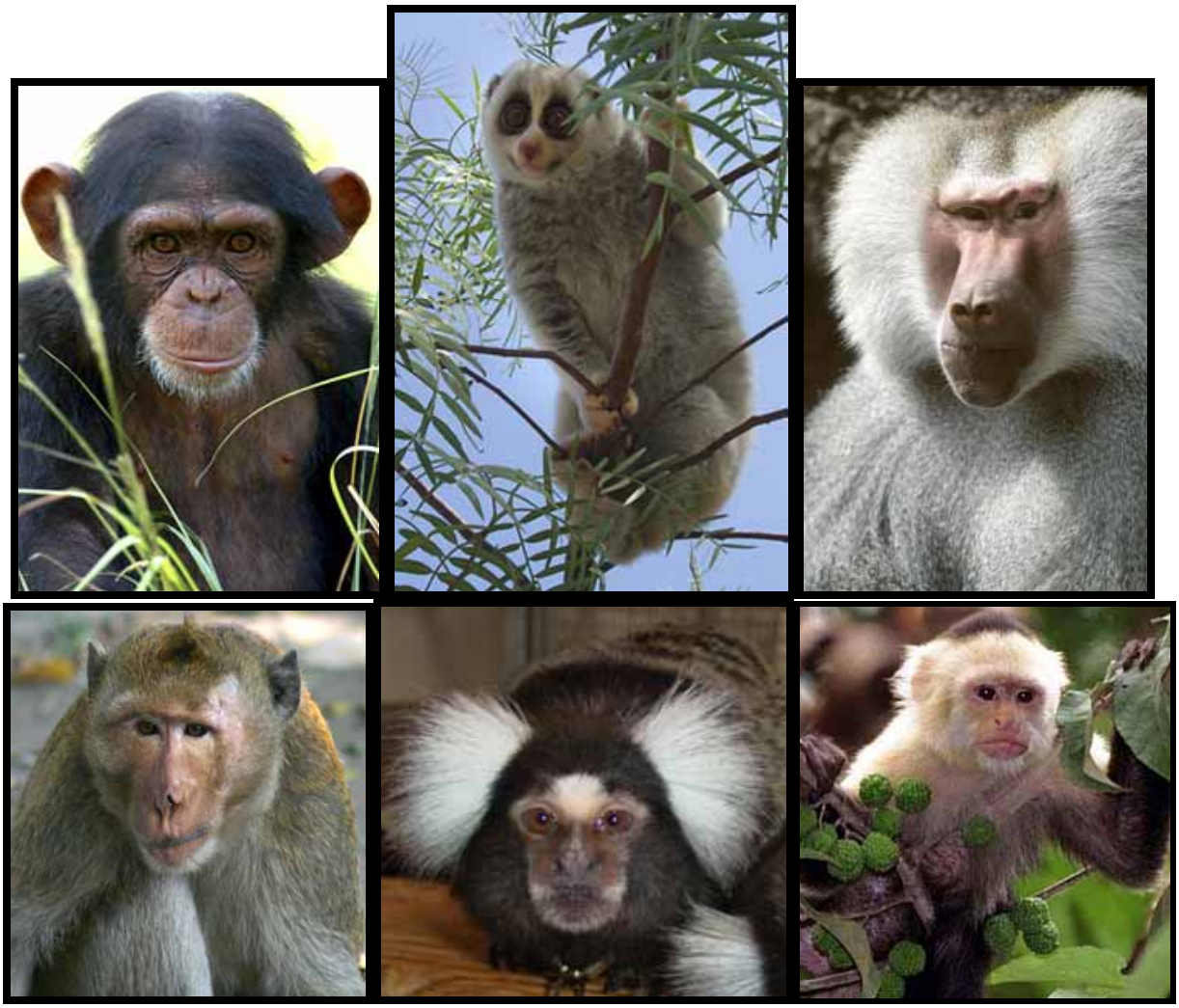
International Primatological Society

RESEARCH CONSERVATION EDUCATION CAPTIVE CARE

IPS INTERNATIONAL GUIDELINES FOR THE ACQUISITION, CARE AND BREEDING OF NONHUMAN PRIMATES



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IPS Captive Care Committee Members
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Vice President for Captive Care:
Colleen McCann
Wildlife Conservation Society
Bronx Zoo/Mammal Department
2300 Southern Boulevard
Bronx, NY 10460, USA

Hannah Buchanan-Smith
Scottish Primate Research Group
Department of Psychology
University of Stirling
Stirling FK9 4LA
Scotland, UK

Lisa Jones-Engel
Division of International Programs
National Primate Research Center
Box 357330
University of Washington
Seattle, Washington 98195, USA

Kay Farmer
Scottish Primate Research Group
Department of Psychology
University of Stirling
Stirling FK9 4LA
Scotland, UK

Mark Prescott
National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs)
20 Park Crescent
London W1B 1AL
England, UK

Helena Fitch-Snyder
Zoological Society of San Diego
Box 120551
San Diego, CA 92112-0551, USA

Sylvia Taylor (*posthumous*)
USDA/APHIS/Animal Care
APHIS/Animal Care
Tampa, FL 33601, USA

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1. INTRODUCTION

The guidelines presented here were prepared by the International Primatology Society (IPS) Captive Care Committee (CCC) (list of committee members provided on Page i), sent out for comment to IPS members, and subsequently endorsed by the IPS Executive Council at the XXIst IPS Congress in Entebbe, Uganda. The guidelines have been revised to take into account considerable advances in scientific knowledge in the field of primatology (e.g., physiological, psychological, socio-ecological and behavioral) and major changes in attitudes and practice, especially regarding animal welfare. They aim to promote good practice in the acquisition, care and breeding of primates, and the enhancement of animal welfare. Many of the guidelines are not original; rather they are synopses of relevant laboratory and exotic animal standards, guidelines and regulations from a variety of agencies. In preparation of this document, the Committee used the references listed in **Annex 1** and suggests that the reader refer to them directly for specific details and specifications.

The captive management of nonhuman primates requires specialized care and housing that takes into account their physical, physiological, psychological, and social needs. Increased primate utilization and experimentation in both habitat and importing countries has resulted in the need for internationally accepted guidelines for primate acquisition, care and experimentation. In this way we can ensure that primates are utilized and cared for in an appropriate manner and that valid scientific results are obtained from their experimental use.

Many developed (non-habitat) countries have already established their own standards for primate care and welfare but these standards may not be appropriate for primate habitat countries, which include many developing nations. Additionally, these guidelines may be at odds with some national legislative requirements, (for example, use of natural substrates is not permitted in U.S. laboratories, and primates are required to be transported singly as opposed to the Guidelines' recommendations here) and therefore may not always be attainable. However, where good scientific evidence exists to improve captive primate welfare, there should be pressure to change existing legislative requirements that fall short of the optimal captive conditions. Although the political, social and economic realities differ greatly among countries, general standardized guidelines are needed which are acceptable and attainable worldwide, regardless of legal, cultural or economic background. Therefore, it is the aim of this document to provide guidelines that work to ensure the implementation of appropriate standards for the care of primates regardless of the mission and goals of the captive facility that houses them, or the geographic region in which they are found.

It is not the purpose of the Committee, or these guidelines, to condemn or condone primate usage for biomedical research or testing. It must be stressed, however, that primates should be used only when there is no appropriate alternative biomedical model, and then only the minimum number of animals to give scientifically valid results. Furthermore, all aspects of the animal's captivity and use should be repeatedly evaluated over its lifetime, so that pain, suffering, and distress are avoided, minimized or treated, and animal welfare is maximized. The Committee recommends that the ethical and humane considerations of primate experimentation follow the mandate set forth in Russell and Burch's (1992) 3 'R's: replacement, reduction and refinement. Within this recommendation is the realization that the acquisition of, and experimentation on,

primates will continue for the foreseeable future. Hence it is vitally important that internationally acceptable standards are adhered to in all countries and the establishment of self-sustaining captive breeding colonies is strongly encouraged in order to decrease or eliminate the demand on wild primate populations. Information on conditions and practices at domestic and international breeding and supplying centers should be made available to users of primates, ethics committees and funding bodies. This will enable these bodies to make informed decisions about where and how they acquire their animals (www.bbsrc.ac.uk/funding/news/NC3RsPrimateGuidelinesSep06.pdf).

Additionally, since the publication of the first edition of the guidelines there has been an alarming increase in the number of primates becoming captive as a result of illegal activities. While many of these confiscated primates end up in sanctuaries and/or rescue centers as a result of more effective enforcement efforts, the caretakers of such operations are then faced with providing lifelong care to these individuals who have become casualties of the illegal trade in primates. Therefore, in addition to efforts to preserve these threatened populations throughout their natural range, there is the added challenge of caring for those individuals who fall victim to the illegal trade in wildlife. And there are associations of sanctuaries that strive to improve the standards of primate care under these difficult circumstances (e.g., Pan African Sanctuary Alliance (PASA) [http://www.panafricanprimates.org]; The Association of Sanctuaries (TAOS) http://www.taosanctuaries.org). These guidelines must take into account these particular captive situations and provide the resources and information to enable such operations to provide the most appropriate care for the individuals in their charges. Therefore, while the original purpose of the guidelines was focused on the use of primates for biomedical research, the current guidelines aim to be applied to all captive conditions whether by design (e.g., breeding/supply centers, laboratories, zoos) or by default (e.g., sanctuaries, rescue centers, government agencies). Regardless of the intentional use of captive primates, the goal is to provide the appropriate care while in captivity, and therefore, the guidelines should be universally accepted as the best practices for their care and use. However, it is important to note that the IPS does not condone the private ownership of primates as pets for various ethical and welfare reasons (see **Annex 2**).

2. ACQUISITION FROM THE WILD

Wild primates are under increasing pressures from habitat destruction, human encroachment, bushmeat hunting and disease transmission. These pressures have contributed to declining numbers in populations of free-ranging primates and, in some cases, have led to the extinction of primate species. Primates are captured from the wild for a variety of purposes including as a source of bushmeat, as a commodity for the local and international pet trade, and also as a resource to be used in the field of biomedical research. Myriad factors would need to be examined, detailed and quantified if the regulation of the capture of wild primates for consumption or for the pet-trade was to be implemented. Discussion of these factors is outside the original intent of these guidelines. Rather, the guidelines are designed to address the concerns surrounding the capture of wild primates for the establishment of self-sustaining breeding colonies. Sound animal welfare and scientific reasons exist for using captive-bred primates in preference to wild-caught primates, and institutions that currently trap from the wild should adopt policies to decrease reliance upon wild populations. Trapping quotas can be reduced by retaining a significant and increasing proportion of first generation offspring for breeding

second-generation stock. Trapping of apparently "common species" should not be permitted to jeopardize viable populations, as recommended in the World Health Organization (WHO) and Ecosystem Conservation Group (ECG) "Policy Statement on the Use of Primates for Biomedical Purposes" (**Annex 3**). For the most current IUCN Red Listing of primate species see http://www.redlist.org/info/tables/table4a.html.

When it is deemed necessary that animals must be taken from the wild (for example, in order to acquire breeding stock for a sustainable captive breeding program) capture should be restricted to species not threatened and areas where animals are in sufficient abundance to avoid over exploitation, or from habitats which are already being destroyed and will no longer support available primate populations. Acquisition of crop raiding primates for breeding stock may be appropriate in areas where they are causing sufficient damage that their removal or destruction by the local citizens or officials is inevitable, but removal for breeding purposes should not be done without consultation of relevant *in situ* field researchers and wildlife authorities on population status and conditions. It should be noted that many instances of conflict between wild primate populations and human activity are a result of expansion of human activity into dwindling primate habitat. Certain primate populations may actually be decreasing, while also exceeding available natural resources, because of the loss of these resources to human agriculture and industry. In these situations capture for biomedical use should not hold precedence over translocation in places where this is a viable and nationally acceptable alternative.

Questions of species abundance and conservation status must be answered before any trapping program is initiated. These data may be available from published sources (e.g., IUCN Red List, CAMP for Primates, etc.) or they may be obtainable from knowledgeable habitat country collaborators. It is paramount that consultations with independent researchers be obtained in order to maintain objectivity in the conclusions drawn about the conservation status of the population in question. In situations where these data are not readily available or current, it is imperative that determinations of species abundance and conservation status be assessed using standardized, accepted survey and censusing techniques.

Methods of Capture

Capture of wild primates can be associated with significant morbidity and mortality if basic precautions are not taken. However, methodologies for the safe capture and handling of primates are available in the literature (for general overview see: Ancrenaz *et al*., 2003; Jolly *et al*., 2003; and **Annex 4** for "IPS Policy Statement on Protection of Primate Health in the Wild"). The capture of primates from the wild is challenging and potentially dangerous for the animals. Inexperienced handling can lead to significant morbidity and mortality for the animals. Methods used to capture and handle primates, which vary widely between species and countries, should always be humane and cause minimal stress. Institutions should ensure that anyone trapping primates is adequately trained and competent in humane methods of capture. The practice of 'mother-killing' to obtain infants is unacceptable. Capture methods should not render animals, or their troop members, unduly susceptible to injury or death. Animals should not be captured in traps likely to produce injury or left in traps for any period likely to cause harm or distress. The most critical factor when trapping primates is the frequent monitoring of the trap, so that the time limit that the individual is in a trap is not unnecessarily extended, and the likelihood of accidents

or injuries is minimized. There is not a universal time limit for how long a primate can safely be held in a trap as this will depend on the species, the individual, the trap, and a myriad of external factors. For example, small primates may readily remain in a nest box-like trap if provided with food, water and protection from the elements, whereas a nervous primate in an open trap in adverse weather conditions should be removed from a trap immediately.

The welfare of the trapped individual is the sole responsibility of the trapper. Captured individuals should be protected from the direct sunlight and other environmental extremes, and predators. Any animal injured should be given first aid and, if seriously injured or obviously diseased, should be humanely euthanized. For most primates, the most appropriate method will entail sedation followed by a lethal injection of an anesthetic. Under certain emergency field conditions where this is not possible, the quickest and most humane method of euthanasia may be a gunshot to the brain, with or without prior sedation. This should only be done by someone trained in firearms safety and familiar in primate anatomy to ensure the correct placement of the projectile.

Holding and Transport

Animals held in the field should be kept as calm and undisturbed as possible. Cages should be of a size adequate to allow the animal to turn around and adjust posture, slightly elevated off the ground to allow passage of urine and feces, protected from environmental extremes, and provide adequate ventilation for the duration of the transport period. To avoid contagion and trauma, animals should not be caged together except for known family groups, mothers and infants, and young animals. Holding animals in human dwellings must be avoided. Significant morbidity and mortality following exposure to human pathogens has been documented in primates newly captured from the wild and held in human settlements.

Transport from the field should be done quickly and with minimal stress. Care must be taken to provide adequate ventilation, while still protecting the animals from effects of sun, rain and wind. Animals should not be transported in bulk cages, rather groupings should be as outlined above. Transport by common carrier should be in appropriately sized containers that meet or exceed IATA (International Air Transport Association) regulations for international shipments (http://www.iata.org/ps/publications/9105.htm). Contingency plans should be made to provide animals with food, water and shelter and emergency medical care if needed in the event of delays during transit. If an animal is injured, ill, debilitated or has any condition that would endanger it during transport, it should not be transported, except to receive medical care.

When animals are being held for entry into a breeding center or for export they should be housed in suitable facilities with adequate veterinary supervision (see Section 3 - Receipt) and care should be taken not to mix animals of different species or from different sources. National authorities should work to enforce proper handling procedures in both the field and holding facilities and to institute a system, if currently lacking, of licensing trappers and exporters, with provisions for inspection of procedures and facilities. Regulations of CITES (see Section 3), IATA Live Animal Regulations, and all national or local wildlife protection or animal welfare laws should be strictly adhered to in order to ensure proper handling of primates during all stages of transport. It is equally critical for importing countries of primates to be aware of such

regulations placed on exporting countries and to ensure that such regulations are adhered to, as both parties must be held accountable for the conditions under which primates are shipped.

Food and Water

Upon capture, animals must be given species-appropriate food items, and potable water should be continuously available. When animals are held in areas where they were captured they should be fed locally available foods that would form part of their natural diet. Food items with high moisture content, such as fruits, are recommended. Transition to new foods, such as commercially prepared formulas, should be done gradually with continuous monitoring and veterinary advice sought when necessary.

Disease

Morphological, physiological, genetic and behavioral similarities between humans and primates have made primates a model for the study of human diseases. These same similarities also make possible the bi-directional transmission of a variety of infectious agents between humans and primates. Pathogens endemic in human populations can decimate primate populations. This phenomenon has been observed repeatedly over the past decades in captive settings, where epidemics of influenza, tuberculosis, chicken pox and measles have caused mortality rates exceeding 90% among primates, including animals newly captured from the wild.

Primates are especially susceptible to disease after capture because of stress and the exposure to human pathogens. This can result in animal morbidity and mortality and also represents a health hazard to those working with the animals. Strict health precautions should be taken at all stages. Depending on the primate species, tuberculosis can become a serious problem and, where applicable, tuberculin testing should be done as early as practicable. Staff should also be screened for and/or immunized against tuberculosis. Viral diseases are a serious zoonotic health concern, as are various enteropathogens, and therefore, basic viral screening and appropriate treatments should be undertaken for the relevant infectious agents.

3. INTERNATIONAL SHIPMENTS

Significant numbers of primate habitat and user countries are parties to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), which attempts to reduce the threat to species caused by world trade in wildlife. All primate species are listed in either Appendix I (species threatened with extinction) or Appendix II (species which could become endangered if trade is not controlled) of CITES (http://www.cites.org/eng/app/appendices.shtml). Importing facilities are required to adhere to the system of export and import permits designed to prevent removal of animals from a country if detrimental to the survival of the species, and to require comparable documentation of all countries not parties to CITES. For reasons of conservation, animal welfare and public health, primates should not be captured, held or transported for the purpose of pet keeping.

Pre-Shipment Care

If animals are to be held in the country of origin, they should be properly quarantined and conditioned, thus decreasing shipment losses through stress and disease. In many countries, a prerequisite for this basic care would be the upgrading of inadequate holding facilities. The duration of the pre-shipment holding period will vary; therefore, the facilities should be designed to maintain animals adequately (e.g., species appropriate space and furnishings) for weeks and up to months. The conditioning period should be as short as possible so as not to impose excessive stress to the animals. Animals should be conditioned in compatible pairs or groups with proper consideration of their physical and behavioral needs. During this period of export quarantine, there is no reason, and it is therefore unacceptable, to hold animals in transport cages or similar-sized containers. However, depending on their viral status, it may be necessary to house them singly.

Records should be kept of the number of each species caught, the sites and dates of capture, the number of deaths, individual weights, and all information on diseases or treatment, including laboratory reports. Copies of individual animal records should be sent with the shipment, and animals should be marked to enable positive identification by the recipient (see Section 6 – Identification and Records). Records of which animals were paired or grouped together at the suppliers should accompany the animals to their next destination. Good communication between suppliers and recipients is essential. There should be exchange of information important for the welfare and health of the animals and for working safely with the animals supplied.

Transport

Journeys should be planned in advance to minimize disruption to the transported animal's welfare. A journey plan should be produced detailing the responsibilities of various individuals involved in the transport. The journey plan should be agreed upon with the intended recipient and should give accurate details of events at each stage of the journey. The plan should also provide instructions for contingencies in the event of delays and adverse events, and include contact details for all those involved in the journey. It is strongly recommended that contacts (e.g., colleagues from zoos, research laboratories, breeding centers, etc.) en route are notified of the pending shipment in the event a delay occurs at a stopover destination so that a knowledgeable animal care specialist can be made available to assist in the care of the animals during the delay.

In order to avoid any injuries that could occur during transit when an animal's anxiety level is heightened, adult primates should be transported singly unless it is more stressful to separate individuals (e.g., mother-offspring or young sibling pairs). During transportation every attempt should be made to make the animals as comfortable as possible and minimize stress while in their transport containers. It is strongly recommended that animals are acclimatized to the containers and to the conditions that will prevail during transit. Thus, the preparation for shipping should include the habituation of the animals to the transport containers in advance so that they are familiar and comfortable in these containers when the time for shipment arises. If animals are accustomed to nest boxes, consideration should be given to allowing them access to these during transportation, along with provision of familiar scent marking material for relevant

species. Food and water should be provided for any trip exceeding 4 hours — it is strongly recommended to provide food and water sufficient for at least twice the expected duration of the journey. When transporting primates every effort should be made to minimize the number of hours individuals are confined in shipping containers. All efforts should be made by the animal care staff responsible for the shipment to ensure the well-being of the animals during transport in the event there is a need to hold the animal in the shipping container for a prolonged period of time. Transporting primates overseas inevitably entails lengthy transit times, at its maximum reaching upwards of 48 hours. For this reason, it is imperative that shipping containers are sufficiently large (approximately twice the size of the animal) and provide adequate ventilation spaces to ensure safe transport in the event of unforeseen shipping and transport delays.

Transportation should always be by the most expeditious means, with the minimum number of stages between departure and arrival at the final destination. Every effort should be made to avoid changes of aircraft and the carrying of animals of different species, or from different countries, in the same plane. Animals should be supervised until they are shipped and properly attended by competent persons while awaiting transfer. Primates can be adversely affected by temperature changes and extremes. Therefore, the differing climatic conditions prevailing during a journey must always be considered before arranging the routing and carriage of these animals. Primates must not be left outdoors while waiting to be transferred or loaded.

The sender should ensure that animals are in good health before shipping and pregnant females and nursing young should not be shipped without full consideration of the possible consequences of stress. It is required that pregnant females be shipped before the last trimester of pregnancy and young primates not less than one year old. Animals should be transported in containers designed to prevent escape or injury, to provide sufficient ventilation through use of ventilation holes and space bars, and to permit access to food and water. Such containers should be large enough to allow the animals to stand or sit upright, turn around and adjust posture in a natural manner. Containers should be clearly labeled and all accompanying documents must be in order. Required documentation includes a veterinary certificate stating the animal is in good health and has no condition or abnormality that would likely cause it to suffer discomfort or harm under conditions of transport. There should also be clear instructions on required care and foods, and a contact telephone number, in the event of delays during transportation.

International trade in primates is regulated by CITES. The IATA Live Animal Regulations are generally deemed to meet the CITES guidelines in respect to air transport. However, under the auspices of the CITES Animals Committee, the Live Animal Transport (LAT) Working Group was formed to improve regulations regarding risk of injury, detriment or health, or inhumane treatment during transport. The CITES LAT working group continues to work closely with IATA to ensure enhancement of existing regulations and recommend amendments to CITES regulations regarding live animal transport.

Receipt

Animals should be removed from their transport containers as soon as possible upon receipt. After inspection, they should be transferred to a suitable quarantine area with appropriate cages, reunited with their group members unless inappropriate to do so (e.g., illness or incompatibility)

and provided with food and water. Animals that are sick or injured should receive immediate professional care and effective pain relief.

A record should be made for each animal received, including its source, date of arrival and health status. Individual animal records should be matched to the appropriate animal. If not already permanently marked, this should be done shortly after receipt (see Section 6 – Identification and Records). In the event that an animal dies during transport or shortly after, records should be maintained and the cause of death ascertained so that such incidents are not repeated.

A period of acclimatization, quarantine and social adjustment, if with new group mates, is necessary to enable animals to overcome stress from transport and their new environment before scientific procedures are undertaken. The required acclimatization period will vary depending upon the species, the animal's temperament and condition, and on the length of the journey, source and facilities available. New arrivals should be fed a similar diet to that being used in the source institution to facilitate the acclimatization period.

