

The Development of an Operant Conditioning Training Program for New World Primates at the Bronx Zoo

Gina Savastano, Amy Hanson, and Colleen McCann

*Mammal Department
Bronx Zoo/Wildlife Conservation Society
Bronx, New York*

This article describes the development of an operant conditioning training program for 17 species of New World primates at the Bronx Zoo. To apply less invasive techniques to husbandry protocols, the study introduced behaviors—hand feeding, syringe feeding, targeting, scale and crate training, and transponder reading—for formal training to 86 callitrichids and small-bodied cebids housed in 26 social groups. Individual responses to training varied greatly, but general patterns were noted among species. With the exception of lion tamarins, tamarins responded more rapidly than marmosets, Bolivian gray titi monkeys, and pale-headed saki monkeys in approaching trainers and learning behaviors. Marmosets, in comparison to most tamarins, had longer attention spans. This meant that fewer, lengthier sessions were productive whereas shorter, more frequent sessions were most successful for tamarins. Among the cebids, pale-headed saki monkeys needed relatively few sessions to perform basic and advanced behaviors whereas Bolivian gray titi monkeys were less responsive and progressed at a deliberate pace. Marked changes in the animals' behavior during daily husbandry procedures, their voluntary participation in training activities, and the disappearance of aggressive threats toward care staff indicated that training reduced stress and improved the welfare of the animals. During daily training displays, zoo visitors experienced interactive animals while learning the importance of low-stress animal husbandry.

Despite their abundance in captive collections, to date relatively few operant conditioning training programs involving callitrichid primates (marmosets, tamarins, and Goeldi's monkeys) have been developed. This may be due partly to their flighty nature and small physical stature (Epple, 1975; McKinley, Buchanan-Smith, Basset,

& Morris, 2003/*this issue*; Mittermeier, Rylands, Coimbra-Filho, & Fonesca, 1988; Rylands, 1993). Traditional methods of transporting or monitoring health status in the callitrichids often required physical restraint, with concomitant stress, resulting in animals becoming fearful or aggressive toward their caretakers (Brownie & McCann, 2003; Farmerie, Neffer, & Vacco, 1999). In studies investigating indicators of stress in marmosets, a significant increase in locomotor (Smith, McGreer-Whitworth, & French, 1998) and scent-marking behaviors (Barros, Mello, Huston, & Tomaz, 2001) was found when animals were presented with a negative stimulus. Additionally, in a comparative study of trained and untrained marmosets, Bassett, Buchanan-Smith, McKinley, and Smith (2003/*this issue*) demonstrated that stress imposed by invasive husbandry procedures was mitigated by exposure to operant conditioning training, illustrating the positive benefits of applying operant conditioning training to captive husbandry techniques.

The ability to detect signs of illness, weight loss, and pregnancy, as well as monitoring injuries, medicating and transporting individuals is essential for the appropriate care and management of captive collections. The ability to conduct necessary husbandry procedures in a low stress manner while building a positive rapport with each individual should be a primary goal for all captive primate caretakers (Colahan & Breder, 2003/*this issue*; Laule & Desmond, 1995; Reichard, Shellabarger, & Laule, 1992).

The Bronx Zoo's (BZ) New World primate collection includes 86 callitrichids and small-bodied cebids, totaling 17 species, housed in three separate facilities. The primary objective for developing a formal operant conditioning program for the BZ's New World primates was to decrease the level of stress involved in typical husbandry routines, and consequently, improve the welfare of the animals in our collection. In addition to advancing basic husbandry protocols, positive reinforcement training has the added benefit of providing a stimulating, enriching, and trusting environment for the animals (Laule, 1992). This in turn enhances the zoo visitor experience by exhibiting animals who are engaged in their environment, spend less time retreating to nestboxes and other hidden spaces, and can be viewed actively participating in training sessions (Laule & Desmond, 1998).

