Facility for Education & Research in Neuroscience (FERN)
Magnetic Resonance Imaging Center
Standard Operating Procedures

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Facility for Education & Research in Neuroscience
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Introduction

These are the Standard Operating Procedures (SOPs) for the Facility for Education & Research in Neuroscience (FERN) at Emory University. These SOPs were developed based on guidelines from the American College of Radiology (ACR). In some cases, ACR guidelines were used verbatim, and in other cases, paraphrased. Guidelines related to the specific characteristics and operations of the FERN MRI facility were developed in-house based on the intent of the ACR guidelines. Note that the MRI facility is one component of FERN, which will include resources for multiple educational and experimental techniques, including EEG.

These SOPs will be reviewed annually and updated as needed. Significant procedural updates related to safety and training must be made in consultation with the directors of FERN, and approved by the Institutional Review Board. Questions regarding facility operations, or these SOPs, should be directed to the FERN Director or Facilities Manager.

The FERN User Group consists of the PIs, postdocs, and graduate students who perform MRI research at FERN. They are invited to provide feedback and suggestions about FERN policies and activities to the FERN Director and Facility Manager at regular meetings and as needed throughout the year.

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Facility Manager: Kate Revill
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ACR Guidance on MR Safety & Safe Practices

1.1 ACR White Paper on Magnetic Resonance (MR) Safety, Combined papers of 2002 and 2004, available at:
http://cfmi.georgetown.edu/downloads/training/1/ACR-safety-guidelines-2004.pdf

1.2 ACR Guidance Document for Safe MR Practices: 2007 and 2013, available at:
http://www.ajronline.org/doi/pdf/10.2214/AJR.06.1616
and
http://onlinelibrary.wiley.com/store/10.1002/jmri.24011/asset/24011_ftp.pdf?v=1&t=jasmpjer&s=5d58f04b5e7092ce14add30ae5264672385716a8

MRI Facility Personnel/Researchers

Designation and Description of Magnetic Resonance (MR) Personnel and Non-MR Personnel/ Researchers

2.1 FERN Personnel includes the Facility Manager, fMRI operators, and those who perform other work associated with the FERN, such as an administrator.

2.2 All MR Personnel/Researchers must complete at least one MRI safety lecture or prerecorded presentation approved by the FERN Facility Manager. Attendance must be repeated biannually and documented to confirm these ongoing safety certifications. These individuals are referred to as MR Personnel, of which there are two levels.

2.3 It is the responsibility of the FERN Director to determine which MR Personnel/Researcher designations individuals may have.

2.4 A current list of MR Personnel, their levels, and the due date of their next safety training/update must be maintained within the MR facility at all times.

2.5 Level 1 MR Personnel/Researchers

2.5.1 Definition. Level 1 MR Personnel/Researchers are individuals who have had MR safety training as approved by the FERN Manager. The designation of Level 1 MR Personnel/Researcher typically applies to undergraduate and graduate research assistants, post-doctoral fellows, and research assistants from individual laboratories.

2.5.2 Facility access allowance. Level 1 MR Personnel/Researchers are permitted to be in all areas of FERN. Level 1 MR Personnel/Researcher may have keycard access the FERN facility but are not permitted to be there alone.

2.5.3 Documentation of Level 1 MR Personnel/Researcher qualification. Documentation

of Level 1 MR Personnel/Researcher qualification must be recorded on the appropriate form (see Appendix A), updated at least biannually, and must be signed by the FERN Director. Records of documentation must be maintained within FERN.

2.6 MRI Operators

2.6.1 Definition. MRI Operators are MR Personnel/Researchers who have undergone training to operate the Siemens 3T TIM Trio System and who have been approved as MRI Operators by the current MRI Facility Manager.

2.6.2 Facility access allowance. MRI Operators are permitted to be in FERN alone (except when a participant is being scanned, during which time two persons are required) and to supervise Level 1 MR Personnel/Researchers when they are in the facility. MRI Operators are permitted keycard access to FERN.