4. INSTITUTIONAL POLICIES

Proper care and humane treatment of captive primates requires scientific and professional judgment based on sound knowledge of primate natural history, welfare and husbandry. This section is intended to assist facilities that house primates to develop institutional policies governing the care and use of captive animals, commonly referred to as an animal care and use program. This would include a code of practice or guidelines that are in compliance with applicable national laws and regulations (http://www.aaalac.org/resources/internationalregs.cfm). It should be emphasized that these recommendations are intended for both habitat and non-habitat country animal facilities even if the former may not possess the same formal standards and regulations on primate care and use. Additionally, it is strongly recommended that primate centers set up in habitat countries by established U.S. and European facilities need to assure that the same standards of primate care and welfare are maintained in these centers.

Primate Care and Use

Each institution that uses primates for research should establish its own animal care and use program. A senior institutional official, able to speak for the institution on policy, fiscal and personnel matters, must be designated the responsible individual for the animal care program. There should be clear lines of authority for monitoring the animal care program, delegated from this individual to the institutional animal care and use committee, institutional veterinarian(s), or other properly trained and experienced individuals with direct responsibility for the primates. Authority for evaluation of the scientific merit and appropriateness of animal use ordinarily rests with an independent official or committee with expertise in the discipline and area of research represented by the projects in which the animals are used.

Each institution should appoint an animal care and use committee, which should include members with professional experience or training in scientific research involving primate behavior, ecology, welfare, and primate husbandry. The committee should report to the

designated responsible institution official for monitoring all matters concerning the general care and use of primates, reviewing the animal issues of proposals and ensuring that the established guidelines are being followed. All aspects of primate care and use should be continuously reviewed, with commitment to refining conditions and practices.

It is recommended that institutions employ a primate behavior specialist(s). Such persons can assist in a range of areas concerning primate care and use, including: assessing and documenting psychological well-being; advising on normal species-typical behavior and behavioral time budgets; communication signals and staff-animal interactions; enclosure size and design; enrichment; grouping and social dynamics; behavioral monitoring techniques; abnormal behaviors and stereotypies; socialization, habituation and training; behavioral criteria for assessing primate pain, suffering and distress; and staff training.

Each institution should develop its own standard operating procedures that detail all aspects of animal care, manipulation and other relevant procedures. This should be prepared as an official institutional document that forms the basis of the institutional animal care program.

Personnel

There is an acute need for the training of professional and technical personnel in veterinary care, psychological well-being, handling and general management of captive primates and the requirements of species and individuals. Well-trained, competent and motivated personnel can make an enormous difference in improving the welfare of captive primates. The institution should ensure that people caring for and using primates are properly trained and exercise high standards of humane care and treatment. Institutions should employ people trained in laboratory animal science or provide formal on-the-job training. It is an institutional obligation to ensure that professional and technical personnel who perform animal anesthesia, surgery, or other experimental manipulations are qualified through training or experience to accomplish these tasks in a humane and scientifically acceptable manner.

Facilities should develop a comprehensive training program for new staff and establish an adequately funded continuing education and training program to inform staff of novel developments or improved practices in primate care and welfare (e.g., housing, husbandry, handling, behavior, enrichment, health). Programs should include some form of ongoing assessment to ensure that suitable standards and competence are attained and maintained.

Staff training and assessment of competence should be regularly reviewed as part of the animal care and use program. This will help ensure that any possible improvements in primate care and use can be recognized, considered and implemented without undue delay.

Any facility housing nonhuman primates should develop an institutional policy governing the care and handling of nonhuman primates in order to minimize the transmission of zoonotic diseases between human caretakers and the primates in their care. All staff should be made aware of the human safety and health risks of working with nonhuman primates, their tissues or fluids. These risks vary depending on the species viral and health status and the extent of staff exposure. Staff training programs should include specific procedures for minimizing these risks. Herpes B virus of macaques is of particular concern, as infection is likely to be fatal if not immediately

treated. There are many agencies, such as the Center for Disease Control and Prevention (CDC) and the Institute for Laboratory Research (ILAR), that have developed primate handling guidelines that can be adopted for use or modified based on the primates species housed at the facility. Some examples are: http://www.cdc.gov/mmwr/preview/mmwrhtml/00001538.htm ; http://www.nap.edu/readingroom/books/labrats/

Personal Hygiene

The animal care staff needs to maintain a high standard of personal cleanliness. Suitable washing and showering facilities should be provided, and protective clothing should be supplied and laundered by the institution. Outer garments worn in the animal room or outdoor enclosures should not be worn outside the animal facility. Personnel should not be permitted to eat, drink or smoke in animal areas. A separate area or room should be made available for these activities.

5. PRIMATE HOUSING

There should be adequate facility security to protect animals from vandalism. The facility should have secondary containment barriers in the event that a primate escapes from the primary enclosure. It is essential that there be a contingency plan in the event of an animal escape or natural disaster.

Primate caging or housing systems should be designed carefully to meet the physical, physiological, psychological and behavioral needs of captive primates within the confines of management and research requirements.

The housing system should be large enough to permit pair or group housing of conspecifics, freedom of movement, normal postural adjustments, and should contain sufficient furnishings and enrichment items to provide opportunities for the expression of species-typical behaviors (e.g., foraging, exploration, allogrooming, play, etc.). It should provide a secure, comfortable and suitable environment with easy access to food, water and adequate ventilation.

Housing and caging systems, while facilitating research, must function to maintain good health and welfare of the animals. They should be constructed of sturdy, durable materials and must be kept in good repair to prevent injury or escape of animals. Use of natural materials for cage construction and furnishings is encouraged; metal enclosures can be very noisy. Particular attention must be given to eliminating sharp edges and broken wires, keeping cage floors and walls in good condition, and refurbishing or replacing rusted or deteriorating parts. Veterinary, animal care staff and specialists in primate behavior and management should be consulted in the design of housing and caging systems, so that the materials and designs are chosen with consideration for good veterinary care, behavioral management and less stressful handling.

Social Environment and Enrichment

Primates need a complex, stimulating environment for their psychological well-being. Each species' natural behavior and social organization (e.g. monogamous, polygynous) should help determine the size and composition of the social group and determine the visual contact and

distance that the primates have with neighboring conspecific groups. Pair or group housing in an enclosure must be considered the norm for gregarious animals, but only compatible (socially, virological status, etc.) animals should be kept together. Compatibility of animals should be deemed by the resident primate specialist and/or the individual on staff responsible for the welfare of the animals. The formation of same-sex peer groups for holding stock primates, and to prevent breeding, is common in many laboratories. Despite it being an unnatural social grouping for many species, it allows socialization and is certainly a better alternative to keeping animals individually housed. If possible, groups of males and females should be separate as contact may increase intra-group aggression.

Infectious disease study does not necessarily preclude the ability to keep primates in pairs or groups in the same enclosure, without interfering with study validity. Many infectious disease studies are carried out in paired or grouped primates. The same is true of many other types of studies and procedures, such as pharmacokinetic studies and drug safety testing. Larger pens and runs for experimental primates can reduce labor costs and increase ease of sanitation. Individual subjects can be accessed for testing and manipulation through good enclosure design, separation chutes and training using positive reinforcement techniques. Standards for enclosure designs and positive reinforcement training can readily be found in primate husbandry manuals and journal publications (see **Code of Practice 1**).

For experimental animals, where housing in groups is not possible, keeping them in compatible pairs is a viable alternative social arrangement. Single caging should only be allowed where there is an approved protocol justification on veterinary or welfare grounds. Single caging should be for as short a time as possible, and under close supervision. Single caging on experimental grounds should always be avoided if possible but if absolutely necessary, it should be determined in consultation with animal care staff, the primate specialist, the competent person charged with advisory duties in relation to the well-being of the animals, and approved by the relevant ethical committee. In such circumstances, additional resources should be targeted to the welfare and care of these animals. Where possible, they should have visual, auditory, olfactory and tactile contact with conspecifics. Human interaction, even where it is welcomed by the animal, should never be seen as a substitute for conspecifics and does not meet the social needs of a nonhuman primate.

The environment should enable the animal to carry out a complex daily program of activity. The precise features of the living quarters, however, will vary according to species (due to differences in natural behavior) and particular research use. The enclosure should ordinarily allow the animal to adopt as wide a behavioral repertoire as possible, provide it with a sense of security, and a suitably complex environment to allow the animal to run, walk, climb, jump, and sleep comfortably. Materials providing tactile stimuli are also valuable. Opportunities for the animal to control events should be provided (an event is deemed controllable if there is a difference in the likelihood of it occurring depending on an animal's behavior). Some novelty should also be introduced at intervals, which can include, for example, minor changes in the conformation or arrangement of enclosure furnishings. The quality of enrichment is an important aid to the animals' behavioral, physiological and psychological well-being.

Newly formed groups of animals must be closely monitored to detect injuries due to fighting or excessive harassment. A program of action should be in place for managing and minimizing aggressive interaction. Group enclosures should be designed with attention to the animals' size, use of vertical space, other important species-specific characteristics and vertical flight reaction. Double-tiered caging is not recommended. Group enclosures should be enriched with structures such as resting perches and shelters, as well as providing opportunities for species-typical behaviors to prevent boredom. High perches should be provided and in sufficient number to allow all animals to sit on them simultaneously. A combination of indoor and outdoor housing, including exercise areas, is encouraged where possible. Design modifications should be carefully reviewed by knowledgeable primate specialists and tested systematically before implementing enclosure modifications.

Primates in zoos and other captive display settings should have refuges and visual barriers from human view to control potential stress from visitor presence. Enclosures in these facilities should also be set back sufficiently from public areas to reduce the chances of aerosol disease transmission or harassment from visitors. If visitors can walk through a primate enclosure, the visitors should be made fully aware of the appropriate way to behave (e.g., not to feed or physically interact with the primates).

Space Requirements

Several organizations or countries have minimum standards or suggested guidelines for enclosure size and these vary considerably. **Annex 5** illustrates several such standards which are widely used or referred to. It is very important that consideration be given to a suite of characteristics including morphometric, ecological, social, physiological and behavioral characteristics when determining the appropriate enclosure size. A two-tiered system is not recommended as these cages are usually too small. The lower tiers do not allow primates to engage in their vertical flight response, are often darker, and animals in the lower cages tend to receive less attention from attending personnel. Cage construction is a significant, typically long-term investment and users, given their economic and research constraints, should think large rather than small. Large, appropriately furnished cages are unquestionably beneficial to the animals' welfare and could possibly prevent expensive cage replacement costs that might otherwise be incurred in the future. Enclosure size and furnishings should always result from a thorough understanding of the needs of the species and individual, and not just from multiplication of the minimum enclosure dimensions specified in legal guidelines.

Adequate space alone does not in itself provide for good welfare, but larger enclosures allow greater complexity of cage furnishings and other enrichments, and greater flexibility for meeting social needs. Increasing useable space has been shown to increase the amount of natural behaviors and reduce the incidence and frequency of abnormal behaviors and stereotypies in many laboratory primate species.

Physical Environment

The physical environment in which animals are held should be appropriate to the species and its life history. Temperature, humidity and ventilation are important to the health and welfare of

animals and should be maintained within preferred ranges for a given species. Even tropical species have succumbed to heat stress when temperature and humidity combinations have been high. Rapid and extreme fluctuations should be avoided. Animal areas should have adequate ventilation without harmful drafts, and should be ventilated separately from other areas. When mechanical ventilation is required, 10-15 room air changes per hour are generally adequate; air recirculation is discouraged.

Lighting should be controlled to provide a light-dark cycle. Illumination of each cage should be uniform and sufficient for adequate inspection of animals while providing safe working conditions for personnel but not obtrusive to the well-being of the animals. Whenever possible, rooms housing nonhuman primates should be provided with windows, since they are a source of natural light and can provide health benefits as well as environmental enrichment. Noise, especially when sudden and unexpected, can be an important disturbing factor and should be minimized. Special consideration should be given to eliminate exposure to ultrasound that is within the hearing range of both Old and New World primates (those studied are common marmosets, squirrel monkeys and rhesus and long-tailed macaques). The separation of human and physical plant areas from animals help lessen disturbances from noisy activities. Caregivers should be aware of the animals' auditory sensitivities and trained to work without loud intrusions; normally incompatible species, such as dogs, should not be housed where their vocalizations or activities would disturb the primates.

Sanitation

Cleanliness is essential in an animal facility. Animal rooms, corridors, storage spaces, and other areas should be cleaned with appropriate detergents and disinfectants as often as is necessary to minimize debris, and harmful contamination. Cleaning utensils should not be transported between animal rooms.

Enclosures should be sanitized and allowed to dry before new animals are placed in them. Animal cages, racks and accessory equipment, such as feeders and watering devices should be washed and sanitized as needed to keep them clean and free from contamination. Marmosets, tamarins, lemurs and lorises frequently scent mark their environment and the total removal of familiar scents may cause behavioral problems. Alternate cleaning and sanitation of the primary enclosure and enrichment devices retains some of the territorial scent marking and has beneficial effects on the psychological well-being of the animals, reducing over-stimulated scent marking. When possible, animals should be shifted to another enclosure while cleaning their primary enclosure to avoid undue stress and direct contact between the caretaker and the animals. If animals are kept in their enclosures during cleaning (e.g. in large rooms), care must be taken not to get them wet, or cause behavioral stress from cleaning. Pressurized wet cleaning may increase the risk of exposure to pathogens for personnel and animals through the aeration of harmful chemicals or infectious agents; therefore, it is recommended that animals are shifted out of enclosures before pressure hosing. Water bottles, sipper tubes, stoppers, and other watering equipment should be washed and then sanitized by rinsing with water of a least 82 degrees centigrade or appropriate chemical agents to destroy pathogenic organisms. It is vital to check that the watering equipment is fully functional before the primates are returned to their enclosures.

Drain traps and removable covers used during cleaning will prevent bedding from obstructing room drains. Drains used in primate holding rooms should be designed with a larger diameter than required as the minimum needed by the technical specifications. Drain designers should address the potential for drains clogging from hair or enrichment items. A design should include ways to prevent those materials which are not waste from entering any drain located in a primate room. Waste containers and implements should be cleaned frequently. Waste should be removed regularly and disposed of in a safe and sanitary manner. Waste storage areas should be physically separated, vermin-free and easy to clean and disinfect. Hazardous wastes should be incinerated or sterilized before they are removed from the facility. Special precautions must be taken with highly toxic or radioactive waste.

Programs should be instituted to control, eliminate, or prevent infestation by pests such as cockroaches, flies, and rodents. The most effective program prevents entry of vermin into the facility by screening openings, sealing cracks, and eliminating breeding and refuge sites. Pesticides should be used in or near animal areas only when necessary and by properly trained individuals, and with the full knowledge of the investigators using the animals.

However, while basic sanitation is essential, over-cleaning of cages may be detrimental to animal welfare; thus, sterile cages are not encouraged. Deep litter is valuable for comfort, enrichment, absorbing moisture, and has been demonstrated to control bacteria.

6. ANIMAL CARE AND HEALTH

Proper animal care includes providing for the physical and behavioral well-being of captive primates and preventing and controlling disease and injury. Protecting animal health is a responsibility of all persons observing and working with primates, not just the veterinary professionals. Veterinary responsibilities include regular examination of animals (including preventative programs), treatment of ill or injured animals, and maintenance of appropriate health records.

Procurement and Quarantine

Animals should be obtained only from reliable and lawful sources with high standards of care and welfare. They should be received into a quarantine area so that the incoming animals do not put at risk those already present in the facility. New animals should be kept separate until their health status is evaluated, and they should be allowed an acclimatization period prior to their use. This will permit them to adapt to their surroundings, resulting in a more stable physiological and behavioral state. The animals should be screened and their health status evaluated during this period and treated accordingly. Staff should be trained in standard operating procedures to prevent transfer of pathogens from quarantine or isolation areas to stock or experimental areas.

Animals that are suspected of having a contagious disease should be isolated from healthy animals in the colony. Quarantine or isolation status is no impediment to social housing or other enrichment. Under these conditions, enrichment items can be handled either as disposable organic waste would be, or in the same manner as sanitizable caging equipment.

Separation by Species

Physical separation of animals by species is generally recommended to prevent inter-species disease transmission and to reduce the stress caused by inter-species conflict. New World, Old World African, and Old World Asian primate species should be housed separately as latent infections in one group can cause serious clinical disease in others.

Facilities, Equipment, and Staffing

Adequate facilities and equipment should be available to allow a program and health care to be carried out. This will require areas suitable for examination, treatment, surgery, hospitalization, quarantine and disease isolation, necropsy, and suitable diagnostic equipment and services. It is important that emergency veterinary care is readily available at all times and that trained staff members are available to monitor or carry out treatments on weekends, holidays, and night time hours. It is recommended that the facility have the capability to keep the bodies and tissues of animals refrigerated (not frozen) prior to necropsy.

Identification and Records

Whenever possible, primates should be identified in a permanent manner with a microchip appropriate for the kind and size of species. If animals are being relocated, compatibility of microchip readers must be ensured. Positive reinforcement training can facilitate microchip reading. The use of a second more obvious temporary method of marking (e.g., a collar, tail clipping or dye marking) is beneficial for rapid identification. Non-invasive methods of identification should be the principal method of choice, particularly for pre-weaned animals. Ideally, the method used should not be painful, not cause an adverse reaction, not be uncomfortable and not be likely to catch and cause injury.

Individual animal records are essential and should be regularly updated. Identification details should include such information as: the source of the animal, sex, date of birth, parentage, reproductive information (e.g., dates of estrus, breeding and mothering ability), behavioral characteristics (e.g., temperament, abnormal behavior and stereotypies), social information (e.g., all social partners, rank in the group, moves and events that have occurred in the life of that animal, details concerning the compatibility and incompatibility of individuals), and records of socialization, habituation and training. Clinical details should include a history of any surgical procedure, experimental use, relevant clinical and diagnostic information, date and cause of death, and necropsy results. Individual records should accompany animals moved between institutions.

Information from individual records should be used to form a database to analyze primate care and use, and to review the adequacy of systems in order to establish good practices. Electronic databases have the advantage that they can be accessed by staff across a number of sites, enable quick and efficient searching for information (e.g., issue availability, previous use), and can be used to alert staff to the need for action (e.g., vaccination and prophylactic treatment schedules, weaning). Colony health records should reflect morbidity and mortality rates and trends in health status or injury rates, so that the veterinarian can adjust the health care program accordingly.

Nutrition

Animals should be fed palatable, uncontaminated, and nutritionally adequate food, according to the requirements of the species. The diet should be satisfying, both in terms of its appetitive nature and the way the animals have to forage for, and process, the food. Feeders should allow easy access to food while minimizing contamination by urine and feces. However, as animals like to work for their food, increasing processing time, increasing foraging, or providing puzzle feeders or other feeding devices is encouraged. Sufficient food should be available to ensure normal growth in immature animals and maintenance of normal body weight, reproduction, and lactation in adults. Care should be taken in group enclosures to ensure that all animals are allowed sufficient access to a balanced diet and water. *In situ* sanctuaries should aim to provide as much natural food items as possible as they are more readily available.

Variations in dietary components and their presentation can provide interest and environmental enrichment. Scattered food will encourage foraging or where this is difficult, food which requires manipulation, such as whole fruits or vegetables or puzzle feeders, can be provided. Vitamin C is an essential component of the primate diet. New World monkeys require adequate quantities of vitamin D_3 and have a high protein intake. Foraging devices, which stimulate the natural behavior of the animals, may need to be suspended or presented in the upper part of the enclosure, in consideration of the species-typical reluctance of some primates to descend to ground level. Substrate (e.g., wood chips, straw, shredded paper, vegetation) will encourage foraging of spilled food at the floor area.

The veterinarian should be consulted on the diet, any changes in diet, and the dietary enrichment program, to ensure that these do not disrupt nutritional balance or prescribed medical care.

Diet processing and food storage areas should be kept cool, clean and free of vermin and insects. Bulk feeds should be kept in animal rooms and food containers should not be transferred from room to room. Perishable items, such as fruit and vegetables, should be refrigerated if possible. All food should be stored in such a way as to minimize contamination, deterioration or spoilage, and to avoid potential spread of disease agents. Manufactured foods should generally not be stored longer than three to six months to avoid nutritional loss. Commercial feed manufacturers provide information on shelf life of the product.

Water

Animals should have continuous access to fresh, potable uncontaminated drinking water and the watering method chosen should minimize the spread of disease. Watering devices, such as drinking tubes and automatic waterers, should be examined at least once a day to ensure their proper operation. It is better to replace water bottles than to refill them; if refilled, care should be taken that each bottle is replaced on the cage from which it was removed. Where more than one animal is in a cage, there should be an adequate number of watering points.

Veterinary Health

Prevention of disease and alleviation of (both acute and chronic) pain and distress should be the primary objective of veterinary care, in collaboration with a behavioral management program. In addition to good husbandry practices, there are a variety of activities that should be considered. The following aspects of the veterinary program are important at all types of primate holding and using facilities, including suppliers, laboratories, zoos, education centers, and retirement centers.

(1) Veterinarian:

Every supplier, holder or user of primates should designate a qualified veterinarian who has training or experience in primate husbandry to oversee a program of preventive medicine and care. The veterinarian should consult with a behavior specialist regarding programmatic issues which pertain to the behavioral health of primates, socializations, separations, training for procedures, etc. Daily observation of all animals is crucial and can be accomplished by trained technicians who report directly to a veterinarian. The veterinarian should also contribute to the establishment of appropriate institutional policies and procedures and assist in reviewing research proposals. The veterinarian should collaborate with a primate specialist, especially the methods of preventing or minimizing pain and distress, and design a program of health monitoring and prophylaxis. All animals should be observed daily for signs of illness, injury or abnormal behavior by a person trained to recognize such symptoms. All such cases should be reported to the attending veterinarian and the specialist as required and appropriate action taken.

(2) Health Screening, Prophylactic Treatment and Immunization:

Institutions holding, breeding and using primates should have a routine prophylactic regime to prevent and control disease. It is recommended that each primate receive a physical exam by the veterinarian on an annual, or as needed, basis. A proper physical exam, including a thorough dental exam, will usually require sedation for the safety of the primate and examiner. Body weight should be accurately measured on a periodic basis.

Serum samples should be collected, preferably at yearly intervals, from colony animals and frozen for possible future needs, such as disease outbreaks. Periodically, feces should be examined microscopically for evidence of parasites. Primates held outdoors should be immunized against tetanus. Other immunizations, prophylaxis and routine screening tests are available and should be employed as needed depending on exposure risk. More detail can be found in the **Code of Practice 3**.

Geriatric primates and those with special conditions or chronic illness, such as arthritis or diabetes may need additional health monitoring and special medical care.

A necropsy should be performed on all primates that die or are euthanized. This should be done by or under the supervision of the veterinarian.

(3) Zoonoses:

The control of zoonotic disease is a fundamental aspect of the veterinary program for captive primates. Many pathogens can be transmitted from humans to nonhuman primates. The risks of such transmission vary by species of primate and situation. Each institution should have written

policies and procedures that minimize the threat to animal health from human staff or visitors. Such procedures may include required screening and immunization of human workers, volunteers and visitors, and use of masks and other protective equipment. In some cases, humans with contagious respiratory disease may need to be barred from exposure to the primates until the condition is resolved.

(4) Prevention, Alleviation, and Control of Pain and Distress:
Any primate which is injured, ill, or suffering from pain or discomfort should be treated appropriately by the veterinarian, to include appropriate use of analgesics, tranquilizers and anesthetics, where needed. Behavioral disorders and anxiety may also require treatment with psychoactive medication if behavioral therapy fails. There should be clear documentation of which behavioral disorders are being considered and why psychoactive medication is the intervention of choice. The veterinarian working in collaboration with the behavior specialist may also "prescribe" various adjunctive relief measures such as specific housing or husbandry practices, nursing care, physical therapy, behavioral therapy, or enrichments. It should be recognized that there are many forms of pain, discomfort, stress, and distress, including nausea, anxiety, and pruritis. Alleviation of these may require direct intervention with analgesics, tranquilizers, and/or other agents, in addition to the treatment of underlying disease or injury. In some cases, humane euthanasia is the most appropriate way to prevent or relieve pain or distress.