In this article, we describe the development of a formal training program for a large and diverse New World primate collection involving various care staff, making note of important elements that formed the foundation of the program and the results of the first year of the program.

METHODS

Study Animals and Housing Conditions

Eighty-six individual animals of 17 species of New World primates participated in the first year of the training program (see Table 1). Animals are housed in so-

TABLE 1
Participating Study Animals Within the Training Program

Group	Species ^a	Common Name	Group Composition		Group Classification
			No. of Males	No. of Females	
1	<i>Callithrix jacchus</i>	Common marmoset	1	4	Family
	<i>Pithecia pithecia</i>	Pale-headed saki monkey	1	1	Breeding
2	<i>Callithrix kuhlii</i>	Wied's tufted-eared marmoset	0	2	Single-sex female
	<i>Callicebus donacophilus</i>	Bolivian gray titi monkey	2	3	Family
3	<i>Callithrix kuhlii</i>	Wied's tufted-eared marmoset	0	2	Single-sex female
4	<i>Callithrix argentata</i>	Silvery marmoset	2	1	Family
5	<i>Callithrix argentata</i>	Silvery marmoset	1	2	Family
6	<i>Callithrix argentata</i>	Silvery marmoset	3	3	Family
7	<i>Callithrix pygmaea</i>	Pygmy marmoset	2	0	Single-sex male
8	<i>Callithrix geoffroyi</i>	Geoffroy's tufted-eared marmoset	0	2	Single-sex male
9	<i>Callithrix geoffroyi</i>	Geoffroy's tufted-eared marmoset	1	3	Family
10	<i>Saguinus mystax</i>	Mustached tamarin	1	2	Single-sex female
11	<i>Saguinus oedipus</i>	Cotton-top tamarin	1	4	Family
12	<i>Saguinus bicolor</i>	Pied tamarin	1	1	Breeding
13	<i>Saguinus geoffroyi</i>	Geoffroy's tamarin	3	3	Family
14	<i>Saguinus geoffroyi</i>	Geoffroy's tamarin	2	1	Family
15	<i>Saguinus geoffroyi</i>	Geoffroy's tamarin	1	1	Breeding
16	<i>Saguinus midas</i>	Golden-handed tamarin	0	3	Single-sex female
17	<i>Saguinus midas</i>	Golden-handed tamarin	1	1	Breeding
18	<i>Saguinus midas</i>	Golden-handed tamarin	1	1	Breeding
19	<i>Saguinus imperator</i>	Emperor tamarin	2	0	Single-sex male
	<i>Callicebus donacophilus</i>	Bolivian gray titi monkey	2	1	Family
20	<i>Leontopithecus chrysopygus</i>	Black lion tamarin	1	1	Breeding
21	<i>Leontopithecus rosalia</i>	Golden lion tamarin	2	3	Family
22	<i>Leontopithecus rosalia</i>	Golden lion tamarin	2	0	Single-sex male
23	<i>Leontopithecus chrysomelas</i>	Golden-headed lion tamarin	2	0	Single-sex male
24	<i>Callimico goeldii</i>	Goeldi's monkey	1	1	Breeding
25	<i>Pithecia pithecia</i>	Pale-headed saki monkey	1	1	Breeding
26	<i>Pithecia pithecia</i>	Pale-headed saki monkey	1	1	Breeding

Note. Two species listed under the same group number indicate a mixed-species group.

^aTaxonomy follows Groves (1993).

cial groups, which we classify as either a breeding pair (one male and one female), family group (breeding pair with one or more offspring), or single-sex group. In some cases, the primates are housed in mixed-species groups.

