animal's movement, or we use intradermal suturing.

Unfortunately, individual housing is still used in our lab when animals are implanted with either brain or jugular vein catheters.

We almost always socially house rodents after surgery. The only exceptions are external implants and animals with bandaging material.





Housing for chinchillas

We have an investigator who will do research with chinchillas. I have never worked with these rodents before. It would be great if some of you who have direct experience with chinchillas can share practical suggestions on the species-adequate housing and care of these animals.

In their native habitats at high elevation in the South American Andes, chinchillas live in social groups in burrows or crevices in rocks. They are slightly larger than ground squirrels, very active and agile jumpers who can jump up to 6 feet. They clean their dense, velvet-like fur by taking dust baths, in which they roll around in fine pumice, a few times a week. In captivity, they need extensive exercise to keep healthy and since they lack the ability to sweat, ambient temperature needs to be carefully controlled.

I LOVE chinchillas! I worked with them for quite a while; they are so much fun! They can seem a little skittish upon arrival, but once they settle in, they're darling little things. You're going to love them.

I've kept them in standard cat cages, large cat cages and standard rabbit cages. Chinchillas hop [if they don't have enough room to jump], so they need relatively high living quarters. Grated flooring is not suitable for them as their feet can easily get caught in the wires. Thus, you need to provide them with a solid floor surface such as a cage liner.

Chinchillas overheat very quickly, so it is important to keep the room temperature a bit lower than the usual optimal temperature range for the other rodents. They need a hiding/nesting box, preferably one that is

relatively narrow. A shoe box with a hole cut out or a long pipette box with the front torn off are well accepted by the animals; Carefresh or hay provide optimal bedding in such shelters.

The provision of a dust bath is a MUST for chinchillas. Get some dust or very fine, dry sand; put it into a mouse box, place that into their cage and let them go bonko for about 30-45 minutes. It's a blast to watch!

Chinchillas adore wooden blocks and other chewy things designed for smaller pets. Also, I purchased a couple of those large clear exercise balls so we could let the little guys go bananas about once a week for exercise—they're very active little critters! As for food enrichment, small pieces of fruits and veggies, yogurt drops, raisins and other small items are always a hit. Just don't overdo the sugar or you're going to have little beggars who won't eat their chow.

Finally, hay is essential for chinchillas and should be provided daily as part of

their standard diet. I've found they enjoy the timothy best.

These rodents like to get above ground level, making it advisable to furnish their living quarters with perches or shelves.

Chinchillas like to take dust baths and they like to chew. We provide them with the dust (fine volcanic ash or eroded pumice rock) in a small cat litter box every day so that they can keep their fur nice and clean rather than oily. They also get wood blocks so that they can chew as much as they want, and we give them fresh hay on a regular basis and a hut in which they can hide and rest.

When we housed our chinchillas in standard caging we used rabbit racks that we furnished with a structure for hiding (PVC tube or elbow or a plastic hut serving also as a perch) and an item for gnawing (pumice stone or wood block). The animals





had weekly access to dust baths and daily access to loose hay. They got treats/rewards (Cheerios or raisins) whenever they were handled by lab staff.

Our chinchillas are housed as compatible pairs (adults) and compatible trios (juveniles). We currently have to keep them in IVCs. Initially we put in plastic huts, but the animals were pushing them against the Lixit and flooding their cages. They still receive regular access to hay, gnawing devices and weekly dust baths.

Hay for rabbits

Does anyone have any suggestions for a hay-dispensing enrichment device for rabbits?

Wire whisks stuffed with hay and hung at the side or from the ceiling of the cage provide great foraging enrichment for rabbits. The wire whisks are inexpensive and easy to clean.

Hay balls are similar to the wire whisks; they are inexpensive pet toys and come with a short chain and a little bell attached to the bottom of the ball. The caged rabbits I worked with liked those hay-stuffed gadgets quite a bit, not only for the sake of foraging but, I think, they also enjoyed making noise with them.

We started giving the hay stuffed tightly into tunnels—normally used for mice—so

the rabbits roll them around and pull the hay out little by little. These tubes consist of polycarbonate so they withstand cagewash and rabbit gnawing.



I put some hay into the paper bags our bedding comes in, roll the bags up and give them to our rabbits, who spend quite some time engaged in foraging from and in them. Rabbits love picking hay out of cardboard or PVC tubes. Closed cardboard boxes filled with hay are a fun thing for rabbits to rip apart to get to the hay.

How often are you all giving hay to your bunnies?

I gave it daily when I cared for rabbits; it was not enrichment but a standard.

All our bunnies receive hay every single day. I've learned that they enjoy a change in the type of hay; I keep several varieties on hand: timothy, botanical, orchard grass, oat hay and alfalfa.

We, too, keep a few different types of hay on hand (meadow and timothy) for those picky eaters.

Where do you purchase your hay?

We obtain all our hay from a local feed vendor. All hay varieties are Oxbow brand, and I am fortunate in that autoclaving is not required for our colony. Thus, we serve right from the bag!

We do the same thing, same hay brand fed right out of the bag, as well.

Do any of you feed autoclaved hay to rabbits? If you do, how do the rabbits react to it?

We used to give our rabbits autoclaved hay, but they would never eat it. They would just make a mess of it. Now we order irradiated hay, and they seem to love it!

We autoclave the hay lightly—250°F for 3 minutes—in small batches. This seems to make it highly palatable as our rabbits love it.

Our rabbits also have no problems with autoclaved hay; they eat it without any hesitation.

Caging for socially housed rabbits

Can anyone recommend good social-housing arrangements for rabbits?

Our rabbits have been housed in floor pens for quite some time. Based on their size, we keep 2-3 does in each pen. The pens have a 42 x 42-inch floor space and a height of 30 inches. It was an animal victory to get the rabbits out of smaller, more sterile cages into these relatively spacious, bedded pens.

We have recently purchased some of the Allentown social rabbit cages; they are pretty expensive. The cages are sturdy and don't break easily. The front door is nice to hang rattles and other items on as well. I do like the Plexiglas divider; it is easy to place and remove when needed. One of the drawbacks to these cages is that the bottom part that can be pulled out has a very low back. If you try to get a rabbit who is hiding in the back and pull the cage bottom out a bit, the animal can jump over the back and down into another rabbit's cage—not a good scenario!

In our facility we use dog runs for group-housed adult rabbits. We remove the partition between the runs to expand the area for more room to move around. Bedding (Betachip) is used to cover the floor in the runs and large cardboard boxes serve as shelters. Some time ago, we group-housed immature New Zealand rabbits in large aquatic tubs; these rabbits were only here for a short period of time so they did not outgrow the tubes.

Our rabbit groups are also kept in dog exercise pens. We furnish the pens with

plastic buckets lying on their sides (sheltered retreats for resting), plastic buckets without bottoms (tunnels to run through), milk crates placed upright (look-outs), one food bowl per rabbit and several Lixits. The floor is covered with wood shavings. We also have various toys (dumbbells and balls) scattered around the floor. Each group of rabbits stays in its pen for up to two months at a time.

We keep a pair of guinea pigs in the floor pens. They do a great job buffering aggression among the bunnies. I'm not sure if it is the constant movement of the guinea pigs that keeps everyone from clearly setting up a territory, or what; but there certainly is more peace among the rabbits.

We have an exercise/socialization program for our adult female rabbits. We went to a pet store and bought the dog exercise pens that can be set up in different configurations. They have a swing door that allows you to easily walk in and out. We have placed several of these playpens in one room and have them all furnished with brown cardboard-like paper, some toys, rattles, hay feeders, water, veggies and hidey houses.



The rabbits are rotated through the playpens. Rabbits in neighboring pens can see, hear and smell each other but they cannot physically contact each other. Each doe stays in her pen for about 30 minutes per session.

When we first started this program the rabbits were shy and mostly stayed in one place with a look on their faces that was not very positive. They now like to hop around,

Same-sex social housing of mature rabbits

Can any of you share a success story of housing female rabbits uninterruptedly together as compatible pairs or groups beyond the age when they have reached sexual maturity?

We have watched our mature female NZW rabbits housed in pairs or groups go from doing really great together for one week to several months to finally being all separated and again single-housed. Serious fighting resulting in dangerous injuries, especially genital wounding, forced us to stop the social-housing attempts for now until we come up with a new, hopefully better strategy for housing does in a social setting.

The NZW female bunnies that we receive from the vendor come as compatible pairs; they are approximately 70 days old. We keep them pair-housed in double cages that are provisioned in each cage section with a tunnel-like platform, serving as an elevated resting surface and hiding area for each of the two rabbits. There is a partial divider that is open in the front half and solid in the back half of the cage; it offers the two rabbits optional visual seclusion in the back of each

play, explore or just hang out watching the other rabbits. We hope that this protected-contact housing arrangement is a good start to transfer the rabbits to full-contact social housing. So far we have had no luck; all does fought with potential cage mates. If anyone has any suggestions on the introduction and continued pair-housing of rabbits, I am all ears—no pun intended!

of the two cage sections. Cage companions stay together through maturity. They are our training rabbits for technicians, sometimes they are assigned to PK studies.

Within the past year, we had 36 adult female pairs; only 3 of these pairs had to be permanently separated due to injurious fighting.

We have tried to socially house male NZW sibling bunnies from birth but had to separate them when they reached sexual maturity because they got into some nasty fights with one another.

Your experience is the same as ours; we stopped trying to pair-house bucks. Being artificially confined in a cage makes it probably impossible for them to keep adequate social distances from each other to prevent overt aggressive disputes.

To socialize adult intact male rabbits with each other is indeed a risky business. I have even witnessed intensive threatening (stomping, urine-spraying and hissing) between singly housed bucks who were kept in a male-only room. At times, I've had



to move individual males within a room to reduce the overall antagonistic tension.

Rabbit bucks are not solitary in nature; in fact, they can live in large warrens with a dominant buck and many subordinate bucks. Surely, there are differences in our laboratory rabbits, but I think these guys ARE social. We should not force non-compatible animals to live together, but I believe we should recognize that we are seeing aggression not because rabbit bucks have no positive social inclinations, but because our housing situation in the lab (small cages/pens, even if very large by laboratory standards) is not appropriate for keeping them together in the same enclosure.

We did a 6-week study looking at a group of six adult intact male NZW rabbits kept in a 5 x 5 feet [1.5 x 1.5 m] large pen provisioned with pine shavings and lots of tunnels and cardboard boxes. The group did not work out well because the animals did not have enough space to properly exhibit submission by fleeing out of sight; this made fights

inevitable. I decided to disband the group for the safety of the animals.

In the research lab setting, it is very unlikely to somehow overcome the spatial needs of adult male rabbits to live together in a well-functioning social structure that makes constant bullying and serious fighting unnecessary.

What speaks against the housing of male rabbits in a protected contact pair-housing arrangement?

We had great success with a protected social contact barrier—cage divider with holes in it—for our adult male NZW rabbits. We filmed them for several weeks throughout the day and night and found they demonstrated a preference for spending time closest to the portion of the divider that provided the greatest amount of contact possible. We saw a greater diversity of behaviors and a normalizing of their circadian rhythm, too (Lofgren et al., 2010).

Dealing with an aggressive rabbit

We have a female rabbit who is intractable. She is a 10-month-old retired breeder who BITES. When I got nailed I thought maybe I missed a cue or she was just having a very bad day. However, today she's no better. I approached her very slowly and quietly. Then, without warning, she lashed. Her ears were up, her eyes were normal, she didn't wiggle her butt, didn't piloerect, didn't thump or hiss, nothing. She is obviously not in any pain, and she's acting completely normal otherwise. I've never met a bunny like her and can say she packs a punch. When you want to get her out of the cage she makes it very clear that you better stay away from her. How do you deal with such an unfriendly, potentially dangerous rabbit without the aid of a sedative?

Have you had this rabbit her whole life? What do you wear in the room when care giving? Could she have had a bad experience with someone dressed in similar-style clothing? If you wear a gown or lab coat you may try switching to something else to see if her behavior changes.

I'll try this afternoon wearing no lab coat and see where we go.

It's late, so this is going to be quick, but I did want to report how things went today. Bunny did MUCH better without me in the lab coat. I allowed her to approach me rather than me approaching her. I then offered her lettuce and hay both of which went over quite well. So, I guess the coat was indeed the issue.

Music enrichment for rabbits

Do those of you caring for rabbits routinely play music in the animal rooms? Do you think it benefits them?

We have a quiet radio playing in our rabbit rooms during the time we are on site. The sound of the radio does make them calmer. The radio also helps to buffer the noise from the hallways that could startle the rabbits. It has a good influence not only on the animals but also on the attending care personnel. I feel relaxed when I am dosing rabbits while listening to gentle music.

Radios play gentle music also in the rooms of our rabbits during the day. The sound

of the radio seems to make the animals not only more relaxed with one another but it also makes them more sociable with attending personnel. Our rabbits hardly ever show startle responses to noise in the hallways, probably because the sound of the radio neutralized this noise.

I've used music for rabbits on and off when I felt it might be beneficial, for instance when the rabbits had to be housed near a noisy area such as cage wash or high traffic hallways. I also made use of music when I noticed the rabbits got upset during noisy periods of construction work. I've always played classical instrumental or lullaby rock

at a moderately low volume and found the music does have a calming effect on the rabbits, especially for high-strung bucks.

I have played easy-listening rock and roll (with vocals), Celtic, and classical music at a comfortably low volume in the rabbit rooms and turned it down to barely audible at the end of day. This made the rabbits much calmer in their cages; they stopped anxiously

running and whirling around and you no longer heard the cage racks bouncing when you passed by their doors on the hallways.

Rabbits would probably prefer a quiet meadow to a relatively loud and noisy environment. Playing music at a low volume may be a good compromise to buffer the unavoidable noise to which the rabbits are exposed in the research laboratory environment.

Trimming nails of rabbits

If you have direct experience with the care of rabbits, do you recommend trimming the animals' nails as needed? Is it practicable in the research lab to trim rabbit nails in order to prevent them from overgrowing?

Yes, it is very important to clip their nails so they don't inflict injuries on themselves and scratch personnel during handling procedures; if you haven't got a good grip on your bunny, scratches from those hind nails can be painful when they have not been trimmed!

All our rabbits are on monthly nail trimming and teeth checks. I think this is a very important part of caring for rabbits no matter what the setting. If you have properly trained staff and stagger groups of animals so they aren't all on the same schedule, it's not a daunting task.

Our rabbits are also on a monthly schedule for nail trimming, teeth checks, body weights and brushing. Our husbandry staff is trained by the veterinarians to do this. They do a bunch each week, so that they are not overwhelmed with the entire colony at the end of the month.

Several years ago, our USDA inspector specifically asked to see our nail trimming records, which we keep in a notebook in the rabbit area. She noted that if we hadn't been doing this, we could have been cited for improper medical care.

I very much agree, nail trimming should be a part of the standard care of rabbits. For scheduling it's not difficult to do a check at rack change. Rabbits are weighed, given a quick look-over, and any nail-trims are done at that time. It's not overly problematic to schedule and if your rabbits are accustomed to the process, it can go relatively quickly.

We found an awesome way to trim rabbit nails! We do it on a regular basis and bought a baby bouncy seat for that purpose! The rabbits love the support. They will lie on their sides and allow nails to be trimmed; you can almost put them to sleep in the seats while gently petting them on their foreheads. One of our care staff came up with this idea and I was so excited to see for myself how well it worked!

Oral meloxicam dosing of rabbits

How do you treat rabbits orally with meloxicam (metacam) without causing undue discomfort or stress?

I can't give any information regarding rabbits but I have given metacam to mice, rats and cats orally in the past and have never had any problems. In fact, my pet cat used to want more! I would just put it on a plate and she would lick the plate clean! So I get the impression it tastes nice; hopefully it's the same for rabbits!

The oral meloxicam suspension works well for our rabbits. We just manually restrain, place the syringe in the corner of the mouth and squirt! The volume usually ends up less than one milliliter. This goes pretty fast if you have people trained to restrain rabbits with gentle firmness.

Our rabbits are treated in the same way. They show no resistance and don't try to spit the meloxicam suspension out.

We use meloxicam oral suspension frequently; our rabbits generally will take it easily. We usually start with applesauce in a syringe, just to get them used to the concept of eating from a syringe. By the time we need to medicate them they are ready to go without issue. The suspension is palatable which is very helpful.

I have found applesauce to be my savior with these guys.

You can even mix the meloxicam with the applesauce in the syringe. I did it years ago; the rabbits loved it!



Non-human Primates

Environmental enrichment for marmosets

For those of you who work with marmosets, I'd love to hear any specific caging and enrichment strategies that you found particularly successful.

I have worked with marmosets for many years. They love tubes to play hide and seek and platforms to lie on their back and call for play partners. They are not

interested in portable toys but they like pieces of wood to chew on and to dig holes in with their teeth. Even though marmosets are very food motivated—they love marshmallows!—they are not willing to make use of puzzle feeders.

But they are willing to search for such treats hidden in cardboard boxes.





When we had marmosets, I found that they have a strong need for nesting/hiding boxes and numerous perches at different levels of their enclosure. Pieces of wood with holes filled with acacia gum keep marmosets busy for a long time; they will literally spend hours getting every little bit of the gum out and eat it. This is a species-typical behavior that can easily be promoted in captivity.

I've used large plastic jars (e.g., Nalgene jars) as nest boxes with holes drilled in them to allow urine to drain; the marms loved them.

Manzanita branches are perfect perches for marmosets; they are very hard, hence last quite a while and they withstand the cage washer.

I make fruit kabobs and hang them from the ceiling of the marmosets' enclosure. The animals will climb all the way up and then hang upside-down relishing the fruits. They are very cute to watch foraging in this way!



Favorite treats for cynomolgus macaques

According to your experience, what is the supreme favorite treat for cyno macaques?

The cynos I used to work with loved Bing cherries! It was so cute to see them after they ate the cherry part because it looked like they had lipstick on due to the juicy red color of the cherry, but I think their favorite part was playing with the seed and eating it!

I had to laugh about the lipstick as it sounded so familiar! Here is a pick of a cyno enjoying a juicy blueberry!

That is the cutest little monk!

The ones I work with will pick out grapes from almost anything.

Gotta go with grapes, and maybe prunes. Even the picky eaters like grapes.

I have yet to find a cyno who dislikes fruit-flavored Jelly Bellies.

Dried cranberries and frozen grapes are favorites of cynos! Fresh mango, too!

Oh, yes! Fresh mango is an all-time favorite! Fresh pineapple is also a cyno favorite, not the pre-packaged stuff that's been cut up and put into little plastic containers, and not canned pineapple; it must be fresh! The cynos like it better if you pick out the pineapple, making sure it's sweet and juicy, and then cut it into pieces yourself—it's just better that way—LOL.



Inexpensive foraging enrichment for macaques

Are you distributing the daily biscuit ration on the cage tops of your macaques as a means of inexpensive foraging enrichment?

We have been doing this for several years and it's been a great success. It is especially beneficial for the heavier animals who now have to work for their food rather than grabbing it out of the feeder and stuffing it in their cheek pouches all at once! For our monkeys housed in the bottom cages, we cannot put feed on the roof of the cage due to two reasons: 1. One type of cage has no grid ceiling. 2. The second type of caging we have does not have enough space between the bedding pan of the top cage and the ceiling of the lower cage. Therefore, we envisioned a basket or puzzle feeder that would serve the same purpose. It needed to be something durable that was easy to fill and clean. I have found a wire basket in a home/bathroom store that is approximately 6 x 3 x 3 inches large. We attached two quick-links to the back of the basket, which then attaches to the front of the cage. The monkeys have to forage and work for their ration from this basket. At first, some of the biscuits ended up on the floor, but after a short while, the monkeys got very good at manipulating the biscuits through the cage bars.

We feed the afternoon biscuit ration on the cage tops to cynos and rhesus. Animals who are exposed to this feeding method the first time waste quite a bit of the food, but they gradually figure it out and retrieve most of the biscuits rather than inadvertently push them over the edge.

Our biscuits are too large to fit through the cage tops. We regularly distribute produce, hay, cereal bars and crackers on the cage tops; it keeps the animals busy to get hold of the food stuff and pull it through the bars.

I don't distribute the biscuits on the top of the cages often because I find that our macaques push most of the biscuits over the edge of the cage top onto the floor. It would be nice to have a small board mounted around the top of the cage to prevent this.

We attach one-inch-high stainless steel rings on the top of the monkey cages, place the biscuits in these rings and let the animals manipulate the biscuits until they can pull them through the mesh and eat them. We use the rings to make sure that the biscuits don't fall over the side of the cage and down to the floor.

This foraging enrichment is very effective; it keeps the animals quite busy retrieving their food.

I'm sure the monkeys enjoy this kind of biscuit presentation more than taking the biscuits freely through the large access hole from the feeder.

Many years ago, I conducted a study that supports your assumption. Eight adult male rhesus macaques were given the choice of freely collecting their standard ration of 33 biscuits from an ordinary food box or working for its retrieval from a custom-made food puzzle. During a one-hour observation session following the simultaneous distribution of biscuits in both feeders, individuals spent on

average a total of 32 seconds collecting 29 biscuits from the ordinary food box versus 673 seconds maneuvering 11 biscuits through the mesh of the food puzzle (Reinhardt, 1994). Obviously, the animals were highly motivated to work for biscuits, with the expression of foraging behavior serving as its own reward. Similar findings have been reported for chimpanzees (Menzel, 1991), stump-tailed macaques (Chamove, 2001), tamarins (Taylor, 2002) and marmosets (de Rosa et al., 2003).

