

# Marmosets & Tamarins (Callitrichids)

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enrichment  
for nonhuman primates





## Introduction

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Nonhuman primates maintained in captivity have a valuable role in education and research. They are also occasionally used in entertainment. The scope of these activities can range from large, accredited zoos to small “roadside” exhibits; from national primate research centers to small academic institutions with only a few monkeys; and from movie sets to street performers. Attached to these uses of primates comes an ethical responsibility to provide the animals with an environment that promotes their physical and behavioral health and well-being. Thus, an obligation is entailed that those individuals/institutions caring for captive primates should make every effort to ensure adequate veterinary care and husbandry are provided, that the animals are housed in appropriate facilities, and that as broad a range of species-typical behaviors are able to be expressed by the animals as is possible for the captive environment.

This book serves as an introduction to the basic behavior and environmental enrichment of several species of nonhuman primates that are more commonly used in education, research and entertainment. In many ways, this book is meant to be a “how to” manual; it is not intended to be a broad scientific review of the primate behavior and enrichment literature. The fundamental premise taken throughout each chapter is that for an enrichment program to be effective, there must be a basic understanding of the biology and behavior of the primate species. The species addressed in this series are: baboons, capuchins, chimpanzees, macaques, marmosets and tamarins, and squirrel monkeys. Each species-section can be read as a stand-alone document without need to reference the other sections. This then allows the user to distribute the different sections to personnel caring for the specific animals.

Each section is divided into five parts: 1) Background, comprised of the habitat of the primate, the physical features of the primate, its psychological and/or so



social behavior, and its mating and reproductive behavior; 2) Social World; 3) Physical World; 4) Special Cases, describing any age-related considerations and concerns associated with individual housing; and 5) Problem Behaviors. The content of this series has been provided by members of the Association of Primate Veterinarians (APV) and the American Society of Primatologists (ASP) who have special expertise in the species addressed. This book is intended to be a primer because it is, indeed, an introduction to the subject of environmental enrichment for primates housed in a diversity of conditions. A list of references and/or other resources (principally on-line) is provided at the end of each chapter that provide additional guidance. The use of scientific references has been limited, but should the reader desire more information about a specific subject, the links at the end of the sections will provide direction to obtaining additional detailed information. Readers are also directed to the National Research Council publication, the Guide for the Care and Use of Laboratory Animals (1996) and the U.S. Department of Agriculture's (USDA) Animal Welfare Regulations to review the regulatory requirements of the Public Health Service and the USDA for the provision of environmental enrichment.

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—Kathryn Bayne, M.S., Ph.D., D.V.M., DAACLAM, CAAB  
Editor, Working Group

*This project is dedicated to the memory of Dr. Sylvia Taylor, Veterinary Medical Officer, Animal Care, U.S. Department of Agriculture, who was a proponent of providing enrichment to nonhuman primates and was generous in sharing her knowledge and expertise in this regard.*

# Marmosets & Tamarins

## Background

### Habitat

In the wild, marmosets and tamarins inhabit diverse habitats, ranging from Costa Rica to southern Brazil and Bolivia. They are principally tree-dwelling animals.

### Physical Features

Marmosets and tamarins belong to the New World primate family Callitrichidae, which is characterized by unique morphological and reproductive traits. Callitrichids, among the smallest (.5 to 1.3 lbs.) of the New World primates, often are brightly colored monkeys with little, if any, gender differences in body size or coloration.

Other distinguishing morphological features of marmosets and tamarins include claws instead of nails on all digits except for the opposable hallux, and two molars on either side of each jaw.



*Cotton-top tamarin (Saguinus oedipus) with nestbox and perches (photo by K.Bayne).*



*Adult Geoffroy's marmoset, Callithrix geoffroyi*  
(photo by H. A. Jensen).

## Behavior

Marmosets and tamarins have rich communicative behavioral repertoires that help individuals communicate within their group and with other groups. Chemical communication via scent marking is one important aspect of callitrichid social and sexual behavior. Scent marking increases when marmosets and tamarins are exposed to unfamiliar animals. Callitrichid primates have specialized glands (found in the anogenital, suprapubic, sternal, and perhaps facial areas), which produce oily secretions that are mixed with urine and deposited on branches and, to a lesser

degree, other surfaces. These scents contain information on species, subspecies, and individual identity, as well as reproductive status, social rank, and the age of the marking. Scents are also thought to facilitate reproductive suppression of subordinate females in some callitrichid species.



