




מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

A close-up photograph of a long-tailed macaque monkey sitting on a white rope with red and blue stripes. The monkey is holding a large, bright yellow flower in its mouth and appears to be eating it. The background is slightly blurred, showing more of the rope and the monkey's fur.

Enrichment and welfare for long-tailed macaques (*Macaca fascicularis*)

Weizmann Institute of Science
Department of Veterinary Resources
2016



Enrichment and welfare for long-tailed macaques

Introduction

Many research institutes worldwide conduct important research in monkeys. The success of this research depends, among other things, on the welfare of the animals, including environmental enrichment in the animal facility.

At the Weizmann Institute of Science we place special emphasis on the enrichment and welfare of monkeys. High standard animal facilities were constructed as part of a holistic program. Great deliberation is invested daily in creating enrichment programs that suit the monkeys and their environmental conditions.

In order to simulate the natural state as closely as possible, a lighting system aimed to imitate the natural cycle of daylight was installed in the animal facilities. Lighting intensity is changed gradually mornings and evenings, to give the monkeys time to prepare for sleep or to wake up.

The Weizmann Institute currently works with long-tailed macaques (*Macaca fascicularis*). In nature, these monkeys live in groups and spend most of their day seeking food. In order to maintain this behavior we developed unique enrichment devices, designed and manufactured by the Institute's workshop to fit the exact conditions of our animal facility. These devices are used by the monkeys on a daily basis. The Institute recognizes the importance of the monkeys' enrichment and welfare for the advancement of science and research.

The training and enrichment programs are an integral part of the conducted research, and their goal is to maintain an optimal mental state of the macaques throughout the entire course of the experiment.

In this booklet, we offer examples of various types of enrichment: environmental, instrumental, social, nutritional, and enrichment by training. An example of a weekly enrichment program is provided, alongside photos of different enrichment devices.

The primary goal of this booklet is to share ideas and information about environmental enrichment with the researchers, students and caretakers.

Yossi Shohat

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Part 1

Why enrichment?

The environment in which the monkeys grow and live has long term influences on their health and behavior.

Environmental enrichment helps to maintain the monkeys' natural behavior, and significantly decreases their stereotypical behaviors, which express a state of mental distress. In addition, enrichment increases playtime, decreases violence within the group, creates psychological welfare and thus benefits the monkeys' mental state throughout the research.

Environmental enrichment is a crucial and essential component in the application and success of research.





Part 2

Enrichment types

Environmental enrichment

Environmental enrichment is the emulation of the natural habitat, i.e. creating a landscape that imitates the monkey's natural environment. The design and modification of the landscape must be done frequently (see part 4 – "Example for weekly enrichment program" for more details).

Environmental enrichment components:

- Sitting-branches at different heights
- Climbing-branches
- Wooden platforms for feeding and sleeping
- Ropes
- Hammocks
- Container for food picking
- Swings
- Mirrors



Food searching container – container filled with wooden chips, where small pieces of food are hidden

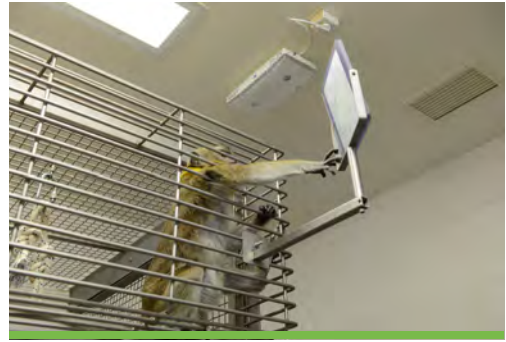


Wooden swing constructed from two branches. Can be used by up to three monkeys simultaneously





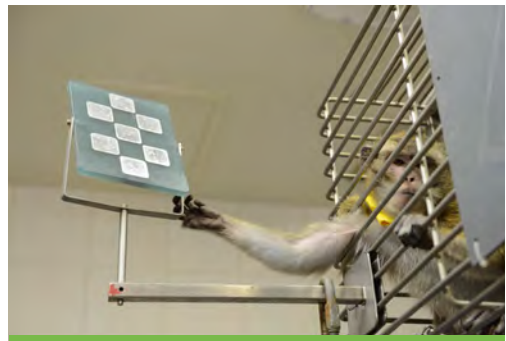
Large two-faced mirror – large mobile mirror, placed temporarily in the center of the animal facility



Rectangular mirror – attached outside the cage. The monkey can reach it with its hands and turn it in all directions