I've tried to find a foraging feeder that works in place of the regular feeder but I haven't come up with anything useful yet.

You may check whether you can simply move the regular feeder away from the large

access hole; in this position, the animals would have to skillfully manipulate and pull biscuits through the mesh or the bars. I did this many years ago and implemented it with success for several hundred rhesus and stump-tailed macaques without any extra material expenses.

That would be a wonderful idea, but our feeders were installed in such a way that many monkeys were able to dismount them and throw them to the floor. As a result of this, the management decided to weld all the feeders onto the cages. So, simply moving them away from the access holes is no longer an option, unfortunately.

Produce for non-human primates

Is it a standard practice to give fruit to non-human primates on a daily basis?

We feed our monkeys daily a fruit in the morning and a veggie in the afternoon. The cebus, rhesus and vervets usually get a half fruit, and a half veggie or a handful of berries or chopped veggies. The baboons get double that amount. I also use some fruits and veggies in our foraging devices along with seeds or nuts.

Our fruit list includes: bananas, oranges, pears, grapefruit, berries, tomatoes, kiwi, pineapple, grapes, cantaloupe, honeydew and some seasonal fruit such as watermelon and pumpkins.

Our veggie list includes: kale, spinach, collards, potatoes, asparagus, broccoli, carrots, turnips w/greens, mustard greens,

parsnips, cauliflower, dandelion greens, brussel sprouts, green beans and corn. The kinds of fruits and veggies that our animals get typically differ from day to day.



We feed our macaques one fruit or one veggie per day, depending on availability. I try to keep the fruit in a 'whole' state so the animals can spend some time processing it. Often I distribute fruits or veggies on top of the cages or place them in foraging toys so that the animals have to work a bit to retrieve the food; it provides extra fun for them.

Our vervet monkeys get fruit daily. We feed what is in season but prefer fruits with skin that can be easily cleaned/sanitized—for example, apples, pears, oranges or mandarins. Every monkey gets a half medium-sized fruit, or a whole small fruit every day for one week and another fruit for the next week in alteration.

I was wondering what everyone's experience has been with mangos. Do you give your NHPs the pit? If you do, what species do you work with; have you run into any problems?

My boys (rhesus macaques) love mangos. I like to keep the produce as natural as possible for our animals, so I do give them whole mangos. They enjoy gnawing on the pits; once the pits get funky I discard them. I never encountered any problem associated with the pits.

We give mangos about once a week and have also given the large seed inside to some animals without any ill effect. So far, none of our macaques have actually eaten the seed, but they all spend a lot of time getting all the fruity and juicy stuff from it.

Our rhesus and cynos get whole mangos frequently. They are most fond of the pit and will work on that for a lengthy period of time. We have not encountered any problems with it.



We have given mangos with the pit to vervets; they love them. We have had no issues. The pit is almost the best part, as they will spend days peeling it into tiny strips and carrying it around with them.

We give whole mangos to both rhesus and cynos and have never had a problem. The animals definitely enjoy them!

I distribute whole mangos to our rhesus, cynos and vervets. We want to give them more to do, so we give them the whole fruit. It is a hit! The animals play with the pit and shred it but it never happened that an animal actually ate a pit.

Coconuts for non-human primates

Dry whole coconuts are favorite foraging/feeding/grooming/play objects for stump-tailed macaques. They don't get tired working on them until the last morsel has fallen through the mesh of the cage floor. It has been my experience that the animals do not get harmed/injured in any way while processing coconuts. I wonder, do other monkeys commonly kept in research labs also benefit from whole coconuts?

Yep! I've given coconuts to rhesus, cynos, pigtailed and baboons. All of them go bonkers! However, occasionally there are older animals who do not manage to crack a coconut open. I let them groom the fuzz off for a few days and then retrieve the coconuts and make a BIG production by throwing them onto the floor to break them open. All animals in the room hoot and holler; it's a great experience for everyone! When everybody has settled down again, I hand out the broken pieces to the original owners of the coconuts; they sure seem to be happy! Now they can gnaw and eat the good stuff without having to make undue efforts.

We tried coconuts with vervets, cynos and rhesus. They all pretty much just groomed the fibers off. They did not break them open. Our guys are all around 4-5 years of age; perhaps they are not strong enough to accomplish this. We smashed the coconuts for them and gave them pieces of shell with coconut meat. Some ate it, others ignored it; nobody got hurt.

We have also used whole coconuts in the past with our female rhesus. Some, we had to help crack, while others, with enough

drops from the top of their perches, were able to break them open—accidentally, I believe. Not everyone liked coconuts, but those who did gave the impression that they really enjoyed them.

When our macaques get their first coconuts, they probably crack them open unintentionally. After a few experiences with these tasty objects, many of our animals take their coconuts to a higher ledge and appear to deliberately drop (or throw) them to the floor, and immediately come down to the floor to eat the coconut meat inside the broken coconut shell.

We use coconuts regularly with our cynos as a first line of treatment for our over-groomers. They readily and very effectively pull all fibers off within only a few days.

We have specifically used coconuts to successfully alleviate over-grooming in a particular male cyno. Man, he cleaned those coconuts bald, LOL!

Many of our cynos will pick out the coconut eyes and then drink the milk. Some—mostly our larger males—will throw the coconuts repeatedly on the ground until they crack open; once they have achieved this, they will relish the coconut meat and finally leave quite a mess that needs to be removed from their cages before the end of the day.

We had one male cyno a few years ago who managed on two separate occasions to get his index finger stuck in a coconut eye after he had picked it out. We had to sedate him to extricate his finger.



We have also used whole coconuts for macaque enrichment for many years without ever having a problem. But speaking of coconuts, I just have to share this story of Mr. Justin, a cyno, who many times repeated a 'task' that left all of us stumped and scratching our heads. At the time we didn't have any way to monitor or videotape him when we were away from his area, and we could not, and never did figure out how in the world he did this 'thing!'

We gave Mr. Justin a whole coconut (his first of many, close to 20 years ago) and within a few days' time we retrieved it from his enclosure as he seemed to have lost interest in it. Oddly, the coconut was still

in one piece with the exception of one little hole—much too small for a macaque hand to slide through—and it felt unusually light in weight. Upon examining the coconut, we found that the entire inside was completely void of the coconut meat! It was slick, smooth and completely clean! Not even one tiny bit of white coconut remained inside! Curious now, I looked with a flashlight even closer and, to my amazement, there weren't any marks from a scratching object

that could possibly have been used by Mr. Justin to get the coconut meat out. It looked like something that might have been accomplished with a specialty tool in a factory somewhere!

In the course of time I collected many of Mr. Justin's empty coconut shells that I painted. I gave them away to friends, but I kept the attached one as a remembrance of my friend Mr. Justin, my one-of-a-kind 'coconut' monkey.

Dolls for macaques

Can anyone recommend a monkey-safe doll or other cuddly item for a young singly housed male rhesus?

We give our guys stuffing-less dog toys or fleece blankets. We haven't had any health issues from them; however, I have not seen any of our rhesus macaques actually use them. That doesn't mean your guy won't, especially if he's alone. In my opinion it's definitely worth the try.

There is no such thing as a monkey-safe doll. One of two things will happen: He'll tear the living daylights out of it and there will be a giant pile of stuffing and leftover fleece to clean out of the cage, or he'll cuddle with it and love it to death. I cared for a young adult male rhesus who loved his stuffed friend so much he would pick it up and take it with him to the testing booth.

At one of my previous facilities there was a young rhesus who had to be separated from her mother and couldn't be paired with another cohort. She was provided—and she

definitely used—a giant stuffed toy. She spent most of the day cuddled with it. The toy was about two to three times her size, so it was easy for her to just completely sleep on it. She was amazingly gentle and never ripped or pulled pieces off the doll.

Other species of primates who had to be separated from their mother for any period of time were given fake shearling or fleece pads. Sometimes the pads were fixed to something like a wooden dowel but often they were just placed in the home cage. The young animals always spent time on the pads and we never had any adverse events like ingestion of fuzz or material twizzling around fingers, toes or tails.

Obviously these items aren't a replacement for a living companion, but I think they can definitely be used to enrich a solitary cage environment.

When we use stuffed animals, we turn them into 'flatties' before we give them to the macaques; we remove the stuffing inside first. I can say that about 3/4 of our macaques love flatties; they tear them up and

make a nice mess. The other quarter of our macaques never damage or tear their flatties; they enjoy holding onto and snuggling with something soft.

Instead of a 'flattie,' we sometimes use a piece of polar fleece material and tie a big knot right in the middle of it. The animals love hanging on to it, dragging it around and cuddling with it. But it's just not the same as having a warm body. Your little guy needs a macaque buddy!

Perhaps you can give him a rabbit buddy, Polly-style?

LOL! I did ask; the answer was a resounding NO!

Wheatgrass for macaques

Does anyone grow wheat grass to give your macaques an opportunity to forage a bit? Do you grow it yourselves? How much and how often do you give it to your primates?

I grow wheat grass right in the window of my office. Our rhesus and cynos love it. I usually give them a handful on top of their cages once a month or so. It's a great treat for them during the winter months when fresh browse is not available. Most of them really enjoy it!

I have sprouted wheat grass seeds for rhesus and cynos at my last job. We purchased clean soil and wheat for human consumption. The wheat seeds germinate quickly and grow rapidly under fluorescent lighting conditions. Within 2-3 weeks the grass is ready to give

I just wanted to let you all know that our lonely little monkey has accepted his monkey doll! I introduced it slowly, acclimated and desensitized him to it over the weeks. Yesterday, I just watched him grooming it for 10 minutes!

So happy for him that he has this outlet until we can get a better fix! Thanks for the support and advice!

Latest update: my little fellow with the monkey doll? He's doing more than just grooming his doll now ... LOL! I walked in on them 'consummating' their relationship. AWKWARD!

to the animals. I would pull the grass sod out of the tray and cut it with a knife into squares—like brownies—and hand them out. The monkeys loved it! First, they ate the grass then broke up the sod and pulled the roots apart to get to the seed sprouts. Most monkeys spent a good amount of time with this destructible, healthy and edible foraging enrichment. The wheat grass turf breaks up into small dissolvable fragments that pass through the drain without any problem.

Attached is one of my favorite rhesus with his wheat grass; his name is CB.

I was just out buying treats for my boys and came across wheat grass at the grocery store; I bought some and will try it.



Making use of leftover powdered chow

Are any of you making use of the leftover fine monkey chow at the bottom of the bags?

I just found a really creative use for the leftover powdered chow (fines) at the bottom of the bags and wanted to share! Before, I was using rice flour but using the chow fines is even better! Here is the monkey chow cookie recipe:

- 2 cups chow fines
- 1 cup peanut butter
- 1 TBSP baking powder
- 1/2 cup almond milk
- 1/2 cup water

Mix all ingredients together and roll out to about 1/4" thickness.

Cut into shapes (I poke decorative holes in top, but that's not necessary).

Optional: press walnut meat on top.

Bake at 375° F for 17 minutes.

Even our picky eaters love these cookies!

That's a great idea!

At my previous work place I collected the crumbs/fines in a big bucket and walked

around the room to each of the approximately 100 monkeys—a bit time consuming but it was really fun—and let them all get handfuls of the powdery stuff; they liked the texture and they loved messing with it and tried to shove as much as they could into their mouths, which left them with crumbs all over their faces; they were so cute!

I use the fines for all kinds of things but don't have access to an oven, so everything I make is given at room temp or chilled.

I mix the fines with things like juice and fruit and then stick wads into paper tubes so the guys can forage. Also, if we have any sick animals, or guys on a 'biscuit strike,' the caretakers will save fines for me so I can make 'meatballs.' If I run out of fines, I just stick some biscuits in the blender and prepare what I need.

I make peanut 'meatballs' with the fines or freeze mixtures of fines and fruit juice or Tang in Dixie cups; the monkeys love the stuff.

Paint roller enrichment for macaques

Recently, on our forum, someone mentioned using paint rollers with a thin coating of a flour/water slurry that dries and flakes off. This keeps the NHPs busy, picking at the little flakes coming off the roller's wool.

I have a cyno who is starting to pluck the hair on his head, and pick at small wounds that would've healed by now. He

lives with a companion and is trying to pick at him too. He is a very smart guy and is always fiddling with stuff. He figured out how to push his fecal pan out, and does it without fail every day; it drives the attending husbandry staff nuts.

I'd love to try this paint roller occupational enrichment idea for this fella

but I'll need some testimonials to convince my bosses before I can try it. Is anyone who has used this type of enrichment willing to give me some practical details? Do you find that the paint roller helps alleviate boredom in macaques?

Yes, paint rollers are very effective in alleviating boredom in macaques but, like grooming boards, they are not a cure for stereotypical over-grooming or stereotypical hair-pulling-and-eating. Picking and manipulating the wool-like cover of the paint roller supersedes stereotypical over-grooming or hair-pulling only temporarily; once the animal stops interacting with the paint roller, he or she will resume the stereotypies.

Our animals get the paint rollers with smeared peanut butter, almond butter, fluff, agave nectar, jelly and other syrups; the monkeys love them. I smear these tasty things on the rollers, then cover them in trail/foraging mix, coconut flakes, foraging

crumbles, freeze dried meal worms, dried fruit/veggies, etc. You can make the device more challenging and last a bit longer by first putting it in the freezer.

I like the paint rollers because the animals love using them. They are safe and withstand cagewash; they are inexpensive and easily disposable. You can hang them on the outside of the cage with a short chain to make it even more challenging for the animals to forage, and you can stuff the center plastic tube with treats if you decide to put the device in the cage. I have successfully included them in a large enrichment program for rhesus and pigtail macaques.

I've used paint rollers in the same way as you have described and yes, the monkeys love them!

I also use the paint rollers, usually with peanut butter, sometimes just plain. Either way, the monkeys seem to like them and



they spend considerable time manipulating and picking them. I'm in a CRO [contract research organization] and I've had no push back from giving the animals paint rollers. I hang them on the outside of the cage with a short chain.

We are using the paint rollers with great success; especially the cynos like this kind of grooming-related enrichment! I take flour and mix it with just enough water to get a sort of pancake-like batter, which I spread all over the roller; I let the roller dry overnight. Next morning, I make a monkey happy with it!

In order to keep the animals interested in the paint roller, we don't give it to them

every day, and we change the color and taste of the spread periodically. Sometimes we add nothing special to the flour-water slurry; at other times we add seeds or currants. Occasionally, we replace the flour-water mix with plain peanut butter and press trail mix into it.

We've been using the paint rollers for many years and haven't encountered any health-related issues. I have never seen an animal tearing at the wool/fleece or eating sections of it.

We too haven't encountered any health issues with the typical fleece-covered paint rollers that we use in our macaque colony.

Wood enrichment for macaques

I wondered if any of you use wood in your primate cages, either as a perch or a block of wood for chewing or playing? Do you find the primates value it and use it? Are there reasons it cannot be used?

We do use wood; it's a very popular item with all our caged NHP species—rhesus, cynos and AGMs [African Green Monkeys]. The animals get 6-cm long wood sticks that have a diameter of 1-2 inches and have little holes drilled into them to hide treats such as raisins. The animals LOVE to dig the treats out, and then will often try to peel strips off the wood with their teeth as if it were a Polly-O string cheese.

Our macaques LOVE their wood sticks; they really enjoy peeling each and every speck of bark off the sticks. I sometimes smear

peanut butter or honey on the sticks to turn them into treats. The best part is, the sticks can go through cagewash! Once they get too brittle or start to break apart, you can throw them out and replace them with new sticks.

We use a lot of wood enrichment and the macaques (all species) love it! We've never had a problem with it. Sometimes we take a piece of cherry wood and drill holes through it so we can hide peanut butter or other treats inside. We don't attempt to clean or disinfect the wood, but discard it when needed and give a new one each time. The animals also enjoy peeling the bark.

I give our caged macaques manzanita sticks to chew on and play with. The animals are used on GLP safety studies; we had no research-, health- or husbandry-related issues

with this kind of enrichment. Manzanita wood is so hard that the animals can gnaw off only small pieces at a time and the bark does not strip off, so there is no danger of drain clogging when the room is hosed down.

Gnawing sticks cut from manzanita are, indeed, very user-friendly albeit a bit hard for some monkeys, especially the older ones (over 25 years).

Our guys ignore manzanita sticks. I give them softer wood sticks cut from red oak, maple or birch. The macaques—especially the cynos—go ga-ga for them and some turn them to shreds in less than a week! We hose the debris out of the pans and collect them over the covered room drains.

We also use gnawing sticks made from birch, maple and red oak branches. Our macaques definitely prefer them to the manzanita sticks. During the summer, we also offer natural browse such as maple, willow and grapevine. We don't have drains, so that's not an issue for us.

We have an offsite facility of 200 acres of mostly wooded area. On occasion, I go and cut wood sticks and limbs in varying sizes from a variety of trees. Our macaques go nuts over the fresh bits of wood. We have not had any problem with the covered drains.

Based on your own observations, what do you think makes wooden gnawing sticks so attractive for non-human primates?

Wooden branch material is something the animals would find in nature; they can chew it and clean their teeth, change the shape of it, perch on it, and they can gnaw and shred it into little pieces. There are so many things



they can do with wood compared to many of the commercial toys.

I think they like gnawing on wood for various reasons. It gives them something to do; they spend quite a lot of time gnawing on the wood and stripping pieces off with their teeth and/or hands. Some monkeys enjoy peeling the rough bark off and nibbling on the tender wood underneath. They don't actually eat it, but they seem to enjoy 'tasting' it a bit. Some strip off long fibers from the wood underneath and use these fibers to floss their teeth. Others have a good time rubbing the wood stick back and forth with their hands. We have one monkey who enjoys not so much gnawing on the wood, but throwing the stick up in the air and catching it. He hides it, buries it in the shavings, and then re-finds it again and starts all over. It's a game for him.

Mirror enrichment for macaques



I'm curious how many of you hang enrichment mirrors on the inside or outside of non-human primate cages?

We hang stainless steel mirrors on the outside because they would interfere with the squeeze-back mechanism if hung inside the cage.

We do the same.

Our macaques also have their mirrors attached with 3-link chains on the outside of their cages. I love the way the animals manipulate the mirrors to view their surroundings.

This is a good example of macaques using a tool. Obviously, these guys must have learned how the mirror works and how the mirror must be tilted so that objects become visible that are not in one's field of vision. Pretty smart!

We hang the mirrors also with 3-link chains on the outside of the animals' cages. One of our boys loves manipulating the mirror to look at himself for long periods of time; he's also the one who loves watching his reflection in the stainless steel ball; perhaps he's just vain.

We hang mirrors on the outside of the cage, but the monkeys also get reflective balls to use inside their cages. They seem to enjoy both items very much!

Enrichment with stainless steel balls

If you give your monkeys stainless steel balls for environmental enrichment, how do the animals make use of the balls? Do you leave them in the cage all the time?

Our macaques love these reflecting balls! They enjoy watching themselves in the shiny mirror covering; they also like to

push the ball back and forth on the floor, apparently enjoying the 'wobbly' effect from the sand inside the ball! But like anything that is not alive and not edible, the animals lose interest in them after a while. When we notice this, we take the balls away and give them back a few months later, and the animals love them again!



We give the stainless steel balls out in a rotation as well. The animals get fascinated when they are new and shiny. They hold them and shake them—as they contain a bit of sand—and look at their reflections; they also sit on them. They really like the balls.

Our monkeys also like them. It's fun to watch them push the balls and watch their faces when these roll back. Before long, the animals start to get bored by the balls. We, therefore, rotate them out just like all the other toys with cage change. This implies that our monkeys get their stainless steel balls once a month for a period of two weeks.

These balls are not that heavy, and I catch our cyno pairs throwing them around all the time. They can get quite dull-looking but a good cleaning makes them shiny again; that's how the animals like them most. We have encountered no injuries associated with the balls.

I currently have an adult male rhesus who loves his stainless steel ball so much he

tries to take it everywhere with him. I ran into problems with this obsession when he would bring the ball along into his training chair and hold it very attentively with his feet. He was so distracted by his toy that he was no longer able to concentrate on the computer task he works with. We finally had to attach the ball with a chain to the inside of the cage so he can cuddle with it at home, but he can no longer take it along to the training chair. When he is on 'vacation,' we take the chain away and give him the ball so that he can carry it around and do with it whatever he pleases.

We also had a male rhesus who was very attached to his reflective ball. It was rather cute; he would take it to the corner of the cage with his biscuits and eat with it. After we found a compatible cage mate for him, his obsession for the ball abated.

One of our vervets would often hold his stainless steel ball up in the air for the others in the room to see, as if it were his magic crystal ball. He is a trip; very amusing, to say the least.



Thieves by nature

It was a warm summer day that started out like most. But this day, my husband had to go to a meeting nearly 70 miles from the sanctuary and didn't expect to be back until evening. This was one of two days a week that we didn't have volunteers scheduled so I was on my own for chore duty. This wasn't a problem, as I was more than able to complete the daily tasks on my own. I thought this might actually be a relaxing day for me, as the day before every enclosure had been deep cleaned and there wasn't really much to clean up that day anyway. After feeding, I planned on cleaning the special needs area and then spend a few quiet hours interacting with the 'primitives.'

After that I might read a book or watch TV; maybe I could catch up on computer work.

