LAB_032 Magnetic resonance imaging (MRI), computed tomography (CT), positron emission tomography (PET) and single photon emission tomography (SPECT) in live mice and rats (Expiry: December 2027)

I. OBJECTIVE

To effect safe and humane MRI, CT, PET and SPECT imaging in live mice and rats.

II. COMMENTS / RECOMMENDATIONS

- At the Centre for Advanced Imaging (CAI) this procedure must be performed by a CAI approved experienced operator or the operator must have completed an induction and training by Facility Manager or approved operator.
- CT, PET and SPECT imaging requires the operator to hold relevant radiation licenses from Queensland Health. Additionally, the facility utilized must be appropriately registered for radioactivity procedures.
- Appropriately trained personnel are required for scanning with the PET/MRI, PET/CT and SPECT/CT multi-bed mouse holder.
- Two appropriately trained personnel are required for all after hours' experiments.
- PPE should include disposable gloves, safety glasses, face mask, long sleeved lab gown, closed in shoes.
- Almost all imaging facilities are "shared spaces" with unknown commensal microbial status. Once transported to a shared space it is often not possible, for biosecurity reasons, to return rodents to their original animal facility. Arrangements for transportation and ongoing care of experimental animals must be made with relevant animal facility managers when planning projects that aim to use a shared imaging facility.
- Any contrast agents or PET/SPECT isotopes used must be described in the AEC application (including name, type, volume, route, needle gauge to be used).
- Mice and rats should be maintained under general anaesthetics for no longer than 3 hours. Specific application, including justification to the AEC is required should longer durations of anaesthesia be required.
- The current, relevant anaesthesia SOP should also be reviewed as more detail on anaesthetic monitoring is available in that document.

III. EQUIPMENT

- Vaporous isoflurane anaesthetic unit, including:
  - Precision isoflurane vaporiser
  - Relevant monitoring equipment
  - Induction chamber

  - Nose cone
  - Rodent anaesthetic circuit (one-way)
  - Isoflurane scavenging system
- Imaging unit (small animal imaging system options at CAI):
  - Bruker 16.4T micro-imaging MRI
  - Bruker 7T MRI/PET
  - Bruker 9.4T MRI
  - Bruker Si78 PET/CT
  - Bruker Albira SPECT/CT
  - Molecubes γ-cube (SPECT) and X-cube (CT)
- Single bed and multi-bed animal holders
- Respiratory sensor/ monitoring device (e.g. respiratory pillow)
- Contrast agents or PET/SPECT isotopes, if relevant.
- Heating Pad
- Species specific cage or transport box

IV. PROCEDURE

1. Fill the anaesthetic induction chamber with 4-5% isoflurane and oxygen gas mixture (~1L/min is appropriate, given a 2-5L induction chamber).
2. Place the rodent into the anaesthetic induction chamber.
3. Note: depending on the system, more than one animal may be imaged simultaneously.
4. Once adequately anaesthetised, set the animal up on the tooth hook of the relevant animal holder, with the nose cone in place to maintain anaesthesia (1-2% isoflurane, ~400mL/min gas flow rate) for the duration of the scan.
5. As required, use padding and tape to secure the respiratory sensor and restrict any involuntary movement of the anaesthetised animal.
6. Position MRI coils if required.
7. Ensure suitable system temperature for the animal is being maintained (approximately 30 °C).
8. Administer contrast agents or PET/SPECT isotopes, as approved.
9. Monitor the animal's respiration throughout scan to ensure adequate maintenance of anaesthesia or any indicators of anaesthesia becoming too deep.
10. The animal should be maintained under anaesthetics for no longer than 3 hours.

11. At the end of the scan, remove the animal and ensure that the isoflurane vaporiser and oxygen gas supply are turned off.
12. Return animal to home cage, placed on a heating pad.
13. Monitor the animal continuously until fully recovered. Monitoring should occur for at least one hour or longer as needed to ensure full recovery.

V. REFERENCE INFORMATION

Researchers must maintain "records of monitoring and assessment of animal wellbeing", as per Clause 2.4.18 (vii) of the Australian code for the care and use of animals for scientific purposes (NHMRC, 2013). Attached is an example of an animal monitoring sheet that should be used with live mice undergoing imaging:

Microsoft Excel Worksheet

Version #	Reviewing AEC (note: all other relevant AECs ratify the approval)	AEC Review Date	Approved Until
3	MBS	December 2024	01/07/2023
Minor changes made: 08/03/2022 (this was not an AEC review, thus "approved until" remains to be 01/07/2023)			