



# Environmental Enrichments for Nonhuman Primates: A Resource Guide

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**AWIC Resource Series No. 47**

**Edited by Elizabeth Tobey & Kristina Adams,**

**Animal Welfare Information Center**

**National Agricultural Library, <https://www.nal.usda.gov/>**

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## About this Document

This publication updates AWIC's *Environmental Enrichment for Nonhuman Primates Resource Guide, June 2006* (AWIC Resource Series No. 32 2006) which was last updated in 2015. It covers literature published from 1999 to July 2021. Literature dating before 1999 can be found in another AWIC publication, [Environmental Enrichment for Nonhuman Primates Resource Guide: January 1992-February 1999](#).

The 2021 revision includes a new organization of the bibliography's resources. The bibliographic chapters are divided into subject areas that cover enrichment for nonhuman primates, abnormal behavior exhibited by nonhuman primates, social housing, and animal training as an enrichment strategy. Within each of these sections, citations are grouped into these species categories:

- General non-human primate or multiple species resources
- Great apes (chimpanzees, bonobos, gorillas, orangutans, gibbons)
- Macaques (all species)
- Baboons
- Callitrichids (Marmosets and Tamarins)
- Other primate species

Citations included in these chapters were selected from multiple sources. In each chapter, the citations are arranged alphabetically according to the last name of the primary author.

The websites and online information resources are divided into 6 sections:

- Resources on environmental enrichment, for all nonhuman primates,
- Organizations and professional societies whose members may be involved in nonhuman primate management or research,
- United States National Primate Research Centers (NPRCs),
- Additional university primate centers and animal colonies located in the United States and associated territories,
- Environmental enrichment products and supplier information, *and*
- Discussion groups on nonhuman primates and enrichment.

You may check the National Agricultural Library's (NAL) online catalog, [AGRICOLA](#), to see which books and periodicals that the library has in its holdings. Some online periodicals in NAL's holdings are only available to USDA employees through the [Digitop](#) portal. Other articles are open access and may be downloaded for free. If you are not a USDA employee, check with your local or institutional library to see whether your library subscribes to these periodicals or can order them on interlibrary loan.

Information on how to request materials that are included in the collection of the National Agricultural Library (NAL) may be found on the [Request Library Materials](#) page. USDA employees may request books and articles through Document Delivery. Please read carefully as there are certain restrictions on media and document types. All patrons are encouraged to explore local library resources first before contacting the National Agricultural Library. If you are not a USDA employee, you may visit the library during its hours of operation to request items from

our circulation desk or read electronic articles on site. You may also request items on interlibrary loan through your home library (check with the loan office of your institutional, university, or public library for further information).

This bibliography contains approximately 1093 citations and links. (In some instances, the same citation has been added to two separate sections if it fits in multiple categories, but most of the 1012 citations are unique). The bibliography is comprised of:

- 1012 bibliographic citations for journal articles, books, book chapters, dissertations, and conference papers/proceedings
- 38 links to websites where content is provided about non-human primate enrichment
- Links to websites of 11 primate research centers, including the seven National Primate Research Centers
- 9 primate and/or enrichment organizations and 2 primate online forums
- 23 vendors which sell environmental enrichment and housing supplies for non-human primates and other laboratory and zoo animal species

This document includes links to the draft policy published in the Federal Register on July 15, 1999 by the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Animal Care and the *Final Report on Environment Enhancement to Promote the Psychological Well-being of Nonhuman Primates* that was drafted by a committee of experts from areas of research, teaching, regulation, and exhibition and led to the draft policy. Relevant sections of United States Animal Welfare Act and regulations are also included as well as parts of the *Guide for the Care and Use of Laboratory Animals* (NRC, 1996 and 2011).

Readers are cautioned as to the dynamic nature of the internet and the fact that web addresses and content are subject to change. All sites are current as of July 2021.

#### Acknowledgements

The editor would like to thank Dr. Jodie Kulpa-Eddy of USDA, APHIS, Animal Care for her comments and editing of the introductory material for this document. Thank you to Jean Larson of the USDA Animal Welfare Information Center for her guidance on document lay-out and thorough editing of the entire document. Elizabeth Tobey revised, updated, and reorganized the bibliography in 2021. Finally, special thanks to Sandra Ball of the Animal Welfare Information Center for the Web publishing of this document.

#### **Compiled by:**

**Kristina M. Adams, M.S.** 2006.

USDA. NAL. [Animal Welfare Information Center](#).

Revised by **Elizabeth Tobey, MLIS.** 2021.

USDA. NAL. [Animal Welfare Information Center](#).

## Contents

About this Document .....	1
Introduction.....	4
Article on the Birth of Behavioral Management.....	5
U.S. Government Agency Information .....	11
U.S. Laws, Regulations and Guidelines for Environmental Enhancement of Nonhuman Primates.....	13
Selected Federal Documents on Environmental Enrichment for Nonhuman Primates .....	14
Environmental Enrichment .....	15
General nonhuman primate or multiple species resources.....	15
Great apes (chimpanzees, bonobos, gorillas, orangutans, gibbons).....	25
Macaques (all species) .....	33
Baboons .....	38
Callitrichids (Marmosets, Tamarins, Goeldi’s Monkeys).....	38
Other Primate Species .....	42
Social Housing .....	48
General nonhuman primate or multiple species resources.....	48
Great apes (chimpanzees, bonobos, gorillas, orangutans, gibbons).....	50
Macaques (all species) .....	52
Baboons .....	58
Callitrichids (Marmosets and Tamarins).....	59
Other Primate Species .....	60
Training.....	62
General nonhuman primate or multiple species resources.....	62
Great apes (chimpanzees, bonobos, gorillas, orangutans, gibbons).....	66
Macaques (all species) .....	69
Baboons .....	72
Callitrichids (Marmosets and Tamarins).....	73
Other Primate Species .....	73
Abnormal Behavior and Stereotypies .....	74
General nonhuman primate or multiple species resources.....	74
Great apes (chimpanzees, bonobos, gorillas, orangutans, gibbons).....	79
Macaques (all species) .....	83
Baboons .....	94
Callitrichids (Marmosets and Tamarins).....	95
Other Primate Species .....	96