(5) Surgery and Other Procedures:
Good surgical techniques, appropriate anesthesia and analgesia, proper instrumentation and competent pre- and post-operative care are all essential to the welfare of the animal and the success of the surgery. Aseptic surgery should be conducted only in facilities intended for that purpose. Surgical areas must be maintained to ensure cleanliness, and surgeries must be performed with aseptic procedures, directly supervised by trained, experienced personnel. Appropriate facilities and equipment should be available for post-surgical care. Minor surgical procedures, such as wound suturing and certain biopsies, can be performed under less stringent conditions, but not in the animal house.

Monitoring of animals for the assessment of procedural and post-procedural pain should be undertaken by appropriately trained personnel. Protocols for the alleviation of pain and for treatment of infection or wound breakdown should be under direct veterinary control and should be initiated in good time. Post-surgical pain can be largely prevented by administering 'pre-emptive analgesia' before or during surgery, in conjunction with post-operative pain management. Retrospective analysis or review of the peri-operative care plan should be carried out and any improvements identified should be incorporated in subsequent protocols.

Several long-acting analgesics are available to treat post-operative pain. If shorter acting agents are used, care must be taken to ensure that trained personnel observe the animal before the end of expected duration of action of the agent and can re-administer the subsequent dose of analgesic. This may require night-time monitoring and treatment. Videotaped monitoring may be required or useful as an adjunct to human monitoring to identify any animal needing additional analgesia post-operatively.

It is recommended that surgeries be scheduled as early in the day and in the work week as possible to allow the longest period of post-operative monitoring during regular work hours and to avoid the onset of complications at night or on a weekend.

Behavioral Health

Breeders, users and care staff should be aware of the natural history of the animals and where variations in conditions and practices may impinge upon welfare, so as to refine these where possible. Such predictive factors include: early weaning, the time when first placed in single housing, tenure in species-typical social groups, number of veterinary procedures experienced, etc. It is important to be able to recognize precursors to abnormal behavior and to deal with them in a timely fashion.

Ongoing assessments should be conducted to monitor for abnormal behaviors indicating that animals are unable to cope with their environment and appropriate action taken as necessary (e.g., housing and husbandry practices should be examined and changed so that such behaviors are reduced). For animals used long-term, additional consideration should be given to ensure that their behavioral, social and physiological needs are adequately met which may require additional resources. In addition to the ongoing poor welfare of the individual, the need to retain animals showing marked abnormal behavior in scientific studies should be seriously questioned as there is a strong possibility that such animals may skew scientific data when used in some areas of research and testing.

7. BREEDING IN CAPTIVITY

The only satisfactory solution for ensuring the future supply of primates for biomedical needs of laboratories or zoological parks is captive propagation. Primate breeding programs, while strongly encouraged as an alternative to the use of wild-caught animals, should be undertaken only in those institutions with proper facilities and experienced personnel. A population management plan should be carefully constructed to ensure the health and assurance of a viable population for the program's needs. Institutions should be aware of the welfare requirements of species and individuals, and manage their breeding systems to ensure good welfare. Ideally, breeding systems should mimic those found in the wild, both in approximate numbers in naturally occurring groups and sex ratios. This is, however, frequently compromised due to environmental, caging or research constraints. The main breeding systems commonly practiced are summarized below.

Animals chosen for breeding should be selected on the basis of health, genealogy, behavior, temperament, conformation, potential reproductive performance and mothering ability; and these should be reviewed regularly. The duration of breeding life should be determined by the condition of the animal and its role in the colony. For all species, birth by Caesarean section should not be permitted on more than two occasions, unless justified by scientific need.

Captive primate collections should not rely on the import of wild caught primates for the continuation of their programs, but rather use alternative means to introduce new stock into their

breeding populations (e.g., exchange individuals with other known breeding colonies; accept legally rescued or confiscated individuals).

Good communication between breeder and user is essential to match supply and demand as closely as possible and to ensure continuity of husbandry and care. Where animals are to be handled frequently by the user, there is benefit in carefully habituating them to the presence and behavior of humans during early development. Familiarity with humans makes it possible for care staff to observe uninterrupted behavioral patterns and minimizes the stress involved with handling.

Animals will normally successfully rear single or twin offspring without intervention. However, a management policy for rejected infants is required to minimize suffering in these animals. In the case of sanctuaries and rescue centers, hand-rearing of confiscated primates is the norm (see **Code of Practice 1** for hand-rearing guidelines). A re-examination and amendment of management practices is recommended in order to reduce the incidence of infant rejection. It is important for primates to grow up in stable social groups, preferably their natal group with their mothers, if social interactions and parenting skills are to develop adequately. It is, therefore, preferable to leave young animals, and especially future breeding animals, in their natal colony until they have become independent. This is the best way to establish long-term breeders that will lead to self-sustaining colonies. Should young animals, for their own welfare, have to be weaned or separated earlier, it is advisable to incorporate them into a well-organized group to avoid damage to their social development, behavior, physiology and immune competence. The appropriate age ranges for weaning will depend on the species and the individual; clinical and behavioral indicators should be used to make this determination (see **Code of Practice 1**).

Free-Ranging and Outdoor Enclosures

This system requires large enclosures or an island. Advantages include more efficient utilization of natural outdoor space, less labor, and the provision of continuous exercise, habitat variability, and social interactions for the animals. Disadvantages include difficulties in identifying, monitoring and capturing animals, questionable or unknown parentage and animals that are relatively more stressed by human interaction. The risk of disease transfer from vectors is increased and consequently appropriate disease-prevention measures need to be taken. In addition, unless the climate permits, indoor provision is required for cold and/or wet periods. Multiple food and water sites must be available. Animals should be habituated to humans and trained to enter smaller cages or enclosures for sample collections or examination.

Harem Groups

This method is similar to free ranging but groups are generally comprised of 1-2 males and 4-12 females. This allows accurate paternal determination (when one male is used) but, with most species, it is not possible to determine precise conception dates. The harem system allows more accurate monitoring of health status and breeding, compared with the free-ranging system, but the restricted space means greater potential for instability of the hierarchy. Therefore, groups must be closely monitored to check whether any animal is being excessively harassed and that all animals have adequate access to food and water and shelter. The provision of environmental

enrichment and visual barriers is important. Harem mating systems for macaques are recommended in preference to timed mating strategies because offspring reared in this way show fewer social abnormalities.

Timed Mating Strategies

Timed mating strategies should not be followed except for taxa that have a solitary social system or where specific reproductive data are required. While the breeding of individually caged animals is typically practiced in research colonies, timed mating strategies should not be routinely followed unless the time of mating needs to be known for scientific purposes. Using this method, females are caged individually or in small groups and introduced to a male during their fertile period. In addition to the increased labor and expense, the disadvantage of this system is a compromise in social interaction for both mother and infant and social disruption for the father.

Family Groups

Monogamous species live in family groups in the wild and can be maintained as family groups in captivity. Depending upon the species, consideration must be given to reproductive suppression of subordinate animals and to the appropriate removal time of matured progeny to avoid fighting and inbreeding.

Rearing and Weaning of Primates

To ensure normal psychological development, a complex and stimulating rearing environment must be provided. Allowing infants to grow with their mothers and in a social group is necessary for normal development. Infants should not be separated from their natal group at an early age but should remain with their mother until weaning age which varies greatly between species. Hand-rearing should only be carried out if the health of the infant (or mother) is in jeopardy.

8. EXPERIMENTAL AND ETHICAL CONSIDERATIONS

The IPS endorses the efforts of the Institute of Laboratory Animal Research (ILAR) National Research Council's "Guide for the Care and Use of Laboratory Animals" which is recognized as the standard for quality animal care and use in many countries around the world. The ILAR has developed international guiding principles for research involving laboratory animals. These principles are reproduced as **Annex 6**. In addition, the following principles, relating more specifically to primates, should be adhered to.

Assessment of the ethical and welfare implications of any primate use should encompass the entire life history of the animals concerned. This is essential for fair and proper harm-benefit assessment; weighing on one hand the welfare impact of acquisition and transport, housing in captivity, laboratory husbandry and the necessary scientific procedures, and on the other hand, the possible beneficial outcomes of the research for humans and animals.

Physical Restraint

Primates of many species can be quickly trained using positive reinforcement techniques to co-operate with a wide range of scientific, veterinary and husbandry procedures (such as presenting a limb for a blood collection, giving urine samples on request, and co-operating with capture and immobilization procedures). Such training is advocated whenever possible, using positive reinforcement techniques as a less stressful alternative to traditional methods using physical restraint. Techniques that reduce or eliminate adverse effects not only benefit animal welfare but can also enhance the quality of scientific research, since suffering in animals can result in physiological changes which are, at least, likely to increase variability in experimental data and, at worst, may even invalidate the research. Staff should be given formal training in these operant conditioning techniques.

Restraint procedures should be used only when less stressful alternatives are not feasible. Animals to be placed in restraint equipment should receive prior conditioning using positive reinforcement. The method used and period of restraint should be the minimum required to accomplish the research objectives. Brief physical restraint of primates for examination, collection of samples, and a variety of other clinical and experimental manipulations can be accomplished manually or by administering chemical agents, such as ketamine hydrochloride, if necessary (for basic restraint and handling methods see Fowler, 1995; Bush, 1996).

Disarming the canines of extremely aggressive male primates by removal or reduction has occasionally been performed to protect other animals in the social group and preserve the social grouping. It is strongly recommended that this procedure should not replace sound behavioral management. Dental disarming should only be performed for health reasons or approved research projects. It should not be performed to facilitate pet keeping or human handling (see the American Association of Veterinary Medicine [AVMA] position statement on removal or reduction of canine teeth in primates. http://www.avma.org/issues/policy/animal_welfare/teeth_removal.asp

Chronic Pain

Primates more closely resemble humans than any other animal model in manifesting chronic diseases that are major public health problems, making them the preferred animal models for these conditions (http://pin.primate.wisc.edu/research/pibr/p39-41.html). A wealth of literature documents chronic conditions in primates that in humans are associated with chronic pain. Most prominent among these are spondylarthropathies and osteoarthritis which are common conditions seen in captive primates (Rothschild and Woods, 1992). These and other diseases (e.g., AIDS) are reported to be associated with chronic physical pain or discomfort in humans, and are also likely to incur pain in primates. While chronic pain is often difficult to treat in humans without incurring possible adverse side effects, humans still routinely take pain relief when they are experiencing physical discomfort.

Suffering in research animals should be reduced to a minimum following Russell and Burch's (1992) principle of refinement. Staff must be trained to recognize species-specific behavioral and physiological indicators of possible acute and chronic pain and have a treatment program in place for the alleviation of pain. If for scientific reasons, investigators propose to withhold pharmacological treatment for chronic pain in conditions associated with chronic pain in

humans, it must be stated explicitly and approval for withholding analgesics must be obtained from the relevant regulatory body. Additionally, there is an extensive literature for humans on the relationship between chronic pain and depression (Bair *et al*., 2003) and increasingly there is awareness in captive primate facilities of the need to identify and treat these conditions (Bentson *et al*., 2005; Shively *et al*., 2005, 2006). In the following section, some behaviors that have been associated with acute pain in primates are presented.

Anesthesia and Analgesia

Primates typically show little reaction to surgical procedures or to traumatic injury. Obvious signs of pain are not readily seen. However, signs of pain may include:

- reduced appetite and/or reduced interest in food treats;
- avoiding companions;
- poor or absent grooming;
- increased attention from cage mates;
- facial contortions, clenching of teeth;
- restlessness and shaking accompanied by grunts or groans;
- self mutilation;
- huddling in a crouched posture, head pressing, touching or pushing or scratching affected area, favoring limb(s), reduced movement, increased or decreased aggressiveness toward caregivers, and other changes in behavior.

The proper use of anesthetics, analgesics and tranquillizers in primates for the control of acute and chronic pain and stress is necessary for humane and scientific reasons. Federal regulations in the U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training, state that "…minimization of discomfort, distress, and pain when consistent with good scientific practices, is imperative." Unless the contrary is established, investigators should consider that procedures that cause pain or distress in human beings may cause pain or distress in other animals (http://www.absc.usgs.gov/research/vet/policies/IRACPRIN.htm). Furthermore, the National Institutes of Health (NIH) state that, "Procedures that may cause more than momentary or slight pain or distress to the animals will be performed with appropriate sedation, analgesia, or anesthesia, unless justified for scientific reasons in writing by the investigator". The use of the most appropriate drug is a matter for the attending veterinarian's professional judgment. The veterinarian should provide research personnel with guidelines and advice concerning choice and use of these drugs. Muscle relaxants or paralytic drugs are not anesthetics and must not be used alone for surgical restraint. Paralytic (e.g., curariform) drugs should not be used without full anesthesia (http://www.nap.edu/readingroom/books/labrats/; see Section 3 - Pain, Analgesia, and Anesthesia).

If a procedure would be expected to cause pain or distress in humans, then assume it will do so in nonhuman primates unless specific evidence to the contrary. Pain or distress is manifested in many forms (e.g., nausea, fear, anxiety, pruritis). Therefore, projects should be examined to identify all procedures or stages where pain or distress may be inflicted upon the animal.

If a painful procedure needs to be performed without the use of an analgesic because it would defeat the purpose of an experiment, the experimental procedure (without analgesics), justification for withholding analgesia, monitoring protocol, and endpoint(s) must be incorporated into the animal use protocol and approved by the IACUC prior to implementation.

Food and Water Deprivation

There are a number of alternatives to the traditional use of food and water deprivation. If this practice is absolutely scientifically necessary for research, it should be for as short a time as possible. Periodic breaks should be given, and changes in body weight should be carefully monitored. A good rapport between the human trainer and animal is important for successful training with positive reinforcement. Food and/or water deprivation should not be resorted to as a substitute for good training skills.

Multiple Procedures

Severe procedures should only be used in situations where the potential scientific value of the experiment is significant and a less stressful alternative method does not exist. If an animal is subjected to a procedure likely to cause significant pain or suffering, repetition of the same or other painful procedures is discouraged. Consider all the potential welfare costs to each individual, including those associated with housing and husbandry, when making a decision about re-use or continued use.

The relocation of an ex-breeding animal at the end of a useful breeding life to a user establishment for use in scientific procedures is likely to have adverse welfare effects. However, the use of ex-breeding animals must be weighed against the use of a new experimental animal as the alternative. Knowledge of the breeding animal's temperament and history will assist with making the best informed decision on an appropriate assignment.

Euthanasia

Euthanasia, or the killing of animals rapidly and painlessly, should be carried out by trained and competent personnel using recognized, acceptable techniques. The most appropriate method for primates is first to administer a sedative (e.g., ketamine) to reduce the need for restraint during administration, and then an overdose of barbiturates (see The 2000 Report of The AVMA Panel on Euthanasia: http://www.avma.org/issues/animal_welfare/euthanasia.pdf). Intravenous, but not intraperitoneal, administration of barbiturates is recommended. Inhalation of anaesthetics is used in studies where perfused tissue must be collected but is not recommended for routine use. Euthanasia of primates should ideally be conducted in an area separate from other primates. Stress prior to euthanasia may be minimized by training primates to cooperate with relocation to the procedures room and with the process of restraint.

Retirement

When animals are placed in retirement, the quality of life which the individual experiences is the crucial consideration, in view of the adaptation to new social and environmental conditions the individual must make and its likely future.

Health and behavior records should follow primates to all of the subsequent facilities where they are kept. Laboratories should advise retirement centers and any other recipient facilities of any major surgery, experimental procedures, or agent exposures, which may have bearing on the plan of health monitoring and disease at the subsequent facilities, or may affect the interpretation of laboratory results. The purpose of this is also to allow recipient facilities to be aware of any special housing, husbandry, or veterinary care that is needed, and to anticipate clinical signs of latent complications. This can be done in a way that achieves these objectives, without compromising proprietary information.

Retirement centers should provide the same quality of housing and care as other types of facilities with primates. Those which house primates that have previously been used in infectious disease research with human pathogens will need to take special precautions to protect human safety and health and to protect the primates from long-term sequelae.

Since many of the primates at retirement centers are likely to be geriatric, the veterinary program should focus on early detection and management of geriatric conditions. Obesity is also a major cause of illness at retirement centers.

ANNEX 1

SELECTED REFERENCES

Acha, P.N. and Szyfres B. (2003). *Zoonoses and Communicable Diseases Common to Man and Animals, 3rd Edition. Vol. III: Parasitoses*. Pan American Health Organization (PAHO), Washington, D.C.

American Association of Zoo Veterinarians (AAZV). (2006). *Guidelines for Euthanasia of Nondomestic Animals*. http://www.aazv.org/displaycommon.cfm?an=1&subarticlenbr=441

American Veterinary Medical Association (AVMA.). (2005). *Animal Welfare Position Statements*. http://www.avma.org/issues/animal_welfare/default.asp

American Veterinary Medical Association Panel on Euthanasia. (2001) 2000 report of the AVMA panel on euthanasia. *Journal of the American Veterinary Medical Association.* 218, No.5: 669-696.

American Psychological Association. (1985). *Guidelines for Ethical Conduct in the Care and Use of Animals.* American Psychological Association, Washington D.C. http://www.apa.org/science/anguide.html

Ancrenaz, M., Setchell, J.M. and Curtis, J. (2003). Handling, anaesthesia, health evaluation and biological sampling. In: Setchell, J. and Curtis, D. (eds.), *Field and Laboratory Methods in Primatology,* Cambridge University Press, Cambridge, pp. 122-139.

Animal Welfare Information Center. (2003). *Animal Welfare Act and Regulations*. http://www.nal.usda.gov/awic/legislat/usdaleg1.htm

Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) International. (2006). *Accreditation Position Statements*. http://www.aaalac.org/accreditation/positionstatements.cfm; International regulations: http://www.aaalac.org/resources/internationalregs.cfm

Bair, J.M., Robinson, R.L., Katon, W. and Kroenke, K. (2003). Depression and pain comorbidity: A literature review. *Archives of Internal Medicine* 163: 2433-2445.

Bankowski, Z. and Jones, N.H. (1983). Biomedical Research Involving Animals. *Proceedings of the XVIIth CIOMS Round Table Conference,* Geneva.

Bennett, B.T., Abee, C.R. and Henrickson, R. (1995). *Nonhuman Primates in Biomedical Research: Volume 1, Biology and Management.* Academic Press, New York.

Bennett, B.T., Abee, C.R., and Henrickson, R. (1998) *Nonhuman Primates in Biomedical Research: Volume 2, Diseases.* Academic Press, New York.

Bentson, K.L., Crockett, C.M., Montgomery, H.B., Anderson, D.M. and Kelley, S.T. (2005). Floating limb activity: Possible clues to physiological underpinnings. *American Journal of Primatology* 66: 181-182.

Berry, D.J. (1991). *Reference Materials for Members of Animal Care and Use Committees*. AWIC Series #10, Department of Agriculture, National Agricultural Library, Beltsville.

Biological Council. (1987). *Guidelines in the Use of Living Animals in Scientific Investigations, 2nd Edition*. The Biological Council, London.

Buchanan-Smith, H.M., Prescott, M.J. and Cross, N.J. (2004). What factors should determine cage size for primates in the laboratory? *Animal Welfare* 13: S197-S201.

Buchanan-Smith, H.M., Rennie, A.E., Vitale, A., Pollo, S., Prescott, M.J. and Morton, D.B. (2005). Harmonising the definition of refinement. *Animal Welfare* 14: 379-384.

Bush, M. (1996). Methods of capture, handling and anesthesia. In: Kleiman, D.G.; Allen, M.E., Thompson, K.V. and Lumpkin, S. (eds.), *Wild Mammals in Captivity: Principles and Techniques*, University of Chicago Press, Chicago, pp. 25-40.

Canadian Council on Animal Care. (1993). (Adopted May 1999). *Guide to the Care and Use of Experimental Animals, Vol. 1, 2nd Edition*. Canadian Council on Animal Care, Ottowa.

Centers for Disease Control and Prevention (CDC). (1987). Guidelines for Prevention of Herpesvirus Simiae (B Virus) Infection in Monkey Handlers. *Morbidity and Mortality Weekly Report* 36(41): 680-682, 687-689. http://www.cdc.gov/mmwr/preview/mmwrhtml/00015936.htm

Centers for Disease Control and Prevention (CDC). (1999). *Biosafety in Microbiological and Biomedical Laboratories*, *4th Edition*. U.S. Department of Health and Human Services, Public Health Service, Bethesda. http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm

Cohen, J.I., Davenport, D.S., Stewart, J.A., Deitchman, S. Hilliard, J.K., Chapman, L.E. and the B Virus Working Group. (1995). Guidelines for the prevention and treatment of B Virus infection in exposed persons. *Clinical Infectious Diseases* 20: 421-439. http://www.cdc.gov/ncidod/diseases/BVIRUS.pdf

Convention on International Trade in Endangered Species (CITES). (2006). Appendices I, II and III. http://www.cites.org/eng/app/appendices.shtml

Council of Europe. (1989.) (Adopted May 1999). *Council Directive on the Introduction of Measures to Encourage Improvement in the Safety and Health of Workers at Work*. Directive 89/391/EEC.

Council of Europe. (2004). *European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes*, ETS No. 123. Council of Europe Strasbourg, France.

Crandall, L.S. (1964). *The Management of Wild Mammals in Captivity*. University of Chicago Press, Chicago.

Denison, R.A. and Balbus, J.M. (2006). Environmental Defense Perspective on Integrated Approaches to Chemical Testing and Assessment. *Focus Session, Proceedings of the 39th Joint Meeting of the Chemicals Committee and Working Party on Chemicals, Pesticides and Biotechnology, 15-17 February 2006.* http://www.oecd.org/dataoecd/19/34/36286018.pdf

Diehl, K.H., Hull, R., Morton, D., Pfister, R., Rabemampianina, Y., Smith, D., Vidal, J.M. and van de Vorstenbosch, C. (European Federation of Pharmaceutical Industries Association and European Centre for the Validation of Alternative Methods). (2001). A good practice guide to the administration of substances and removal of blood, including routes and volumes. *Journal of Applied Toxicology*. 21(1): 15-23.

Erwin, J., Maple, T.L. and Mitchell, G. (1979). *Captivity and Behavior: Primates in Breeding Colonies, Laboratories and Zoos.* Van Nostrand Reinhold, New York.

European Commission. (1995). (Adopted May 1999). *Euthanasia of Experimental Animals*. DGXI.

European Commission. Health and Consumer Protection Directorate-General. Scientific Committee on Animal Health and Welfare. (2003). *The Welfare of Non-Human Primates Used in Research*. http://europa.eu.int/comm/food/fs/sc/scah/out83_en.pdf

European Union. 1986. (Adopted May 1999). *Council directive on the approximation of laws, regulations and administrative provisions of the member states regarding the protection of animals used for experimental and other scientific purposes*. Directive 86/609/EEC. http://ec.europa.eu/food/fs/aw/aw_legislation/scientific/86-609-eec_en.pdf
For general info: http://ec.europa.eu/environment/chemicals/lab_animals/revision_en.htm

Federation of European Laboratory Animal Science Associations (FELASA). (1995). Recommendations on the education and training of persons working with laboratory animals: Categories A and C. *Laboratory Animals* 29: 121-131. http://www.lal.org.uk/pdffiles/LAfel7.PDF

Federation of European Laboratory Animal Science Associations (FELASA). (1997). Sanitary aspects of handling non-human primates during transport. *Laboratory Animals* 31: 298-302. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=9350699&dopt=Citation

Federation of European Laboratory Animal Science Associations (FELASA). (1999a). Guidelines: Education of specialists in laboratory animal science (Category D). *Laboratory Animals* 31: 1-15. http://www.lal.org.uk/pdffiles/LAfel3.PDF

Federation of European Laboratory Animal Science Associations (FELASA). (1999b). Health monitoring of non-human primate colonies. *Laboratory Animals* 33: S3-S18. http://www.lal.org.uk/pdffiles/LAfel5.pdf

Federation of European Laboratory Animal Science Associations (FELASA). (2000). Recommendations for the education and training of persons carrying out animal experiments (Category B). *Laboratory Animals* 34: 229-235. http://www.lal.org.uk/pdffiles/lafel6.pdf

Federation of European Laboratory Animal Science Associations (FELASA). (2001). *FELASA Quick Reference Guide on Nutrition*. http://www.felasa.eu/Documents/Nutrition.rtf

Fiennes, R.N.T.W. (1972). *Pathology of Simian Primates. Part I, General Pathology: Part II, Infectious and Parasitic Diseases*. Karger, Basel.

