

**PROTOCOL FOR ANIMAL USE AND CARE**  
*Handwritten forms are not accepted*  
**CRPRC**

EH&S USE ONLY  
**PROTOCOL # 10104**  
**EXPIRES: \_\_\_\_\_**

**Investigator**

Last Name: \_\_\_\_\_  
 First: \_\_\_\_\_  
 Middle: \_\_\_\_\_  
 email: \_\_\_\_\_  
 Department: \_\_\_\_\_  
 Phone / Fax: \_\_\_\_\_  
 After hrs. #: \_\_\_\_\_

**Contact**

Last Name: \_\_\_\_\_  
 First: \_\_\_\_\_  
 Middle: \_\_\_\_\_  
 email: \_\_\_\_\_  
 Department: \_\_\_\_\_  
 Phone: \_\_\_\_\_  
 After hrs. #: \_\_\_\_\_

Species (common names): \_\_\_\_\_ Number: \_\_\_\_\_ Source: \_\_\_\_\_

Titi monkey	12	Primate Center
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Project Title: Anterior and posterior parietal cortex in titi monkeys

Overnight housing location:: CRPRC/CNS Day use only : \_\_\_\_\_

Animals will be maintained by: [X] Vivarium [ ] Investigator (If investigator maintained, attach husbandry SOP's.)

**Procedures:** Provide a one or two sentence layman's description of the procedures employed on the animals in this project. This information will help the animal care staff understand any conditions they may encounter while caring for your animals.

Animals will undergo sterile surgical procedures, and microelectrodes will be used to record from neurons (cortical mapping) in visual and somatosensory cortical areas of the brain. These animals will recover for approximately one week, and will then be trained to criterion in a reaching task. A second mapping procedure will then commence, and small aspiration lesions of the neocortex will be performed. Upon recovery, the animals will again train to criterion. Finally, an acute mapping experiment that lasts for approximately 3 days will occur, after which the animals will be euthanized.

**Special Husbandry Requirements:** Describe any special requirements your animals have with respect to **food, water, temperature, humidity, light cycles, caging type, bedding**, or any other conditions of husbandry.

For both the chronic and acute phases of the experiment, the animal will be food deprived on the day prior to surgery.

Other instructions for animal care staff: (check applicable entries)

- | Sick Animals   | Dead Animals  | Pest Control   |
|--|---|--|
| <input checked="" type="checkbox"/> Call Investigator  | <input checked="" type="checkbox"/> Call Investigator     | <input type="checkbox"/> Call Investigator               |
| <input checked="" type="checkbox"/> Clinician to treat | <input checked="" type="checkbox"/> Save for Investigator | <input checked="" type="checkbox"/> OK to use pesticides |
| <input type="checkbox"/> Terminate                     | <input type="checkbox"/> Bag for disposal                 | <input type="checkbox"/> No Pesticides in animal area    |
| <input type="checkbox"/> Necropsy                      | <input type="checkbox"/> Necropsy                         |  |

**Hazardous Materials** (*only if in the animal room*):

Infectious Agents?	[ ] Yes [X] No	Agent(s):	
Radioisotopes?	[ ] Yes [X] No	Agent(s):	
Chemical Carcinogens?	[ ] Yes [X] No	Agent(s):	
Toxic Chemicals?	[ ] Yes [X] No	Agent(s):	

Funding source:	NIH	Previously approved?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Is the project already funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Previous protocol number (if any):	

**What Veterinarian or veterinary clinic will provide care for your animals? (check one)**

<input type="checkbox"/>	Lab Animal Health Clinic ( 2-0514 )	<input checked="" type="checkbox"/>	California Primate Research Center ( 2-0447 )
<input type="checkbox"/>	VMTH Large Animal Field Service ( 2-0292 )	<input type="checkbox"/>	Another Veterinarian

If you checked "Another Veterinarian", please provide:

Veterinarian:		Address:	
Day phone:			
Emergency phone:		Email:	

*If your veterinarian is not affiliated with one of the three service units listed above, please contact the campus veterinarian, 2-2357 (email [pcillman@ucdavis.edu](mailto:pcillman@ucdavis.edu)) for current information about training and record keeping requirements.*

**Summary of Procedures:**

a) Briefly describe the **overall intent** of the study. Include in your description a statement of your hypothesis, the objectives and significance of the study. Your target audience is a faculty member from a discipline unrelated to yours. Do not use jargon.

