

# Monkey Restraint Device



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### **Abstract**

*B'Ann Gabelt is a research scientist in the Ophthalmology Department. In order to perform glaucoma research on rhesus monkeys, they must be restrained for administration of topical eye drops. The current device used for restraint has several minor flaws. This paper suggests methods to remedy these flaws, including a design that would ideally restrain the monkey and fit the customer's constraints.*

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### **Introduction**

Scientists know more about the rhesus macaque monkey (*Macaca mulatta*) than any other nonhuman primate. Research involving these monkeys has yielded some of the most important medical accomplishments of the last 50 years (Philipkoski, 2003).

Biological, medicinal, and physiological research has taken advantage of the fact that rhesus monkeys are more than 95% genetically similar to humans. These fields continue to utilize the rhesus for studies ranging from learning and behavior, to bioterrorism anthrax defense.

In our client's, B'Ann Gabelt's, lab there are three types of studies going on. Two of the studies done are used to learn more about how certain drugs and procedures affect patients with glaucoma. The third study is trying to determine the mechanism by which humans lose their ability to focus as they get older. Monkeys undergo the same changes and are an excellent model for the human condition. A large part of these studies involves administering eye drops to the monkeys. This can become quite difficult with certain monkeys and that is why certain restraint systems are used.

### **Background Information**

There are many different techniques used for restraining nonhuman primates in experimentation. Depending on the experiment, no restraint may be needed at all. A simple intravenous injection is easily done without a restraint, provided the monkeys

receive a reward. (Figure 1) For more intensive treatments that necessitate complete immobility of the animal, complex restraints must be used. (Figure 2) These restraints generally require that the monkey be sedated or anesthetized prior to restraint, so that the monkey can be placed in the restraint without harm to the animal or the animal handlers. However,



Figure 1 Monkey receiving intravenous injection without restraints

sedation often times is not an option if the sedative causes an interference with the study at hand. In these cases, alternative methods must be invented to restrain the monkeys for experimentation.

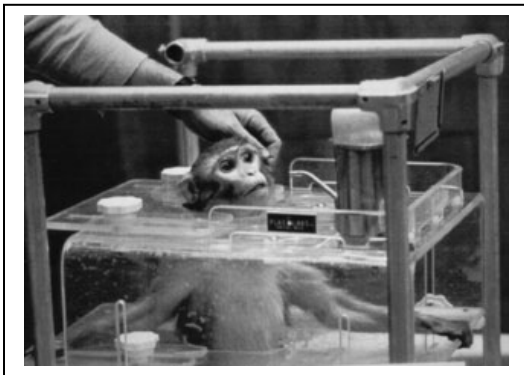


Figure 2 Monkey in complete restraint

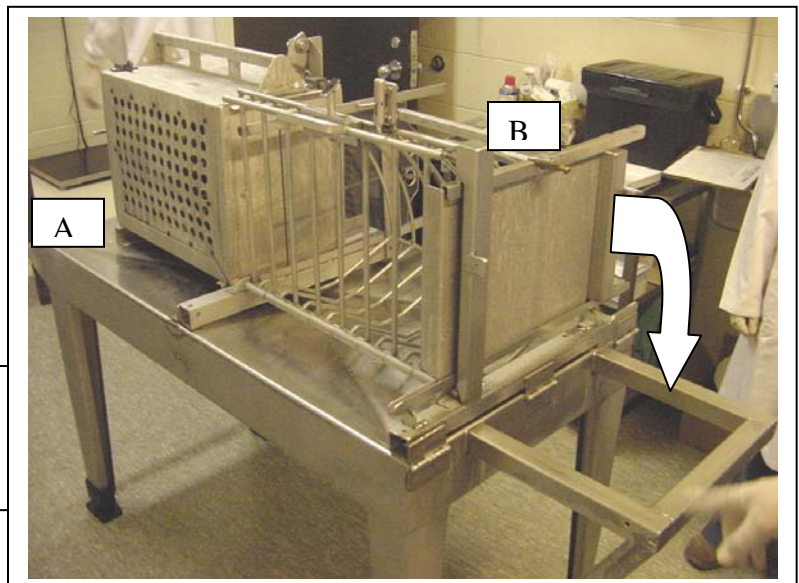
For the studies that Gabelt is involved with, the eye drop administration process is often performed daily, and habitual sedation is not an option. Gabelt received a custom made

monkey restraint device from the Wisconsin Regional Primate Research Center that

restrains the monkeys without sedating them. (Figure 3-b)