Fowler, M.E. (1995). *Restraint and Handling of Wild and Domestic Animals, 2nd Edition*. Iowa State University Press, Ames.

Fulk, R. and Garland, C. (1992). *The Care and Management of Chimpanzees* (*Pan troglodytes*) *in Captive Environments.* North Carolina Zoological Society, Asheboro.

Gibson S. (1998). Bacterial and mycotic diseases. In: Bennett, B.T., Abee, C.R., and R. Henrickson (eds.) *Nonhuman Primates in Biomedical Research: Vol. 2, Diseases.* Academic Press, London, pp. 59-111.

Greensmith, M.L., Van Hoosier, G.L. and Hau, J. (2002). *Handbook of Laboratory Animal Science. Vol. 1*. CRC, Boca Raton.

Groves, C.P. (2001). *Primate taxonomy.* Smithsonian Institution Press, Washington, D.C.

Hart, L.A. (2003). Guidelines for the care and use of mammals in neuroscience and behavioral research: Responsible conduct with animals in research. *Occupational Health and Safety in the Care and Use of Nonhuman Primates*. National Research Council. Washington, D.C.

Hau, J. and Van Hoosier, G. L. (2003). *Handbook of Laboratory Animal Science*, *Vol. 2*. CRC, Boca Raton.

Hau, J. and Van Hoosier, G. L. (2005). *Handbook of Laboratory Animal Science, Vol. 3*. CRC, Boca Raton.

Honess, P.E., Johnson, P.J. and Wolfensohn, S.E. (2004). A study of behavioural responses of non-human primates to air transport and re-housing. *Laboratory Animals* 38(2): 119-132.

Institute for Laboratory Animal Research (ILAR). (1996). *Guide for the Care and Use of Laboratory Animals,* National Research Council, Bethesda. http://www.aaalac.org/resources/theguide.cfm
Unformatted text version: http://www.nap.edu/readingroom/books/labrats/chaps.html

Institute for Laboratory Animal Research (ILAR). (1998). *The Psychological Well-Being of Nonhuman Primates: A Report of the Committee on Well-Being of Nonhuman Primates*. National Academies Press, Washington, D.C. http://www.nap.edu/books/0309052335/html/index.html

Institute for Laboratory Animal Research (ILAR). (2004). *The Development of Science-Based Guidelines for Laboratory Animal Care: Proceedings of the November 2003 International Workshop.* National Academies Press, Washington, D.C. http://www.nap.edu/books/0309093023/html

Institute for Laboratory Animal Research (ILAR) Committee on Guidelines for the Humane Transportation of Laboratory Research Animals. (2006). *Guidelines for the Humane Transportation of Research Animals*. National Academies Press, Washington, D.C. http://newton.nap.edu/catalog/11557.html#toc

Institute for Laboratory Animal Research (ILAR) Committee on Nonhuman Primates, Subcommittee on Care and Use. (1980). Laboratory Animal Management: Nonhuman Primates. *ILAR News* 23(2-3): l-44.

Interagency Research Animal Committee (IRAC) Recommendation on LD50 Testing. (1993). http://oacu.od.nih.gov/ARAC/iracld50.pdf

International Primatological Society. (1993). IPS International Guidelines for the Acquisition, Care and Breeding of Nonhuman Primates. Codes of Practice 1-3. *Primate Report* 35: 3-29. http://pin.primate.wisc.edu/ips/codes.txt

International Air Transport Association. (2006). *Live Animal Regulations. 33rd Edition*. International Air Transport Association, Montreal. http://www.iata.org/ps/publications/9105.htm

IUCN/SSC Re-introduction Specialist Group. (1998). *IUCN/SSC Guidelines on Re-introduction*. IUCN, Gland. http://www.iucn.org/themes/ssc/sgs/rsg/rsgcdrom/PDFs/English.pdf

Jolly, C.J., Phillips-Conroy, J.E. and Müller, A.E. (2003). Trapping primates. In: Setchell, J. and Curtis, D. (eds.), *Field and Laboratory Methods in Primatology,* Cambridge University Press, Cambridge, pp. 110-121.

Jones-Engel, L., Schillaci, M.A. and Engel, G. (2003). Interaction between humans and nonhuman primates. In: Setchell, J. and Curtis, D. (eds.), *Field and Laboratory Methods in Primatology,* Cambridge University Press, Cambridge, pp. 15-24.

Jones-Engel, L., Engel, G.A., Heidrich, J., Chalise M., Poudel, N., Viscidi, R., Barry, P., Allan, J., Grant, R. and Kyes, R. (2006). Temple monkeys and health implications of commensalism, Kathmandu, Nepal. *Emerging Infectious Diseases* 12: 900-906. http://www.cdc.gov/ncidod/eid/vol12no06/06-0030.htm

Laule, G.E., Bloomsmith, M.A. and Schapiro, S.J. (2003). The use of positive reinforcement training techniques to enhance the care, management and welfare of laboratory primates. *Journal of Applied Animal Welfare Science.* 6: 163-173.

Lindburgh, D.G. (1989). *The Macaques: Studies in Ecology, Behavior and Evolution.* Van Nostrand Reinhold, New York.

Mansfield, K. and King, N. (1998). Viral diseases. In: Bennett, B.T., Abee, C.R. and Henrickson, R. (eds.), *Nonhuman Primates in Biomedical Research: Vol. 2, Diseases,* Academic Press, London, pp. 1-57.

Medical Research Council (MRC). (2004). *Best practice in the accommodation and care of primates used in scientific procedures*. MRC Ethics Guide. http://www.nc3rs.org.uk/downloaddoc.asp?id=92

National Centre for the Replacement, Refinement and Reduction for Animals in Research (NC3Rs). (2006). *NC3Rs Guidelines: Primate Accommodation, Care andUuse*. www.bbsrc.ac.uk/funding/news/NC3RsPrimateGuidelinesSep06.pdf

National Institutes of Health (NIH). (1988). *Institutional Administrator's Manual for Laboratory Animal Care and Use.* National Institutes of Health, Bethesda.

National Institutes of Health, Office of Laboratory Animal Welfare (NIH/OLAW), Policies and Laws. *Public Health Service Policy on Humane Care and Use of Laboratory Animals* (Amended August, 2002). http://grants.nih.gov/grants/olaw/references/phspol.htm
For general info: http://grants.nih.gov/grants/olaw/olaw.htm

National Institutes of Health/Office for the Protection from Research Risks (NIH/OPRR). (1989). Animal care and use: policy issues in the 1990's. *Proceedings of NIH/OPRR Conference,* Bethesda.

National Research Council (NRC) Committee on Animal Nutrition. (2003). *Nutrient Requirements of Nonhuman Primates, Second Edition*. National Academies Press, Washington, D.C.

National Research Council (NRC) Committee on Guidelines for the Use of Animals in Neuroscience and Behavioral Research. (2003). *Guidelines for the Care and Use of Mammals in Neuroscience and Behavioral Research*. National Academies Press, Washington, D.C.

National Research Council (NRC) Committee on Occupational Health and Safety in the Care and Use of Nonhuman Primates. (2003). *Occupational Health and Safety in the Care and Use of Nonhuman Primates.* National Academies Press, Washington, D.C.

Office of Laboratory Animal Welfare (OLAW). (2005). *Guidelines for Investigating and Reporting Animal Care and Use Concerns.* Adapted from the OLAW/ARENA Institutional Animal Care and use Committee Guidebook. Approved Feb. 2005, Revised Oct. 2005. http://www.ncifcrf.gov/rtp/lasp/intra/acuc/fred/guidelines/ACUC_Concerns.pdf

Office of Laboratory Animal Welfare (OLAW) and Applied Research Ethics National Association. (2002). *Institutional Animal Care and Use Committee Guidebook. 2nd Edition*. Office of Laboratory Animal Welfare. Bethesda.
http://grants2.nih.gov/grants/olaw/GuideBook.pdf

Office of Laboratory Animal Welfare (OLAW), National Institutes of Health (NIH). (2002). *Public Health Service Policy on Humane Care and Use of Laboratory Animals.* Office of Laboratory Animal Welfare, Bethesda.

Olfert, E.D., Cross, B.M. and McWilliam, A.A. (1993). *Guide to the Care and Use of Experimental Animals*, *Vol. 1: 2nd Edition*. Canadian Council on Animal Care (CCAC). Ottowa.

Organisation for Economic Co-operation and Development (OECD). (November 2000). *Guidance document on the recognition, assessment, and use of clinical signs as humane endpoints for experimental animals used in safety evaluation.* Environmental Health and Safety Publications, Series on Testing and Assessment, No. 19.

Organisation for Economic Co-operation and Development (OECD). (2001). *Test Guideline 401 will be deleted: A Major Step in Animal Welfare: OECD Reaches Agreement on the Abolishment of the LD_{50} Acute Toxicity Test.*
http://www.oecd.org/document/52/0,2340,en_2649_34377_2752116_1_1_1_1,00.html

Orlans, F.B., Simmonds, R.C. and Dodds, W. J. (1987). Effective animal care and use committees. *Laboratory Animal Science*. Special Issue. American Association for Laboratory Animal Science and Scientists Center for Animal Welfare, Cordova.

Ott-Joslin, J.E. (1993). Zoonotic diseases of non-human primates. In: Fowler, M.E. (ed.) *Zoo and Wild Animal Medicine.* WB Saunders, Philadelphia, pp. 358-373.

Poole T. B. (1999). *The UFAW Handbook on the Care and Management of Laboratory Animals. Vol. 1: Terrestrial Vertebrates, 7th edition*. UFAW, Herts.

Prescott M.J. (2001). *Counting the Cost: Welfare Implications of the Supply and Transport of Non-Human Primates for Use in Research and Testing*. Royal Society for the Prevention of Cruelty to Animals, Horsham, West Sussex.

Prescott, M.J. (2006). Finding new homes for ex-laboratory and surplus zoo primates. *Laboratory Primate Newsletter*. 45(3): 5-8. http://www.brown.edu/Research/Primate/lpn45-3.pdf.

Prescott, M.J. (2006). *Primate Sensory Capabilities and Communications Signals: Implications for Care and Use in the Laboratory*. NC3Rs #4. National Centre for the Replacement, Refinement and Reduction of Animals in Research, London. http://www.nc3rs.org.uk/news.asp?id=187

Prescott, M.J. and Buchanan-Smith, H.M. (2004). Cage sizes for tamarins in the laboratory. *Animal Welfare* 13: 151-158.

Prescott, M.J. and Jennings, M. (2004). Ethical and welfare implications of the acquisition and transport of non-human primates for use in research and testing. *Alternatives to Laboratory Animals*. 32(S1A): 323-327.

Prescott, M.J. Bowell, V.A. and Buchanan-Smith, H.M. (2005). Training laboratory-housed non-human primates, Part 2: Resources for developing and implementing training programmes. *Animal Technology and Welfare* 4: 133-148.

Reinhardt, V. (1997). Training nonhuman primates to cooperate during handling procedures: A review. *Animal Technology* 48: 55-73. http://www.awionline.org/Lab_animals/biblio/at55.htm

Reinhardt, V. (2002). Comfortable quarters for nonhuman primates in research institutions. In: Reinhardt, V. and Reinhardt, A. (eds.), *Comfortable Quarters for Laboratory Animals, 9th Edition*, Washington, D. C., Animal Welfare Institute, pp. 65-77. http://www.awionline.org/pubs/cq02/Cq-prim.html

Reinhardt, V. and Reinhardt, A. (2006). Annotated Bibliography on Refinement and Environmental Enrichment for Primates kept in Laboratories. *Animal Welfare Institute* http://www.awionline.org/lab_animals/biblio/index.html

Rennie, A.E. and Buchanan-Smith, H.M. (2006a). Refinement of the use of non-human primates in scientific research. Part I: the influence of humans. *Animal Welfare* 15: 203-213.

Rennie, A.E. and Buchanan-Smith, H.M. (2006b). Refinement of the use of non-human primates in scientific research. Part II: housing, husbandry and acquisition. *Animal Welfare* 15: 215-238.

Rennie, A.E. and Buchanan-Smith, H.M. (2006c). Refinement of the use of non-human primates in scientific research. Part III: refinement of procedures. *Animal Welfare* 15: 239-261.

Rhoades, R. H. (2002). *Humane Society of the United States Euthanasia Training Manual.* Humane Society of the United States. Washington, D.C.

Rosenblum, L.A. and Coe, C. L. (1985). *Handbook of Squirrel Monkey Research*. Plenum Press, New York.

Rothschild, B.M. and Woods, R.J. (1992). Erosive arthritis and spondyloarthropathy in Old World primates. *American Journal of Physical Anthropology* 88: 389-400.

Russell, W.M.S. and Burch, R.L. (1992). *The Principles of Humane Experimental Technique*. Methuen, London, 1959. UFAW, Herts. http://altweb.jhsph.edu/publications/humane_exp/het-toc.htm

Segal, E.F. (1989). *Housing, Care and Psychological Wellbeing of Captive and Laboratory Primates.* Noyes, Park Ridge.

Setchell, J.M. and Curtis, D.J. (2003). *Field and Laboratory Methods in Primatology: A Practical Guide*. Cambridge University Press, Cambridge.

Schillaci, M.A., Jones-Engel, L., Heidrich, J.E., Miller, G.P. and Froehlich, J.W. (2001). A field methodology for lateral cranial radiography of nonhuman primates. *American Journal of Physical Anthropology* 116: 278-284.

Shively, C.A., Register, T.C., Friedman, D.P., Morgan, T.M., Thompson, J. and Lanier, T. (2005). Social stress-associated depression in adult female cynomolgus monkeys *(Macaca fascicularis). Biological Psychology* 69: 67-84.

Shively, C.A., Register, T.C., Friedman, D.P., Gage, H.D., Bounds, M.C. and Clarkson, T.B. (2006). Neurobiological substrates of a relationhip between depression and atherosclerosis in adult female cynomolgus monkeys (*Macaca fascicularis). American Journal of Primatology* 68: 36-37.

Smith, J.A. and Boyd, K.M. (2002). *The Boyd Group Papers on the Use of Non-Human Primates in Research and Testing*. Leicester, British Psychological Society Scientific Affairs Board Standing Advisory Committee on the Welfare of Animals in Psychology. http://www.boyd-group.demon.co.uk/primatespapers.htm

Southwest Foundation for Biomedical Research. (1999). *Primates in Biomedical Research: The Need to Use Primates in Research*. Southwest Foundation for Biomedical Research Report of Progress, pp. 39-41. http://pin.primate.wisc.edu/research/pibr/p39-41.html

Swallow, J., Anderson, D., Buckwell, A.C., Harris, T., Hawkins, P., Kirkwood, J., Lomas, M., Meacham, S., Peters, A., Owen, S., Prescott, M., Quest, R., Sutcliffe, R. and Thompson, K. (2005). Guidance for the transport of laboratory animals. *Laboratory Animals* 39: 1-39.

United Kingdom Co-ordinating Committee on Cancer Research. (1997). *UKCCCR Guidelines for the Welfare of Animals in Experimental Neoplasia 2nd Edition*, London.

United States Department of Agriculture Animal and Plant Health Inspection Service. Animal Care. (July 15, 1999). *Final Report on Environment Enhancement to Promote the Psychological Well-Being of Nonhuman Primates.* USDA. Riverdale, Maryland: http://www.aphis.usda.gov/ac/eejuly15.html

Weed, J. and Raber, J. (2005). Balancing animal research with well-being: Establishment of goals and harmonization of approaches. *ILAR Journal* 46: 118-128.

Wolfensohn, S. and Honess, P. (2005). *Handbook of Primate Husbandry and Welfare.* Horizontal Blackwell, Ames and Oxford.

Wood, M. and Smith, M. (1999). *Health and Safety in Laboratory Animal Facilities*. Laboratory Animals Ltd. by Royal Society of Medicine Press, London.

World Health Organization. (1971). *Health Aspects of the Supply and Use of Non-Human Primates for Biomedical Purposes.* Technical Report Series No. 470. World Health Organization, Geneva.

ANNEX 2

THE AMERICAN ZOOS AND AQUARIUMS (AZA) PRIMATE ADVISORY GROUPS' PRIMATE PET TRADE POSITION STATEMENT

There is an active trade in pet primates in many areas of the U.S, where it is still possible to buy primates in pet stores, from private breeders and through animal dealers. The four primate advisory groups of AZA, the Prosimian TAG, the New World Primate TAG, the Old World Monkey TAG, and the Ape TAG, support the elimination of the trade in pet primates for the following reasons:

1) Pet primates pose a risk to public health and safety through communicable illness/diseases such as Herpes B, hepatitis, and intestinal pathogens and through injuries inflicted during sudden and unpredictable episodes of aggressive behavior.
2) Elimination of the legal trade in pet primates aids enforcement of federal legislation that prohibits private ownership of those nonhuman primates regulated by the Centers for Disease Control (Code of Federal Regulations Subchapter F - Quarantine, Inspection, and Licensing Part 71 Foreign Quarantine).
3) Pet primates are often maintained in inadequate housing and without consideration for their social and psychological needs.
4) There is an adverse impact on wild populations through the smuggling and import of primates that ultimately end up in the pet trade.
5) Pet primates are unable to contribute genetically to those conservation programs in which they are needed due to their isolation from the managed population and also in many cases to deficits in their social skills related to their rearing and maintenance in isolation from other nonhuman primates.

It is the consensus of AZA's primate advisory groups that ***education*** about primates and ***legislation*** to restrict the trade in primates as pets are likely to be the most effective means of curbing the trade in pet primates, and the following actions are encouraged among AZA institutions:

(1) manage zoo collections to eliminate the sale, trade or other disposition of zoo primates to individuals, or to animal dealers known to place primates with individuals;

(2) develop and produce materials for zoo visitors and potential primate buyers;

(3) cooperate with other organizations and agencies (including the American Society of Primatologists, animal advocacy groups where appropriate, and local municipal and legislative agencies) to develop and enact the legislation needed to restrict the trade in pet primates.

ANNEX 3

POLICY STATEMENT ON USE OF PRIMATES FOR BIOMEDICAL PURPOSES ADOPTED BY WORLD HEALTH ORGANIZATION (WHO) AND ECOSYSTEM CONSERVATION GROUP (ECG)*

The ECG and WHO recognize that nonhuman primates play an important role in biomedical research and testing, and that their use as experimental animals has made a significant contribution to advances in human health and disease control.

The ECG and WHO are committed to maintaining the current diversity of the Order Primates and to ensuring the survival of representative, self-sustaining populations of all species in their natural habitats.

A total of 76 primate taxa are currently considered endangered, vulnerable and rare by the IUCN. Since these taxa are either in serious decline or already at very low and precarious population levels, any exploitation of them threatens their continued survival. Therefore, the ECG and WHO strongly recommended that:

1. endangered, vulnerable and rare species be considered for use in biomedical research projects only if they are obtained from existing self-sustaining captive breeding colonies (i.e. in captive breeding, all animals are required to be at least F2 generation);

2. species categorized as status unknown or indeterminate also not be considered for use in such research projects until adequate data indicate that they are not endangered, vulnerable or rare.

Members of more than 30 species of nonhuman primates, the majority of them wild-caught, are currently being used world-wide in biomedical research and testing. However, sustained yield trapping strategies for wild primates, based on long-term ecological field studies and adequate demographic data, have not yet been developed for any primate species. Continuing habitat loss in most areas where primates occur makes demographic projections difficult and unreliable in most cases. The ECG and WHO therefore recommended that:

1. wild-caught primates be used primarily for the establishment of self-sustaining captive breeding colonies, the eventual goal of which should be to captive-breed most or all (depending on species) of the primates used in research;

2. populations of the apparently common primate species be trapped only in:

    (a) special management areas where demographic data are available, where the populations are continually monitored to avoid over exploitations, and where sustained yield trapping strategies are being developed and tested;

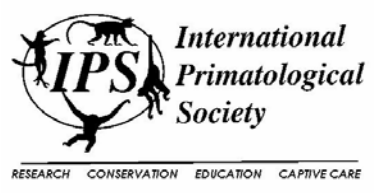
(b) areas where animals are living in agricultural or other man-modified environments and have been shown to be agricultural nuisances that would otherwise be destroyed; or

(c) areas where the habitat is already being destroyed, where the primates would otherwise be killed or would die from starvation or stress, and where translocation is not a viable alternative.

To minimize impact on free-living populations, the ECG and WHO urge that trapping, holding and shipping techniques be perfected to the point that accidental death, destruction of habitat, disruption of family groups, and other forms of wastage are kept to an absolute minimum.

The ECG and WHO urge researchers and their funding agencies to assist in the control of international commerce in primates by requiring proper export and import documentation on all animals that they purchase or otherwise obtain, and to refuse animals obtained in contravention of CITES and/or protective legislation in the source countries.

ANNEX 4



IPS POLICY STATEMENT: PROTECTION OF PRIMATE HEALTH IN THE WILD

WHEREAS many of our primate subjects are already being negatively impacted by human activities that result in destruction of their habitat and fragmentation of their populations; and

WHEREAS the study of primates often involves the close proximity of the subjects, the research workers and their guides; and

WHEREAS very little information is available on the presence of or exposure to infectious disease in wild primate populations; and

WHEREAS evidence suggests that many primate species are susceptible to many of the pathogenic infections that afflict humans and that the transmission of infection can occur in both directions;

The International Primatological Society therefore RECOMMENDS:

- THAT field research workers consult with veterinary and medical experts to develop health and sanitation standards specific to the research site.
- THAT field researchers observe these prescribed health and sanitation standards throughout their research and that these standards be considered in all research proposals;
- THAT the health and sanitation standards apply equally to local staff and volunteers employed by the research worker and that the observance of these standards is an ethical obligation;
- THAT experts in primate handling and anesthesia be involved in training researchers and staff in proper handling or anesthesia techniques if the experts are not actually present in the field;
- THAT efforts are made to maximize the knowledge gained during primate research by consulting or collaborating with experts in other disciplines to properly obtain data or samples that may help with understanding primate diseases;
- THAT field primatologists, assisted by veterinary and medical advisors, initiate and develop occupational health programs for employees and their family members living in or near the study site. This should include consideration for sanitary and health protocols, relevant infectious disease screening, immunization, and/or quarantine periods as appropriate, in accordance with current professional recommendations.