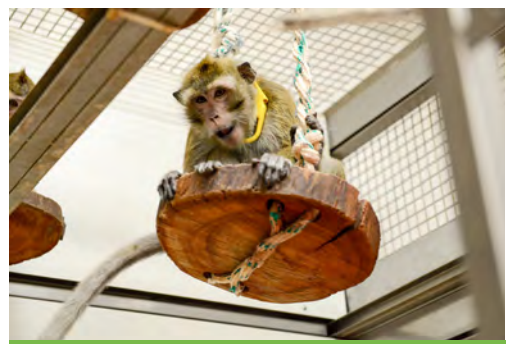
Enlarging mirror – enlarges the reflected image 5 times. attached outside the cage. The monkey can reach it with its hands and turn it in all directions



"Broken mirror" – comprised of many small mirrors, resulting in an intriguing reflection. attached outside the cage. The monkey can reach it with its hands and turn it in all directions

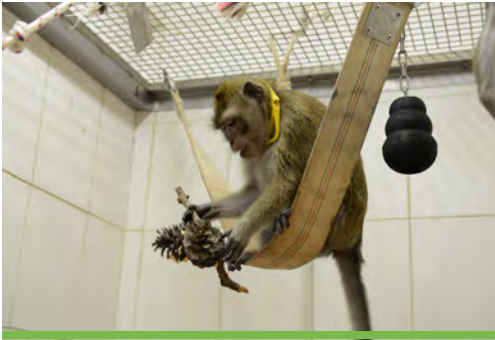


Wooden hammock, made from three branches



Tree trunk swing – wide surface, allows comfortable seating

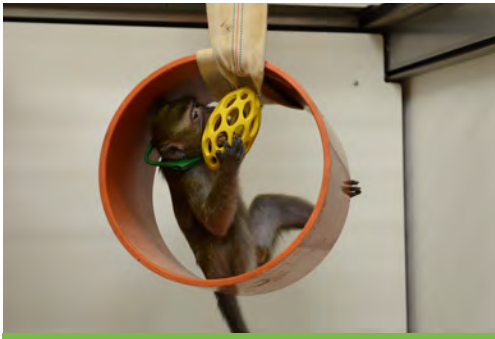




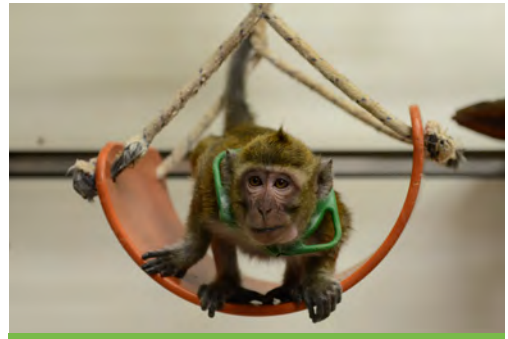
Sitting spot – made from firehydrant hose. Flexible placement in places where wooden swings cannot be fitted



Wooden swing for single monkey



Full cylinder swing



Half cylinder swing



Sitting platform made from a tree trunk



Visual barriers – reduce aggression





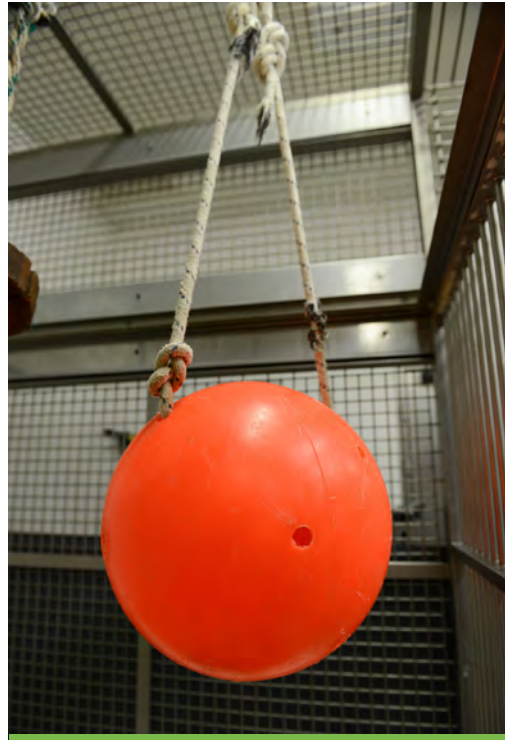
Monkey eating a fruit, picked from the branch



