

Final Report

Autumn Sorrells

Proposal # AWE-2205-66 Positive reinforcement training and its implications on physiological and behavioral parameters in squirrel monkeys

Research Accomplished

We have completed the first phase of this research, which measured the physiological stress response following capture and handling in a squirrel monkey colony at UCSF. We have also completed data collection on the second phase, which incorporated changes to the initial research design to include a variation in voluntary weight retrieval and sample collection. This second phase utilized a subsequent group of squirrel monkeys.

Due to unforeseen requirements by the original Principal Investigator, the first phase was concluded without obtaining a sufficient sample size to perform appropriate data analysis. However, preliminary results indicated an interesting trend in varying stress responses elicited by dominant and subordinate animals.

Salivary cortisol was measured to determine the physiological stress response following capture and handling for weighing under the standard operational practices. Baseline values and post-training values were also obtained. Preliminary results suggest that stress reduction through training and social status are positively related in female and inversely related in male monkeys. Subordinate male monkeys show a decrease in salivary cortisol while performing trained behaviors and dominant male monkeys show an increase in salivary cortisol for trained behaviors when compared to standard weighing techniques. Conversely, dominant female monkeys show a decrease in cortisol for trained behaviors, and subordinate female monkeys show an increase. This information proved useful when designing the second phase of the study.

Specific Aims

In this second year, we are completing data analysis from the second group. Time constraints were not an issue this year, allowing us adequate training and collection time. The initial study design was modified in several ways to improve sample collection and accommodate husbandry requirements as well. The initial study design indicated that monkey weights would be obtained using a small portable scale positioned within their home cage. This was refined to the following shaping plan: target inside nest box, maintain position while nest box door is closed, technician then removes nest box and places on a scale. This change was initiated due to the difficulties of taring the small scale between weights as well maintaining a secure base. We also modified the sample collection technique by using plain cotton rolls versus flavored cotton rolls. Animals did not show a preference or increased willingness to work for one over the other.

Preliminary results from the first phase indicated that dominant and subordinate animals respond differently to training. It has been observed that cortisol stress response results in smaller increments when basal levels are higher (Coe & Levine 1995). It has also been observed that

subordinate male squirrel monkeys have approximately 50% more cortisol when compared to dominant male squirrel monkeys (Abbott et al 2003). However, cortisol levels are approximately equal in subordinate and dominant female squirrel monkeys (Abbott et al 2003). These values are appropriate when considering the social dynamics within their societies. Within their society, subordinate males carry the highest rate of physical or psychological stressors (i.e. little social support). We intend to utilize social status, sex, age, and group size as factors in our own data analysis in order to better understand the stress response on individuals in this multi-level group.

Data analysis for the second phase has commenced, and will be completed by the end of February 2006. The abstract for the completed work was submitted to the 2006 Animal Behavior Management Alliance conference in San Diego. We have recently received an invitation for an oral presentation at this conference, which we will give in March.

Research Effectiveness

We expect the results of this study to provide important information regarding the specific physiological stress response of the squirrel monkey as well as data needed to improve husbandry techniques within the laboratory setting for this species. We expect to use this data as a basis for exploring other primate colonies and the techniques utilized within their daily husbandry routines. We can then further expand our evaluations into other species typically used in research as well. Ultimately, many animals and technicians will benefit from the outcome of this study.

Basic manipulative husbandry procedures for laboratory animals often require restraint and may result in a stressful experience for both the animal and handler involved. In fact, restraint is often used to induce stress in subjects of stress physiology research (Watts & Stookey 1999). By implementing a training program using positive reinforcement, such procedures could be performed in a less stressful manner using voluntary cooperation from the animals.

Salivary cortisol has become a popular measure of quantifying stress as a non-invasive alternative. Salivary free cortisol levels have been investigated in squirrel monkeys with great success, indicating its viability in cortisol determination using repeated sampling (Fuchs et al 1997; Tienfenbicher et al 2003).

It has been observed in rhesus monkeys that habituation to various noxious events, such as venipuncture and restraint, does not cause a significant stress response, however exposure to novel events, such as a transport carrier, does result in a significant stress response (Line et al 1987). A similar response was observed in squirrel monkeys in a study conducted by Coe et al (1978). A reduction in vocalizations, struggling and excretion was observed after a three-week period of daily capture and handling, while providing a preferred reward to reduce aversive effects. These examples illustrate that habituation and training could decrease the stress response in primates to the majority of husbandry procedures in biomedical facilities.