

SOP 17
Student Run MRI Experiments

MRI Facility

Centre for Neuroscience Studies

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SUMMARY

The purpose of this document is to outline the procedures and policies regarding Centre for Neuroscience Studies (CNS) graduate students running their own MRI experiments and becoming a scanner operator.

The CNS MRI Facility is a service to all members and a learning experience for all of our students. We wish to extend this learning to hands-on experience with the equipment to a select group of students who are focused on imaging as a career path.

It is recommended that all students interested in becoming operators read through the documentation on our website at <http://neuroscience.queensu.ca/facilities/mri-facility> and contact the MRI Manager, Donald Brien, at briend@queensu.ca if they have any questions about starting this process.

PREREQUISITES

The opportunity to become an operator at the CNS MRI Facility is primarily aimed at PhD candidates and postdoctoral fellows with a primary focus on imaging as their field of study and career path. As such, we require the following prerequisites to be met before requesting scanner operator training:

- 1) The requesting student must receive the approval of their supervisor to commit the time and effort to this training.
- 2) The requesting student must be at the PhD level or higher in their training, preferably in their second year or beyond of their PhD.
- 3) The requesting student must have an approved, fully funded protocol with the MRI Facility. Please see SOP 04, “New Protocols and Ethics Procedures”. It is understood that the student will only be authorized to run their approved protocol. They will not be provided the opportunity to run other protocols for their labs.
- 4) The requesting student must have completed or be registered for the grad-level course NSCI 803: “Magnetic Resonance Imaging”. Please see: <http://neuroscience.queensu.ca/academic/current-students/magnetic-resonance-imaging>”.
- 5) The requesting student must have up to date First Aid training. Proof is required. It is not the responsibility of the MR Facility to provide funding for First Aid Training.
- 6) The requesting student must be an authorized user. Please see SOP 03, “Safety and Operator Training Procedures”. This requires the student to read all of the MRI Facility SOPs, sign the compliance statement, (http://neuroscience.queensu.ca/sites/default/files/2022-01/sop_compliance_statement.pdf) and complete the safety checklist for individuals (http://neuroscience.queensu.ca/sites/default/files/2022-01/cns_safety_individual.pdf). Note that a much more rigorous review of safety will be part of the extended training
- 7) The requesting student must complete the “Request for Scanner Training” (Appendix 1).

POLICIES

Once a student is fully trained, the following policies will apply:

- 1) The regular research rates for MR Usage will apply.
- 2) The principal investigator and their students are fully responsible for the quality of their data collection. The MRI manager and MRI Lead will continue to maintain the equipment as part of regular MRI duties, but the quality of collected data and any potential errors that are not directly related to a scanner malfunction are the sole responsibility of the investigator and student.
- 3) The student may only run their own studies that will directly contribute to their thesis and/or other research. They are not to run studies for other investigators or lab members.
- 4) The two-person rule still applies. The student must have, at minimum, one other authorized user with them at all times (referred to as 'experimental support personnel' in SOP 6 – "Emergency Procedures") to coordinate in the case of emergencies. Note that only one person needs to have operator training, whereas the others may just be authorized users without operator training.
- 5) The MRI and related facilities are an expensive and important investment for the CNS and Queen's University. It is also a potentially dangerous environment that requires the utmost care and precaution. The operator training is a privilege and can be taken away by the MRI Manager or MRI Lead at any time for violations of these policies, violations of best practices of safety, or disrespect of the equipment and/or staff.

3T SCANNER TRAINING

Once a student has met the prerequisites, the next step to becoming an operator will be to attend two user training classes with the MRI Manager, followed by practical training. These classes will be scheduled on an as needed basis. The classes are as follows:

Introductory Scanner Training

The first training class will be an introduction to the equipment of the MRI. This will constitute a three-hour class, with the first hour being a demonstration run by the MRI Manager. The demonstration will be on a phantom bottle and cover the operation of the bed and console to run a pre-made protocol. Following that, the second hour will allow the student to replicate the demonstration for a hands-on session of the scanner operation, guided by the MRI Manager. Finally, we will review all of the peripheral equipment and demonstrate appropriate usage.

Human Scanner Training

The second class will be another 3 hour session. In this class we will run the student's protocol on a volunteer participant. Topics covered will be detailed safety screening procedures, security, bedside manner and instructions for the participant, and more advanced parameter manipulation of sequences, as required. This session may be customized depending on the needs of the student and their project. We will also cover troubleshooting of the MRI and related components, as well as the peripheral equipment.

Upon completion of training, the student must complete the "Completion of Operator Training Form – Yellow Badge" (see Appendix 2) and have it signed by the MRI Manager.

PRACTICAL TRAINING – THE BADGE SYSTEM

A badge system is used to keep track of where students are in the learning process. The MRI Manager will maintain a list of students in this badge program and their current designation.