The goal of this investigation is to describe the details of topographic order of somatosensory representations in areas 3a, 3b, 1 and 2 (anterior parietal), and of somatosensory and visual representations in area 5 (posterior parietal). This will be done by recording from neurons in these areas before and after behavioral training and ultimately after lesions to selected cortical fields. The proposed research has two separate goals. First, we will examine the role of anterior parietal fields (3a, 3b, 1 and 2) in the expression and maintenance of affective social relationships that rely on extensive tactile contact. Second, we will examine the role of area 5 in visually guided reaching and grasping, as it relates to grooming and motivated contact, as well as manual dexterity, and the generation of body centered coordinates.

**b) Procedures employed in this project:**

Please check the appropriate boxes if any of these procedures will be employed in your project:

- |   |  |  |
|---|--|--|
| <input type="checkbox"/> Monoclonal Antibody Production **                  | <input type="checkbox"/> Food or water restriction                   | <input type="checkbox"/> Special diets; food or water treatment.   |
| <input type="checkbox"/> Polyclonal Antibody Production **                  | <input checked="" type="checkbox"/> Non-recovery surgical procedures | <input type="checkbox"/> Induced illness, intoxication, or disease |
| <input type="checkbox"/> LD 50 or ID50 studies.                             | <input checked="" type="checkbox"/> Survival surgical procedures     | <input type="checkbox"/> Death as an endpoint (see i below)        |
| <input checked="" type="checkbox"/> catheters, blood collection, intubation | <input checked="" type="checkbox"/> Multiple survival surgery        | <input type="checkbox"/> Trapping, banding or marking wild animals |
| <input type="checkbox"/> Prolonged restraint. (8 hrs+)                      | <input checked="" type="checkbox"/> Behavioral modification.         | <input type="checkbox"/>   |
| <input checked="" type="checkbox"/> Fasting prior to a procedure.           | <input type="checkbox"/> Aversive conditioning.                      | <input type="checkbox"/>   |

\*\* If this protocol only describes antibody production, you may use the attached antibody production page in lieu of completing section c below.

c) Describe the use of animals in your project in detail, with special reference to any of procedures checked above. Include any physical, chemical or biological agents that may be administered. List each study group, and describe all the specific procedures that will be performed on each animal in each study group. Use terminology that will be understood by individuals outside your field of expertise. (Note: This cell will expand to whatever length you require. You may make this section as long as you wish, but try to be concise. Some projects may require one or two pages.)

The overall goal of these experiments is to determine the role of anterior parietal fields in the expression and maintenance of social behavior, and of posterior parietal area 5 in visually guided reaching and grasping. We will examine the organization of areas 3a, 3b, 1, 2 and 5 using electrophysiological techniques. The effects of unilateral lesions in areas 3b and 1 on passive tactile contact will be examined, as well as the effects of unilateral lesions of area 5 in generating forelimb reaching movements.

In these experiments, multiple unit electrophysiological recording methods will be used in combination with histological techniques for identifying boundaries of cortical fields, and with lesion studies in which animals are trained and observed before and after a discrete lesion is placed in a cortical area.

The twelve monkeys will be separated into two groups of six. Briefly, Group 1 monkeys will be mapped, trained, remapped/lesioned (areas 3b and 1), trained further, and finally remapped again. Group 2 monkeys will be mapped, trained, remapped/lesioned (area 5), trained further, and finally remapped again. These procedures are described below:

**Initial surgery:** Both Group 1 and Group 2 animals will participate in the initial mapping surgery. The animals will be food deprived 12 hours prior to surgery. In these experiments, the titi monkeys will be initially anesthetized with telazol (10mg/kg) followed by Isoflurane inhalation anesthesia (1.5-2.5%). Preoperatively, amoxicillin (7.5 mg/kg) will be administered to prevent infection, and dexamethasone (0.4mg/kg) will be administered to prevent brain swelling. Once anesthetized, the animals will be intubated and canulated. A continuous drip of Ringers Lactate (10ml/kg/hour) will be administered throughout surgery. These experiments will be done under standard sterile conditions at the California Regional Primate Center. Throughout these experiments, the animal's heart rate, respiration, blood oxygenation, and rectal body temperature will be continuously monitored.

