Small Animal Magnetic Resonance Imaging (MRI)
- MRI and Contrast Enhanced (MRI)
IACUC Standard Procedure
Effective Date: May 2016

Description of procedure:

1. Magnetic Resonance Imaging

Animals will be imaged under general anesthesia. The animal will be anesthetized prior to the actual imaging process, and then maintained under anesthesia during the imaging study. The animal will be positioned within the scanner, with the imaging platform maintained at 37°C and will be visually monitored throughout the scan.

Magnetic resonance imaging is performed by observing the rates of relaxation (T1, T2, T2*, T1rho) of particular atoms within tissue as their nuclear spins are perturbed from homeostasis (in a static magnetic field) using radio-frequency excitations. The rates of relaxation are intrinsic properties of tissue and are affected by the tissue microenvironment, water diffusion, and magnetic field strength, among other things. These differences in relaxation rates can be visualized as contrast changes within a grayscale image.

Following the scan, the animal will be allowed to recover from anesthesia and housed at the UCSF LARC space for repeated imaging studies if needed. Recovered animals can be maintained for up to 1 year for repeated imaging studies. Each session can last between 60-240 minutes. At the end of the imaging studies, the animal will be returned to the LARC housing at China Basin, or if the investigator’s approved IACUC protocol allows, the animals will be transferred to other sites or euthanized.

2. Contrast Enhanced MRI

Animals will be imaged under general anesthesia. The animal will be injected with Gadolinium-diethylenetriamine penta-acetic acid (Gd-DTPA), other Gadolinium chelates or magnetic agents suitable for MR imaging via IP (intraperitoneal) or IV (intravenous) routes. Properly trained operators should be required to anesthetize animals for IV or IP injections.

The animal will be anesthetized prior to the actual imaging process, and then maintained under anesthesia during the imaging study. The animal will be positioned within the scanner, with the imaging platform maintained at 37°C, and will be visually monitored throughout the scan. The MRI is performed as described previously.

Following the scan, the animal will be allowed to recover from anesthesia and housed at the UCSF LARC space for repeated imaging studies if needed. Recovered animals can be maintained for up to 1 year for repeated imaging studies. Each session will last 60-240 minutes. At the end of the imaging studies, the animal will be returned to the LARC housing, or if the investigator’s approved IACUC protocol allows, the animals will be transferred to other sites or euthanized.
3. If you are collaborating with the Radiology department, you must generate a modification to your approved IACUC protocol in RIO. This modification should include the following:

   a. An explanation of why you are adding the imaging procedures
   b. Addition of the Radiology personnel who will be handling your animals and performing the procedures
   c. Addition of the locations (specific rooms) where the procedures will take place and where the animals will be housed
   d. Addition of all contrast agents, anesthesia, analgesia, etc. to the “Agents” section in RIO
   e. In lieu of describing the procedures listed here, you may reference this document. For example, “imaging procedures will be carried out as described in the “Imaging Procedures for live animals in the 7T animal MRI scanner” Standard Procedure.

   **This modification must be reviewed and approved before imaging may begin.** Contact the IACUC office 476-2197 with questions.

**Regulated materials:**

- This procedure generally uses gaseous anesthesia (e.g., isoflurane) which is recommended and is not a regulated material. Alternative anesthetics that are controlled substances (e.g., ketamine, pentobarbital, buprenorphine) require a CSA.
- All agents should be listed in the “Agents” section of the protocol in RIO.

**Agents:**

- Isoflurane, potential injectables depending on protocol.
- This procedure involves anesthesia, and injected contrast media.
- All agents administered to animals should be listed in the “Agents” section of RIO.

**Adverse effects, monitoring, and management:**

<table>
<thead>
<tr>
<th>Adverse Effects</th>
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<tbody>
<tr>
<td><strong>Procedure, Agent or Phenotype</strong></td>
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<tr>
<td>Contrast Agents</td>
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**Monitoring Parameters**

<table>
<thead>
<tr>
<th>Monitoring Parameters</th>
<th>Frequency</th>
<th>PI/Lab will Document</th>
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</thead>
<tbody>
<tr>
<td>General appearance and behavior</td>
<td>Daily Monday - Friday</td>
<td>Yes</td>
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Describe the conditions, complications, and criteria (e.g. uncontrolled infection, loss of more than 15% body weight, etc.) that would lead to removal of an animal from the study, and describe how this will be accomplished (e.g. stopping treatment, euthanasia).

An affected animal will be removed from the study if it exhibits signs such as labored respiration, decreased appetite or activity, poor grooming, distress, uncontrolled infection, uncontrolled edema or BCS <2. Any such conditions, complications, and instances will be documented. Animals removed from the study will be euthanized.