

ENVIRONMENTAL ENRICHMENT FOR NONHUMAN PRIMATES

Prepared by: Hilda Tresz
Behavioral Management Coordinator
Phoenix Zoo
2003



Table of contents

Introduction

I. Species-typical and species-appropriate behavior

II. Core requirements for facilities to enhance environmental enrichment for nonhuman primates

A. Social groupings

1. Social organization
2. Social signals
3. Grooming
4. Social communication in captivity
5. Detrimental effects of single-caging
6. Avoiding potential detrimental effects in social housing
7. Separation
8. Social adjustments and the physical environment
9. Effects of human interaction
10. Periodic or partial contact
11. Exceptions

B. Social needs for infants

C. Structure and substrate

1. Resting behavior
2. Postures and tail positions
3. Locomotion
4. Special needs of older infants and juveniles
5. Designing for arboreality
6. Designing enclosure furnishing
7. Designing for social adjustments
8. Sanitation

D. Foraging opportunities

1. The goal of providing foraging opportunities
2. Specialized foraging adaptations of different species
3. Forage placement

4. Foraging devices
5. Foraging for insects
6. Gum feeding
7. Water
8. Plants
 - List of toxic plants by common name
 - List of toxic plants by scientific name
 - Approved browse list for primates at the Phoenix Zoo
9. Special considerations

E. Manipulanda

F. Stimulating all five senses

1. Visual
2. Auditory
3. Tactile
4. Olfactory
5. Gustatory
6. Environments
7. Levels of stimulation-Controlling exposure

G. Providing animals novelty and control over aspects of the environment

1. Complexity
2. Controllability
3. Incorporating novelty and control into enhancement plans

H. Adaptive Behaviors

III. Special considerations

- A. Infants and young juveniles
- B. Those that show signs of being in psychological distress through behavior or appearance
- C. Individually housed nonhuman primates that are unable to see and hear nonhuman primates of their own or compatible species

IV. The classification of primates

- A. Distribution of nonhuman primates by families
- B. Taxonomy

V. List of primate species currently housed at the Phoenix Zoo

VI. List of innovations for nonhuman primates broken down to species at the Phoenix Zoo

- A. Social enrichment
- B. Training
- C. Structure and substrate
- D. Foraging opportunities
- E. Manipulanda
- F. Stimulating all five senses

VII. Resources

Introduction

Environmental enrichment is a tool that can be used to improve an animal's psychological and physical well-being by stimulating its ability to cope with daily changes in the social and physical environment, engaging the animal in species-appropriate behaviors and activities, and reducing or eliminating maladaptive or pathological behaviors, thereby improving quality of life.

Regulatory Background:

In 1985, Congress passed amendments to the Animal Welfare Act that directed the Animal Plant and Health Inspection Service (APHIS) to promulgate regulations that provide for psychological well-being of nonhuman primates. In February 1991, the USDA/APHIS issued a ruling that states:

“Dealers, exhibitors, and research facilities must develop, document and follow an appropriate plan for environment enhancement adequate to promote the psychological well-being of nonhuman primates. The plan must be in accordance with the currently accepted professional standards as cited in appropriate professional journals or reference guides, and as directed by the attending veterinarian.- Applied ethologists and stress physiologists recognize that a variety of indicators are necessary to assess an animal's psychological well-being. Indicators such as glucocorticoid levels, responses to preference tests and motivation challenges, immunosuppression, genetic expression, social behavior, and self-directed behaviors such as stereotypes and self-mutilation have opened a window into understanding the needs of animals in their own language. Observations by field ethologists and laboratory biologists are paved the way for better understanding of the ultimate and proximate causation of behaviors seen in captivity. While some order-specific generalizations can be made, available research indicates that psychological well-being is also species specific and varies between individuals based upon experience and genetics. To meet the mandate that psychological needs be addressed, there has been a proliferation of facility designs, enrichment devices, and programs for non human primates, suggesting that well-being encompasses more than a clean environment, good physical health, and successful reproduction”. -U.S. Department of Agriculture. Animal and Plant Health Inspection Service.9CFR Part 3: Animal Welfare Standards; Final Rule. Federal Register 56(32):5499 (1991).

The purpose of this document is to present captive husbandry guidelines for the care and psychological well-being of nonhuman primate species at the Phoenix Zoo. These guidelines have been developed in accordance with the USDA animal Welfare Act (Environmental Enrichment for Nonhuman Primates Resource Guide January 1992-February 1999; Final Report on Environmental Enhancement to Promote the

Psychological Well-being of Nonhuman Primates July 15, 1999 and the AZA Zoo Standards for the Housing of Nonhuman Primates (unpublished report).

General management practices that effect the entire Phoenix Zoo primate collection will be discussed and then the specific need of each primate species will be addressed.

I. Species-typical and species-appropriate behavior

USDA regulations state, “The physical environment in the primary enclosures must be enriched by providing means of expressing non-injurious species-typical activities”. [U.S. Department of agriculture, Animal and Plant Health Inspection Service 1998: CFR 3.81(b)]

A primate in captivity will not be able to exhibit the full range of behaviors that occur in nature. Collection managers would not want to promote infanticide or harmful aggression. The primate itself would not wish to suffer infanticide, predation, or other conditions that sometimes occur in nature. In passing the Animal Welfare Act, Congress did not intend such extremes to be promoted in the maintenance of captive primates. Therefore, in this policy, the term “species-appropriate behavior” has been adopted instead of the more common term, “species-typical behavior”.

II. Core requirements for environmental enrichment for nonhuman primates

This policy recognizes five elements as critical to environments and programs that promote psychological well-being in nonhuman primates:

- A. Social grouping
- B. Social needs of infants
- C. Structure and substrate
- D. Foraging opportunities
- E. Manipulanda

An acceptable program of environmental enhancement should address all five. In addition, an enhancement plan also may want to consider:

- F. Stimulating all five senses
- G. Providing the animal novelty and control over aspects of the environment
- H. Adaptive behaviors

- Stimulation of only one type of normal behavior should not be considered adequate.

Example: the positive effect is dramatically greater if cage furniture and daily multiple feedings of standard diets and treats are used together rather than if they are used alone.

- Prevention is better than treatment, in mental health as in physical health (Schapiro *et.al.* 1996a). The USDA's obligations under the Animal Welfare Act include requiring standards aimed at *prevention* of problems.
- The performance of stereotypical behaviors remains an important and valid indicator of welfare problems for most situations (Broom and Johnson 1993, Olfert *et. al.* 1993, Toates 1995, Wemelsfelder 1993). The benefit of any interpretive doubt should go to the animals (Bekoff 1994, Duncan *et.al.* 1993).
- *Welfare should be seen as more than just absence of negative behavior* (Bayne 1989:27, Broom and Johnson 1993, Poole 1992).

A. Social groupings

USDA regulations state, “The environmental enhancement plan must include specific provisions to address the social needs of nonhuman primates of species known to exist in social groups in nature” [U.S. Department of Agriculture, and Animal Plant Health Inspection Service 1998:9 CFR 3.81 (a)].

The following aspects should be considered:

1. Social organization- the gregariousness of a primate in nature varies not only with its species, but may also vary with its age, sex, kinship to others, the season, the habitat, and the particular activity.
2. Social signals- that communicate emotional states or information between individuals. The signals may be visual, vocal, olfactory, or tactile. They can convey dominance, submission, intent to attack, anxiety, reconciliation, reassurance, alliance, sexual receptivity, a desire for grooming or play, a willingness to nurse, territorial boundaries, and so on (Estes 1991, DeWall 1989, Rowe 1996). Knowledge of these communicative and associated sensory abilities may suggest various enrichment ideas (Buchanan-Smith 1997).
3. Grooming- is a critical form of tactile communication and stimulation and is critical in maintaining social bonds for most species.
4. Social communication in captivity- can be used by managers to recognize affiliative or stable bonds as well as aversion or impending aggression (Bernstein 1991, Rosenblum and Andrews 1995). It is therefore important that captive environments for primates allow for the adequate expression of social signals by the sender and reception by the receiver.
5. Detrimental effects of isolation- Managers should consider the pronounced association between abnormal behaviors and/or physiological disturbance and isolated housing.
6. Avoiding potential detrimental effects of social housing- Managers should consider the effects of pair or group caging versus individual caging. These effects can include social stress, competition for food, disease transmission, wounding, and the possible need for contraception.
7. Separation- from the mother, a sibling or nursery peer, a cage partner, or a roommate is stressful for animals have been compatibly paired or grouped.
8. Social adjustments and the physical environment- Social compatibility can be influenced by environmental structure and complexity (Chance *et. al.* 1983). Appropriate enclosure size, design, and furnishings can make attempts at social housing and the process of introduction more successful. Two unfamiliar individuals, at first pairing, may actually require more than twice the minimum space required by USDA for each individual alone because of the distance they feel they must maintain from each other.
9. Effects of human interaction- Positive interaction with humans (whether conspecific socialization is impossible or forced contact by human facility personnel is necessary) can improve the social environment for captive primates (Bayne *et. al.*

1993, Bloomsmith *et. al.* 1997, K.C. Baker 1997). It should not replace conspecific social interaction.

10. Periodic or partial contact- Primates are very much physical contact animals. In the absence of tactile contact, opportunities of visual and auditory contact should be provided. In situations where continuous social housing is not appropriate, caging allowing periodic full contact or even partial contact with conspecifics can be justified with appropriate supporting evidence. The more socially restrictive the housing arrangement is, the more rigorously it must be justified. This does not mean that every individual primate must be forced into social contact. There will be some situations where single housing would still be preferred to contact with unsuitable conspecifics.

11. Additional Considerations

- a. If a nonhuman primate exhibits vicious or overly aggressive behavior, or is debilitated as a result of age or other conditions (e.g., arthritis), it should be housed separately.
- b. Nonhuman primates that have or suspected of having contagious disease must be isolated. When an entire group or room of nonhuman primates is known to have or believed to be exposed to an infectious agent, the group may be kept intact during the process of diagnosis, treatment, and control.
- c. Nonhuman primates may not be housed with other species of primates or animals unless they are compatible, do not prevent access to food, water, or shelter by individual animals, and are not known to be hazardous to the health and well-being of each other. Compatibility must be determined in accordance with generally accepted professional practices and actual observations, as directed by the veterinarian.
- d. Individually housed nonhuman primates must be able to see and hear nonhuman primates of their own or compatible species unless the attending veterinarian determines that it would endanger their health, safety, or well-being.

B. Social needs of infants

It must be recognized, the infant is an active participant in its own postnatal development. W.A. Mason (1971) characterizes the developmental trends in infant primates as a balance between two functional systems:

- Filial “mother - directed”
- Explorative - “other - directed”

Both functional systems exist throughout the life of a developing infant.

The weaning process also consists of two concurrent processes:

- Nutritional weaning
- Behavioral weaning

Nutritional weaning is completed at the time the infant is no longer dependent on the mother for total provision of food. Behavioral weaning is a transition encompasses the period during which the infant may nurse, not primarily to obtain food, but to obtain comfort and reassurance during times of stress (Byrne and Suomi 1995, Van Roosmalen and Klein 1988). For the infant, maternal separation or loss is accompanied by a complex series of behavioral and physiological changes. Initially, an agitation/protest phase is observed, characterized by increased locomotion, distress vocalizations, and oral and digestive behaviors. This phase is followed by a depressive/despair phase, in which the infant becomes increasingly withdrawn and despondent, manifesting reduced locomotion, slouched postures, and diminished interest in play activities.

The optimal situation in which any primate should develop is one that permits the infant to remain with its biologic mother through weaning in the company of a species-normal social group (Pazol and Bloomsmith 1993, W.A. Mason 1991).

International Primatological Society guidelines recommend infants should be allowed to remain in contact with the mother until at least 12-18 months old. Primate Vaccine Evaluation Network guidelines recommend infants should not be weaned before 6 month.

C. Structure and substrate

The most basic components of the physical or inanimate environment are the enclosure structure (its size, shape, and design) and the substrates within it (J. Coe 1989, Maple and Perkins 1996). The term “substrate” commonly refers to the “base on which an organism lives” and would include flooring, turf, sand, bedding materials and furnishings, perches, swings, ropes, ledges, nest boxes, barrels, culverts and water features.

In order to accommodate species-appropriate behavior, the enclosure must have adequate space. Use of legal cage size will not always meet an animal’s behavioral requirements (NRC/ILAR 1998:18). Adequate space is not just a question of numeric dimensions or total volume, but also one of shape and design.

