MRI Operator Training and Accreditation

Introduction

This document describes the training and accreditation procedure for MRI Scanner Operators at the Magnetic Resonance Imaging (MRI) Laboratory, part of the Brain and Behaviour Laboratory (BBL), University Medical Centre (CMU), University of Geneva.

These regulations apply in their entirety regardless of a candidate's previous experience or qualifications.

Eligibility for MRI Operator Training

MRI Operator Training and Accreditation is **not** automatically made available to researchers who have had a research project accepted by the BBL scientific committee, due to the limited resources available for training. Generally it will be necessary for researchers to collaborate with an already accredited operator, or to perform image acquisitions at times when a BBL staff radiographer is available.

Operator Training and Accreditation is available to researchers only if expressly stipulated in the context of the project acceptation and with the approval of the director of the MRI lab.

Prerequisites

Before the practical part of the training can begin, the candidate will need to…

- take part in the **BBL MRI Safety Briefing** (~60 minutes, given by the MRI Safety Officer, or a person authorised by the MRI Safety Officer). This is to ensure the candidate has a thorough understanding of the risk factors for accidents and side effects of MRI and how to avoid them by adequate screening procedures, exclusion of participants where appropriate, and safe use of any additional instrumentation.
- fill in the "MRI Safety Questionnaire for Collaborators" (obviously, the presence of contraindications to exposure to the static magnetic field of the scanner precludes access to the lab and therefore accreditation as scanner operator).
- **obtain a badge** that allows access to the lab. The candidate will receive the necessary paperwork following the MRI Safety Briefing.
- review the scanner manufacturer's safety information (DVD).
- gain a basic understanding of the working principle of MRI.

Practical Training

The candidate will then accompany one (or several) already qualified MRI operators when they perform MR image acquisitions. This will allow the candidate to familiarise themselves with the various aspects of MR imaging in the BBL, as described in the following. It is recommended that the studies in question are not the candidate's own, as the involvement with the scientific aspects (stimulus presentation etc) tends to distract from learning about the responsibilities of the scanner operator.

Safety Rules and Lab Regulations:

The candidate will need to become familiar with…

- the location of the different safety zones and the corresponding access regulations.
- the responsibilities of the MRI Scanner Operator for the safety of the other persons present in the lab, and the mandatory safety screening procedures for access to the High Field Area and for imaging.
- the requirements for approval by the Scientific Committee of the BBL, for approval by the Institutional Review Board, and for insurance cover, before any study may commence, and without which no image acquisition may be performed on human participants.
- the MRI lab booking rules.
- the BBL rules for use of IT infrastructure.

The MRI Scanner Hardware:

The candidate should…

- be able to identify the different parts of the MRI scanner and related installations.
- be able to explain the working principle of MRI (magnetic field, radio waves, gradients).
- understand the principle of a superconducting magnet and of the water and helium cooling systems, and the meaning of related technical alarms.
- know how to switch on and shut down the scanner and its sub-systems.
- understand the meaning of the fault indicators and technical alarms, and know the procedures indicated in case of faults (including fault reporting and creating error log files).

Other Instrumentation:

The candidate will need to become familiar with…

- the use of the various PCs in the lab.
- the operation of the video matrix switch and the back projection system.
- the operation of the eye tracker, and know how to change its light bulb.
- the very basics of operation (without going into details) of the modular physiological measurement system, the thermal stimulation system, and any other instrumentation which is permanently installed in the lab. (Operators need to know which of the instruments are MRI compatible and may be brought into the MRI environment.)
- the safe routing of electrode leads and cables to avoid damage and burn injuries, and the correct way to handle cables and optical fibres and to coil them for storage without damaging them.

Interaction with Study Participants:

In order to be able to perform MRI acquisitions on human participants, the candidate will have to…

- know the essential steps in preparation (Written Informed Consent form and Safety Questionnaire, oral safety check, auditory protection, and patient alarm).
- know what to do in case a participant presents a possible contra-indication (consult online data base, obtain information from implant manufacturers, advice from physician and/or medical physicist)

- be able to explain the whole experimental procedure and the working principle of the MRI scanner and other instruments to study participants, in a manner that is comprehensible to lay persons.
- know how to operate the patient table and how to install participants comfortably, how to use the various head fixation devices, and how to install and uninstall head coils and mirrors.
- provide ophthalmic correction if necessary.
- know how to operate the intercom system and verify its function, and how to demonstrate the use of the patient alarm.
- be able to set up and use the response button system and the audio system (MRI compatible headphones).
- alleviate possible anxiety by maintaining communication *throughout* the procedure, thereby making sure the participants know at all times what is going on.
- notify participants *immediately* before the start of any manipulation that could produce gradient noise and/or table motion, so as not to startle the participants. (If more than a few seconds have elapsed, the warning should be repeated before starting the procedure.)
- acquire sufficient knowledge of the French language to be able to interact with study participants as described above, as well as with university technical personnel and emergency services.

Scanner Operation:

In order to be able to operate the MRI scanner, the candidate should learn how to …

- use the patient table emergency releases (electronic and mechanical) and how to re-engage table operation, as well as how to move the table without electricity, horizontally and vertically.
- perform the patient registration on the MRI host computer, and how to fill in the scanner log book correctly.
- prepare and run MRI sequences, to build and save protocols, and know the meaning of the main sequence parameters.
- transfer data over the DICOM network and how to write data to CD/DVD.
- judge image quality and check for obvious artefacts (dropout, movement).
- operate the locking mechanism of the shielded room.

Emergencies:

In order to be able to handle unexpected situations and emergencies, the candidate must…

- be able to explain what a "quench" is and what measures are necessary in case of a quench, be it intentional or unintentional.
- understand when to initiate an intentional quench.
- know how to react in case of a power failure or a fire alarm, especially when there is a person inside the MRI scanner at the time.
- be familiar with the function and operation of the different types of emergency controls and their locations (quench, power shut-down, table/sequence stop, table brake, mechanical crank, silencing acoustic alarms).
- know how to react if the participant presses the alarm, panics, turns out to be claustrophobic, or if a medical emergency should occur.

- know the emergency phone numbers and which information to transmit when making an emergency call.
- know how to interpret MRI scanner error messages, how to save the error log files, and who to notify in case of errors and/or equipment breakdown.

Mandatory Practical Experience:

Each candidate needs to participate in a number of MRI experiments with an already authorised MRI Scanner Operator, in order become familiar with the MRI scanner, with the lab and its other instrumentation, and in order to be able to react calmly and efficiently in case of technical problems or emergency situations.

Usually, the number of MRI sessions required corresponds to one entire study (16-20 study participants), with the candidate performing the second half of the experiments themselves, under the supervision of an accredited operator. A candidate demonstrating a high level of knowledge and skill, such as might be the case for those with previous relevant experience, may require fewer sessions, subject to the MRI Safety Officer's approval.

Accreditation:

The MRI Scanner Operator who supervises the practical training will keep the MRI Safety Officer informed of the candidate's progress. As soon as the necessary level of skills and experience has been reached, the operator will notify the Safety Officer, who will then attend at least one of the candidate's scanning sessions, and will furthermore ask the candidate to demonstrate their knowledge of the points described in this document. The MRI Safety Officer will then either issue the accreditation or recommend further training.