

ENVIRONMENTAL ENRICHMENT GUIDELINES

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Purpose

In accordance with the *Guide for the Care and Use of Laboratory Animals (Guide)*, research facilities must provide appropriate environmental enrichment for all animals. The principal goal of this enrichment is “to enhance animal well-being by providing animals with sensory and motor stimulation, through structures and resources that facilitate the expression of species-typical behaviors and promote psychological well-being through physical exercise, manipulative activities, and cognitive challenges according to species-specific characteristics” (*Guide*; pg. 52-3).

The Animal Care and Use Committee (ACUC) and the Office of Laboratory Animal Care (OLAC) recognize the importance of behavioral enrichment to the well-being of captive animals. Enrichment strategies are based on attempts to address the expression of species-typical behaviors and allow animals some control over their immediate environment. Veterinary staff, animal resource supervisors, animal technicians, and laboratory personnel all play a role in the development and provision of appropriate behavioral enrichment approaches.

General Considerations

- Most animals used in research at UC Berkeley are considered social species and therefore, as a standard practice, social species are pair/group housed.
- Exceptions to the use of standard enrichment must be requested in the Animal Use Protocol (AUP) and approved by the ACUC.
- Exceptions to pair/group housing for social species must be described and scientifically justified in the Principal Investigator (PI)'s AUP and approved by the ACUC. Exceptions may also be based on veterinarian-approved *medical*

exemptions.

- Exceptions should be identified on the cage card and include one of the following terms: **Protocol, Attrition, Aggression, Medical, or Breeding.**

Protocol: *The exception is written in the Animal Use Protocol and has been approved by the ACUC.*

Attrition: *The animal is the only one remaining in that cage because all others have been utilized in projects.*

Aggression: *Animals that have been separated due to fighting.*

Medical: *The veterinary staff has indicated that this animal should be singly housed due to a health concern.*

Breeding: *In cases such as harem breeding, males may be singly housed after breeding or females may be singly housed prior to parturition.*

- With the exception of Nonhuman Primates, and solitary species (hamsters) any single housed animal will be provided with additional enrichment (see the animal species in this document for details).
- Any auditory enrichment provided will not exceed normal conversational volume level (approximately 60 dB). Music with strong beats or talk radio with loud voices (screaming, arguing) should be avoided.
- Addition of any species not standardly housed on campus will initiate review of species-specific enrichment opportunities at the time of development of animal care Standard Operating Procedure (SOP).

Enrichment by Species

Nonhuman Primates (*Macaca mulatta* and *Callithrix jacchus*)

Animal Welfare Regulations (9§CFR 3.81) state that "...research facilities must develop, document, and follow an appropriate plan for environmental enhancement adequate to promote the psychological well-being of nonhuman primates".

A. Social grouping

1. As per the regulations, the environmental enhancement plan for nonhuman primates (NHPs) must include specific provisions to address the social needs of NHP species known to exist in social groups in nature.
2. OLAC veterinary staff ensures that all NHPs have visual, auditory, olfactory and, where feasible, tactile contact with con-specifics. The caging currently available for housing NHPs provides visual as well as potentially grooming contact through removable stainless-steel grid dividers. OLAC will pair house NHPs whenever possible. Animals will be purchased as compatible pairs whenever possible. If OLAC's Attending Veterinarian (or veterinary designee) determines that an animal is incompatible with pair housing, that status will be documented. When AUPs require individual housing, NHPs will have visual, auditory, or olfactory contact with each other whenever possible. Individual housing must be described and scientifically justified in the PI's AUP and approved by the ACUC.

- B. Structure and substrate – Primary enclosures must be enriched by providing means of expressing non-injurious species typical activities. All OLAC NHP cages have at least one permanently fixed perch that increases utilization of

available cage space. Cages can be divided horizontally or vertically to promote climbing behaviors and allow for variation in cage configuration.

1. For applicable species, scent transfer will be permitted through provision of porous objects (e.g., hammocks, perches, etc.) which are changed out on an offset schedule from that of the housing enclosure.