To promote a space to be structured, usable, and species appropriate the following elements should be considered:

1. Resting behavior- Primates display a variety of different comfort postures during resting and sleeping: lying down; sprawling out prone, sternally or laterally; sitting upright; crouching or vertically clinging. Most of the primates build night and day nests of soft materials.
2. Postures and tail positions- In designing enclosures for primates with long tails, one must take into account the position, angle and the length of the tail so that it may be unobstructed and held comfortably in a normal manner (NRL/ILAR 1998). Enclosures are need to be designed for “normal postural adjustments with adequate freedom of movement” required by USDA regulations in 9 CFR Section 3.80(a)(2)(xi).
3. Locomotion- Locomotor styles vary among taxonomic groups from brachiation and similar forms of suspensory locomotion through leaping and terrestrial knuckle walking. All enclosures should promote proper locomotion. If the animals do not have room to execute normal locomotion, the implementation of programs of periodically releasing primates into exercise areas should be considered.
4. Special needs of older infants and juveniles- the frequency with which juveniles use certain locomotion styles may differ from that of adults of the same species. The wild ranges of locomotor behavior “provide the greatest opportunity for developing strength, balance and coordination” (Dunbar 1989). “All captive immature animals should be provided with enough space to engage in vigorous locomotor play” (Goosen *et. al.* (1984) and should be provided with the same interior cage height as adults of their species.
5. Designing for arboreality- all arboreal species should be provided a full use of vertical space and structures such as trees, ropes, walls, poles, jungle gyms, and enclosure wall mesh (Bennett and Davis 1989, Burt and Plant 1990). Primates display “vertical flight reaction” All animals should be provided with a minimum flight distance through which they can retreat from fear-inducing stimuli (Hediger 1964). The International Primate Society Guidelines (1993) recommended that primates be able to “perch above human eye level”.

6. Designing enclosure furnishing- Enclosures furnished with natural and artificial materials of various sizes and arrangements are better suited to appropriate behaviors. Animals living in homogeneous enclosures with large, inflexible, continuous supports exhibit different patterns of locomotion than those in more naturalistic and complex environments with smaller, interrupted, flexible supports. The kind of structural items preferred by primates are not easily predicted. Perches, shelves, ladders, swings, ropes, barrels, boxes and other structures can be made of many materials. Wood, plastic and fiber have the advantage of being non-thermo conductive, which is helpful outdoors. Substrates used to cover the enclosure floor can be soft, as are straw, wood wool, paper, blankets, vegetation etc. These materials can effect space utilization (McKenzie *et. al.* 1986). They may prove comfort, be part of a foraging, and constitute manipulable items.

7. Designing for social adjustments- Primate enclosures should allow individuals to avoid social threats or other noxious stimuli by maintaining sufficient distance or making use of visual barriers, partitions, privacy areas, and escape routes (Applebee and Marshall *et. al.* 1991,

8. Sanitation- All primate enclosures with natural substrates (i.e. hay, sand woodchips, mulch, soil, etc.) must be spot-cleaned daily, removing fecal material and food waste to prevent feces accumulation and insect and rodent infestation. Hard substrates are typically cleaned daily with appropriate detergents or disinfectants. Exhibit props that have been scent-marked (pheromones) should not be regularly cleaned, avoiding unnecessary stress to those primates that would otherwise have to re-mark their territory over and over. Exhibit perching that has been scent-marked can be brushed clean of food and fecal material and then rinsed with water, allowing the scent to be retained. Exhibit furnishing should be changed when wear or unsafe conditions warrant, but no more than half at a time for scent-marking species.

D. Foraging opportunities

Foraging is a time consuming event involving searching for, retrieving or acquiring, and processing food.

1. The goal of providing foraging opportunities – Wild primates may spend 25% to 90 % of their time foraging. They also have diverse diets that may include browse, seeds, leaves, flowers, gum, fruits, insects, and animal matters. The percentage of food types is not consistent from month to month. No correlation has been observed between the seasonality of the habitat and the degree of dietary variability. This indicates that dietary variability should be part of a feeding enrichment program (Chapman and Chapman 1990). To promote psychological well-being it is not sufficient to merely provide a nutritionally adequate diet. It is important to (1) increase processing time, (2) stimulate the senses by providing foods other than the typical pre-formulated pellets, and (3) periodically change the availability of food in time and space. Foraging programs should require primates to “work” for food items, spend more time processing foods, and increase their exposure to novel foods. In the wild, “working for food” is one of the most frequently found species-typical and time-consuming behaviors, yet many captive primates are deprived of this stimulation. Mental stimuli may be provided to animals by requiring them to complete cognitive tasks to obtain their food.

2. Specialized foraging adaptations of different species – When foraging techniques are employed, species characteristics must be considered. Are the primates leaf, gum, insect, or fruit eaters? Are they terrestrial or arboreal foragers? How do they forage? What body positions do they take? How do they use their hands? Do they use tools? Levels of cognitive ability and manual dexterity will determine what foraging techniques offered are effective. The type of food and where and how it is obtained in the wild also needs to be considered.

3. Forage placement - Foraging opportunities can be presented in a variety of ways, either naturally or with devices. An outdoor environment allows primates to forage in a natural way if food is placed on the ground or in trees as it would be found in nature. This environment should be imitated by scattering food in a foraging substrate (such as wood chips, shavings, straw, hay, leaf litter or shredded paper. Aggression and monopolization by individuals can be prevented in group housing situations by offering food in multiple locations.

4. Foraging devices- Foraging devices are ranging from feeder boxes, puzzles, acrylic food puzzles, to various shaker boxes, toys and peg boards placed outside enclosures where food has to be manipulated with “tools” to pull it through the peg maze. Foraging devices can be made more complex by suspending them from the ceiling. As is the case with other types of enrichment strategies, different species, age groups, and individuals may prefer different types of foraging devices (C. Wattson 1997). Not all foraging devices are effective in a given situation (Lutz and Farrow 1996), and facilities may need to try several methods.

5. Foraging for live prey- Live prey also causes primates to work for their food. Live prey allows primates to stalk, grab, poke, and pry for their food. Live prey can include beetles, caterpillars, moths, grasshoppers, locusts, ants, crickets, mealworms, butterflies, centipedes, millipedes, spiders, slugs, snails, frogs, and fishes. Insects can be provided in either passive (allow slow dispersal of the live prey) or active (require the primate to “work” to obtain live prey) dispensers.

6. Gum feeding- Gum Arabic is an ingredient in many food products, including bakery, confectionery, dairy, and frozen dessert products. The gum mixture can be presented in free-hanging liquid dispensers, holes drilled in branches, logs, or trees, or specially made dowels.

7. Water- Drinking water should be fresh (“potable”) at all times and should be dispensed in the most appropriate manner. Watering devices such as “hog-suckers”, small mammal

bottles, and bubbler drinkers are acceptable. When exhibit pools are used as the source of drinking water, fresh water make-up should be available. Water quality in primate exhibits should be checked regularly. Water can be a very useful enrichment technique. Wild primates obtain water by mouth, by cupping it in their hands, or by using leaves as sponges. Besides drinking it, they use water in other ways- to take a bath, cool their temperature, play, or soak their food items.

8. Plants- Fresh browse is great source of natural enrichment. Herb gardens can be grown in wooden boxes covered with wire mesh, protecting the roots. The veterinarian can offer plants with medicinal value. These plants are believed to be related to control of parasites and gastrointestinal disorders, regulation of fertility, and possible antibacterial or antihepatotoxic activity (Huffman and Wrangham 1994).

In order to avoid plant poisoning the Phoenix Zoo has established a policy that the Veterinarian must approve all plants utilized within the zoo as well as those specified on the browse list. The browse coordinator is responsible for scheduling and coordinating browse distribution and for verifying appropriateness of materials.

The University of Illinois presents the following list of plants toxic to animals,
Veterinary Medicine Library:

LIST OF TOXIC PLANTS BY COMMON NAME

[Alfalfa \(*Medicago sativa* L.\)](#)

American Coffee Berry Tree see [Kentucky Coffee Tree](#)

[Bloodroot \(*Sanguinaria canadensis* L.\)](#)

[Bouncing Bet \(*Saponaria officinalis* L.\)](#)

[Bull Nettle \(*Solanum carolinense* L.\)](#)

[Bracken or Brake Fern \(*Pteridium aquilinum* L.\)](#)

Burning Bush see [Fireweed](#)

[Buttercup \(*Ranunculus* spp.\)](#)

Carelessweed see [Pigweed](#)

[Castor Bean \(*Ricinus communis* L.\)](#)

[Clover, Alsike & Other Clovers \(*Trifolium hybridum* L. & other species\)](#)

[Cocklebur \(*Xanthium strumarium* L.\)](#)

Creeping Charlie see [Ground Ivy](#)

[Crown of Thorns \(*Euphorbia milii*\)](#)

[Curly Dock \(*Rumex crispus* L.\)](#)

[Daffodil \(*Narcissus* spp.\)](#)

[Delphinium \(*Delphinium* spp.\)](#)

Devil's Trumpet see [Jimson Weed](#)

[Dogbane \(*Apocynum* spp.\)](#)

[Dutchman's Breeches \(*Dicentra cucullaria* \(L.\) Bernh.\)](#)

[Elderberry \(*Sambucus canadensis* L.\)](#)

[English Ivy \(*Hedera helix* L.\)](#)

[Ergot \(*Claviceps purpurea* \(Fr.\) Tul.\)](#)

Fern, Bracken (*Pteridium aquilinum* L.)

[Fireweed \(*Kochia scoparia* L.\)](#)

[Foxglove \(*Digitalis purpurea* L.\)](#)

[Ground Ivy \(*Glechoma hederacea* L.\)](#)

Hemlock

[Poison \(*Conium maculatum* L.\)](#)

[Water \(*Cicuta maculata* L.\)](#)

[Hemp \(*Cannabis sativa* L.\)](#)

[Horse Chestnut, Buckeyes \(*Aesculus hippocastanum* L.\)](#)

[Horse Nettle \(*Solanum carolinense* L.\)](#)

[Horsetails \(*Equisetum arvense* L. & other species\)](#)

[Hyacinth \(*Hyacinth orientalis*\)](#)

[Hydrangea \(*Hydrangea* spp.\)](#)

Ivy

[English \(*Hedera helix* L.\)](#)

[Ground \(*Glechoma hederacea* L.\)](#)

[Poison \(*Toxicodendron radicans* \(L.\) Kuntze\)](#)

[Jack-in-the-Pulpit \(*Arisaema* spp.\)](#)

[Jamestown Weed](#) see [Jimson Weed](#)
[Japanese Yew \(*Taxus cuspidata* Sieb. & Zucc.\)](#)
[Jerusalem Cherry \(*Solanum pseudocapsicum* L.\)](#)
[Jimson Weed \(*Datura stramonium* L.\)](#)
[Kentucky Coffee Tree \(*Gymnocladus dioica* \(L.\) K. Koch\)](#)
[Kentucky Mahogany Tree](#) see [Kentucky Coffee Tree](#)
[Klamath Weed](#) see [St. Johnswort](#)
[Lamb's Quarters \(*Chenopodium album* L.\)](#)
[Lantana \(*Lantana camara* L.\)](#)
[Larkspur \(*Delphinium* spp.\)](#)
[Lily-of-the-Valley \(*Convallaria majalis*\)](#)
[Lupine \(*Lupinus* spp.\)](#)
[Mad Apple](#) see [Jimson Weed](#)
[Maple, Red \(*Acer rubrum*\)](#)
[Mayapple \(*Podophyllum peltatum* L.\)](#)
[Milkweed, Common \(*Asclepias syriaca* L.\)](#)
[Mint, Purple \(*Perilla frutescens*\)](#)
[Nicker Tree](#) see [Kentucky Coffee Tree](#)
[Nightshade \(*Solanum* spp.\)](#)
[Oleander \(*Nerium oleander* L.\)](#)
[Ohio Buckeye \(*Aesculus glabra* Willd.\)](#)
[Philodendron \(*Philodendron* spp.\)](#)
[Pigweed \(*Amaranthus* spp.\)](#)
[Poison Hemlock \(*Conium maculatum* L.\)](#)
[Poison Ivy \(*Toxicodendron radicans* \(L.\) Kuntze\)](#)
[Poke \(*Phytolacca americana* L.\)](#)
[Purple Mint \(*Perilla frutescens*\)](#)
[Redroot](#) see [Pigweed](#)
[Rhododendron \(*Rhododendron* spp.\)](#)
[Rhubarb \(*Rheum rhaponticum* L.\)](#)
[Squirrelcorn \(*Dicentra canadensis* \(Goldie\) Walp.\)](#) see [Dutchman's Breeches](#)
[Staggerweed \(*Dicentra* spp.\)](#) see [Dutchman's Breeches](#)
[St. Johnswort \(*Hypericum perforatum* L.\)](#)
[Stink Weed](#) see [Jimson Weed](#)
[Stump Tree](#) see [Kentucky Coffee Tree](#)
[Sudan Grass \(*Sorghum vulgare* var. *sudanense* Hitchc.\)](#)
[Summer Cypress](#) see [Fireweed](#)
[Thorn Apple](#) see [Jimson Weed](#)
[Tulip \(*Tulipa* spp.\)](#)
[Water Hemlock \(*Cicuta maculata* L.\)](#)
[White Snakeroot \(*Eupatorium rugosum* Hout.\)](#)
[Wild Onion \(*Allium* spp.\)](#)
[Yellow Sage](#) see [Lantana](#)