Once anesthetized, the scalp will be cut, the temporal muscle slightly retracted, and a craniotomy (approximately 1.5 cm<sup>2</sup>) will be made over the region of interest. The dura will be cut and retracted, and the cerebral cortex exposed. Once exposed, the cortex will be continuously bathed with sterile saline solution. After the cortex is exposed, the area of interest will be quickly explored using electrophysiological recording methods used previously by the PI ( et al., 1993).

Tungsten recording electrodes will be lowered into the cortex and the neural responses to visual, somatic, and bimodal stimulation will be monitored using a loudspeaker and an oscilloscope, and the responses will be also be documented by hand by a member of the mapping team. A Kopf microdrive will be used to lower the electrode into sulcal cortex along the intraparietal sulcus. Once the responses have been identified and documented, the electrode will be raised and moved to the next site for exploration. Penetrations will be spaced approximately 500-1000 μm apart. In this way, a rapid assessment of the boundaries of cortical area 5 will be established. Once the boundaries and responses of this area have been sufficiently determined, a sterile contact lens will be placed directly above the cortex, the edges of the dura placed over the lens, and a small piece of gelfoam will be placed over the dura. The contact lens mimics the dura quite well. During recovery, the dura flaps adhere to the contact lens (rather than the cortical surface), and form a seal. Cerebral spinal fluid accumulates between the dura/contact lens and the surface of the cortex, as it normally would. Upon re-opening, the cortex looks normal, and neurons respond well. Thus, for multiple surgeries and electrophysiological recordings, this procedure is excellent. The craniotomy will be repaired using dental acrylic, the muscle and skin will be sutured, and the animal will be allowed to recover.

The animals will be allowed to recover for one week, after which time the behavioral experiments will commence. The titi monkeys will be administered Buprenorphine (0.03mg/kg) IM BID postoperatively to relieve pain or any discomfort that the surgical procedures may produce.

**Passive observation:** Group 1 monkeys will be observed (and videotaped) for 10 minutes per day for 3 days per week, and behaviors of interest will be scored. Behaviors of interest include:

- Frequency of attempts to initiate contact, and duration of successful contact attempts

- Frequency and duration of bouts of grooming, passive contact, and tail-twining
- Frequency of grasping, grabbing, or nuzzling
- Laterality (left, right, or both) of any contact behavior

**Training:** Group 2 animals will participate in the behavioral training procedures. One week after recovery, the animals will begin training in a reaching/grasping task, which will take place at the CRPRC. The training will involve daily sessions of approximately one hour, in which the animal will reach into an acrylic box in order to obtain a food reward from one of three target locations within the box. A video camera will record all reaching tasks for later analysis. In addition, on some trials, non-toxic ink will be applied to the monkey's hand prior to the start of the reaching task. The ink will mark paper sheets beneath the reach targets for later analysis. These trainings sessions will continue until the animal reaches a criterion of 90% accuracy. Once this criterion is reached, a second sterile mapping procedure will commence for the Group 2 animals.

**Remapping and lesions:** The animals will be food deprived 12 hours prior to surgery. In these experiments, the titi monkeys will be initially anesthetized with telazol (10mg/kg) followed by Isoflurane inhalation anesthesia (1.5-2.5%). Preoperatively, amoxicillin (7.5 mg/kg) will be administered to prevent infection, and dexamethasone (0.4mg/kg) will be administered to prevent brain swelling. Once anesthetized, the animals will be intubated and canulated. A continuous drip of Ringers Lactate (10ml/kg/hour) will be administered throughout surgery. These experiments will be done under standard sterile conditions at the California Regional Primate Center. Throughout these experiments, the animal's heart rate, respiration, blood oxygenation, and rectal body temperature will be continuously monitored.