*Marmoset (Callithrix geoffroyi) parents sitting with their infants* (photo by H. A. Jensen).

## Mating and Reproduction

The social behavior of callitrichids within groups, in many ways, revolves around two aspects of callitrichid reproduction: reproductive suppression, which prevents subordinate males and females from engaging in sexual behavior, and extended residence of offspring in the natal family group. Subordinate females and adult-aged daughters living in their natal family group do not typically engage in reproductive activity and, in most cases, nonbreeding females are endocrinologically suppressed and do not ovulate. Likewise, subordinate males and adult-aged sons typically do not engage in sexual behavior. Reproductive suppression is known to be lifted from subordinate individuals when a new breeding male is introduced and following the death or illness of a breeding male or female.

Cooperative care is another important component of callitrichid social life. Marmosets and tamarins typically produce fraternal twins that are cared for by all group members, including both male and female non-reproductive individuals. This is particularly important because, at birth, litters weigh approximately 15 – 25 percent of adult body weight. Numerous studies have demonstrated that subordinate individuals provide a significant amount of care to infants born into the group. Indeed, the breeding male has been shown to participate less in carrying behavior when there are multiple helpers (e.g., adult offspring), with a concomitant increase in his survivability. The expression of competent caregiving behavior, however, requires experience with infants (either one's own or siblings). It is suggested, then, that individuals remain within their natal groups during the rearing of the next one or two litters.

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## Social World

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The social lives of marmosets and tamarins are unique among primates. Marmosets and tamarins are the only primates known to exhibit a cooperative breeding system, characterized by extended residence of offspring within the family group, breeding that is mostly limited to a single breeding pair, and care of offspring provided by group members other than the parents.



*Subadult male marmoset (Callithrix kuhlii ) carrying infant sibling (photo by C. N. Ross).*

In captive settings, callitrichid primates are commonly housed in groups comprised of a single breeding adult male and female, along with the independent (subadult and juvenile) and dependent (infant) offspring of the breeding pair. Captive groups generally do not contain unrelated individuals, because social groups containing unre-

lated same-sex individuals are likely to be unstable. Studies of captive and wild populations of callitrichid primates, however, have revealed that there is some degree of intra-specific variation in social structure that can remain stable over long periods of time. In fact, a variety of different social structures have been found to result in stable social groups, including the following:

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- fathers with offspring
- mothers with offspring
- same- and opposite-sex siblings (note: opposite-sex sibling groups are not recommended for cotton-top tamarins)
- same-sex pairs or small groups of unrelated or unfamiliar individuals
- single same-sex or opposite-sex individuals of different species

Intra-group aggression is generally directed toward non-breeding individuals by their same-sex sibling or same-sex parent. Displacement, threat behavior, chasing, and minor injuries often precede the eviction of an individual from a social group. The victim is easily identified because he/she will often separate from the group, show fearful behavior when approached by group members (especially an aggressor), and generally remain closer to the floor of the cage than other group members. Temporary separation for a period of hours or days may allow an individual that was in the process of being evicted to be reintegrated into a social group. These aggressive events within families are often triggered by periods of fertility in the dominant female, and special care should be taken to monitor group relations in the two to three weeks after the birth of infants, when the dominant females are likely to be ovulating.



Introducing an adult male and female is quite easy. Generally, a brief period of limited contact through mesh or a “howdy cage,” followed by a brief period of close observations once full contact is allowed, is all that is needed. Successfully introducing same-sex unrelated individuals or new adults into breeding groups, however, often is more difficult. In fact, the likelihood of failure increases with the age of the same-sex individuals already present in the group. For these introductions, much longer introduction and observation times are necessary.

## Physical World

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### Housing

An ideal captive environment for callitrichid primates promotes good physical health, allows for successful reproduction and rearing of offspring, and facilitates the acquisition of skills that the animals would need to survive in the wild. Although there are no clear specifications for optimal habitat size, habitats should be large enough, and rich enough, to allow and promote a full range of naturalistic behaviors, social interactions, and locomotion patterns. The general rule for callitrichid housing is that no housing is too large. Also, as callitrichids are tree-dwellers and range up to 10 meters above the ground in their natural habitats, vertical space is extremely important. If space is limited, narrow, tall housing is preferred to wide, low housing.