C. Foraging opportunities and manipulanda

1. NHPs are offered a variety of foods by animal caretakers as enrichment, provided they are not limited by research protocol or veterinary advice. In addition, food items may be provided in coordination with lab members as part of positive reinforcement training in the lab. These food items may include but are not limited to a variety of wet and dried fruits, nuts, seed mixes, and popped corn. Task-oriented feeding methods are introduced in an attempt to prolong the useful enrichment time of particular food items and to help satisfy species-specific foraging behaviors. Specifically, these include puzzle feeders, foraging boards, tube feeders, Kong toys, etc. These foraging devices are in addition to activities associated with experimental manipulation.
2. Manipulanda are objects that can be moved, used, or altered in some manner by the primate's hands. OLAC-maintained NHPs are offered a variety of manipulanda on a daily basis. These include Kong toys, oak sticks, raw coconuts, nylon dog bones, mirrors, etc.
3. Manipulanda and foraging items are exchanged at least once every two weeks.

D. Other enrichment

1. Audio or video enrichment is provided at least three times per week.
2. In instances where long-term (more than 12 hours) restraint is required, nonhuman primates must be provided the opportunity daily for unrestrained activity for at least one continuous hour during the period of restraint, unless continuous restraint is required by the research project and has been approved by the ACUC.
3. Special Considerations – Any evidence of psychological distress observed by the animal care staff or others is reported directly to the veterinary staff and recorded in the daily health report for the animal in question. Observations made by the veterinary staff are noted in the appropriate medical record and the need for a more individual environmental enrichment plan, or modification, is assessed for that animal by the veterinarian.
4. Exemptions – According to the AWR, “the attending veterinarian may exempt an individual NHP from participation in the environmental enrichment plan because of its health or in consideration of its well-being” (9§CFR 3.81, e). The basis of the exemption must be recorded by the attending veterinarian for each exempted nonhuman primate. Unless the basis for the exemption is a permanent condition, the exemption must be reviewed at least every 30 days by the Attending Veterinarian. For a research facility, the ACUC may exempt an individual NHP from participation in some or all of the otherwise required environmental enrichment plans for scientific reasons set forth in the research proposal. The basis of the exemption shall be documented in the approved protocol

and must be reviewed at appropriate intervals by the ACUC, but not less than annually. Records of any exemptions must be maintained by the research facility and must be made available to USDA officials or officials of any pertinent federal funding agency upon request.

5. Recordkeeping – Written records are kept on each animal that document the environmental enrichment available, as well as any problems noted and the associated corrective action taken. A daily enrichment log is maintained for each animal.

Rabbits (*Oryctolagus cuniculis*)

Social housing – Whenever possible, young rabbits are housed in groups or pairs unless the requirements of the research protocol or animal health concerns make this impossible. Rabbits assigned to protocols requiring individual housing may be presented with regular “play time.” This may involve placing one or multiple rabbits in an empty plastic child’s pool or portable canine exercise pen, where the animals can exercise and interact with conspecifics.

- A. Manipulanda/toys – Rattles, whiffle balls, plastic barbells, and other veterinarian approved toys are provided on a daily basis.
- B. Food enrichment – Timothy hay cubes, and fresh fruits or vegetables (e.g., carrots, lettuce, apples) are offered on a daily basis.
- C. Other enrichment – Auditory enrichment in the form of music is provided on a regular basis in order to reduce the startle effect of sudden noises in the animal facility.
- D. Recordkeeping – Written records are kept documenting the environmental enrichment available, as well as any problems noted and the associated corrective action taken. A daily enrichment schedule is posted in the animal room.

Guinea Pigs (*Cavia porcellus*)

- A. Social housing – Whenever possible, guinea pigs are housed as compatible pairs or as breeding groups unless the requirements of the research protocol or animal health concerns make this impossible. Guinea pigs housed in breeding groups may be housed in circular tubs or static cages that comply with floor space regulations.
- B. Structure and substrate – A PVC (or other material such as a hut) refuge may be placed in each primary enclosure. Guinea pigs are housed on wood shavings that allow them to express burrowing and nesting behaviors. This does not take away from the required floor space even though the height requirement is reduced.
- C. Food enrichment – Hay, hay cubes, lettuce, and other fresh vegetables are offered on a regular basis.
- D. Other enrichment – Guinea pigs have regular positive interactions (e.g., petting, playing) with animal care staff.
- E. Recordkeeping – A daily enrichment schedule is maintained in the animal room.
- F. Single Housed Guinea Pigs: Extra hay cubes or hay should be added and/or a PVC tube or hut.