LIST OF TOXIC PLANTS BY SCIENTIFIC NAME

Acer rubrum -- (Maple, Red)
Aesculus glabra Willd. -- (Ohio Buckeye)
Aesculus hippocastanum L. -- (Horse Chestnut, Buckeye)
Allium spp. -- (Wild Onion)
Amaranthus retroflexus. -- (Pigweed)
Apocynum spp. -- (Dogbane)
Arisaema spp. -- (Jack-in-the-Pulpit)
Asclepias syriaca L. -- (Common Milkweed)
Cannabis sativa L. -- Hemp
Chenopodium album L. -- (Lamb's Quarters)
Cicuta maculata L. -- (Water Hemlock)
Claviceps purpurea (Fr.) Tul. -- (Ergot)
Conium maculatum L. -- (Poison Hemlock)
Convallaria majalis -- (Lily-of-the-Valley)
Datura stramonium L. -- (Jimson Weed)
Delphinium spp. -- (Delphinium)
Dicentra spp. (Dutchman's Breeches & Squirrelcorn)
Digitalis purpurea L. -- (Foxglove)
Equisetum arvense L. & other species -- (Horsetails)
Eupatorium rugosum Hout. -- (White Snakeroot)
Euphorbia milii -- (Crown of Thorns)
Glechoma hederacea L. -- (Ground Ivy)
Gymnocladus dioica (L.) K. Koch -- (Kentucky Coffee Tree)
Hedera helix L. -- (English Ivy)
Hyacinth orientalis -- (Hyacinth)
Hydrangea spp. -- (Hydrangea)
Hypericum perforatum L. -- (St. Johnswort)
Kochia scoparia L. -- (Fireweed)
Lantana camara L. -- (Lantana)
Lupinus spp. -- (Lupine)
Medicago sativa L. -- (Alfalfa)
Narcissus spp. -- (Daffodil)
Nerium oleander L. -- (Oleander)
Perilla frutescens -- (Purple Mint)
Philodendron spp. -- (Philodendron)
Phytolacca americana L. -- (Poke)
Podophyllum peltatum L. -- (Mayapple)
Pteridium aquilinum (Desv.) Hier. -- (Bracken or Brake Fern)
Ranunculus spp. -- (Buttercup)
Rhododendron spp. -- (Rhododendron)
Rheum rhaponticum L. -- (Rhubarb)
Ricinus communis L. -- (Castor Bean)
Rumex crispus L. -- (Curly Dock)

Sambucus canadensis L. -- (Elderberry)
Sanguinaria canadensis L. -- (Bloodroot)
Saponaria officinalis L. -- (Bouncing Bet)
Solanum spp. -- (Nightshades)
Solanum carolinense L. -- (Horse or Bull Nettle)
Solanum pseudocapsicum L. -- (Jerusalem Cherry)
Sorghum vulgare var. *sudanense* Hitchc. -- (Sudan Grass)
Taxus cuspidata Sieb. & Zucc. -- (Japanese Yew)
Toxicodendron radicans (L.) Kuntze -- (Poison Ivy)
Trifolium hybridum L. & other species -- (Alsike & Other Clovers)
Tulipa spp. -- (Tulip)
Xanthium strumarium L. -- (Cocklebur)

Approved browse list for primates at the Phoenix Zoo:

Common Name	Scientific Name	Family
Acacia	<i>Acacia spp</i>	Fabaceae
Queen Palm	<i>Arecastrum romanzoffianum</i>	Palmae
Desert Broom	<i>Baccharis sarothroides</i>	Compositae
Bamboo	<i>Bambusa spp</i>	Gramineae
Carob Tree	<i>Ceratonia siliqua</i>	Fabaceae
Palo Verde	<i>Cercidium spp</i>	Fabaceae
Lemon Grass	<i>Cymbopogon citrates</i>	Gramineae
Umbrella Grass	<i>Cyperus alternifolius</i>	Cyperaceae
Ficus	<i>Ficus spp</i>	Moraceae
Hibiscus	<i>Hibiscus spp</i>	Malvaceae
Desert Fern	<i>Lysiloma micrphylla</i>	Fabaceae
Mint	<i>Mentha spp</i>	Labiatae
Banana	<i>Musa spp</i>	Musaceae
Cat Nip	<i>Nepeta cataria</i>	Labiatae
Cat Mint	<i>Nepeta faassenii</i>	Labiatae
Basil	<i>Ocimum basilicum</i>	Labiatae
Oregano	<i>Origanum vulgare</i>	Labiatae
Jerusalem Thorn	<i>Parkinsonia spp</i>	Fabaceae
Fountain Grass	<i>Pennisetum setaceum</i>	Gramineae
Date Palm	<i>Phoenix dactylifera</i>	Palmae
Pine	<i>Pinus spp</i>	Pinaceae
Cottonwood	<i>Populus fremontii</i>	Salicaceae
Mesquite	<i>Prosopis spp</i>	Fabaceae
Pumpkin	<i>Pumpkin</i>	Cucurbitaceae
Pomegranite	<i>Punica granatum</i>	Punicaceae
Rose	<i>Rosa spp</i>	Rosaceae
Palmetto	<i>Sabal spp</i>	Palmae
Sugar Cane	<i>Saccharum spp</i>	Gramineae
Gooding's Willow	<i>Salix goodingii</i>	Salicaceae
Bulrush	<i>Scirpus spp</i>	Cyperaceae
Tamarisk	<i>Tamarix spp</i>	Tamaricaceae
Yellow Bells	<i>Tecoma stans (flowers)</i>	Bignoniaceae
Cape Honeysuckle	<i>Tecomaria capensis (flowers)</i>	Bignoniaceae
Tipu Tree	<i>Tipuana tipu</i>	Fabaceae
Cat-tails	<i>Typha spp</i>	Typhaceae
California Fan Palm	<i>Washingtonia filifera</i>	Palmae
Mexican Fan Palm	<i>Washingtonia robusta</i>	Palmae

9. Special considerations- Some precautions are needed for using plants as environmental enrichment. Because extra food over the normal diet could result in obesity weights need to be monitored and amounts fed adjusted. Increasing the level of difficulty too much in a foraging program may cause distress and will not necessarily increase foraging behavior (Novak *et.al.* 1998). All aspects of an enrichment program, including foraging strategies, need to be evaluated on a continual basis to address any potential problems and make necessary adjustments.

E. Manipulanda

Manipulanda are objects that can be moved, used or altered in some manner by the primate's body parts. The items may be artificial or natural.

When toys are new they may stimulate curiosity and may increase play behavior. Animals, however, lose interest in or habituate to toys over time. Rotating toys on the basis of texture, shape, and color helps to maintain interest (NRC/ILAR 1998).

The goal of providing manipulanda is to increase the time that a primate is engaged in manipulatory behaviors similar to those exhibited in the wild and to decrease abnormal behavior. Not all items are equally interesting to a primate and it is suggested to customize objects for the species using them.

Having objects to manipulate is particularly important for primates that are socially restricted (Bonski *et.al.* 1999).

Most manipulanda are designed to stay inside the enclosure, but some hang on the outside. Special care must be taken to ensure objects given to primates are reasonably safe for the species: that they cannot injure their hands on them; that they do not chew and swallow harmful amounts of them; that they do not become inescapably entangled in them. Some type of manipulanda must be periodically cleaned and removed. The benefits to the animals must be weighed against the cost and potential risks.

It is important for an animal to have control over its environment. This could be the one reason why simple, destructible objects are often preferred by primates over more complex indestructible ones (Sambrook and Buchanan-Smith 1997).

It is also important the animal has the ability to escape from the object if threatened by it. Sometimes a novel object or situation will evoke "neophobia" or fear in a primate. Careful consideration of species, age, rearing history and other individual characteristics in choosing objects will reduce the likelihood of fear reactions.

Manipulanda as a critical element overlaps with two others – structure and substrate in the primate's enclosure and providing foraging opportunities. Manipulable objects play a role in social interactions, and infant development, which must be carefully understood. However, the most important aspect of manipulanda may be that, if selected and used well, they can stimulate several senses and permit the animal to experience novelty and a sense of control over part of its environment.

F. Stimulating all five senses

In designing a plan to meet all critical elements a facility must also consider stimulation of the five senses: visual, auditory, olfactory, tactile and gustatory.

1. Visual- Spacing between individuals, body postures, and facial signals, especially the complex facial signals in hairless-faced monkeys and apes, all convey information. Primate social relations are maintained and changed through the use of visual communication. Caregivers need to be aware of the importance of visual communication when housing primates.

Methods of enriching the environment visually may involve the use of:

- **Light**- Primates generally require around 12 hours of light daily. When held indoors, natural light from skylights or windows should be provided wherever possible. Fluorescent lights that produce full-spectrum illumination should be available on timers in all indoor primate facilities to supplement natural lighting and to extend the photoperiod during the shorter days of northern hemisphere winter to 12 hours of light. Standard enclosures can be altered by replacing bars and walls by clear Plexiglas. Giving nocturnal animals red or blue lights rather than total darkness during the reverse dark cycle promotes their normal activity levels (Wright *et.al.* 1989). Simulating dawn and dusk by gradually turning on or off the lights is also beneficial.
- **Color**- Cool-spectrum light (green) can reduce the incidence of anxiety behaviors such as spacing and rocking (Fritz *et. al.* 1997). Sunlight has more ultraviolet radiation than fluorescent light, and there is a peak in the blue-green rather than in the yellow-green region of the visible spectrum may produce similar effects to the cool-spectrum lights (Thorington 1985). When color dyes are added to food items, it may increase consumption.
- **Motion** -can be used as visual stimulation in various forms such as TV, videos, or vide games (Brent and Stone 1996). Television should only be presented in a way that primates have the choice not to watch it.
- **Mirrors**- some monkeys and the great apes can perceive a mirror image as their own. Small portable mirrors are repeatedly manipulated and remain the source of fascination over period of months.

2. Auditory- Auditory stimuli consist of:

- Vocalization from other primates can communicate messages such as danger, fear, discovery of food, etc. Auditory calls are especially important when visual transmission of messages is not possible.
- Sounds from the natural environment- Animals also make non-vocal sounds, such as banging or drumming, to express their emotions.
- Music and naturalistic sounds- available at times throughout the day may reduce aberrant behaviors (National Institutes of Health 1991). Giving the choice of turning the music on or off can increase the time spent with playing music.
- Noise- Excessive noise can stress and even cause physical damage to the auditory system. Auditory stimulation can be aversive and turn into noise and seems to be most effective when primates have some control over it. USDA recommends that noise levels in animal facilities do not exceed 85 decibels. This applies to background noise (e.g. HVAC units) in combination with other noise e.g. radio, tape recorders).

3. Tactile- stimulation is provided by all aspects of a primate's environment, including:

- Cage mates. Primates receive much tactile stimulation when grooming cage mates. If primates cannot be grouped so they are together all the time, tactile contact should be allowed with conspecifics or caretakers on a periodic or scheduled basis or through grooming bars (Crockett *et. al.* 1997, Taylor *et. al.* 1998). Grooming can be used in operant conditioning as a positive reinforcer.
- Floor substrate provides stimulation when they search through it for hidden food items.
- Food has tactile stimulation properties; it is an important part of an animal's feeding behavior.

4. Olfactory

- Scent marking- specialized glands produce volatile, strong-smelling chemicals called pheromones to signal the individual's presence. Urine washing is another type of olfactory signaling. Olfactory communication is used for territorial defense, to foster aggregation of group members, and to signal alarm or aggression. In some species, scents indicate not only species and gender, but also individual identities. Olfactory stimulation is essential for the scent marking species, and objects must be provided which allow them to mark their environment.
- Providing artificial scents such as perfumes or colognes is a very valuable enrichment. However, their potential negative effects should be considered. Zookeepers wearing perfumes or other scents could get bitten, heavily groomed or receive other unexpected behaviors from animals with whom they have direct contact.

5. Gustatory- The relative lack diversity in captive primate's diets restricts their experience of different tastes, textures, consistencies, sizes, and colors of food items.

- Increasing variety of captive diets is the simplest way to increase the variety of sensory characteristics of food (Bloomsmit 1989).
- Species preferences need to be considered in providing gustatory variety.

Other considerations in stimulating the five senses:

f. Environments

- Natural vs. Artificial - Natural environments provide primates with more sensory enrichment opportunities.
- Outdoors vs. Indoors – Outdoor environments provide stimuli caused by weather changes and the sights, smells, and sounds of other species. Many primate programs try to create naturalistic environments indoors with various substrates. Large indoor rooms with naturalistic substrates may prove inadequate to promote normal behavior with many primate species.
- Stimulus-poor environments - Environmental enrichment may be of greater importance to primates confined to indoor, stimulus-poor rooms than those that can go outdoors.
- Temperature- Most primates (with the exception of a few cold tolerant species) are adapted to warm, relatively constant temperatures. Indoor exhibits and holding facility temperature should be monitored continually and maintained between 65-85F (AZA Guidelines); outdoor exhibit temperatures should also be monitored. Extreme fluctuations in temperature should be avoided for all species.
- Humidity- many animals develop skin and respiratory problems at low ambient humidity. The relative humidity of indoor primate facilities should be monitored and maintained between 40-60% (AZA Guidelines) Low humidity should be corrected with forced air humidifiers, controlled automatically by a humidistat.