It was early morning, about 6 o'clock. I left the house with the monkeys' food bowls, my laser light and a pocket full of treats. As always, I locked the house and drove up the hill to the macaque buildings. The macaques greeted me with the usual array of hoots and grunts, anxiously anticipating their breakfast. I hadn't eaten my breakfast yet, as I always feed them before myself. I was rather hungry, looking at all the lovely food in their bowls. Fresh mangos, apples, sweet oranges, grapes and even the tamarind sparked my appetite. As I passed out the breakfast bowls I could hear grunts of satisfaction and

approval. That always brings a smile to my face and makes me laugh. What a great way to start the day!

Everyone had their breakfast and I could hear the crunching sounds of food being eaten all around me. I remember thinking how fun it would be to make an audio recording of macaques eating peanuts, fresh carrots and other foods that are noisy when being processed and eaten by them.

I was indeed getting hungry so I started to leave the area, but when I did, Eve, a juvenile cyno, quickly approached the front of her enclosure and extended her arm out toward me, begging for a quick groom from her human. I stopped to appease her and sat down on the ground in front of her enclosure. Eve is such a sweet girl! She reached out and ever so gently began grooming my arm with her right hand and, as Eve always does, firmly gripped onto my sleeve with her left hand so I wouldn't get away until she was finished. This always makes me chuckle.

I was about to end our grooming session and I think that Eve sensed my intent to stand up. It was at this moment that she noticed my keys on a ring that were barely visible in my pocket. Or perhaps she had known they were there all along. The rule is that nothing, absolutely nothing, when near the macaques is to be kept in pockets or anywhere else on a person's body that one is not willing to share with the macaques. They are all thieves by nature and much quicker than any human. But I hadn't planned on stopping to visit until after my breakfast and I simply forgot to remove the keys.

There I sat on the floor, watching Eve proudly examining my key ring on a high ledge furthest from the front of her enclosure where I helplessly sat. She had my key ring that had not only keys to every macaque's enclosure on the property, but my car keys

and my house keys. My phone was in the house. My breakfast was in the house. My spare set of keys was in the house. My husband was 70 miles away and wouldn't be back until evening.

As I sat and watched, Eve ate her breakfast as she maintained a tight grip on my keys with her foot. A very tight grip, as she knew I desperately wanted them back! No matter how hard I tried to act like I didn't care, she knew I wanted them back! I doubted now that coaxing her with trail mix would be too successful as she was full!

Eve toyed with me most of the day. She would bring the keys within just a few inches of her enclosure front, and if I so much as looked at the keys she would pull them back, and seem to enjoy my desperation. She was so deliberate in the way she teased me with the keys.

For the rest of the day I snacked on trail mix. I was thankful we have a restroom in the special needs barn, and thankful we have a Sierra Springs water dispenser in the macaque building. I didn't have a chair to sit in; those are kept in the shed. The shed was locked. That key was also in Eve's possession. But I put a pile of clean polar fleece blankets on the floor and sat on those for part of the day.

It had to be close to dinner time when I heard a car pull up to the building. It was my husband! As soon as he opened the door, I began telling him what had happened. Before I could finish, I heard a 'clang.' I glanced over, and realized that Eve had thrown my keys out of her enclosure into the aisle way. She was sitting there with her arm extended out toward me, begging for a quick groom from her human. I laughed until I cried!

What is this stuff?

I am experiencing something so weird and not knowing what it really is drives me almost crazy. I am hoping someone on the forum is familiar with this weird stuff and has an answer, even if the answer will make me feel quite stupid.

We have three new rhesus retirees, and I am finding the following two or three times each day in two of the three boys' cages: small round 'puddles' that are white/cream in color. They feel like floppy rubber and have the appearance of a very hard-cooked egg white, but they are much firmer, like rubber! These puddles are about 1/8" thick, and 2" in diameter. There is no odor to them. I can peel them off the surface with a gloved hand very easily. They don't tear or rip easily. There is absolutely no wetness to them. I am finding them on various surfaces in the caging. If they were vomit or coming from the mouth, I would see other food stuffs; it isn't stool, as normal feces is present in the cages; it isn't urine, as normal urine is also in the cages. I know it is coming from the monkeys; it HAS to, as there is nothing in their environment that is anything like this substance. So I'm wondering at this point, could it be semen? But if so, why is it hard like rubber? Whatever this is, it starts out as a liquid and hardens very quickly.

I have just looked again in the caging and nothing was there, returned within less than an hour and found it once more! I also find it in areas where there is a grate, and you can see where it 'dripped' over the grate and the drips going down each side of the grate are solid connected to the 'stuff' on top of the grate. It's like a liquid was poured and instantly hardened into rubber as it was

running over the edges, before it even had a chance to drip to the bottom of the caging.

The truck drivers who delivered the boys gave us several packets of what they called 'solid water' which was kind of tea-colored. I have never seen this before. I opened one of the packs and, sure enough, it has a similar texture as this stuff I am finding in the males' cages, but it has not quite the same color. Could it be that the solid water can turn into these weird puddles? We never gave it to the three macaques; we tossed it, but I am assuming the animals had direct contact with it during their trip to our facility. I can't find any info on solid water and know nothing about this product.

Please help me figure this out!

We find these 'puddles' in Bubbas' enclosure; they consist of semen, and heaven help you if he gets hold of your leg and the stuff gets on your clothing, it does not come off easily at all!

Rhesus semen dries to a rubbery consistency and kind of plugs up the female's vagina so she can't go mate with another male right after. When I worked in a breeding colony we would find these 'plugs' all over during the mating season.

These plugs turn from rubber to concrete within a day! If you don't remove them quickly enough, you literally need acid.

Thank you! This is really interesting and something I never knew. Now I know.

I didn't know either! All our guys eat the puddles before they have a chance to dry;

blech! Interesting evolutionary technique though.

I can't even begin to tell you guys how much hysterical laughter this has caused around here today! One of our vets—who shall remain nameless—also determined that this 'alien substance' was odorless. He wasn't the only one; he consulted with two colleagues who also were completely stumped.

I am, however, thankful I did not spend a great deal of money having this 'substance' analyzed in a crime lab somewhere.

No problem! I used to have a male cyno 'boyfriend' who would offer me a special present most mornings when I made my rounds. I always told him thank you and I appreciated the thoughtfulness but noted that I prefer my men less hairy and tail-less! I'm glad you didn't have to go all CSI (crime scene investigation). LOL!

I am still laughing!

Music, video and television enrichment

Do music and movies provide meaningful enrichment for non-human primates?

Through extensive observation in our macaque buildings, we have learned that soft music and nature sounds have a calming effect on the animals; heavy metal and hard rock have a more agitating effect on the animals. Hearing the recorded sounds of macaques lip-smacking and grooming also has a positive effect, especially at times when there is any squabbling between the monkeys. I like to make my own 'music' for the macaques by recording nature sounds such as waterfalls and birds trilling, and combine these recordings with the sounds of lip-smacking and 'happy grumbles.' This is their favorite music.

Since the animals in research facilities are already under stress and have little or no ability to modify their environment, the addition of thoughtfully selected music is probably an environmental modifier in a positive way.

In my experience, happy music makes happy staff and happy animals. Therefore, the type of music is not really important. If a technician in the room is happy, singing or head-bopping to her or his favorite music, the animals will respond positively.

We always make sure that the music is loud enough to mask noise when the room is actively in use. The volume of the music is turned down when the attending technician has done her or his work and is leaving the room.

Oddly enough, I ran a little experiment last week in regard to volume of music in a room with caged macaques.

I am the resident DJ [disc jockey] at my institution. I have learned over the years that there are particular types of music macaques prefer over others. For example, instrumental, jazz, classical, and what I like to call 'quiet songs' seem to be preferred over loud rock and gospel—yes, I have played the Mississippi Mass Choir for NHPs. Anyway, as

a classically trained musician, I decided to see how the monkeys would react if a classical piece was allowed to hit a triple forte—that's VERY loud for any nonmusicians. I chose Vivaldi's Winter as it starts very quietly and builds to a massive climax. I cranked the volume and stood next to the radio and watched. When the climax came and the sound was literally booming, the guys showed absolutely no change in behavior. They all just continued to sit quietly. Another staff member came into the room and told me the music was audible in the hallway and didn't I think it was too loud? I then asked this individual if he felt the monkeys find the music loud. He looked around, and with a very surprised tone, said, "No. They don't seem to mind at all." I felt ever-so-slightly vindicated.

I haven't used music in our primate rooms but think I should after reading all the suggestions.

Our cynos and rhesus seem to enjoy watching TV. We make sure to alternate different programs, sometimes movies like *Bonanza* or *Avatar*, at other times just the news channel for an hour or so between movies. *Uncle Buck* with John Candy seems to be a hit with all our macaques. Typically, we provide TV all day for three or four days in a row, skip a day or two and then continue with movies. Once or twice a year there will be no TV for up to a week! That way the animals don't seem to get bored watching movies.

I find TV also beneficial during times when we might be having thunder and lightning, or distant fireworks in July, or other unusual noises that might otherwise scare the monkeys. The TV kind of blends stuff like that into the background and keeps everyone reasonably calm.

If our techs try to move or remove the TV from the animal room during movie time, they get a huge wave of protests from our monkeys.

We make use of TV for the entire day after the care techs have hosed the animal rooms in the morning; the videos are changed regularly so that the animals don't lose interest in this kind of enrichment. We have cynos; they really seem to enjoy watching and listening to the TV. They are very quiet and mellow in the rooms much of the day. The sound of the TV also helps to cover loud noises in the corridors.

I believe that a restricted access to the TV might be a good idea to avoid habituation and loss of interest, resulting in boredom.

That's my thought as well; it's just how this facility does it. What is very noticeable is that the rooms of our cynos are very calm. Since there is a lot of construction noise, the sounds of the TV covers much of it up. When the TV is turned off during construction noise, the monkeys invariably shake the cages as if they want to protest and have the TV turned on again. The sound of the TV might create a nice background for the monkeys that has a more relaxing effect than the intense noise created by the construction machinery.

I do think TV enrichment is worth it.

At my previous place of employment we played DVD movies every Monday, Wednesday and Friday during work hours for our cynos and on Tuesday and Thursday we provided music only. On weekends we did neither, to give them a break. They seemed to look forward to watching movies and used their mirrors to watch the TV screen for most of the day.



At my current place of employment, the TV is playing all day during work hours, seven days a week. The monkeys give the impression of having lost interest in watching TV and they don't pay much attention to it.

Our rhesus are much more interested in watching DVD movies than our vervets (AGMs) and cynos. I have one rhesus male who sits back, puts his feet up and munches on a biscuit while watching. He needs a Barcalounger! He really loves Elmo. LOL! You seriously can't pull his attention away from it when it's on. He's the only one I've seen respond that way to movies though.

Our system is kinda randomized. All rooms have a TV/DVD on an 8-hour timer. Any time personnel are in the room and nothing is playing, they put in a new DVD when they exit. This implies that the time the monkeys are exposed to movies varies from day to day. The monkeys (cynos) all move up to the front of the cages when they see activity on the TV screen.

DVDs are all donated by the staff and previewed by me (I may take the good stuff home on occasion). We have about six DVDs per room and these are all changed out every 14 days along with the cages.

I think TV is useful if not over-used. Our rule here is that TV will not exceed three days a week. Our rhesus and cynomolgus macaques watch a wide variety of material, including nature films, sitcoms, cartoons and work-out videos. Cartoons are usually given the least amount of attention by the monkeys. We have a room of rhesus females who LOVE to watch a storyboard version video of an animated film. One female also showed the already mentioned feet-up-sit-back-with-a-good-biscuit behavior.

We also have a VCR and show movies in our primate rooms on a rotating basis. Oddly enough the monkeys like some Disney movies and they do watch them very attentively. One or two will move a bit to the left or to the right so that they can look around you if you happen to stand in front of the screen during *Shrek*.

My experience has been similar with the movies. Many of my monkeys exhibit a definite interest—through orienting toward the TV screen—in the *Lion King* series, *Madagascar*, and other Disney films. We have a group of cynos who all chime in and sing along to the scene in *Cinderella* when the mice are singing while making the dress "Cinderella, Cinderella, Night and Day it's Cinderella!" Some of them

sound really good and seem to know the melody note for note! It is quite entertaining, and reminds me of the *Gremlins* scene when they all sing along to *Snow White*.

They used to play nature shows or cartoons like *Little Mermaid* and *Aladdin* for the indoor rhesus macaques at our lab. The monkeys couldn't care less most of the time. The enrichment team did not give up and took a bunch of videos of the outdoor monkeys and played those for the indoor monkeys: the monkeys were fascinated! They would watch intently, sometimes lip-smacking and grunting, and sometimes threatening. To watch other monkeys on the screen was very entertaining and engaging for them. Their enthusiastic response was so encouraging that the enrichment team is now using almost exclusively videos taken from outdoor monkeys as enrichment for the indoor monkeys; thank goodness—I don't think rhesus macaques care very much about *Aladdin*.



Our rhesus macaques respond just like yours; they love the vids of other macaques, but couldn't care less about cartoons.

Recently, I changed the video enrichment for our monkeys (cynos and rhesus mostly) from Disney animated to real monkey clips and a snow monkey documentary. It seems to me that the animals are more interested in the real monkey movies than in the animated movies; therefore, I show them now primarily videos of macaques rather than cartoons.

We recently showed one of our macaques a YouTube clip of a show called *Monkey Thieves*, that is based on rhesus macaques in India. He absolutely loved it, lip-smacking at the screen and very intently watching; it was great!

I purchased the documentaries *Clever Monkeys* and *Romeo & Juliet: A Monkey's Tale* for our macaques. Of all of the movies my guys can watch, these two are definitely the ones that captivate them most. They must love to see the monkeys in Thailand breaking into homes and running away with sweets; it's funny to see them getting so excited while watching the movies.

Our favorite in-house video is an old special on the torque macaques in Sri Lanka that contains bonus clips of monkeys stealing things—like pies—from window sills in India. We've put it in the VCR many times, so now it plays in fits and spurts; our rhesus macaques don't seem to care and everyone watches the video with full attention and lots of chattering as if it's the best thing in the world to do! This morning I popped in *Aladdin*—and the room became silent in about two minutes.



Water enrichment for macaques

Based on your own experience, what are practical options for making use of water as environmental enrichment for monkeys kept in standard cages?

We have started doing this with some of our singly-housed guys—mostly adult male cynos and a few young-adult male rhesus. We use horse-feed tubs (relatively flexible thick plastic tubs, about 18 inches in diameter), fill them with a few inches of water and toss in a handful of foraging mix or baby carrots. This is placed on the bottom of the cage once weekly (removed after about 24 hours). Most of the cynos enjoy picking the treats out. I haven't seen them splashing around.

Offering the animals larger pools into which they can climb and then play in the water is one of our long-term goals.

I've just started introducing water enrichment to our guys.

We're using the cage bottom of a mouse cage as the bucket and fill it with about 3-inch-deep water. Chunks of floating produce are added along with some raisins. So far I have exposed three adult cynos (one single animal and one pair) to these little pools.

The paired animals stayed away from the water while I was in the room. When I came back four hours later, the two had eaten all the raisins and all the apple pieces and had dumped the water out into their waste pan.

The third, temporarily singly housed cyno came to the water right away while I was standing there watching him. He splashed with the water, retrieved and ate all the apple pieces and raisins and kept dunking his head into the water. When I came back four hours

later, he had done the same as the other two, i.e., poop soup!

I will say that emptying the big waste trays with all the water in it was cumbersome at best. I'm wondering if even less water will have the same enrichment effect; otherwise husbandry is going to hate me, LOL!

We also use clean shoebox-style mouse caging, fill them with water and put them inside our 4-bank caging. I add floating toys or produce. The monkeys love it! Our juvenile rhesus macaques have been seen splashing in their 'pools' which are, however, not big enough for them to actually get in.

I am also a fan of using the bottom of mouse or rat cages filled with water. Water-filled feed buckets are also great. Adding fruits or veggies or other items that float or sink increases the entertainment value of the water for our macaques.

Just a bucket of water will do for our caged cynos. It's fun for them; they splash with

the water, climb into the bucket and dunk their heads into the water. There is not enough room for them to actually swim but I definitely think that a big bucket filled with water can provide great enrichment for caged macaques.

I don't know how your cages are set up, but maybe it is possible to let a little water run into their cages. They really love playing with water coming from a hose. Just a thought!

I guess your suggestion is a double-enrichment: hose plus water.

Do the animals use the hose to spray water on targets, such as onlookers—be it other monkeys or care personnel?

We've only had two (one rhesus and one cyno) who have done this: they put their fingers over the end of the hose and spray onlookers as well as other macaques. It's pretty humorous to watch, as it is clearly intentional! The rhesus who does this will also fill his own pool with the water hose.

Catching caged macaques

How do you train/condition macaques to voluntarily exit into a transfer cage/box without forcefully pulling the individual animal forward with the squeeze-back of the cage?

Once an animal is trained, can any care person catch him or her without making use of the squeeze-back?

I am working with rhesus macaques. What I like to do first is make the transfer box a part of the trainee's home cage that can be thoroughly explored by the animal. For that

purpose I connect the open transfer box to the open home cage, lock it securely to the cage and place favorite treats—like frozen grapes!—in it. I will leave this arrangement for a few days so that the animal can find out that the transfer box is not scary after all.

Once the animal gives the impression of not being afraid of the transfer box, I lure her or him into the box with encouraging words, gently close the door of the box, and let the animal settle down and eat the treats while I praise her or him. I will go through

this little exercise several times, adding brief commands like "In!" to prompt the animal to enter the box, and "Hold!" to get the animal stationed in the box so that I can close the entrance without any ado. After a minute or so, I open the door of the box and let the animal return into the home cage where she or he gets another treat reward for good cooperation. It has been my experience that rhesus macaques can be trained easily to enter into transfer boxes.

When I have trained several animals, I ask the attending care staff to come with me in the animals' rooms so that I can demonstrate to them the steps of the capture procedure—including the treat-reinforcement of cooperation—and familiarize them with the vocal prompts. Everyone needs to be on the same page so that the animals can rely on what they have learned during the initial training. It is important to emphasize, never to use the squeeze-back in order to force an animal to exit into the transfer box; patience is a key condition to gain the animals' trust and willingness to do what is expected of them.

I teach our macaques first to target in their home cages and then to target in the transfer box attached to the cage. I have a good trust-based relationship with them, so it has been my experience that the animals learn quickly to do what I expect them to do ... in exchange for their individually favored treats.

I have applied the same training technique you have described with very good results. For the macaque colony I worked with, all trained animals would cooperate during the capture procedure with any of the NHP staff—techs, investigators and vet. These animals were very food motivated, so their favored food treats were great incentives to do what was expected of them. I would like to add though

that for some individuals we would move the squeeze-back forward in the cage just a few inches; this seemed to give them the signal that it was time to move, almost like our alarm clocks go off and we get out of bed.

We rotate our macaques from their home cages into a 'weigh station' that is also a capture cage by simply closing a guillotine door behind them once they go in. They access this weigh station through a guillotine door installed in the middle of a longer transfer tunnel. We put treats in the station so when they are going through the tunnels to a new area, it's like a little 'pit stop' they can go into through an opened guillotine door and get treats we placed beforehand.

When we train the animals, we never capture them in the beginning, but leave the guillotine door open so, when they are finished grabbing the treats, they can re-enter the tunnel and go back to their regular housing. After they have experienced this exercise a few times, we start closing the guillotine door of the weigh station just briefly after they have entered, and re-open the door right away so they can leave again or stay and eat treats. During subsequent sessions, we keep the animals in the weigh station progressively longer. It is really nice to witness how they get more and more confident with this procedure without anxiety and without fear. Each time they enter the weigh station we say, "In ya go!" Once trained, "In ya go!" is enough to have them go into the weigh station without hesitation. Matter of fact, we usually can't even finish saying that before they go in!

The nice thing about this setup is that there is actually a squeeze cage within the weigh station. For minimizing stress when the squeeze cage must be used, we acclimate all trained animals when they are in the weigh

station by gently pulling the squeeze-back just enough to bring them forward a bit, talking softly and giving them a treat, then releasing the squeeze-back and walking away. They soon have no fear when the squeeze-back is pulled forward and actually associate that with something they like: their favored treat.

When training rhesus and stump-tailed macaques to exit from their home cages into a transfer box, I first make sure that the trainee comes to the front of the cage and takes raisins from my hand. The animal gradually settles down and stays at the front of the cage while I am gently talking. After several visits, the animal shows no signs of fear but will come to the front of the cage when I am entering the room.

During the next sessions, I carefully pull the squeeze-back, thereby coaxing the animal to come forward, sit down and take raisins from my hand. I have to repeat this only a few times until the animal will respond when I unlock the squeeze-back; the clicking sound and some encouraging words prompt the trainee to come forward without me needing to pull the squeeze-back.

I can now connect the closed transfer box to the front of the cage and go through our little routine until the animal is completely at ease with this exercise.

Finally, I connect the open transfer box with the cage door, unlock the squeeze-back—by now the animal will respond to a gentle vocal command like “Come Elli, let’s go!”—and let the animal walk or dash into the transfer box in which raisins or an apple are waiting to be consumed. Depending on the animal’s response, I may repeat this final step a few times.

Any compassionate animal care person will now be able to catch this animal, first

with the trainer being present and then alone. The trick is very simple: Have the animal work WITH you; any force or impatient behavior are bound to trigger resistance, and you will lose the game!