Fruit branches placed on cage walls



Searching tub – a large container that can be filled with dry leaves or wooden chips and food treats. Alternatively it can be filled with water so the monkeys can bathe



Swing



Double tiered wooden swing – two mokeys can swing at once



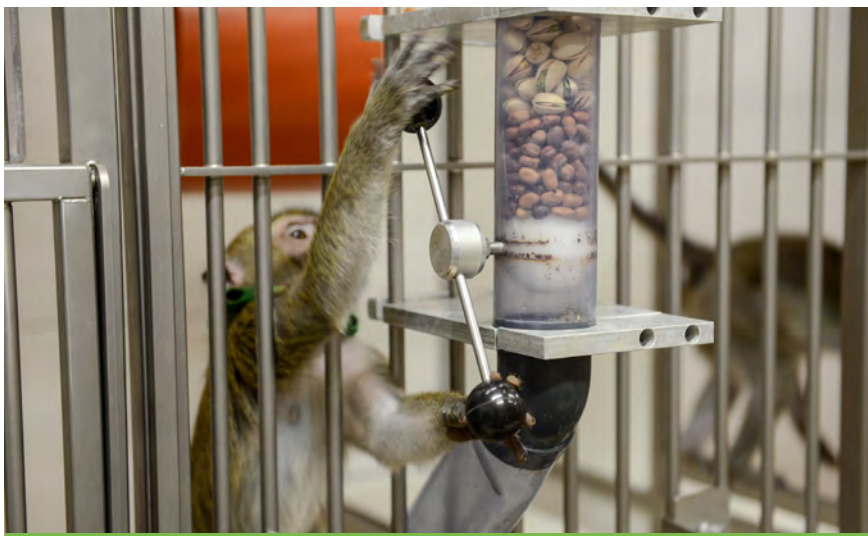
Horizontal double swing – made of tree trunk sections, place for two or more



Instrumental enrichment

In instrumental enrichment, like in nature, the monkey is required to invest physical and cognitive energy in order to acquire food, occasionally by competing against other group members.

The monkeys' curiosity allows us to mentally challenge them in figuring out how to use various feeding apparatuses (see examples in this chapter).

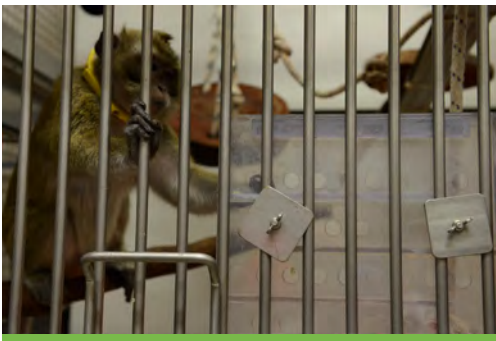


Dispenser – when the handle is turned 360 degrees, a measured food portion comes out and slides through the tube to the cage floor. The floor is covered with wooden chips, so the macaque has to descend and search for the food. Thus we conserve the natural searching behavior of this species.

There are two different types of dispensers, one for small seeds and the other for various nuts



Mobile – a colorful box to be hung outside the cage. Each facet has a different feature



Food labyrinth – placed on the cage wall. The monkey uses it's fingers to push food treat along the labyrinth



Food cylinder – the cylinder has to be turned a full turn for the food to fall out to the cage floor. The floor is covered with wooden chips, so the macaque has to descend and search for the food. Thus we conserve the natural searching behavior of this species.

There are different hole sizes for different treats



Rotating drawer hive – a hanging device, made from several drawers with different openings at both ends. Food is extracted using fingers or hands. The drawers cannot be pulled out completely, but open in both directions



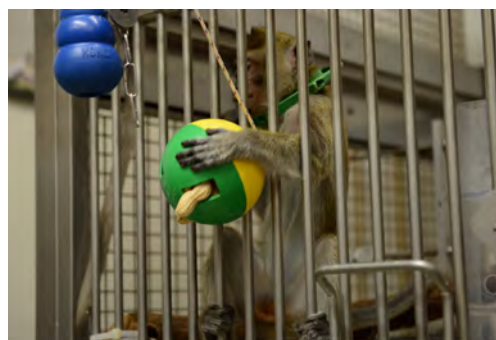
Food puzzle – each bowl has to be lifted separately for the food treat to be extracted



Fixed drawer hive – a hanging device with three drawers with identical openings at both ends