7. Levels of stimulation- Controlling exposure- all primates need to be carefully observed to assess how various stimuli affect them. Caretakers can be a major source of stimulation for individually housed primates, but caretaker's mannerisms, voice patterns, and timing of visits may calm or stress these primates (Cooper and Markowitz 1979).

G. Providing the animal novelty and control over aspects of the environment

In designing a plan to meet all critical elements a facility must also consider the need to provide the animals with some degree of novelty and control over their environment. Novel objects provide opportunities for animals to interact, use species-appropriate behaviors, expand their captive behavioral repertoire, and replace abnormal behaviors. Novel objects are those that have a relatively high degree of unpredictability to the animal in that many, if not all, of the properties are unknown to it. Objects are usually classified within a range between extremely novel and totally familiar. The more properties of an object that are known to the animal (predictable by it), the less novelty is inherent in the object.

- High levels of predictability are considered to be boring.
- High degree of unpredictability may result in extreme stress (Fragaszy and Adams-Curtis 1991, Sambrook and Buchanan-Smith 1997). Care must be taken when providing novel objects or situations within an environmental enrichment plan. The type, quantity, and duration of novelty provided must not be distressing to the primates. It is important to know the individual animal and its level of anxiety when introducing novelty or environmental change.

The use of novelty as enrichment can be best understood by examining two concepts: complexity and controllability.

1. Complexity

Environmental complexity includes:

- The amount time and types of interaction with conspecifics
- The number and types of structure
- Substrate
- Manipulable objects
- Sensory stimulations

Object complexity includes:

- Visual
- Tactile
- Olfactory
- Auditory
- Gustatory

An object or structure's ability to be used in interactions with conspecifics and its ability to stimulate a wide variety of the senses increases its value as an enrichment device. Novel objects and situations presented to primates do not have to be complex, however, evidence suggest primates prefer complex stimuli (Humphrey 1972). The best criterion for determining whether an object or condition is still novel is the animal's interest in it.

Facilities must continually evaluate their enrichment programs and rotate objects and conditions or provide new ones as interest in the current ones decreases.

2. Controllability

Control is considered to be highly attractive for animals because it is an adaptive aspect of behavior.

Caging reduces the degree of control animals have over their environment and outside stimuli (Chamove and Anderson 1989). From the animal's perspective, the exercise of control over changes in the environment is more important than the degree of novelty in the change (Fragaszy and Adams-Curtis 1991).

Primates prefer enrichment devices that give them the opportunity to interact with and generate predictable responses from an object. Being comfortable in a captive environment depends on the primate's ability to produce predictable environmental changes through its own actions (Fragaszy and Adams_Curtis 1991).

3. Incorporating novelty and control into enhancement plans

Social housing is the optimal method for providing novelty. However, the presence of social housing should not preclude other types of environmental enrichment. Addition of novel items and complex stimuli into social housing supports the development and expression of complex social behaviors and interactions.

When animals are housed together, access to novel items can sometimes be restricted by factors related to the primate's age and social status. Placement of novel items within wood shavings, straw, or other substrates can increase the utilization of these items by preventing monopolization by dominant animals.

Facilities should take into account the special needs of infants. Young primates who are restricted in their social development explore and play less (Suomi 1987).

Novel food items are easy way to enrich any captive environment.

Primates use tools more frequently than any other taxa. Their cognitive abilities must be considered when providing manipulanda.

In singly housed conditions, cognitive stimulation with a variety of manipulanda appears to be more important due to the lack of social complexity and stimulation.

Individual primate personalities should be considered. "As with humans, perhaps one monkey's caviar is another's rotten fish" (Novak and Drewsen 1989).

The challenge of any enrichment program is twofold: (1) to provide novelty that is appropriate stimulating yet non-distressing, (2) to afford an opportunity for the animal to exert some control over its environment.

H. Adaptive Behaviors

Adaptive behaviors represent an animal's capacity to respond to its changing environment. The captive environment represents a particular challenge for both the animal and its caretakers. The solicitation of adaptive behaviors through classical or operant conditioning programs may allow the animal to productively adapt to its captive circumstances by facilitating necessary activities (medical behaviors such as the taking of blood samples) as well as providing the animal with physical and psychological challenges and stimulation as it participates in the training process. While not the principal goal of enrichment, the training of behaviors may represent enriching activities with adaptive benefits to the animal. All training programs at the Phoenix Zoo must comply with the standard procedures outlined in the Behavioral Management Protocol.

III. Special considerations

Certain nonhuman primates must be provided special attention regarding enhancement of their environment, based on the needs of the individual species and in accordance with the instructions of the veterinarian. Nonhuman primates requiring special attentions may include the following:

A. Infants and young juveniles

Primate Vaccine Evaluation Network guidelines state infants should not be weaned before 6 month and recommending weaning at 12 months of age. International Primatological Society guidelines recommend the young of most species should be allowed to remain in contact with the mother until at least 12-18 month old.

B. Hand rearing

Every reasonable effort shall be made to create an environment that fosters mother rearing of newborn nonhuman primates, including attempted reintroduction of rejected infants and attempted fostering to a proven nonhuman primate surrogate mother.

If hand rearing becomes the only available option, the event should be maintained in the primate area in direct proximity to the birth group. This allows visual, olfactory and auditory access to both the developing infant and the conspecifics of the birth group.

Hand rearing infant primates in this manner will allow them the opportunity to begin the socialization process as early as possible.

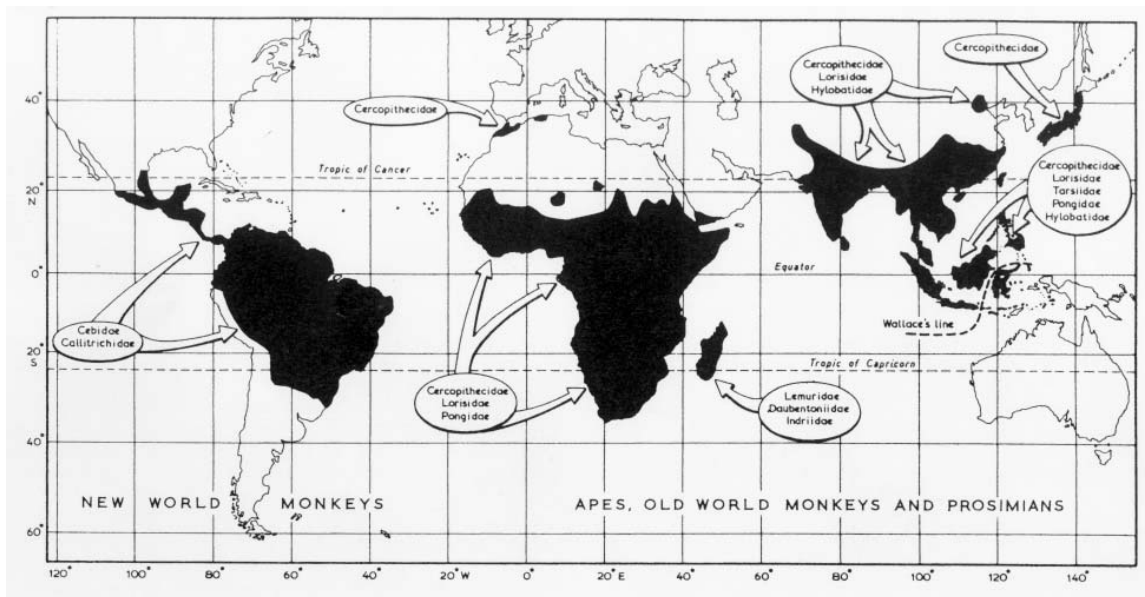
The health of medically compromised infants will be addressed as a first priority with socialization to occur at a time determined by the staff veterinarian in conjunction with the appropriate management team. Socialization and subsequent reintroduction efforts shall proceed as early as physically and socially possible.

C. Those that show signs of being in psychological distress through behavior or appearance.

D. Individually housed nonhuman primates that are unable to see and hear nonhuman primates of their own or compatible species.

IV. The classification of primates

A. Distribution of nonhuman primates by families



B. Taxonomy

Cheirogaleidae (dwarf and mouse lemurs)

- Allocebus
 - Allocebus trichotis (hairy-eared dwarf lemur)
- Cheirogaleus
 - Cheirogaleus major (greater dwarf lemur)
 - Cheirogaleus medius (fat-tailed dwarf lemur)
- Microcebus
 - Microcebus berthae
 - Microcebus griseorufus
 - Microcebus murinus (gray mouse lemur)
 - Microcebus myoxinus
 - Microcebus ravelobensis
 - Microcebus rufus (brown mouse lemur)
 - Microcebus sambiranensis
 - Microcebus tavaratra
- Mirza
 - Mirza coquereli (Coquerel's mouse lemur)

Lemuridae (lemurs)

- Eulemur
 - Eulemur coronatus (crowned lemur)
 - Eulemur fulvus (brown lemur)
 - Eulemur fulvus albifrons
 - Eulemur fulvus albocollaris
 - Eulemur fulvus collaris
 - Eulemur fulvus fulvus
 - Eulemur fulvus mayottensis
 - Eulemur fulvus rufus
 - Eulemur fulvus sanfordi
 - Eulemur macaco (black lemur)
 - Eulemur macaco flavifrons
 - Eulemur macaco macaco
 - Eulemur mongoz (mongoose lemur)
 - Eulemur rubriventer (red-bellied lemur)
- Hapalemur
 - Hapalemur aureus (golden bamboo lemur)

- [Hapalemur griseus](#) (bamboo lemur)
 - [Hapalemur griseus alaotrensis](#)
 - [Hapalemur griseus griseus](#)
 - [Hapalemur griseus JF2002](#)
 - [Hapalemur griseus meridionalis](#)
 - [Hapalemur griseus occidentalis](#)
- [Hapalemur simus](#) (greater bamboo lemur)
- [Lemur](#)
 - [Lemur catta](#) (ring-tailed lemur)
- [Varecia](#)
 - [Varecia variegata](#) (ruffed lemur)
 - [Varecia variegata rubra](#)
 - [Varecia variegata variegata](#)

[Megaladapidae](#)

- [Lepilemur](#)
 - [Lepilemur dorsalis](#) (gray-backed sportive lemur)
 - [Lepilemur edwardsi](#) (Milne-Edwards's sportive lemur)
 - [Lepilemur leucopus](#) (white-footed sportive lemur)
 - [Lepilemur mustelinus](#) (weasel lemur)
 - [Lepilemur ruficaudatus](#) (red-tailed sportive lemur)
 - [Lepilemur septentrionalis](#) (northern sportive lemur)
- [Megaladapis](#)
 - [Megaladapis edwardsi](#)

[Indridae](#)

- [Avahi](#)
 - [Avahi laniger](#) (woolly lemur)
 - [Avahi occidentalis](#)
- [Indri](#)
 - [Indri indri](#)
- [Propithecus](#) (sifakas)
 - [Propithecus diadema](#) (diademed sifaka)
 - [Propithecus diadema candidus](#)
 - [Propithecus diadema diadema](#)
 - [Propithecus diadema edwardsi](#)
 - [Propithecus diadema marshi](#)

- [Propithecus diadema perrieri](#)
- [Propithecus tattersalli](#) (Tattersall's sifaka)
- [Propithecus verreauxi](#) (white sifaka)
 - [Propithecus verreauxi coquereli](#)
 - [Propithecus verreauxi coronatus](#)
 - [Propithecus verreauxi deckeni](#)
 - [Propithecus verreauxi verreauxi](#)

[Daubentoniidae](#) (aye-eyes)

- [Daubentonia](#)
 - [Daubentonia madagascariensis](#) (aye-aye)

[Galagonidae](#) (galagos)

- [Galago](#)
 - [Galago alleni](#) (Allen's squirrel galago)
 - [Galago demidovii](#)
 - [Galago gallarum](#) (Somali galago)
 - [Galago matschiei](#) (Matschie's galago)
 - [Galago moholi](#) (South African galago)
 - [Galago senegalensis](#) (Senegal galago)
- [Galagoides](#)
 - [Galagoides demidoff](#) (Demidoff's galago)
 - [Galagoides zanzibaricus](#) (Zanzibar galago)
- [Otolemur](#) (greater bushbabies)
 - [Otolemur crassicaudatus](#) (thick-tailed bush baby)
 - [Otolemur garnettii](#) (small-eared galago)

[Loridae](#) (lorises)

- [Loris](#)
 - [Loris tardigradus](#) (slender loris)
- [Nycticebus](#)
 - [Nycticebus coucang](#) (slow loris)
 - [Nycticebus intermedius](#)
 - [Nycticebus pygmaeus](#) (pygmy slow loris)

- [Nycticebus sp.](#)
- [Perodicticus](#)
 - [Perodicticus potto](#) (potto)
 - [Perodicticus potto edwardsi](#)

[Tarsiidae](#) (tarsiers)

- [Tarsius](#)
 - [Tarsius bancanus](#) (western tarsier)
 - [Tarsius syrichta](#) (tarsier)

[Cebidae](#)