The monkey is transported from a squeeze-back transportation cage to the restraint device. A squeeze-back cage is equipped with a special

Figure 3 Treatment cage (B) with push back transport cage (A). Here the cage is fully open.



back panel that can be moved forward to guide a monkey out of the cage. (Figure 3-a)  
Once the monkey is fully in the treatment cage, the device is flipped up into a vertical position. (Figures 3 and 4)

The cage can be adjusted to fit the various sized, 8-25lb, monkeys in order to somewhat restrict their movement. (Figures 4)  
The monkey is in an upright position and the lab worker administering the eye drops stands behind it. In order to effectively administer the eye drops the monkey's head must be tilted back. The lab worker reaches through the bars of the cage and holds the monkey's head back by holding onto the fur on the back of its head. The lab worker then administers the eye drops.



Figure 4 Treatment cage in vertical position. Here the cage is nearly fully closed.

### **Design Problem**

The monkeys are highly active and this can cause problems during the procedure. Once the cage is flipped up and adjusted to fit the monkey, the monkey still has somewhat free use of its hands, allowing it to cover its eyes, grab, and scratch. The monkeys also tuck their chins into their necks making it very difficult to tilt their heads back. The lab worker must somehow use one hand to tilt the monkey's head back and one to administer the eye drops, while trying to avoid being scratched, bit, or having the monkey grab something.

## Design Constraints

Our client would like a device that will effectively restrain the head of the monkey and possibly the arms, in a humane fashion, in order to make the eye drop administration process as simple as possible. The restraint that is to be designed must work with the existing restraint system, and be able to adjust to the different sized monkeys. The restraint must be able to resist consistent abuse from nonhuman primates, and must be able to be sterilized. More specific constraints can be found in the appendix. (Appendix 1)

## Prototype Designs

### Design 1—Chin Restraint

Our first design addresses the problem of the monkeys tucking their chin to avoid eye drops. This design would be made of a dense, tough plastic that could be set across the bars of the treatment cage. It would be just large enough to attach a chin restraint to, but otherwise small enough to fit inside the bars of the treatment cage (< 15x5x10 cm). The device incorporates a chin restraint that, when positioned directly against the monkey's chin, would properly restrain the monkey from tucking its head down. (Figure 6) This design could be slid up to the monkey's head, and then locked in place by a wing nut, or some other fastener positioned directly behind it, thus preventing the monkey from pushing the restraint away. (Figure 7) However, this device offers no protection to the researcher from the flailing claws of the monkey. The monkey still can cover its eyes, as well.

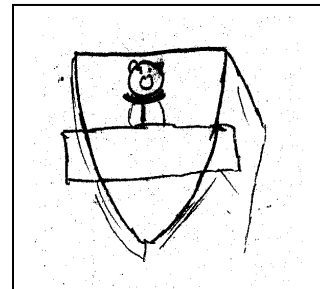


Figure 6 Display of design 1 pushed to the monkey's chin.