It is all very easy if you can establish a mutual trust relationship with the animal. Once the animal trusts you, and you trust the animal, you have already won the game; the training will be an enriching experience for both of you.

Do you find that the animals are more wary again after a procedure?

If an animal has learned in the course of a successful training program that she or he can trust you, you have won a treasure that will allow you to do other procedures—for example weighing or blood collection—with that animal without losing the animal’s learned cooperation during the capture procedure.

Can you train group-housed macaques living in pens to exit one at a time into a transfer box?

I have successfully trained two breeding troops (28 and 33 members) of rhesus macaques to exit one-by-one into a transfer cage without using any kind of force. The animals will come out in a pretty predictable order—some of them spontaneously, others on vocal command—which makes it easy for one person to catch a specific animal, for example one that needs medical treatment. Patience and a simple chute system were the tools of the training (Reinhardt, 1990).

Working with African green monkeys (vervets)

We are expecting African green monkeys at our facility. I have no experience with this species and wonder if some of you can give me some background information about the characteristics of these animals and how they are best housed and handled.

I’ve worked with greens twice in the lab and, although I believe them to be lovely creatures, I found them to be quite hyper! They were skilled at curving themselves into pretzel shapes which made it very hard to physically restrain them for injections or sampling. If you’re planning on regular samples, I highly suggest you implement a PRT program for them. However, bring your patience for that as well, as their hyperactivity makes for very short attention spans. I also found them to be somewhat fearful. It took quite some time for them to get confident enough to approach the front of their cage for a treat in the feeder box, with me standing there just watching. And, when I say ‘quite some time’ I mean several weeks! When I saw them in their natural habitat, they gave a much less timid and fearful impression.

Our vervets were pretty quiet and not hyperactive, but they were initially shy and it took me quite some time to win them over and get them to take treats from my hand.

All our animals were females. When we got them they were all individually caged. When I tried pairing them, potential cage mates broke out in fights fairly quickly even though they had first lived side by side, separated from each other by grooming-contact bars. Unlike with rhesus and cynomolgus macaques, I found it difficult to

read the vervets’ social gestures, so it was difficult for me to make any predictions of whether or not two females would get along when I would remove the dividing panel. There was only one pair who seemed to be compatible, with both neighbors grooming each other through the bars and giving the impression of being compatible with each other. When I removed the divider, all was fine for two nights, but then the two got into a serious fight and had to be split up again.

We had these vervets for about a year. They enjoyed all the regular toys, fruits and veggie enrichment.

Vervets are great animals and have an awesome temperament! They can be very shy at first and tend to stay at the back of the cage, but with patience and perhaps some gentle training you can get to know them and gain their trust. They are very smart and learn quickly. Vervets are my favorite animals to work with!



When I worked with African greens I noticed that they are much more docile than rhesus macaques. They demonstrated less threatening/aggressive behaviors towards the staff. I found them to be pretty sweet.

Social housing was challenging. Unlike the rhesus, who tended to let you know right away whether they were compatible or not, the vervets would often be fine together initially, for days, weeks, even months, and then out of the blue start fighting with each other rather viciously and had to be separated.

It is also my experience that social housing of vervets can be a rough-going process with lots of fighting, excited flipping and high energy, percussive vocalizing.

I thought I would give everyone a smile by sharing this picture I took in South Africa a couple of years ago while on a volunteer trip. This face certainly sums up the personality of greens.



Training African green monkeys (vervets)

Have you trained vervets (African greens) to cooperate during husbandry- or research-related procedures with or without success?

If you can reply, please indicate the procedure for which the animals were trained by you.

I've target and pole-and-collar trained a few vervets. I've also trained them in a research-related behavioral task, where they had to grab a hanging ball, hold on to it and push it back and forth. I've found they are very food-motivated but slow learners when compared with rhesus macaques.

My question now is: did you SUCCESSFULLY train a few vervets to cooperate during the pole-and-collar chair restraint procedure? Did all the animals cooperate during each step of the procedure, including presenting for pole-attachment in their home cages?

Haha! Yes, well sort of, but not without having to use the squeeze mechanism. All three animals sat nicely during target training and did well acclimating to the pole, getting close to them and even locking on to their collars. However, after I actually had chaired them for the first time, it took a very long time until they allowed me to pole them again in their home cages! I did eventually need to gently squeeze them, but after a couple times they voluntarily presented their collar again to me without being squeezed. All three of them pretty much reacted the same way.

I have trained 16 vervets to successfully accept pole-and-collar and chairing procedures, including IV catheter placement



for dosing and blood collection. They all learned what was expected from them; they just took a little longer than macaques.

Vervets are very food motivated. I made use of this and tried to train 20 vervets to touch a target on command from their cage and to hold onto the target while I held one of their hind legs. I was successful with 10 animals; they all stayed put! One guy did the whole process, right off the bat because he knew what I wanted from watching me train the other guys in the room. His shaping plan was monkey see, monkey do.

The other 10 animals were extremely timid and persistently avoided interacting with me. I made almost no progress with them.

Acclimating to be chair-restrained

How do you go about acclimating your non-human primates to a study function—like chair restraint?

When we acclimate cynomolgus macaques to the chair, we gradually increase the amount of time an animal is restrained in the chair. First, we leave the animal in the chair for a 10-minute period, during which we try to reduce the stress of the experience as much as possible. During the next 20-minute chair acclimation session we make her or him familiar with the different restraint positions during dosing and sample collection procedures. We finally repeat this in a 30-minute session. At the end of each session we offer a food reward and return the animal to the home cage where we offer again a treat.

I think it's very important to keep the first acclimation sessions short, i.e., at the most 10 minutes each. The animal should experience that nothing harmful is happening to her or him and then, before getting too nervous and stressed, be allowed to quickly return to the familiar home cage to calm down and relax and receive a food reward offered by the person who is in charge of the acclimation process.

If I had my way, the monkeys would first be allowed to climb on the restraint chair and explore the chair with hidden treats in great detail, before they are restrained in it for the first time.

When acclimating young rhesus or cynos to the restraint chair, I usually keep several

other animals in cages in the room. They see that I do no harm to their companions in the chair; actually they also get food rewards at the end of each session. I got the feeling that this helps the onlookers to deal with the acclimation process more easily when it is their turn.

I've definitely also seen this phenomenon! I was target-training two African greens in a room full of them, just to practice the skill for myself. After a couple of weeks of teaching these two animals to correctly respond to the target command, I turned to another cage in the room, and the monkey in that cage spontaneously reached out and grabbed the target, before I could even give the command; then he was looking at my hands intensely for the grape; Cutie!

The first time in the chair is quite stressful for the monkeys, so I put them in for only 5 minutes. After one day off, I repeat the chair acclimation for 10-15 minutes. After a day off, the animals are chair restrained for 30 minutes; during this time, I will gently stroke their legs, shave the insertion site(s) and place vet wrap around the shaved area(s); this session is again followed by another day off. In most cases we have to repeat this session several times, depending on the individual animal's reactions. Once an animal is reasonably at ease with being restrained and handled, she or he will be kept in the chair during a final acclimation session for 4 hours. During this final session I give them their regular food, water and, as a reward, a favored treat. Generally I have a rhesus ready to go for a 6- to 8-hour study period with

4-6 acclimation sessions; cynos will usually require 8 or more sessions.

I need to emphasize that a lot of patience is needed to acclimate the animals successfully. They determine the speed of the process, and there is no problem when a session has to be repeated once or several times until I get the feeling that the animal is at ease with it.

We have implemented an acclimation program that takes place while the macaques (cynos and rhesus) are waiting in quarantine. During that time, they get used to the presence of people dressed in protective garb, overcome their fear and accept food offered by hand; they are slowly

familiarized with common lab procedures such as being pushed to the front of the cage with the squeeze-back, being clipped to the cage, exiting into a transfer box, being led with a pole and getting chair-restrained. By the time the animals are released from quarantine, they can typically handle most of the procedures that will be done with them during their assignments to research studies.

Our quarantine-period acclimation program of new animals was developed by investigators, vet staff and animal care staff. The techs responsible for feeding/ changing these animals are the ones who do the acclimation-to-study procedures in coordination with the study staff.

Training macaques to test the Lixit of their cage

Is it possible to train macaques to touch the Lixit of the cage so that attending personnel can check that the watering system is properly functioning?

I wanted to get our rhesus macaques to test their water Lixits on command, instead of the caretakers having to put a pole through the mesh of the cage and push the tip of the Lixit. This routine procedure often frightens the animals quite a bit; they sometimes grab the pole in a self-defensive or aggressive reaction and struggle with the caretaker who then has to remove the pole by force. Even if they don't grab it, they often cower at the opposite side of the cage in a fearful posture.

We thought it would be a great idea if we could have the monkeys target their finger to a laser light point, then transfer it to the Lixit and finally fade out the laser (or

even continue to use the laser, if necessary). Sadly, I never got to see the idea come to fruition, because it was argued that it would not be worth it to invest the time necessary to train all the rhesus monkeys at the facility—so hard to change those traditional perceptions! I'm no longer at that facility, but I believe that others more recently have tried working on this behavior and getting it approved.

Back when I was the enrichment tech at my last job, I trained one cynomolgus macaque to check his Lixit with a laser pointer. My current position doesn't give me the time to do this kind of work, but I think it could be incredibly valuable, plus would serve as a great form of enrichment for the monkeys.

... and for the caretaker who does the training.



We have successfully trained with a laser pointer at least one cyno in each pair/group to target to their Lixits. Currently this stands at about 35 cages housing a total of 63 animals. We no longer need to check the Lixits with poles. Most of the animals no longer even need the laser and will check the Lixit upon a verbal command and a simple hand gesture. It's fun to watch the animals as the technician goes around the room and all the animals are checking their Lixits themselves (Ferraro et al., 2013).

I trained 8 rhesus (6 males and 2 females) and 15 cynomolgus (12 males and 3 females) macaques to check their Lixits, using a laser pointer as the target. The macaques were already familiar with me, and 8 of the cynos had been pole-and-collar trained by me.

To start with, I conditioned each macaque to the sound of a clicker (bridge),

by clicking and providing a food reward. This was followed by introducing the individual to the laser pointer either on the side of the cage or the back of the cage. When the macaque touched the laser point on the cage, I clicked and gave the animal a reinforcement treat. After the animal consistently touched the laser point on the cage wall or the back of the cage, the laser point was moved to the Lixit.

Training sessions lasted five minutes or less. After an average of four sessions, 7 of the 8 rhesus (88%) and 13 of the 15 cynomolgus macaques (87%) checked their Lixits on cue. In the beginning, the laser pointer was still needed but it was eventually phased out; a verbal cue was then sufficient to prompt the animals to check their Lixits (Haba Nelsen et al., 2010).

Pair-housing of macaques with cranial implants

Can anyone give some reference indications about the possibility of pair-housing macaques who have been fixed with implants to record neural activity? I need this information to revise a protocol in which the investigator wants to leave the animals (rhesus and pig-tailed macaques) single-housed with visual contact with other caged macaques in the same room. I remember that I have read somewhere that there is a possibility of avoiding single-housing of non-human primates who have cranial implants.

I am happy that you try to have this particular protocol revised/refined so that macaques with cranial implants are allowed to live with a compatible companion. Here are a few supportive references:

- › Reinhardt V, Houser WD and Eisele S 1989 Pairing previously singly caged rhesus monkeys does not interfere with common research protocols. *Laboratory Animal Science* 39: 73-74
- › Reinhardt V 1997 Refining the traditional housing and handling of laboratory rhesus macaques improves scientific methodology. *Primate Report* 49: 93-112
- › Roberts SJ and Platt ML 2004 Pair-housing macaques with biomedical implants: a safe and practical alternative to single-housing. *American Journal of Primatology* 62(Supplement): 96-97
- › Truelove M 2009 Social housing of nonhuman primates with cranial implants: A discussion. *Laboratory Primate Newsletter* 48(2): 1-2

I worked in a colony with cranially implanted rhesus, and the major concern was removal of

sutures by the partner before wound healing. Our compromise was that the animals were separated from their cage mates for a couple of days post-op and were then re-paired.

This concern is probably not based on actual observations but on an assumption? As attending vet, I worked with well over 100 pair-housed, cranial-implanted female rhesus macaques; I do not remember a single case of suture removal after surgery by the cage companion. The surgery was always done in the morning; the operated animal was typically returned to her companion in the pair's home cage by late afternoon. Rather than jeopardizing proper healing of the implantation site, the presence of the familiar companion is likely to buffer post surgical stress, thereby supporting the recovery process.

It has been my experience that some investigators working with headcap-implanted macaques request that their animals be caged alone; they argue that a companion would compromise the recovery process, especially by messing with the sutures, setting local infections at the margin of the implantation site and/or damaging the implant. If you have worked or are working with cranial-implanted macaques, would you say that these concerns are realistic enough for an Animal Care and Use Committee to exempt study-assigned animals from being housed with another compatible companion?

No! Such concerns should not be used to keep these animals alone in single cages. I would recommend that cage mates are introduced prior to implant surgery.

Our rhesus macaques did occasionally develop infections along the margins of the implantation sites, but this was seen in both paired and non-paired animals. I have seen animals grooming their partner's implant with no ill effects either.

We are working with cranially implanted adult male rhesus macaques; most of these animals live with a compatible partner, some live alone. Anecdotally, it seems to me that we end up having more margin infections in singly housed animals than in pairs.

I have also observed many times how the animals groom their partner's implantation site. They are very focused while grooming and pick up any tiny crust material. In fact, they do keep the implantation site very clean.

We pair-house our macaques both with cranial implants and with arm implants; we have never had an issue. Our PI gave in about five years ago and has been pleasantly surprised.

Even during grooming sessions, cage companions rarely touch the implants but they carefully clean each other's margins; I think my singly housed implanted guys spend more time picking at their own implants.

Almost all of our pair-housed macaques (cynos, rhesus and bonnets) have cranial implants of one style or another; so far we haven't had any trouble with any of them damaging each other's posts, wells, etc. Any implant failure we've had in our pairs has not been caused by the other monk but usually was a mechanical failure.

We have many studies here where the macaques have cranial implants; the majority of these animals are pair-housed. Some were paired prior to receiving the implant

and others were paired after the implant was placed. Checking the animals regularly, I get the impression that those who are housed alone pick at the margin of the implantation site quite often while those housed with a cage companion are less likely to do this, probably because their partner keeps the margin meticulously clean during mutual grooming sessions.

We do not accept single-housing due to having a cranial implant as justification.

Post-surgical pair-housing of non-human primates

What's your policy on returning monkeys to social companion(s) after surgery? Have you seen infections in post-op monkeys associated with cage mates interfering with the sutures?

We usually re-pair within a few days after surgery and have not had any incidence of a partner pulling sutures; we worry about missing sutures more with our singly housed monkeys.

Our surgeries are pretty invasive, so we like to give the monks some time to recover before re-pairing them. Rather than allowing for full body contact, we pair the post-op animals with their familiar cage companions in a protected contact-housing arrangement (grooming-contact bars). This is not a hard and fast rule; if we observe a monkey spending most of her or his time at the grooming bars close to the companion and eating well, we will remove the grooming-contact bars early. We did have some breakdowns/tiffs when we re-paired a monkey after surgery too early; we now observe the behavior of the two animals more carefully to make sure that they will get along well with each other when the grooming-contact bars are removed.

In the past we kept the post-op monkey alone until sutures were removed, but since we have begun re-pairing earlier, we haven't had any issues with the buddy pulling sutures out. Actually, I would even guess our suture failure rate (removal) is lower with our pairs than with our singles.

As soon as the post-op animal is fully awake, not groggy from anesthesia and not physically compromised from the surgery, we re-pair or re-group her or him. We bury sutures, so there is no issue with partners pulling at the sutures; but if there were skin sutures, I'd be more worried about the post-op animal pulling her or his own sutures rather than the cage mate!

In my experience, the animals who had a cage mate prior to surgery seem to recover quicker when allowed to be paired back with their friend than those who didn't have a cage companion or who weren't allowed to be paired back with their familiar cage mate. Their appetites return quicker and they give the impression of being much happier and less affected by the surgery; they recover relatively quickly. I rarely saw the cage mate mess with the sutures. It happened pretty often that animals who were caged alone after the surgery picked at the sutures, probably because they had no friend to comfort them and keep them occupied.

We re-paired rhesus macaques with their cage companions after cranial-implant surgery as soon as they were fully awake, alert and fully mobile. I don't remember that this practice ever caused any clinical complications, but it was evident that these animals recovered much better than in the past when all animals were strictly single-caged, so they had no companion while recovering from surgery.

Separation of paired companions

It sometimes happens that previously single-caged monkeys are paired with a compatible cage companion for a few weeks and then separated again for research-related reasons. I wonder if the positive experience of finally living with a cage companion is balancing the negative experience of losing the companion again. Would the single-caged monkey perhaps be better off staying alone and being spared the distress of losing a compatible cage companion?

My thought is that it's kinder to let them have a short time together than none at all.

Yes, I completely agree. Better to have loved and lost than to have never loved.

It's certainly better to share the cage with another compatible monkey, even for a short time, than being always alone.

In my opinion, any time spent together with a companion is preferable to no time at all; and this is probably true for all social animals.

I agree!

In our facility, social housing is the default, and a study director needs a very strong argument for single housing—that goes not only for monkeys but also for dogs, mice and rats. I assign all monkeys as compatible pairs to studies. We plan necropsy schedules around keeping pairs together throughout the process so that a cage mate is not left behind. It took a long time to change study directors' minds to be amenable to this approach, but it does work well; it preserves established pairs and makes it unnecessary to spend time re-pairing animals with new partners.

Remote video recording of caged non-human primates

Is anyone on the forum video recording non-human primates in order to evaluate new enrichment items, to check the compatibility of new pairings and to assess possible stereotypies during times when the animals are not disturbed by human activities?

We have cameras in every NHP room, recording all the time; the momentary recordings can be viewed at any time on computers at the vet staff's desk; they can also be rewound and viewed at a later time.

This remote monitoring system works great for behavioral and pairing assessment.

I video record frequently during the evening hours, after everyone has gone home for the day, to assess pair compatibility and abnormal behavior. Video recording has been a great tool since so many monkeys behave differently when humans are in the room.

By video recording our caged macaques I've been able to investigate abnormal behavior and set up interventions that work.

It has been especially useful for cases of covert self-injury. Only through video can you see what triggers the behavior and what consequences are potentially maintaining it. Otherwise, you're just operating on your best guess which, in some cases, can be dead wrong and waste valuable treatment time.

Video recording has also let me keep together compatible pairs that everyone thought should be separated. We had one pair who had issues whenever certain individuals entered the room: the dominant would stare at the subordinate partner, who then would scream loudly. The two rarely fought and if they did, it never had serious consequences. So, I recorded them at various time points and discovered that the two were one of the most bonded monkey pairs ever; they slept together, ate together, played together, and groomed each other endlessly. The video made it very clear that it was certain people that were setting them off. With a little investigation, I found out that some people felt bad for the subordinate male and always tried to give him treats, but not to the dominant male because they thought he was being a 'bad' monkey.

We changed how people interacted with the pair and everyone was happier for it! So yes, I would say remote video recording most definitely provides a wonderful tool to improve animal welfare.

We've used remote video recording when no person was in the animal room to assess some forms of potential enrichment for marmosets. For example, we used it to assess whether marmosets value being provided with additional heat/light in a specific area of the cage. After habituating the marmosets to the camera by setting it up in front of the cages of family groups for a few days, we filmed the area of the cage

where the light/heat would be provided, for 20 minutes at the same time every day for 7-10 days to get baseline readings as to how long marmosets spent in that area of the cage and what behaviors they performed. Then we filmed the animals and the same area of the cage, at the same time and for the same duration, with the heat/light provided; this allowed us to find out how long marmosets were in the test area and what behaviors they performed, and compare these data with the baseline readings. We continued the video recordings on several consecutive days to see if the animals lost interest in the enrichment.

Findings showed that the marmosets spent more time in the specified area of the cage and spent more time in groups basking and allogrooming when the heat/light was provided. The animals showed no sign that they lose interest in the extra source of heat/light.

The remote recordings also made us aware of a gap in one of the family cages which a baby marmoset could escape through: When we looked at film of one of the baseline sessions, most of the 20 minutes was taken up with Selfie, a baby marmoset who had obviously been curious about the camera, got out of the cage through the gap, and spent most of the time licking the camera lens and filming close-ups of his face! Then he returned to the cage before we came in to retrieve the camera!

At the moment, GoPro cameras (small cable-less cameras that can be positioned in the cage) are being assessed as alternatives to cameras positioned externally. The problem is: now we get even more Selfies!



Refined ECG procedure

For those of you who perform ECGs on your monkeys, I am curious what type of clip you might use. We use the alligator-type clip and then flatten the teeth on them, but they still seem to pinch the animals' skin quite a bit. It would be nice to find an alternative that is less uncomfortable for the animals.

A few years back I went to Ace Hardware and tried all of their alligator-type clips, trying to find something that was less harsh. I ended up with a little alligator that has no teeth, just fine lines, similar to a small hemostat. It also didn't clamp down hard in the closed position. I removed the existing ECG alligators, soldered them on and shrink-wrapped some plastic around the junction. I apply lube and attach this instrument between two toes. There are no adverse effects when using these little alligators. I got several extras at that time but have not needed to replace any yet.

Cleaning: since there are lots of little grooves, I soak the gel off and use an eye spear to clean between the grooves. Works great. Happy toes!