Cages often are constructed of wood or polyvinyl chloride (PVC) frames with steel or wire mesh. Many zoological parks also are constructing callitrichid housing from textured rockwork with glass or wire fronting. The primary furnishing for callitrichid housing should be natural tree branches and other surfaces on which the monkeys can climb, leap, and run. Branches should be arranged to provide a network of pathways by which the animals can move about their home. Branches are particularly important because marmosets and tamarins use these as the normal substrate for scent marking. If natural branches are not provided, the monkeys will scent mark on smooth, nonabsorbent substrates, and the marks may soil their fur.

Marmoset and tamarin group members sleep huddled together, so a nest box, placed high in the cage should be provided. Floors should be covered with wood

chips or shredded paper; this provides padding for young animals, which are most likely to fall from a branch onto the floor, and it also encourages animals to forage through the bedding. Food and water should be made available on a feeding platform or in a bowl placed high in the cage in a location that prevents contamination by urine and feces.

Since wild marmosets and tamarins are highly territorial under most conditions, visual and auditory contact between different social groups should be limited. When multiple groups are housed in close proximity to one another, and when overcrowding occurs within social groups, increased aggressive behavior is not uncommon. Further, chronic arousal associated with prolonged exposure to unfamiliar animals can lead to abortions and infant loss. Visual barriers, and sometimes sound absorbing materials, should be used to prevent territorial and aggressive displays between groups.

In light of the important role scent marking plays in social and sexual behavior, it is often suggested that husbandry practices maintain a sanitary, but smell-intact, environment by sanitizing cages less frequently and/or allowing some scent-marked items (e.g., nest box, perch, branches, etc.) to remain unsanitized and, thereby, retain their odor. However, some practical experience suggests that

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*Golden Lion Tamarin (Leontidius sp.) using a rope crossing between trees (photo by K. Bayne).*

sanitizing these items routinely does not result in adverse effects on the health or reproductive capacity of the animals. Regardless, most guidelines allow for the maintenance of scent-marked branches in cages for periods of several weeks to several months.

Environmental enrichment items and devices also are a necessary part of callitrichid housing. Not only do they promote the development of behavioral and logical skills and mental and sensory stimulation, but they can prompt naturally occurring behaviors in the animals.

The amount, type, and presentation of enrichment should be varied to prevent boredom. Foraging devices, artificial gum trees, cardboard boxes and gallon milk jugs with large holes cut in them, paper towel and toilet paper, are commonly used for enrichment.

## Feeding

Meeting the nutritional needs of callitrichid primates is essential to their health and well-being in captivity. The diets of wild marmosets and tamarins include tree exudates (sap or gum), fruits, buds and flowers, nectar, insects, and small vertebrates. Since proportions vary between and within species, only general nutritional issues will be covered here. However, it is important to avoid over-feeding these animals with food treats such that they do not consume a nutritionally balanced diet. Further detailed information can be found in the Callitrichid Husbandry Manual.



*Example of basic cage with ladder/swing and polyvinyl chloride (PVC) nestbox. Branches can be added for scent-marking (photo by K.Bayne).*



*Golden Lion Tamarin (Leontideus sp.) perching on a branch (photo by K. Bayne).*

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Young monkeys begin to beg for and eat solid food between three to five weeks of age. Approximately 20 percent of the diet of wild marmosets and tamarins is protein. A canned marmoset diet, which is now commercially available, should provide the foundation of the diet. New World primate biscuits also should be offered, along with an assortment of fresh fruits and vegetables. Two fruits and two vegetables should be offered daily. Cooked and uncooked cereals, and cooked pasta, are ideal sources of carbohydrates. Treats can include gum arabic, marshmallows, raisins, crickets, mealworms, and waxworms.

In the wild, callitrichids spend nearly 60 percent of their day foraging for food. Live food or highly preferred food items hidden in bedding simulates a natural situation and provides an additional opportunity for enrichment. A foraging box can be easily made by placing highly preferred food items into small holes that have been cut into a cardboard box filled with bedding. Callitrichids also enjoy food items suspended from branches, and treat cups with lids and peek holes.

## Special Cases

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### Age-related Considerations

Healthy marmosets and tamarins maintain good abilities to forage and move about well into their old age. The only major issue with older animals is difficul-

ty in chewing solid food because of tooth wear and loss. In these cases, soaking food in liquids prior to feeding or provisioning animals with softer diets are two easy solutions.

In terms of normal social development, most institutions that rear marmosets and tamarins have a policy of keeping young individuals in their family groups until they have had exposure to and experience with one or more sets of younger siblings. It is assumed that this experience will increase the likelihood of success in rearing young when the animals are placed in a position where breeding is possible. As mentioned above, however, older siblings are sometimes involved in mild to serious fights with same-sex siblings, and may need to be removed from the group. Decisions about removing an individual from a group should be made in light of the need for normal experience with siblings and the seriousness of the aggression.