Websites and Online Information .....	98
Online Resources .....	98
Organizations and Professional Societies .....	101
U.S. National Primate Centers .....	103
Additional Primate Centers and Animal Colonies .....	103
Discussion Groups .....	103
Products and Suppliers .....	104

## Introduction

In 1985, the Animal Welfare Act (AWA) was amended to include laws on providing a physical environment adequate to promote the psychological well-being of nonhuman primates. In time, this concept became synonymous with the terms "environmental enrichment" or "environmental enhancement." The Congressional delegates responsible for the new amendments intended to allow for more exercise, play, and compatible social interactions for captive nonhuman primates. In 1989, the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) responded to the new AWA amendments by drafting regulations based on the advice received from 10 primate experts.

These proposed regulations contained requirements for social housing, inanimate enrichment items, and exercise for nonhuman primates. The regulations became a final rule in 1991 and still exist today ([9 CFR Sec. 3.81](#)). (For more information on the history and intent of the 1985 amendments, see Kulpa-Eddy et al., 2005.)

After five years of enforcing the regulations on environmental enrichment for nonhuman primates, APHIS surveyed their Animal Care (AC) inspectors about the implementation of enrichment plans at research facilities, exhibitors, and dealers. The consensus among AC inspectors was that most facilities did not understand how to develop an adequate environmental enrichment plan that would promote the well-being of nonhuman primates. In response to this concern, additional clarification was set forth in the [Final Report on Environment Enhancement to Promote the Psychological Well-being of Nonhuman Primates](#) which was included in a [draft policy](#) and issued for public comment on July 15, 1999. Ultimately, the policy was not implemented. However, the draft policy and Final Report did provide a great deal of science-based information for facilities housing nonhuman primates and many began implementing aspects identified under five general elements (social grouping, social needs of infants, structure and substrate, foraging opportunities, and manipulanda).

Environmental enrichment is defined by the Library of Congress as "enhancing the environment of confined animals in order to encourage natural behaviors and improve their quality of life (Kreger, 1999)." An effective environmental enrichment program enhances species-appropriate behaviors and activities, increases behavioral choices, and encourages appropriate responses to environmental challenges. Environmental enrichment for nonhuman primates can include provision of novel objects, increased foraging opportunities, and opportunities for social interaction. After the 1985 AWA amendments, many facilities initially approached



environmental enrichment as simply giving the animals toys. However, in response to published research and input from specialists, including the writers of the USDA draft policy, many facilities housing nonhuman primates now regard their enrichment plans as part of a larger behavioral health and management program. [Weed and O'Neill-Wagner](#) (2006) discuss the evolution of behavioral management programs in zoos and laboratory research environments in the section below. The creation of a successful behavioral management program and subsequent environmental enrichment plan is based on an understanding of the natural history of each particular species. Facilities that maintain nonhuman primates in captivity develop enrichment plans by taking into account species-appropriate behavior, individual animals' medical and behavioral histories, and the current limitations of their environment. The safety of the animals and personnel should always be considered.

In the United States, USDA, APHIS, AC is responsible for enforcement of the AWA. AC implements the standards for humane care set forth in the AWA and regulations and achieves compliance through inspections of regulated facilities, educational programming, and cooperative efforts with other agencies and organizations.

For laboratory animal care, the National Institutes of Health (NIH), Office of Laboratory Animal Welfare (OLAW) enforces the Public Health Service (PHS) policy on Humane Care and Use of Laboratory Animals for researchers receiving federal funding from PHS. The contact information for both agencies is provided below in the section on U.S. Government Agency Information.

## References

Kreger, M. (1999). [Environmental Enrichment for Nonhuman Primates Resource Guide: January 1992-February 1999](#). Animal Welfare Information Center Beltsville, Maryland, USA, 115 p. National Agricultural Library Digital Collections, <https://naldc.nal.usda.gov/catalog/7052421>,

Kulpa-Eddy, J.A., S. Taylor, and K. Adams (2005). USDA Perspective on Environmental Enrichment for Animals. *ILAR Journal* 46(2): 83-94.

[Article on the Birth of Behavioral Management](#)

## **Animal Behavior Research Findings Facilitate Comprehensive Captive Animal Care: The Birth of Behavioral Management**

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During the past several decades there has been an explosive increase in animal behavior research in captive and wild animal populations. This growing body of scientific investigation expands the understanding of basic principles underlying animal behavior relative to biology, psychology,

ecology, and natural history. As scientific research reveals increasing detail about the mechanisms influencing and driving animal behavior, the ability to appropriately manage and enhance the captive animal experience is opened to more possibilities and options including the area of animal well-being. In fact, this expanding informational resource is being applied today by a new breed of experts, Animal Behavior Managers, found working worldwide in facilities such as zoos, animal breeding colonies, and biomedical research institutions.

What prompted this shift from scientific discovery to applied principles of animal management? Some would consider the passage of welfare legislation (AWA, 1985) to be a defining moment for the regulatory acceptance and application of animal behavior research findings. While this legislation formally codified the idea of environmental enhancement and introduced the phrase 'psychological well-being', the concept had already been described in the 1972 and 1985 editions of *The Guide for the Care and Use of Laboratory Animals (The Guide)* and was likely the influence for later legislation. The *Guide*, published by the National Research Council through the Institute for Laboratory Animal Resources and the National Institutes of Health, is intended "to assist scientific institutes in providing professionally appropriate care for laboratory animals." Proper management is defined in the 1972 *Guide* as "any system of housing and care that permits animals to grow, mature, reproduce, or *behave normally*, and to be maintained in physical comfort and good health." Elsewhere in the 1972 edition, the term psychological well-being was utilized relative to physical activity and exercise. Revisions to the 1985 *Guide* include the recommendation that 'consideration be given to enriching the environment'. The term 'Behavioral Management' also first appeared in the same edition and describes various ways to promote well-being by providing social opportunities, structural complexities, and stimulating activities for captive animals. These regulations and guidelines responded to behavior goals for achieving psychological well-being using environmental enhancements in addition to the traditional clinical, husbandry, and design aspects of captive animal management.