- [Alouattinae](#)
 - [Alouatta](#) (howler monkeys)
 - [Alouatta belzebul](#) (black-and-red howler monkey)
 - [Alouatta caraya](#) (black howler monkey)
 - [Alouatta fusca](#) (howler monkey)
 - [Alouatta guariba](#)
 - [Alouatta palliata](#) (mantled howler monkey)
 - [Alouatta pigra](#)
 - [Alouatta sara](#) (Bolivian red howler monkey)
 - [Alouatta seniculus](#) (howler monkey)
 - [Alouatta stramineus](#)
- [Aotinae](#)
 - [Aotus](#) (night monkeys)
 - [Aotus azarai](#) (Azara's night monkey)
 - [Aotus infulatus](#)
 - [Aotus lemurinus](#) (lemurine night monkey)
 - [Aotus nancymae](#) (Ma's night monkey)
 - [Aotus nigriceps](#) (black-headed night monkey)
 - [Aotus trivirgatus](#) (douroucouli)
 - [Aotus vociferans](#) (noisy night monkey)
- [Atelinae](#)
 - [Ateles](#)
 - [Ateles belzebuth](#) (long-haired spider monkey)
 - [Ateles fusciceps](#) (brown-headed spider monkey)
 - [Ateles geoffroyi](#) (black-handed spider monkey)
 - [Ateles paniscus](#) (black spider monkey)
 - [Ateles paniscus x Ateles fusciceps](#) (black spider monkey x brown-headed spider monkey)
 - [Ateles sp.](#) (spider monkey)
 - [unclassified Ateles](#)

- Brachyteles
 - Brachyteles arachnoides (woolly spider monkey)
- Lagothrix (woolly monkeys)
 - Lagothrix lagotricha (common woolly monkey)
- Callicebinae
 - Callicebus (titi monkeys)
 - Callicebus brunneus (brown titi)
 - Callicebus cupreus
 - Callicebus hoffmannsi (Hoffmanns's titi)
 - Callicebus moloch (Dusky titi)
 - Callicebus personatus (masked titi)
 - Callicebus torquatus (yellow-handed titi)
- Cebinae
 - Cebus (capuchin monkeys)
 - Cebus albifrons (white-fronted capuchin)
 - Cebus apella (brown capuchin)
 - Cebus capucinus (white-faced sapajou)
 - Cebus kaapori
 - Cebus olivaceus (weeper capuchin monkey)
 - Cebus sp.
 - Saimiri (squirrel monkeys)
 - Saimiri boliviensis (Bolivian squirrel monkey)
 - Saimiri oerstedii (Red-backed or Central American squirrel monkey)
 - Saimiri sciureus (Common squirrel monkey)
 - Saimiri ustus (Golden-backed or bare-eared squirrel monkey)
 - Saimiri vanzolinii (Blackish squirrel monkey)
- Pitheciinae
 - Cacajao
 - Cacajao calvus (red uakari)
 - Cacajao melanocephalus (black uakari)
 - Cacajao rubicundus
 - Chiropotes
 - Chiropotes satanas (black-bearded saki)
 - Chiropotes satanas x albinus
 - Pithecia (saki monkeys)
 - Pithecia irrorata (bald-faced saki)
 - Pithecia pithecia (white-faced saki)
- unclassified Cebidae
 - Aotinae gen. sp.

Callitrichidae (marmosets and tamarins)

- Callimico
 - Callimico goeldii (Goeldi's marmoset)
- Callithrix
 - Callithrix argentata (black-tailed marmoset)
 - Callithrix aurita (white-eared marmoset)
 - Callithrix emiliae
 - Callithrix cf. emiliae
 - Callithrix geoffroyi (Geoffroy's marmoset)
 - Callithrix humeralifer (tassel-eared marmoset)
 - Callithrix jacchus (white-tufted-ear marmoset)
 - Callithrix kuhli
 - Callithrix mauesi
 - Callithrix penicillata (black-pencilled marmoset)
 - Callithrix pygmaea (pygmy marmoset)
 - Callithrix saterei
- Leontopithecus
 - Leontopithecus chrysomelas (gold-and-black lion tamarin)
 - Leontopithecus chrysopygus (golden-rumped lion tamarin)
 - Leontopithecus rosalia (golden lion tamarin)
- Saguinus
 - Saguinus bicolor (Brazilian Bare-faced tamarin)
 - Saguinus bicolor bicolor (pied bare-faced tamarin)
 - Saguinus bicolor martinsi
 - Saguinus fuscicollis (brown-headed tamarin)
 - Saguinus fuscicollis fuscicollis
 - Saguinus fuscicollis melanoleucus
 - Saguinus geoffroyi (Geoffroy's tamarin)
 - Saguinus imperator (tamarin)
 - Saguinus labiatus (red-chested mustached tamarin)
 - Saguinus midas (Midas tamarin)
 - Saguinus midas midas
 - Saguinus midas niger (black-handed tamarin)
 - Saguinus mystax (moustached tamarin)
 - Saguinus nigricollis (black-and-red tamarin)
 - Saguinus oedipus (cotton-top tamarin)
 - Saguinus tripartitus (golden-mantled tamarin)

Hylobatidae (gibbons)

- Hylobates
 - Hylobates agilis (agile gibbon)
 - Hylobates agilis albibarbis
 - Hylobates agilis unko
 - Hylobates concolor (crested gibbon)
 - Hylobates concolor leucogyneus
 - Hylobates concolor siki
 - Hylobates gabriellae (Red-cheeked Gibbon)
 - Hylobates hoolock (Hoolock gibbon)
 - Hylobates klossii (Kloss's gibbon)
 - Hylobates lar (common gibbon)
 - Hylobates leucogenys (White-cheeked Gibbon)
 - Hylobates leucogenys leucogenys
 - Hylobates moloch (silvery gibbon)
 - Hylobates muelleri (Mueller's gibbon)
 - Hylobates pileatus (pileated gibbon)
 - Hylobates syndactylus (siamang)

Hominidae

- Homo/Pan/Gorilla group
 - Gorilla
 - Gorilla gorilla (gorilla)
 - Homo
 - Homo sapiens (human)
 - Pan (chimpanzees)
 - Pan paniscus (pygmy chimpanzee)
 - Pan troglodytes (chimpanzee)
- Pongo
 - Pongo pygmaeus (orangutan)
 - Pongo pygmaeus abelii (Sumatran orangutan)
 - Pongo pygmaeus pygmaeus (Bornean orangutan)

Cercopithecidae (Old World monkeys)

- Cercopithecinae
 - Allenopithecus
 - Allenopithecus nigroviridis (Allen's swamp monkey)
 - Cercocebus
 - Cercocebus aterrimus
 - Cercocebus galeritus (agile mangabey)
 - Cercocebus torquatus (red-crowned mangabey)
 - Cercopithecus
 - Cercopithecus aethiops (African green monkey)
 - Cercopithecus ascanius (black-cheeked white-nosed monkey) L
 - Cercopithecus aterrimus
 - Cercopithecus cephus (moustached monkey)
 - Cercopithecus diana (Diana monkey)
 - Cercopithecus erythrogaster
 - Cercopithecus erythrotis
 - Cercopithecus hamlyni (owl-faced monkey)
 - Cercopithecus lhoesti (L'Hoest's monkey)
 - Cercopithecus mitis (blue monkey)
 - Cercopithecus mona (Mona monkey)
 - Cercopithecus neglectus (De Brazza's monkey)
 - Cercopithecus nictitans (white-nosed guenon)
 - Cercopithecus patas
 - Cercopithecus petaurista (lesser white-nosed monkey)
 - Cercopithecus pogonias (crowned guenon)
 - Cercopithecus preussi
 - Cercopithecus pygerythrus
 - Cercopithecus sabaesus
 - Cercopithecus solatus
 - Cercopithecus tantalus
 - Erythrocebus
 - Erythrocebus patas (red guenon)
 - Lophocebus
 - Lophocebus albigena (gray-cheeked mangabey)
 - Lophocebus aterrimus
 - Macaca (macaques)
 - Macaca arctoides (stump-tailed macaque)
 - Macaca assamensis (Assam macaque)
 - Macaca brunnescens
 - Macaca cyclopis (Taiwan macaque)
 - Macaca fascicularis (crab-eating macaque)
 - Macaca fuscata (Japanese macaque)

- [Macaca hecki](#)
- [Macaca hecki x tonkeana](#)
- [Macaca maura](#) (moor macaque)
- [Macaca maura x tonkeana](#)
- [Macaca mulatta](#) (rhesus monkey)
- [Macaca nemestrina](#) (pig-tailed macaque)
- [Macaca nigra](#) (Celebes crested macaque)
- [Macaca nigrescens](#)
- [Macaca ochreata](#) (booted macaque)
- [Macaca radiata](#) (bonnet macaque)
- [Macaca silenus](#) (liontail macaque)
- [Macaca sinica](#) (toque macaque)
- [Macaca speciosa](#) (stump-tail macaque)
- [Macaca sylvanus](#) (Barbary ape)
- [Macaca thibetana](#) (Pere David's macaque)
- [Macaca tonkeana](#) (Tonkean macaque)
- [Macaca sp.](#)
- [Mandrillus](#) (forest baboons)
 - [Mandrillus leucophaeus](#) (drill)
 - [Mandrillus sphinx](#) (mandrill)
- [Miopithecus](#) [LinkOut](#)
 - [Miopithecus ougouensis](#)
 - [Miopithecus talapoin](#) (talapoin)
- [Papio](#) (baboons)
 - [Papio anubis](#) (olive baboon)
 - [Papio cynocephalus](#) (yellow baboon)
 - [Papio cynocephalus x Papio anubis](#)
 - [Papio hamadryas](#) (hamadryas baboon)
 - [Papio papio](#) (Guinea baboon)
 - [Papio ursinus](#) (chacma baboon)
 - [Papio sp.](#)
- [Theropithecus](#)
 - [Theropithecus gelada](#) (gelada baboon)

Colobinae

- [Colobus](#) (black-and-white colobus monkeys)
 - [Colobus angolensis](#) (Angolan colobus)
 - [Colobus guereza](#) (guereza)
 - [Colobus guereza kikuyuensis](#)
 - [Colobus polykomos](#) (king colobus)
- [Nasalis](#)
 - [Nasalis larvatus](#) (proboscis monkey)

- Presbytis
 - Presbytis comata (grizzled leaf monkey)
 - Presbytis cristata
 - Presbytis cristata pyrrhus
 - Presbytis entellus (Hanuman langur)
 - Presbytis femoralis (banded leaf monkey)
 - Presbytis francoisi
 - Presbytis johnii
 - Presbytis melalophos (mitred leaf monkey)
 - Presbytis obscura
 - Presbytis phayrei
 - Presbytis senex
- Procolobus
 - Procolobus badius (red colobus)
- Pygathrix
 - Pygathrix avunculus (Tonkin snub-nosed monkey)
 - Pygathrix bieti (black snub-nosed monkey)
 - Pygathrix nemaeus (Douc langur)
 - Pygathrix roxellana (golden snub-nosed monkey)
- Semnopithecus
 - Semnopithecus entellus
- Trachypithecus (leaf monkeys)
 - Trachypithecus cristatus (silvered leaf monkey)
 - Trachypithecus francoisi (Francois's leaf monkey)
 - Trachypithecus geei
 - Trachypithecus johnii (hooded leaf monkey)
 - Trachypithecus leucocephalus
 - Trachypithecus obscurus (dusky leaf monkey)
 - Trachypithecus phayrei (Phayre's leaf monkey)
 - Trachypithecus pileatus
 - Trachypithecus vetulus (purple-faced leaf monkey)

VI. List of primate species currently housed at the Phoenix Zoo

1. Prosimians
 - 0.4 Ringtail lemur
 - 3.3 Red ruffed lemur

2. Old World Monkeys
 - 1.4 Hamadryas baboon
 - 1.2 Mandrill

3. New world Monkeys
 - 1.1 White-faced saki monkey
 - 1.1 Black howler monkey
 - 0.2 Black-handed spider monkey
 - 4.10.5 Common squirrel monkey
 - 3.4 Golden lion tamarin
 - 0.2 Bolivian squirrel monkey
 - 2.0 Cotton-top tamarin
 - 1.1 White-fronted marmoset

4. Apes and lesser apes
 - 1.3 Bornean orangutan
 - 1.1 Siamang

VII. A list of innovations broken down to species at the Phoenix Zoo

Prosimians

Ring-tailed lemur (Lemur catta)

Social enrichment:

0.4 Ring-tailed lemur

Training:

Caged lemurs:

- on going crate training
- on going scale training

Structure and substrate:

Island and outside exhibit, natural substrate.

Foraging opportunities:

Browse- especially tamarisk (3-4 x per week)

Banana filled coconuts (1/2 per animal, once a month)

Bamboo sections stuffed with pureed food (1 foot stalks with 2 tbsp, 2-3 x per month)

Manipulanda:

Wire mesh puzzle feeder (2-3 x per week)

Wicker basket (permanent on exhibit)

Snake skin (autoclaved) occasionally

Stimulating all five senses:

Fecal of the month

Urine (autoclaved) (1x per week)

Last updated: 11-20-06

Red-ruffed lemur (Varecia rubra)

Social enrichment:

3.3 Red-ruffed lemur

Training:

Shift training

Structure and substrate:

Island and outside exhibit, natural substrate.