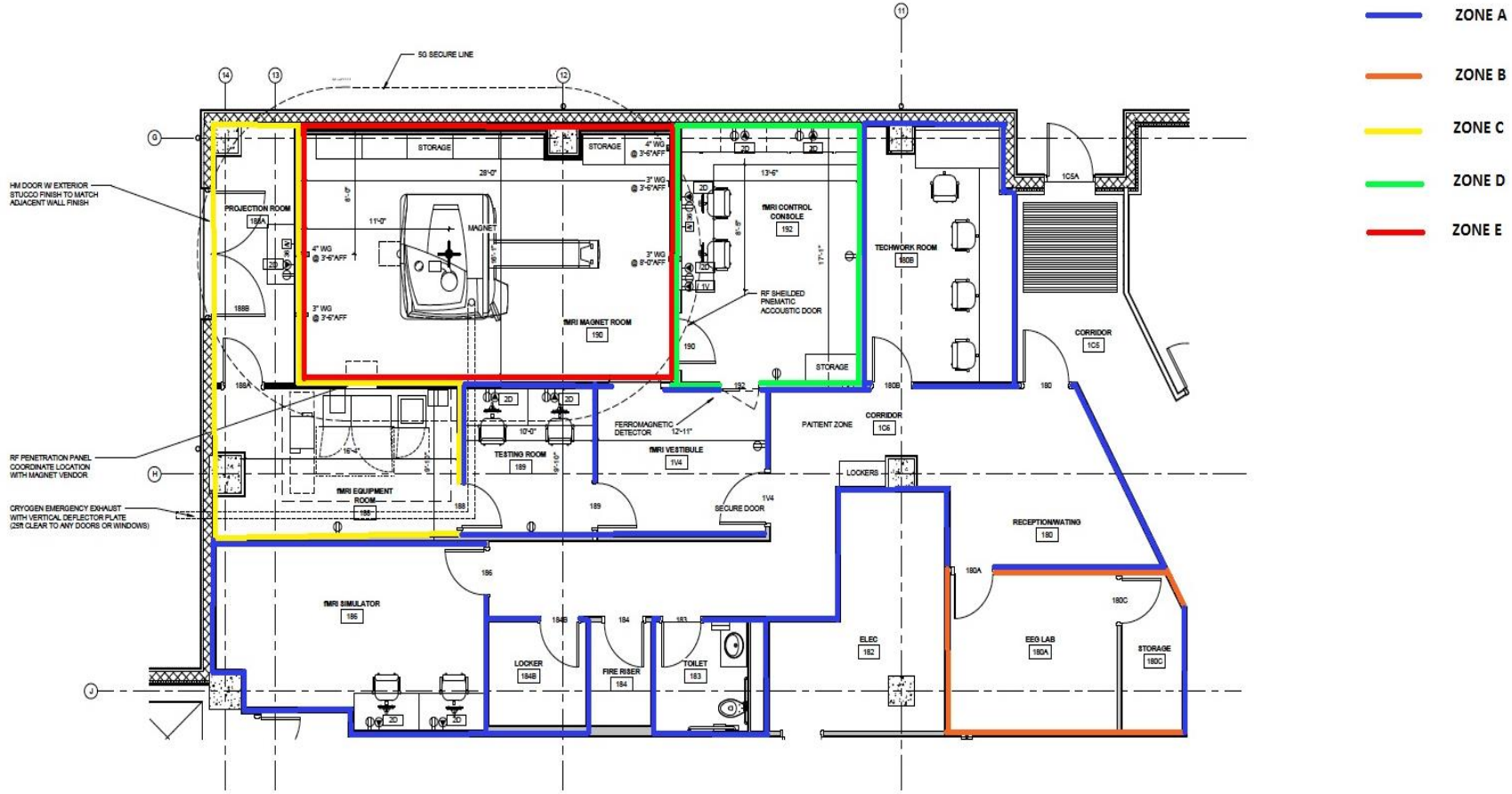
2.6.3 Documentation of MRI Operator qualification. Documentation of MRI Operator qualification must be recorded on the appropriate form (see Appendix A), updated at least biannually, and must be signed by the FERN Director. Records of documentation must be maintained within FERN.

2.6.4 Training for MR Operators is described in Section 10.

Facility Description

In March 2013, a new 3 T Siemens Trio (whole-body) scanner was installed in the PAIS building, purchased with ONR DURIP funds. This scanner will be dedicated to research and education. This system comes equipped with 32 channels, which can be configured in a wide variety of combinations through the TIM software. It includes standard sequences for EPI BOLD, diffusion, perfusion imaging, and DTI. We have a variety of coils, including a 32-channel head coil, 12-channel head coil, transmit/receive birdcage head coil, flex coils, neck matrix and spine matrix coils.

Scanning is carried out in the 3,000 square foot Facility for Education and Research in Neuroscience (FERN), the centerpiece of which is the 3 T fMRI. From its inception, the plan for a new building for Psychology and Interdisciplinary Sciences (PAIS) included space for an fMRI scanner system within a suite dedicated to research in cognitive and affective neuroscience. The new building now is complete; occupancy began in May 2009. The 119,000 square foot building is located in close proximity to the Emory College of Arts and Sciences departments of Anthropology, Chemistry, Mathematics and Computer Science, and Physics; it is a short walk from allied departments in the School of Medicine, including Neurology, Pediatrics, and Psychiatry, and from the Goizueta Business School. The main floor of the building houses the 3,000 square foot Facility for Education and Research in Neuroscience (FERN)In addition to a 3 Tesla MR scanner, FERN will feature (a) MRI simulator ("mock scanner"), to acclimate participants to the imaging environment and train them to remain still (critically important for pediatric and special populations; no simulator facilities are available on the Emory campus); (b) full psychophysiology recording suite (Biopac: heart rate, startle, skin conductance); (c) eye tracker; (d) behavioral testing space; and (e) additional space for consent and behavioral training. FERN also features a waiting area and bathroom and locker facilities. Long term, we also plan to apply for a magneto-encephalography (MEG) system. If that is successful, the MEG will be housed in the same suite. Thus, the scanner will be situated in an environment that is optimized for research on cognitive and affective neuroscience, using a variety of complementary, state-of-the-art techniques for peering into the brain.


ZONE A
ZONE B
ZONE C
ZONE D
ZONE E
50 SECURE LINE
HM DOOR W/ EXTERIOR STUCCO FINISH TO MATCH ADJACENT WALL FINISH
RF PENETRATION PANEL COORDINATE LOCATION WITH MAGNET VENDOR
CRYOGEN EMERGENCY EXHAUST WITH VERTICAL DEFLECTOR PLATE (25ft CLEAR TO ANY DOORS OR WINDOWS)
PROJECTION ROOM
188A
STORAGE
MAGNET
fMRI MAGNET ROOM
190
RF SHIELDED PNEMATIC ACCOUSTIC DOOR
fMRI CONTROL CONSOLE
192
TECHWORK ROOM
180B
CORRIDOR
1C5
1C5A
PATIENT ZONE
FERROMAGNETIC DETECTOR
fMRI VESTIBULE
1V4
SECURE DOOR
TESTING ROOM
189
fMRI EQUIPMENT ROOM
188
LOCKERS
RECEPTION/WAITING
180
180A
180C
fMRI SIMULATOR
186
LOCKER
184B
FIRE RISER
184
TOILET
183
ELEC
182
EEG LAB
180A
STORAGE
180C

Safety Procedures

(Developed based on ACR White Papers 2002, 2004 & MR Safety Guidelines 2007, 2013)

3.1 Pregnancy-Related Issues

In keeping with current ACR guidelines, pregnant MR Personnel/Researchers are permitted to continue working in all areas of FERN throughout their pregnancies. Acceptable activities include, but are not limited to, positioning individuals within the scanner, imaging, and entering the magnet room in the case of an emergency. Pregnant MR Personnel/Researchers should NOT be present within the magnet room while imaging is in progress.