You are smart and compassionate, truly committed to animal welfare. Thanks for sharing!

Very cool!

This is very interesting! Thank you for sharing. Your monkeys are lucky to have someone that goes on their own time to make things better. Very cool!

We used those traditional alligator clips for a long time but in the past few years have switched to the sticky pads for all species.

They work really well, and are much more comfortable than the alligator clips.

We also experienced problems with the alligator clips causing noticeable pain reactions. We were able to do a very short 'snapshot' ECG on one of our primates in his chair by simply placing each clip inside a (lubricated) closed fist or foot. One tech just gently held the fist and foot closed. Of course this would not work in a surgical setting or lengthy procedure. I do like the idea of the sticky pads.

We also use these adhesive snap pads. They don't seem to bother the animals at all.

I have one more question to add. Has anyone seen any irritation caused by the glue of the sticky pads?

I've never seen any irritation from the sticky pads on monkeys.

I've heard of that happening. One of the PIs at my facility does a lot of work using ECG pads. He himself had an allergic reaction to the adhesive, but he said it's like 1% of the human population or something. He felt special.

I have never seen skin irritations resulting from the sticky pads in our monkeys.

I have never seen any irritation resulting from the pads on any of our animals—monks, pigs, dogs. We have seen irritation due to shaving though. We shave just a little bit more than the space needed to place the pad. All of our ECGs are performed on conscious animals, so the pads really seem to work better than the alligator clips.

Thank you for sharing this very valuable information. The Selfie-story demonstrates very nicely that remote video recording can show you things that you would have missed when directly observing the animals in their room.

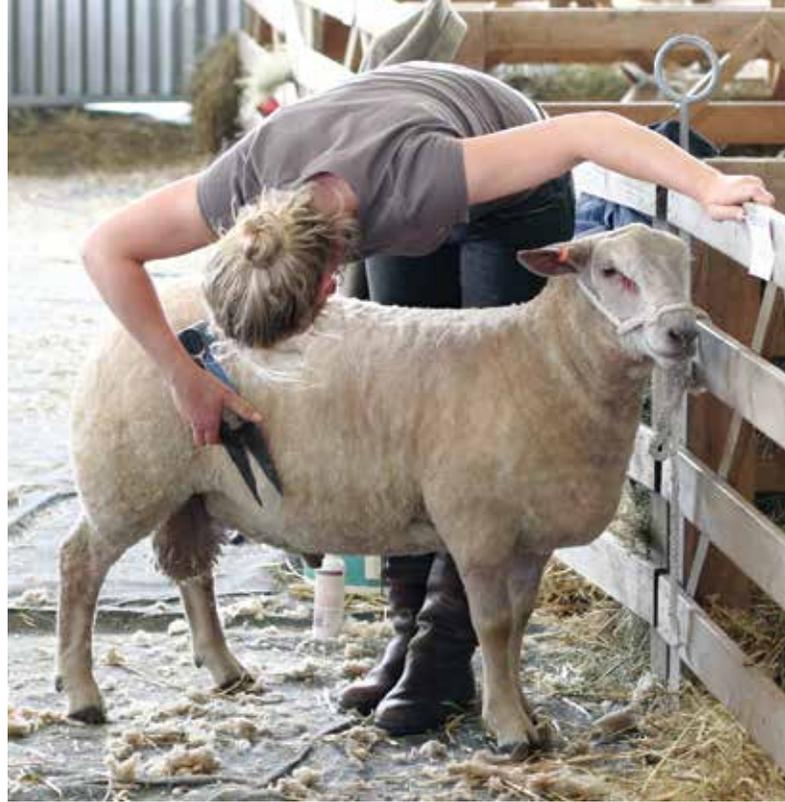
Farm Animals

Species-adequate housing and handling

What are practical options for providing farm animals—swine [excluding Göttinger minipigs], cattle, horses, sheep and goats—species-adequate housing/living conditions in the research setting? And, what are practical options for avoiding/minimizing stress or distress reactions when farm animals are handled/moved during husbandry and research procedures?

I worked with sheep and goats in a research setting at a university. Both species were kept in small herds, each herd in a large room provisioned with bedding and hay. I spent much extra time with the sheep and goats; they liked it when I scratched and stroked them. I had a very good relationship with these animals, so it was very easy for me to handle them during husbandry procedures.





Social housing for these species is of the utmost importance; they will suffer greatly if kept in isolation even for a short period of time.

It has been my experience with dairy cattle that these animals gained trust in me much easier and quicker than macaques. I did endocrinological research with cows and this implied that blood samples had to be collected from individual animals regularly, sometimes around the clock. There was no need to actually train the cows to cooperate, i.e., stand still; after a few gentle-and-firm but also patient sampling procedures via catheter or directly via jugular venipuncture, the animals kind of got it and made no fuss at all. I remember the times when I took blood samples at night from recumbent cows on the pasture without any ado. The animals did not even bother to get up. Compared to my experience with macaques, these cows were very, very amazing and

easy to work with. I wonder if sheep, goats and swine react similarly to gentle-and-firm handling as cattle do.

Yes, sheep and goats do react just as well to gentle-and-firm handling and conditioning as cows do. I find sheep become accustomed to handling quicker than goats and in many cases they become almost too friendly, poking you with their foreheads with friendly intentions over and over again while you try to go about doing your work.

Swine do act similarly but I find them to be more cautious and timid than sheep. It takes probably more to deserve a pig's trust. They really are quite affectionate critters once they know that the person caring for them is never a source of stress but always has good intentions. I have over the years given many IM injections to farm pigs without ever triggering fear or self-defense reactions. I

spent much time with them and had a very good relationship with them. They loved it when I scratched their backs with a firm brush; experience had conditioned them to trust me, so it was very easy to give them injections.

Based on my experience and observations, I feel that the following basic conditions must be met when a research institution intends to provide species-adequate housing and handling conditions for cattle, swine, sheep and goats:

- › Cattle: full-contact social housing; regular friendly direct contact with humans; access to outdoors and access to

shade; access to a scratching/rubbing device (e.g., brush).

- › Swine: full-contact social housing; regular friendly direct contact with humans; provision of a rooting substrate; access to a scratching/rubbing device (e.g., tree stump).

- › Sheep: full-contact social housing; regular friendly direct contact with humans; straw bedding.
- › Goats: full-contact social housing; regular friendly direct contact with humans; nibbling/foraging opportunities (e.g., suspended basket filled with hay).

I agree with your 'must' list for sure.



Environmental enrichment for Göttinger minipigs

We have a strict liquid-diet study coming up with Göttinger minipigs. Nothing can be given to the animals that they could possibly bite on or chew for at least two weeks; this implies no chains or toys for enrichment. Does anyone have any ideas, other than perhaps playing movies, that could possibly work as species-adequate enrichment for these animals?

In similar circumstances we purchased plastic, weighted balls that were very large so that the pigs couldn't get a mouth-hold on them. This allowed them to push the ball all around their pen. Note, this can get very loud!

Hopefully you also have the option of adding in additional people-based enrichment, like brushing.

Yes, pigs like it very much when they are brushed. That would be a great way of providing environmental enrichment during the two weeks when these pigs will have no opportunities to bite or chew objects.

The suggestion of balls on the floor is a very good idea.

You could also hang such balls in the pigs' enclosures at a height that allows them to play with the ball with their snouts but makes it impossible for them to reach/chew the suspending chain. I would smear some enticing tasty stuff on the balls so that the pigs spend extra time licking the surface of the dangling ball.

Pigs use their sense of smell a lot, so it would make sense to use odors as olfactory enrichment.

I have added peppermint extract to water pools; our minipigs go nuts for the smell!

You could apply such peppermint extract on big suspended balls. The pigs would probably get quite excited and keep moving the balls round and round with their snouts.

Love the idea of olfactory enrichment; I might try to do something with that. Also, the very large ball to push around seems to be good; we do have those in house.

Lots of human interaction, play time, belly rubs and training are good options for environmental enrichment when anything chewable is excluded for research-related reasons. There is no doubt in my mind that our pigs love human company more than any of their toys or treats. Also, water enrichment would be perfect for your situation; pigs love water, and spraying with the hose does not require a lot of extra time, but the pigs get so much entertainment from it. I have worked with pigs who would wait by the door when they see a hose, just so they can run through it—like a kid in a garden water sprinkler.



Rooting opportunities for pigs

Rooting is probably the most characteristic behavior of pigs/swine who are wild or have access to a natural habitat. How can we make it possible for pigs to engage in this important activity in the research lab setting?

You can enable rooting behavior in the research setting by giving pigs things and substrates they can dig in and push around with their snouts. I used to give our pigs 'rooting bins.' I took a large rubber feeding bin and placed treats under stainless bowls turned upside down in the feeder. The pigs would have to root the bowls right-side-up-and-out of the feeder to obtain the treats. They were very good at it. I would also make piles of shredded paper and sprinkle treats on them. The pigs really enjoyed digging with their snouts through the piles to get the treats. Buster Food Cubes designed for dogs also work very well for pigs. These

plastic toys hold treats; they must be pushed and rolled around on the floor so that treats fall out. They are not expensive, easy to clean and sturdy enough to withstand rough treatment from the pigs for quite a while. The pigs engage in quite a bit of rooting when they interact with these gadgets.

Recycling was one of my favorite things to do and I would save old rubber stoppers from rodent bottles and thread them on a long rope. I hung the rope over the pens in such a way that it kind of dangled invitingly over the pigs' heads. They got hours of enjoyment chewing on the rubber stoppers and pushing the rope side to side in the pen with their snout; these ropes also worked well just loose on the floor for a good game of tug-o-war with a friend!

Another favorite was to use the empty rodent bedding bags or cardboard boxes, fill them with shredded paper or hay mixed

with treats. The pigs would root the bags and push the boxes around the room, and finally tear everything up to get to the treats.

A basketball smeared with peanut butter gets rooted around a lot until the pigs have it licked clean.

I would rotate these various rooting options, so the pigs have something new each day for a whole week, and then start over again another week. It has been my experience that pigs never get tired of rooting.

Pigs love to root for goodies that are hidden in cardboard boxes. I always close the boxes by weaving the flaps to avoid using tape. Every single pig has found his or her way through to the goodies and then had a blast tearing up the box.

That is a great idea!

We use tennis balls, dumbbells, Jingle Balls, chains and Flexi-Keys. They play with all the gadgets, but they like the Flexi-Keys the best, especially when I attach them to chains. They love to nose the keys, pull and gnaw on them. We also change out their toys every week.

Are Flexi-Keys the plastic set of different colored toy keys that your pigs can chew on? I'm always amazed at how popular those are with so many species, including macaques; human babies love them.

Yes, the Flexi-Keys are the different colored keys. The pigs will root and gnaw on them all

day. Sometimes I spray the keys with a scent, like mango, or lemon too, just for some olfactory enrichment.

We provide wood shaving bedding onto which we sprinkle treats for our pigs; they love rooting in it! We also give them big plastic balls baited with treats that fall out through holes when the pigs nudge and roll them with their snouts.

It has been my experience that pigs love to play with suspended chains, especially when an object or several objects are attached that the animals can explore with their snouts and with their mouths.

We cover suspended chains with a garden hose or fire hose—for durability and as a noise buffer. Sometimes we hang Jolly Balls or other toys from the end and hang a second chain/hose off the side. I saw one pig spinning around on it; quite adorable!



We use plastic chains for our pigs, usually with a dangling toy attached to the end. Our pigs seem to enjoy large Jolly Apples suspended from a chain. Large PVC pipes, hung horizontally, with various dangling toys attached, provide great rooting entertainment for pigs. We also freeze cups of juice with fruit slices and hang them on the chains; they are a huge hit!



Jacket acclimation for pigs

I'm wondering if there are any folks on the forum who have any advice or written protocols for acclimating pigs to wearing jackets? These will be 30-50 kg farm pigs; the jackets are custom-made. The animals will have to wear them for about two weeks. Typically we acclimate all our pigs for one week; is this perhaps not long enough?

Our plan on jacket acclimation for pigs is as follows:

- › Step One: The jacket is introduced to the animal with positive human contact and/or treats.

- › Step Two: The jacket is partially placed on the animal for a short time (i.e., no less than 10 minutes). Once acclimated to partial placement of the jacket, the jacket will be zippered and adjusted and left on the pig for longer periods of time (i.e., 4 hours). Manipulating the jacket can be very stressful, so it is very important to thoroughly acclimate the pig to zipping the jacket and adjusting it. Positive human contact and/or treats are given.
- › Step Three: The jacket is placed on the animal and kept on for the day.

These first three steps may be repeated if necessary.

- › Step Four: The jacket is placed on the animal and kept on as needed for study.

We typically place the jackets during anesthesia recovery and the animals do surprisingly well. The issues we've encountered with long-term use of the jackets are:

- › If you use males, watch for soiling of the jacket's underside.
- › Irritation of the forelimbs at the jacket armholes. There are two types of jackets available, one of which has fabric covering the mesh edges; the fabric helps to cushion the armholes and seems to be more comfortable for the pigs.
- › Group-housed pigs tend to chew on each other's jackets and damage the zippers.
- › Some of the jackets tend to ride up around the neck of the animal; this can become a source of great discomfort. It's therefore important to make sure to check the placement often and slide the jacket caudally as needed.

I have utilized jackets for a number of swine studies. In my experience the animals adapt to the jackets quite well, with larger breeds doing better than smaller breeds. I think it's because they tend to have calmer personalities. Yorkshires do particularly well with the jackets; so much so we actually stopped acclimating them during one project because we found they didn't need it. Some of these pigs were quite sizeable—close to 80 kilograms!

I've found females to be more suitable, as you can use a longer jacket without fear of them urinating on it and developing skin irritations. Additionally, the longer jackets tend to ride up much less. If you're going to

keep the jackets on the pigs for an extended period, you must be sure to loosen them occasionally to avoid irritation of the skin.

We're also hoping to acclimate the pigs not only to the jackets but also to a sling, because the animals will have a bandage that needs to be changed every 2-3 days.

Making use of the sling can be an excellent idea—depending upon the bandage location. If it's going to be on their backs, you're golden, if not, you will encounter considerable challenges.

As the sling is designed to work by pressing against the skin, I would recommend doing a 'dry run' with the pig already in the jacket. I'm not sure if the pressure of the sling will cause the jacket to feel more irritating. Also, have lots of little treats on hand for rewards during the sling acclimation and for each time you have to change the bandage. Jelly beans can work like magic! Pieces of Oreo cookie, juice in a squirt bottle, and apple pieces are also very well received. Play to their sweet tooth and they'll love you for it and allow you to do the necessary procedures with them more readily.

We found that bandage changes can be done better without a sling. I know this depends a lot on the size/type of bandage you will be changing, but the sling just makes it harder for our study. We feed the pigs at bandage change time and they are distracted enough by their food that we can do a full bandage change while they just stand by their feed dish. Occasionally a staff member may need to sit on the floor by the pig's head with treats if the pig finishes the feed ration too quickly.

Miscellaneous

Practicability of wood shaving bedding for indoor-housed animals

When you keep animals on wood shavings, how do you avoid the floor drains getting clogged?

Our pigs are kept on pine shaving bedding. We scoop the pen and have a basket strainer in the floor drain to prevent clogging.

The pen is then foamed, scrubbed and rinsed, ready for the pigs to return. Attending personnel who pay attention rarely allow the drains to clog. However, certain personnel, no matter what they were told to pay attention to, manage to clog the drains every time they are on duty!



The pigs we have worked with seemed to really like their aspen shaving bedding, particularly when treats were mixed into it. We had special covers made to keep the shavings out of the drains. Our main problem, I think, was compliance: The husbandry group repeatedly did not cover the drains when they should have, so we did have avoidable issues with clogged drains.

We, too, keep our pigs on wood shavings. The animals are housed in dog runs (pairs) or in open rooms (groups). We scoop the shavings into garbage bags, then sweep the floor to get the leftovers. We have round plastic plates that sit underneath the drain covers (which have holes) to catch any fine stuff from going down the drain. Once we have cleaned the floor, we remove the drain cover and clean out anything that has accumulated on top of the plastic plate underneath. It is a lot of work but worth the benefits of solid-floor housing for the pigs. We have the same drain-protection arrangement for our group-housed sheep.

At our facility, research is done with many long-term sheep who are all free-roaming in groups of 4-5 individuals in large rooms with thick stall mats and aspen bedding. We use a tiny-perforated cover that is intended to prevent more than minuscule amounts of bedding to pass into the drain. We spot clean (muck/shovel) or strip the bedding fully every day, depending on how many sheep are in the room. Our rooms are fully stripped and sanitized at least monthly or more often if needed, and for this we move the sheep into a centralized anteroom. Yes, we find it practicable to keep our animals on aspen bedding; with our cleaning system we are encountering no clogging issues with the drains.

Our facility has a room of stationary monkey cages; we refer to it as our 'EU room' as the over-6-foot-high cages meet the EU housing standards. We use aspen shavings as bedding and foraging substrate in these cages. The cages have removable pans; shavings are scooped out and discarded. So far, our drains have been okay; we do cover them with screens, as a backup.

Where I used to work, we had many group-housed monks in large pens with wood shavings. Drains were protected with a commercial stopper. When the pen required cleaning, the animals were either moved into an outdoor section attached to the pen or via 'a trap door' to an adjacent pen so the area could be swept clean.

Every now and then, the guys were allowed to distribute their own bedding in the clean pen. Staff would ensure the staples were removed from the packaging and then just let the kids go nuts!

Cleaning up messy enrichment

Has anyone had issues with giving corn on the cob to macaques? Do the animals eat the cob? Did you encounter clogging problems with the sewage drain?

I've not seen our macaques eat the cobs, but you need to remove the cob anyway and not flush it down the drain. It'll plug the drain for sure!

Our rhesus and cynos eat the corn but not the cob; yes, they may nibble the cob but not ingest it. We use drain covers to catch the leftovers and prevent them from clogging the drain.

Our cynos and rhesus LOVE corn on the cob! Actually, they love any produce that takes a bit of processing, such as pomegranates, pumpkins or squash. I've never seen them eat the cob. Our rooms have no drains, so that's not an issue for us.

Our macaques also love corn on the cob; we are set up in such a way that drains can't plug. Our animals get the corn right off the stalk without shucking it, so they get to peel away all the layers ... and make an amazing mess! But it's so much fun for them!

Yes, they LOVE it unshucked. That's how I managed to get it banned at my facility. I handed it out once—only once! I knew it would be a mess, so I purposely went into the rooms early in the morning to pull as much of the 'waste' from the cages as I could. But, I didn't get to our third room before one of the service folks found out. The complaining and bellyaching that ensued was one of the

most ridiculous arguments I've ever had. Mind you, all of our drains are covered to avoid blockage and our cages have open back flush pans. The complaint came from the fact that it took "too much time" to hose out the cage and the silks made "a huge mess" in the pans. When facility management came down on me, you'd think it was the 100th time I gave them unshucked corn and someone suffered a life-altering injury because of it. Long story short, it's at the top of the "never allowed to give the monkeys" list. Bugs me like you wouldn't believe!

I have had the same problems in my facility. I used corn on the cob a couple times but because it clogged the drains, we had to stop giving it to our primates. They loved it though! I've had to stop so many enrichment ideas such as destructible items like treats



in paper bags, raisin boxes, etc. because of the drains. I feel sad for the monkeys; after all, they contribute their lives to research, so why not devote a little extra time for special enrichment that they enjoy so much? I think the animals would deserve it if research grants would include a special budget for the animals themselves! Such a budget would cover expenses for enrichment-related cleanup time, special enrichment and retirement after release from research.

I'm sorry to hear there are others who have issues with making the critters happy. I sadly get complaints all the time about destructible enrichment, whether it be paper, produce or certain toys. I've actually had to stop giving paper boxes to the pigs because some members of the attending service staff do not pay attention and will wash the torn and chewed up cardboard down the drains rather than remove it from the run prior to getting out the hose. Then, I'm the one who is called in to remove the contents from the



drain because it's considered to be my fault. However, I do have some amazing caretakers who love to give their animals the 'cool stuff' and are willing to spend the extra time for cleaning up the mess. With these folks, I'm able to sneak the good stuff in on weekends when there isn't anyone around to complain.

One of my favorite stories is from the one and only time we handed out long pieces of sugar cane to the cynos. What a mess! I never intended for each animal to get over a foot-long piece of the stuff; but they did and went nuts! When it swelled up and got caught in the flush drains of the quads, the caretaker created a snake-type apparatus from coat hangers and duct tape and got to work! She was in there forever getting that stuff out of the flush drains. Afterwards, she took me aside quietly to let me know what happened and asked that we perhaps consider giving them less of the stuff if we ever used it again. But, because she had to sign in and out of the room, the management got wind of what happened and sugar cane hit the banned list. That individual and I still laugh about it every now and again and use the words 'sugar cane' as code for anything banned.

I love the 'sugar cane' code words; so funny.

We experienced a similar situation with new 'messy' enrichment. Just like with any change, there was a good deal of complaining at the onset. But with the support of the managers, we pushed forward and eventually the nuisance of enrichment just became part of the daily routine. I got my fair share of eye rolls when they saw me with my bag of goodies, but many staff members who were initially resistant to the change noticed how happy the animals were. Once they accepted the new enrichment practices, many of them even started approaching

me with their own ideas. What a wonderful feeling that was!

I make sure to include the animal care staff in making decisions on what enrichment to provide whenever possible. That seems to make them more agreeable with and excited about the program. We are several years into the new enrichment routine and the only pushback I usually get now is some playful remarks about messing up their animal rooms.