Foraging opportunities:

Browse- especially tamarisk (3-4 x per week)

Banana filled coconuts (1/2 per animal, once a month)

Bamboo sections stuffed with pureed food (1 foot stalks with 2 tbsp, 2-3 x per month)

Manipulanda:

Wire mesh puzzle feeder (2-3 x per week)

Wicker basket (permanent on exhibit)

Snake skin (autoclaved) occasionally

Stimulating all five senses:

Fecal of the month

Urine (autoclaved) (1x per week)

Last updated: 11-20-06

Old World Monkeys

Hamadryas baboon (Papio hamadryas)

Social Enrichment:

1.4 Hamadryas baboon

Training:

Stationing, target and shift training

Structure and substrate:

Outside enclosure with natural substrate
Night house with concrete and mesh benches
Shredded paper (1x per week)
Mulch from edible brows in night house- Discontinued
Fire hose hammock (permanent)

Foraging opportunities:

Browse (every day)
Milo (1/4 of cup, 3 x per week)
Sunflower seeds (1/4 of cup, 2 x per month)
Whole fruit and vegetables
Dates harvested on zoo grounds (seasonal)
Ornamental oranges harvested on zoo grounds (seasonal)
Popcorn (1 x per week)
Ice cubes (3 x per week in summer)
Grape in ice cubes (1-2 per animal, 1 x per week, in summer)
Giant popsicle (?)
Pumpkin/watermelon (2 x per year)
Peanut butter (1 tbsp, 1 x per week)
Jelly (1 tbsp, 1 x per week)
Prickly pear (1-2 pads, 1 x per week)
Peanuts (1/8 cup, 1 x per week)
Honey (1 tbsp, 2 x per month)
Raisins (1 tbsp, 1 x per week)
Cereal (1/4 of a cup, 1 x per month)
Oatmeal (1/4 of a cup, 2 x per month)- Discontinued
Rice (1/4 of a cup, 2 x per month)
Yogurt (1/4 of a cup, 2 x per month)
Bread (1 slice 1 x per week)
Jell-O (1/4 of a cup, 2 x per month)
Pudding (1/4 of a cup, 2 x per month)
Kool-Aid, PowerAde, juice, Gatorade (1/4 of a cup, 2 x per month)
Roses (half a bucket, when available)
Live crickets- Discontinued

Manipulanda:

Paper boxes (1 x per week)
Paper (1 x per week)
Paper bags (1 x per week)
Clothing (1 x per Month)
Logs (2 x per month)
Tree trunks with roots (permanent)
Chains in night house (every day)
Ropes in night house (every day)

Black puzzle feeder (every day)
Metal puzzle feeder (every day)
Barrels (every day)
Large forage unit (every day)
Plastic tubes (every day)
Plastic balls (every day)
Plastic toys (every day)
Bowling ball (every day)
Boomer ball (every day)
Piñata (2 x per year)
Seed shaker (1/4 cup parrot mix, 2 x per month)
Portable cement stand with replaceable bamboo pipes?
Milk crates swing (permanent?)
Cargo nets (permanent?)
Tire hung by chain (permanent)
Palm log with holes (?)
Pine cones (1 x per week)
Feathers (?)
Snake skin (autoclaved) occasionally
Cricket feeder - Discontinued

Stimulating the five senses:

Herbs (when available)
Spices (1 x per week)
TV (every day)
Videos (every day)
Radio (every day)
Mirrors (every day)
Food coloring (1 x per week)
Non toxic bubbles (1 x per week)
Snow (1 x per year)
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 11-20-06

Mandrill (Manrdrillus sphinx)

Social enrichment:

1.2 Mandrill

Training:

Stationing, target and shift training

Structure and substrate:

Outside enclosure with natural substrate

Night house with concrete and mesh benches

Straw for holding area (1 x per week)

Shredded paper (1 x per week)

Mulch from edible brows in night house- Discontinued

Foraging opportunities:

Browse (every day)

Milo (1/4 of cup, 3 x per week)

Sunflower seeds (1/4 of cup, 2 x per month)

Pine cones (1 x per week)

Whole fruit and vegetables (1 x per week)

Dates harvested on zoo grounds (seasonal)

Ornamental oranges harvested on zoo grounds (seasonal)

Popcorn (1 x per week)

Ice cubes (3 x per week)

Grape in ice cubes (1-2 per animal, 1 x per week)

Giant popsicle (?)

Pumpkin/watermelon (2 x per year)

Peanut butter (1 tbsp, 1 x per week)

Jelly (1 tbsp, 1 x per week)

Prickly pear (1-2 pads, 1 x per week)

Peanuts (1/8 cup, 1 x per week)

Honey (1 tbsp, 2 x per month)

Raisins (1 tbsp, 1 x per week)

Cheerios (1/4 of a cup, 2 x per month)

Oatmeal (1/4 of a cup, 2 x per month)

Rice (1/4 of a cup, 2 x per month)

Yogurt (1/4 of a cup, 2 x per month)

Bread (1 slice 1 x per week)

Jell-O (1/4 of a cup, 2 x per month)

Pudding (1/4 of a cup, 2 x per month)

Kool-Aid, PowerAde, juice, Gatorade (1/4 of a cup, 2 x per month)

Roses (half a bucket, when available)

Live crickets (3 x per week)

Cranberry souce (15oz can, 1 x per week)

Manipulanda:

Paper boxes (1 x per week)
Paper (1 x per week)
Paper bags (1 x per week)
Clothing (1 x per Month)
Logs (2 x per month)
Tree trunks with roots (permanent)
Chains in night house (every day)
Ropes in night house (every day)
Black puzzle feeder (every day)
Metal puzzle feeder (every day)
Barrels (every day)
Milk crates (every day)
Large forage unit (every day)
Plastic tubes (every day)
Plastic balls (every day)
Plastic toys (every day)
Bowling ball (every day)
Boomer ball (every day)
Piñata (2 x per year)
Seed shaker (1/4 cup parrot mix, 2 x per month)
Portable cement stand with replaceable bamboo pipes?
Milk crates swing (permanent?)
Cargo nets (permanent?)
Tire hung by chain (permanent)
Palm log with holes (?)
Pine cones (1 x per week)
Feathers (?)
Snake skin (autoclaved) occasionally
Cricket feeder (?)

Stimulating the five senses:

Herbs (when available)
Spices (1 x per week)
TV (every day)
Videos (every day)
Radio (every day)
Mirrors (every day)
Food coloring (1 x per week)
Non toxic bubbles (1 x per week)
Snow (1 x per year)
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 11-20-06

New world Monkeys

Black howler monkey (Alouatta caraya)

Social enrichment:

1.1 Black howler monkey

Training:

None

Structure and substrate:

Wire mesh structure with natural perching and substrate.

Hay bedding daily in winter.

Foraging opportunities:

Browse (4-5 x per week)

Scattered diet (every day)

Hay piles with treats (1 cup per animal, 1-2 x per month)

Honey, jam, ketchup smears (1-2 tbsp per animal, 2-3 x per month)

Frozen juice (1 cup per animal, summer only, 3-4 x per week)

Dry cereal (1/2 cup per animal, 1 x per week)

Sugar free Jell-O (? Per animal, 1 x per week)

Nylabone (1 x per month)

Manipulanda:

Plastic bottle stuffed with hay (1-2 x per week)

Hammock (every other month)

Burlap bag (1-2 x per week)

Cloth (1 x per month)

Paper box (2-3 x per month)

Cereal box with hay and diet (1 x week)

Paper tubes (1-2 x per month)

Ropes (1-2 x per month)

Boomer toys (1-2 x per month)

Non-toxic bubbles (1-2 x per month)

Monkey shine mirror (1-2 x per week)

Kong toy (1 x per week)

Disco ball (1-2 x per week)

Snake skin (autoclaved) occasionally

Stimulating all five senses:

Fecal of the month

Urine (autoclaved) (1x per week)

Last updated: 11-20-06

White-faced saki monkey (Pithecia pithecia)

Social enrichment:

1.1 White-faced saki monkey

Training:

None

Structure and substrate:

Outside enclosure with sleeping box.

Foraging opportunities:

Browse (2-3 x per week)

Scattered seeds (1 tbsp per animal, 1-2 x per week)

Frozen treats (1 cup per animal, 2-3 x per week)

Manipulanda:

Kong toy (1 x per week)

Snake skin (autoclaved) occasionally

Stimulating the five senses:

Fecal of the month

Urine (autoclaved) (1x per week)

Last updated: 11-20-06

Siamang (Hylobates syndactylus)

Social enrichment:

1.1 Siamang

Training:

Stationing, presenting body parts and shift training

Structure and substrate:

Island with natural substrate, trees, grass, telephone poles and ropes.

Fire hose hammock (permanent on exhibit)

Cargo net (permanent on exhibit)

Night house made of wire with plastic flooring.

Foraging opportunities:

Mealworms (10 per animal, 1 x per week)
Jelly (1tbsp per animal, 1 x per month on the 10th)
Peanut Butter (1 tbsp per animal, 1 x per month on the 20th)
Gatorade (10 cc per animal, 2 x per week)
Gatorade Popsicle with diet items (1 per animal, 1 x per week)
Grapes (10 per animal, daily)
Large mixed nuts (3 per animal, 1 x per week)
Raisins (1/4 cup per animal, 2 x per month)
Cheerios (1/4 cup per animal, 2 x per month)
Melon (1/4 cup per animal, 1 x per week)
Dates (1/4 cup per animal, 1 x per week, summer only)
Browse (2-4 small pieces of mulberry, willow or rose, 1 x per week)

Manipulanda:

White plastic barrel (permanent on exhibit)
Branch swing (permanent on exhibit)
Bucket and Rope feeder (2 x per week)
Puzzle feeder #1 (used on monthly rotation schedule)
Puzzle feeder #2 (permanent on exhibit)
Paper towel rolls (1 x per week)
Small paper boxes (1 x per week)
Snake skin (autoclaved) occasionally
Boomer ball with chain (1 x per week)
Feeder ball (1 x per week)
Feeder mop (2 x per week)
Plastic Grass doormat (1 x per week)
Bungee rope (permanent on exhibit)
Natural looking feeder tube (1x per week)
Rope with wooden/bamboo spaces
Wooden spool
Milk crate swing

Stimulating the five senses:

Spices (2 x per week)
Perfumes (2 x per week)
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 11-20-06

Common squirrel monkeys (Saimiri sciureus) and Bolivian squirrel monkeys (Saimiri boliviensis boliviensis)

Social enrichment:

4.10.5 Common squirrel monkey

Training:

Classical conditioning to come into night house and for scheduled feeding times.

Structure and substrate:

Outside wire enclosure with natural substrate, trees, shelves, tree limbs and rock work.
Night house made of concrete with plastic benches

Foraging opportunities:

Live crickets (10 per animal 2 x per week)
Super worms (4 per animal 1 x per week)
Wax worms (8 per animals 1 x per week)
Mealworms (6 g. per animal 3 x per week)
Jelly (1 tbs. per animal 3 x per week)
Peanut butter (1 tbs. per animal 1 x per month)
Gatorade (2 x per week)
Gatorade ice cubes or popsicles (1-2 per animal, 2 x per week)
Raisins (5 pieces per animal 2 x per month)
Sunflower seeds (4 seed per animal 1 x per week)
Cheerios (1/8 cup 2 x per month)
Broken up corn cob (4 cobs for 15 animals 1 x per month)
Gatorade ice cubes (2 x per week)
Puree fruit ?

Manipulanda:

Tire swing (off exhibit 1x per month)
Bucket and Rope feeder (2 x per week)
Milk crates (off exhibit every day)
Puzzle feeder (1 x per month)
Paper towel rolls (1 x per week)
Cardboard tubes hanging from rope (1 x per week)
Wax worm boxes with diet (1 x per week)
Animal cracker boxes (1 x per week)
Foraging container (2 x per week)
Cricket feeder (2 x per week)
Snake skin (autoclaved) occasionally
Plastic door mat with smeared diet (1 x per week)
Plastic Easter eggs with diet (1 x per week)
Bungee rope (1 x per week)
“Suet basket” (1 x per week)

Burlap pouches (1 x per week)
Napsack (discontinued)
Forage hammock (discontinued)
Mealworm bag (1 x per week)

Stimulating all five senses:

Herbs growing into exhibit (seasonal)
Perfumers/Spices (2 x per week)
Perfume (2 x per week)
Bubbles
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 11-20-06

Bolivian squirrel monkey (Saimiri Boliviensis)

Social Enrichment:

0.2 Bolivian squirrel monkey

Training:

Stationing, target and shift training, beginning scale training

Structure and substrate:

Outside wire enclosure with natural substrate, plants, trees, shelves, tree limbs, rope ladders and ropes.
Night house made of wood and metal with plastic benches.