### **From Environment Based to Behavior Based Terminology**

Markowitz (1974; 1978) proposed a term *Behavioral Engineering* to describe changes in zoo collection management to expand the range and expression of natural behavior of the animals and thereby improve the animals' well-being. These changes included implementing naturalistic feeding, problem-solving, and locomotor challenges for the animals. As a result of Markowitz's innovations, animals began to engage in more species typical behavior. This allowed zoo animal managers to improve the visual, auditory, and learning experience of the zoo visitors, while stimulating and enriching the captive animals. Although it appeared to be a win-win situation, his concept was initially met with limited acceptance from the zoological community, likely due to the terminology. Zoo professionals were concerned that *Behavioral Engineering* terminology meant engineering the animal's behavior rather than engineering environments that improved the animal's well-being (Markowitz, 1982; Markowitz, personal communication, 2006).

Similarly, the term *Environmental Enrichment* has experienced difficulties since its inception. Newberry (1995) describes some of the problems associated with this term. The difficulty with the 'EE' terminology is due to a limited number of scientifically guided assessments of enrichment techniques or procedures and hard evidence regarding effectiveness in actual use. The "EE" catch phrase came to include any implementation of changes in the captive animal's space regardless of the overall impact. Even though enrichment plans evolved out of the Animal Welfare Regulation mandate to "enhance the environment", those plans dedicated solely to

enriching the animal's physical environment often fell short of desired behavioral outcomes due to individual animal social and housing needs, rearing history, biology, genetic makeup, developmental life stage, and experimental stressors.

A number of approaches focused more on structured activities such as individual animal training, socialization, and dietary diversity to meet the needs of individual animals and researchers. Plans have been referred to as *Behavioral Performance Plans* (Swaisgood, & Sheperdson, 2005), *Refined Husbandry and Management Plans*, (Rice, 1994), *Clinical Ethology Plans* (Ladewig, 2005), *Wildlife Management Plans for the Laboratory* (Bayne, 1995), *Interdisciplinary Approaches* (Lund et al, 2006), *Cooperative Approaches* (Reinhardt & Cowley, 1990; Vertein & Reinhardt, 1989), and *Time Management Plans* (Schwammer, 1997), just to name a few.

Approaches differed in their attention toward individual animal needs. Treatment and prevention of individual behavior problems varied widely, as did performance training of animals relative to implementation of specific research protocols. While some environments allowed for expression of species normative behavior in captivity, others did not. Variation in terminology and focus likely corresponded to variation in behavioral results. Animal responses to routine and standardized enrichment techniques have been wide-ranging, at times unanticipated, and even counter intuitive to popular belief (cf. Line et al., 1990; Markowitz & Timmel, 2005; Morgan et al., 1998).

Observing these diverse responses offered a much-needed opportunity for reevaluating the systematic approach required to achieve well-being. Reviews by Bloomsmith & Else, 2005; Kulpa-Eddy et al., 2005; and Lutz & Novak, 2005, provide a historical perspective on the evolution of enrichment programs for animals with particular attention to programs for nonhuman primates. This lack of standardized enrichment implementation and diversity of outcomes most likely led to the widespread use of the more popular *Behavioral Management* terminology.

### **From Technically Based to Scientifically Based Enrichment**

It is also likely that transitioning from the most prevalent term *Environmental Enrichment* to the less familiar *Behavioral Management* required a common purpose to gain acceptance. Use of the term *Behavioral Management* suggests a broader program scope regardless of whether it is implicitly or explicitly stated in any formal documentation (Rice et al., 2002). There also seems to be a general consensus from the literature that captive animal welfare programs are gradually evolving from technically based to scientifically based programs. This is a sensible transition since vast resources of scientific literature and clinically logged data continue to develop a strong foundation that allows for more comprehensive animal husbandry and clinical care programs. These advancements have taken generic environmentally based enrichment plans to a more scientific individualized animal enrichment technology based upon known relationships between the animal's environment, from birth to maturity, and its overall behavior profile.

Although scientifically based assessments of enrichment programs are in their infancy (Baker et al., 2006; Bloomsmith & Else, 2005; Crockett, 1998), current behavioral management plans at zoos and in primate laboratories have successfully advanced to a point where the behavioral and clinical needs of animals in socially and physically stimulating environments are currently an integral component of the overall animal program (Bloomsmith & Else, 2005; Maple &



Archibald, 1991). Collaborative programs between clinical and behavioral specialists at these facilities are becoming the standard rather than the exception. Baker et al. (2006) surveyed several laboratory and university facilities which house nonhuman primates. The focus of the survey was enrichment and behavioral management. They found that nearly half of all enrichment program managers working at primate facilities had formal training in behavior methods. The day-to-day behavioral management of the animals is increasingly tasked to individuals trained specifically in animal behavior and assessment techniques. The impetus for this change may be due in part to the concerted efforts of a few individuals who began their careers working in the zoo community and in some cases managing primate research facilities.

Gail Laule and Tim Desmond were among the first to formally document methods for enhancing the captive experience for zoo and laboratory animals, (Desmond, 1994; Laule, 1993). One individual in particular, Dr. Michale Keeling, formerly at the M.D. Anderson Cancer Center in Texas, demonstrated great foresight by adopting these behavioral management techniques to the laboratory (Keeling et al., 1991). Dr. Keeling was a program director who realized the benefits of hiring individuals with behavioral backgrounds to work in the primate laboratory at Bastrop, Texas. Keeling and his colleagues (Keeling et al., 1991) proposed a strong bias for action regarding the management of primates and enrichment programs in laboratories. Many of those management tenets for working with non-human primates have become commonplace in the general laboratory and zoological community (Bloomsmith et al., 1991; Schapiro, 2000; Schapiro et al., 2003; Schapiro et al., 1994; Schapiro et al., 2005; Whittaker et al., 2001; NRC, 1998).