When I think of how many years these monkeys have given of themselves—actually without their consent—for the benefit of mankind, it seems so reasonable that spending a few extra moments to clean up a mess once in a while, a mess that brings them such joy, would be a kind thing to do. I very much agree, it would be more than fair if investigators would include in their research grant applications some funding for periodic extra cleanup time during special enrichment, such as offering monkeys the opportunity to process and eat whole corn on the cob or whole melons, whole pumpkins and other produce that requires a lot of peeling, chewing and gnawing.

It should be a standard practice to have all drains furnished with suitable covers that make it possible for personnel to swiftly collect all waste material that could clog the sewage drains of the animal rooms. That's the least we could request to make it less frustrating when we want to implement messy enrichment that is particularly attractive for the animals in our charge.

How practicable is it to feed caged macaques and baboons (not groups living in large pens) whole produce of the season that is bound to create quite a mess, for example,



corn on the cob, melons, pumpkins, oranges and bananas? The animals love it, but is it worth the extra time spent to clean up before you can leave for the day?

Totally worth the effort!

It is worth the effort! I always let the care staff choose which day is most convenient to give the animals whole produce, and then I help them with the cleanup. That way it's not such a chore. We feed corn on the cob with the husks, whole bananas and sometimes whole squash.

Yes, whole produce is so worth the effort, you just have to ensure the drain covers are in place so nothing like corn cobs or banana peels goes down the drain. Otherwise, I find the animals clean up pretty well. We open our cages daily to pull the biscuits, so it's not much more effort to remove pieces of produce. The amount of time the animals spend processing and eating the produce is



well worth the little extra time for cleaning up leftovers.

Oh my gosh, YES, it is so worth any extra cleanup! We have offered corn on the cob to our caged macaques temporarily in quarantine cages, and watching how much they enjoy this treat is absolutely the highlight of my day! And I'm sure theirs as well.

I can say that it's also worth it to feed whole produce not only to non-human primates but also to most other species commonly found in research labs. It might take extra time to clean messy leftovers in cages or runs/pens but seeing how macaques, pigs, rabbits, gerbils and other animals enjoy real foraging activities is very relaxing and rewarding. I've not encountered anyone who thought it wasn't worth it, or at least not encountered anyone who verbalized that concern.

Our guys and girls eat the entire corn on the cob and banana; yep, cob and peel too! With

oranges, they typically peel it enough to get at the insides and then leave us a really nice, still-formed orange peel.

In my opinion, the benefit for giving whole produce far outweighs the cons of cleaning up after them. I also feel that it's our job to do that. After all, at the end of the day, I get to go home, they don't. I am the one to give our animals the produce, and I am also the one who cleans up after them, so I understand both sides of the argument, but still feel the cleanup is worth offering the animals this kind of enrichment.

I very much like your work ethics! The simple fact is, it not only benefits the animals in your charge but it also makes you happy.

Your monkeys are lucky to have you! Most of our macaques also eat the entire corn on the cob, EVERYTHING is gone! It's so rewarding to watch them enjoy it so much!

Abnormal behavior – A misleading term

Is it really correct to label stereotypical movements/behaviors as 'abnormal' when they are shown by individuals who are kept in species-inadequate confinement conditions? Do these stereotypes not reflect a desperate attempt to cope with a situation that frustrates certain inherent drives, e.g., exercising, interacting with conspecifics, foraging, escaping, etc.? What is really 'abnormal' is perhaps not the subject's attempt to deal with the frustrating situation but the situation itself, e.g., restricted, barren living quarters.

I get so frustrated by the lack of understanding people show with primate behavior. If a primate shows any aggression or resorts to self-destructive behavior, people who have the say often resort to medication instead of improving the animal's living environment. Does the medication stop the behavior? Maybe, but then you have a disengaged, glassy-eyed primate. Does this improve the animal's quality of life? I would say no.

Medication can temporarily reduce the incidence of self-destructive behavior but it fails to stop it permanently, i.e., cure the primate from this behavioral pathology (Weld et al., 1998; Eaton et al., 1999; Macy et al., 2000; Izard & Langner, 2004; Fontenot et al., 2005; Tiefenbacher et al., 2005; Watson et al., 2009). Medication suppresses the symptoms, but it does not remove the cause of the behavioral pathology.

People rarely take the time to find out what the animals are trying to tell us with these so-called abnormal behaviors.

A single-caged male rhesus monkey resorts to repetitive self-destructive biting, perhaps, not because he is crazy but because he is desperately lacking social companionship; when he is running over and over again in circles or is pacing back and forth over and over again, he is perhaps not having enough space to express his biologically inherent drive to engage in species-typical locomotion such as running, jumping, climbing and walking longer distances; when he is poking his eyes or pulling his ears over and over again, he is perhaps extremely bored



because there is nothing for him to do all day long; even his food is freely accessible and requires no foraging effort.

We need to investigate if the conditions under which the animals are forced to live are perhaps species-inappropriate and then change/refine them accordingly to better address the animal's species-typical needs for the expression of normal, i.e., healthy behavior patterns.

In my opinion an animal's stereotypy can certainly be considered as 'abnormal' behavior as it reflects that there is or has been a situation that is compromising her or his welfare.

I've observed many behaviors that are commonly labeled 'abnormal,' yet seemed reasonable for me to consider quite normal. One instance was with a research retiree macaque who had lived in a small cage for over 17 years. On arrival he repeatedly stood and turned in small circles, even though he was now in a large enclosure. In the beginning he turned around and around and around until I felt almost dizzy watching him.

I knew the dimensions of the cage he had been confined to for so many years, and for me it would have seemed more abnormal for him to just stand there and not move about. His body was craving for exercise; turning over and over in a small circle was the only movement the little space of the cage allowed him to perform! I was pretty certain that this behavior had over time become habitual, and that was the only reason it continued, even given the large area of his new living quarters. The great thing about this boy is that he stopped the behavior completely over time! But even if he hadn't, I still would not label it

as an 'abnormal behavior' but as a 'habitual adaptive behavior.'

When a human prisoner walks back and forth or walks in a circle for several hours each day, nobody would label his behavior as 'abnormal,' as it is obvious that the restricted space of the cell leaves the person no other option to release the biologically inherent need to move/exercise the body.

When a caged non-human primate or dog shows the very same repetitive movement patterns, we label the repetitive running in circles or the repetitive pacing back and forth as 'abnormal'—some people even use the homocentric term 'undesirable'—behaviors; why? It seems to me that it is not the animal's repetitive behavior that is abnormal, but rather the human-designed housing conditions that trigger it.

But when we don't label stereotypy as 'abnormal' it can give food for thought for those people who defend inadequate housing conditions for animals by pointing out that their behavior simply shows that they have adapted to the situation: "So what's wrong with the way animals are housed?!"

I have to agree and understand people not wanting to label the behavior as 'abnormal' because it shows that the animal is trying to cope with a given situation; that is a very 'normal' response. My main concern is addressing the cause that triggers an abnormal behavior. What's forcing an animal to cope with the situation and what can I do about it to free the animal of such pressure?

Not being able to cope with species-inadequate living conditions, animals—and humans—develop all kinds of unusual, sometimes even self-destructive so-called

abnormal behaviors. This implies that abnormal behaviors cannot be categorized as 'coping strategies,' as these always fail.

Animals who exhibit normal behaviors under species-inadequate living conditions are the ones who have developed strategies that do allow them to successfully cope with this abnormal situation.

The label 'abnormal' behavior is, in my opinion, superfluous; it does have a discriminative connotation that is unlikely to promote sound scientific methodology. There is nothing wrong with the animal, but much is wrong with the species-inadequate housing conditions under which the animal is forced to live.

When I worked with non-human primates, I often thought of things from their point of view. I would speculate how it would be to have nothing meaningful to do 24 hours a day, every day, for the rest of my life. I would

envision my living space to be equivalent to the size of my kid's bathroom—not very big. There is water freely supplied to me and a means to go to the bathroom that suits me fine. I get the same kind of food every day for free, but what would I do with my time?! I am someone who is active and likes to exercise, so I would always imagine myself running back and forth from wall to wall, maybe running in place, doing sit-ups and push-ups over and over again to fill the utmost boring void. When I pondered in this way, I stopped looking at the monkeys' behaviors that were considered to be undesirable as abnormal—a completely understandable coping strategy to an inadequate living quarters environment.

It seems fair to ask oneself: "How would I behave if I were the animal, confined for life in the small boring cage?" The answer to this question could be the key to refining the animal's living quarters in a meaningful, i.e., species-appropriate way.

Fear of humans

Many animals in research labs are afraid of humans as a result of adverse conditioning. If you feel that this can compromise scientific data collected from these animals and/or that it is an animal welfare concern, do you do something about it?

Whenever we get new orders of dogs (hound mixes with body weights of 18-25 kg), there is usually at least one shy or scared animal among them. The enrichment technician and I spend about 30-60 minutes per day with these fearful dogs. We will sit in the runs with them, offer canned

food by hand, stuffed animals (not left in the run with them), and lots of head/ear rubs. We have gotten very good results from this type of extra hands-on approach. We will also introduce them to and pair-house them with other dogs who are already well-acclimated and don't bark a lot. These, more confident dogs show them the ropes, helping them to acclimate faster to their new environment and to the attending personnel. After a week of two, the initially withdrawn dogs will generally have come out of their shell and are now ready to start going through training.

Animals who are well acclimated and don't appear to be afraid of humans will be better animal models. Their cortisol levels will be lower; they will be more willing to cooperate for procedures, as well as be more comfortable in this very unnatural setting. A little extra effort on our part goes a long way.

... and it also makes our work with the animals more satisfying.

At my previous job, I had only worked with monkeys; I really didn't want to work with dogs for several reasons: one, they are man's best friend and I knew it might be a little more emotionally hard on me and two, I loved working with the monkeys so much! Well, management had a different plan for me and made me work with the dogs and basically took me out of the monkey section for a while.

Anyway, my first time down in the dog area of our company was not what I had expected. I was taken into one of the animal housing rooms and the very first dog I saw was sitting in the back corner of his cage,



trembling and looking so sad and scared. I remember thinking to myself: is this what they all are going to look like down here? This is exactly why I didn't want to work with the dogs! It was breaking my heart already. The good thing was, almost all of the other dogs in the room were so happy and excited to see a person; they were barking and jumping and trying to get attention.

The scared, shy dog—his name was Sleepy—was different. All the techs said he was very nervous, timid and extremely reserved. Right then I told myself that I was going to make this dog happy! Sleepy became my mission. I don't know what exactly happened to make him so fearful and difficult; he resisted coming forward in his cage for blood draws or to be taken out of his cage for dosing procedures. He was bile-cannulated, so he needed to be handled a lot; most of the techs were scared of him because he had bitten one of them during a procedure. That only strengthened my resolution to make this dog feel safe and loved.

At first, Sleepy was the same way with me as he was with the others but I was persistent and didn't give up on him. I would just hang out at first around his cage and let him see me interacting with the other dogs. After a few visits, I slowly started making contact with him by opening his cage door and sitting at the edge and reassuringly talking to him. Eventually, I would start gently petting him with outstretched arm in the back corner; he liked it and gradually got so used to it that he would spontaneously come up to the front of his cage so that I could pet him right next to me. As I sit here typing this, I am brought to tears because our connection was so special to me.

To make a long story short, he became my best buddy and I can't tell you how many people (management and staff) noticed and

commented on the change in him. He would come to the front of his cage when I came into the room and he would let me pet him and eventually let me pick him up and do whatever I needed to do with him (dosing, blood draws, port flushes, injections, etc.). While he wasn't as good with the other techs as he was with me, he did come out of his shell and his original, rather difficult behavior was no longer an issue. The vet said that she was so impressed by how different Sleepy was when she would do her rounds; he no longer was sitting in the back of his cage but would come to the front and let her pet him.

I received many compliments from people on how much Sleepy had changed but the best compliment was his trust in me and the connection we had for several years until he had to be put down for health reasons. I will never forget him and the affectionate connection I had with him.

Thank you for sharing this beautiful and touching story.

Cats often behave as if they are very afraid when you approach them, probably because they have a hard time trusting humans. How do you deal with this shyness when you need to handle a cat in the research lab?

My advice is simple; three things: patience, patience and patience. Don't forget patience. But keep a beach towel handy.

In addition to the ever-essential component of patience, I found that pairing patience with baby food (puréed meat) can significantly advance your positive associations with cats. This has worked for me with both research-purpose cats and feral-rescue cats; I have never had a cat who didn't love the baby

food. If you have cats who won't even come out while you are near, leave a dollop in their food bowl overnight. The next day, sit on the ground and put a spoonful a few feet from you. Then each day move a bit closer. Within a few days you can lightly touch them as they are eating next to you. Keep pairing the food with your presence in small steps until you see their body posture relax when you are near and/or handling them.

You can also use the baby food as reinforcement reward for anything you need to train them on (crating, nail trims, coming when you call their name, etc.).

And of course always remember, you move at THEIR pace, not yours!

It is relatively easy to help non-human primates overcome their fear of humans. Who can share a personal experience?

An older rhesus male came to live at our sanctuary after retiring from research. He was a very large, and absolutely beautiful animal but he did not trust anybody, probably because of traumatic experiences with humans. He made it clear that he didn't want to have anything to do with humans. Even in passing by his enclosure, not making any eye contact, he would charge the caging and threaten aggressively. But I could tell after observing him for some time that his aggression was fear-driven. There was something about him that made me feel very much like he was really just afraid and very distrusting of humans. In his own mind, acting tough might likely keep those he was afraid of away from him.

I worked with this majestic creature for several weeks in just trying to gain his trust and make him feel safe and comfortable in his new environment. I wouldn't make any eye contact because that appeared to upset him,



but would sit quietly near his enclosure with a handful of treats, eating a few myself, and placing one in for him that he could get when I left, because as long as I sat there he wouldn't approach me or the treats I had shared.

After a few daily visits, he slowly came to where I was sitting and grabbed the treat roughly, giving my hand a quick slap before he retreated to his back ledge. I could feel the 'adrenaline rush of progress' and was just so excited for him! I kept doing this every day until he stopped slapping my hand after taking his treat. Finally, right as he put his fingers on the treat in my hand, I would rub my thumb against his hand as he was pulling it away from mine. I TOUCHED HIM! And he didn't slap; he grumped at me briefly, but that was it. As days went by, I was able to make more and more contact between his hand and mine to the point where I could hold the treat tightly between my fingers and while he was working at getting it loose, I could groom the top of his hand just briefly before I released my grip on his treat.

Now, when I enter the macaque barn, I hear this big fellow lip-smacking and the closer I get to his enclosure the more excited

he becomes. I sit in my stool and groom his arms and legs, he licks yogurt from a spoon and then grooms my hand before I leave. While this guy doesn't tolerate anyone else (just yet) he has taken a very strong liking to me, and I am beyond thrilled and so happy for him! He looks forward to his Polly each day and really enjoys feeling like he has a friend, and an ally! And I know in time he will learn that he can trust others as well.

There's just nothing that can warm my heart more than winning the friendship of a creature who was so distrustful in the beginning! It is well worth the extra effort, even in those that take such a long time, when you can make such a tremendous positive difference for them and see how much it improves their lives!

Thank you for sharing this awesome story. It shows there is always hope!

Your buddy reminds me of Devil, a 5-year-old rhesus male. Devil was a typical rowdy who lived alone because many attempts to pair him up with a companion were unsuccessful. He would even attack big senior males,

only to be beaten up. Nobody liked him for practical safety reasons. When you approached his cage he would throw a fit like a devil. His fits were accompanied by sham self-biting of his right arm. There was no way of luring him with treats into some kind of friendly behavior. He was a psychological wreck; he must have had particularly bad experiences with people when he was a juvenile animal.

I knew he was not 'bad' by his very nature, but he just didn't let me, or any other person, stay close to his cage without making it very clear that he wanted to be left alone. I believed in this fellow, so I pondered how his gentleness could be fostered in order to overcome his probably justified mistrust. I had quite a bit of experience with pairing adult rhesus macaques with juveniles and noticed that the adults, including the males, are inhibited to show overt aggression against those little kids. Yes, Devil was not an exception: The moment I released a juvenile potential cage companion into his cage, Devil became a different animal. He approached the kid while moving his lips in a kind of lip-smacking manner, touched the kid very, very gently and then the two were huddling. Devil literally embraced the kid without showing any signs of agitation, let alone aggression. This pair turned out just beautifully. The little kid turned Devil into a sweet, gentle daddy. Not only that: Devil lost all his fierceness towards people! He, along with his little companion, accepted food treats while calmly sitting right up front. And more amazingly: Devil stopped the self-biting behavior.

This and similar experiences with other animals have become treasured memories for me.

When I worked with macaques, I helped the animals overcome their fear of humans by

allowing them to learn through experience that they could trust me while I trained them to cooperate with me during common handling procedures.

I agree with what you said about working with the macaques and building that trust. In my experience, a lot of the trust building can be done while newly acquired animals are in quarantine. They can be spoiled with treats and given lots of human interaction during this time. I will also start some training with them, once they have become used to me. Just some basic commands such as stationing and shifting from their home cage to a play cage and back are very helpful and easy for them to learn. Usually within the time frame of quarantine (about 40 days at our facility), the macaques have established a trust relationship with the one or two of us who attend their room. When quarantine is lifted, the animals have lost their fear of humans; they are now relatively relaxed when a person with whom they are not familiar comes into their room.

Can you help rabbits and rodents to overcome their fear of humans and perhaps even gain their trust so that you can do procedures without distressing them?

Rabbits seem to have a spontaneous fear of humans, any human! They are so easily stressed and may even panic when a person approaches them. Overcoming that fear and building up a trust relationship with them has been extremely important in my work.

The period from when new rabbits arrive to when they're ready to be handled requires a lot of patience and many, many comforting interactions with them. I work with them every morning, just using a soft voice—sometimes singing. Moving very gently, I allow them to



explore me. They are usually bug-eyed and nervous at first but then come around, get curious and cautiously smell me, and finally allow me to gently touch their nose. After a couple of days, I can briefly touch their backs, but their response is initially very tense. At the end of the first week most rabbits will allow me to pet them on their backs without getting uptight. All of this is accompanied with a soothing voice; they like opera!

By week two, some of the new rabbits will hop up to me and put their nose invitingly down so that I pet them. I've had some rabbits who, after a couple of weeks of positive interactions with me, run up to me and lick me when I come into their room. These rabbits will remain calm through almost any treatment I have to do with them, e.g., PO meds, IM injections for sedation, eye drops and nail trimming.



It really just seems to be a matter of giving the rabbits a chance to learn through experience that there is no need to be afraid of you, but that you always have friendly intentions when you approach them. The more positive experiences they have with you, the happier they are to see you in general, and the more willing they are to let you handle them even in uncomfortable positions, because they know that they can trust you.

Conditioning rodents to procedures helps greatly but you can probably not eliminate their fear of humans, as they are prey species.

I have noticed that young mice, when they first arrive at the facility, won't tolerate being picked up bodily for any reason. If the mice are long-term residents, they will allow me to scoop them up and hold them in my cupped hand and if the time is up, move them to another cage. Regular gentle handling helps mice to become less anxious and fearful of what is going to happen because they already know what I will do with them, and I think that they also know through experience that I do not intend to do them any harm.

Fear of humans is likely to affect research data collected from the fearful animal; so it is important to minimize this extraneous variable as much as possible.

In my experience with guinea pigs and hamsters I definitely can say yes, it is quite easy to gain the trust of individual animals. I love these little critters; bonding with them happens spontaneously. I find that they are relatively at ease with study procedures and experience very little or no apprehension and fear overall!

I cannot help but develop a personal interest and compassion for rodents or rabbits who



are being taken care of by me on a daily basis. I think they are all amazing creatures in their own right. It is a very touching experience when a little rodent sits quietly in your hand and shows no signs of fear.

About 20 years ago we had a C57/BL female mouse; she had a very sticky eye and the clinical veterinarian asked me to put cream on the eye three times a day for seven days. After two days, the mouse would stand on my hand and tilt her head sideways towards me so I could easily put the cream in her eye without restraining her. I was stunned that a mouse would do this; at first I thought it was by chance, but she did it every time. She made a full recovery. I did visit that little mouse pretty much every day while she was with us. I will probably never forget her.

One of my favorite rats was more than 2 years old and was part of an alcohol intake study. Understandably, he was sometimes quite difficult to deal with, so on one occasion he struggled so vigorously that one of his toenails was ripped off, causing a lot of bleeding. I had become quite fond of him, after having spent a good hour trying successfully to stop the bleeding! He didn't like me messing with him but he gradually relaxed. After our time together he would let me reach in and pick up his back feet and look at them and apply ointment as needed. I think he sensed that I really wanted to help him, so he trusted me—as I trusted him. In my opinion, it is absolutely worth the time and energy and sometimes frustration that goes into making the lives of all animals—from mouse to monkey—in research labs better. They very much deserve it!



Suffering

The term 'suffering' has found its way into the scientific literature and legislative documents pertaining to the use of animals in research and education. What would be a demonstrative example of a situation in which you had the feeling that an animal in your care was suffering?

A monkey housed alone in a barren cage, a rabbit kept in a standard cage that is so small that it prevents more than two hops, a mouse awkwardly restrained for injections—these are all examples of animals who are suffering in the given circumstance. I don't think the extraordinary effort we put into minimizing suffering changes the fact that these animals *are* suffering.