3.1.1 ACR guidelines permit pregnant women to undergo MR imaging. Pregnant woman may be scanned with IRB approval.

3.2 Safety concerns related to children

3.2.1 Although permitted by ACR guidelines, children who are research volunteers will not be sedated for MRI at FERN.

3.2.2 Children should have their pockets checked by MR personnel, either manually or with a metal detector, prior to entering the magnet room. Prior to bringing personal objects such as stuffed toys into the magnet, these objects must be checked for ferromagnetic content with the metal detector.

3.2.3 Because children may be unreliable historians, children must be screened in conjunction with their parents or guardians. Some older children may have tattoos, ferromagnetic jewelry, makeup, and even possible pregnancies that their parents do not know about, and therefore, to get reliable reports of these objects they should be questioned separately from parents. As a rough guideline, children aged 10–17 will be screened both with their parents or guardians and separately to ensure an accurate

account of safety prior to entering the magnet area. Children younger than 10 years old will be screened with their parents or guardians.

3.3 Auditory considerations

3.3.1 Research participants, patients, and anyone accompanying these individuals in the MRI room during imaging must wear hearing protection. These must be in place prior to initiating any MR sequences.

3.4 Thermal issues

3.4.1 General issues: The body temperature increases if the participant absorbs more energy per unit of time than can be dissipated through thermoregulation (increased perspiration and blood flow). During the MR examination, patients may experience heat sensations on the skin and may begin to perspire. Their pulse rates may increase as well. The effects vary from patient to patient. The intensity of these effects depends on the measurement program selected. Following the examination, the body will cool off and the pulse rate will return to normal. The increase in core body temperature is usually well below 1 degree during the course of the MR examination if the Specific Absorption Rate limits are maintained.

3.4.2 Specific Absorption Rate (SAR)

3.4.2.1 Definition: A quantity that describes how much electromagnetic energy is absorbed by the body over time, typically expressed in units of watts per kilogram. SAR depends upon the pulse sequence and the size, geometry, and conductivity of the absorbing object.

3.4.2.2 Possible adverse effects: A high local SAR may result in RF burns. A high SAR evenly distributed across the entire body exerts stress on the patients' cardiovascular and thermoregulation system.

3.4.2.3 Protection against risk: SAR is limited in MRI studies to minimize body temperature increases. Accurately determining SAR is difficult; it depends upon heat conduction and body geometry as well as upon the blood flow changes. The Siemens 3T system requires the participant's weight and birth date to be input when setting up the participant. It uses those two measures to calculate an appropriate SAR. If the SAR is too high for a given set of user-specified parameters, a message appears on the computer interface of the system indicating that it will not allow the image sequence with those parameters. As further protection against risk, participants should be asked about their comfort level during the session.

3.4.3 Individuals with electrically conductive materials

3.4.3.1 Individuals with electrically conductive materials in their bodies, such as wires, leads, or implants will not be imaged in the MRI scanner due to thermal or voltage dangers relating to the presence of a strong, rapidly varying magnetic field.

3.4.4 Individuals with tattoos that have ferromagnetic properties may be imaged as long as care is taken to keep the affected area thermally insulated (using pads, ice packs, etc). It is also advisable to keep the affected area as far as possible from the inner walls of the MR scanner bore. Individuals whose tattoos are less than 48 hours old should not be scanned as it may cause the tattoo edges to run, although this presents no additional physical danger to the person in the magnet.

3.4.5 Conductive Loops

3.4.5.1 Description: Having one's hands or legs in contact can form an electrical current loop. Skin to skin contact from hands to legs or touching knees together is another form of a conductive loop.

3.4.5.2 Possible adverse events: Although unlikely, local burns could result from this type of body position. The most general result is a feeling of discomfort. In some instances the subject may feel as though their arms or legs have "fallen asleep" or have a tingling sensation. This sensation will go away and is not permanent.

3.4.5.3 Protection against risk:

3.4.5.3.1 Avoid conductive loops problem by placing individuals on the patient bed in positions that do not form conductive loops. Furthermore, this issue must be described to the participant so that if he/she shifts positions on the patient bed, conductive loops are not created. Specifically, individuals must be instructed not to cross their arms or legs while in the magnet.

3.4.5.3.2 In addition, participants should be informed about the potential of local burns and tingling sensations to occur, and to alert the MR operator in such instances.

3.5.6 Drug delivery patches and pads: Some drug delivery patches contain metallic foil, thus increasing the risk of thermal injury. If the patch is in the volume of excitation of the transmitting RF coil, the individual must not undergo MR imaging at FERN. If the drug delivery patch is outside of the volume of excitation of the coil, the individual can undergo imaging with an ice pack applied directly to the patch. The individual should be instructed to let the MR Personnel/Researcher know immediately if the patch begins to warm.

3.6 Cryogen-Related Issues

3.6.1 If anyone is in the magnet room while a quench occurs, OPEN the magnet room

door immediately for ventilation or the participant has the potential to suffocate.

3.6.2 In the event of a system quench, it is imperative that all personnel, research participants, and patients be evacuated from the magnet room, as quickly and safely as is feasible. Site access should be immediately restricted until the arrival of Siemens equipment service personnel.