Sweet bubble machine - flavoured sweet bubbles



Food dispensing ball – peanuts are placed inside. The monkey extracts them through the holes with its fingers



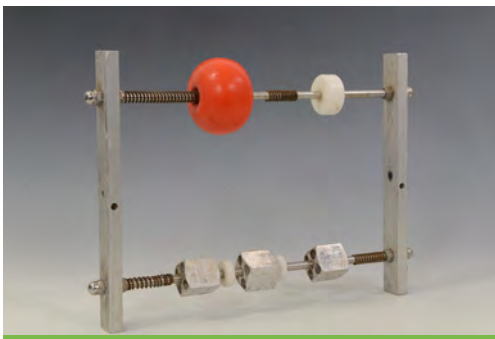
Sturdy rubber and plastic toys



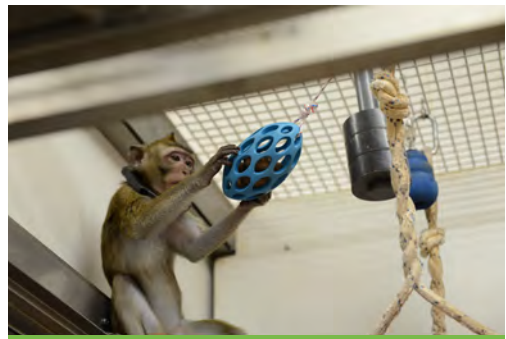
Treats hidden in a pinecone



Plastic cylinder with colorful balls rattling inside



Mobile made from various elements (ball, coils, metal cubes) that can be moved up and down the rods. Installed vertically or horizontally



Flexible rubber net filled with nuts, placed in or outside of the cage



Nutritional enrichment

Nutritional enrichment offers various ways to deliver food of different types while controlling amounts, and allows us to design a balanced and healthy diet for the monkeys.

In nature, monkeys spend a significant amount of their time seeking and gathering food. This search often includes danger and struggles with other group members. In certain cases food is of limited diversity, substantially decreasing the cost-effectiveness of the search.

The major advantages of a nutritional enrichment program are prevention of competition, decrease in intra-group aggressiveness and diversification of the menu.



Three different **commercial diets** for macaques



Vitamins – each monkey receives a vitamin pill three times a week, in order to prevent risk of nutritional insufficiency

“Ensure plus” – A nutritional shake that is given on a daily basis to monkeys undergoing recordings, in order to provide additional nutritional support

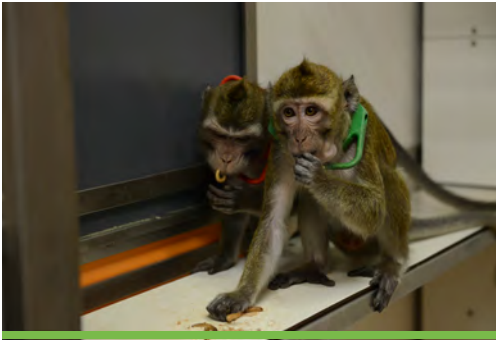


A variety of **vegetables**



A variety of **fruit**





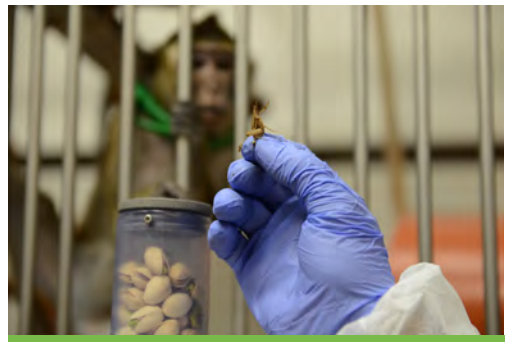
Mealworms



Flowers



Crickets



Nuts seeds and lentils



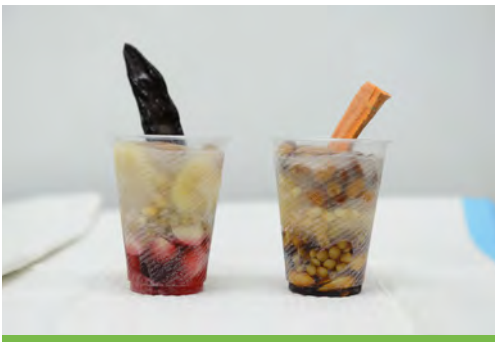
Pinecones filled with food treats



Wooden log with drilled holes, filled with treats



Fruit tree branches



Fruit and seed popsicles

Social enrichment

Social enrichment is extremely important for the monkeys' psychological welfare.