Foraging opportunities:

Live crickets (5 per animal 2 x per week)
Super worms (2 per animal 1 x per week)
Wax worms (5 per animal 1 x per week)
Mealworms (1 g. per animal 3 x per week)
Jelly (1 tsp. per animal 4 x per month)
Raisins (5 per animal 2 x per month)
Orange (1/4 per animal 2 x per month)
Gatorade (1cc per animal 2x per week)
Pureed fruit (1/8cup per animal 4x per month)
Diluted apple juice ice cubes (1cc per animal 2x per month)
Jell-O egg molds with unflavored Jell-O (1cc per animal 2x per month)

Manipulanda:

Puzzle feeder (1 x per month)
Cricket feeder (2 x per week)
Mealworm feeder (2 x per week)

Orange feeder (2 x per month)
Mat feeder (2 x per week)
Log swing feeder (2 x per week)
Mealworm bag with holes (2 x per week)
Suet basket feeder (2 to 3 x per week)
Burlap pouch (2 x per week)
Forage container (daily)
Snake skin (autoclaved) occasionally
Small plastic toys (in night house)
Small plastic boomer balls (in night house)
Plastic Easter eggs with diet (1 x per week)
Bungee rope (1 x per week)

Stimulating the five senses:

Spices (2 x per week)
Perfume (2 x per week)
Bubbles (1x per week)
Herbs (fresh or dry)
Extracts
Radio
Mirrors
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 12-13-06

Golden lion tamarins (Leontopithecus rosalia)

Social Enrichment:

3.1 Golden lion tamarin (housed as 2.0; 1.1)

Training:

Stationing, target and shift training, beginning scale training

Structure and substrate:

Outside wire enclosure with natural substrate, plants, trees, shelves, tree limbs, rope ladders and ropes.

Night house made of wood and metal with plastic benches.

Foraging opportunities:

Live crickets (5 per animal 2 x per week)
Super worms (2 per animal 1 x per week)
Wax worms (5 per animal 1 x per week)

Mealworms (1 g. per animal 3 x per week)
Jelly (1 tsp. per animal 4 x per month)
Raisins (5 per animal 2 x per month)
Orange (1/4 per animal 2 x per month)
Gatorade (1cc per animal 2x per week)
Pureed fruit (1/8cup per animal 4x per month)
Diluted apple juice ice cubes (1cc per animal 2x per month)
Jell-O egg molds with unflavored Jell-O (1cc per animal 2x per month)

Manipulanda:

Puzzle feeder (1 x per month)
Cricket feeder (2 x per week)
Mealworm feeder (2 x per week)
Orange feeder (2 x per month)
Mat feeder (2 x per week)
Log swing feeder (2 x per week)
Mealworm bag with holes (2 x per week)
Suet basket feeder (2 to 3 x per week)
Burlap pouch (2 x per week)
Forage container (daily)
Snake skin (autoclaved) occasionally
Small plastic toys (in night house)
Small plastic boomer balls (in night house)
Plastic Easter eggs with diet (1 x per week)
Bungee rope (1 x per week)

Stimulating the five senses:

Spices (2 x per week)
Perfume (2 x per week)
Bubbles (1x per week)
Herbs (fresh or dry)
Extracts
Radio
Mirrors
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 12-13-06

Cotton-top tamarins (Saguinus oedipus)

Social Enrichment:

2.0 Cotton-top tamarin

Training:

Stationing, target and shift training

Structure and substrate:

Outside wire enclosure with natural substrate, plants, trees, shelves, tree limbs, rope ladders and ropes.

Night house made of wood and metal with plastic benches.

Hay

Paper

Straw

Foraging opportunities:

Live crickets (5 per animal 2 x per week)

Super worms (2 per animal 1 x per week)

Wax worms (5 per animal 1 x per week)

Mealworms (1 g. per animal 3 x per week)

Jelly (1 tsp. per animal 4 x per month)

Raisins (5 per animal 2 x per month)

Orange (1/4 per animal 2 x per month)

Gatorade (1cc per animal 2x per week)

Pureed fruit (1/8cup per animal 4x per month)

Diluted apple juice ice cubes (1cc per animal 2x per month)

Jell-O egg molds with unflavored Jell-O (1cc per animal 2x per month)

Manipulanda:

Puzzle feeder (1 x per month)

Cricket feeder (2 x per week)

Mealworm feeder (2 x per week)

Orange feeder (2 x per month)

Mat feeder (2 x per week)

Log swing feeder (2 x per week)

Mealworm bag with holes (2 x per week)

Suet basket feeder (2 to 3 x per week)

Burlap pouch (2 x per week)

Forage container (daily)

Snake skin (autoclaved) occasionally

Small plastic toys (in night house)

Small plastic boomer balls (in night house)

Plastic Easter eggs with diet (1 x per week)

Bungee rope (1 x per week)

Stimulating the five senses:

Spices (2 x per week)

Perfume (2 x per week)
Bubbles (1x per week)
Herbs (fresh or dry)
Extracts
Radio
Mirrors
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 12-13-06

White-fronted marmoset (Callithrix Geoffroyi)

Social Enrichment:

1.1 White-fronted marmoset

Training:

Stationing, target and shift training

Structure and substrate:

Outside wire enclosure with natural substrate, plants, trees, shelves, tree limbs, rope ladders and ropes.

Night house made of wood and metal with plastic benches.

Foraging opportunities:

Live crickets (5 per animal 2 x per week)

Super worms (2 per animal 1 x per week)

Wax worms (5 per animal 1 x per week)

Mealworms (1 g. per animal 3 x per week)

Jelly (1 tsp. per animal 4 x per month)

Raisins (5 per animal 2 x per month)

Orange (1/4 per animal 2 x per month)

Gatorade (1cc per animal 2x per week)

Pureed fruit (1/8cup per animal 4x per month)

Diluted apple juice ice cubes (1cc per animal 2x per month)

Jell-O egg molds with unflavored Jell-O (1cc per animal 2x per month)

Manipulanda:

Puzzle feeder (1 x per month)

Cricket feeder (2 x per week)

Mealworm feeder (2 x per week)

Orange feeder (2 x per month)
Mat feeder (2 x per week)
Log swing feeder (2 x per week)
Mealworm bag with holes (2 x per week)
Suet basket feeder (2 to 3 x per week)
Burlap pouch (2 x per week)
Forage container (daily)
Snake skin (autoclaved) occasionally
Small plastic toys (in night house)
Small plastic boomer balls (in night house)
Plastic Easter eggs with diet (1 x per week)
Bungee rope (1 x per week)

Stimulating the five senses:

Spices (2 x per week)
Perfume (2 x per week)
Bubbles (1x per week)
Herbs (fresh or dry)
Extracts
Radio
Mirrors
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 12-13-06

Black-handed spider monkey (Ateles geoffroyi)

Social enrichment:

0.2 Black-handed spider monkey

Training:

Night house, shift and target training

Structure and substrate:

Island with natural substrate
Hay piles with hidden food (1 x week)
Ropes (1 x week)
Cotton (1 x week)
Raffia (1 x week)
Hemp (1 x week)

Foraging opportunities:

Browse (1 x per week)

Palm frond piñata balls filled with food (1 per animal with 1 cup treat, 2-3 x per year)
Pine cones with cheerios (2 per animal with 1 cup treat, 1 x per week)
Paper tube with honey and sunflower seeds (1 per animal with 1 tbsp honey and
Seeds (sunflower, milo, safflower) (1-2 tsp per animal, 1-2 per month)
Pumpkin/gourd (1-3 times per year)
Frozen juice (1 x per month)
Gator-aid (1 x per month)
Condiments (1 x week)
Sugar free jell-O (1 x per month)
Air popped popcorn (½ cup, 1 x week)

Manipulanda:

Boomer toys (1 x week)
Kong toy (1 x week)
Snake skin Snake skin (autoclaved) occasionally
Nylabone (1 x week)
Burlap bag (1 x week)
Pinata (1 x per month)
Puzzle feeder (1 x week)
Coconut shell (1 x per month)
Cloth (1 x week)
Paper items (cardboard box, craft paper, shredded paper, newspaper, etc.) (1 x week)
Cricket feeder (1 x week)
“Everlasting Treats” (1 x month”

Stimulating all five senses:

Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 11-20-06

Great Apes

Bornean orangutan (Pongo pygmaeus)

Social enrichment:

1.3 Bornean orangutan

Training:

Husbandry and medical training

Structure and substrate:

Open air exhibit with metal dome, concrete island surrounded by moat. Metal climbing structure. Concrete night house area.

Sheets (3-4 x per week)

Towels (3-4 x per week)

Cloth (1-2 x per week)
Shredded paper (when available 2-3 x per week)
Newspaper (daily)

Foraging opportunities:

Browse (every day)
Frozen ice treats (1-2 cups per animal, 4-5 x per week)
Bamboo soaked in juice or Gatorade (1 foot stalks per animal, 1 x per month)
Palm frond piñatas (1 cup treat, every other month)
Popcorn (1-2 cup per animal, 1-2 x per week)
Honey/peanut butter spread on night house walls (2 tbsp per animal, 1-2 x per week)
Scents -spices (3-4 x per week)
Pine cones (3-4, 4-5 x per month)
Knox gelatin eggs (none)
Cooked vegetables (temporarily discontinued)
Herbs (3-4 x per week)

Manipulanda:

Paper boxes (daily)
Paper bags (daily)
Plastic spool (none)
Non-toxic chalks (3-4 x per week)
Boomer balls (1-2 x per year)
Piñatas (1-2 x per year)
Snake skin (autoclaved) occasionally
Disco ball (1 x per month)

Stimulating all five senses:

All spices and extracts are approved
Television (every day)
Radio (every day)
Nature tapes (1 x per month)
Mirror (2-3 x per month)
Non-toxic soap bubbles (1-2 x per week)
Fecal of the month
Urine (autoclaved) (1x per week)

Last updated: 11-20-06

VIII. Resources

IMATA- International Marine Animal Trainers Association
IAATE- International Avian Association of Trainers and Educators
ABMA- Animal Behavior Management Alliance
AAZK – American Association of Zoo Keepers
AZA – American Zoo and Aquarium Association

Books and articles:

- Bayne, K.A.L. 1989.** *Resolving issues of psychological well-being and management of laboratory nonhuman primates.* In *Housing, Care and Psychological Well-being of Captive and Laboratory Primates.* E.F. Segal, ed., Noyes Publications: Park Ridge, New Jersey, pp. 27-39
- Bennett, C.L., and Davis, R.T. 1989.** *Long term animal studies.* In *Housing, Care and Psychological Well-being of Captive and Laboratory Primates,* E. F. Segal. Ed., Noyes Publications: Park Ridge, New Jersey, pp 213-234
- Bloomsmith, M.A. 1989.** *Feeding enrichment for captive great apes.* In *House Care and Psychological Well-being of Captive and Laboratory Primates,* E. F. Segal. Ed., Noyes Publications: Park Ridge, New Jersey, pp 336-356
- Broom, D.M., and K.G. Johnson 1993.** *Stress and animal welfare.* Chapman and Hall; London, England
- Buchanan-Smith, H.M. 1997.** *Considerations for the housing and handling of New world primates in the laboratory.* In *Comfortable Quarters for laboratory Animals,* Eighth Edition, 1997, V. Reinhardt, ed., Animal Welfare Institute: Washington, D.C., pp. 75-84
- Chamove, A.S. and J.R. Anderson 1989.** *Examining environmental enrichment.* In *House Care and Psychological Well-being of Captive and Laboratory Primates,* E. F. Segal. Ed., Noyes Publications: Park Ridge, New Jersey, pp 183-202
- Coe, John 1992** *Plan ahead for Behavioral Enrichment in Environmental Enrichment kaleidoscope: research, management and design.*
- DeWall, F.B.M. 1989.** *Peacemaking Among Primates.* Harvard University Press: Cambridge, Massachusetts, 294 p.
- Duncan, I.J.H., J. Rushen, and A.B. Lawrence 1993.** *Concusions and implications for animal welfare,* A.B. Lawrence and J. Rushen, eds., CAB International: London, United Kingdom, pp. 193-206
- Estes, R.D. 1991.** *The Behavior Guide to African Mammals Including Hoofed Mammals, Carnivores, Primates.* University of California Press: Berkeley, California, 611 p.
- Fragaszy, D.M. and L. Adams-Curtis 1991.** *Environmental challenges in groups of capuchins.* In *Primate responses to Environmental Change,* H.O. Box, ed., Chapman and Hall: new York, pp. 237-264
- Hediger, H. 1964.** *Wild animals in captivity.* Dover Publications Inc.: New York, p 207
- Kazdin A. 1994.** *Behavior modification in applied settings.* Pacific Grove CA: Books/Cole publishing Company
- Kleiman D, Allen M, Thompson K, Lumpkin S, editors. 1996.** *Wild mammals in captivity: Principles and techniques.*
- Maple, T.L. and L.A. Perkins 1996.** *Enclosure furnishings and structural environmental enrichment.* In *Wild Mammals in Captivity: Principles and Techniques,* D.G. Kleiman, M.E. Allen, K.V. Thompson, and S. Lumpkin, eds., University of Chicago Press: Chicago, Illinois, pp. 212-222
- Mason, W.A. 1971.** *Motivational factors in psychological development.* In *Nebraska Symposium on Motivation.* W.J. Arnold and M.M. Page, eds University of Nebraska press, pp. 35-37