3.6.3 The sudden appearance of white clouds or fog around or above the MRI scanner indicates that cryogenic gases have vented partially or completely in the magnet room. Police, fire, and other emergency personnel should be restricted from entering the room with their axes, oxygen tanks, etc., until it can be confirmed that the magnetic field has dissipated. There may still be a considerable residual static magnetic field despite a quench or partial quench of the magnet.

3.7 Claustrophobia and anxiety

3.7.1 Individuals undergoing MR imaging will be screened for known claustrophobia and anxiety about undergoing imaging. If these individuals wish to undergo MR imaging, they will first be offered an opportunity to practice in the simulated MR environment (mock scanner). All individuals undergoing imaging are advised that they may speak to the MR Personnel/Researcher throughout the imaging session, or squeeze the handheld squeeze bulb to indicate that they need attention or wish to be removed from the magnet and patient bed.

3.8 Contrast Agent Safety

3.8.1 No contrast agents will be used within FERN.

3.9 Firefighter, police, and security safety considerations: For the safety of these emergency personnel who are responding to an emergency call at FERN a MRI Operator should be on site if

possible, prior to the arrival of the emergency responders, to ensure that they do not have free access to the magnet room.

3.9.1 The FERN Director and Facilities Manager are responsible for prospectively educating the local fire marshals, firefighter association, police, and security personnel about the potential hazards of responding to emergencies in the MR suite. It should be stressed that even in a fire or other emergency, the magnetic fields may be present and fully operational. Therefore, emergency personnel with air tanks, axes, crowbars, or other firefighting equipment, as well as guns, etc., cannot be given free access to the magnet room. Such access might prove catastrophic or even lethal to those responding or others in the vicinity.

3.9.2 In addition to training, emergency personnel will also be provided with documents providing information about the facility and safety issues.

3.9.3 FERN has an MR-safe fire extinguisher that is located in the control room 192 just outside the MRI room. Also for fire safety, there is a smoke detector system and a sprinkler system that will be automatically activated in case of smoke or fire, respectively.

3.9.4 If there is a fire requiring firefighters or other emergency personnel to enter the MR facility with non-MR safe equipment, either the magnet must remain locked or off limits, or a decision to quench the magnet should be very seriously considered. This decision should be made if needed to protect the health and lives of the responders and other persons present. Should a planned quench be performed, a MRI Operator must ensure that all emergency personnel and unscreened individuals continue to be restricted from Zone IV until the static field is no longer detectable or at least sufficiently attenuated such that it no longer present hazardous conditions to persons with ferromagnetic objects, such as axes or oxygen tanks.

3.10 Power outage considerations.

3.10.1 In the event of power outage, MRI Operators must be able to release the scanner table so that it can be mechanically pulled out if the emergency power system fails to initiate.

3.10.2 Because power outages have implications for several aspects of system function, they should be reported to the Facilities Manager as soon as possible.

Safety Screening for individuals entering MRI area (Magnet Room)

4.1 The Screening Protocol and IRB approved screening forms are included in the SOPs document.

4.2 The purpose of safety screening is to ensure that no one enters the magnet room with ferromagnetic objects, either in their bodies, on their bodies, or as part of any materials or equipment that is being brought into the magnet room. Safety screening of ALL individuals entering the magnet room is a cornerstone of keeping the MRI environment safe.

4.3 A formal screening protocol is in place for the FERN, and was developed with the guidance of ACR materials. The procedure and documentation forms are approved by the Institutional Review Board (IRB).

4.4 In keeping with the recommendations of the ACR, the magnetic safety screening is essentially the same for all individuals entering the magnet room. Individuals undergoing imaging must answer additional questions, such as height and weight. Such questions are relevant to safety issues, such as specific absorption rate (SAR), or to the presence of objects that may affect the quality of the images or the participant's comfort during imaging.

4.5 FERN staff and all MR Personnel/Researchers must undergo MR Safety Screening as part of their employment process and/or prior to beginning research training or work in the magnet room. MR Personnel/Researchers are not required to be screened prior to each and every entry into the magnet room. However, MR Personnel/Researchers must immediately report to the FERN Director or Facilities Manager any trauma, procedure, or surgery they undergo during employment in which a ferromagnetic metallic object or device may have been introduced within or onto them. At such a time, the employee will be re-screened to determine if any safety issues prevent him/her from safely working in the magnet room.

4.7 Research participants must be fully safety screened prior to entering the magnet room at every session, which includes administration of the MR Safety Questionnaire and screening for

ferromagnetic personal belongings and devices on them or in them, such as watches, jewelry, pagers, and cell phones.

4.7.1 Metal detectors are not to be used as a substitute for careful screening by MR personnel, but may be used in the screening process.

4.7.2 Any individual undergoing MR imaging must remove all readily removable metallic personal belongings and devices on them, such as watches, jewelry, pagers, cell phones, body piercings (if removable), and cosmetics containing metallic particles, and place these items in lockers in the vestibule. It is recommended that clothing items that may contain metallic fasteners, hooks, zippers, loose metallic components, or metallic threads be also removed or screened with a metal detector prior to entering the magnet room to ensure that they are not ferromagnetic. Research participants and patients may wear site-supplied scrubs or a gown.

4.7.3 All individuals whose screening reveals a history of potential ferromagnetic foreign object penetration must undergo further investigation prior to being admitted into the magnet room. Examples of acceptable methods of screening include patient history, plain X-ray films, prior CT or MR studies of the questioned anatomical area, or access to written documentation of the type of implant or foreign object that may be present. After positive identification has been made as to the type of implant or foreign object that is within the patient, MR compatibility must be assessed using product labeling or Shellock MR Safety guidelines. Decisions based on published MR compatibility or safety claims must recognize that all such claims apply to specifically tested static field and static gradient field strengths.