It encourages physical activity, maintains a playful behavior, establishes social status, maintains and increases natural behavior and grooming and provides mental support.

Monkeys are social animals, and therefore lack of social interactions may lead them to stereotypical behavior. experimental protocols sometimes demand solitary housing. This may cause severe stereotypical behaviors which directly affect the research itself. Here at the Weizmann Institute of Science we put a special emphasis on the monkeys' social needs, and they are therefore strictly housed as a group.



Monkeys swinging together on a hammock



Enrichment by training

Training is an opportunity to present the monkey with new and interesting stimuli. The training is not meant to disrupt natural behaviors; on the contrary, it is directed at maintaining and enriching them. Training often stimulates the monkey cognitively, alleviates its boredom and includes challenges, positive reinforcements, bonding with the trainer, and more.

It should be noted that training doesn't necessarily have to relate to the subject of research, but instead functions as an additional reward for the monkey in its everyday routine.



Feeding two monkeys simultaneously – this type of training reduces competition and aggression between individuals





Physical contact – trainer inside the cage



Physical contact – trainer outside the cage. This is an advanced stage of training, the monkey expressing confidence and trust in the trainer





Hand feeding – trainer inside the cage



Hand feeding- trainer outside the cage. The monkey is taught to take food treat using his mouth. The purpose of this training is to create a stronger bond with the trainer, and to teach that the hand is a positive reinforcement





"Ensure" feeding – trainer in the cage



"Ensure" feeding - trainer outside the cage








Part 3

Example for weekly enrichment program

Weekly table (divided into morning and noon):

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Morning	Change cage landscape	Large mirror	Food mixture	Frozen fruits	Change cage landscape	Ice cream	Refill food in apparatuses
	Whole fruits	Dispenser	Puzzles	Introduce rubber toys	Refill food in apparatuses	Sweet 'soap' bubbles	Food mixture
Noon	Training	Training	Training	Training	Training		
	Refill food in apparatuses	Leaves and flowers	Flour worms	Dispenser	Seeds mixture	Flour worms	Meeting of entire group
Afternoon	Meeting of entire group	Seeds mixture	Ice cream	Meeting of entire group	Leaves and flowers	Dispenser	Leaves and branches
	Food mixture	Sweet 'soap' bubbles	Filled cones	Food mixture	Water pool	Food mixture	Large mirror

	Environmental enrichment
	Instrumental enrichment
	Social enrichment
	Nutritional enrichment
	Training

Notice that this example enrichment program comprises all enrichment types. In addition, the safety of the apparatuses and devices, ropes, and inner cage is inspected on a monthly basis.



Part 4

Summary

The recent years have brought about an increase in awareness of the scientific community to the importance of improvement of the animals' habitat.

The understanding that living conditions affect the captive animal's health and behavior to a large extent drives a change in the current common perceptions of the scientific community.

This understanding led to the construction of better housing facilities, high quality enrichment programs, increased regulation over research institute, and the realization that the success of an experiment relies on the mental and physical state of the animal. Environmental and natural enrichment aid in maintaining natural behavior and strongly decrease stereotypical behavior.

Our approach at the Weizmann Institute of Science to the housing and caring of monkeys is primarily focused on satisfying their fundamental daily needs, including rich and varied nutrition, supportive environment imitating the natural habitat as closely as possible, and continuous medical observation and intervention. Additionally we provide enrichment in the form of new and continuously changing toys and devices for food search, that help to preserve the monkeys cognitive and physical abilities. Gradual training for the research tasks is incorporated in the daily routine, tasks that are matched to the individual characters of our monkeys.

All these elements together (housing, food, enrichment, training) provide the suitable conditions for a healthy mental balance of our animals, and a healthy social balance within the animal house, conditions that are essential for successful research.

Monkeys in captivity depend on us entirely, from the moment they arrive to the time they are released for rehabilitation. We are therefore committed to enrich their world as much as possible. Naturally, humans often see the world through human eyes, and seldom through those of monkeys. This is a challenge we must rise to meet repeatedly, until we understand their language.

This booklet was composed following many years of working with monkeys, and I am happy to share my accumulated knowledge with the reader. My hopes are that I have also enriched your world on the subject of environmental enrichment for monkeys.

Yossi Shohat

For more information and questions regarding "The enrichment and environmental welfare of *Macaca fascicularis*" please contact me at:

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