Rejection of infants by parents and the inability of infants to maintain contact with caregivers are fairly regular occurrences in captive marmosets and tamarins. In some cases, lack of infant success is associated with infant health and vigor (e.g., low birth-weight infants are unable to maintain a grip on their parent's fur). In other cases, parents (particularly mothers) may actively reject and fail to carry and nurse their infants. A number of zoos and research facilities have reported some success in hand-rearing infants. Specific details of hand-rearing protocols can be found in the Callitrichid Husbandry Manual.

It is important to note that hand-rearing is associated with a variety of behavioral problems, particularly as the hand-reared individuals reach reproductive age. Therefore, decisions about hand-rearing rejected infants should involve a careful consideration of the animal's purpose in the facility as an adult. An individual that is highly aggressive toward people may not be a good animal for a zoological exhibit, for example.

## Individual Housing

Like other primates, marmosets and tamarins are highly social, and individual or solitary housing is strongly discouraged. In the event that animals need to be housed individually, efforts should be taken to maximize regular social contact with caretakers. Marmosets and tamarins have been housed successfully with birds or rodents. Specific examples of successful mixed-species housing can be found in the Callitrichid Husbandry Manual. However, in no case should



*Infant Wied's black tufted-ear marmoset, Callithrix kuhlii  
(photo by J. E. Fite).*

a marmoset or tamarin be housed with a New World primate from the Family Cebidae, including squirrel monkeys, capuchins, spider monkeys. Cebids can carry viruses, such as Herpesvirus saimiri, that do not affect their own health but could be lethal for marmosets and tamarins.

In the event that animals do require

individual housing, efforts should be taken to compensate for the isolation by providing additional enrichment. Increased and regular positive social contact with caretakers should be encouraged, but these people should be familiar and non-threatening to the animals. Increasing the complexity of the physical environment with live plants or other cage furnishings is also a worthwhile endeavor. Marmosets and tamarins rely extensively on vocalizations for communicating both within and between groups, and isolated animals can be stimulated to call by hearing vocalizations from their own or related species.

Downloadable versions of vocalizations can be found in a variety of locations (e.g., <http://pin.primate.wisc.edu/av/vocals/>).

## Safety Issues

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As with all primates, marmosets and tamarins do not like handling, and alternatives to handling should be sought. The animals are easily trained to do a variety

of tasks (e.g., present for physical examination, sit on a scale for weighing, voluntarily enter a transport cage). Training works best if the animals are worked regularly and if training occurs before the day's feeding. However, even well-fed animals can be trained with highly preferred food items. Detailed examples and descriptions of procedures can be found in the *Callitrichid Husbandry Manual*.

Marmosets and tamarins should be handled as little as possible, since they tend to be highly reactive to unusual stressors. For routine procedures that are short (less than five minutes), such as physical examination or biological sample collection, hand-held restraint can work well. Animals can be captured with fine-mesh nets ("butterfly net mesh") and removed by hand. However, the netting procedure can be a major stressor for other group members. Animals can be readily trained to enter a detachable nest box, and removing the animal in a separate procedure room can minimize this distress. Handlers should wear protective leather gloves. A grip from behind the animal's back, with thumb and middle finger underneath the forearms, provides the most secure holding position. Most animals will take treats during this restraint, which can serve as a reward and enrichment during the handling. If handlers are also caretakers, different clothing should be worn during manual restraint procedures to minimize distress for the animals during other routine caretaking activities.

For procedures of longer duration, animals should be given some form of chemical immobilization. Ketamine hydrochloride (intramuscular injection) provides good immobilization for medium-term procedures (5 - 15 minutes) and suggested dosages are provided in the *Callitrichid Husbandry Manual*. For long-term procedures (more than 15 minutes) inhalable anesthetics are recommended, particularly isoflurane. A cat-sized face mask can be used to deliver the anesthetic. Some facilities have had success in inducing isoflurane anesthesia by placing the animal into an empty 2-liter plastic soda bottle with a removable bottom, and directing the anesthetic gas into the bottle. This procedure minimizes the struggle and stress of placing the mask over an awake and alert animal. For these longer procedures, care should be taken to monitor and maintain core body temperature (warming blanket or warm water bottle) since body temperature can drop quickly in an anesthetized animal.