4.7.4 Under no circumstances will individuals be admitted into the magnet room of the FERN if they have aneurysm clips, cardiac pacemakers, diaphragmatic pace makers, auto-defibrillators, deep brain stimulators, or other electromechanically activated devices.

4.7.5 Research participants and patients as well as their escorts must complete an MR safety-screening questionnaire prior to entry into the magnet room. All escorts who remain in the facility beyond the arrival with the patient or research participant must undergo this screening in case they need to enter into the magnet room.

4.7.6 There is potential for thermal injury from excessive RF power deposition. If a person undergoing MR imaging is in contact with electrically conductive material such as a tattoo with metal particles in it, cold compresses or ice packs can be placed on the affected body area during imaging.

4.7.7 Final decisions regarding whether a given participant or patient can undergo MRI in the FERN must be made by a MRI Operator following criteria for acceptability predetermined by the FERN Director, and approved by the Institutional Review Board. The MRI Operator confirms this decision by signature on the participant or patient's MR screening form.

4.7.8 If any MRI Operator who screens a participant finds that additional considerations are necessary before approving the participant to enter the magnet room or undergo imaging, the case must be brought to the FERN Director and Facilities Manager who will make the final determination (with additional information from the potential participant or consultation with other experts as needed) about whether the participant is eligible for MR imaging at FERN.

Protocol for Ensuring Magnet Room and MR Imaging Safety

Step by Step Procedures and Screening Form

Facility for Education & Research in Neuroscience (FERN)

Protocol-Steps for Screening:

5.1 Screening begins with providing information regarding the safety issues within the magnet room and the importance of accurate and complete responses to the screening questions so that we can determine the safety of having the individual in the magnet room. Here's a sample script for what could be said in this process: "*The MRI Machine has a very strong magnet. The magnet is so strong that it creates a forceful pull throughout the entire magnet room. Since many metal objects are magnetic, it is dangerous to bring metal objects into the magnet room. The magnet can pull metal objects through the air into the magnet, injuring anyone in the way. Some individuals have metal in their bodies. If they enter the magnet room the metal inside their body may move or heat up possibly injuring this person. Thus, to ensure your safety while you are in our MRI facility, I will need to ask you safety questions. You must answer these questions completely and honestly if you wish to go into the magnet room. However, you may choose not to answer these questions and not to enter the magnet room. If you are unsure how to answer any of my questions please be sure to let me know*."

5.1.1 After the above information is provided verbally to the person being screened, the appropriate paper questionnaire will be given to the person, which they must fill out fully. Note: Fill out questionnaire in its entirety each time the person undergoes MR imaging.

5.1.2 A MRI Operator conducts the screening interview. The interviewer will go through each question one-by-one to ensure that there is no safety concerns before the person enters the magnet room (Zone IV). MRI Operators are safety trained, understand the rationale for each question and are able to answer questions and address safety concerns of people entering the magnet room. Therefore, this interview cannot be performed by Level 1 MR personnel/Researchers.

5.1.3 An important part of the interview process is to ensure that all metallic personal items are removed from the person prior to entering the magnet room. These include jewelry (wristwatches, earrings, etc.), bobby pins, barrettes, hearing aids, shoes, wallet, and credit cards. Once the interview is complete, both the MRI Operator interviewer and the person being screened must sign and date the questionnaire. The questionnaire will then be filed in the locked file cabinet located in the FERN facility.

Key Points for Safety in the Magnet Environment:

5.2 Be vigilant about who is entering the control and magnet rooms.

5.3 Individuals unfamiliar with the magnetic resonance environment and its hazards are at the greatest safety risk.

5.4 Everyone entering the magnet room, including emergency responders, must be fully screened and must remove all ferrous material from their person.

5.5 Safety training is required of ALL personnel who will use the neuroimaging facility.

Three (3) Types of Emergency Buttons for Different Purposes

5.6 Intercom MR Control Panel

5.6.1 The Table Stop Button. Press the Table Stop button immediately in case of accidents or risk of injury due to table movements (points of injury through crushing/bruising). If a table stop button is hit, the table comes to an immediate stop.

5.6.2 In the control room: Press the red button on the top of the Intercom Console to stop the patient table movement. If it occurs in the middle of an exam, the scan is also stopped. Imaging can also be stopped using the scanner software.

5.6.3 In the MRI instrument room: Press the red button in the MR control panel.

5.7 To resume normal table operation, press the Table Movement Up/Inward button and then press the Table Movement Down/Outward button. This will cancel the Table Stop. The fastest

way to move the subject out of the bore is pressing the Home Position button in the MR control panel.

5.8 In case of power failure or defective motorized drive, the table can be manually pulled out of the magnet bore. To do so, locate the red arrow on the patient table, pull the unlocking handle outward and upward to the end stop. The tabletop is mechanically decoupled from the motorized drive unit. Pull the tabletop out of the magnet using the handle at the foot end.