Animals in the training program are housed in indoor glass-fronted naturalistic exhibits. These exhibits are viewable to the public from 1000h to 1600h daily. Enclosures vary in size but are approximately 2 m wide \times 1.5 m deep \times 3 m high. Exhibit furnishings include natural branches, natural and artificial vines, a nestbox, plastic plants, and a pine-bark mulch substrate over a concrete floor. Exhibit floors, glass, and plants are spot-cleaned daily; the mulch substrate is removed and the enclosures disinfected weekly. Most animals have access to an off-exhibit enclosure overnight, measuring approximately 1.5 m wide \times 1 m deep \times 3 m high. These enclosures are furnished with natural branches and enrichment items (puzzle feeders, foraging boxes, and gum-arabic feeders) and are cleaned daily. The animals are fed twice daily, in the morning between 0830h and 1000h and in the afternoon between 1400h and 1600h. Training sessions are conducted in the animals' exhibit spaces during public viewing hours. Frequently, there are visitors observing the sessions.

Materials

Equipment utilized in the training program is listed in Table 2. The training crates have mesh sides and two plexiglass guillotine doors: one on one end and one side of the crate (see Figure 1). When in the crate, the animals receive their food rewards through the mesh sides of the crate. Some crates are configured with clips so that two crates can be attached along side each other with the side doors lined up to each other. This set-up works well for larger groups as animals that come into the crate can be locked into one side, leaving the other side open for additional animals to enter.

Because of the callitrichids' small physical size, food rewards and amounts used in the training program were determined by consultation with the zoo's nutritionist. The most commonly used rewards include small pieces of banana or grape, apple sauce, gum arabic, crickets, waxworms, and mealworms with amounts equaling 10% of the caloric value of the total diet. Food given during training sessions is removed from the animal's daily diet to avoid over feeding and skewing the recommended diet.

Behaviors

The behaviors that the animals are trained to do, and their defining criteria, are listed in Table 3. Basic behaviors identified to be most important for animal management include hand feeding, syringe feeding, targeting, scale and crate

TABLE 2
Equipment Used in Training Program

<i>Item</i>	<i>Use</i>
Clicker (Click and Treat™)	Bridge
Wooden dowel—1 cm diameter × 20 cm long	Target
Quick-draw Training Pouch™	To hold food rewards
1 cc plastic syringes	To dispense food rewards
Beaded pony-tail holders of different colors	Stations
Small plastic battery-operated scale, platform size 14cm × 14cm (Ohaus model LS200™)	To obtain weights on callitrichids
Large metal battery-operated scale, platform size 30cm × 40cm (Weigh-tronix model QC3265™)	To obtain weights on callitrichids, titi and saki monkeys
Wooden crates with two plexiglass doors and mesh sides (30cm × 30cm × 40cm)	For crate training callitrichids
Wooden crates with two plexiglass doors and mesh sides (40cm × 40cm × 50cm)	For crate training titi and saki monkeys
Aluminum platforms 40cm × 50cm, 1m high	For setting the large scale and training crates on
Plexiglass platform 14cm × 19cm, 1m high	For setting the small plastic scale on
Transponder reader (Avid Power Tracker IV™)	To detect identifying transponder microchips in animals



FIGURE 1 Crate training with a family group of cotton-top tamarins (*Saguinus oedipus*). Note the two crate set-up that is advantageous for training with larger groups (see text). (Photo credit: Julie Larsen/Wildlife Conservation Society)