Once anesthetized, the scalp will be cut, the temporal muscle slightly retracted, and the previous craniotomy will be reopened by removing the dental acrylic cap. The gelfoam will be removed, the dura will be retracted, the contact lens removed, and the cerebral cortex exposed. Once exposed, the cortex will be continuously bathed with sterile saline solution. After the cortex is exposed, the area of interest will be quickly explored using electrophysiological recording methods used previously by the PI ( et al., 1993).

Tungsten recording electrodes will be lowered into the cortex and the neural responses to visual, somatic, and bimodal stimulation will be monitored using a loudspeaker and an oscilloscope, and the responses will be also be documented by hand by a member of the mapping team. A Kopf microdrive will be used to lower the electrode into sulcal cortex along the intraparietal sulcus. Once the responses have been identified and documented, the electrode will be raised and moved to the next site for exploration. Penetrations will be spaced approximately 500-1000  $\mu\text{m}$  apart. In this way, a rapid assessment of the boundaries of cortical area 5 will be established. Once the boundaries and responses of this area have been sufficiently determined, small vacuum aspiration lesions will be made.

The lesions will be made to areas 3b and 1 (**Group 1**), or to area 5 (**Group 2**). These lesions will be made using a small tapered glass nozzle coupled to plastic tubing and a glass air chamber. An adjustable valve will allow the force of vacuum to be adjusted, ensuring very small lesions will be made in a controlled fashion. Immediately after the lesions are complete, the cortex along both sides of the edges of the lesion will be remapped using the techniques described above. This will help determine that the lesion did target the desired location, and that the lesion was complete.

Once the lesions have been verified, a sterile contact lens will be placed directly above the cortex, the edges of the dura placed over the lens, and a small piece of gelfoam will be placed over the dura. The craniotomy will be repaired using dental acrylic, the muscle and skin will be sutured, and the animal will be allowed to recover.

The animals will be allowed to recover for one week, after which time the behavioral experiments will again proceed. The titi monkeys will be administered Buprenorphine (0.03mg/kg) IM BID postoperatively to relieve pain or any discomfort that the surgical procedures may produce.

Upon recovery, the lesioned monkeys will continue the reaching training as described above. The training will proceed until criterion of 90% accuracy is again achieved, at which point the final mapping procedure will commence. In the event that the animals do not reach criterion, training will proceed no longer than six months, at which point the final mapping will commence.

**Final mapping:** Both Group 1 and Group 2 animals will participate in these experiments, in which the animals will be initially anesthetized (IM) with ketamine hydrochloride (10 mg/kg) or telazol (10mg/kg), and Isoflurane

(1 - 2%). Once anesthetized, the animals will be intubated and cannulated, and a continuous infusion of Lactated Ringers + 2.5% dextrose (10ml/kg/hour) will be administered. A urinary catheter will be placed and remain in the animal for the duration of the experiment, or a small diaper will be used to collect urine. The animals in these experiments may be artificially ventilated at 8 - 15 breaths per minute at a pressure of 20-25 ml/Hg. Surgical procedures for exposing the neocortex will be as described for the second mapping surgeries. After the cortex is exposed, screws will be secured into the skull and an acrylic well will be made around the opening in the skull, and filled with silicone fluid to prevent desiccation, and maintain cortical temperature. Throughout these experiments the animals temperature, heart rate, respiration and blood oxygenation will be monitored. In addition, in animals that are ventilated, CO<sub>2</sub> levels will be monitored. These procedures will be done for the length of the experiment (2 - 3 days), after which, the animal will be euthanized (60mg/kg pentobarbitone).

During this 2–3 day period, all vital signs are measured and recorded by trained personnel. Currently, there are three senior members of the team, all of who have extensive experience with long-term recording experiments of this type in primates. One of these three individuals is always in the room with the animal, and is paired with a more junior person to help these individuals gain experience with mapping procedures and animal maintenance. Further, there is always an on-call veterinarian from the primate center that we can access during any phase of our experiments.

