

MRI Training for Scanning at the VA

Acquiring permission to scan is straightforward at the VA Boston Neuro-Imaging Center and requires careful following through a series of steps listed below. No one except for trained or in-training scanner operators should be at the scanner during imaging without prior approval.

1. Familiarize yourself with MRI safety and operations principles
2. Watch the safety video
3. Observe a certified scanner operate the console for three months
4. Take an MRI operator test.

Conditions that Exclude a Subject:

- Cardiac pacemaker
- Surgical aneurysm clips
- Neurostimulator
- Implanted pumps
- Metal fragments in body or eyes (must carefully rule out any shrapnel)
- Pregnancy
- Nitroglycerine patch (rule out if the subject cannot remove patch)
- Colored contact lenses should not be worn in scanner
- Cochlear implants
- Weight >450lbs (also consider shoulder and chest size)

Any questions about eligibility for a particular medical device MUST be checked with mrisafety.com prior to the subject's arrival to the VA.

There are several safety tutorials online that you can review. For example: <http://www.mrc.wayne.edu/safety.htm>

All investigators must be CITI certified as well as safety certified from the Neuroimaging Center.

Operator: MRI Safety / Things Not to Bring or Wear in the Scanner Room:

- Wear closed shoes with minimal amount of metal parts. No open toed shoes, sandals or flip-flops are allowed in the scanning and prep areas.
- No short skirts/shorts allowed. Proper, professional attire is expected in the scanning and prep areas.
- ANYTHING in your pockets
- Metal jewelry (face and body piercing should be removed if possible).
- Watches
- All hair holders must be removed
- Eye glasses
- Colored contact lenses (remind participant to bring a case to store)

- contacts in during scanning)
- No food or drinks are allowed in the magnet lab areas. The ONLY exception is that research subjects have a drink of water prior to or immediately following an experiment. Do not throw food wrappers of any kind in the wastebaskets.
- Do not bring wheelchairs into the scanner room.
- No electronic equipment, including physiological monitors, is allowed in the scanner room.

Investigators are responsible to make sure that anyone else in the area is also aware of the rules (e.g. it is possible that a VA employee may come in to the scanning control room that is not familiar with the dangers of the scanner). However, individuals not in training, or already certified to scan should NEVER enter the room containing the magnet under any circumstances, unless that person has filled out a metal screening form and is a family member of the participant being scanned. The scanner door should be closed at all times.

Participant: MRI Safety / Things Not to Bring or Wear in the Scanner Room:
(Participants should be informed about this in ADVANCE of coming to the VA for scanning)

- Wear closed shoes with minimal amount of metal parts. No open toed shoes, sandals or flip-flops are allowed in the scanning and prep areas.
- No short skirts/shorts allowed. Proper, professional dress is expected in the scanning and prep areas.
- ANYTHING in your pockets
- Eye shadow (many contain metallic specks that can heat up)
- Metal jewelry (face and body piercing should be removed). People with non-removable piercings or rings will not be scanned. Wedding rings should be taken off prior to a scan.
- Watches
- Hair holders containing metal clasps, springs, or bands. Elastics with no metal band are ok
- Eye glasses
- Metal on clothing (i.e. metal buttons, snaps or trimming, under wire bras, belt buckles)
- Colored contact lenses (remind participant to bring a case to store contacts in during scanning)
- No food or drinks are allowed in the magnet lab areas. The ONLY exception is that research subjects have a drink of water prior to or immediately following an experiment. Do not throw food wrappers of any kind in the wastebaskets.

MRI overview:

Magnetic Resonance Imaging (MRI) is an imaging technique widely used to study brain structure and function as well as for a variety of other medical imaging purposes. MRI uses Magnetic Resonance (MR) to achieve contrast in the tissue types found in the human body based on their proton density. The basic principle of MRI operation relies on magnetizing the participant using a large magnetic field produced by the scanner. While in the magnetized state the protons located in the tissue start to precess at a well defined frequency. The precession frequency is directly proportional to the strength of the magnetic field. Precessing protons possess a small net magnetic field due to a rotating movement of charge (+1) inherent in protons. Magnetization results in the net proton magnetic field aligning themselves in one of the two possible orientations relative to the scanner magnetic field: the low energy parallel state or the high energy anti-parallel state. At this point a radio frequency (RF) pulse is emitted exactly matching the precessional frequency of protons in the tissue. Protons with their net magnetic field in the low energy parallel state absorb this (RF) pulse, hence the name magnetic resonance, and gradually change orientation from being parallel to the magnetic field to being perpendicular to it. This is called transverse magnetization as the net magnetic field from each individual proton has flipped 90 degs into the transverse plane. In reality transverse magnetization lasts only a brief moment and then decays back to the original magnetization state. Head coil placed around the participant's head detects the transient change in the orientation of the net proton magnetic field from the anti-parallel to the transverse and back to the anti-parallel orientation. This relatively small and rapid change in the magnetic field induces a current in the coil that comprises the MRI signal.