TABLE 3
Behaviors Trained in the Training Program

<i>Behaviors</i>	<i>Verbal Cue</i>	<i>Visual Cue</i>	<i>Criteria</i>
Basic behaviors			
Hand feed	—	Food in hand	Animal takes the treat either in their hand or mouth directly from the trainer's hand
Syringe feed	—	Presence of syringe	Animal takes liquid from a syringe
Target	Target	Point to target or extend target to animal	Animal touches nose to the tip of the target and holds until released by bridge
Station	Station	Point to ponytail holder	Animal sits within one body length of their specific colored ponytail holder
Scale	Scale	Point to scale	Animal sits on the scale and stays until released by bridge
Crate	Box	Point to crate	Animal enters crate and waits while door is closed
Transponder read	—	Transponder reader	Animal stands on all fours while transponder wand is passed along their back and shoulder blades
Advanced behaviors			
Up	Up	Index finger pointed up	Animal stands up on legs and holds until released by bridge
Palpate	Belly	Index finger pointed up	Animal stands up on legs and holds while trainer manipulates their hand along the animal's abdomen
Back	Back	Keeper holds own hand above animal's back	Animal sits while trainer runs his/her hand down the length of the animal's back
Tail	Tail	Keeper holds own hand above animal's tail	Animal sits while trainer runs his/her hand down the length of the animal's tail
Hand	Hand	Keeper holds own index finger sideways in front of animal	Animal places the appropriate hand on trainer's finger (appropriate hand is determined by which side of the body the trainer's finger is on)
Stethoscope	—	Presence of stethoscope	Animal sits while stethoscope is placed on their chest, abdomen, and back
Otoscope	Ear	Presence of otoscope	Animal sits while an otoscope is placed in their ear
Ultrasound	Up/belly	Presence of ultrasound equipment	Animal holds in an Up position on a t bar while their abdomen is prepped with gel and an ultrasound wand placed and moved around on their abdomen

Note. An em dash (—) = no verbal cue used.

training, and transponder reading. After a group has learned to perform all of the basic behaviors, advanced behaviors that include tactile manipulations are introduced (see Table 3). Behaviors are trained through positive reinforcement; the animals receive rewards for performing desired behaviors, whereas undesired behaviors are ignored. Standard operant conditioning techniques using clickers as bridges and successive approximations are used (Laule, Bloomsmith, & Schapiro, 2003/*this issue*; Pryor, 1999).

Program Organization

Six keepers form the core group of trainers in the program. Each trainer is scheduled to work a minimum of 3 days each week with the New World primate collection. Trainers are allotted two 30-min training sessions per day. Within each session, approximately 5 min is spent on preparation, 10 min on training, 5 min on equipment removal and clean-up, and 10 min on record keeping.

Each trainer serves as the primary trainer for two or three groups of monkeys. Primary trainers are responsible for introducing new behaviors to the animals (see Figure 2). Once a behavior is consistently performed by an animal according to established criteria, other keepers act as secondary trainers. The secondary trainers assist in maintaining established behaviors and are available to work with the animals in the primary trainer's absence. Each team member involved serves as a primary trainer on some groups as well as a secondary trainer on others. Daily records



FIGURE 2 A Geoffroy's tamarin (*Saguinus geoffroyi*) takes a food treat from a syringe while being palpated. (Photo credit: Julie Larsen/Wildlife Conservation Society)

are kept and bi-monthly meetings are held to track training progress and to facilitate communication among the trainers and animal department managers.

RESULTS

The training program is ongoing and continues to develop as both the staff and animals advance their skills. Here we present the results from the first year of the program.

Logistical Challenges

Initiating and maintaining a training program for New World primates at the BZ posed several challenges due to the size of the primate collection, the unavoidable rotation of keeper staff throughout the various animal facilities, and the movement of animals between facilities for exhibit and husbandry purposes. Maintaining training consistency between keepers and animals required significant attention. To address this, uniform training criteria were created, written records of training sets were kept, and weekly meetings were held for communication.

Animal Challenges

In addition to logistical challenges, animal challenges were, and always will be, encountered. Table 4 lists some of the animal challenges that we encountered and the techniques used to overcome them.

The trainers observed that the animals' responses to training varied greatly among individuals, groups, and species (see Table 5). The results show a wide range in the number of sessions conducted prior to a behavior being successfully accomplished by most of the animals in the groups as well as differences among species in which behaviors were learned successfully. Hand feeding from a keeper took from 1 to 150 training sessions, syringe feeding from 1 to 10 sessions, targeting from 1 to 8 sessions, entering a crate from 1 to 20 sessions, going onto a scale from 1 to 75 sessions, going to a color-coded station from 1 to 40 sessions, and allowing their implanted microchip identification transponders to be read from 1 to 3 sessions. Ten of the groups responded particularly well to training and were taught advanced behaviors (see Table 6).