Yellow Badge

Upon completion of the user training classes, the student will be designated a yellow badge. A yellow badge designation allows the student the following privileges:

- The student may operate the scanner to complete sessions of their protocol. The student **MUST** be under the supervision of the MRI Manager or an MRT technician

Green Badge

The final steps in the student becoming an authorized operator for their study will be to first run their protocol, as described in the Yellow Badge section, from beginning to end, a minimum of 10 times. As per their yellow badge privileges, they may only run under the supervision of another operator. Generally, this will be the MRI Manager. Following this, the student will attempt to pass a hands-on test administered by the MRI Manager. This supervised, hands-on experience will prepare the student for independent work. If necessary, the student will inform the MRI Manager about the sessions they run for record keeping. All yellow badge students with 10 practical sessions will be eligible for their green badge. The green badge is awarded upon completion of the hands-on Green Badge Test (Appendix 3).

For the hands-on test, the MRI Manager will observe the yellow badge student run their protocol one more time, without assistance from the MRI Manager. Please contact the MRI manager when you have met the requirements and feel comfortable enough with the process. This test is to assess the student's ability to administer their protocol without assistance, while following all facility procedures. Topics covered will be:

- Subject safety screening.
- Peripheral set up.
- Equipment handling and bed operation.
- Console usage and scanning.
- Bedside manner.
- Troubleshooting.
- Data transfer.
- Teardown – Leaving the MRI suite as they found it: clean and all peripheral equipment returned to its proper place.

It is highly recommended that the student reviews all SOPs on the MRI Facility web site, prior to taking the hands-on test. All topics may be covered. The Manager may ask follow up questions and offer scenarios relating to emergency procedures.

If no substantial assistance is required from the MRI Manager to complete the session and no important steps are omitted in the scanning procedure, the student will be awarded a green badge, allowing the following additional privileges:

- 1) The student will be given full access to the MRI suite, including a fob for the MRI control room and a key to the MRI room.
- 2) The student may run sessions independently, following the policies outlined above and the responsibilities outlined below. Most importantly, they may not run studies as 'favours' for other research groups and must run scans directly related to their research.

If the student is not deemed sufficiently independent by the MRI Manager, they may continue as a yellow badge and apply to take the hands-on test again at a future date. It will be recommended that they continue to run supervised scans to increase their level of comfort with the scanning process.

RESPONSIBILITIES

Once a student has achieved green badge status, the following responsibilities apply:

- 1) The student must leave the MRI room, control room, and all supporting areas in a clean and tidy manner, as they found them. See Appendix 2 for the teardown list that must be adhered to at the end of a study.
- 2) The student must inform the MRI Manager of any and all issues with the MRI, the MRI console, or any peripheral equipment. If any equipment is damaged during the course of an experiment, the manager needs to know as soon as possible.
- 3) The student must continue to adhere to all policies as specified in the MRI SOPs located at our website: <http://neuroscience.queensu.ca/facilities/mri-facility#sop>.
- 4) In the event of equipment malfunction or an emergency during a study, the student should contact one of the support personal listed in Appendix 4: Troubleshooting and Emergency Contact List.
- 5) Prevent unauthorized personnel from entering the MRI area during a scanning session. The MRI facility is a lab space of the paying lab during each session and should be treated securely.
- 6) Prevent any unvetted personnel / participants from entering the Magnet Room.
- 7) Prevent any unauthorized metal or equipment from entering the Magnet Room.

APPENDIX I – Request for Scanner Training: CNS MRI 3T MAGNETOM Prisma

Personal Information

Name: _____

Position (year of PhD, post-doc): _____

Principal Investigator: _____

Department or Centre: _____

Protocol Information

Approved Protocol Number: _____

Protocol Title: _____

Funding Source: _____

Prerequisites

First Aid (Copy / proof submitted)

Safety Training / Authorized User

NSCI 803

Authorization

Principal Investigator _____
Name Signature Date

MRI Manager / Lead _____
Name Signature Date

APPENDIX 2 – Completion of Operator Training Form – Yellow Badge

This document certifies that the following trainee has met the prerequisites for scanner training, as outlined in SOP #17, and has completed both basic and intermediate training with the MRI Manager. This trainee is therefore certified for yellow badge status in the CNS MRI Facility, as outlined in SOP #17.

Trainee

Name

Signature

Date

MRI Manager / Lead

Name

Signature

Date

APPENDIX 3 – MRI Teardown Checklist

Upon the completion of any study at the CNS MRI Facility, the magnet room, control room, and all supporting areas are to be left in a clean and tidy state in preparation for the next study. Failure to clean up after your study may result in the loss of operator privileges.

Magnet Room:

- Dirty linen placed in the hamper
- Bed left in the lowest position out of the magnet
- All coils returned to their original storage positions – spine / 1 head coil may be left on the bed
- Headphones returned to their place and coiled neatly
- Squeeze ball placed at the end of the bed and coiled neatly
- Button boxes placed back in their place and coiled neatly
- EyeLink Eye Tracker returned to the cupboard and any cables coiled neatly
- Any other peripheral equipment also returned neatly to its place
- Any PMU devices should be returned to the charging station and related equipment put back in the drawer
- Biopac system leads returned to their place and coiled neatly
- Any peripheral unique to the study should be taken away or stored in an agreed upon place
- In-bore screen placed properly
- Any litter collected and disposed of
- Lights off
- **Door closed AND LOCKED – **failure to lock the magnet room door after a session will result in immediate revocation of scanning privileges****