The United States Department of Agriculture does not use the term 'suffering' in its Policy #11 (USDA, 1997) on Painful Procedures, but its definition of a painful procedure does imply that such a procedure can be a cause of suffering in animals used in research:

A painful procedure is defined as any procedure that would reasonably be expected to cause more than slight or momentary pain and/or distress in a human being to which that procedure is applied.

Research facilities must list individual animals who are subjected to such a procedure *without* anesthetics, analgesics, sedatives, and/or tranquilizers in column E of their annual reports. These are the animals for whom the term 'suffering' would apply.

I checked the most recent published USDA report on animals used in research

for the fiscal year 2010 and found that a total of 97,123 animals used in research experienced "more than slight or momentary pain or distress" that was *not* relieved with drugs. This figure, which does *not* include the most commonly used animals—rats and mice—makes it quite clear that many animals *do* suffer in research laboratories.

The statement of the USDA Policy is in line with the elaboration on the Use of Clinical Signs as Humane Endpoints by the OECD (Organisation for Economic Co-Operation and Development, 2000):

If something is known to cause suffering in humans, it should be assumed to cause suffering in animals.

It seems reasonable to assume that a person who is forcefully restrained for a life-threatening procedure without being sedated is suffering, i.e., experiences extreme anxiety. I do believe that a monkey, a dog, a rabbit or a mouse is very likely to suffer in a similar manner during such a situation; anxiety-triggered diarrhea/urination, hyperventilation, struggling and significantly elevated stress hormones will reflect the animal's state of suffering. I would also argue that a social animal who is kept in social isolation for an extended period of time is suffering, i.e., experiences extreme loneliness and boredom in a similar manner as a human prisoner does; the development of behavioral pathologies, for example, self-mutilation, will reflect the person's and the animal's distress, i.e., suffering (e.g., Yaroshevsky, 1975; Fittinghoff et al., 1974).



I think the easiest way to define 'suffering' would be 'unrelieved pain.' Of course, we must consider that there is not only physical/physiological pain (e.g., injury of the body) but also psychological/emotional pain (e.g., boredom) that can lead to suffering if the pain is not relieved.

The term 'suffering' is a bit tricky in our industry because it conjures definite imagery in the person hearing it.

I have two cats who were rescued from a shelter. One of them doesn't like going for car rides and will vocalize for almost the entire journey. It's pretty clear that he is suffering but I'd hesitate to use that word in describing the experience. I'd say he's *upset* or he's *nervous*.

As insiders we can appreciate that the word 'suffering' doesn't have to mean pain or illness or even mistreatment. But are there other words we can use that aren't quite so loaded? I wouldn't use the word suffering to describe a mouse or a rat placed in a restrainer but might say that the mouse is

'stressed.' Or if animals are being moved from one cage area to another and are expressing fear responses, I'd say that the animals are 'nervous.' I'd reserve 'suffering' for an animal who was in need of immediate intervention. Many years ago one of the animals in my care was attacked by her mate and had severe lacerations/bite wounds. I definitely used the word 'suffering' to describe her condition.

It's true, the term 'suffering' can be tricky, but we may have to use it when we are confronted by public opinion about animal research in laboratories. Suffering is a term that is avoided by biomedical investigators who do invasive research with animals, but suffering is a very common word in the language of the public, especially the public concerned about animal welfare. I think it can be useful to have a good understanding of the word 'suffering' when being engaged in a discussion with people who are against invasive research with animals for ethical reasons. It would probably not be helpful to categorically deny the fact that animals in research labs can suffer.

What is dangerous, in my work, is to deny an animal's ability to suffer. It's often easy to be dismissive of suffering, if it is *justified* in a protocol. The approval of a Class E study by an IACUC does not magically erase the suffering that the animal must undergo.

The word 'suffering' will always mean different things to different people. But, anybody with experience in this industry should be able to recognize an animal who isn't as she or he should be. A common term used between technicians in my unit is an 'unhappy mouse.' Now we all know that it is the incorrect terminology, but it is something we have all

ended up using, as we can all relate to it and we all have a similar understanding of what it means to each one of us.

Perhaps 'suffering' is the safest term to use as it doesn't anthropomorphize but can be understood by most people.

'Suffering' is a complicated word because I feel there are many degrees of it and it happens for a multitude of reasons. I think there is physical suffering as well as emotional suffering. Physical suffering may be something like pain that cannot be relieved, whether it be chronic or acute. Emotional suffering may be something that resembles a social animal being permanently housed alone.

I have never used the term 'suffering' in any of my publications related to animal care and animal welfare, even though I believe that animals have the capacity to suffer, albeit to a probably lesser degree than humans. In humans, pain/injury—a physiological phenomenon—can easily turn into suffering—an emotional phenomenon—because of the strong identification with my body and the self-created story about the possible personal consequences of my pain/injury: poor me, how could that have happened to me! When taking care of seriously injured/harmed animals, they never gave me the impression of having this problem; they kind of accepted

the pain/injury and did the proper actions to enhance the healing process.

Rather than using the rather charged term 'suffering' I prefer to use the term 'distress' which overlaps very nicely with what is commonly understood by the term suffering. Here are two rather clear and scientifically acceptable definitions of this term:

- › "Distress is an aversive state resulting from maladaptation or inability to adapt to stressors. ... Distress is usually associated with a change in motility or locomotion, and can result in stereotype behaviour. ... Retreat to a corner of the cage or excessive struggling or vocalisation on dosing are examples of distress in anticipation of an experimental procedure" (Organisation for Economic Co-Operation and Development, 2000).
- › "The term distress can be used to describe a state in which an animal, unable to adapt to one or more stressors, is no longer successfully coping with its environment and its well-being is compromised. Generally, a state of distress develops over a relatively long period of time; however, short, intense stressor(s) can also compromise animal well-being and induce acute distress" (National Research Council, 2008).

Choosing the correct pronouns

When you talk or write about an intact animal, do you refer to the animal as an object or do you refer to the animal as a female or a male?

I refer to an animal who is not neutered/spayed as 'she' or 'he' depending on whether the animal is a female or a male.

It seems more personal to say 'he' or 'she' when referring to an animal. I would feel a bit uncomfortable referring to an intact female or an intact male as 'it' as if the animal were an object without gender.

I never use the pronoun 'it' when speaking of a critter; it's always a 'he' or 'she.'

For me an animal is always either a female, i.e., 'she' or a male, i.e., 'he.' It would never cross my mind to refer to a female or male animal with the pronoun 'it.'

If I do not know the gender, I still won't refer to the animal as 'it,' but simply say 'the animal,' or 'the mouse,' etc.

I am using the pronouns 'he' or 'she' regardless of whether the animal is intact or not. An animal is not a thing that I would refer to as 'it.'

By using the proper pronouns 'she' and 'he' when talking about the animals in our care we deconstruct the false idea that we consider animals as objects and treat them accordingly.

I never refer to an animal as 'it,' 'that' or 'which.' I use those pronouns when talking or writing about inanimate objects but not when referring to living beings, such as the animals at my workplace.

When animals have nicknames I prefer to use those, otherwise I refer to individual animals in accordance with their gender; this applies to all animals I am working with.

I also refer to the animals in my charge as 'he' or 'she,' never as 'it,' even if the animal has been neutered or spayed.

Strictly speaking, it would be grammatically wrong to refer to a female animal with the neutral pronoun 'it' rather than with the correct gender-specific pronoun 'she.' The same is true for a male animal. The gender-neutral pronoun 'it' is correctly used only when referring to something that has no gender, for example an object.

I always refer to an animal's gender. To me the pronoun 'it' refers to an inanimate object not a living being.

There are scientists who prefer to regard animals as objects because they believe that referring to them as 'she' or 'he' would hinder them from being strictly objective while doing their research with these animals and interpreting the research data collected from them. Perhaps as a result of this objectification, scientists are often emotionally distant towards the animals they do research with and, therefore, care little about their well-being.

It's sad when researchers are against referring to animals by their proper gender. I believe that some investigators need to distance themselves emotionally in order to feel okay with the research they are conducting with the animals. It's probably easier to inflict pain and suffering on a 'thing' or on an 'object' rather than on a real animal who wants to live and is endowed with feelings.

Calling animals by their gender (or names) is, in a subtle way, protecting them from being treated/used/disposed as if they were research objects, without consideration of their feelings and well-being.

Minimizing noise in hallways

Baldwin et al. (2007) concluded from a survey of personnel involved with animal facilities: "Because faculty are the least aware of noise as a potential problem but are primarily responsible for designing experiments, research involving animals may be confounded by noise as an unknown variable. This effect may lead to unnecessary numbers of animals being required to achieve statistical significance and possibly to erroneous interpretation of results." Evidence demonstrates that audible and ultrasonic sounds of intensities common in animal facilities have deleterious effects on rodent physiology (Burwell & Baldwin, 2006).

How do you minimize noise in the hallways of animal quarters? Have you come up with any great engineering solutions to minimize or even eliminate the sounds of caging or other equipment being moved around?

In a word: Wheels ... Make sure the wheels on all your movable equipment are in good order. In addition, one thing we've done that cuts noise is the elimination of most stainless steel lab carts. We now go with Rubbermaid carts; what a difference!

At our facility, we have also moved from metal carts to Rubbermaid carts.

We exchanged old, loud and squeaky casters and wheels of our carts with new ones that are rolling very smoothly and produce hardly any sound. It made a big difference!

At our laboratory, automatic swinging doors were installed at the two ends of hallways

to reduce noise. The husbandry staff just pushes a button and the doors open to allow ease of movement of caging, equipment, etc., so there is no loud banging. The doors close automatically after a set period of time, and when they close (although still metal doors) it is very quiet.

Several years ago, we replaced heavy metal doors that divide corridors with plastic swinging ones. Pushing equipment through the plastic doors creates much less noise. Another thing I find very helpful is to move long equipment on carts with two people; that way both ends of the equipment can be controlled so there is less chance of scratching at walls.

I do like the idea of using two people to move large pieces. This not only is bound to cut down on noise but it is also much safer, ergonomically, for the staff.

Does anyone utilize transfer boxes made of polyplastic material instead of metal for the transport of non-human primates or other species in order to reduce noise?

All our transfer boxes are made of sound-buffering plastic material. For rodents we just buy cheap tool boxes and drill holes in them.

Ultrasound an extraneous variable

Do you test for ultrasound in the animals' environment at regular intervals and if so, what device do you use and what do you find? What do you think are the biggest culprits for ultrasound in a research laboratory?

A simple \$30 bat detector will locate ultrasound in the range of rat hearing. I use one in my home with my pet rats; it helps me hear their ultrasonic vocalizations.

Commonly used equipment that makes noise in the ultrasonic range are computers and monitors, ventilation systems (some are very bad!) and lights, even some red lights that are supposedly used for testing rodents during their active period. I am sure there are a lot more sources of ultrasound in the animal quarters.

One additional source of ultrasound that we noticed is running water. Taps seem to emit very loud ultrasound in the rodent audible range. We could clearly measure significant ultrasound noise from several feet away using an ultrasound microphone when the tap was running. Our technicians often run taps for several minutes to get the water cold before refilling bottles. When this happens, the rats get very alert and restless; obviously, the noise of the loud ultrasound disturbs them quite a bit.

Did you have metal or ceramic sinks? Was there anything you could do to eliminate this source of ultrasound?

Especially when the water drips or runs in a stainless steel sink, that causes a lot of ultrasound.

All our sinks were stainless steel, and I'm sure you are correct that this would contribute to the noise.

My understanding is that plastic caging (IVC or static cages) blocks out the ultrasonic sounds from the room. However, any sounds from the IVC itself could create an uncontrolled variable; also, during handling procedures, the animals are taken out of their 'insulated' plastic cages and unintentionally exposed to ultrasounds in the room.

Other sources of ultrasound noise that are not associated with equipment but with people are keys and sniffing. Dangling keys make a lot of noise. Human sniffing (because of a cold or allergies) is also making intense noise; it can startle rats and make them freeze.

We obtained a high frequency meter to detect sounds resulting from construction activities that might be problematic for our rodents. To our surprise, we discovered the noise associated with drilling and jack hammering was not within the animals' hearing frequency range, but jangling keys, water running into metal sinks, and glass water bottles clinking were significant sources of ultrasound that are likely to be perceived as very loud by the rodents.

Workload – Cage changes

I have been working on a process audit at my facility and was looking for some feedback from others in the industry. The question is geared to facilities that house mice in ventilated rack systems. I would like to know how many cage changes per day/ per week are expected from each technician and how much time is allocated for the task?

It's easy to say, "Care techs should be changing X number of cages per day." But it's not as cut and dried as it sounds:

- › Are the techs also expected to separate weanlings?
- › Are there special studies in the room that require more attention (e.g., tumor studies or chemical dosing studies)?
- › Are the animals diabetic?
- › Are the technicians doing treatments?
- › What's the configuration of the room?
- › How much traffic is there from other people needing to enter the room to retrieve cages or perform procedures?
- › Is the technician being called away for issues in other areas?

For our facility we expect techs to change 100 to 150 cages per day. Our cages are ventilated with automated watering and are delivered to a central supply corridor as complete cage set-ups. The techs must retrieve cages using a specialized cart that is designed to hold the caging items for delivery to cagewash. Our entry and exit corridors are fairly long, so techs working at the far end have a long way to push the cart. Cages are changed inside an Animal Transfer Station and gloves are sprayed with disinfectant between each cage and

changed between projects. Our goal is that all cage changing is done by 1:00 pm so that cagewash isn't getting slammed with caging at the end of the day. Floors are mopped daily and the technicians also have procedural rooms that they need to clean and stock each day as well.

Our guys do on average 210 cages a day, i.e., 3 sides a day and each side holds 70 cages.

I would caution using a pure numbers approach to determine the load that is expected from techs. While there is a need to have a ballpark number, the type of experiment, breeding, rack type, room size, how supplies can get into the rooms and other practical factors should be taken into account. Do you want 'mouse flippers' or do you prefer techs who have enough time to perform the health monitoring thoroughly, distribute enrichment and take note of any irregularities in the animal holding area without worrying about cage count numbers?

In my experience, a pure number metric makes bean counters happy, but neither techs nor mice.

I wholeheartedly agree with you!

Implementing new environmental enrichment ideas

How do you go about it when you have an environmental enrichment idea that you want to implement at your facility?

When I was involved in the animal enrichment program for my company (I have a whole new role now) we had an enrichment committee that would meet every month to investigate new enrichment devices and how to evaluate their usefulness for the animals. I personally would make full use every year of the resources and vendors at the TriBranch Symposium. I would specifically hit all the enrichment vendors and obtain lots and lots of their environmental enrichment free samples to bring back to my company and distribute them to animals. When I saw animals showing interest in certain gadgets and interacting with them over several days, I put them on my list for our next committee meeting. We would order just a few of each of these samples, monitor their use by the different animal species on site over the course of several weeks and report back at our next meeting. We then made our request for funding to buy those enrichment items in bulk that had proven to trigger species-typical, non-injurious activities and behaviors in the animals over extended periods of time.

When we housed dogs and pigs at our facility, we were pretty much free to try any kind of environmental enrichment device.

You were lucky to kind of freely implement new environmental enrichment devices for

the dogs and pigs at your facility. When I worked with macaques, a lot of preparatory work was needed before I could approach the administration with a proposal for the implementation of a new Refinement in our colony of several hundred macaques. To start with, I had to get permission by the senior veterinarian to expose a few animals who were presently not assigned to any ongoing research to a new idea. Typically, I conducted a formal study to demonstrate if the new idea achieves the intended effect, creates no hygienic issues, causes no harm to the animals, causes no harm to personnel, is not labor intensive and does not cost much. Once this preliminary hurdle was passed, I could ask the administration for permission to go ahead with the implementation of the new idea.

This rather complicated process did do the trick in most cases. I was able to implement quite a number of unconventional ideas: installing high perches in all cages, providing all animals with unsealed wood (gnawing sticks), transferring single-caged animals to compatible pair-housing, modifying the standard feeders into puzzle feeders, and providing each animal daily with a whole apple. There was one refinement idea that did pass the first hurdle, but I was not able to implement it on a large scale: training the animals to cooperate during injection and blood collection in the familiar home cage. In the course of a year, I successfully trained about 60 animals, but finally gave up because of time constraints and lack of interest by the PIs.

My experience is much like yours.

All new ideas must first be reviewed by the veterinarians. I will then submit a proposal to the director in which any published findings related to the new idea are discussed and permission requested for a preliminary testing of the idea with a small number of animals. When the findings of the pilot study demonstrate the usefulness of the new idea, I will draft an official guideline (Standard Operating Procedure), and once that's approved, the new enrichment/refinement idea is ready to be implemented. The whole process can take quite a while, especially when the new idea aims at refining traditional handling practices of non-human primates. For example, I have been working on implementing a positive reinforcement training program for our macaques for the last three years; I have just now submitted the final draft of the SOP.

I wish you good luck!

It's worth making so much effort to get the official support of a new idea. Once

implemented, chances are that a new enrichment or refinement remains in place even after you have left the facility. I must admit, one of my ideas got watered down in the course of time: The daily apple was cut into eight sections, one little piece per monkey in order to save money. I am not so sure if the PIs' salaries were also cut in order to save money.

Yes, although the process can be annoying and frustrating at times, the result can be very valuable and satisfying, especially when you have the assurance that the implementation of your idea is officially supported independent of you, the start-up person.

I also have to follow a multi-step approval process for new enrichment items, particularly with our canines and NHPs. Sanitization has become a hot topic recently as a lot of the new commercial toys become more and more intricate in design.

mice and large animals and everything in between. That way, when IACUC, USDA, vets, or anyone else walks through the facility and sees a singly housed animal, there is a card on the cage indicating why the animal is singly housed (e.g., aggression, only animal left in the cohort, research-related reasons). This system pre-dated me here, so I had nothing to do with the idea, but I think it works really well.

At my previous institution, we had a spreadsheet for tracking the social-housing

history of all of our monkeys. It was a handy way to see at a glance:

- › which animals had been housed with whom,
- › which animals are socially compatible,
- › which animals are socially incompatible,
- › which animals are singly housed, for what reason, and
- › what are the plans to transfer singly housed animals to compatible social housing?

Our USDA VMO really liked this spreadsheet; it was pretty low tech, but effective.

That is a great idea. Too often animals are left singly housed because nobody is sure of the reason why the animal is living alone.

Sometimes we will hold off the weaning of mice for a day or two to ensure the pups can be weaned together with another litter of the same strain so that no mouse ends up singly housed. One of my colleagues used to put slips on the cages saying, "Lonely female. Please give me some friends." when there were singly housed female mice.

The medical records database of our NHPs has housing status and cohort/partner information (social compatibility or incompatibility) as one of the fields. I can easily scan a room on the computer or run a report of singly housed animals. I use this information to keep a monthly report for the vets on the animals' housing status. The report helps me determine potential pairs in order to resolve single-housing status.

The pair-housing status and the reason(s) for single-housing of our macaques are entered in the animals' computerized records. Every month we document the reason(s) for single-housing and what attempts have been made to transfer

single animals to compatible pair-housing arrangements.

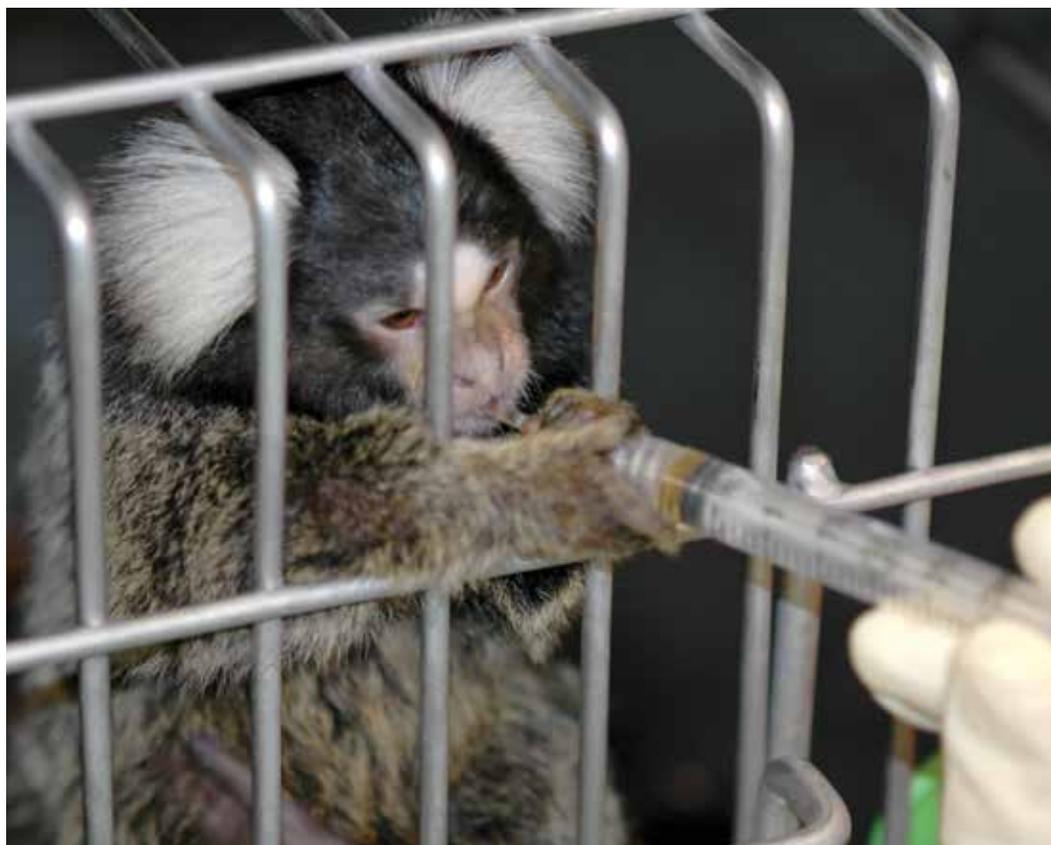
We try as much as possible to castrate and/or vasectomize our male macaques to open up more pairing or grouping options, i.e., pair males with females and overly dominant males with other males.