DISCUSSION

Although training session length varies between species, the data in Tables 5 and 6 are useful in providing an indication of species differences in the time in-

TABLE 4
Animal Challenges Within the Training Program

<i>Challenge</i>	<i>Solution</i>
Food rewards: avoiding obesity	Consult with the staff nutritionist to establish approved reward items and quantities
Identifying animals and their motivations for training	Maintain records describing physical characteristics of individuals and their reward preferences
Training large groups	Establish control by training individuals to station
Timid individuals	Use a single trainer to develop a trust bond, introduce bolder, or previously trained animals to the group
Overeager, dominant, or aggressive individuals	Ask overeager animals to station at a distance so that the trainer can focus on others; also, offer a time-consuming reward such as nuts with shells, super mealworms, or whole grapes that keep the overeager animal occupied

vestment required for training of basic and advanced behaviors. Although some animals participated in the training program immediately and performed all of the basic behaviors within five training sessions (e.g., Group 6, silvery marmosets), others required months even to accept hand feeding (e.g., Group 21, golden lion tamarins).

Tamarins

In general, lion tamarins were relatively slow to become comfortable with training. Building a rapport with each individual animal was a lengthy process, and relatively long training sessions were needed. On the contrary, tamarins (*Saguinus spp.*) responded more quickly than all marmosets and cebids with regard to approaching trainers as well as learning behaviors. Individuals would become engaged immediately as the trainer entered the enclosure and set up materials, volunteering to begin the training session. However, *Saguinus spp.* lost interest in sessions more rapidly than did marmosets or cebids. Shorter, more frequent sessions throughout the day proved most productive for *Saguinus spp.* Pied tamarins stopped responding to the trainer after just a few minutes into the sessions. However, if the trainer left the enclosure and then re-entered a short time (even < 1 min) later, they generally regained interest. Thus, a schedule that provided up to 10 short training sets a day was the most productive for this species.

Marmosets

In general, marmosets took longer than tamarins or cebids to begin interacting with the trainer. However, once a bond was formed and a behavior established,

TABLE 5
Time Scale for Training Basic Behaviors

Group	Species ^a	No. of Training Sessions for Animals to Perform Behavior						
		Hand Feed	Syringe Feed	Target	Station	Scale	Crate	Transponder Read
1	<i>Callithrix jacchus</i>	60	2	1	40	1	1	1
	<i>Pithecia pithecia</i>	1	^b	^c	^c	2	10	0
2	<i>Callithrix kuhlii</i>	20	5	4	^c	3	7	2
	<i>Callicebus donacophilus</i>	30	^c	^c	^c	2 ^d	10	^c
3	<i>Callithrix kuhlii</i>	10	5	5	8	3	5	1
4	<i>Callithrix argentata</i>	1	1	2	^b	1	3	^c
5	<i>Callithrix argentata</i>	2	1	6	^c	1 ^d	2	3
6	<i>Callithrix argentata</i>	1	2	2	5	2	4	1
7	<i>Callithrix pygmaea</i>	90	^c	^c	^c	2 ^d	4	^c
8	<i>Callithrix geoffroyi</i>	1	3	1	^c	1	6	1
9	<i>Callithrix geoffroyi</i>	2	2	^b	^b	2	2	^c
10	<i>Saguinus mystax</i>	5	2	1	^c	1	5	^c
11	<i>Saguinus oedipus</i>	5	3	^c	^c	10	10	^c
12	<i>Saguinus bicolor</i>	1	1	8	^c	1	1	1
13	<i>Saguinus geoffroyi</i>	4	1	1	^c	1	1	1
14	<i>Saguinus geoffroyi</i>	1	10	1	^c	7	8	^c
15	<i>Saguinus geoffroyi</i>	20	^b	^b	^c	9	^c	^c
16	<i>Saguinus midas</i>	2	1	^c	^c	4	4	^c
17	<i>Saguinus midas</i>	1	1	1	2	1	1	1
18	<i>Saguinus midas</i>	1	2	1	^c	1	1	1
19	<i>Saguinus imperator</i>	1	1	2	2	3	5	1
	<i>Callicebus donacophilus</i>	20	^c	^c	^c	3 ^d	^b	^c
20	<i>Leontopithecus chrysopygus</i>	120	1	1	15	2	20	1
21	<i>Leontopithecus rosalia</i>	150	3	^b	^b	25	10	^c
22	<i>Leontopithecus rosalia</i>	60	^b	^b	^c	3 ^d	^b	^c
23	<i>Leontopithecus chrysomelas</i>	15	^c	^c	^c	3 ^d	^c	^c
24	<i>Callimico goeldii</i>	50	^b	^b	^b	75 ^d	^c	^c
25	<i>Pithecia pithecia</i>	1	^b	4	^c	2	8	1
26	<i>Pithecia pithecia</i>	1	^c	2	15	1	4	^c