Control Room:

- All patient sessions closed in all tabs and home screen left waiting for the next study
- Turn off projector if used
- Turn off eye tracker if used
- Reset button boxes to main menu
- Magnet Trigger should be connected to button box
- Log out of all display / other computers
- If you are the last scan of the day: shut down scanner
- Safety form clipboards returned to their places
- Any litter collected and disposed of
- Any spills or messes should be cleaned up
- Remove any specialized equipment you needed for your study
- Place all chairs neatly at respective desks or places in the room

- White board clean
- Lights off if no more studies immediately following
- Door closed and locked

Waiting Room:

- Any litter collected and disposed of
- Any spills or messes should be cleaned up
- All furniture should be replaced to a neat and tidy position
- If custodian services are needed, inform the MRI Manager
- Safety form clipboards returned to their places
- Lights off if no more studies immediately following

APPENDIX 4 – Green Badge Certification Test

Person being observed: _____

Person observing: _____

Date: _____

| | Satisfactory | Unsatisfactory |
|---|--------------|----------------|
| Setting up | | |
| Proper selection of coils and preparation of bed with linen | | |
| Peripheral equipment properly set up and tested | | |
| Projector properly turned on and aligned | | |
| Beside manner / Communication with participant | | |
| Proper discussion, completion, and vetting of safety form | | |
| Safety form signed | | |
| Proper register of console with participant information | | |
| Putting the participant in the scanner | | |
| Encourages participant to go to the bathroom | | |
| Checks participant for metal before entering room | | |
| Asks participant to remove shoes | | |
| Provides participant with goggles if required | | |
| Provides the participant with scrubs if required | | |
| Beside manner / Communication with participant | | |
| Provides participant with headphones or earplugs | | |
| Describes noises and methods of communication | | |
| Describes operation of and gives participant squeeze ball | | |
| Offers pillow for legs | | |
| Correctly sets up peripheral equipment required | | |
| Asks if participant needs a blanket for warmth | | |
| Describes MRI experience to participant | | |
| Correctly positions participant in coil | | |
| Correctly pads participant in coil | | |
| Correctly connects all coils required | | |
| Correctly attaches and positions mirror if required | | |
| Correctly works the table | | |
| Correctly landmarks the participant | | |
| Correctly slides participant into scanner | | |
| Running the study | | |
| Speaks with participant before beginning first scan | | |
| Starts localizer and all scans properly | | |
| Displays proficiency with basic console operation | | |
| Displays proficiency with basic slice positioning | | |

| | | |
|---|--|--|
| Knows how to spot and troubleshoot console errors (prompted) | | |
| Knows how to partially and fully reboot the scanner if required (prompted) | | |
| Set up peripheral equipment (projector, buttons, etc...) | | |
| Coordinated with support person if required | | |
| Works in a timely manner | | |
| Synchronizes scans properly with external stimuli | | |
| Speaks to participant consistently and in a professional manner | | |
| Can troubleshoot button box / trigger issues (prompted) | | |
| Knows who has to fill out which safety forms (prompted) | | |
| Knows who is allowed to be in the MRI control room (prompted) | | |
| Knows who is allowed to be in the Magnet room (prompted) | | |
| Safety | | |
| Knows what to do if squeeze ball is pressed | | |
| Knows the purpose and procedures of the electrical stop button | | |
| Knows the purpose and procedures of the magnet stop button | | |
| Knows that you always need 2 authorized users to scan, including one green badge or above | | |
| Knows what to do in the case of fire or medical emergency | | |
| Knows what to do in the case of fire alarm | | |
| Knows what to do in the case of police emergency | | |
| Knows who to contact for all troubleshooting and safety concerns | | |
| Tear Down | | |
| Properly removes participant from scanner | | |
| Properly adheres to the teardown checklist | | |
| Properly completes and places participant safety forms in the filing cabinet | | |
| Overall Confidence | | |

MRI Manager / Lead _____
Name Signature Date

APPENDIX 5 – Troubleshooting and Emergency Contact list

SOP #2, “Personnel and Emergency Contacts”, contains a complete list of emergency contacts. However, for green badge students who run into trouble during sessions, there will always be one CNS staff member on call. This will generally be the MRI Manager; however, the MRI Manager may designate another staff member listed below, if the MRI Manager is not available.

On-call Contacts:

| Name / Title | Phone number |
|-----------------------------------|--------------------|
| Donald Brien MRI Manager | Cell: 613-583-5680 |
| Jason Gallivan Acting MRI Lead | Cell: 613-217-8808 |
| Kelly Moore CNS Manager | Cell: 613-449-3784 |

AUTHORIZED SIGNATURES

Prepared by:

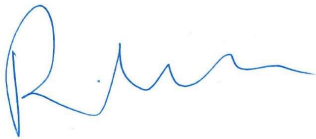


January 20, 2020

Donald Brien
Manager, CNS MRI Facility

Date

Approved by:



January 20, 2020

Roumen Milev, MD, PhD, FRCPsych, FRCPC
Director, Centre for Neuroscience Studies

Date