We will stabilize the eye with the eye ring, technique to prevent eye movements while mapping, so that visual receptive fields can be recorded in the cortical area of interest with accuracy. We have used the eye ring technique in previous experiments in monkeys and other mammals (see below) and will use it in these experiments in titi monkeys. Very thin pieces of suture are gently threaded through the sclera in four places (temporal, nasal, upper and lower eye). The suture is then tied around a metal eye ring, which has a straight metal extension at one end. The straight metal edge of the ring is then secured to the screw previously inserted in the skull with dental acrylic. This prevents the eye from moving in the orbit.

Tungsten recording electrodes will be lowered into the cortex and the neural responses to visual, somatic, and bimodal stimulation will be monitored using a loudspeaker and an oscilloscope, and the responses will be also be documented by hand by a member of the mapping team. A Kopf microdrive will be used to lower the electrode into sulcal cortex along the intraparietal sulcus. Once the responses have been identified and documented, the electrode will be raised and moved to the next site for exploration. Penetrations will be spaced approximately 500-1000  $\mu$ m apart. In this way, a rapid assessment of the boundaries of corticals 3a, 3b, 1, 2 and 5 will be established. In the lesioned animals, the borders of the lesion will be explored to determine if large changes were brought about by the continued training. In addition, adjacent areas of cortex will also be mapped to determine if the lesions have caused plasticity in adjacent areas in order to compensate for the disruption of the lesioned area.

Once a full map of area 3b and 1, area 5, and adjacent areas has been acquired, or until the electrophysiological signal begins to deteriorate, the animal will be given a lethal dose of sodium pentobarbital, and perfused transcardially with 0.9% saline, followed by appropriate fixatives.

**d) Study Groups and Numbers:** Define, in the form of a table, the numbers of animals to be used in each experimental group described above. The table may be presented on a separate page as an attachment to this protocol if you prefer. The Normal format should be three columns: Study Group, Procedure, Number of animals. The number of rows should follow from the number of study groups; **you may add as many rows as you require**. The chart must fully account for the number of animals you intend to use under this protocol. Assign each group to an invasiveness category according to the chart below.

Group	Procedures / Drugs	Number of Animals	Category
1	Areas 3b and 1: Initial mapping/behavioral training/second mapping + lesion/ continued training/final mapping. (ketamine or telazol and Isoflurane)	6	3
2	Area 5: Initial mapping/behavioral training/second mapping + lesion/ continued training/final mapping. (ketamine or telazol and Isoflurane)	6	3

## Categories of invasiveness

Category	Description
1	Little or no discomfort or stress <b>Examples:</b> domestic flocks or herds being maintained in simulated or actual commercial production management systems; the short-term and skillful restraint of animals for purposes of observation or physical examination; blood sampling; injection of material in amounts that will not cause adverse reactions by the following routes: intravenous, subcutaneous, intramuscular, intraperitoneal, or oral.
2	Minor stress or pain of short duration <b>Examples:</b> cannulation or catheterization of blood vessels or body cavities under anesthesia; minor surgical procedures under anesthesia, such as biopsies or laparoscopy; short periods of restraint beyond that required for simple observation or examination, but consistent with minimal distress
3	Moderate to severe distress <b>Examples:</b> major surgical procedures conducted under general anesthesia, with subsequent recovery; prolonged (several hours or more) periods of physical restraint; induction of behavioral stresses such as maternal deprivation
4	Severe pain near, at or above the pain tolerance threshold <b>Examples:</b> exposure to noxious stimuli or agents whose effects are unknown; exposure to drugs, chemicals, or infectious agents at levels that markedly impair physiological systems and which cause death, severe pain, or extreme distress; Surgical experiments which have a high degree of invasiveness.

Further descriptions of these categories are included in the instructions following this document.

e) **Rationale for species and numbers:** How did you determine that 1) the species choice was appropriate and 2) the number of animals in each study groups was the minimum number necessary to achieve sound scientific results?

Our choice of primate is governed by peripheral morphology, the structure and use of the hand, and brain morphology. The titi monkeys offer the technical advantage of a relatively smooth neocortex, while having a similar organization of cortical areas as the rhesus monkey. Thus, areas that are not accessible in the highly fissured macaque brain, can be studied more readily in these New World monkeys. Much of the organization of the neocortex is already understood so that our experiments can be specifically directed towards our particular interests, without having to do preliminary studies to understand general organizational features. The titi monkeys offer the advantage of availability, as well as the opportunity to relate behavioral specializations to neural organization. This species also offers the advantage of having overt, discrete sensory mediated behaviors associated with the expression and maintenance of affective social relationships.