MRI operation:

The MRI scanner is located on the first floor at the Jamaica Plain VA Boston Medical Center. It occupies a specially designed room thoroughly shielded to prevent loss of magnetization and MRI signal deterioration, and to provide safety. After the participant has been placed on the scanner bed the operation of the scanner takes place from the control room, adjacent to the scanner room. A computer workstation located in the control room is used to input participant information as well as to select the sequence of the scanning procedures. An intercom device provides means for communication between the scanner operator and the participant. This device also incorporates a squeeze ball signaling interface by which the participant may alert the operator should the need arise or signal that everything is going well.

You will need to prepare the MRI room prior to the scan. To turn on the lights in the scanner room use the two switches located to the left of the computer terminal. Get a clean sheet from the cart in front of the scanner and lay it down on the scanner bed. This sheet should be placed in the linen basket when

scanning is complete. Take a new set of earplugs from the top shelf in the cabinet to the right of the scanner and place them on the sheet. Find the large gray leg rest in front of the scanner and position it on the scanner bed to insure participant's comfort during scanning. Make sure the headphone wires and the squeeze ball tubes are not tangled together.

Once the scanning room is ready you will need to pre-screen the participant before letting him/her enter the scanning room. Explain the procedure to the participant clearly: We will be scanning you for about an hour, we will do about 7 scans, each scan will be 5-10 minutes, please keep your head still, etc. Check with the participant about using the rest room and anything else that they may need to do prior to scanning. Any excess clothing (jackets, shoes, sneakers, things with pockets, etc.) should be removed. Use a lockable shelf at the desk to temporarily store participant's personal belongings. Ask the participant if he/she has dentures. If the participant has dentures they should be removed and placed into a pink container found on a middle shelf in the top leftmost cabinet in the control room. Ask the participant about any recent tattoos. If there are any recent tattoos, warn the subject that if a heating or a tingling sensation occurs he/she should immediately tell about it. Tattoos with metal containing ink are not allowed in the scanner room. Female participants that have the potential to be pregnant need to take a pregnancy test prior to entering the scanner room. Verify that the participant is not wearing any ferromagnetic material by using a metal detector.

When the participant is ready to be scanned open the door to the scanner room and allow the participant to enter. Follow the participant and shut the door after yourself. Lower the scanner bed so that the participant can comfortably lie down. Make sure that the participant uses the earplugs, and that they are put in correctly. It is important that the earplugs are compressed and properly positioned in the ears so that they will expand and maximally block noise. Explain the use of the squeeze ball, and make sure that the participant has comfortable access to it at all times. A small piece of tape may be used to attach the squeeze ball cord to the scrubs of the participant to ensure that it does not get lost or dropped during the scanning session. Attach the head coil gently, and try to position the participant so that the line in the head coil is just above the eyebrows of the participant. Position the head clamps to stabilize the participant during scanning. The head clamps can be found on the shelf to the right of the scanner. Avoid placing the head clamps too tightly as it may discomfort the participant. Instruct the participant to try not to move during scanning, and that the padded guides help the participant keep their head still during the session. These should not be too tight. Make sure that the participant closes their eyes for positioning with the laser. The participant should be positioned so that the red horizontal line of the laser is aligned with the raised line on the head coil. Once positioning is done, put the participant in the scanner.

To operate the scanner from the control room first enter the participant's information and then select the appropriate scanning sequence. Note that private information such as first/last names and date of birth should not be entered in the computer. Instead enter a unique subject ID and use 01/01/1985 as a date of birth; it is ok to leave other fields blank.

Passing the test:

To pass the test and obtain scanning privileges a candidate will need to demonstrate a thorough understanding of the safety and operations principles and have at least 3 months of observational experience.

Emergency information for MR scanners:

*In case of emergency call: **911**

Incident Reporting:

In the rare event that a subject reports any untoward or unexpected reaction to the scan (e.g. painful cutaneous sensation, nausea, etc.) the experiment is to be terminated and the incident reported to David Salat.

Standard VA imaging protocols can be found at:

XXX

Standard protocols should never be modified without prior approval. Investigator protocols can be developed, however, this must be approved in advance.

VA Boston Neuro-Imaging Center

Acknowledgement of Reading and Understanding

Hand in this form at the time of your observation to become a certified MRI scanner for the VA Boston Neuro-Imaging Center.

I, _____ acknowledge that I have read this packet and understand the rules and safety and operational regulations of the scanning area for the VA Boston Neuro-Imaging Center.

Signature

Date

Witness Signature

Date