ANNEX 5

GUIDELINES FOR MINIMUM CAGE SIZES FOR NONHUMAN PRIMATES: Council of Europe

Below is a table summarizing the minimum enclosure dimensions for primates that are recommended for adoption by the Council of Europe Convention ETS 123 (Appendix A). The full text of the revised Appendix can be found at:
http://www.coe.int/T/E/Legal_affairs/Legal_co-operation/Biological_safety%2C_use_of_animals/Laboratory_animals/GT%20123%20%282004%29%201%20E%20Appendix%20A%20final%20for%20adoption%20DRAFT2.pdf

Marmosets and tamarins*	Minimum floor area (m^2) for 1**-2 animals plus offspring up to 5 month of age	Minimum height (m)***	Minimum volume (m^3) per additional animal over 5 months of age
Marmosets	0.5	1.5	0.2
Tamarins	1.5	1.5	0.2
Squirrel monkeys*§	Minimum floor area (m^2) for 1**-2 animals	Minimum height (m)	Minimum volume (m^3) per additional animal over 6 months of age
	2.0	1.8	0.5
Macaques and vervet monkeys	Minimum floor area (m^2)	Minimum height (m)	Minimum volume (m^3) per animal*
Animals < 3 years of age#	2.0	1.8	1.0
Animals ≥ 3 years of age##	2.0	1.8	1.8
Animals held for breeding purposes###		2.0	3.5
Baboons	Minimum floor area (m^2)	Minimum height (m)	Minimum volume (m^3) per animal*
Animals < 4 years of age¢	4.0	1.8	3.0
Animals ≥ 4 years of age¢¢	7.0	1.8	6.0
Animals held for breeding purposes¢¢¢		2.0	12.0

* Parameters given here are comparable for similar sized prosimian species
** Animals should only be kept singly under exceptional circumstances and if appropriate (e.g. lorises)
*** The top of the enclosure should be at least 1.8 m from the floor
§ Squirrel monkeys should preferably be kept in groups of four or more animals
# Minimum volume of the enclosure = $3.6m^3$. An enclosure of minimum dimensions may hold up to three animals
Minimum volume of the enclosure = $3.6m^3$ .An enclosure of minimum dimensions may hold up to two animals
In breeding colonies no additional space/volume allowance is required for young animals up to 2 years of age housed with their mother
¢ Minimum volume of the enclosure = $7.2m^3$. An enclosure of minimum dimensions may hold up to two animals
¢¢ Minimum volume of the enclosure = $12.6m^3$. An enclosure of minimum dimensions may hold up to two animals
¢¢¢ In breeding colonies no additional space/volume allowance is required for young animals up to 2 years of age housed with their mother

GUIDELINES FOR MINIMUM CAGE SIZES FOR NONHUMAN PRIMATES:
Institute of Laboratory Animal Research (ILAR)

Below is a modified table summarizing the recommended space for nonhuman primates from: ***Guide to the Care and Use of Laboratory Animals,*** ILAR, Commission of Life Sciences, National Research Council, 1996: 28 (Table 2.2). The full text of this Table can be found at:
http://newton.nap.edu/html/labrats/index.html. (html version)
http://www.nap.edu/openbook/0309053773/html/index.html (pdf version).

Primate Group	Weight, kg[a]	Floor Area/Animal, ft^2 [b]	Height [c] in[d]
Prosimians & Monkeys[e, f]			
Group 1	Up to 1	1.6	20
Group 2	Up to 3	3.0	30
Group 3	Up to 10	4.3	30
Group 4	Up to 15	6.0	32
Group 5	Up to 25	8.0	36
Group 6	Up to 30	10.0	46
Group 7	>30[g]	15.0	46
Apes (Pongidae)[f]			
Group 1	Up to 20	10.0	55
Group 2	Up to 35	15.0	60
Group 3	>35[h]	25.0	84

[a]To convert kilograms to pounds, multiply by 2.2.
[b]To convert square feet to square meters, multiply by 0.09.
[c]From cage floor to cage top.
[d]To convert inches to centimeters, multiply by 2.54.
[e]Lorisidae, Lemuridae, Callitrichidae, Cebidae, Cercopithecidae, and *Papio*. Baboons might require more height than other monkeys.
[f]For some species (e.g., *Brachyteles, Hylobates, Symphalangus, Pongo,* and *Pan*), cage height should be such that an animal can, when fully extended, swing from the cage ceiling without having its feet touch the floor. Cage-ceiling design should enhance brachiating movement.
[g]Larger animals might require more space to meet performance standards.
[h]Apes weighing over 50 kg are more effectively housed in permanent housing of masonry, concrete, and wire-panel structure than in conventional caging.

ANNEX 6

GUIDELINES FOR THE CARE AND USE OF LABORATORY ANIMALS
Institute for Laboratory Animal Resources (ILAR)

In 1985, the Council for International Organizations of Medical Sciences (CIOMS), http://www.cioms.ch/, an international nongovernmental organization, published the "International Guiding Principles for Biomedical Research Involving Animals", which provided basic guidelines for many countries. In 1996, the Institute of Laboratory Animal Research (ILAR) National Research Council published the **"Guide for the Care and Use of Laboratory Animals"**, and is now recognized as the standard for quality animal care and use in many countries around the world. The ***Guide*** is the basis for the Association for the Assessment and Accreditation of Laboratory Animal Care International (AAALAC International) and is also central to the Public Health Service (PHS) Policy on the Humane Care and Use of Laboratory Animals. The ***Guide*** is intended to assist IACUCs, researchers, and veterinarians in fulfilling their obligation to plan, conduct, and oversee animal experiments in accordance with the highest scientific, humane, and ethical principles. The ***Guide*** makes recommendations based on published data, scientific principles, expert opinion, and experience with methods and practices proven consistent with high-quality, humane animal care and use. These recommendations are consistent with other regional standards (e.g., European Directive 86/609/EEC).
http://ec.europa.eu/food/fs/aw/aw_legislation/scientific/86-609-eec_en.pdf

The goal of the ***Guide*** is to promote the humane care of animals used in biomedical and behavioral research, teaching, and testing; the basic objective is to provide information that will enhance animal well-being, the quality of biomedical research, and the advancement of biological knowledge that is relevant to humans and animals. The Guide charges users of research animals to operate in accordance with all local, state, federal, and international regulations while encouraging the following principles:

- Design and performance of procedures on the basis of relevance to human or animal health, advancement of knowledge, or the good of society.
- Use of appropriate species, quality, and number of animals.
- Avoidance or minimization of discomfort, distress, and pain in concert with sound science.
- Use of appropriate sedation, analgesia, and anesthesia.
- Establishment of experimental end points.
- Provision of appropriate animal husbandry directed and performed by qualified persons.
- Conduct of experimentation on living animals only by or under the close supervision of qualified and experienced persons.

Guide for the Care and Use of Laboratory Animals. Institute of Laboratory Animal Resources, Commission of Life Sciences, National Research Council. 1996. Washington, D.C.: National Academy Press. http://www.nap.edu/readingroom/books/labrats/chaps.html (unformatted text version)

The ***Guide*** is currently available in Chinese, English, French, Japanese, Korean, Portuguese, Russian, Spanish, and Taiwanese (http://www.aaalac.org/resources/theguide.cfm).

IPS INTERNATIONAL GUIDELINES FOR THE ACQUISITION, CARE AND BREEDING OF NONHUMAN PRIMATES

Codes of Practice 1-3

PREFACE

These Codes of Practice have been prepared to supplement the **IPS INTERNATIONAL GUIDELINES FOR THE ACQUISITION, CARE AND BREEDING OF NONHUMAN PRIMATES** which outline the general principles to be observed in order to ensure best practices and facilitate the well-being of captive primates.

Codes of Practice 1-3 give more detailed information as to how the guidelines can be applied to nonhuman primates in laboratories, breeding or holding facilities, as well as in zoos, sanctuaries and rescue centers. While the Codes of Practice are intended to supplement the Guidelines, they may also be used independently.

Adherence to the IPS Guidelines and Codes of Practice will not only encourage best practices in the care of primates, but will also improve the welfare of the animals and thus raise the quality of science based on them.

The Committee is grateful to those individuals who prepared the documents and to the experts whose advice was incorporated in the final drafts. IPS may publish further Codes of Practice, where the need arises. The present publication covers subjects that the Captive Care Committee regards as the most important.

IPS Code of Practice 1:
HOUSING AND ENVIRONMENTAL ENRICHMENT

AIM

The aim of this code of practice is to outline the requirements for housing and care of nonhuman primates and the criteria for ensuring that their welfare, physical, behavioral and psychological needs are met as far as is possible in captive conditions.

The principle underlying this code is that captive primates should be kept in environments that allow them the freedom to express most normal behavior patterns (Webster, 1984; NIH/OLAW, 2005). Primates are highly intelligent sentient beings; they require environmental stimulation and display a complex behavioral repertoire. Furthermore, it is fully acknowledged that nonhuman primates have the capacity to experience pain associated with experimental procedures as would human primates (Markowitz and Spinelli, 1986; OECD, 2000; Smith and Boyd, 2002; U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training: http://www.absc.usgs.gov/research/vet/policies/IRACPRIN.htm).

PHYSICAL ENVIRONMENT

Primates are adapted to a natural habitat where survival depends upon a complex behavioral repertoire, the use of intelligence and high levels of vigilance. The greater the departure of the captive environment from the natural situation, the more critical each attribute of the enclosure becomes in terms of meeting the animal's needs (Kleiman *et al*., 1996; Shepherdson, 2003).

Physical factors of significance in housing primates are size of enclosure, construction materials, its complexity and basic design in relation to capture methods and those of maintaining hygiene. It is not necessarily true that the larger the enclosure the better this will be for the animal. Size of enclosure is only of significance in terms of usable space and complexity within it (e.g., a large room with bare walls provides only a floor as usable space); thus the quantity of space provided is less important than its quality (see Izard, l991; Line *et al*., l991; Fitch-Snyder and Schulze, 2001; Prescott and Buchanan-Smith, 2004).

The selection of species for research studies should be based on sound scientific grounds, and then within the scientific design. The particular species chosen should experience the lowest welfare costs as a result of experimentation (including acquisition, transport, housing and handling). However, when selecting a species, one must take into account its relative size and what affects that may have on experimental design. For example, due to their small size, large series of blood samples cannot be taken from callitrichids and small-bodied prosimians, and therefore more animals may be required in the experiment (Smith and Boyd, 2002). Careful cost/benefit analyses—taking this and other considerations into account—must be performed (ILAR, 1996; Wolfensohn and Honess, 2005).

For primates, space is three-dimensional and should allow the individual to display its normal repertoire of locomotor behavior, namely, to walk, climb, run, jump and swing. In an open situation, such as a compound, climbing frames or trees are recommended, or, in a cage, vertical climbing surfaces and perches. The provision of horizontal surfaces on which the primate can rest comfortably and perform social interactions (e.g., sprawling during a grooming session) is also important.

Both Old and New World primates used in the laboratory have a vertical flight response when alarmed by a terrestrial predator. Thus the vertical dimension of the cage is of importance and cages where the primate is able to perch above human eye level are recommended (Reinhardt and Reinhardt, 1999, 2000). Furthermore, some primates, such as marmosets, tamarins and lorises, avoid the lower half of their enclosures and prefer the highest available areas. This substantially reduces the cage volume available to them (Prescott and Buchanan-Smith, 2004). Food and other key resources should be placed high in the enclosure so that individuals are not forced to a less preferred height to obtain food (Buchanan-Smith *et al*., 2002; Fitch-Snyder *et al*., in press).

Single housing should be avoided for social species. Where it is absolutely necessary for the individual to be confined in a restricted space and/or housed singly, access to a large complex play area with compatible companions is strongly recommended in order to mitigate the adverse effects of restrictive physical and social housing (see Jaeckel, 1989).

Ideally, primates should be kept in large cages or compounds where a complex social and physical environment can be provided. This has been shown to be practicable even in the laboratory setting (Izard, l991; Snowdon, 1991; Wolfensohn and Honess 2005). In large enclosures, to facilitate handling and manipulation, the animals can be trained to enter a smaller enclosure or restraint cage by the use of positive reinforcement. Similarly, they can be trained, for example, to present an arm or other body part to accept injections (Reinhardt, 1997; Laule *et al*., 2003; Schapiro *et al*., 2003; Prescott *et al.,* 2005).

In many cases primates are kept in small metal cages, on the grounds of economy of space and the fact that the cage can be put into an automatic cage washer and sterilizer. However, recent experience has shown that such over-cleaning is not necessary and that the animals benefit when cages are custom built to extend from floor to ceiling, thus taking maximum advantage of the space available in the room. Free-standing wooden cages on a concrete base are very economical to build, compared with commercially purchased metal ones, and dividers or smaller compartments can be installed to facilitate handling (Burt and Plant, 1990). Other materials, like plastic, that greatly dampen the noise may be suitable in some cases. However, it is important to note that this recommendation may be at odds with some national legislative requirements (for example, use of natural substrates is not permitted in U.S. laboratories), although most primate facilities see the benefit in using wood caging and perching for captive primates.

In most laboratories primates are kept indoors within a restricted range of temperature and humidity. Where outdoor facilities are provided there will be a degree of climatic variability. This can be beneficial, providing that tropical species in cold climates have access to a warm indoor area and shade is provided in hot climates. Legislation specifying narrow temperature

ranges may make it illegal to keep an animal at a temperature which it would commonly experience in the wild, for example, golden lion tamarins in their natural habitat in Brazil experience temperatures as low as 4^{o} C, but in a European laboratory the minimum at which they can legally be kept is 24^{o} C. It must be appreciated, however, that the extremes of temperature that the animals experience in the wild may prove hazardous in captivity if the animals are incapable of behavioral or physiological temperature regulation. It is important to note that such regulations take into account the acceptable comfort range for that species in captivity, which may differ from that of their wild counterparts as a result of a lack of exposure and acclimatization to variable temperature ranges (Kleiman, 1978).

While hygiene is of paramount importance for the maintenance of a primate's clinical health, this should not be at the expense of providing an environment to promote psychological health and well-being. The experience of zoos has shown that animals whose behavioral and psychological needs have been met in environments that are complex, stimulating and provide natural substrates are no more likely to succumb to disease than animals in traditional tiled and concrete floored enclosures which are washed and disinfected daily (Kleiman *et al*., 1996). On the contrary, complex environments show added benefits to their behavioral and psychological well-being (Shepherdson *et al*., 1998; Fitch-Snyder and Schulze, 2001; Clum *et al*., 2005).

Whenever possible, primates should be provided with a 'soft' environmental surface that is not necessarily less hygienic than the traditional metal cage. A woodchip substrate is actually bactericidal so that the provision of natural materials for primates should not lead to reduction in standards of hygiene (Chamove *et al*., 1982). Special consideration should be given to primates, such as prosimians and callitrichids, who scent mark their cages and materials must be provided to allow them to engage in this important social communication behavior (Snowdon, 1991; Fitch-Snyder and Schulze, 2001).

All animals require a secure environment in order to prosper (Poole, 1988). This security translates into predator avoidance, which means providing sufficient space in the enclosure to exceed the animal's flight distance, providing companions that help to protect the group by warning of danger, or providing concealed areas for hiding and sleeping.

ENRICHING THE ENVIRONMENT

Behavioral Priorities

One of the aims of these guidelines is to describe how to provide opportunities for primates to express most normal behavior patterns (Clum *et al.,* 2005). However, all behaviors are not of equal significance to the animal and the opportunities to carry out certain types of behavior are of particular benefit.

The most important of which are:

1) Physical contact with conspecifics (Schapiro *et al*., 1996; Lutz and Novak, 2005).
2) Opportunities for increased foraging (Chamove *et al*., 1982; Chamove, 2001)

3) Opportunities for normal locomotion to maintain physical health (Leu *et al.*, 1993; Pines *et al*., 2005).
4) A secure environment, including opportunities to avoid conspecifics and potential or perceived threats, and a comfortable place to sleep (Segal, 1989; Laule, 2005).
5) Novelty and variety of objects to allow stimulation of cognitive abilities (Wemelsfelder, 1984; Beaver, 1989; Matsuzawa *et al*., 2006).
6) Opportunities to exert choice and control over the environment (Buchanan-Smith, 1997; Shepherdson, 2003; Metzger and McCann, 2005).

Two forms of practical techniques to implement change can be incorporated into the captive situation:

1) *Unpredictable environmental changes which can elicit an adaptive response from the animal*

Foraging time can be increased by providing some of the animal's food in such a way as to make its delivery or discovery unpredictable (McCann *et al*., 1993), for instance, food can be concealed in the substrate or scattered about the enclosure. Artificial turf can provide a useful, readily cleaned substrate for foraging (Lam *et al*., 1991; Bayne *et al*., 1992; Fekete *et al.*, 2000). This also has the advantage that it increases usable space in the cage by encouraging the animals to use the floor, although this may be undesirable in primarily arboreal species which are reluctant to approach the ground. Various artificial substrates have been shown to provide benefits to both the animal's physical and mental abilities by increasing foraging time and decreasing the frequency of abnormal behaviors (Chamove *et al*., 1982;. Anderson and Chamove, 1984; Bryant *et al*., 1988; Boccia, 1989; Burt and Plant, 1990; Byrne and Suomi, 1991; Riviello, 1995; Baker, 1997; Brown and Gold, 1997; Chamove, 2001; Blois-Heulin and Jubin, 2004).

For the small, more insectivorous mammals, zoos have found that cricket or mealworm dispensers can be provided (i.e., a hollow log with holes in it from which the crickets emerge spontaneously or a corked plastic tube with holes in it containing fine sawdust and mealworms (see Shepherdson, 1989; Shepherdson *et al*., 1998; Fitch-Snyder and Schulze, 2001); there is no reason why a similar technique should not be used in laboratories, where experimental protocols permit. Gum feeders are excellent foraging devices for marmosets (McGrew *et al*., 1986). Electronic devices that dispense food, either randomly or on demand, can also be used where long-term housing is contemplated for socially deprived or closely confined animals (Markowitz and Spinelli, 1986). The use of mobile artifacts can provide unpredictable environmental enrichment. A simple swing is valuable as most primates will incorporate it into play sessions; it encourages jumping and balancing and, when more than one individual uses it, the position of the swing in space becomes difficult to predict.

Unfortunately, the need for routines within the laboratory means that feeding, one of the most important events in the day of a captive primate, is often on a temporarily predictable schedule. It is known that primates exhibit food-anticipatory behavior, characterized by increased arousal and activity, if fed on such highly predictable temporal schedules (Mistlberger, 1994; Bassett and

Buchanan-Smith, 2007). It is also known that delays to temporarily predictable feeding schedules are detrimental to welfare (Waitt and Buchanan-Smith, 2001). It is recommended that primates are fed several times a day, and are encouraged to employ foraging behaviors in order to obtain their food; however, foraging tasks should be challenging but not too difficult as to preclude gaining access to critical daily food rations.

2) The provision of enrichment items that allow the animal the ability to choose and to facilitate change in the environment.

It is important to provide animals with a degree of choice and ability to exhibit preferences. The environment must be sufficiently variable to allow such choices to be made (Buchanan-Smith, 1997). Natural materials such as logs and branches are often provided and can occupy the animal for long periods of time (Sambrook and Buchanan-Smith, 1997). However, artifacts such as cardboard boxes, telephone directories, milk crates and heavy duty plastic buckets have also proved effective (O'Neill, 1989). The responsiveness of the object appears to be critical in maintaining animal interest by a larger proportion of animals and for longer periods of time than devices which do not respond in this way (Markowitz and Line, 1989; Sambrook and Buchanan-Smith, 1997). Care must be taken to ensure that such artifacts do not contain toxic or hazardous materials and that boxes are not stapled. Extra labor will be involved in cage cleaning but this must be balanced against the gain in well-being of the primates.

Barrels, balls, baskets, simple puzzles and other toys have been used but their effectiveness seems to depend on their novelty. To overcome the problem of habituation, toys should be changed regularly. Primates are likely to habituate less rapidly to more complex artifacts that offer a range of possible manipulations. Electronic toys and games can also be effective (Line *et al*., l990). The kind of manipulation that is appropriate will also depend on the species of primate in question. It has been shown that environmental complexity can alter infant development as well (Ventura and Buchanan-Smith, 2003).

Opportunity to Exert Control

There is strong evidence that control, or the perception of control, has powerful effects on cognitive, social and emotional functioning (Overmier *et al*., 1980; Mineka *et al*., 1986). An event is deemed controllable if there is a difference in the likelihood of it occurring depending on an animal's behavior (Overmier *et al*., 1980; Sambrook and Buchanan-Smith, 1997; Metzger and McCann, 2005). In the wild, in order to survive and reproduce, primates must exert control over what they eat, where they sleep, with whom they mate and so on. As control is a major adaptive feature of their behavior, it is considered to be very important, yet captive animals inevitably experience reduced control over their environment, compared with their wild counterparts (Chamove and Anderson, 1989). Markowitz (1982) argues that the frequent lack of control experienced by captive animals may be highly detrimental to their welfare. A complex, responsive environment and positive reinforcement training are ways to give captive primates control.

SOCIAL GROUPING

A compatible conspecific probably provides more appropriate stimulation to a captive primate than any other potential environmental enrichment factor (e.g., Schapiro *et al.*, 1996; Lutz and Novak, 2005; Rennie and Buchanan-Smith, 2006b). The presence of a conspecific enables the primate to utilize its repertoire of social behavior, which can occupy a considerable proportion of the daytime activity budget in captivity and provide a social buffer to stress (Smith *et al*., 1998).

Except for solitary primates such as lorises, and unless absolutely essential, primates should not be housed alone in a cage on a long-term basis (more than 30 days). Even during quarantine there are advantages to housing primates in compatible pairs, such as reducing anxiety associated with a new environment (Honess *et al*., 2004). The natural social grouping in the wild can be used as a guide when creating a captive group with respect to reproductive strategy (i.e., monogamous, harems, promiscuous or multi-male/multi-female) and kinship ties (i.e., family group, female-bonded or male-bonded group). Johnson *et al*. (1991) and Price and McGrew (1990) have shown that reproductive success may be increased in tamarins by creating natural social groupings.

A captive group of compatible individuals may not resemble the wild social structure, as captive animals are usually unrelated and often a female-biased sex ratio has to be maintained to avoid fighting between males. Captive breeding groups of macaques are usually harems, with one male and several females, because aggression between males in the more natural multi-male/multi-female group can cause serious problems in a restricted space. However, these problems can be overcome by designing an enclosure in such a way that animals cannot be cornered or blocked from any key resource (such as food, water, sleeping sites) by dominant members of the group. Similarly, same sex peer groups, although unnatural, are often formed for management purposes. To ensure aggression is minimized, same sex groups of males should be kept separate from female groups. In providing a satisfactory social environment in captivity, individuals must be able to avoid aggressors and multiple food and drinking sources should be available to prevent one animal from monopolizing them (Kleiman *et al*., 1996).

In creating a captive social group, the main considerations should be that the animals show positive social interactions and a minimum of overt aggression. A useful indicator of good group compatibility, for younger animals, is the incidence of social play, because this is behavior that only occurs in a relaxed situation (Fagen, 1981; Pereira and Fairbanks, 1993).

Increased space does not necessarily lead to a reduction in aggression and in situations where group behavior is controlled by a dominant animal, the opportunity to be out of sight of the dominant individual may lead to more, not less, aggression (Erwin, 1986). However, places to retreat from dominant individuals are important and visual barriers should be provided.

When attempting to create compatible groups or pairs, the individuals' reactions towards one another should always be carefully monitored before placing them in physical contact so that full contact aggression is prevented (Reinhardt *et al*., 1988). Careful choice of group- or pair-mates and correct interpretation of their initial behavior will help prevent harmful and stressful situations for the primates (Majolo *et al.* 2003).

Where the experimental protocol makes it difficult to provide the animals with a sufficiently rich social environment, a good repertoire with human caretakers can be valuable (Heath, 1989). Even a few minutes a day spent interacting with the animal and allowing it to groom oneself can make a significant difference to the quality of its life. For the singly housed primate, environmental enrichment is particularly important in reducing the occurrence of abnormal behaviors (Bayne *et al*., 1991, 1992; Brent and Long, 1995; Schapiro *et al.*, 1996; Kessel and Brent, 1998; Bourgeois and Brent, 2005).

Wherever it is practicable, it is recommended to train primates to co-operate in carrying out particular tasks. This not only provides variation and gives the animal some control over its environment but it also may be of great value if the animal has to be given medical treatment, weighed or moved from one place to another (Laule *et al*., 2003; McKinley *et al*., 2003; Savastano *et al*., 2003). Positive reinforcement training may also help animals cope with routine stressors (Bassett *et al*., 2003). Training can reduce the stress associated with scientific, veterinary and husbandry procedures, and can enhance the care and well-being of primates in captivity by, for example, reducing aggression, improving socialization and reducing or eliminating abnormal behavior (Savastano *et al*., 2003; Prescott and Buchanan-Smith, 2007). The training method used should be positive reinforcement, wherever possible (Laule *et al*., 2003; Prescott *et al*., 2005). Trained primates are of particular value in long-term studies, where the animal and experimenter may spend many years working together (Jaeckel, 1989; Matsuzawa, 1989; Biological Council, 1992).