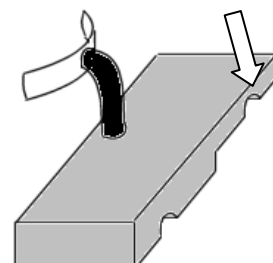


Figure 7 Technical Drawing of design one. The arrow indicates where a wing nut could be placed on the rail of

### Design 2—Wide Sheet

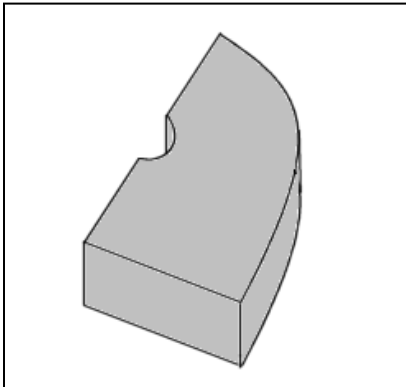
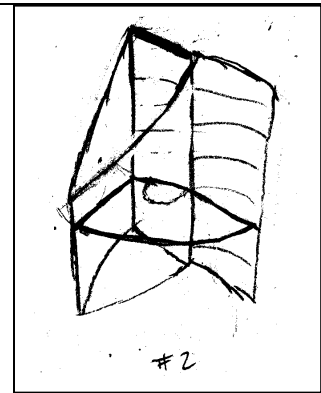


Figure 8 Technical drawing of the sheet design

The purpose of this design is to give the handler of the monkey a degree of safety while administering the eye drops. (Figure 8) The hole in this wide plastic sheet would allow just enough

Figure 9 Design 2 when implemented into the treatment cage.



room for the monkey's head to project, but the width of the design (~ 35x25x4 cm) keeps the monkey's hands below the sheet so that the scientist giving the monkey eye drops doesn't have to worry about flailing arms and sharp claws. (Figure 8) If the scientist doesn't have to worry about dodging claws, the eye drops can be administered more quickly, and the monkey can spend minimal time in restraints. (Figure 9)

This restraint would also be made of some high density, tough plastic that could withstand the wear and tear of monkey abuse. It would be designed to be large enough to safely protect the scientist, but fit inside the bars of the treatment cage, so that it can be locked in place near the body of the monkey. Unfortunately, this design cannot stop the monkey from tucking its chin—it would still have the freedom about the neck to duck its head and avoid the eye drops.

### Design 3—Final Design

Our final design follows logically from our previous designs, and incorporates the main ideas and best features of our two previous designs. It is

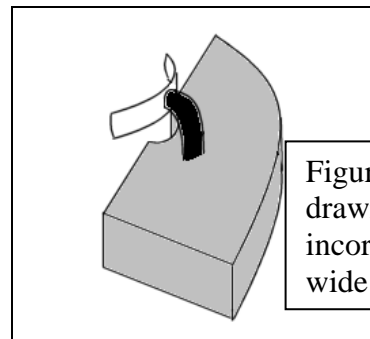
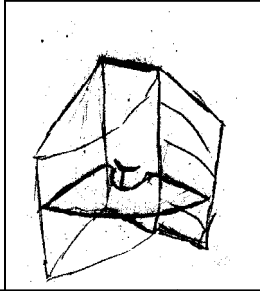


Figure 10 Technical drawing of design three: incorporating both the wide sheet and the chin

equipped with a plastic chin restraint that can be easily slid to the monkey's head, and also includes the wide winged design of the second design, to allow the scientist easy handling. (Figure 10) A combination of these two aspects could effectively increase the ease of eye drop administration, while making the entire process quicker and less



traumatic for the monkey.

Figure 11 Design 3 implemented into treatment cage

### **Conclusion**

Design 3 was chosen because it solves two of the design problems; it prevents the monkey from using its hands and also prevents chin tucking. This allows the scientist to concentrate mainly on tilting the monkey's head up and administering the eye drops as quickly as possible. It may be difficult to find a chin restraint that fits monkeys of all sizes and effectively restrains them. An adjustable chin strap would hopefully solve this problem. Since the device is to rest on the bars of the cage it could cause problems if a monkey's head is not exactly above or below a certain level. The device is designed to be placed on any level of the bars and hopefully will work with monkeys of all heights.

Finally, the restraint we implement will have to resist the strength of the monkeys. Monkeys have a tendency to move anything they can. (Gabelt, 2003; interview) The prototype must lock solidly in place; a wing nut placed behind the design may not be

enough support. A better system of locking the prototype down to the cage must be devised.