- Novak, M.A. and K.H. Drewson 1989.** *Enriching the lives of captive primates: Issues and problems.* In Housing, Care and Psychological Well-being of Captive and Laboratory Primates. E.F. Segal, ed., Noyes Publications: Park Ridge, New Jersey, pp. 161-182
- Napier, J.R. & P.H. 1986** *The natural history of the primates*
- Olfert, E.D., B.M. Cross, and A.A. McWilliam, (eds.), 1993.** *Guide to the care and Use of Experimental Animals*, Volume 1 (2nd edition), Canadian Council on Animal care, Ottawa, Canada, 211p.
- Ortega, Ivan 1999** *Managing Animal behavior through Environmental Enrichment with emphasis in rescue and Rehabilitation centers.* Durrell Wildlife Conservation Trust
- Priest, Gary. 1990.** *Animal Management and Enrichment*
- Pryor, Karen. 1984.** *Don't Shoot the Dog! The New Art of Teaching and Training.* Simon and Schuster. New York, NY
- Ramirez K. 1999.** *Animal training: Successful animal management through positive reinforcement.* Chicago, Ken Ramirez and the Shedd Aquarium.
- Reynolds, G. S. 1975.** *A Primer of Operant Conditioning.* Scott, Foresman and Company. Glenview, Illinois
- Rosenblum, L.A. and M.W. Andrews 1995.** *Environmental enrichment and psychological well-being of nonhuman primates.* In Nonhuman Primates in Biomedical research, Biology, and Management, B.T. Bennett, C.R. Abee, and R. henrickson, eds., Academic Press; New York., pp. 101-112
- Rowe, N. 1996.** *The Pictorial Guide to the Living Primates.* Pagonias Press: East Hampton, New York; 263 pp.
- Sevenich, Marty.** *Guidelines for Animal Training Programs*
- Suomi, S.J. 1987.** *Genetic and maternal contributions to individual differences in rhesus monkey biobehavioral development.* In Perinatal Development: A Psychobiological Perspective, N. Krasnegor, E. Blass, M. Hofer, and W. Smotherman, eds. , Academia Press, pp. 397-420
- Thorington, L. 1985.** *Spectral irradiance and temporal aspects of natural and artificial light.* In The medical and biological effects of light. R.J. Wurtman, M.J. Baum, and J.T. Potts, eds., New York Academy of Sciences; New York, pp. 28-54
- Toates, F. 1995** *Stress: conceptual and biological aspects.* John Wiley and Sons, Ltd.: New York
- Van Roosmalen, M.G. and L.L. Klein 1988.** *The spider monkey, genus Ateles.* In Ecology and behavior of Neotropical Primates, Vol. 2, Mittermeier, R.A., A.B. Rylands, A.F. Coimbra-Filho, and G.A.B. De Fonseca, eds., World Wildlife Fund, Washington, DC., pp. 455-538
- Widner, Kim 1994** *Initiation of zoo-wide enrichment program at the Knoxville Zoo*
- Wright, P., D. Haring, M. Izard, and E. Simons 1989.** *Psychological well-being of nocturnal primates in captivity.* . In House Care and Psychological Well-being of Captive and Laboratory Primates, E. F. Segal. Ed., Noyes Publications: Park Ridge, New Jersey, pp 61-65

Smithsonian's National Park Elephant Management Manual
The Living Desert Animal handling and Training Protocols
Indianapolis Zoological Society Training Protocol Samples
Auckland Zoo Mission Statement
Point Defiance Training Protocol
Toledo Zoo Animal Behavior Management Program
Columbus Zoo Training Protocol Samples
Ocean Park Honk Kong Training Philosophy and Protocol
Operant Conditioning Protocol for the Memphis Zoo
Birmingham Zoo Environmental Enrichment protocol
Central Park Wildlife Center Management Guidelines for the care and Psychological Well-being of nonhuman primates
AZA Managing Animal Enrichment & Training Program

Applebee, K.A., Marshall, P.E., and McNab, A.M. 1991. *A prototype rhesus cage to satisfy the needs of the Home office, research, the animal technician, and most importantly, the monkey.* *Animal Technology* 42(1):23-37

Baker, K.C. 1997 *Human interaction as an enrichment for captive chimpanzees: A preliminary report.* *American Journal of Primatology* 42(2):92

Bayne K.L., S.L. Dexter, and G.M. Strange 1993. *Effects of food treats and human interaction.* *Contemporary Topics in Laboratory Animal Science* 32(2): 6-9

Beeler, Mark C. 1996. "Basic Marine mammal Training Terminology and Techniques defined and explained." *International Marine Animal Trainers Association Newsletter*, vol. 21, no.1.

Bekoff, M. 1994. *Cognitive ethology and the treatment of nonhuman animal: how matters of mind inform matters of welfare.* *Animal Welfare* 3(2): 75-96

Bernstein, I.S. 1962. *Social housing of monkeys and apes: group formations.* *Laboratory Animal Science* 41(4): 329-333

Bloomsmith, M.A., S.P. Lambeth, A.M. Stone, and G.E. Laule 1997. *Comparing two types of human interaction as enrichment for chimpanzees.* *American Journal of Primatology* 42(2): 96

Boinski, S., S.P. Swing, T.S. Gross, J.K. Davis 1999. *Environmental enrichment of brown capuchins (Cebus apella): behavioral and plasma and fecal cortisol measures of effectiveness.* *American Journal of Primatology* 48(1): 49-68_

Brent, L. and A.M. Stone 1996. *Long term use of televisions, balls, and mirrors in enrichment for paired baboons.* *American Journal of Primatology* 39(2): 139-145

Burt, D.A. and M.Plant 1990. *Observations on a caging system for housing stump-tailed macaques.* *Animal Technology* 41(3): 175-179

Byrne, G.D. and S.J. Suomi 1995. *Development of activity patterns, social interactions, and exploratory behavior in infant tufted capuchins, (Cebus paella).* *American Journal of Primatology* 35: 255-270

Chance, M.R.A., B.Byrne, and E. Jones 1983. *A tandem cage for handling group-living monkeys.* *Laboratory Animals* 17: 129-132

Chapman, C. and Chapman, L.J. 1990. *Dietary variability in primate populations.* *Primates* 31(1): 121-128

- Coe, J. 1989.** Naturalizing habitats for captive primates. *Zoo Biology Supplement* 1: 117-125
- Cooper, D.L. and H. Markowitz 1979.** *Handlers effects on contact comfort behaviors of two trios of juvenile chimpanzees in the zoo.* *Psychological reports* 44: 1015-1018
- Crockett, C.M., R.U. Bellanca, C.L. Bowers and D.M. Bowden 1997.** *Grooming-contact bars provide social contact for individually-caged laboratory macaques.* *Contemporary Topics in Laboratory Animal Science* 36(6): 53-60
- Demlong, Michael; Deroo, Mary 1993** *Behavioral Architecture: Designing Animal Exhibits for animals* *Animal Keeper's Forum*, Vol. 20, No.12
- Dewey y, Allie 1995** *The Development of an Enrichment Master plan.* *Animal Keeper's Forum*, Vol. 22, No. 1
- Du Bois, Thaya 1992** *The Los Angeles Zoo environmental enrichment program: we get a lot of help from our friends.* *AAZPA/CAZPA Annual Conference Proceedings*
- Dunbar, D. 1989.** *Locomotor behavior of rhesus macaques on Cayo Santiago.* *Puerto Rican Health Science Journal* 8(1): 79-85
- Fritz, J, S.M. Howell and M.L. Schwandt 1997.** *Colored light as environmental enrichment for captive chimpanzees (Pan troglodytes).* *Laboratory Primate Newsletter* 36:(2): 1-4
- Goosen, C., W. Van der Gulden, H. Rozemond, H. Balner, A. Bertens, R. Boot, J. Brinkert, H. Dienske, G. Janssen, A. Lammers, and P. Timmermans 1984.** *Recommendations for the housing of macaque monkeys.* *Laboratory animals* 18: 99-102
- Humphrey, N. K. 1972.** *Interest and pleasure: two determinants of a monkey's visual preferences.* *Perception* 1: 395-416
- Lutz, C. K., and R. A. Farrow 1996.** *Foraging device for singly housed long tailed macaques does not reduce stereotypies.* *Contemporary Topics in Laboratory Animal Science* 35(3): 75-78
- Mason, W.A. 1991.** *Effects of social interaction on well-being: developmental aspects.* *Laboratory Animal science* 41:323-328
- McKenzie, S.M., A.S. Chamove, and A.T. C. Feistner 1986.** *Floor-coverings and hanging screens alter arboreal monkey behavior.* *Zoo Biology* 5(4): 339-348
- Novak, M. A., J. H. Kinsey, M.J. Jorgensen, and T.J. Hanzen 1998.** *Effects of puzzle feeders on pathological behavior in individually housed rhesus monkeys.* *American Journal of Primatology* 46: 213-227
- Pazol K. A. and M.A. Bloomsmith 1993.** *The development of stereotyped body rocking in chimpanzees reared in a variety of nursery settings.* *Animal Welfare* 2(2): 113-129
- Poole, T. 1992.** *Nature and evolution of behavioral needs in mammals.* *Animal Welfare* 1(3): 203- 220
- Sambrook, T.D. and H.M. Buchanan-Smith 1997.** *Control and complexity in novel object enrichment.* *Animal Welfare* 6(3):207-216
- Scharpiro, S.J., M.A. Bloomsmith, S. A. Suarez, and L.A. Porter 1996.** *Effects of social and inanimate enrichment on the behavior of yearling rhesus monkeys.* *American Journal of Primatology* 40(3): 247-260
- Seidensticker, John; Forthman, Debra 1994** *Planning for the species: Incorporating behavioral and ecological data.* *AZA Annual Conference Proceedings*

Sharpiro, S.J., M.A. Bloomsmith, L.M. Porter, and S.A. Suarez 1996. *Enrichment effects on rhesus monkeys successfully housed singly, in pairs, and in groups.* Applied animal behavior Science 48(3-4): 159-172

Shepherdson, David 1991 *A wild time at the zoo: practical enrichment for zoo animals.* AAZPA Annual Conference Proceedings

Shepherdson, David 2003 *Environmental enrichment Programs in Zoos Guiding The Next Step Forward.* AZA Behavior & Husbandry Advisory Group Report.

Taylor, W.J. and M.L. Laudenslager 1998. *Low-cost environmental enrichment plan for laboratory macaques.* Lab Animal 27(4): 28-31

Tresz, H., L. Ambrose, H. Halsch, A. Heath 1997 *Providing enrichment at no cost.* The Shape of Enrichment, Vol.6, No. 4

Tresz, H. 2001 *Providing enrichment at no cost, Part II.* The Shape of Enrichment, Vol.10, No.4

Tresz, H. 2002 *Behavioral Enrichment 101* Animal Keeper's Forum, vol.29, No.2

USDA *Final Report on Environmental Enhancement to Promote the Psychological Well-being of Nonhuman Primates* July 15, 1999

USDA *Environmental Enrichment for Nonhuman Primates Resource Guide* Jan. 1992-Feb. 1999

Watson, C. 1997. *Getting serious about monkey business.* Science and Animal care 8(2): 1-3

Websites:

ABMA list serve: to sign up contact mthompson@memphiszoo.org)

Animal Trainers Forum <http://members.tripod.com/~AnimalTrainersForum>

Karen Pryor's Website <http://dontshootthedog.com>

Cambridge Center for Behavioral Studies <http://www.behavior.org/animals/index.cfm>

Managing Animal behavior through Environmental Enrichment
<http://www.zoolex.org/ivan/sect4.html>

Keepers Link <http://wagntain.com/OC/>

Animal Enrichment Program <http://csew.com/enrich/>

<http://www.clickandtreat.com>

<http://www.clickertrainer.com>

<http://www.greenwooddogs.com>

<http://www.clickerzoneuk.co.uk/>

<http://www.nkconcepts.com/books.htm>

<http://www.clickertrainingvideos.com/>

<http://www.geocities.com/marineanimalwelfare/doesthe.htm>

<http://www.naturalencounters.com>

AZA website www.aza.org

webmaster@animalark.org

<http://www.synalia.com>

www.library.uinc.edu/vex/toxic/intro.htm

The Psychological well-Being of Nonhuman Primates (1998).
<http://books.nap.edu/books/0309052335/html/5.html>

<http://www.ncbi.nlm.nih.gov/Taxonomy/Browser>

Environmental Enrichment for Nonhuman Primates Resource Guideline January 1992-February 1999 - awic@nal.usda.gov

Annotated Bibliography on Refinement and Environmental Enrichment for Primates kept in Laboratory, 2003

http://www.animalwelfare.com/Lab_animals/biblio/index.html#contents

Protocol was last updated on: 11-20-06