The behavioral and lesion studies will require a minimum of 6 animals for each lesion group. Our group size for all previous studies has been six animals for two reasons. First, individuals within a species can vary, this is particularly true for cortical maps. Because we expect changes to our maps after behavioral training, it is critical that we have enough animals to determine the degree of variability that exists normally for maps of areas 3b, 1 and 5. Second, there is variability in animal anesthesia and maintenance. Different animals respond differently to a particular anesthetic, in some animals neurons in all cortical areas respond very well, and much data can be obtained from a single animal. In other animals of the same species, anesthetic sometimes depresses neural response, and it is difficult to obtain maps for the areas of interest. Thus, in order to overcome natural variability in cortical map organization, and variability in response to anesthetic, we request six animals per group for a total of 12 animals.

f) **Surgery:** If the project involves survival surgery, where will the surgery be conducted?

Building:

Chronic, Primate Center, Acute, CNS

Room:

Surgical suite PC, 137 CNS

Who will be the surgeon?

g) **Anesthetics, Analgesics, Tranquilizers, Neuromuscular blocking agents:**

Post procedural analgesics should be given whenever there is possibility of pain or discomfort that is more than slight or momentary. If postoperative analgesics are not to be given, justify the practice under part (i) below.

Provide the following information about any of these drugs that you intend to use in this project.

Species	Drug	Dose (mg/kg)	Route	When and how often will it be given?
Callicebus moloch	ketamine hydrochloride	10 mg/kg	IM	At the start of each surgical procedure/ to supplement Iso as judged by investigator

C. moloch	Isoflurane inhalation	to effect 1-2%	inhalation	Throughout surgery
C. moloch	Diazepam	0.5mg/kg	IV	Once, 24 hours after the beginning of acute experiments.
C. moloch	Telazol	10mg/kg	IM	Once at the beginning of experiments
C. moloch	Dexamethasone	0.4 mg/kg	IM	Once at the beginning of experiments
C. moloch	Atropine	0.4mg/kg	IM	Once at the beginning of acute experiments
C. moloch	Cefazolin	25mg/kg	IV	Once at the beginning of acute experiments
C. moloch	Dopram	0.2mg/kg	IM	Once at the beginning of acute experiments
C. moloch	Buprenorphine	0.03mg/kg	IM & ID	1/12 for 40 hours postoperatively
C. moloch	amoxicillin	7.5 mg/kg	IM	preoperatively and postoperatively
C. moloch	Oxymorphone	15 mg/kg	IM TID	as above

h) **Neuromuscular blocking agents** can conceal inadequate anesthesia and therefore require special justification. If you are using a neuromuscular blocking agent, please complete the following:

Why do you need to use a neuromuscular blocking agent?

What physiologic parameters are monitored during the procedure to assess adequacy of anesthesia?

Under what circumstances will incremental doses of anesthetics-analgesics be administered?

i) **Adverse effects:**

Describe any potential adverse effects of the experiment on the animals (such as pain, discomfort; reduced growth, fever, anemia, neurological deficits; behavioral abnormalities or other clinical symptoms of acute or chronic distress or nutritional deficiency)

All surgical procedures are done under anesthesia. In the final mapping experiments, the animals will be anesthetized and euthanized immediately after the experiment so that the animal will not experience pain or discomfort. For the initial and remapping experiments, the animals generally recover quite rapidly, 1-2 hours postoperatively. Possible adverse effects include: headache, dehydration, and infections.

How will the signs listed above be ameliorated or alleviated? If signs are not to be alleviated or ameliorated by means of post-operative analgesics or other means, explain why this is necessary.

The animal is hydrated throughout all experiments with a continuous infusion of Lactated Ringers (10 ml/kg/hr). To alleviate any postoperative discomfort or pain, the animals are administered analgesics (see above). To prevent infection, the animals are administered antibiotics preoperatively, and sterile conditions are maintained throughout surgery. Further, the animal is constantly evaluated by the veterinary staff at the Primate Center, and there is extensive consultation between the PI and veterinarians regarding post-operative recovery, and necessary treatment if any adverse affects occur. If any adverse effects persist, and the animal appears to be in pain or serious discomfort, it will be euthanized.