Note. This table indicates the number of training sessions it took for most of the animals in the groups to perform the behaviors.

^aSee Table 1 for the common names. ^bBehavior is being trained. ^cTraining for this behavior has not been started.

^dBehavior is done while trainer is outside enclosure.

TABLE 6
Time Scale for Training Advanced Behaviors

Group	Species ^a	No. of Training Sessions for Animals to Perform Behavior							
		Up	Palpate	Back	Tail	Hand	Stethoscope	Otoscope	Ultrasound
1	<i>Callithrix jacchus</i>	2	6	2	8	10	1	12	20
	<i>Pithecia pithecia</i>	10	b	b	8	10	20	b	b
4	<i>Callithrix argentata</i>	2	b	b	2	b	b	b	b
6	<i>Callithrix argentata</i>	2	b	b	b	b	b	b	b
9	<i>Callithrix geoffroyi</i>	2	c	b	2	b	b	b	b
16	<i>Saguinus midas</i>	3	7	5	2	b	6	b	b
17	<i>Saguinus midas</i>	2	4	3	1	b	5	b	b
19	<i>Saguinus imperator</i>	2	2	5	1	b	2	2	b
20	<i>Leontopithecus chrysopygus</i>	3	b	b	b	5	b	b	b
25	<i>Pithecia pithecia</i>	8	b	b	b	15	b	b	b
26	<i>Pithecia pithecia</i>	2	b	b	2	10	b	b	b

Note. This table indicates the number of training sessions it took for most of the animals in the groups to perform the behaviors.

^aCommon names are given in Table 1. ^bThis behavior has not yet been trained. ^cThis behavior is being trained.

additional training progressed rapidly (see also, McKinley et al., 2003/this issue). Common marmosets took 60 sessions to hand feed, but several subsequent behaviors were learned in under 10 sessions. They are now one of the most advanced groups in our collection. Overall, marmosets responded best to few (one or two) longer sessions (10 to 15 min) throughout the day.

Pygmy marmosets were the most difficult of all the marmosets in the training program due to their shy nature and cautious disposition. Initially, the trainer had to be in the enclosure, unmoving, for 25 min before the animals would respond positively. Pygmy marmosets have slow, deliberate movements, and hand-feeding efforts were most successful when the trainer reached his or her hand out all the way to the animals and offered food rewards directly in front of their mouths—maintaining the greatest possible distance between trainer and animal. For all other species in the program, trainers held the food reward at various distances in front of the animals, so that they would approach and actively take the food item.