Rats (*Rattus norvegicus*)

- A. Social housing – Rats are pair or group housed unless the requirements of the research protocol, or animal health concerns make this impossible. Any exception to pair or group housing must be written in the animal use protocol and approved by the ACUC.
- B. Structure and substrate – Additional nesting materials, such as virgin pulp bedding or strips of paper fibers may be requested by the investigator.
- C. Manipulanda/toys – Nylabones, wooden, or other chew toys used for gnawing are the standard enrichment for rats.
- D. Single Housed Rats: Additional Nylabones, and cardboard or PVC tube should be added.

Mice (*Mus musculus*)

- A. Social housing – Mice are pair or group housed unless the requirements of the research protocol or animal health concerns make this impossible. Any exception to pair or group housing must be written in the animal use protocol and approved by the ACUC.
- B. Structure and substrate – Synthetic Fiber nest building material (e.g., a nestlet) and a 4 gram crinkle paper puck are the standard nesting materials provided for all animals; these materials allow for the expression of nesting behaviors. Exceptions to the use of the standard Enrichment must be requested in the AUP and approved by the ACUC.
- C. Manipulanda/toys – Items such as paper or plastic housing structures, or running wheels may be requested by the Investigator.
- D. Single Housed Mice: An additional crinkle paper puck or nestlet must be added.

Hamsters (e.g., *Mesocricetus sp.*)

- A. Social housing – While hamsters are not generally considered a social species, compatible individuals may be pair or group housed unless the requirements of the research protocol or animal health and welfare concerns make this impossible.
- B. Structure and substrate – Hamsters are provided with virgin pulp bedding or wood shavings that allow them to express burrowing and nesting behaviors.
- C. Manipulanda/toys – Wooden chewing enrichment is also offered on an as needed basis for animals requiring additional chewing opportunities to maintain dental health.
- D. Single Housed Hamsters: A shepherd shack should be added.

Voles (*Microtus spp.*)

- A. Social housing – Compatible individuals are pair housed unless the requirements of the research protocol or animal health concerns make this impossible.
- B. Structure and substrate – Voles are housed on wood shavings. Synthetic Fiber nest building material (e.g., a nestlet) and/or structures to hide in, such as jars or huts, are also provided.

- C. Single Housed Voles: A nestlet and crinkle paper puck are standard enrichment, but if singly housed, the animal must have a tube.

Tuco tucos (*Ctenomys sociabilis*)

- A. Social housing – Compatible individuals are pair or group housed unless the requirements of the research protocol or animal health concerns make this impossible.
- B. Structure and substrate – Animals are housed on wood shavings in a tube and nesting box system designed to emulate natural burrow systems. Additional nesting materials, such as virgin pulp bedding or strips of paper fibers, may be offered at the discretion of the Animal Resource Manager or if specifically requested by the Investigator (e.g., for some breeding females).
- C. Manipulanda – Wooden chewing enrichment is also offered on an as-needed basis for animals requiring additional chewing opportunities to maintain dental health. Food enrichment – corn, carrots, and lettuce provide a variety of water sources.
- D. Single Housed Tuco: A PVC tunnel connector is added.

Bats

Multiple bat species, including *Rousettus aegyptiacus* and *Phyllostomus discolor*, may be used in research. The natural history and behavior of the species being maintained is reviewed by lab and animal care staff in order to develop a species-specific behavioral enrichment plan.

- A. Social housing – Bats are pair or group housed unless the requirements of the research protocol, as approved in the AUP, or animal health concerns, make this impossible.
- B. Structure and substrate – Flight rooms contain stainless steel mesh grids attached to several locations around the perimeter of the ceiling and in several locations near the center of the ceiling to provide roosting locations; these roosting locations provide a substrate for bats to cling to (hanging head-down) and to huddle in groups.
- C. Manipulanda/toys – Flight rooms may be equipped with silk plants, ropes, baskets, and nets. Bats housed in cages are provided with a sanitizable towel hung in the cage.
- D. Single Housed Bats: A sanitizable towel is hung in the cage. Additional enrichment will provide expanded areas for roosting and climbing including but not limited to an extra sanitizable towel, rope toy, or wooden perches.

Birds

A variety of avian species, including those listed below, may be used in research or teaching. The natural history and behavior of the species being maintained is reviewed by lab and animal care staff in order to develop a species-specific behavioral enrichment plan.