It is clear that the major focus of current environmental enhancement programs is more than just providing supplemental toys for animals to manipulate. This is true regardless of whether animals are housed in a research laboratory or zoological collection. The concept of behavioral management addresses questions about animal behavior as a critical and integral component of the overall health and well-being of these animals. Benefits from the efforts of dedicated animal behavior specialists working at all levels of laboratory and zoo collection management are being experienced by the animals as well as veterinarians, principal investigators, animal care staff, business office managers and the general public. Programs will continue to evolve and address well-being as more data are generated allowing improved captive animal management. The challenge for the future is to continue finding support for scientifically updating the principles and procedures of behavioral management. Markowitz and Timmel (2005) point out that there is continued reluctance from funding agencies to support needed basic research into issues relative to facility design, husbandry techniques or behavioral methods which potentially enhance animal well-being. Continued support from individuals responsible for laboratory and zoological review, accreditation, and oversight is critical to move these programs forward. This is especially true if the principles advocated by practitioners of behavioral management are to ultimately gain acceptance as the new standards of animal care.

### **Acknowledgments**

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Photo credit: Wisconsin National Primate Research Center/University of Wisconsin–Madison

## U.S. Government Agency Information

### U.S. Government Agency Information

In the United States, USDA, APHIS, Animal Care is the agency responsible for enforcement of the Animal Welfare Act and associated regulations. For researchers receiving Public Health Service funding, DHHS, NIH, Office of Laboratory Animal Welfare monitors compliance with the *PHS Policy on Humane Care and Use of Laboratory Animals*.

**U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Office of Animal Care (AC),**

<https://www.aphis.usda.gov/aphis/ourfocus/animalwelfare>

APHIS/AC enforces the Animal Welfare Act and develops animal care regulations for exhibitors, researchers, and animal dealers. APHIS/AC answers questions regarding the regulations including those about the psychological well-being of nonhuman primates. The staff also refers patrons to regional offices where they can communicate directly with Animal Care inspectors and veterinary medical officer.

**Riverdale, Maryland office:**

USDA/APHIS/AC  
4700 River Road, Unit 84  
Riverdale, MD 20737-1234  
E-mail: [animalcare@usda.gov](mailto:animalcare@usda.gov)

**Fort Collins, Colorado office:**

USDA/APHIS/AC  
2150 Centre Ave.  
Building B, Mailstop 3W11  
Fort Collins, CO 80526-8117  
E-mail: [animalcare@usda.gov](mailto:animalcare@usda.gov)  
Phone: (970) 494-7478  
Fax: (970) 494-7461

**Raleigh, North Carolina office:**

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**Center for Animal Welfare (CAW) office:**

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2312 East Bannister Road, RM 1180  
Kansas City, MO 64131-3011

Physical Address:  
USDA–APHIS Center for Animal Welfare  
6501 Beacon Drive  
Kansas City, MO 64133  
Phone: (816)737-4200

**Department of Health and Human Services (DHHS), National Institutes of Health (NIH), Office of Laboratory Animal Welfare (OLAW), <https://olaw.nih.gov/>**

Located at the NIH, Office of Extramural Research (OER), OLAW enforces the [PHS Policy on Humane Care and Use of Laboratory Animals](#) for researchers who receive Public Health Service funding. It produces conferences and workshops relating to responsible animal care and use in

biomedical research. OLAW can provide guidance on the development of plans to enhance psychological well-being of nonhuman primates. The PHS Policy requires adherence to the Animal Welfare Act regulations and the Guide for the Care and Use of Laboratory Animals.

Mailing Address:

Office of Laboratory Animal Welfare (OLAW)  
National Institutes of Health  
6700B Rockledge Drive, Suite 2500, MSC 6910  
Bethesda, MD 20892  
(20817 zip code for delivery service or hand delivery)

Phone: 301-496-7163

Email: [olaw@mail.nih.gov](mailto:olaw@mail.nih.gov)

[U.S. Laws, Regulations and Guidelines for Environmental Enhancement of Nonhuman Primates](#)

In the 1985 amendments to the Animal Welfare Act (Improved Standards for Laboratory Animals Act), Congress included mention of "psychological well-being" for nonhuman primates and the final version of the regulations as they appear in the [Code of Federal Regulations](#).

In addition to the Animal Welfare Act, those who receive funding from the Public Health Service or are accredited by the [Association for Assessment and Accreditation of Laboratory Animal Care International](#) (AAALAC) must also comply with the *Guide for the Care and Use of Laboratory Animals*, which is based on a performance standards approach. The *Guide* is intended to assist institutions in caring for and using animals in ways judged to be scientifically, technically, and humanely appropriate. The [2011 Guide \(Eighth Edition\)](#) contains standards related to environmental enrichment in the section "[Environment, Housing and Management](#)." It may be downloaded free-of-charge from the website of [National Academies Press](#). Translated editions of the *Guide* are available in [multiple languages](#), including Spanish, Chinese, Japanese, Russian, Tamil, and Thai.