5.9 The Emergency Power Off (EPO) Button

Press the EPO button to:

5.9.1 Stop all electronics associated with the MRI, including the control room computer;

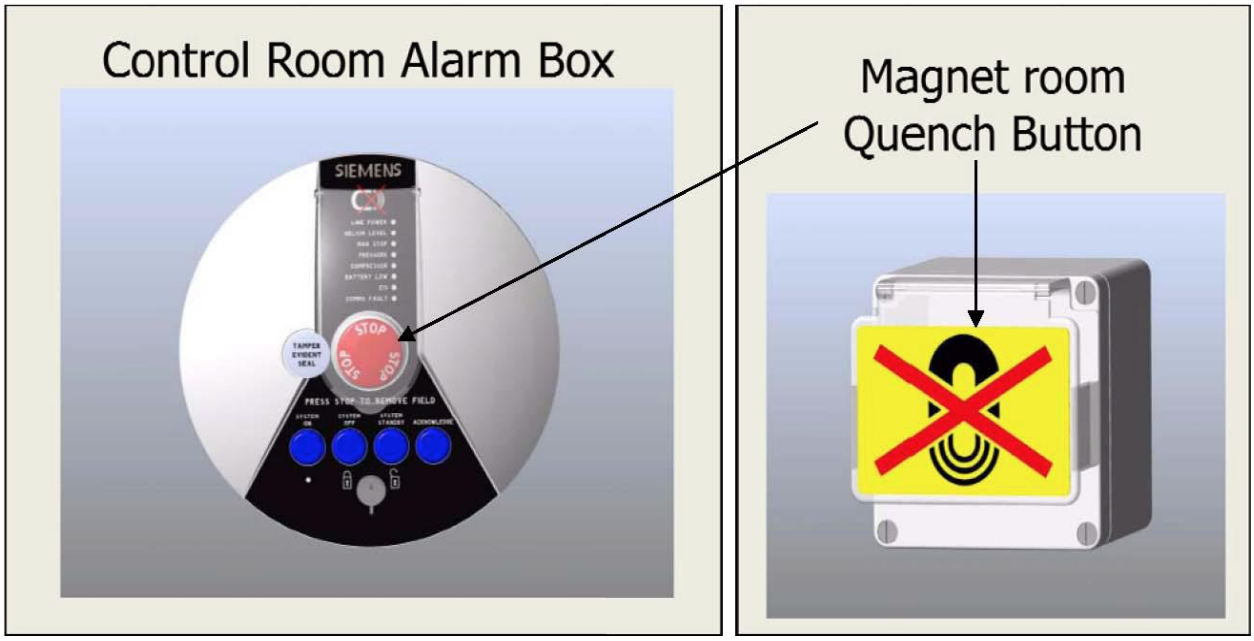
5.9.2 Release the brake on the patient table.

5.9.3 Three locations of the EPO buttons

5.9.3.1 Control Room: (192).

5.9.3.2 Magnet Room: (190).

5.9.3.3 Equipment Room: (188).



The Quench Button

5.10.1 Quenching the magnet is a LAST RESORT: it is dangerous if not done properly.

5.10.2 BEFORE initiating a quench, attempt to remove a person from the magnet without quenching — this is a safer alternative than an unnecessary quench.

5.10.3 If you determine that quenching the magnet is the safest option, press the QUENCH button to bring down the magnetic field VERY RAPIDLY.

5.10.4 If a person is in the magnet room OPEN THE DOOR BEFORE QUENCH.

5.10.5 The room must be ventilated or persons inside will suffocate rapidly!

5.10.6 If NO ONE is in the magnet room, quench with the DOOR CLOSED.

5.10.7 CALL 911 as soon as is possible, and Siemens service 1-888-7436 (1-888-SIEM), Functional Location #429050. Call the contacts on the FERN emergency contact list immediately.

5.10.8 DO NOT leave the scene. There is no danger as long as there is adequate ventilation.

5.10.9 Even after the magnet has quenched, there may still be a considerable static magnetic field.

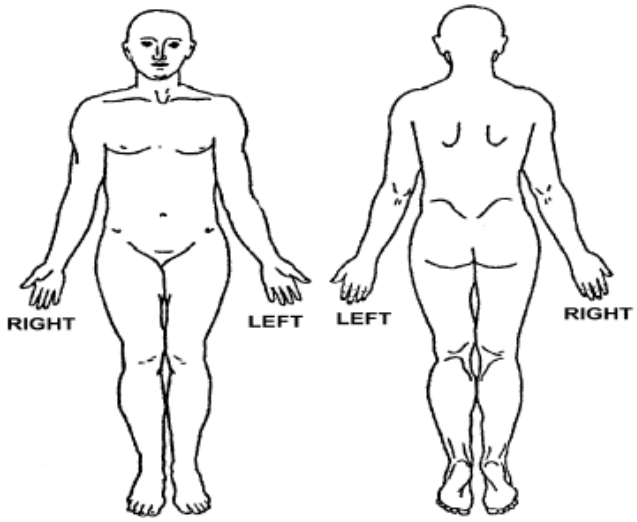
5.10.10 Precautions must be taken for all FERN and emergency personnel entering the magnet room.

WARNING: Certain implants, devices, or objects may be hazardous to you and/or may interfere with the MR procedure (i.e., MRI, MR angiography, functional MRI, MR spectroscopy). Do not enter the MR system room or MR environment if you have any question or concern regarding an implant, device, or object. Consult the MRI Technologist or Radiologist BEFORE entering the MR system room. The MR system magnet is ALWAYS on.