Rearing Young Primates

An appropriate rearing environment is probably the most critical aspect for the development of normal, healthy primates, able to cope with the challenges they face within the captive environment. Young primates should be reared with an appropriate social background, and not artificially weaned unless they meet species-specific criteria of age, body weight and behavioral independence. Nursery rearing, in the absence of adults, can result in behavioral abnormalities (Capitanio, 1986; Marriner and Drickamer, 1994; Bellanca and Crockett, 2002). Individuals who are weaned early or socially isolated are usually less adaptable and show higher levels of abnormal stereotyped behavior (Harlow and Harlow, 1971; Goosen, 1989; Lutz *et al*., 2003). They may also show deficiencies in social behavior and abnormalities may even extend to the endocrine and immune systems (Reite, 1987; Laudenslager *et al*., 1990; Dettling *et al*., 2002).

Primiparous females should have had experience of observing other females caring for their infants and, in species which have a cooperative rearing system such as marmosets and tamarins, for helping in their rearing. Otherwise, when faced with an infant of their own they may be neglectful, abusive or even infanticidal (Gardin *et al*., 1989).

The young monkey should not normally be separated from its mother at an early age (i.e., at 6-8 months) but should remain in contact for one year to 18 months, in most species. There is unlikely to be any greater productivity through early weaning, in seasonally breeding species, such as rhesus monkeys. Even in non-seasonal breeders, any slight increase in productivity must be offset against the resulting behavioral abnormalities of the offspring (Goosen, 1989;

Reinhardt, 2002). Most biomedical research workers require normal, healthy subjects for their experiments, with little variability amongst individuals, and this is best achieved through normal social development, and the extension of the developmental period. When removed from the natal group, the youngsters should be housed socially.

There are occasions when young may have to be removed from their mothers earlier than 12 months, on welfare, or veterinary health grounds. The need for early removal should be thoroughly assessed, and where absolutely necessary the re-socialization of young is recommended as soon as possible. Another reason for early weaning may be to minimize disease transmission, for example, to decrease the possibility of transmission of B virus (*Herpes virus simiae*) in macaques. To avoid the adverse effects of this practice, it is recommended that macaques are bred from specific pathogen free colonies, a number of which have been established.

On occasion, parents will die before offspring are weaned, and unless conspecific foster parents can be found, offspring will need to be hand-reared by humans. Early deprivation is known to have devastating effects and the behavior and physiology of such individuals is likely to be very different from their family-reared counterparts. Unless hand-reared offspring are returned to a social group at an early age, it may be difficult to integrate them into social groups, and as a result, they may experience inadequate socialization. In this instance, consideration should be given as to whether it is better to euthanize such individuals at birth. Rotational hand-rearing is a frequent practice with common marmosets in many laboratories. Although twins are the norm in the wild in this species, triplet and quadruplet births are now increasingly common and a highly productive system of rotational hand-rearing has been developed that significantly reduces mortality. However, the long-term impact of this practice on behavior and physiology has not been determined (Buchanan-Smith, 2006), but it is known that early deprivation adversely affects this species in the long-term (Dettling *et al*., 2002).

Through years of captive breeding in zoos, hand-rearing protocols for many primate species are well established (Hampton and Hampton, 1967; Pook, 1977; Rohrer, 1979; Rettberg-Beck and Ballou, 1987; Porton, 1997). Through this collective experience it is known that some species are not good candidates for hand-rearing as a result of differential success across the primate taxa in hand-reared individuals becoming competent social and reproductive adults. Thus, captive breeding recommendations will vary depending on the needs of the managed population and the role of the individual in that population.

ASSESSMENT OF WELFARE

What is Animal Welfare?

A scientific definition of animal welfare and discussion of the topic, as developed and used by the American Association of Zoos and Aquarium's (AZA) Animal Welfare Committee (www.aza.org/AnMgt), is presented below:

> "Animal welfare is the degree to which an animal can cope with challenges in its environment as determined by a combination of measures of health (including pre-clinical physiological responses) and measures of psychological well-being.

- Good health represents the absence of diseases or physical/physiological conditions that result (directly or indirectly) from inadequate nutrition, exercise, social groupings, or other environmental conditions to which an animal fails to cope successfully.

- Psychological well-being is dependent on there being the opportunity for animals to perform strongly motivated, species-appropriate behaviors, especially those that arise in response to aversive stimuli.

- Enhanced psychological well-being is conditional on the choices animals have to respond appropriately to variable environmental conditions, physiological states, developmental stages and social situations, and the extent to which they can develop and use their cognitive abilities through these responses."

There are many different ways to describe the concept of animal welfare and the AZA definition can be interpreted in various ways. For example, the complex subject of psychological well-being can be broken down into easier to handle topics such as: 1) addressing the motivational needs of the animals (e.g., the need to nest); 2) providing animals with choices and control; 3) matching the environment to the animals' natural adaptations; and 4) encouraging the animals to develop and use their cognitive abilities. Good welfare is dependent on animals being encouraged to develop and use their natural mental and physical skills. Enrichment and husbandry training play an important role in this process by providing the animals with behavioral choices and positive mental challenges (Laule and Desmond, 1994).

In developing care standards that meet the welfare needs of primates it is useful to assess them in terms of inputs and outputs. Inputs are the variables that caretakers can manipulate in developing captive environments (enclosure size, temperature, social companions, training, etc.), and outcomes are measures of how the animals respond to those environments (or how the animals "perform" in those environments in terms of behavioral repertoire, level of stress or frequency of distress, longevity, reproduction, etc.). Managers should document outcomes using measures such as physiological measurement of stress (e.g., heart rate telemetry, hormonal studies), frequency of illness or injury, maintenance of normal immune function, reproduction, longevity, and the absence (or reduction) of stereotypic behaviors. Applying new knowledge on outputs of various husbandry protocols will lead to the continued advancement of care standards. It is critical that all captive facilities—be it a zoological park, research laboratory or sanctuary—contribute to the growing knowledge of primate care, as each facility will have a unique set of skills and expertise based on the mission of the facility.

In creating the list of input variables it is important to consider that different species have different needs at various stages in their lives and standards should take into account the entire life cycle. It is recommended that information from field studies are referred to in identifying those elements of the physical and social environment central to the well-being of a species, and therefore, of high priority in designing and managing captive environments. In addition, field studies can provide baseline "normal" values for many physiological and behavioral parameters. Additionally, behaviors in some taxa are highly plastic. For example, there are species whose sociality in the wild is constrained by the abundance and distribution of food resources. When these constraints are eliminated in captive settings, the animals may engage in considerable affiliative social interactions, thus allowing for the long-term maintenance of what in the wild

would be short-lived social groupings. Thus, recognizing that there is substantial individual variation within many taxa is also important. Where this is the case, standards for those taxa will need to address how to provide for the expression of this individual variation. One illustrative example is by Capitanio *et al*. (2006), who are currently developing a sophisticated program of bio-behavioral characterization for rhesus monkeys.

Just as inputs may vary among taxa in their importance, so may some outcomes be better measures of animal well-being than others, depending on the species in question. For instance, reproduction can be a measure of well-being, but for prolific breeders reproduction alone might be a poor indicator of well-being. Thus, it is more accurate to apply a suite of criteria in order to assess welfare (Suomi and Novak, 1991). These include: physical measures (e.g., clinical and nutritional); behavioral-ecological measures (e.g., social and environmental); physiological measures (e.g., behavioral or endocrine profiles of stress); and biological measures (fertility and fecundity). When these measures are combined, a more accurate assessment of individual welfare is yielded.

Population management issues also play an important role in an animal's welfare. Good genetic and demographic management plays an integral role in insuring animal welfare (Ballou and Lacy, 1995). When animal numbers are not managed in a manner that considers available space, overcrowding occurs and it becomes harder to provide appropriate space for every individual in the population. Similarly, poor demographic management can result in populations in which post-reproductive animals predominate and the population is in danger of dying out. Poor genetic management can result in increased disease and mortality associated with inbreeding and/or loss of genetic variability. Where recognized, adherence to the population management group's genetic and demographic plans will improve the overall health of the population, and in most instances, the well-being of individuals within the population (Seal *et al*., 1990; Lacy *et al*., 1995; Ballou and Lacy, 1995; Ballou and Foose, 1996; Williams-Blangero *et al*., *2002*).

Finally, it is acknowledged that different users of primates will have different goals in housing various taxa. For example, the social environment of a zoo animal will not be the same as that for an animal in a research colony. Additionally, primates selected for release programs may be deliberately isolated from human contact and exposed to a range of stressors from which the general collection will be protected (potential predators and parasites, risk of injury, etc.). Thus, care standards should address the need for different management practices under these different scenarios. Since management will differ depending on the goal for a particular taxon, it is imperative that the institution's population management plan clearly defines the goals for housing each taxon (Ralls and Ballou, 1992; Lacy *et al*., 1995). Regardless of the goal, animal well-being should be a primary consideration in the development of animal care standards.

Impact of Pain, Suffering and Distress on Animal Welfare

As described above, animal welfare is a condition of an individual's physical health and psychological well-being, measurable by several properties (Broom, 1991). This includes being free from pain, suffering and distress (for general overview see: Moberg and Mench, 2000). Pain can be a consequence of, for example, fighting, disease or experimental protocols. Suffering can

include boredom, anxiety and fear, which are probably the most common adverse effects of captivity. Many of the techniques described above aim to prevent or reduce these negative welfare states. Stress is a psycho-physiological response induced by a disruption in homeostasis; an excessive or inappropriate activation of the body's "fight or flight" response. However, not all stress is necessarily negative. It is important to differentiate stress into distress, when the outcome of a stressor has negative implications, and eustress, the outcome of which has positive implications. It is critical that staff are trained to recognize pain, suffering and distress to allow appropriate treatment.

Indicators of Welfare in Primates

The behavior of captive primates should be monitored at regular intervals by trained and experienced personnel to determine their well-being. The relationship that caregivers have with the primates in their care is critical to ensure good well-being (review in Rennie and Buchanan-Smith, 2006a), and staff should be trained to identify changes in species-specific stress-related behaviors, although the assessment of welfare can be difficult (Mason and Mendl, 1993; Broom, 1996; Dawkins, 1990, 1998).

Indicators of *poor welfare* are:

1. A very restricted repertoire of behavior in comparison with the wild. Most methods of increasing the range of species-typical behaviors (apart from those associated with highly distressing situations, such as infanticide) represents an improvement for the animals.

2. An abnormal activity budget - the individual may be inactive and not make full use of the environment - or it may not interact with conspecifics and show little curiosity towards novel objects (these symptoms are similar to human depression). Alternatively, the animal may be hyper-reactive to minimal stimuli.

3. Inadequate social behavior, for example, primates may be hyper-aggressive, fail to mate, prove infanticidal or neglectful of their young.

4. Abnormal behaviors such as stereotypies, self-directed social behavior, juvenile behavior in adults, learned helplessness or self-mutilation (see Erwin and Deni, 1979; Poole, 1988).

While indicators of good welfare might be the opposite to indicators of poor welfare—such as: a broad range of species-typical behaviors, a normal activity budget, curiosity and exploration of the environment, etc.—further good welfare indicators include an ability of the primate to cope with challenges and affiliative social relations amongst group members.

There are considerable differences between species (Clarke *et al*., 1988) and even the ways in which individual primates react to captivity (Capitanio, 1999), thus it is important that each animal is regularly monitored to ensure that its individual needs are being fully met.

SUMMARY

The captive environment should incorporate sufficient usable space and environmental complexity to allow primates to show a wide repertoire of behavior appropriate for the species, including beneficial social behavior.

The provision of compatible companions greatly extends the range of activities possible for the individual. Primates of gregarious species should, unless there are compelling medical or scientific reasons for not doing so, be housed socially in shared enclosures.

Where single caging is absolutely unavoidable, the primates' environment can be improved by environmental enrichment to encourage a varied daily time budget, exercise, both physical and mental, and the development of motor skills.

Assessing environmental quality can best be achieved by monitoring behavior to identify indications of poor welfare. Where possible, behavior in captivity should approximate the species' natural repertoire and time budget.

Where behavior is indicative of poor welfare, appropriate improvements to the environment should be made immediately and the individual's behavior regularly re-assessed to ensure that any improvements are not ephemeral.

Finally, while nonhuman primates should be provided with a stable home environment, there should be sufficient variability, in the form of temporally or spatially unpredictable events, to provide adequate levels of stimulation. Further, the animal should also be able to exert some control over its environment.

REFERENCES

Anderson, J.R. and Chamove, A.S. (1984). Allowing captive primates to forage. In: *Standards in Laboratory Animal Management*. The Universities Federation for Animal Welfare, Potters Bar, pp. 253-256.

Association of Zoos and Aquariums (AZA) (2007). Animal Management. www.aza.org/AnMgt

Baker, K.C. (1997). Straw and forage material ameliorate abnormal behaviors in adult chimpanzees. *Zoo Biology* 16: 225-236.

Ballou, J.D. and Lacy, R.C. (1995). Identifying genetically important individuals for management of genetic diversity in captive populations. In: Ballou, J.D., Gilpin, M. and Foose, T. (eds.), *Population Management for Survival and Recovery*, Columbia University Press, New York, pp. 76-111.

Ballou, J.D. and Foose, T. J. (1996). Demographic and genetic management of captive populations. In: Kleiman, D.G., Allen, M., Thompson, K., Lumpkin, S. (eds.), *Wild Mammals in Captivity*, University of Chicago Press, Chicago, pp. 263-283.

Bassett, L. and Buchanan-Smith, H.M. (2007). Effects of predictability on the welfare of captive primates. *Applied Animal Behaviour Science* 102: 223-245.

Bassett, L., Buchanan-Smith, H.M., McKinley, J. and Smith, T.E. (2003). Effects of training on stress-related behavior of the common marmoset (*Callithrix jacchus*) in relation to coping with routine husbandry procedures. *Journal of Applied Animal Welfare Science* 6: 221-233.

Bayne, K, Mainzer, H, Dexter, S.L., Campbell, G., Yamada, F. and Suomi, S.J. (1991). The reduction of abnormal behaviours in individually housed rhesus monkeys *(Macaca mulatta)* with a foraging/grooming board. *American Journal of Primatology* 23: 23-35.

Bayne, K., Dexter, S., Mainzer, H., McCully, C., Campbell, G. and Yamada, F. (1992). The use of artificial turf as a foraging substrate for individually housed rhesus monkeys (*Macaca mulatta*). *Animal Welfare* 1: 39-53.

Beaver, D.B. (1989). Environmental enrichment for laboratory animals. *ILAR News* 31: 2.

Bellanca, R.U., and Crockett, C. M. (2002). Factors predicting increased incidence of abnormal behavior in male pigtailed macaques. *American Journal of Primatology* 58: 57-69.

Biological Council. (1992). *Guidelines on the handling and training of laboratory animals*. The Universities Federation for Animal Welfare, Potters Bar.

Blois-Heulin, C., Jubin, R. (2004). Influence of the presence of seeds and litter on the behaviour of captive red-capped mangabeys (*Cercocebus torquatus torquatus)*. *Applied Animal Behaviour Science* 85: 340-362.

Boccia, M.L. (1989). Long-term effects of a natural foraging task on aggression and stereotypies in socially housed pigtail macaques. *Laboratory Primate Newsletter* 28: 18-19.

Bourgeois, S.R. and Brent, L. (2005). Modifying the behaviour of singly caged baboons: Evaluating the effectiveness of four enrichment techniques. *Animal Welfare* 14: 71-81.

Brent, L. and Long, K.E. (1995). The behavioural response of individually caged baboons to feeding enrichment and the standard diet: A preliminary report. *Contemporary Topics in Laboratory Animal Science* 34: 65-69.

Broom, D.M. (1991). Animal welfare: Concepts and measurement. *Journal of Animal Science* 69: 4167-4175.

Broom, D.M. (1996). Animal welfare defined in terms of attempts to cope with the environment. *Acta Agriculturae Scandinavica, Section A - Animal Science, Supplement* 27: 22-28.

Brown, D.L. and Gold, K.C. (1997). Effects of straw bedding on non-social and abnormal behavior of captive lowland gorillas *(Gorilla gorilla gorilla)*. In: Holst, B. (ed.), *Proceedings on the 2nd International Conference on Environmental Enrichment*, Copenhagen Zoo, Frederiksberg, pp. 27-35.

Bryant, C.E., Rupniak, N.M.J. and Iversen, S.D. (1988). Effects of different environmental enrichment devices on cage stereotypies and autoagression in captive cynomolgus monkeys. *Journal of Medical Primatology* 17: 257-269.

Buchanan-Smith, H.M. (1997). Environmental control: An important feature of good captive callitrichid environments. In: Pryce, C., Scott, L. and Schnell, C. (eds.), *Marmosets and Tamarins in Biological and Biomedical Research*, DSSD Imagery, Salisbury, pp. 47-53.

Buchanan-Smith, H.M. (2006). Primates in laboratories: Standardisation, Harmonisation, Variation and Science. *ALTEX – Alternatives to Animal Experimentation*, 23: 115-119.

Buchanan-Smith, H.M., Shand, C. and Morris, K. (2002). Cage use and feeding height preferences of captive common marmosets (*Callithrix j. jacchus*) in two-tier cages. *Journal of Applied Animal Welfare Science* 5: 139-149.

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

Byrne, G.D. and Suomi, S.J. (1991). Effects of woodchips and buried food on behavior patterns and psychological well-being of captive rhesus monkeys. *American Journal of Primatology* 23: 141-151.

Capitanio, J.P. (1986). Behavioral pathology. In: Mitchell, G., Erwin, J. and Swindler, D.R. (eds.), *Comparative Primate Biology, Volume 2A: Behavior, Conservation, and Ecology*, A.R. Liss, New York, pp. 411-454.

Capitanio, J.P. (1998). Social experience and immune system measures in laboratory-housed macaques: Implications for management and research. *ILAR Journal* 39: 12-20.

Capitanio, J.P. (1999). Personality dimensions in adult male rhesus macaques: Prediction of behaviors across time and situation. *American Journal of Primatology* 47: 299-320.

Capitanio, J.P., Keyes, R.C. and Fairbanks, L.A. (2006). Considerations in the selection and conditioning of Old World monkeys for laboratory research: animals from domestic sources. *ILAR Journal* 47: 294-306.

Chamove, A.S. (2001). Floor-covering research benefits primates. *Australian Primatology* 14: 16-19.

Chamove, A. S. and Anderson, J. R., 1989. Examining environmental enrichment. In: Segal, E. F. (ed.), *Housing, Care and Psychological Well-being of Captive and Laboratory Primates*, Noyes, Park Ridge, pp. 183-202.

Chamove, S., Anderson, J.R., Morgan-Jones, S.C. and Jones, S.P. (1982). Deep woodchip litter: Hygiene, feeding and behavioral enhancement in eight primate species. *International Journal Study Animal Problems* 3: 308-318.

Clarke, A.S., Mason, W.Z. and Moberg, G.P. (1988). Differential behavioral and adrenocortical responses to stress among three macaque species. *American Journal of Primatology* 14: 37-52.

Clum, N., Silver, S. and Thomas, P. (2005). *Proceedings of the 7th International Conference on Environmental Enrichment (ICEE), New York, USA, 31 July – 5 August 2005.* Wildlife Conservation Society, New York. http://www.wcs.org/media/file/ICEEProceedingsFinal.pdf

Dawkins, M. S. (1990). From an animal's point of view: Motivation, fitness and animal welfare. *Behavioral and Brain Sciences* 13: 1-61.
Dawkins, M.S. (1998). Evolution and animal welfare. *Quarterly Review of Biology* 73: 305-328.
Dettling, A.C., Feldon, J. and Pryce, C.R. (2002). Repeated parental deprivation in the infant common marmoset (*Callithrix jacchus*, Primates) and analysis of its effects on early development. *Biological Psychiatry* 52: 1037-1046.
Erwin, J. (1986). Environments for captive propagation of primates: interaction of social and physical factors. In: Benirschke, K.W. (ed.), *Primates: The Road to Self Sustaining Populations,* Springer-Verlag, New York, pp. 297-305.
Erwin, J. and Deni, R. (1979). Strangers in a strange land: abnormal behaviours or abnormal environment? In: Erwin, J., Maple, T.L. and Mitchell, G. (eds.), *Captivity and Behaviour: Primates in Breeding Colonies, Laboratories and Zoos,* Van Nostrand Reinhold, New York.
Fagen, R. (1981). *Animal Play Behaviour*. Oxford University Press, London.
Fekete, J.M., Norcross, J.L. and Newman, J.D. (2000). Artificial turf foraging boards as environmental enrichment for pair-housed female squirrel monkeys. *Contemporary Topics in Laboratory Animal Science* 39: 22-26.
Fitch-Snyder, H. and Schulze, H. (2001). *Management of lorises in captivity, a husbandry manual for Asian lorisines* (*Nycticebus and Loris ssp*.). Center for Reproduction of Endangered Species, Zoological Society of San Diego, San Diego, CA.
Management of Lorises in captivity
Fitch-Snyder, H., Schulze, H., and Streicher, U. (in press). Enclosure design for captive slow and pygmy lorises. In: Shekelle, M., Groves, C., Maryanto, I., Schulze, H. and Fitch-Snyder, H. (eds), *Primates of the Oriental Night*, Research Center for Biology, Indonesian Institute of Sciences, Bogor, Indonesia.
Gardin, J.F., Jerome, C.P., Jayo, M.J. and Weaver, D.S. (1989). Maternal factors affecting reproduction in a breeding colony of cynomolgus macaques (*Macaca fascicularis*). *Laboratory Animal Science* 39: 205-212.
Goosen, C. (1989). Influence of age of weaning on the behaviour and well-being of rhesus monkeys. *UFAW Symposium: Laboratory Animal Welfare Research - Primates*, pp. 17-22.
Hampton, S.H. and Hampton, J.K., Jr. (1967). Rearing marmosets from birth by artificial laboratory techniques. *Lab Animal Care* 17: 1-10.
Harlow, H. F. and Harlow, M. K. (1971). Psychopathology in monkeys. In: Kimmel, H.D. (ed.), *Experimental Psychopathology: Recent Research and Theory*, Academic Press, New York, pp. 203-229.
Heath, M. (1989). The training of cynomolgus monkeys and how the human/animal relationship improves with environmental and mental enrichment. *Animal Technology* 40: 11-22.
Honess, P.E., Johnson, P.J. and Wolfensohn, S.E. (2004). A study of behavioural responses of non-human primates to air transport and re-housing. *Laboratory Animals* 38: 119-132.
Institute for Laboratory Animal Research (ILAR). (1996). *Guide for the Care and Use of Laboratory Animals.* National Research Council, Bethesda.
Izard, M.K. (1991). Efforts to promote psychological well-being in prosimian primates at the Duke University Primate Research Center. In: Novak, M.A. and Petto, J. (eds.), *Through the Looking Glass - Issues of Psychological Well-Being in Captive Non-Human Primates,* American Psychological Association, Washington, D.C., pp. 137-148.

Jaeckel, J. (1989). The benefits of training rhesus monkeys living under laboratory conditions. *UFAW-1989 Symposium: Laboratory Animal Welfare Research – Primates,* pp. 23-25.

Johnson, L.D., Petto, A.J. and Sehgal, P.K. (1991). Survival and reproduction as measures of psychological well-being in cotton-top tamarins. In: Novak, M.A. and Petto, J. (eds.), *Through the Looking Glass - Issues of Psychological Well-Being in Captive Non-Human Primates,* American Psychological Association, Washington, D.C., pp. 93-102.