**Citation information for 2011 *Guide*:**

National Research Council. 2011. *Guide for the Care and Use of Laboratory Animals: Eighth Edition*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/12910>.  
Online: <https://www.nap.edu/catalog/12910/guide-for-the-care-and-use-of-laboratory-animals-eighth>

Below are links to the sections of United States Code and the Code of Federal Regulations that discuss environmental enrichment for non-human primates, as well as other federal documents on the Animal Welfare Act:

- 7 U.S.C. § 2143 (2018 edition): [Standards and certification process for humane handling, care, treatment, and transportation of animals](#)
- Title 9, Part 3, Subpart D, §3.81 (from eCFR): [Environment enhancement to promote psychological well-being](#)



- [Animal Welfare Act and Animal Welfare Regulations \(aka “The Blue Book”\)](#), Animal and Plant Health Inspection Service, Animal Care Division, revised July 2020

#### Selected Federal Documents on Environmental Enrichment for Nonhuman Primates

**APHIS, Animal Care division publications on environmental enrichment and psychological well-being of non-human primates. These can be located on Animal Care’s Publications, Forms, and Guidance Documents page, [https://www.aphis.usda.gov/aphis/ourfocus/animalwelfare/SA\\_Publications/CT\\_Publications\\_And\\_Guidance\\_Documents](https://www.aphis.usda.gov/aphis/ourfocus/animalwelfare/SA_Publications/CT_Publications_And_Guidance_Documents)**

- [Options for Meeting Social Needs of Primates](#) (October 2018)
- [Primates: Natural Social Groupings and Compatibility](#) (October 2018)
- [Supporting Natural Behaviors in Primates](#) (October 2018)
- [Enrichment Devices for Primates](#) (June 2019)
- [Primates: Special Needs of Infants and Young Juveniles](#) (October 2018)
- [Special Needs of Primates Showing Signs of Psychological Distress](#) (October 2018)
- [Special Needs of Primates With Research Restrictions](#) (October 2018)
- [Special Needs of Primates Unable To See or Hear Other Primates](#) (October 2018)
- [Primates: Special Needs of Great Apes](#) (October 2018)
- [Final report on environment enhancement to promote the psychological well-being of non-human primates](#) (July 15, 1999)
- Animal Welfare: [Draft policy on environment enhancement for nonhuman primates](#), *Federal Register* Vol. 64, No. 135 (July 15, 1999)

#### **OLAW (Office of Laboratory Animal Welfare):**

Enrichment for Nonhuman Primates. National Institutes of Health, Office of Laboratory Animal Welfare. <https://olaw.nih.gov/resources/publications/enrichment-for-nonhuman-primates.htm>

Description: This is a set of six booklets providing an overview of behavior and enrichment for baboons, capuchins, chimpanzees, macaques, marmosets and tamarins, and squirrel monkeys commonly used in research, education and entertainment. You may request a hard copy of any of the booklets, by emailing the NIH, Office of Laboratory Animal Welfare (OLAW) at [olaw@od.nih.gov](mailto:olaw@od.nih.gov).



Photo Credit: Wisconsin National Primate Research Center/University of Wisconsin-Madison

## Environmental Enrichment

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## Social Housing

### General nonhuman primate or multiple species resources

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## Training

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## Baboons

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## Abnormal Behavior and Stereotypies

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## Websites and Online Information

### Online Resources

Animal Welfare Institute, Nonhuman Primates. <https://awionline.org/content/non-human-primates>

Description: AWI's website includes articles on NHP enrichment in its publication [AWI Quarterly](#), a [Refinements](#) database, the [LAREF Refinement Forum](#), and [free online publications](#) on NHPs and other laboratory animals.

Carlson, Jody. (2008). *Safe pair housing of macaques*. Washington, DC: Animal Welfare Institute. 48 p. <https://awionline.org/store/catalog/animal-welfare-publications/animals-laboratories/safe-pair-housing-macaques>

Description: This book published by the Animal Welfare Institute discusses the steps involved in pair housing macaques safely. Chapters include selecting potential pairs, the familiarization process, how to pair animals, and long-term compatibility considerations.

Catarrhine Café Cookbook. Psychological Well being Program, Washington National Primate Research Center. Online: <https://www.wanprc.org/wp-content/misc/cookbook-for-external.pdf>

Description: Compiled by R. Bellanca and D. Koberstein, the cookbook contains foraging enrichment ideas originally intended for macaques and baboons but applicable for other species of non-human primates. It includes “Tricks of the Trade,” recipes, and examples of enrichment items.

Cocks, Leif. (n.d.). Guidelines for the Housing and Management of Orang Utan (*Pongo pygmaeus* and *Pongo abeli*). Australasian Primate TAG. Australasian Zookeeping.

[http://www.australasianzookeeping.org/Husbandry Manuals/Orangutan Guidelines.pdf](http://www.australasianzookeeping.org/Husbandry%20Manuals/Orangutan%20Guidelines.pdf)

Description: Provides information on the care of orangutans in captivity. Includes a chapter on activity patterns and behavioral enrichment.

Come See Our World: A Project of Americans for Medical Progress: Primates at a Glance.

<https://www.comeseecourworld.org/animal-groups/primates/>

Website geared towards general public on non-human primates in laboratory research at National Primate Research Centers. Includes photographs and videos of baboons, Titi monkeys, Rhesus macaques, and marmosets. Positive reinforcement training is discussed in some of the videos.

Common Marmoset Care, University of Stirling (UK) and NC3Rs,

<https://www.marmosetcare.stir.ac.uk/>

Website on the care of marmosets in captivity geared towards laboratories, zoos, private owners and educators. Includes multimedia resources on environmental enrichment, housing, training and handling, feeding, behavior and postures, and facial expressions.

Database on Refinement of Housing, Handling, and Husbandry and Environmental Enrichment for Animals in Research. Animal Welfare Institute.

<https://awionline.org/content/refinement-database>

Description: A searchable database of enrichment and refinement citations for all laboratory animals, including nonhuman primates..

Disney's Animal Kingdom Theme Park ® Animal Training Program Course.

<http://www.animaltraining.org/>

Description: Provides information about the framework used to train animals at the Animal Kingdom. The web site provides information on learning theory and training terminology; working within an animal's current facility, species natural history, and individual background; and the process of creating a training program, from setting goals to implementation and evaluation.

