



# Florey Neuroscience Institutes

## Small Animal Magnetic Resonance Imaging Facility Policy

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### 1. Introduction

The animal magnetic resonance imaging (MRI) facility (the Facility) was established with funding and support from a number of Melbourne research institutions, Universities and the Federal Government. The core equipment, the 4.7 Tesla magnet, was commissioned in 1998. The Facility is located in the basement of the Howard Florey Building and is currently under the supervision of the Howard Florey Institute (HFI).

The Facility's objectives are:

- To provide an important technical capability to encourage collaboration, deliver graduates, and create new knowledge by biological science researchers;
- To stimulate national research and support major biomedical research programs;
- To achieve critical mass in operations, including fostering enhanced utilization through development of a platform of imaging resources; and
- To achieve and maintain financial viability.

Magnetic Resonance (MR) technology allows non-invasive assessments of structural and functional anatomy *in vivo*, substituting for surgery, biopsies and injecting dyes to allow the study of organs and systems.

Animal MRI is typically utilized in animal models of cardiovascular disease, neurological disease, metabolism, development, toxicology and cancer research, particularly studies involving:

- *in vivo* of organ/systems, potentially in real time
- longitudinal monitoring, such as damage and disease progression or therapy regression and effects
- biomarker detection and correlation assessments
- metabolite detection and dynamic level changes (through spectroscopy) of migratory capacity of labeled cells
- 3D localization
- phenotyping genetically engineered animals
- innovative MR techniques under development.

The Facility equipment comprises:

- Bruker Biospec 4.7 Tesla 47/30 DBX MRI/MRS system, with Proton and X-nuclei channels
- Three sets of actively shielded gradients
- Integrated respiratory and ECG gating devices
- Surface and volume coils
- Columbus CIV-101 ventilator, using compressed medical grade air and oxygen
- PowerLab 8-channel physiological monitoring and recording systems



- ECG, heart rate, systolic and diastolic pressures, core temperature
- Operator console operating a Linux system running ParaVision (ver 3.1 and 4.0)
- Computers interfaced to an AVANCE digital spectrometer with two transceiver channels
- Image post-processing software: MEDx, SPM5 and MISTar.

## 2. Facility Services

Services provided by the Facility/MR team include:

- Running standard sequences representing ultra-high resolution (60-80 microns) imaging of rats and mice and very high resolution (160 microns) imaging of larger animals such as rabbits, cats and guinea pigs;
- Developing study protocols tailored to meet requirements (“scoping”) of biological and imaging researchers;
- Image acquisition, applying any of the standard sequences in known or tailored protocols;
- Image analysis, utilizing Facility licensed software or customized/developed software;
- Assistance with animal handling, including stereotaxic/surgery procedures; and
- Assistance with obtaining ethical approvals.

The Facility performs the following standard sequences, either alone or in combination (protocols):

- T1-weighted MRI - structural imaging
- T2-weighted MRI - structural imaging
- Proton Density-weighted MRI - structural imaging
- Diffusion-weighted imaging - functional imaging
- Diffusion-tensor imaging (DTI standard) - functional
- T2 mapping - T2 quantification
- Echo Planar Imaging - fast functional imaging
- Inversion Recovery - structural imaging
- T1-weighted Gradient Echo - structural imaging
- T2\*-weighted Gradient Echo – structural imaging
- MR Spectroscopy (PRESS STEAM sequences) - functional imaging
- Magnetization Transfer - special structural
- Manganese-enhanced magnetic resonance imaging (MEMRI) - structural and functional
- Cardiac imaging (structural and cine)
- Arterial Spin Labelling to measure the cerebral blood flow.

Variations to the standard sequences are available. The scanning time of each sequence varies dramatically depending on the animal size and image quality (resolution, contrast, signal to noise ratio, etc).

### 2a. Acquisition Process

The written record between the Facility and user of the required actions regarding the user’s study, the capabilities of the MR team, the Facility imaging equipment and associated support activities, ethics approvals and other Florey resources all contribute to producing images, potentially novel or enhanced techniques, through the following activities:

- Executing an existing sequence or protocol that completely meets the user's requirements in accordance with scheduled commitments and produces committed image deliverables
- Completing animal handling procedures and anaesthetics in accordance with ethics approvals
- Optimising the procedure (including development of hardware) to improve the image obtained
- Developing a novel procedure in any of animal handling, general imaging, signal capture, anaesthetics, contrast agents, protocols
- Researching, expert consultation and developing activities where committed parameters are unable to be satisfied through representations made in scoping studies
- Confirming with the user that deliverables satisfy scoping parameters
- Renegotiating scoping parameters where agreed to be performed procedures are unable to deliver agreed expectations
- Maintaining the Facility by service of the scanner, monitoring/replacement of its coolant/gas consumables, and scheduled maintenance of other equipment
- Communicating service charge information to facilitate billing or associated value transfer
- Where new procedures or amended procedures are developed, documenting in accordance with specified formats for review and approval
- Specifying procedures performed in a format suitable to support study publication
- Reporting outcomes for management purposes.

The output of this process will be image data from the study in the data format specified which is available for further analysis or removal by the researcher.

## **2b. Analysis Process**

The image data from the study, the capabilities of the Facility team, the Facility image-analysis equipment (hardware and software) and associated support activities and resources allow the interpretation of image data with significance to the study under consideration or generally to such studies (i.e. potentially novel or enhanced techniques), through the following activities:

- Interpreting image data with or without the contribution of the study's researcher to satisfy the expectations scoped
- Identifying and assessing image assessment techniques and tools (especially software)
- Purchasing (more typically licensing) and commissioning of image assessment tools and maintenance through support agreements
- Educating users in image analysis
- Expert consultation, particularly where commitments in scoping studies are unable to be satisfied
- Confirming with the user that deliverables satisfy scoping parameters
- Renegotiating scoping parameters where "agreed to be performed" procedures are unable to deliver agreed expectations
- Software upgrades/error resolution
- Communicating service charge information to facilitate billing or associated value transfer
- Where new procedures or amended procedures are developed, documenting in accordance with specified formats for review and approval
- Specifying procedures in a format suitable to support study publication
- Depending on subjectivity, the review of findings and independent interpretation
- Reporting outcomes for management purposes.



The output of this process will be specific, relevant image data in the data format specified and a report in accordance with the scope parameters.

### **3. Access to the Facility**

Facility access is available to:

- A collaborative project with Facility staff; and
- A project performed on a service-only basis by Facility staff.

It is a priority for collaborative projects to achieve the completion of high quality research with a publication of the results in high impact factor journals.

The principles of the access policy are (in descending order):

- Compliance with the other Facility policies;
- Quality of the research study;
- Alignment of the research study with collaborative objectives; and
- Satisfaction of commercial objectives of the Facility.

The Facility is committed to being self-funded and users must be able to demonstrate that they will meet the costs identified in the Fee Schedule. Access will be selected on the scientific merit of the study and other benefits to the Facility such as collaborations, and graduate teaching. Service-only projects will be performed only to the extent that they do not displace collaborative projects.

Procedures for accessing the Facility and the Fee Schedule are available at:  
[www.florey.edu.au/research/scientific-laboratories/neuroimaging/mri-use-procedures](http://www.florey.edu.au/research/scientific-laboratories/neuroimaging/mri-use-procedures)

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