*Note: if any unanticipated adverse effects not described above do occur during the course of the study, a complete description of those effects and the steps taken to mitigate them must be submitted to the committee as an amendment to this protocol.*

Is death an endpoint in your experimental procedure? [ ] Yes [ x] No

*(Note: "Death as an endpoint" refers to acute toxicity testing, assessment of virulence of pathogens, neutralization tests for toxins, and other studies in which animals are not euthanized, but die as a direct result of the experimental manipulation). If death is an endpoint, explain why it is not*

possible to euthanize the animals at an earlier point in the study. If you can euthanize the animals at an earlier point, describe the clinical signs which will dictate that an animal will be euthanized.

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**j) Literature search for alternatives and unnecessary duplication:**

*This section is specifically required by Federal law. You are required to conduct a literature search to determine that either 1) there are no alternative methodologies by which to conduct this study, or 2) there are alternative methodologies, but these are not appropriate for your particular study. "Alternative methodologies" refers to reduction, replacement, and refinement (the three R's) of animal use, not just animal replacement. You must also show that the study is not unnecessarily duplicative of other studies.*

What was the date on which you conducted this search?

04/11/02

List the databases searched or other sources consulted (there should be more than one). Include the years covered by the search.

Database Name	Years Covered	Keywords / Search Strategy
Medline	1990 - present	Visual, somatosensory, primates, electrophysiology
Biosis	1990 - present	as above
PSYC-info	1990 - present	as above

What were your findings with respect to alternative methodologies?

There are no alternatives to recording from neurons in living animals. Likewise, examining the connections of a neural structure cannot be done in non-living animals.

Has this study been previously conducted?

Yes  No

If the study has been conducted previously, explain why it is scientifically necessary to replicate the experiment.

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**k) Disposition of animals:** At what point in the study, if any, will the animals be euthanized?

The animals will be euthanized at the end of phase 2, after the completion of acute electrophysiological mapping experiments.

**l) Methods of euthanasia:** Even if your study does not involve killing the animals, you should show a method that you would use in the event of unanticipated injury or illness. If anesthetic overdose is the method, show the agent, dose, and route.

Species	Method	Drug	Dose (mg/kg)	route
Callicebus moloch	lethal injection	pentobarbital sodium	60mg/kg	IV

**m) Surplus animals:** What will you do with any animals not euthanized at the conclusion of the project?

All animals will be euthanized at the conclusion of the experiments.

n) **Project Roster:** Please provide the names of all the individuals who will work with animals on this project. This page will not be made available to the public. Give either the University Employee ID # or a valid UC Davis email address so that we can document training and occupational health compliance for regulatory agencies. Include all investigators, student employees, post-doctoral researchers, staff research associates, post-graduate researchers and laboratory assistants who will actually work with the animals. You don't need to include the staff of the vivarium in which your animals will be housed.

The principal investigator is responsible for keeping this roster current. If any staff is added or subtracted from this project, you must amend the protocol by sending the campus veterinarian a memo describing any changes.

Last Name	First Name	Middle Name	UC ID Number or SSN	Email Address

#### Occupational Health Program:

Supervisors must enroll their employees in the campus Occupational Health Program if the workers are at increased risk of illness or injury (such as allergy, physical injury, or infectious disease) because of their work. Enroll workers by having them complete an "Animal Contact History Form", available from Employee Health Services (phone 752-2330). For further information, visit our web site at <http://clueless.ucdavis.edu/health/> or read the UC Davis Policy & Procedure Manual 290-25.

#### Training:

Supervisors are responsible for insuring that their employees are adequate trained, both in the specifics of their job and in the requirements of the Federal Animal Welfare Act. EH&S offers free, basic wet labs in laboratory animal handling and techniques, and lecture format classes in the requirements of the Animal Welfare Act. To schedule a class for your unit, contact EH&S at 2-2364. Autotutorials are also available on the world wide web at <http://clueless.ucdavis.edu/>.