Enrichment for Nonhuman Primates. National Institutes of Health, Office of Laboratory Animal Welfare. <https://olaw.nih.gov/resources/publications/enrichment-for-nonhuman-primates.htm>

Description: This is a set of six booklets providing an overview of behavior and enrichment for baboons, capuchins, chimpanzees, macaques, marmosets and tamarins, and squirrel monkeys commonly used in research, education and entertainment. You may request a hard copy of any of the booklets, by emailing the NIH, Office of Laboratory Animal Welfare (OLAW) at [olaw@od.nih.gov](mailto:olaw@od.nih.gov).

Enrichment and Social Housing Resources, Grants & Funding page, National Institutes of Health, OLAW. [https://grants.nih.gov/grants/olaw/primate\\_enrichment-social\\_housing.htm](https://grants.nih.gov/grants/olaw/primate_enrichment-social_housing.htm)

Description: Resources for PHS grant recipients on enrichment and social housing for laboratory animals. Most of the links are for nonhuman primates.

Enrichment Record. <http://enrichmentrecord.com/>

Description: An online portal for discussing animal enrichment, including [primate enrichment](#). Includes archive of the e-zine, [Enrichment Record](#) and an enrichment [poster repository](#).

International Directory of Primatology. Primate Info Net. Wisconsin National Primate Research Center. <https://primate.wisc.edu/primate-info-net/pin-international-directory-of-primatology/>

Description: The International Directory of Primatology provides information about organizations, population management groups, information resources and people currently active in the areas of primate research, education and conservation.

IPS Captive Care Committee (2007). IPS International Guidelines for the Acquisition, Care and Breeding of Nonhuman Primates, Second Edition. International Primatological Society.

<http://www.internationalprimatologicalsociety.org>

Description: These guidelines, prepared by the Captive Care and Breeding Committee, aim to promote good practice in the acquisition, care and breeding of primates and the enhancement of welfare.

*Laboratory Primate Newsletter* (Archived, 1984-2011). Brown University.

<https://www.brown.edu/Research/Primate/>

The quarterly newsletter provides information of interest to people involved in nonhuman primate research. The website contains all issues of *Laboratory Primate Newsletter*, policies, graduate programs, and related links. The site also contains a very useful environmental enrichment section called *Articles on Environmental Enrichment and Psychological Well-being* which contains all articles on environmental enrichment and psychological well-being that were printed in the newsletter from 1984-2003. The site topics are social enrichment, environmental enrichment, training, physiological and other measures of stress and psychological well-being, rearing and social development, colony management, editorials, and information resources. Articles are available full text and free of charge.

The Macaque Website. National Centre for the Replacement, Refinement & Reduction of Animals in Research. <https://www.nc3rs.org.uk/macques/>

Description: Find information and practical guidance on the natural history and behavior of macaques, the care and management in captivity, and ways to assess their welfare. The overall aim is to help improve the welfare of macaques in laboratories and the quality of science derived from them. This educational resource is intended to complement the published literature and features over 200 videos and images from research and breeding facilities around the world with different animal management procedures.

Primate Info Net. Wisconsin National Primate Research Center.

<https://primate.wisc.edu/primate-info-net/>

Description: Primate Info Net (PIN) is designed to cover the broad field of primatology, providing original content and links to resources about non-human primates in research, education and conservation. Through e-mail lists, Google Groups and other resources, PIN also supports an informal “primate information network” comprised of thousands of individuals around the world working with non-human primates.

PrimateLit: a bibliographic database for primatology. (Archived 2018). MINDS@UW. University of Wisconsin-Madison Libraries. <http://digital.library.wisc.edu/1793/78863>

Description: The PrimateLit database provides bibliographic access to the scientific literature on nonhuman primates for the research and educational communities. Coverage of the database spans 1940 to 2018 and includes all publication categories (articles, books, abstracts, technical reports, dissertations, book chapters, etc.) and many subject areas.



Reinhardt, V. and A. Reinhardt (2008). *Environmental Enrichment and Refinement for Nonhuman Primates Kept in Research Laboratories: A Photographic Documentation and Literature Review*, 3rd edition, Animal Welfare Institute: Washington, DC, USA, 129 p.  
Online: <https://awionline.org/store/catalog/animal-welfare-publications/animals-laboratories/environmental-enrichment-and>

Description: The 2008 3rd edition contains information on all nonhuman primate species. It provides literature reviews, pictures, and a bibliography of refinement techniques that can be used in research laboratories.

Reinhardt, Viktor. Comfortable Quarters for Nonhuman Primates in Research Institutions. Animal Welfare Institute. [http://ebooks.lib.ntu.edu.tw/1\\_file/AWI/96122405/12.htm](http://ebooks.lib.ntu.edu.tw/1_file/AWI/96122405/12.htm)

Description: Published by the Animal Welfare Institute, *Comfortable Quarters* offers suggestions and recommendations about how husbandry-related variables can be minimized or avoided thereby maximizing the animals' well-being and reducing the number of subjects required to obtain reliable research data.

The Shape of Enrichment. <https://theshapeofenrichmentinc.wildapricot.org/>

The Shape of Enrichment, Inc. is a non-profit corporation that offers a variety of services to animal care professionals worldwide. Founded in 1991, The Shape of Enrichment, Inc. is dedicated to promoting worldwide environmental enrichment efforts for captive animals and encouraging improvements in animal welfare through education and international exchanges of enrichment theory and application.

Whittaker, M. (n.d.) Managing Monkey Behavior: Advancing the Social Management of Old World Monkeys. Active Environments, Inc.

[https://www.academia.edu/34493637/Managing\\_Monkey\\_Behavior\\_Advancing\\_the\\_Social\\_Management\\_of\\_Old\\_World\\_Monkeys](https://www.academia.edu/34493637/Managing_Monkey_Behavior_Advancing_the_Social_Management_of_Old_World_Monkeys)

Description: This paper presents a review of social housing and management of old world monkeys in captivity. It also discusses positive reinforcement training.

Working Safely with Nonhuman Primates. National Institutes of Health, Office of Laboratory Animal Welfare. <https://olaw.nih.gov/resources/publications/work-safely.htm>

Description: Video on working with nonhuman primates. Available online in several video formats. A free CD may be ordered by contacting [olaw@od.nih.gov](mailto:olaw@od.nih.gov).