Pale-Headed Saki Monkeys

Among the cebids, pale-headed saki monkeys were the most enthusiastic training participants. As with the tamarin species, they immediately approached the trainer

when he/she entered their enclosure and learned basic behaviors in relatively few sessions. Although saki monkeys learned rapidly, sessions often were interrupted or forced to end due to over-riding social interactions (the male was more interested in soliciting the female, diverting attention from training activities).

Bolivian Gray Titi Monkeys

Bolivian gray titi monkeys were the most difficult of all the species in the program to train. All individuals in the three groups were extremely shy and initially impossible to hand feed. With the introduction of less timid species from the training program (emperor tamarins and Wied's tufted-eared marmosets) to their exhibits, the titi monkeys began to approach trainers and hand feed. The introduction of more approachable individuals allowed titi monkeys to learn by observation. They also appeared to respond to competition with the other species for food rewards. Currently, all the titi monkeys hand feed and, on the condition that the trainer is outside their enclosure, stand on a scale, and enter a crate. To date, cooperative feeding of titi monkeys and either tamarins or marmosets in the same enclosure has been unsuccessful. The titi monkeys are still slow to approach the trainer, allowing the callitrichids to dominate the sessions. By separating the callitrichids into the overnight enclosure area (and rewarding them for doing so), the titi monkeys are able to participate in the training sessions.

Overall Positive Effects

Although quantitative data on indicators of stress were not collected, several changes in the animals' behavior indicate that the training program has substantially reduced the stress levels of the animals during specific husbandry procedures (crating and transporting animals) and has had an overall positive effect on the collection. Prior to the training program, the animals typically responded to the presence of keepers in their enclosures by moving to the highest area, retreating into nestboxes (and, with lion tamarins, closing the nestbox door), alarm calling, and/or displaying aggressive threats. After participation in the training program, they no longer threaten keepers when they enter the enclosure and, instead, eagerly approach and interact with the keepers and voluntarily participate in the training sessions. Thus, the rapport between the keeper staff and this collection has greatly improved, and the welfare of the animals has been enhanced. The observed behavioral changes in the trained animals are consistent with other studies reporting the positive effects of operant conditioning training on the psychological well-being of animals (Colahan & Breder, 2003/*this issue*; Farmerie et al., 1999; Laule & Desmond, 1995, 1998).

CONCLUSIONS

The New World primate operant conditioning training program at the BZ has benefited the public, keepers, and, most important, the animals in the program. The training program has improved the visitor experience on two levels. Members of the public now view interactive animals engaged in their environment. They are more visible in their exhibits than they were prior to the establishment of the program and more frequently perch in the front of their enclosures where visitors can easily view them. The public also learns about the importance of enhancing the care of the animals by applying low-stress husbandry techniques during our daily public displays and informational graphics describing the program.

For the animal keeper staff, working closely with the animals in the training program has been a very enriching and rewarding experience. Keepers are provided an opportunity to know the animals on a more individual basis, interact with them in a positive way, and appreciate the benefits that the training has for the welfare of the animals in their care.

Finally, and most important, the training program benefits the animal collection. The animals appear to be more comfortable during daily husbandry procedures, and their voluntary participation in the training program indicates that training is, on balance, a positive activity for them. Assessing the health and reproductive status of the animals through weight monitoring and tactile manipulations has substantially increased our ability to detect pregnancies, weight loss, obesity, and illness at early stages. The introduction of syringe feeding has facilitated medicating individuals in a group and reduced the need to separate animals from their group (to ensure medication consumption). Crate training has substantially reduced the need to capture and physically restrain animals, an obviously stressful procedure (Reinhardt, 2003/*this issue*), while simplifying the transport of animals among the various enclosures—a necessary activity for the exhibition of a zoo collection.

In conclusion, despite the various challenges involved in the development of a formal training program for a large, diverse primate collection, success can be attained if the goals of the program are prioritized and the available resources maximized. More important, if enhancing the welfare of the animals remains the primary objective of the program, then the challenges encountered become the stimulus for new solutions.

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