## **References**

Kristin Philipkoski, Americans for Medical Progress. "Research's need for rhesus macaque monkeys grows." *Wired News*. URL: <http://www.amprogress.org/News/News.cfm?ID=566&c=62>. Accessed: 09/30/03

# Appendix 1

## Product Design Specification

**Function:** To develop a method of modifying the existing monkey restraint device to effectively restrain a monkey's head or neck simplifying the eye drop administration process.

**Client Requirement:**

- Restrain the head of the monkey
- Must be compatible with existing restraint device
- Work with various sized monkeys
- Device should not harm the monkey physically
- It must be stationary and doesn't require one to hold it while giving treatment

**Design Requirements:**

**1. Physical and Operational Characteristics**

- a. Performance Requirements:** It will be used at least 10 times a day for the whole year. The restrain device we'll design must be flexible; it should be able to hold and restrain monkeys of various sizes. The height of the monkeys can range anywhere from 2 ft to 3 ft and they can weigh anywhere from 8 to 25lbs. The device shouldn't hinder the treatment and should be small as possible. **Material should be resistant to monkey claws.**

- b. Safety: The device shouldn't be uncomfortable for the monkey or he/she may make the treatment process worse by reacting negatively to the device. It should be gentle and provide a comfortable support. It should have no sharp edges that may cause harm to the monkey physically. The device should also be very strong and unbreakable. As witnessed, monkeys at times can be very aggressive and strong. If the device is fragile, it may break easily. This may lead to loss of monkey and may harm the monkey physically if the device breaks in small pieces. The device should follow the "animal humane" requirements and must not create a negative impact on the monkey.
- c. Accuracy and Reliability: Accuracy is not a necessity, but precision is. The device needs to be compatible with various monkeys, so it is very hard to make it accurate. It should, however, be adjustable for monkeys of various sizes (2-3 ft) and weights (8-20 lbs).
- d. Life in Service: The device will be used on a regular basis. It will be used daily for at least five hours a day and five days a week. It will be kept at one place, the treatment room.
- e. Shelf Life: The device must operate under extreme forces and loads. The monkeys may at times be aggressive, so it is imperative that the device is capable of withstanding monkey's force. The device must also be durable. Since it will be used regularly, the device must be made of durable material.
- f. Operating Environment:

- i. Temperature Range: 25 degrees Celsius
  - ii. Pressure Range: 4 GPM at 20 PSI
  - iii. Dirt or Dust: very dirty environment.
  - iv. User: Must be user friendly to people of all sizes and strengths.
- g. Ergonomics: The device must be very flexible. It should be compatible with monkeys of various sizes. The device must not need more than a one person to operate. It should be easily adjusted while wearing latex gloves.
- h. Size: The size of the product must correlate with the pre-existing monkey restraint device. Additionally, it should accommodate 8-25lb monkeys. The device must fit through the treatment cage and removed easily at the end of the treatment.
- i. Weight: It should not weigh more than three pounds.
- j. Materials: The materials used must be non-toxic, rigid (able to withstand strength of monkeys), tough (able to withstand scratching from monkeys), easily sanitized and nonabrasive.
- k. Aesthetics: No bright colors that will scare the monkey. Device must fit around the upper region of the monkey easily.

## **2. Production Characteristics**

- a. Quantity: Only one unit is needed.
- b. Target Product Cost: The device must cost less than \$200.

### **3. Miscellaneous**

- a. Standards and Specifications: Probably need some type of approval from the animal rights activists (RARC). Since the device is being used to restrain the monkeys, it must be checked to see whether it is humane or not.
- b. Customer: Because this monkey restraint device can be used only with the restraint used by our client, it would be impossible to market to other customers. However, the idea, if novel, could be patented.
- c. Patient-related concerns: Confidentiality of all processes occurring in Ophthalmology Department involving monkeys is extremely important to our client. The discussion of this device and the monkeys must be limited outside in the public.
- d. Competition: No current comparable product has been found or used.