Exemptions from enrichment

Enrichment is provided for all birds used in research or teaching. Exemptions from enrichment are only allowed if deemed necessary by the attending veterinarian or with

scientific justification in an ACUC approved protocol.

Physical restraint

Birds cannot be maintained in restraint devices unless required for health reasons as determined by the attending veterinarian or with scientific justification in an ACUC approved protocol. Any birds that are restrained for more than 12 hours must be provided the opportunity daily for unrestrained activity for at least 1 continuous hour during the period of restraint, unless scientifically justified in the protocol and approved by the ACUC.

A. Finches (*Poephila guttata*)

1. Social Housing – Zebra finches are housed as pairs or in small groups unless the requirements of the research protocol or animal health concerns make this impossible.
2. Structure and substrate – Finches are provided with nest boxes, wooden and/or rope perches of various thicknesses, paper nesting material and weekly access to a “bird bath”.
3. Manipulanda/toys – Cages are equipped with items such as small mirrors, plastic rings, rope perches and swings.
4. Food enrichment – Greens, egg supplement, and various seeds are scattered about the cage to provide foraging opportunities on a regular basis.
5. Single housed Finches: Hospital cages should be full of toys, a mirror, bird bath and perch. A nest should be hung when possible. Cohort vocalizations should be audible.

B. Starlings (*Sturnus vulgaris*)

1. Social housing – Starlings are housed in small to medium-sized groups in large, walk-in, naturalistic, outdoor aviaries.
2. Structure and substrate – Aviaries contain fresh tree branches and sheltered areas.
3. Starlings: Are not housed alone.

C. Poultry and game birds

1. Social housing – Based on research and/or animal health requirements, birds are group housed by species whenever possible.
2. Structure and substrate – Ducks are provided with regular access to pools for swimming and floating enrichment.
3. Food enrichment – Chickens are provided with scattered food and occasional meal worms. Live or dried mealworms and/or dried shrimp, and greens (lettuce, collards, or cabbage) are also provided daily.
Partridges are provided with live or dried mealworms daily.
4. Chickens: Are not housed alone.

D. Hummingbirds

1. Social housing – While hummingbirds are not generally considered a social species, compatible individuals may be pair or group housed unless the

requirements of the research protocol or animal health and welfare concerns make this impossible.

2. Food enrichment – Hummingbirds are offered their daily nectar in hanging plastic flower-shaped devices so as to mimic the way that they obtain food in the wild.
3. Single housed Hummingbirds: extra plastic flowers and stick perches are provided.

Reptiles

A wide variety of reptile species, including snakes and lizards, may be used in research or teaching. The natural history and behavior of the species being maintained is reviewed by lab and animal care staff in order to develop a species-specific behavioral enrichment plan.

- A. Social housing – Based on research and animal health requirements, social species are housed as pairs or in small groups when possible.
- B. Structure and substrate – Arboreal species are provided with increased vertical space and perches to allow for the expression of climbing behaviors. Terrestrial species are often provided with a substrate which promotes burrowing and ovipositing behavior. Visual contact is allowed for some species, while hide boxes or hanging visual hides are provided for other species as appropriate.
- C. Other enrichment – A bowl of water is provided to terrestrial species for full-body soaking.
- D. Single housed Reptiles: All reptile environments are enriched thus additional enrichment is not necessary.

Amphibians

A wide variety of amphibian species are used in research and teaching. The natural history and behavior of the species being maintained is reviewed by lab and animal care staff in order to develop a species-specific behavioral enrichment plan.

- A. Social housing – Axolotls, salamanders, and *Xenopus laevis* are housed in groups of similar-sized animals unless the requirements of the research protocol or animal health concerns make this impossible.
- B. Structure and substrate – Terrestrial species are often provided with a substrate which promotes burrowing behavior. Hide boxes are often provided as refugia. PVC tubes are placed in larger tanks to provide hiding places. Floating rubber balls are provided to *Xenopus tropicalis*.
- C. Other enrichment – A bowl of water is provided to terrestrial species for full-body soaking.
- D. Single housed Amphibians: PVC tube should be added.

Fish

- A. Social housing – Fish are housed in social or breeding groups at an appropriate stocking density.
- B. Structure and substrate – Gravel, rocks, or plastic plants may be provided if requested by the Investigator to improve breeding success.

C. Singly housed fish: Plastic plants should be provided.

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