As a general rule we will castrate our males before a study begins. However, if we have males already on study and the investigator is worried about hormonal changes due to castration that could potentially have an effect on their data, we offer vasectomy as an alternative. This system has been pretty effective to encourage pair-housing of our macaques. There are times we don't get compliance but we work on getting our investigators to see the benefits of housing social animals in social settings.

Monitoring social housing

Does anyone want to share tips, tricks, procedures, processes that have been implemented at your institution to facilitate social housing; maybe something that you found has really been a game changer for getting the program up and running, or something that might be unique to your institution?

We have a card with multiple check boxes that gets placed on the cage of any singly housed animal specifying why the animal is caged alone. The same card is used for



We are making progress

Some of you have worked with and for animals in research labs for many years.

- 1. Is it your experience that progress has been made and is still being made to refine housing and handling practices of the animals (rats and mice included)?*
- 2. Are investigators/researchers/veterinarians more willing to support refinement efforts?*
- 3. Do you think that the changes that you are witnessing promote animal welfare?*

4. Do these changes also promote sound scientific methodology and reliable research results?

Yes to all four questions.

Yes, many investigators/researchers/veterinarians have become more willing to support efforts to refine housing conditions of animals in research facilities. It has been my experience that young researchers

and investigators who do behavioral research are more open to explore and willing to implement refinement than senior researchers and investigators who do biomedical research.

I do believe great strides have been made since I first began working in animal research. I have not been in the field for that long (since 2005) and yet I have seen drastic changes in how the housing has been refined and enrichment has been improved and implemented.

When I first started working in the industry, mice were given a Nestlet and a Nylabone and that was regarded as sufficient. Now there are so many varieties of nest building materials, chews and wooden blocks, shelters and platforms available for rodents; the multitude of environmental enhancement options for rodents has become comparable to that of non-human primates. Mice like variety too!

After working in research for almost 11 years I have seen progress in refining our housing practices of the NHPs, rabbits, canines and rodents. Handling has also been refined, especially the handling of primates. This I believe makes better research animals; the calmer an animal is during a procedure, the more valid will be the data collected from him or her.

Our vets are always supportive of new ideas for refining handling procedures and implementing species-adequate environmental enrichment.

I've noticed a little more interest from the investigators and study directors regarding possible ways to enhance animal welfare as it pertains to housing and handling conditions. Of course, I would always like to see more accomplished and

new refinements implemented faster, but I believe the conditions for the animals will continue to improve.

I believe we can speed the process by collecting more data demonstrating that well-designed refinement options enhance the scientific reliability of data collected from animals assigned to research.

REFERENCES

Animal Welfare Regulations 2013 9 C.F.R. Parts 1-4

Arnold CE and Estep DQ 1990 Effects of housing on social preference and behaviour in male golden hamsters (*Mesocricetus auratus*). *Applied Animal Behaviour Science* 27: 253-261

Arnold CE and Gillaspy S 1994 Assessing laboratory life for Golden Hamsters: Social preference, caging selection, and human interaction. *Lab Animal* 23(2): 34-37

Baldwin AL, Schwartz GE and Hopp DH 2007 Are investigators aware of environmental noise in animal facilities and that this noise may affect experimental data? *Journal of the American Association for Laboratory Animal Science* 46(1): 45-51

Berdoy M 2003 *The Laboratory Rat: A Natural History*. Berdoy M: Oxford, UK

Burlingame LA and Lofgren JL 2014 Presence of nesting material does not prevent ability to accurately identify sick or dead mice during routine health checking. *Journal of the American Association for Laboratory Animal Science* 53: 603

Burwell AK and Baldwin AL 2006 Do audible and ultrasonic sounds of intensities common in animal facilities affect the autonomic nervous system of rodents? *Journal of Applied Animal Welfare Science* 9: 179-200

Chamove AS 2001 Floor-covering research benefits primates. *Australian Primatology* 14(3): 16-19

Corbett A, McGowin A, Sieber S, Flannery T and Sibbitt B 2012 A method for reliable voluntary oral administration of a fixed dosage (mg/kg) of chronic daily medication to rats. *Laboratory Animals* 46: 318-324

David JM, Knowles S, Lamkin DM and Stout DB 2013 Individually ventilated cages impose cold stress on laboratory mice: A source of systemic experimental variability. *Journal of the American Association for Laboratory Animal Science* 52: 738-744

Davidz JR and Mason DJ 1955 Socially facilitated reduction of a fear response in rats. *Journal of Comparative and Physiological Psychology* 48: 149-151

de Rosa C, Vitale A and Puopolo M 2003 The puzzle-feeder as feeding enrichment for common marmosets (*Callithrix jacchus*): a pilot study. *Laboratory Animals* 37: 100-107

Eaton GG, Worlein JM, Kelley ST, Vijayaraghavan S, Hess DL, Axthelm MK and Bethea CL 1999 Self-injurious behavior is decreased by cyproterone acetate in adult male rhesus (*Macaca mulatta*). *Hormones and Behavior* 35: 195-203

Ferraro A, Brunelli R, Nelsen SL, Andrews-Kelly G and Schultz P 2013 Making use of a laser pointer as training and enrichment tool: a discussion by the Laboratory Animal Refinement & Enrichment Forum. *Animal Technology and Welfare* 12: 195-196

Fittinghoff NA, Lindburg DG, Gomber J and Mitchell G 1974 Consistency and variability in the behavior of mature, isolation-reared, male rhesus macaques. *Primates* 15: 111-139

Fontenot MB, Padgett EE, Dupuy AM, Lynch CR, De Petrillo PB and Higley JD 2005 The effects of fluoxetine and buspirone on self-injurious and stereotypic behavior in adult male rhesus macaques. *Comparative Medicine* 55: 67-76

Gaskill BN, Rohr SA, Pajor EA, Lucas JR and Garner JP 2009 Some like it hot: Mouse temperature preferences in laboratory housing. *Applied Animal Behaviour Science* 116: 279-285

Gaskill B, Garner JP and Pritchett-Corning K 2011 Energy reallocation to breeding performance through improved behavioral thermoregulation. *American Association for Laboratory Animal Science Meeting - Abstracts of Poster Sessions*: 29

Gaskill BN, Winnicker C, Garner JP and Pritchett-Corning KR 2013 The naked truth: Breeding performance in nude mice with and without nesting material. *Applied Animal Behaviour Science* 143: 110-116

Goldsmith JF, Brain PF and Benton D 1978 Effects of the duration of individual or group housing on behavioral and adrenocortical reactivity in male mice. *Physiological Psychology* 21: 757-760

Haba Nelsen SL, Bradford D and Houghton P 2010 Laser Lixit™ training: an alternative form of target training that can be utilized in the daily husbandry care of rhesus macaques (*Macaca mulatta*) and cynomolgus macaques (*Macaca fascicularis*). *American Journal of Primatology* 72(Supplement): 27

Hughes HC, Campbell S and Kenney C 1989 The effects of cage size and pair housing on exercise in beagle dogs. *Laboratory Animal Science* 39: 302-305

Hurst JL and West RS 2010 Taming anxiety in laboratory mice. *Nature Methods* 7: 825-826

Izard K and Langner P 2004 Treatment of self-injurious behavior in a chimpanzee (*Pan troglodytes*). *American Journal of Primatology* 62(Supplement): 44-45

Jackson E, Demarest K, Eckert WJ, Cates-Gatto C, Nadav T, Cates LN, Howard H and Roberts AJ 2015 Aspen shaving versus chip bedding: effects on breeding and behavior. *Laboratory Animals* 49: 46-56

Jirkof P, Cesarovic N, Rettich A and Arras M 2013 Housing of female mice in a new environment and its influence on post-surgical behaviour and recovery. *Applied Animal Behaviour Science* 48: 209-217

Lee CT 1973 Genetic analyses of nest building behavior in laboratory mice (*Mus musculus*). *Behavior Genetics* 3: 247-256

Lofgren JL, Wrong C, Hayward A, Karas AZ, Morales S, Quintana P, Vargas A and Fox JG 2010 Innovative social rabbit housing. *American Association for Laboratory Animal Science Meeting Official Program*: 131

Macy JD, Beattie TA, Morgenstern SE and Arnsten AF 2000 Use of guanfacine to control self-injurious behavior in two rhesus macaques (*Macaca mulatta*) and one baboon (*Papio anubis*). *Comparative Medicine* 50: 419-425

Menzel EW 1991 Chimpanzees (*Pan troglodytes*): Problem seeking versus the bird-in-hand, least-effort strategy. *Primates* 32: 497-508

Nelson C and Dysko R 2006 Effects of humidity and environmental enrichment on "food-chewing" behavior in mice. *American Association for Laboratory Animal Science Meeting Official Program*: 154

National Research Council 2008 *Recognition and Alleviation of Distress in Laboratory Animals*. The National Academies Press: Washington, D.C.

Organisation for Economic Co-Operation and Development 2000 *Guidance Document on the Recognition, Assessment, and Use of Clinical Signs as Humane Endpoints for Experimental Animals Used in Safety Evaluation*. OECD: Paris, France

Porter G and Lane-Petter W 1965 The provision of sterile bedding and nesting materials with their effects on breeding mice. *Journal of the Animal Technician Association* 16: 5-8

Reinhardt V 1990 Avoiding undue stress: Catching individual animals in groups of rhesus monkeys. *Lab Animal* 19(6): 52-53

Reinhardt V 1994 Caged rhesus macaques voluntarily work for ordinary food. *Primates* 35: 95-98

Roper TJ 1973 Nesting material as a reinforcer for female mice. *Animal Behaviour* 21: 733-740

Scales M and McDonald KM 2011 Factors influencing the preferred nesting location of laboratory mice. *American Association for Laboratory Animal Science Meeting - Abstracts of Poster Sessions*: 31

Seier JV, Mdhluli M, Collop T, Davids A and Laubscher R 2008 Voluntary consumption of substances of unknown palatability by vervet monkeys: a refinement. *Journal of Medical Primatology* 37: 88-92

Sachser N, Dürschlag M and Hirzel D 1998 Social relationships and the management of stress. *Psychoneuroendocrinology* 23: 891-904

Taylor TD 2002 Feeding enrichment for red-handed tamarins. *The Shape of Enrichment* 11(2): 1-3

Tiefenbacher S, Fahey MA, Rowlett JK, Meyer JS, Pouliot AL, Jones BM and Novak MA 2005 The efficacy of diazepam treatment for the management of acute wounding episodes in captive rhesus macaques. *Comparative Medicine* 55: 387-392

United States Department of Agriculture 1997 Policy #11. *Animal Care Resource Guide AC*: 11.1-11.2

Van de Weerd HA, van Loo PLP, van Zutphen LFM, Koolhaas JM and Baumans V 1997 Preferences for nesting material as environmental enrichment for laboratory mice. *Laboratory Animals* 31: 133-143

Van Loo PLP 2001 *Male Management - Coping with aggression problems in male laboratory mice (Doctoral Thesis)*. University of Utrecht: Diest, Belgium

Van Loo PLP and Baumans V 2004 The importance of learning young: the use of nesting material in laboratory rats. *Laboratory Animals* 38: 17-24

Van Oortmerssen GA 1971 Biological significance, genetics and evolutionary origin of variability in behaviour within and between inbred strains of mice (*Mus musculus*). A behaviour genetic study. *Behaviour* 38: 1-92

Watson SL, McCoy JG, Fontenot MB, Hanbury DB and Ward CP 2009 L-tryptophan and correlates of self-injurious behavior in small-eared bushbabies (*Otolemur garnettii*). *Journal of the American Association for Laboratory Animal Science* 48(2): 185-191

Weld KP, Mench JA, Woodward RA, Bolesta MS, Suomi SJ and Higley JD 1998 Effect of tryptophan treatment on self-biting and central nervous system serotonin metabolism in rhesus monkeys (*Macaca mulatta*). *Neuropsychopharmacology* 19: 314-322

Yaroshevsky F 1975 Self-mutilation in Soviet prisons. *Canadian Psychiatric Association Journal* 20: 443-446

PHOTO CREDITS

- 1 ROSS FUNNELL
- 2 TOP: STUDIO CURVE, BOTTOM: KATTNI
- 3 AMAYA RODRIGO
- 4 LEANNE J
- 5 PRIORITY PET HOSPITAL
- 6 JILL
- 7 JETEFF
- 8 DON BURKETT
- 9 STEVE POLLOCK
- 10 COREY SEEMAN
- 11 COREY SEEMAN
- 12 TONI ALTER
- 13 JEAN-PIERRE LOUIS
- 15 EDUARDO MERILLE
- 16 TOP: HELEN HALDEN, BOTTOM: BIANCA BUENO
- 19 STEPH HILLIER
- 20 DANICA DIOR
- 21 STARSANDSPIRALS
- 22 NATASHA DOWN
- 23 JEN
- 25 BRIANNA GASKILL
- 26 LEFT: MICHELE CUNNEEN, RIGHT: JESSICA PEVELER
- 30 JESSIC PEVELER
- 31 MICHELE CUNNEEN
- 33 STEPHEN
- 34 TECH ROYAL
- 35 RATTYROO
- 36 BRAD CLINESMITH
- 37 CRAZY ALASCAN
- 38 MICHELE CUNNEEN
- 39 JIM KENEFICK
- 41 PATRICIA STOCKEBRAND
- 42 PATRICIA STOCKEBRAND
- 43 AHCROSMAN
- 44 TOP: PATRICK GAGE KELLEY, BOTTOM: SARA
- 45 JOSH RUSSELL
- 46 STAFF OF THE UNIVERSITY OF BIRMINGHAM
- 48 MYRI BONNIE
- 51 BAGSGROOVE
- 53 JEFF
- 54 MARCIE DONNELLY
- 55 TOP: POLLY SCHULTZ, BOTTOM: VIKRAM VETRIVEL
- 57 ANNIE MOLE
- 58 JANINE
- 60 TOP: JAN ARENDTSZ, BOTTOM: POLLY SCHULTZ
- 63 MARCIE DONNELLY
- 65 LESLIE JENKINS
- 67 JCMTAUS
- 68 NGCHONGKIN
- 69 POLLY SCHULTZ
- 70 THRIOL
- 75 PEGGY O'NEILL-WAGNER
- 76 FITZRIE
- 77 NAVANEETH
- 81 CHANTAL LYONS
- 82 EVELYN SKOUMBOURDIS
- 83 ARNO MEINTJES
- 86 ANTHONY FERRARO
- 92 ANDY
- 95 ERIK TJALLINKS
- 96 ED_NEEDS_A_BICYCLE
- 97 DOLAN HALBROOK
- 99 EVA THE WEAVER
- 105 LOUIS DIVINCENTI
- 107 MICHIEL S
- 108 MATTHEW KLEIN
- 109 MIKE ROWE
- 110 CAROL MITCHELL
- 111 MICHAIL PISHCHAGIN
- 114 ALI MOORE
- 116 POLLY SCHULTZ
- 118 NORTH TEXAS RABBIT SANCTUARY
- 119 TOP: STEREOMETRIC, BOTTOM: KITTY YING
- 120 PEHPSII ALTEMARK
- 121 TOP: ALICE, BOTTOM: IAN CROWTHER
- 132 MARCIE DONNELLY

INDEX

- abnormal behavior, see stereotypical behavior
- acclimating cats to human contact: 115
- acclimating dogs to human contact: 113
- acclimating mice to human contact: 119
- acclimating monkeys to be chair-restrained: 83-85
- acclimating monkeys to human contact: 115-116
- acclimating pigs to wearing a jacket: 101-102
- acclimating rabbits to human contact: 21-22, 117-119
- aggressive rabbit: 49
- bandage change, pigs: 102
- barking, how to decrease it: 12-15
- blood collection, cats: 6
- blood collection, cattle: 96
- blood collection, dogs: 8-10
- blood collection, vervets: 83
- cage change, hamsters: 38, 41
- cage change, mice: 28, 32, 41, 128
- caging for chinchillas: 42-44
- caging for rabbits: 46-47
- caging for rats: 34-35, 41
- calming cats: 4-6
- calming macaques: 73
- calming rabbits: 50
- catching cats from cage: 6
- catching macaques from cage: 78-80
- chow leftover for macaques: 64
- cleaning up messy enrichment: 105-110
- coconuts for non-human primates: 59-61
- cold stress in mice: 26-31
- corn on the cob: 107, 109-110
- cupping rodents: 24-25
- dolls for macaques: 61-62
- drains, sewage: 62, 67, 105-109
- dust bath for chinchillas: 42-44
- ECG procedure: 93
- enrichment, cleaning: 107-110
- enrichment for cats: 1-3
- enrichment for chinchillas: 42-44
- enrichment for dogs: 15
- enrichment for macaques: 56-69, 73-78, 81, 85, 90
- enrichment for marmosets: 53-54, 91-92
- enrichment for mice: 27, 29, 32-34
- enrichment for pigs: 98-101
- enrichment for rabbits: 44-45, 49-50
- enrichment for rats: 34-37
- enrichment, implementing: 129-130, 133
- Enviro-dri: 25-29, 31
- exercise/play for dogs: 7-8, 14-15
- exercise/play for macaques: 111-113
- exercise/play for rabbits: 22, 46-47
- fear of humans: 113-121
- flooding of rodent cages: 27, 31, 44
- food grinding by mice: 32-33
- food wasting by dogs: 11-12
- foraging enrichment for macaques: 56-58
- freezing reaction: 10-11
- gnawing sticks for macaques: 66-67
- handling cats: 4-6
- handling cows: 96-97
- handling dogs: 10
- handling macaques: 117
- handling mice: 19-20, 23-25, 30, 119-120
- handling rabbits: 21-22
- handling sheep: 96-97
- hay for chinchillas: 43-44
- hay for rabbits: 44-45

health check of mice: 25, 27-29
identifying mice in their nest: 27-30
implementing new enrichment ideas: 129-130
injection, macaques: 129
injection, mice: 23-25
injection, pigs: 96-97
injection, rabbits: 21, 118
lab coat effect: 49
laser pointer: 2, 85-86
mangos for macaques: 58
mirror enrichment for macaques: 68
music enrichment for monkeys: 73-74
music enrichment for rabbits: 22, 49-50
nail trimming of dogs: 8-9
nail trimming of rabbits: 21, 50
Nestlet: 26-31
nesting material for hamsters: 38
nesting material for mice: 25-31
noise and ultrasound as variables: 126-127
oral dosing of marmosets: 132
oral dosing of rabbits: 51
oral dosing of rodents: 39
paint rollers for macaques: 64-66
platforms for cats: 1-2, 16
platforms for dogs: 12-14
platforms for marmosets: 54
platforms for rats: 35-36, 133
play area/pen/room: 7-8, 14-15, 46-47, 117
playing, cats: 2-3
playing, dogs: 7-9, 14-15
playing, macaques: 55, 58-59, 67, 77
playing, pigs: 98-101
playing, rats: 20-21
post-surgical recovery of rodents: 40-41
produce for monkeys: 57-61
progress: 132-133
pronouns for animals: 124-125
resting surfaces, see platforms
restraint of cats: 4-6
restraint of dogs: 8-10
restraint of mice: 23-24
rooting opportunities for pigs: 97, 99-101
running wheel for cats: 2
scratching posts for cats: 2
scruffing: 5, 23
social housing after surgery: 37, 41, 87-89
social housing, caging for rabbits: 46-48
social housing, default: 90
social housing, monitoring: 130-131
social housing of cranial-implanted
macaques: 87-88
social housing of male mice: 34
social housing of same-sex hamsters: 38
social housing of same-sex rabbits: 46-48
social housing of vervets: 81-82
stereotypical behavior: 14-16, 33, 65, 90,
111-113, 124
stories: 19-21, 60-61, 70-72, 91, 108, 114-117,
120
stress, avoiding/minimizing: 4-6, 23-25, 39,
41, 79, 87, 95
suffering: 122-124
temperament of vervets: 81-83
toys for cats: 2-3, 6
toys for dogs: 8
toys for monkeys: 54, 61-62
toys for pigs: 98-101
toys for rabbits: 22, 44, 46
training dogs not to bark: 13
training to cooperate during procedures,
dogs: 8-11
training to cooperate during procedures,
macaques: 78-80, 84-86, 117, 129
training to cooperate during procedures,
vervet: 83-84
training to test the Lixit, macaques: 85-86
trust relationship with animals: 4, 6, 8, 9,
19-22, 78-81, 96-97, 115-121

water enrichment for macaques: 77-78
wheat grass for macaques: 62-63
wood for enrichment: 43, 53-54, 66-67, 129
wood shavings, practicability: 105-106
workload, changing cages: 128
video monitors/remote video-taping: 14, 60,
90-92
videos/movies/television for macaques:
74-76
zip ties for cats: 2-3