Kessel, A.L. and Brent L. (1998). Cage toys reduce abnormal behavior in individually housed pigtail macaques. *Journal of Applied Animal Welfare Science* 1: 227-234.

Kleiman, D.G. (1978). *The Biology and Conservation of the Callitrichidae*. Smithsonian Institution Press, Washington, D.C.

Kleiman, D.G., Allen, M.E., Thompson, K.V. and Lumpkin, S. (1996). *Wild Mammals in Captivity: Principles and Techniques*. University of Chicago Press, Chicago.

Lacy, R.C., Ballou, J.D. Starfield, A., Thompson, E. and Thomas, A. (1995). Pedigree analyses. In: Ballou, J.D., Gilpin, M., Foose, T. (eds.), *Population Management for Survival and Recovery,* Columbia University Press, New York, pp. 57-75.

Lam, K., Rupniak, N.M.J. and Iversen, S.D. (1991). Use of a grooming and foraging substrate to reduce cage stereotypies in macaques. *Journal of Medical Primatology* 20: 104-109.

Laudenslager, M.L., Held, D.E., Boccia, M.L., Reote, M.L. and Cohen, J.J. (1990). Behavioral and immunological consequences of brief mother-infant separation: A species comparison. *Developmental Psychobiology* 23: 247-64.

Laule, G. (2005). The role of fear in abnormal behavior and animal welfare. In: Clum, N., Silver, S. and Thomas, P. (eds.), *Proceedings of the 7th International Conference on Environmental Enrichment, New York, USA, 31 July – 5 August 2005,* Wildlife Conservation Society, New York, pp. 120-125.

Laule, G.E. and Desmond, T. (1994). Use of positive reinforcement techniques to enhance animal care, research, and well-being. *Proceedings: Wildlife Mammals as Research Models: in the Laboratory and the Field.* A seminar sponsored by the Scientists Center for Animal Welfare at the American Veterinary Medical Association Annual Meeting, San Francisco, pp. 53-59.

Laule, G.E., Bloomsmith, M.A and Schapiro, S.J. (2003). The use of positive reinforcement training techniques to enhance the care, management and welfare of laboratory primates. *Journal of Applied Animal Welfare Science*. 6: 163-173.

Leu, M., Crockett, C.M., Bowers, C.L. and Bowden, D.M. (1993). Changes in activity levels of singly housed longtailed macaques when given the opportunity to exercise in a larger cage. *American Journal of Primatology* 30: 327.

Line, S.W., Clarke, A.S., Markowitz, H. and Ellman, G. (1990). Responses of female macaques to an environmental enrichment apparatus. *Laboratory Animals* 24: 213-220.

Line, S.W., Markowitz, H., Morgan, K.N., and Strong, S. (1991). Effects of cage size and environmental enrichment on behavioral and physiological responses of rhesus monkeys to the stress of daily events. In: Novak, M.A. and Petto, J. (eds.), *Through the Looking Glass - Issues of Psychological Well-being in Captive Non-human Primates,* American Psychological Association, Washington, D.C., pp. 160-179.

Lutz, C.K. and Novak, M. (2005). Environmental enrichment for nonhuman primates: Theory and application. *Institute for Laboratory Animal Research Journal* 46: 178-191.

Lutz, C., Well, A. and Novak, M. (2003). Stereotypic and self-injurious behavior in rhesus macaques: A survey and retrospective analysis of environment and early experience. *American Journal of Primatology* 60: 1-15

Majolo, B., Buchanan-Smith, H.M. and Morris, K. (2003) Factors affecting the successful pairing of unfamiliar common marmoset (*Callithrix jacchus*) females. *Animal Welfare* 12: 327-337.

Markowitz, H. (1982). *Behavioral Enrichment in the Zoo.* Van Nostrand Reinhold, New York.

Markowitz, H. and Spinelli, J.S. (1986). Environmental engineering for primates. In: Benirschke, K.W. (ed.), *Primates: The Road to Self-Sustaining Populations*. Springer-Verlag, New York, pp. 489-498.

Markowitz, H. and Line, S. (1989). Primate research models and environmental enrichment. In: Segal, E. (ed.), *Housing, Care and Psychological Well-being of Captive and Laboratory Primates*, Noyes, Park Ridge, pp. 203-212.

Marriner, L.M. and Drickamer, L.C. (1994). Factors influencing stereotyped behavior of primates in a zoo. *Zoo Biology* 13: 267-275.

Mason, G.J. and Mendl, M. (1993). Why is there no simple way of measuring animal welfare? *Animal Welfare* 2: 301-319.

Matsuzawa, T. (1989). Spontaneous pattern construction in a chimpanzee. In: Heltne, P. and Marquardt, L. (eds.), *Understanding Chimpanzees*, Harvard University Press, Cambridge, pp. 252-265.

Matsuzawa, T., Tomonaga, M. and Tanaka, M. (2006). *Cognitive Enrichment in Chimpanzees: An Approach of Welfare Entailing an Animal's Entire Resources*. Springer-Verlag, New York.

McCann, C., Elbin, S. and Thomas, P. (1993). Primate enrichment at the International Wildlife Conservation Park. *Proceedings of the AAZPA Northeast Regional Conference*, Pittsburgh, PA, pp. 682-689.

McGrew W.C., Brennan, J.A. and Russell, J. (1986). An artificial "gum-tree" for marmosets (*Callithrix j. jacchus*). *Zoo Biology* 5: 45-50.

McKinley, J., Buchanan-Smith, H.M., Bassett, L. and Morris, K. (2003). Training common marmosets (*Callithrix jacchus*) to cooperate during routine laboratory procedures: Ease of training and time investment. *Journal of Applied Animal Welfare Science* 6: 209-220.

Metzger, E. and McCann, C. (2005). The effect of choice on primate well-being. In: Clum, N., Silver, S. and Thomas P. (eds.), *Proceedings of the 7th International Conference on Environmental Enrichment, New York, USA, 31 July – 5 August 2005*, Wildlife Conservation Society, New York, pp. 22-25.

Mineka, S., Gunnar, M. and Champoux, M. (1986). Control and early socioemotional development: Infant rhesus monkeys reared in controllable versus uncontrollable environments. *Child Development* 57: 1241-1256.

Mistlberger, R.E. (1994). Circadian food-anticipatory activity: formal models and physiological mechanisms. *Neuroscience and Biobehavioral Reviews* 18: 171-195.

Moberg, G.P. and Mench, J.A. (2000). *The Biology of Animal Stress: Basic Principles and Implications for Animal Welfare*. CABI Publishing, New York.

National Institutes of Health (NIH)/Office of Laboratory Animal Welfare (OLAW). (2005). *Enrichment for nonhuman primates: A six-booklet series on providing appropriate enrichment for baboons, capuchins, chimpanzees, macaques, marmosets, tamarins and squirrel monkeys*. http://grants.nih.gov/grants/OLAW/Enrichment_for_Nonhuman_Primates.pdf

O'Neill, P. (1989). Room with a view for captive primates: Issues, goals, related research and strategies. In: Segal, E. F. (ed.), *Housing, Care and Psychological Well-Being of Captive and Laboratory Primates*, Noyes, Park Ridge, pp. 135-160.

Organisation for Economic Co-operation and Development (OECD). (2000). *Guidance document on the recognition, assessment, and use of clinical signs as humane endpoints for experimental animals used in safety evaluation.* Environmental Health and Safety Publications, Series on Testing and Assessment, No. 19. http://www.olis.oecd.org/olis/2000doc.nsf/LinkTo/env-jm-mono(2000)7

Overmier, J.B., Patterson, J. and Wielkiewicz, R.M. (1980). Environmental contingencies as sources of stress in animals. In: Levine, S, and Ursin, H. (eds.), *Coping and Health,* Plenum Press, New York, pp. 1-38.

Pereira, M.E. and Fairbanks, L.A. (1993). *Juvenile Primates: Life History, Development and Behavior*. Oxford University Press, New York.

Pines, M.K., Kaplan, G. and Rogers, L.J. (2005). Use of horizontal and vertical climbing structures by captive common marmosets (*Callithrix jacchus*). *Applied Animal Behaviour Science* 91: 311-319.

Pook, A.G. (1977). Some notes on the development of hand-reared infants of four species of marmoset Callitrichidae. *The Thirteenth Annual Report of the Jersey Wildlife Preservation Trust*, pp. 38-46.

Poole, T.B. (1988). Normal and abnormal behaviour in captive primates. *Primate Report* 22: 3-12.

Porton, I. (1997). Birth management and hand-rearing of captive gorillas. In: Ogden, J. and Wharton, D. (eds.), *The Management of Gorillas in Captivity: Husbandry Manual of the Gorilla Species Survival Plan*, AZA Gorilla SSP and Atlanta/Fulton County Zoo, pp. 111-123.

Prescott, M.J. and Buchanan-Smith, H.M. (2004). Cage sizes for tamarins in the laboratory. *Animal Welfare* 13: 151-158.

Prescott, M.J. and Buchanan-Smith, H.M. (2007). Training laboratory-housed non-human primates, part 1: a UK survey. *Animal Welfare* 16: 21-36.

Prescott, M.J., Bowell, V.A. and Buchanan-Smith, H.M. (2005). Training laboratory-housed non-human primates, Part 2: Resources for developing and implementing training programmes. *Animal Technology and Welfare* 4: 133-148.

Price, E.C., and McGrew, W.C. (1990). Cotton-top tamarins (*Saguinus (o.) oedipus*) in a semi-naturalistic captive colony. *American Journal of Primatology* 20: 1-12.

Ralls, K. and Ballou, J.D. (1992). *Managing Genetic Diversity in Captive Breeding and Reintroduction Programs.* Trans. 57th North American Wildlife & Natural Resource Conference, pp. 263-282.

Reinhardt, V. (1997). Training nonhuman primates to cooperate during handling procedures: A review. *Animal Technology* 48: 55-73.

Reinhardt, V. and Reinhardt, A. (1999). The monkey cave: The dark lower-row cage. *Laboratory Primate Newsletter* 38: 8-9.

Reinhardt, V. and Reinhardt, A. (2000). The lower row monkey cage: An overlooked variable in biomedical research. *Journal of Applied Animal Welfare Science* 3: 141-149.

Reinhardt, V., Hauser, D., Eisele, S. Cowley, D. and Vertein, R. (1988). Behavioral responses to unrelated rhesus monkey females paired for the purpose of environmental enrichment. *American Journal of Primatology* 14: 135-140.

Reite, M. (1987). Infant abuse and neglect: lessons from the primate laboratory. *Child Abuse and Neglect* 11: 347-355.
Rennie, A.E. and Buchanan-Smith, H.M. (2006a) Refinement of the use of Non-human Primates in Scientific Research. Part I: The influence of humans. *Animal Welfare* 15: 203-213.
Rennie, A.E. and Buchanan-Smith, H.M. (2006b) Refinement of the use of Non-human Primates in Scientific Research. Part II: Housing, husbandry and acquisition. *Animal Welfare* 15: 215-238.
Rettberg-Beck, B. and Ballou, J D. (1987). Survival and reproduction of hand-reared golden lion tamarins. In: Ballou, J D., *International Studbook for the Golden Lion Tamarin*, *Leontopithecus rosalia rosalia*, National Zoological Park, Washington, D.C., pp. 10-14.
Riviello, M.C. (1995). The use of feeding board as an environmental enrichment device for tufted capuchin monkeys (*Cebus apella*). *Primate Report* 42: 23-24.
Rohrer, M.A. (1979). Hand-rearing golden lion marmosets, *Leontopithecus rosalia*, at the Oklahoma City Zoo. *Animal Keeper's Forum* 6: 33-39.
Sambrook, T.D. and Buchanan-Smith, H.M. (1997). Control and complexity in novel object enrichment. *Animal Welfare* 6: 207-216.
Savastano, G., Hanson, A. and McCann, C. (2003). The development of an operant conditioning program for New World primates at the Bronx Zoo. *Journal of Applied Animal Welfare Science* 6: 247-261.
Schapiro, S.J. and Bloomsmith, M.A. (1995). Behavioral effects of enrichment on singly-housed, yearling rhesus monkeys: An analysis including three enrichment conditions and a control group. *American Journal of Primatology* 35: 89-101.
Schapiro, S.J., Bloomsmith, M.A., Porter, L.M., and Saurez, S.A. (1996). Enrichment effects on rhesus monkeys successively housed singly, in pairs, and in groups. *Applied Animal Behaviour Science* 48: 159-171.
Schapiro, S.J., Bloomsmith, M.A. and Laule, G.E. (2003). Positive reinforcement training as a technique to alter nonhuman primate behavior: Quantitative assessments of effectiveness. *Journal of Applied Animal Welfare Science* 6: 175-187.
Seal, U.S., Ballou, J.D., Padua, C. (1990). *Leontopithecus: Population Viability Workshop.* Captive Breeding Specialist Group (IUCN). Apple Valley, MN.
Segal, E.F. (1989). *Housing, Care and Psychological Well-being of Captive and Laboratory Primates.* Noyes, Park Ridge.
Shepherdson, D. (1989). Environmental enrichment in zoos: 2. *Ratel* 16: 68-73.
Shepherdson, D.J. (2003). Environmental enrichment: Past, present and future. *International Zoo Yearbook* 38: 118-124.
Shepherdson, D.J., Mellen, J.D. and Hutchins, M. (1998). *Second Nature: Environmental Enrichment for Captive Animals*. Smithsonian Institution, Washington, D.C.
Smith, J.A. and Boyd, K.M. (2002). *The Boyd Group Papers on the Use of Non-Human Primates in Research and Testing*. Leicester, British Psychological Society Scientific Affairs Board Standing Advisory Committee on the Welfare of Animals in Psychology. http://www.boyd-group.demon.co.uk/primatespapers.htm
Smith, T. E., McGreer-Whitworth, B. and French, J. A. (1998). Close proximity of the heterosexual partner reduces the physiological and behavioral consequences of novel-cage housing in black tufted-ear marmosets (*Callithrix kuhli*). *Hormones and Behavior* 34: 211-222.

Snowdon, C.T. (1991). Naturalistic environments and psychological well-being. In: Novak, M.A. and Petto, J. (eds.), *Through the Looking Glass - Issues of Psychological Well-Being in Captive Non-Human Primates,* American Psychological Association, Washington, D.C., pp. 103-115.

Suomi, S.J. and Novak, M.A. (1991). The role of individual differences in promoting psychological well-being in rhesus monkeys. In: Novak, M.A. and Petto, J. (eds.), *Through the Looking Glass: Issues of Psychological Well-Being in Captive Nonhuman Primates,* American Psychological Association, Washington, DC, pp. 50-56.

U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training. http://www.absc.usgs.gov/research/vet/policies/IRACPRIN.htm

Ventura, R. and Buchanan-Smith, H.M. (2003). Physical environment effects on infant care and infant development in captive common marmosets *Callithrix jacchus. International Journal of Primatology* 24: 399-413.

Waitt, C. and Buchanan-Smith, H.M. (2001). What time is feeding? How delays and anticipation of feeding schedules affect stump-tailed macaque behavior. *Applied Animal Behaviour Science* 75: 75-85.

Webster, A.F. (1984). *Calf Husbandry, Health and Welfare*. Collins, London.

Wemelsfelder, F. (1984). Animal boredom: Is a scientific study of the subjective experiences of animals possible? In: Fox, M.W. and Mickley, L.D. (eds.), *Advances in Animal Welfare Science*, Humane Society of the United States, Boston, pp. 115-153.

Williams-Blangero, S., VandeBerg, J.L. and Bennett D. (2002) Genetic management of nonhuman primates. *Journal of Medical Primatology* 31: 1-7.

Wolfensohn, S.E. and Honess, P. (2005). *Handbook of Primate Husbandry and Welfare*. Blackwell Publishing Ltd., Oxford.

IPS Code of Practice 2:
LEVELS OF TRAINING FOR PRIMATE CARE STAFF

AIM

The aim of this code of practice is to indicate the desirable levels of expertise that should be expected from staff responsible for the day-to-day care of nonhuman primates in the laboratory, breeding center, zoo, and where applicable, sanctuaries and rescue centers.

INTRODUCTION

The code of practice is intended to be applied internationally. The usual method of training in most countries will be in-house by more experienced staff. In some countries there may be greater opportunities for formal training than in others; where such courses are available, IPS encourages employers to offer opportunities for staff to attend them. Additionally, there are numerous resources available on primate care training that can provide guidance on developing appropriate staff training programs (see References listed on page 67 for some representative examples).

Additionally, with limited opportunities for training in primate habitat countries; the Captive Care Committee strongly encourages non-habitat country primatologists to partner and mentor the primate care staff at such facilities for capacity building through staff exchange programs, training workshops and/or provide funds for attendance to continuing education courses and workshops. By doing so, the primate captive care community will better be able to approximate a universal standard of primate care as set forth by IPS.

EXPERTISE REQUIRED FOR DIFFERENT LEVELS OF RESPONSIBILITY

The grades of knowledge will be specified from the most basic level to the most senior. Staff at each level must be familiar with all the knowledge required at lower grades.

Grade 1: Animal Technician

Food:

- appropriate diets for the animals
- optimum storage conditions, shelf life and control of vermin
- different methods of feeding (e.g., hoppers, dispensers, foraging)
- preparation of diets under hygienic conditions
- frequency of feeding and quantities of food required at different ages and reproductive states, such as pregnancy and lactation
- provision of any dietary supplements (e.g., vitamin D_3 for callitrichids) and method of delivery

Water:

- familiarity with sources of drinking water
- the need for animals to have access to a constant supply of clean water
- maintenance and sanitation of water bottles or automatic waterers

Physical Environment:

- optimum and range of conditions appropriate for the species
- appropriate conditions of temperature and humidity
- familiarity with and ability to operate controls
- changing air filters (where fitted) and lights
- checking and maintaining escape proof barriers
- regular checking and, where necessary, cleaning of trapped drains

Hygiene:

- understanding the needs of hygiene and likely results of inadequate cleaning
- wearing appropriate clothing and protective accessories
- maintaining personal hygiene
- knowledge of frequency of cleaning routine
- different methods of cleaning/disinfection/sterilization and appropriate disinfectants and concentrations to be used
- types of bedding and how often they should be replaced
- identification of common pest and control techniques
- waste disposal methods which are hygienic and do not pollute the environment
- correct storage of consumables, drugs and disinfectants

Health and Welfare:

- ability to recognize normal and abnormal behaviors and report changes
- recognition of pain and distress and the detection of early signs of ill health in the animals
- contact procedure to obtain veterinary advice
- operation of isolation and quarantine procedures
- responsibility for reporting to the management any illness among members of staff, to determine whether it might be hazardous to the monkeys (e.g., TB or Herpes) and to safeguard the health of personnel
- knowledge of basic nursing techniques
- provide species-appropriate environmental enrichment

Rapport with Animals:

- appropriate attitudes in dealing with animals
- familiarization and knowledge of training techniques to ensure their cooperation
- methods of safe handling including the use of sedatives in an emergency
- awareness of compatibility between monkeys, particularly in a breeding colony

Records and Daily Log Book:

- familiarity with methods of animal identification
- writing of daily records (form of record, information required)
- awareness of all security procedures
- procedure for daily reporting of all matters of significance to the senior technician

Grade 2: Senior Animal Technician

Experience:

- all skills specified in grade 1
- minimum of 4 years experience

Collection Management and Colony Health:

- maintain supply of animals and knowledge of all associated legislation
- monitor animal health (see IPS Code of Practice 3: Health Care)
- responsibility for specific animals and allocating their care to particular staff
- procedures for marking animals for identification
- familiarity with common diseases and their symptoms
- familiarity with any zoonotic hazards
- routine veterinary health monitoring procedures
- dosing methods for common medicines
- knowledge of appropriate anesthetics for the species and method of administration, anesthesia and control
- maintain a quarantine, hospital and isolation unit
- special care during illness, or post operatively
- maintain health records for each animal
- recognition of hierarchical structure in colony, prevention and control of aggression
- ability to operate emergency sedation and euthanasia techniques
- knowledge of processing methods of animals for post mortem examination

Breeding Programs:

- conduct and development of the breeding program
- recognizing signs of estrus and pregnancy, parturition and dystocia
- monitoring maternal care
- keeping detailed records of reproductive history, social compatibility and genetic relationships of all colony members
- development of and adherence to population management plan
- techniques for hand rearing rejected infants and subsequent socialization procedures (if this is the policy of the unit)

Housing and Enrichment:

- appropriate caging for the species with adequate space to meet the needs of the animal
- provision and maintenance of cage furniture and forms of environmental enrichment
- establishment of cleaning routine

Biology of Animals:

- for each species
- its geographical range and climate
- reproductive physiology
- natural social organization of the species
- natural diet and habitat
- social groups which are appropriate for captive conditions
- basic behavioral repertoire (or ethogram)

Management:

- drawing up work schedules
- monitoring staff performance and efficiency
- staff training
- ensuring that health and safety of staff are protected and that their vaccination histories are recorded and updated
- procedures for dealing with bites and scratches
- enforcing dress and hygiene regulations
- monitoring staff health and ensuring that appropriate precautions such as vaccinations are up to date
- ensuring that there is good communication between all staff at all levels

Maintaining Supplies:

- regular re-stocking of supplies
- recording sales or transfers to other colonies and supplying relevant documentation
- ordering supplies of food and bedding and routine medications for the animals
- checking the condition of all supplies and ensuring that commercial diets and medications are used before last date for shelf life and that they are stored correctly
- replacement of worn or damaged cage furniture
- knowledge of appropriate transport containers for animals and national and international regulations relating to their transportation

Record Keeping:

- transferring information from daily log book to permanent files
- regular updating of animal records: deaths, births, acquisitions, health, reproductive conditions, etc.

Experimental Procedure:

- knowledge of laws or regulations controlling experiments
- familiarity with the aims and requirements of the scientific research
- communication with the unit manager, veterinarians and scientists on research proposals
- expertise in humane handling and training the animals to cooperate in procedures
- use and administration of analgesics
- ability to carry out simple routine procedures with minimal stress to the animal

Grade 3: Facility Manager

Experience: All Skills of Grades 1 and 2

Qualifications:

- a degree in biological or veterinary science or animal technology
- or 8 years practical hands-on experience in a primate colony
- preferred: an additional specialist qualification in primate medicine, behavior or laboratory animal science

Responsibilities:

- efficient operational running of the facility
- preparation and management of budgets
- maintain staffing levels
- the welfare of staff
- maintain high standards of animal welfare
- ensure that veterinary services are available at all times
- ensure availability of veterinary advice on matters such as disease prophylaxis, zoonoses, methods of humane euthanasia and provision of health certificates
- consult with behavior staff, in collaboration with veterinary and facility staff, on relevant issues germane to colony management
- provision of environmental enrichment to meet behavioral needs
- staff training, education and motivation
- staff working schedules and holidays
- job descriptions
- staff promotion and grading
- production schedules
- prevention of any infringements of state, regional or international laws and regulations
- adequate insurance cover for the facility, its staff and third party claims
- accountability to the local community in terms of noise, pollution, security of enclosures

Animal Experimentation:

- a good working relationship and communication with the facility's veterinarian(s) to collaborate on all matters relating to animal health and welfare
- good communication with the facility's scientists
- the unit manager should understand the scientific aims of the research with his/her animals and balance these against the severity of the procedure to be implemented
- ensuring that experiments causing harm to the primates use the minimum number of animals, employ the least stressful methods and could not be carried out using non-sentient material or other captive-bred domestic species. In the event of a conflict between the animal care staff (unit manager and veterinarian) and the scientific staff over the welfare of an animal, the animal care staff should have the final decision. The animal care staff should have the power, under exceptional circumstances, to terminate an experiment or euthanize the animal if they judge that the suffering inflicted is unjustifiable.