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## Other Resources

Callitrichid Husbandry Manual, produced by the American Zoological Association. E-mail: bzadmin@brookfieldzoo.org

*The Psychological Well-Being of Nonhuman Primates*, produced by the Institute for Laboratory Animal Research of the National Resource Council, at <http://books.nap.edu/books/0309052335/html/index.html>

## Common Names of the Callitrichids

### Marmosets:

- Callithrix acariensis*: Rio Acari marmoset  
*C. argentata*: Black-tailed marmoset, Silvery marmoset  
*C. aurita*: White-eared marmoset, Buffy tufted-ear marmoset  
*C. chrysoleuca*: Golden marmoset, Silky marmoset, Golden-white tassel-ear marmoset  
*C. emiliae*: Sneathlage's marmoset  
*C. flaviceps*: Buff-headed marmoset, Buffy headed marmoset, White-eared marmoset, White-headed marmoset

*C. geoffroyi*: White-fronted marmoset, Geoffroy's marmoset, Geoffroy's tufted-ear marmoset  
*C. humeralifer*: Santarem marmoset, Tassel-eared marmoset, Black and white tassel-ear marmoset, White-shouldered marmoset, Golden marmoset, Silky marmoset, Yellow-legged marmoset  
*C. intermedia*: Aripuanã marmoset  
*C. jacchus*: Common marmoset, White ear-tufted marmoset, Tufted-Ear marmoset  
*C. kuhlii*: Weid's black tufted-ear marmoset  
*C. lucippe*: Golden-white bare-ear marmoset  
*C. manicorensis*: Manicore marmoset  
*C. marcai* or *Callithrix argentata marcai*: Marca's marmoset  
*C. mauesi*: Rio Maues marmoset, Maues marmoset  
*C. melanura*: Black-tailed marmoset  
*C. nigriceps*: Black-headed marmoset  
*C. penicillata*: Black-eared marmoset, Black ear-tufted marmoset, Black-pencilled marmoset, Black-plumed marmoset  
*C. saterei*: Satere marmoset  
*Cebuella pygmaea*: Pygmy marmoset

### Goeldi's Monkey


*Callimico goeldii*: Goeldi's marmoset, Goeldi's tamarin, Calimico

### Tamarins

*Saguinus bicolor*: Pied tamarin, Bare-faced tamarin, Pied bare-face tamarin, Brazilian bare-faced tamarin  
*S. fuscicollis* ssp: Ávila Pires' Saddle-back tamarin, Crandall's Saddle-back tamarin, Cruz Lima's saddle-back tamarin, Spix's saddle-back tamarin, Lesson's saddle-back tamarin, Illiger's saddle-back tamarin, Red-mantle saddle-back tamarin, Andean saddle-back tamarin, White saddle-back tamarin, Geoffroy's saddle-back tamarin, Saddle-back tamarin, Weddell's saddle-back tamarin  
*S. geoffroyi*: Geoffroy's tamarin, Rufous-naped tamarin  
*S. graellsi*: Rio Napo tamarin, Graell's black-mantle tamarin  
*S. imperator* ssp: Black-chinned emperor tamarin, Bearded emperor tamarin  
*S. inustus*: Mottle-faced tamarin  
*S. labiatus* ssp: Red-bellied tamarin, Red-chested tamarin, Red-chested mustached tamarin, Thomas' mustached tamarin  
*S. leucopus*: White-footed tamarin, Silvery-brown bare-faced tamarin, Silvery-brown bare-face tamarin  
*S. martinsi*: Martin's tamarin, Martin's bare-face tamarin, Ochraceous bare-face tamarin  
*S. midas*: Midas tamarin, Red-handed tamarin, Golden-handed tamarin, Rufous-handed tamarin, Lacepede's tamarin  
*S. mystax* ssp: Moustached tamarin, Red-capped tamarin, White-rump mustached tamarin  
*S. niger*: Black-handed tamarin  
*S. nigricollis*: Spix's black mantle tamarin, Black-mantle tamarin, Black-mantled tamarin, Black-and-red tamarin  
*S. oedipus*: Cotton-top tamarin, Pinche marmoset, Cotton-head tamarin, Cotton-tops, Liszt monkey  
*S. tamarin*: Negro tamarin  
*S. tripartitus*: Golden-mantled tamarin, Golden-mantle saddle-back tamarin  
*S. weddelli*: Weddell's tamarin



# enrichment for nonhuman primates




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- ~ American Society of Primatologists



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