## Organizations and Professional Societies

American Association of Zoo Keepers (AAZK). <https://aazk.org/>

Description: AAZK is an organization made up of professional zookeepers and other people dedicated to professional animal care and conservation.

Association of Zoos and Aquariums (AZA). <https://www.aza.org/>

Description: Formerly called the American Zoo and Aquarium Association, AZA is a nonprofit organization dedicated to the advancement of zoos and aquariums in the areas of conservation, education, science, and recreation. The AZA Office of Conservation and Science coordinates Taxon Advisory Groups (TAG) which monitor the status of particular species in captivity and provide recommendations on species management in captivity and with respect to conservation efforts. Primate TAGs include New World Primate, Old World Monkey, and Prosimian. TAGs prepare [animal care manuals](#) which are available for free download. Committees, such as the

Behavior and Husbandry Advisory Committee, specialize in broad scientific areas and are coordinated to serve in advisory capacities for TAGs. The AZA holds regional and annual conferences at which environmental enrichment at zoos is often discussed. Services are geared towards member institutions, but anyone may contact members of these groups for information. There are fees for AZA membership, published membership directories, reports, and conference proceedings.

American Society of Primatologists (ASP). <https://www.asp.org/>

Description: The American Society of Primatologists is an educational and scientific organization whose purpose is to promote the discovery and exchange of information regarding primates, including all aspects of their anatomy, behavior, development, ecology, evolution, genetics, nutrition, physiology, reproduction, systematics, conservation, husbandry, and use in biomedical research. ASP's website features pages on [animal training](#), [social housing](#), and [environmental enrichment](#). The society also publishes the peer-reviewed journal, *American Journal of Primatology*.

The Animal Behavior Management Alliance (ABMA). <https://theabma.org/>

Description: An organization of animal care professionals interested in enhancing animal care through training and enrichment. Information is disseminated to members through a quarterly newsletter called *Wellspring* and annual conferences.

Association of British Wild Animal Keepers (ABWAK). <https://abwak.org>

Description: ABWAK is a non-profit organization specializing in improving cooperation among wild animal keepers. The site has links to information about the journal *Ratel*, training and professional development, and job openings.

Association of Primate Veterinarians (APV). <https://www.primatvet.org>

Description: The members of the APV are veterinarians working with nonhuman primates in zoos and research settings as well as breeders.

EUPRIM-Net Project. <https://www.euprim-net.eu/>

Description: An EU funded project that networks eight European primate centers and is aimed at advancing knowledge and competence in biological and biomedical research, animal keeping and breeding. The project objectives focus on animal welfare, the standardization of procedures and methods, the enhanced availability of non-human primates and training for those working with primates. EUPRIM-Net sponsors research in such areas as Animal Behavioural Management and Positive Reinforcement Training.

International Primatological Society (IPS). <http://www.internationalprimatologicalsociety.org/>

Description: The International Primatological Society was created to encourage all areas of non-human primatological scientific research, to facilitate cooperation among scientists of all nationalities engaged in primate research, and to promote the conservation of all primate species. The Society is organized exclusively for scientific, educational and charitable purposes.

Environmental enrichment issues are addressed by the Captive Care and Breeding Committee. Primate Society of Great Britain (PSGB). <http://www.psgb.org/>

Description: PSGB is the UK's national primatological society, is dedicated to the advancement of primate research, conservation and captive care. The Society publishes *Primate Eye*, three times a year, and celebrates primatology at Spring and Winter conferences each year. The Society's Captive Care Sub-Committee considers all issues that relate to the use, maintenance

and breeding of primates in captivity. It awards grants to support research that benefits primate welfare in captivity, and to assist education projects about captive primate welfare.

### U.S. National Primate Centers

National Primate Research Centers. <https://www.nprcresearch.org/primate/>. Public website: <https://nprc.org/>

Description: There are seven National Primate Research Centers (NPRCs) that are specialized facilities for research using nonhuman primates (NHP). Staffed with experienced research and support personnel, each center provides the appropriate research environment to foster the development of NHP models of human health and disease for biomedical investigations. The NPRCs are affiliated with academic institutions and are accessible to eligible biomedical and behavioral investigators supported by research project grants from the NIH and other sources. The National Primate Research Centers were formerly called Regional Primate Research Centers. The name was changed in April 2002 to reflect the expanded role of the centers. The NPRC website maintains online bibliography on [Health and welfare research in captive and wild primates](#) (2000 to present).

- California National Primate Research Center, University of California-Davis, <https://cnprc.ucdavis.edu/>
- Oregon National Primate Research Center, Oregon Health and Science University, <https://www.ohsu.edu/onprc>
- Southwest National Primate Research Center, Texas Biomedical Research Institute, <https://snprc.org/>
- Tulane National Primate Research Center, Tulane University, <https://tnprc.tulane.edu/>
- Washington National Primate Research Center, University of Washington, <https://wanprc.uw.edu/>
- Wisconsin National Primate Research Center, University of Wisconsin-Madison, <https://primate.wisc.edu/>
- Yerkes National Primate Research Center, Emory University, <http://www.yerkes.emory.edu/>

### Additional Primate Centers and Animal Colonies

Caribbean Primate Research Center, University of Puerto Rico, <http://cprc.rcm.upr.edu/>

Duke Lemur Center, Duke University, <https://lemur.duke.edu/>

Living Links: Center for the Advanced Study of Human and Ape Evolution (part of Yerkes National Primate Research Center, Emory University), [https://www.emory.edu/LIVING\\_LINKS/](https://www.emory.edu/LIVING_LINKS/)

New Iberia Research Center, University of Louisiana at Lafayette, <https://nirc.louisiana.edu/>

### Discussion Groups

Laboratory Animal Refinement and Enrichment Forum (LAREF), Animal Welfare Institute.