Advances in Knowledge:
Facility managers should keep up to date with advances in laboratory animal science, animal welfare science and technological advances in the care and management of nonhuman primates through regular reviewing of captive care journals and publications. Where it is practicable, and staff is available, research in primate husbandry methods, techniques for environmental enrichment and laboratory animal science should be encouraged in the facility.

REFERENCES

Ad Hoc Committee on Education of the Canadian Council on Animal Care (CCAC). (1984). *Syllabus of the Basic Principles of Laboratory Animal Science*. Canadian Council on Animal Care, Ottawa.

American Association for Laboratory Animal Science (AALAS). (1972). Syllabus for the Laboratory Animal Technologist. *American Association for Laboratory Animal Science* Pub. No. 72-2, Joliet.

American Association for Laboratory Animal Science (AALAS). (1989). Training Manual Series, Vol. I, Assistant Laboratory Animal Technicians. *American Association for Laboratory Animal Science* Pub. No. 89-1, Joliet.

American Association for Laboratory Animal Science (AALAS). (1990a). Lesson Plans: Instructional Guide for Technician Training. *American Association for Laboratory Animal Science* Pub. No. 90-1, Joliet.

American Association for Laboratory Animal Science (AALAS). (1990b). Training Manual Series, Vol. II., Laboratory Animal Technicians. *American Association for Laboratory Animal Science* Pub. No. 90-2. Joliet.

American Association for Laboratory Animal Science (AALAS). (1991). Training Manual Series, Vol. III, Laboratory Animal Technologist. *American Association for Laboratory Animal Science* Pub. No. 91-3, Joliet.

Erichsen, S., van der Gulden, W.J.I., Hanninen, O., Hovell, G.J.R., Kallai, L. and Khemmani, M. (1976). *The Education and Training of Laboratory Animal Technicians*. Prepared for the International Committee on Laboratory Animals, World Health Organization, Geneva.

Federation of European Laboratory Animal Science Associations. (1995). FELASA recommendations on the education and training of persons working with laboratory animals: Categories A and C. *Laboratory Animals* 29: 121-131. http://www.lal.org.uk/pdffiles/LAfel7.PDF

Federation of European Laboratory Animal Science Associations. (1999). FELASA guidelines for education of specialists in laboratory animal science (Category D). *Laboratory Animals* 31: 1-15. http://www.lal.org.uk/pdffiles/LAfel3.PDF

Federation of European Laboratory Animal Science Associations. (1999). Health monitoring of non-human primate colonies. *Laboratory Animals* 33: S3-S18. http://www.lal.org.uk/pdffiles/LAfel5.pdf

Federation of European Laboratory Animal Science Associations. (2000). FELASA recommendations for the education and training of persons carrying out animal experiments (Category B). *Laboratory Animals* 34: 229-235. http://www.lal.org.uk/pdffiles/lafel6.pdf

Hau, J. and Van Hoosier, G.L. (2003). *Handbook of Laboratory Animal Science*, *Vol. 2*. CRC, Boca Raton.

Hau, J. and Van Hoosier, G.L. (2005). *Handbook of Laboratory Animal Science, Vol. 3*. CRC, Boca Raton.

Institute for Laboratory Animal Research (ILAR). (2004). *The Development of Science-Based Guidelines for Laboratory Animal Care: Proceedings of the November 2003 International Workshop.* National Academies Press, Washington, D.C. http://www.nap.edu/books/0309093023/html

Institute of Laboratory Animal Resources (ILAR) Committee on Education. (1979). Laboratory Animal Medicine: Guidelines for Education and Training. *ILAR News* 22: Ml-M26.

Institute for Laboratory Animal Research (ILAR) Committee on Nonhuman Primates, Subcommittee on Care and Use. (1980). Laboratory Animal Management: Nonhuman Primates. *ILAR News* 23: l-44.

Kreger. M.D. (1995). *Training Materials for Animal Facility Personnel: AWIC Quick Bibliography Series, 95-08*. National Agricultural Library, Beltsville.

Pan African Sanctuaries Alliance (PASA) www.panafricanprimates.org.

The Association of Sanctuaries (TAOS) www.taosanctuaries.org .

Weed, J. and Raber, J. (2005). Balancing animal research with well-being: Establishment of goals and harmonization of approaches. *ILAR Journal* 46: 118-128.

IPS Code of Practice 3:
HEALTH CARE

AIM

Wild primates are under increasing pressures from habitat destruction, human encroachment, bushmeat hunting and disease transmission. These pressures have contributed to declining numbers in populations of free-ranging primates and, in some cases, have led to the extinction of primate species. When it is deemed necessary that animals must be taken from the wild (for example, in order to acquire breeding stock for a sustainable captive breeding program) capture should be restricted to species that are not threatened and areas where animals are in sufficient abundance to avoid over exploitation, or from habitats which are being destroyed and can no longer support available primate populations. Questions of species abundance and conservation status must be answered before any trapping program is initiated. These data may be available from published sources (IUCN Red List, CAMP for Primates, etc.) or they may be obtainable from knowledgeable habitat country collaborators.

The IPS Code of Practice Health Care recommendations are designed to address the concerns surrounding animal health after capture from the wild. Sound animal welfare and scientific reasons exist for using captive-bred primates in preference to wild-caught primates, and institutions that currently trap from the wild should adopt policies to decrease reliance upon wild populations.

The program of health care for newly captive nonhuman primates will vary according to the origins of the animals, the species involved and the purpose of their use. The use of purpose-bred animals has helped to minimize health problems. Additional advice on health monitoring for nonhuman primate colonies is given in FELASA (1997, 1999).

PRIMATES IN SOURCE COUNTRIES

Primates Captured From the Wild (Feral Primates)

1. Capture of wild primates can be associated with significant morbidity and mortality if basic precautions are not taken. Recommendations for safe capture are outlined elsewhere in the IPS standards.

2. A comprehensive and stringent program of health care for wild-caught primates is necessary. There should be a minimum two-week ’pre-conditioning’ period at the place of capture followed by an additional four weeks conditioning at the main facility. Animals held in the field at the place of capture should be kept as calm and undisturbed as possible. To avoid contagion and trauma during this preliminary pre-conditioning, animals should not be caged together except for known family groups, mothers and infants, and young animals. Holding animals in human dwellings must be avoided. Significant morbidity and mortality following exposure to human pathogens has been documented in primates newly captured from the wild and held in human

settlements. Animals should be housed in suitably enriched conditions and provided with food items they would normally consume when free ranging. In the transportation to the main conditioning facility, the crating, feeding and watering of the animals should conform to IPS standards defined elsewhere. Once at the main facility, animals should be housed in compatible groups wherever possible.

3. All animals newly transferred from the wild to the main facility for further conditioning should be evaluated by a veterinarian upon arrival in the facility for the signs of illness, stress and hyperthermia, dehydration, trauma, or other abnormalities, and treated as necessary. When treatment is necessary, it should follow the veterinary care procedures of the facility (for recommendations and additional references on primate care see: Poole, 1999; AAALAC Reference Resources http://www.aaalac.org/accreditation/resources.cfm).

4. Newly arriving animals should be housed in a quarantine room at the main facility. All individuals from a single source/trapping should be housed in one quarantined room, adequately lit and ventilated, and with suitable space and environmental complexity. Once conditioning of that group has commenced then no additional animals should be introduced into that room. Should additional animals have to be added, then the conditioning period should recommence for all animals in that room from the date that the last individual was introduced (CDC, 1990; Butler *et al*., 1995).

5. Upon receipt of an animal, an individual clinical record should be initiated and maintained throughout the animal's residence. The record card for each animal should provide the date of arrival at the facility, location of capture (geographic locality), species/subspecies, animal number, weight, clinical examination and all procedures carried out. Other recorded information should include samples collected for screening or diagnostic purposes, date of sample collection, type of test, and results.

6. Each individual should be identified in a permanent manner with a microchip appropriate for the kind and size of species.

7. Each animal should be weighed at least twice during the conditioning period.

8. At the start of the conditioning period, each animal should undergo a complete physical examination by a veterinarian or a person suitably trained to carry out such procedures. Observations of all animals should be performed by trained staff at least 1-2 times per day during daily rounds including weekends and holidays. More frequent observations should be conducted for animals under post-surgical observation or intensive medical care as directed by a veterinarian. There should be a final check within a few days of shipment. Parameters to be observed during routine rounds include, but are not limited to, general appearance of animals noting body condition with particular reference to musculature, coat, dentition, buccal mucosa, eyes, signs of pain, distress, or other behavioral abnormality, appetite, fecal and urine presentation, menstruation, tumescence, presence of wounds or abnormal discharge, TB test reading (when conducted), and other abnormalities including behavioral abnormalities indicative of stress (such as stereotypies, self-directed social behavior, juvenile behavior in adults, learned

helplessness or self-mutilation). Observations should be documented on a daily log form. Abnormal observations should be reported to the veterinarian.

9. Three tuberculin tests (0.1 ml of mammalian tuberculin, (15,000 tuberculin units/ml) injected intradermally in either the left or right palpebra using a tuberculin syringe with a 26 gauge or smaller needle) at intervals of two weeks are required for those species of primates susceptible to tuberculosis. Test results should be read at 24, 48 and 72 hours by a veterinary technologist and recorded in the animal's record. Any reactor detected should be removed from the group and the remaining individuals retested until all animals in that group have three consecutive negative tests (Butler *et al*., 1995).

10. Each animal should receive screening for endoparasites, and blood parasites, and treatment against helminths. A standard procedure is an injection of ivermectin at 0.2mg/kg SQ which is repeated 14 days later. Those testing positive for protozoals can be treated or removed from the group depending on the receiver's request (for detailed information and additional references on infectious agents in primates see: Bennett *et al*., 1998).

11. Any animal showing symptoms of illness, such as that associated with respiratory disease, diarrhea or abscesses, should receive appropriate antibiotic and supportive therapy. Animals requiring surgery should be attended to immediately. There should be a small hospital unit where animals can be treated and isolated for intensive medical therapy. A laboratory service should be available to provide back-up diagnostic support.

12. When possible sick animals should be treated in their home cages. To minimize stress associated with movement to unfamiliar surroundings and isolation, efforts should be made to leave animals with minor clinical abnormalities with their group and observe and treat within the group enclosure. When animals must be removed from the group for closer observation and treatment, efforts should be made to house them in an anteroom adjacent to the home group enclosure within individual stainless steel cages in a manner that allows the individually housed animal to maintain visual and vocal contact with the rest of the group, thus reducing possible stress associated with separation anxiety.

13. Facilities and diagnostic laboratory services should be available if additional health screening procedures are required. Such procedures could include radiography, screening for Salmonella, Shigella and other potential bacterial pathogens, the detection of antibodies to Pseudomonas pseudomallei, Herpes B virus, Simian Immunodeficiency virus, Type D retroviruses, hepatitis A and B, measles and filoviruses (for detailed information and additional references on infectious agents in primates see: Bennett *et al*., 1998).

Primates Bred in Captivity (Captive-bred Primates)

Captive-bred primates should be derived from stock that initially underwent a minimum health screening program, as outlined above. An additional two tuberculin tests and further anti-helminth therapy are recommended. The potential breeding stock should also be screened for protozoal pathogens, Salmonella and Shigella by fecal sampling on three consecutive days. One should only use for breeding those animals found negative on testing. Positive Salmonella cases

can be treated and used for breeding, if found to be negative on retest. The breeding stock could also be screened and chosen for having no antibodies to Herpes B virus, SIV SRV I and 2 depending on these viruses' relevance to the species of monkey concerned.

Once the breeding colony has been established, it should be monitored on a regular basis to ensure no breakdown in disease control. Such a program should include the following which could be done every six months:

1. Microscopic fecal examination for parasites
2. Anti-helminth therapy prophylactically or based on fecal exam results.
3. Tuberculin testing.
4. Salmonella and Shigella testing of fecal swabs from each animal.

If the colony is free from Herpes B virus and SIV, serologically monitoring of each animal should be undertaken once a year.

Primates weaned from these colonies should continue to be monitored, as above, with regular weight checks, clinical examinations, and behavioral monitoring.

Primates Bred on Islands (Purpose-bred Primates)

Such animals are derived from stock initially screened as described above and then placed on an uninhabited island previously free of other primates. Once a sustainable population is achieved on that island, weaned animals can be harvested. Confirmation of parentage of such animals may require additional testing (e.g., paternity testing) for verification. Free-ranging in an open environment would require that such animals are subjected to a rigorous health care program similar to that described for feral stock.

PRIMATES IN IMPORTING COUNTRIES

Feral, Captive-bred or Purpose-bred Animals Imported from Habitat Source Countries

The health screening procedures for such stock will vary according to the recipient's requirements and the regulations for such animals within the importing country. A quarantine period of at least 30 days is usually required to ensure the health status of the animals is maintained and to provide a period of adjustment for the animals. Primates should not be imported from suppliers unable to provide the health-screening program described for feral stock. Each animal should arrive with a record card detailing all procedures carried out and be housed in conditions appropriate to the species. It is preferable on animal welfare grounds to pair young adolescent individuals and compatible animals wherever possible. No mixing of new and old stock should occur. If this does happen, then the period of quarantine should start from the date the last animals were received. All animals of one species should be housed in one unit, separate from other species. A similar health monitoring of animals should be applied as outlined for feral stock in the source countries. This would include a preliminary physical examination by trained staff and immediate treatment of health problems. Further health monitoring of stock,

particularly with regard to tuberculin testing and anti-helminth therapy, would depend on the policy of the receiving primate facility and the degree of screening implemented prior to arrival.

It is important to establish a standard protocol of health screening for primates from habitat source countries, particularly with regard to feral stock. The health care program outlined above is a minimum acceptable standard of care that will ensure good health and welfare of each primate is achieved and maintained. It will also lessen the problems likely to be encountered in the importing country. For these reasons, it is essential that the importer only accepts animals from reliable primate facilities with high welfare standards implementing protocols similar to those described. Increasingly, reputable primate facilities in habitat source countries are pursuing AAALAC accreditation to demonstrate their commitment to responsible animal research and good science. It is equally critical for the importer to be aware of all regulations placed on exporting countries and to ensure that such regulations are adhered to, as both parties must be held accountable for the conditions under which primates are imported.

Primates Bred in Captivity

Health screening of such animals should be similar to that outlined for breeding colonies in the source countries. However, with easy access to laboratory facilities and with the wide range of viral screening now available, there is a greater potential for monitoring the colony status of many viral entities. Where new colonies are to be established, consideration should be given to ensuring the breeding stock is free of antibodies to specific diseases, where these are known to be harbored by the species of primate involved and where these could be potential source of health problems (see Bennett *et al*., 1995).

HEALTH CARE OF STAFF WORKING WITH NONHUMAN PRIMATES

To avoid the transmission of infection from nonhuman primates to humans and vice versa, consideration should be given to the health monitoring of staff working with such animals. The transmission of disease can be substantially reduced by ensuring good animal care practices are maintained with appropriate protective clothing, personal hygiene and the facility to provide appropriate vaccinations and health screening of staff working in close proximity with primates. It would be a sound policy to have animal care staff vaccinated against tetanus, polio, rabies and screened for tuberculosis. Vaccination against measles and hepatitis is also recommended when working with some species. The primate facility should have appropriate medical cover to ensure treatment of staff injuries and illness attributable to working with the primates. Such cover should ensure that each member of staff was made aware of the hazards of working with such animals and the preventative measures available to reduce such hazards. Facilities with macaques should establish practices for protecting staff from the risk of infection with Herpes B virus of macaques. They should also have facilities and services available for immediately treating any wounds that are potentially infected with the virus. This disease has a rapid high mortality rate in humans if not immediately treated. Current recommendations for handling potential exposure indicate that the most important first step is to cleanse the wound with clean or sterile running water for 15 minutes within the first 5 minutes of exposure. Provision could also be made to keep records of staff vaccinations and illnesses that could affect the primates on

site; in conjunction with this, a serum bank could be implemented to store serum samples from staff.

There are many agencies, such as the Center for Disease Control and Prevention (CDC, 1987, 1999) and the Institute for Laboratory Research (ILAR, 1996), that provide primate handling guidelines that can be used as a resource for developing an institutional policy based on the species maintained at the facility. For examples, see:
http://www.cdc.gov/od/ohs/biosfty/bmbl/sect7e.htm
http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4s7f.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/00001538.htm
http://www.nap.edu/readingroom/books/labrats/

REFERENCES

American Society of Veterinary Medicine (AVMA). Position Statements: http://www.avma.org/issues/animal_welfare/default.asp

Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) International. (2006). Accreditation Position Statements: http://www.aaalac.org/accreditation/positionstatements.cfm; International Regulations: http://www.aaalac.org/resources/internationalregs.cfm Reference Resources: http://www.aaalac.org/accreditation/resources.cfm

Bennett, B.T., Abee, C.R. and Henrickson, R. (1995). *Nonhuman Primates in Biomedical Research: Volume 1, Biology and Management.* Academic Press, New York.

Bennett, B.T., Abee, C.R. and Henrickson, R. (1998) *Nonhuman Primates in Biomedical Research: Volume 2, Diseases.* Academic Press, New York.

Boardman, W., Dubuis, E., Fielder, J., Lewis, J. and Unwin, S. (2004). *Pan African Sanctuary Alliance (PASA) Veterinary Healthcare Manual*. Unpublished. www.panafricanprimates.org.

Butler, T.M., Brown, B., Dysko, R.C. and Ford, E.W. (1995). Medical management. In: Bennett, B.T., Abee, C.R. and Henrickson, R. (eds.), *Nonhuman Primates in Biomedical Research: Volume I, Biology and Management*, Academic Press, New York, pp. 255-334.

Centers for Disease Control and Prevention (CDC). (1987). Guidelines for Prevention of Herpesvirus Simiae (B Virus) Infection in Monkey Handlers. *Morbidity and Mortality Weekly Report* 36: 680-682, 687-689. http://www.cdc.gov/mmwr/preview/mmwrhtml/00015936.htm

Centers for Disease Control and Prevention (CDC). (1990). Update: Ebola related filovirus infection in nonhuman primates and interim guidelines for handling nonhuman primates during transit and quarantine. *Morbidity and Mortality Weekly Report* 39: 22-23.

Centers for Disease Control and Prevention (CDC). (1999). *Biosafety in Microbiological and Biomedical Laboratories, 4th Edition*. U.S. Department of Health and Human Services, Public Health Service, Bethesda. http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm

Code of Federal Regulations, Title 9 (Animals and Animal Products), Subchapter A (Animal Welfare), Parts 1–3. Available from: Regulatory Enforcement and Animal Care, APHIS, USDA, Hyattsville, MD.

Dubuis, E., Vidal, C., Sourmail, C., Colin, C., Boardman, W., Fielder, J., Lewis, J. and Unwin, S. (2005). *Manuel de Sante Veterinarire pour les Primates*. Pan African Sanctuary Alliance (PASA). Unpublished. www.panafricanprimates.org.

Federation of European Laboratory Animal Science Associations (FELASA). (1997). Sanitary aspects of handling non-human primates during transport. *Laboratory Animals* 31: 298-302. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=9350699&dopt=Citation

Federation of European Laboratory Animal Science Associations (FELASA). (1999). Health monitoring of non-human primate colonies. *Laboratory Animals* 33: S3-S18. http://www.lal.org.uk/pdffiles/LAfel5.pdf

Fowler, M.E. (1993). *Zoo and Wild Animal Medicine*. Iowa State University Press, Ames.

Fowler, M.E. (1995). *Restraint and Handling of Wild and Domestic Animals, 2nd Edition*. Iowa State University Press, Ames.

Fraser, C.M., Bergeron, J.A. and Aiello, S.E. (1991). Fur, Laboratory, and Zoo Animals. In: *The Merck Veterinary Manual, 7th Edition, Part IV,* Merck and Co., Rahway, pp. 976-1087.

Griner, L.A. (1983). *Pathology of Zoo Animals*. Zoological Society of San Diego, San Diego.

Institute for Laboratory Animal Research (ILAR). (1996). *Guide for the Care and Use of Laboratory Animals,* National Research Council, Bethesda.
http://www.aaalac.org/resources/theguide.cfm
http://www.nap.edu/readingroom/books/labrats/chaps.html (unformatted text version)

IUCN/SSC Re-introduction Specialist Group. (1998). IUCN/SSC Guidelines on Re-introduction. IUCN, Gland. http://www.iucn.org/themes/ssc/sgs/rsg/rsgcdrom/PDFs/English.pdf

Kilbourn, A.M., Karesh, W.B., Wolfe, N.D., Bosi, E.J., Cook, R.A. and Andau, M. (2003). Health evaluation of free-ranging and semi-captive orangutans (*Pongo pygmaeus pygmaeus*) in Sabah, Malaysia. *Journal of Wildlife Disease* Jan 39: 73-83.

Kirk, R.W. and Bonagura, J.D. (1992). *Kirk's Current Veterinary Therapy. Vol. XI. Small Animal Practice*. W. B. Saunders, Philadelphia.

Kleiman, D.G., Allen, M.E., Thompson, K.V. and Lumpkin, S. (1996). *Wild Mammals in Captivity.* University of Chicago Press, Chicago.

National Institutes of Health, Office of Laboratory Animal Welfare (NIH/OLAW), Policies and Laws. *Public Health Service Policy on Humane Care and Use of Laboratory Animals* (Amended August, 2002). http://grants.nih.gov/grants/olaw/references/phspol.htm
For general info: http://grants.nih.gov/grants/olaw/olaw.htm

National Research Council (NRC). (1997) *Occupational Health and Safety in the Care and Use of Research Animals.* National Academy Press, Washington, D.C.

National Research Council (NRC). Committee on Occupational Health and Safety in the Care and Use of Nonhuman Primates. (2003). *Occupational Health and Safety in the Care and Use of Nonhuman Primates.* National Academies Press, Washington, D.C.
http://books.nap.edu/openbook.php?record_id=10713&displayrelated=1

Poole T. B. (1999). *The UFAW Handbook on the Care and Management of Laboratory Animals. Vol. 1: Terrestrial Vertebrates, 7th Edition*. UFAW, Herts.

Public Health Service (PHS). (1996). *Public Health Service Policy on Humane Care and Use of Laboratory Animals, Health Research Extension Act, 1985, Public Law 99-158, November 20, 1985 "Animals in Research".* U.S. Department of Health and Human Services, Washington. D.C., PL 99-158.
http://grants.nih.gov/grants/olaw/references/hrea1985.htm
http://grants.nih.gov/grants/olaw/references/PHSPolicyLabAnimals.pdf

Rosen, N., Cress, D., Cox, D., Montgomery, C. and Townsend, S. (2003). *Pan African Sanctuaries Alliance (PASA) Workshop Report*. Conservation Breeding Specialist Group (SSC/IUCN). www.panafricanprimates.org.

Rosen, N., Cress, D. and Montgomery, C. (2004). *Pan African Sanctuaries Alliance (PASA) Workshop Report*. Conservation Breeding Specialist Group (SSC/IUCN).
http://www.cbsg.org/reports/reports/exec_sum/PASA2004Section3.pdf

Rosen, N., Cress, D. and Mills, W. (2005). *Pan African Sanctuaries Alliance (PASA) Workshop Report*. Conservation Breeding Specialist Group (SSC/IUCN). www.panafricanprimates.org.

Rosen, N., Cress, D. and Mills, W. (2006). *Pan African Sanctuary Alliance (PASA) Workshop Report*. Conservation Breeding Specialist Group (SSC/IUCN). www.panafricanprimates.org.

Scientists Center for Animal Welfare (SCAW). http://www.scaw.com/positionstatement1.htm

United States Department of Agriculture (USDA/APHIS) Position Statements:
http://www.avma.org/issues/policy/animal_welfare/usda.asp

Wallach, J.D. and Boever, W.J. (1983). *Diseases of Exotic Animals: Medical and Surgical Management.* W.B. Saunders, Philadelphia.