<https://www.awionline.org/content/refinement-forum-laref>

Description: Moderated by Victor Reinhardt of the Animal Welfare Institute, LAREF facilitates the exchange of experiences about ways to improve the conditions under which laboratory animals are housed and handled. The group is intended to serve the international animal care community in its attempt to promote animal welfare and improve scientific methodology by avoiding or eliminating husbandry-related stress situations. The forum is open to animal care personnel, animal technicians, students, attending veterinarians and researchers who have or had first-hand experience in the care of animals kept in laboratories.

Primate Science Discussion Group, Wisconsin National Primate Research Center, University of Wisconsin-Madison, <https://www.awionline.org/content/refinement-forum-laref>

Description: The purpose of this Google Group is the factual, science-based exchange of ideas and information about nonhuman primates and is intended to serve the international primatological research community. Topics include Primate Husbandry and Enrichment.

### Products and Suppliers

The Andersons, Inc., <https://andersonsplantnutrient.com/engineered-products/lab-and-enrichment>

Products: Bedding, nesting, and enrichment supplies.

Animal Specialties and Provisions, <https://www.animalspecialties.biz/>

Products: Bedding, feed, hydration gels, disposable IVC caging, enrichment items.

Aussie Dog Products, <https://aussiedog.com.au/>

Products: Pet and zoo animal enrichment items, including items specifically for primates.

BioServ, <https://www.bio-serv.com/>

Products: Feed and enrichment items for laboratory animals, including primates.

BioSystems Corporation, <http://www.biosyscorp.com/enrichment-toys/enrichment-toys.html>

Products: Enrichment objects including rodent houses and hemp fiber nesting squares.

Boomer Ball, <https://boomerball.com/en/>

Products: Sells various models of Boomer Balls, plastic enrichment and treat-dispensing balls for zoo animals.

Britz & Company, <https://britzco.com/>

Products: Caging systems for laboratory animals including non-human primates.

Carter2 Systems, Inc., <https://www.carter2systems.com/>

Products: Specializes in nonhuman primate housing, transfer cages and environmental enrichment. Enrichment options include vertical tunnels, play cages, ladders, treat boxes, gym sets and ferris wheels.

Horsemen's Pride, Inc., <http://www.horsemenspride.com/products/>, and Jolly Pets, <https://jollypets.com/>

Products: Producer of equine play products such as Jolly Ball, Jolly Apple, and the Amazing Graze, a treat dispensing toy. Jolly Pets, Inc., a subsidiary of Horsemen's Pride, also produces a line of zoo enrichment devices and toys for pets

Lab Products, Inc., <https://labproductsinc.com/>

Products: Designs and manufactures laboratory animal housing and care equipment. Primate Enrichment System cages allow flexibility in housing options with removable panels.

The Leather Elves, <https://theleatherelves.ecwid.com/>

Products: The Leather Elves makes safe and durable toys for birds. Their new zoo line includes larger toys for carnivores, ungulates, and primates, such as primate puzzles and carousel feeders.

Lenderking Caging Products, <https://www.lenderking.com/>

Products: Makers of specialty laboratory caging for all species. Primate cages include grooming bars, options for socialization, and play housing.

Likit, <https://www.likit.co.uk/>

Products: Manufacturers of a wide range of environmental enrichment products for horses and zoo animals.

Lomir Biomedical, Inc., <https://www.lomir.com/>

Products: Producers of unique primate enrichment devices made of durable opaque polypropylene. Also specializes in jackets and telemetry supplies for several laboratory species.

Nylabone, <https://www.nylabone.com/>

Products: Manufacturer of chew toys for dogs and other animals, including nonhuman primates.

Otto Environmental, <https://ottoenvironmental.com/>

Products: Supplier and manufacturer of enrichment products, foraging devices, caging, transport boxes, and other equipment for all species. Company serves zoos, laboratory facilities, and veterinary practices.

Petmate, <https://www.petmate.com/>

Products: Developer of innovative pet supplies and distributor of many brands including Booda, Snuffy's, and Aspen Pet. The Booda product line includes dog, cat, and bird chew and play toys.

Primate Products, Inc., <http://www.primateproducts.com/>

Products: Supplier of autoclavable hollow toys that are durable enough to withstand rough handling and biting for primates, canines, pigs, and rodents. Also manufactures mirrors, puzzle and nutra-toss foraging devices, and prima-hedrons that can be used to enrich housing for all primate species.

Sanctuary Supplies, <http://www.sanctuarysupplies.com/>

Products: Supplier of hard to find supplies needed by animal sanctuaries, zoos, rescues, and shelters. Products include enrichment devices, cleaning items, and housing supplies for all animal species.

ScottPharma Solutions, <https://scottpharma.net/>

Products: Distributor of laboratory animal food, bedding and environmental enrichment products including bedding and nesting materials.



Shepherd Specialty Papers, <https://www.ssponline.com/>

Products: Manufacturer of ALPHA-dri (alpha cellulose) which is a loose animal bedding of precisely defined composition. Also produce Enviro-Dri which is a bedding developed for pen-housed primates, large animals, and canines. Enviro-Dri is also recommended for the nesting of all animals.

Tapvei, <https://tapvei.com/>

Products: Offers a full range of products made from Aspen wood to serve laboratory animal needs for bedding, nesting material and environmental enrichments.

Wicked Coursing, <https://wickedcoursing.com/>

Products: Wicked Coursing designs and manufactures premium dog lure coursing systems and exotic predator enrichment simulated hunt and chase systems. The company works closely with zoos, rehabilitation, breeding and conservation facilities on species-appropriate equipment, training programs and enclosure design for use with all felids, canids, raptors and cetaceans. They also work closely with animal sanctuaries, rescues, and shelters.

Wildlife Toy Box, <https://www.wildlifetoybox.com/>

Products: Manufacturer of custom enrichment items for zoo animals such as balls, boxes, cubes, trays, looky lous (mirrored enrichment toys), barbels, wobble toys, and cylinders.