Please indicate if you have any of the following:

- ❒ Yes ❒ No Aneurysm clip(s)
- ❒ Yes ❒ No Cardiac pacemaker
- ❒ Yes ❒ No Implanted cardioverter defibrillator (ICD)
- ❒ Yes ❒ No Electronic implant or device
- ❒ Yes ❒ No Magnetically-activated implant or device
- ❒ Yes ❒ No Neurostimulation system
- ❒ Yes ❒ No Spinal cord stimulator
- ❒ Yes ❒ No Internal electrodes or wires
- ❒ Yes ❒ No Bone growth/bone fusion stimulator
- ❒ Yes ❒ No Cochlear, otologic, or other ear implant
- ❒ Yes ❒ No Insulin or other infusion pump
- ❒ Yes ❒ No Implanted drug infusion device
- ❒ Yes ❒ No Any type of prosthesis (eye, penile, etc.)
- ❒ Yes ❒ No Heart valve prosthesis
- ❒ Yes ❒ No Eyelid spring or wire
- ❒ Yes ❒ No Artificial or prosthetic limb
- ❒ Yes ❒ No Metallic stent, filter, or coil
- ❒ Yes ❒ No Shunt (spinal or intraventricular)
- ❒ Yes ❒ No Vascular access port and/or catheter
- ❒ Yes ❒ No Radiation seeds or implants
- ❒ Yes ❒ No Swan-Ganz or thermodilution catheter
- ❒ Yes ❒ No Medication patch (Nicotine, Nitroglycerine)
- ❒ Yes ❒ No Any metallic fragment or foreign body
- ❒ Yes ❒ No Wire mesh implant
- ❒ Yes ❒ No Tissue expander (e.g., breast)
- ❒ Yes ❒ No Surgical staples, clips, or metallic sutures
- ❒ Yes ❒ No Joint replacement (hip, knee, etc.)
- ❒ Yes ❒ No Bone/joint pin, screw, nail, wire, plate, etc.
- ❒ Yes ❒ No IUD, diaphragm, or pessary
- ❒ Yes ❒ No Dentures or partial plates
- ❒ Yes ❒ No Tattoo or permanent makeup
- ❒ Yes ❒ No Body piercing jewelry
- ❒ Yes ❒ No Hearing aid
  (Remove before entering MR system room)
- ❒ Yes ❒ No Other implant _____
- ❒ Yes ❒ No Breathing problem or motion disorder
- ❒ Yes ❒ No Claustrophobia

Please mark on the figure(s) below the location of any implant or metal inside of or on your body.



IMPORTANT INSTRUCTIONS

Before entering the MR environment or MR system room, you must remove all metallic objects including hearing aids, dentures, partial plates, keys, beeper, cell phone, eyeglasses, hair pins, barrettes, jewelry, body piercing jewelry, watch, safety pins, paperclips, money clip, credit cards, bank cards, magnetic strip cards, coins, pens, pocket knife, nail clipper, tools, clothing with metal fasteners, & clothing with metallic threads.

Please consult the MRI Technologist or Radiologist if you have any question or concern BEFORE you enter the MR system room.

NOTE: You may be advised or required to wear earplugs or other hearing protection during the MR procedure to prevent possible problems or hazards related to acoustic noise.

I attest that the above information is correct to the best of my knowledge. I read and understand the contents of this form and had the opportunity to ask questions regarding the information on this form and regarding the MR procedure that I am about to undergo.

Signature of Person Completing Form: _____ Date _____/_____/_____
Signature

Form Completed By: ❒ Patient ❒ Relative ❒ Nurse _____ _____
Print name Relationship to patient

Form Information Reviewed By: _____ _____
Print name Signature

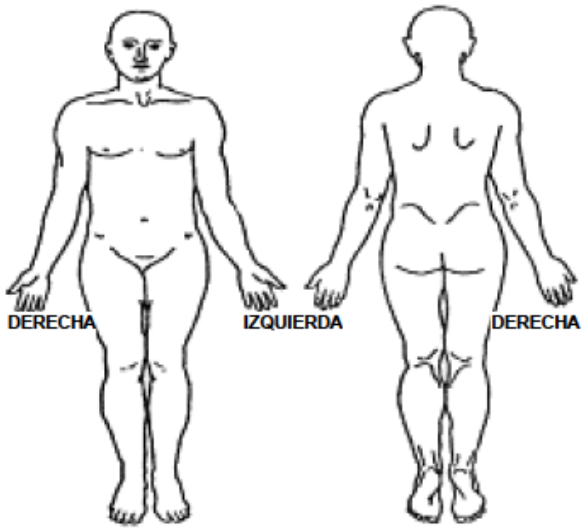
❒ MRI Technologist ❒ Nurse ❒ Radiologist ❒ Other_____

ADVERTENCIA: Ciertos implantes, dispositivos, u objetos pueden ser peligrosos y/o pueden interferir con el procedimiento de resonancia magnética (es decir, MRI, MR angiografía, MRI funcional, MR espectroscopía). **No entre** a la sala del escáner de MR o a la zona del laboratorio de MR si tiene alguna pregunta o duda relacionadas con un implante, dispositivo, u objeto. Consulte con el técnico o radiólogo de MRI ANTES de entrar a la sala del escáner de MR. **Recuerde que el imán del sistema MR está SIEMPRE encendido.**

Por favor indique si tiene alguno de los siguientes:

❒ Sí ❒ No	Pinza(s) de aneurisma
❒ Sí ❒ No	Marcapasos cardíaco
❒ Sí ❒ No	Implante con desfibrilador para conversión cardíaca (ICD)
❒ Sí ❒ No	Implante electrónico ó dispositivo electrónico
❒ Sí ❒ No	Implante ó dispositivo activado magnéticamente
❒ Sí ❒ No	Sistema de neuroestimulación
❒ Sí ❒ No	Estimulador de la médula espinal
❒ Sí ❒ No	Electrodos ó alambres internos
❒ Sí ❒ No	Estimulador de crecimiento/fusión del hueso
❒ Sí ❒ No	Implante coclear, otológico, u otro implante del oído
❒ Sí ❒ No	Bomba de infusión de insulina ó similar
❒ Sí ❒ No	Dispositivo implantado para infusión de medicamento
❒ Sí ❒ No	Cualquier tipo de prótesis (ojo, peneal, etc.)
❒ Sí ❒ No	Prótesis de válvula cardiaca
❒ Sí ❒ No	Muelle ó alambre del párpado
❒ Sí ❒ No	Extremidad artificial ó prostética
❒ Sí ❒ No	Malla metálica (stent), filtro, ó anillo metálico
❒ Sí ❒ No	Shunt (espinal ó intraventricular)
❒ Sí ❒ No	Catéter y/u orificio de acceso vascular
❒ Sí ❒ No	Semillas ó implantes de radiación
❒ Sí ❒ No	Catéter de Swan-Ganz ó de termodilución
❒ Sí ❒ No	Parche de medicamentos (Nicotina, Nitroglicerina)
❒ Sí ❒ No	Cualquier fragmento metálico ó cuerpo extraño
❒ Sí ❒ No	Implante tipo malla
❒ Sí ❒ No	Aumentador de tejidos (e.g. pecho)
❒ Sí ❒ No	Grapas quirúrgicas, clips, ó suturas metálicas
❒ Sí ❒ No	Articulaciones artificiales (cadera, rodilla, etc.)
❒ Sí ❒ No	Varilla de hueso/coyuntura, tornillo, clavo, alambre, chapas, etc.
❒ Sí ❒ No	Dispositivo intrauterino (IUD), diafragma, ó pesario
❒ Sí ❒ No	Dentaduras ó placas parciales
❒ Sí ❒ No	Tatuaje ó maquillaje permanente
❒ Sí ❒ No	Perforación (piercing) del cuerpo
❒ Sí ❒ No	Audífono *(Quíteselo antes de entrar a la sala del escáner de MR)*
❒ Sí ❒ No	Otro implante_____
❒ Sí ❒ No	Problema respiratorio ó desorden del movimiento
❒ Sí ❒ No	Claustrofobia

Por favor marque en la imagen de abajo la localización de cualquier implante o metal en su cuerpo.



⚠ *¡AVISO IMPORTANTE!*

Antes de entrar a la zona de MR ó a la sala del escáner de MR, tendrá que quitarse todo objeto metálico incluyendo audífono, dentaduras, placas parciales, llaves, beeper, teléfono celular, lentes, horquillas de pelo, pasadores, todas las joyas (incluyendo "body piercing"), reloj, alfileres, sujetapapeles, clip de billetes, tarjetas de crédito ó de banco, toda tarjeta con banda magnética, monedas, plumas, cuchillos, corta uñas, herramientas, ropa con enganches de metal, y ropa con hilos metálicos.

Por favor consulte con el Técnico de MRI ó Radiólogo si tiene alguna pregunta o duda ANTES de entrar a la sala de escáner de MR.

NOTA: Es posible se le pida usar auriculares u otra protección de sus oídos durante el procedimiento de MR para prevenir problemas ó riesgos asociados al nivel de ruido en la sala del escáner de MR.

Atestiguo que la información anterior es correcta según mi mejor entender. Leo y entiendo el contenido de este cuestionario y he tenido la oportunidad de hacer preguntas en relación a la información en el cuestionario y en relación al estudio de MR al que me voy a someter a continuación.

Firma de la persona llenando este cuestionario: _____ Fecha____/_____/_____
Firma

Cuestionario lleno por: ❒Paciente ❒Pariente ❒Enfermera _____ _____
Nombre en letra de texto Relación con el paciente

Información revisada por: _____ _____
Nombre en letra de texto Firma

❒ Técnico de MRI ❒Enfermera ❒ Radiólogo ❒ Otro _____

Translated with permission Olga Fernandez-Flygare, M.S., Brain Mapping Center, UCLA School of Medicine, Los Angeles, CA

Emergency Procedures

6.1 Emergency procedures must be visibly posted in FERN, reviewed and updated annually, and must be incorporated into safety training for all FERN Researchers and MR personnel.

6.2 The major risk in the facility is related to individuals entering the MRI facility who are unfamiliar with the MRI environment and its hazards. MR Personnel/Researchers working in the facility must be constantly vigilant of who is entering the control room and magnet room. Especially in emergency situations, MR Personnel/Researchers must ensure that no one without proper training or screening enters the Magnet Room of FERN and that those individuals who do enter have removed all ferrous material from their persons.

6.3 ALL personnel who use FERN must have up-to-date safety training as specified in the requirements for MR personnel. This includes basic safety training for personnel and researchers who use facilities at FERN. These individuals must also be fully aware of the current procedures for both medical emergencies and facility emergencies.

6.4 There is a participant-operated squeeze bulb on the MR patient table that must be given to all research participants while they are in the scanner. Squeezing this bulb activates an audible alarm to the control room, signaling the MR Personnel/Researchers of any problems or discomfort the participant may be experiencing. There is also an intercom system in place between the control room and the magnet room so that the participant and MR Personnel/Researchers may communicate verbally.

6.5 FERN is equipped with a First Aid kit, which is mounted on the wall of the control room. Note that the First Aid Kit itself and its contents are not MR-safe.

6.6 FERN has readily accessible, clearly marked, MR-safe fire extinguishers available. Additionally, there is a smoke detector system and a sprinkler system that will be automatically activated in case of smoke or fire, respectively.

6.7 During imaging activities involving research participants, there must be at least two MR Personnel/Researchers present (one of whom must be Operator certified) whenever a participant is in Magnet Room. This policy is in place to facilitate responses to emergencies.

6.7.1 A typical scenario would be that in addition to the participant and the MRI operator, at least one additional MR-trained person would be present in the control room or elsewhere in Zone III or Zone IV. Thus, in case of an emergency involving the participant, one MR personnel/researcher will be available to attend to the participant while the other can contact emergency personnel and meet and guide them safely within the facility.

6.7.2 The only exception to the rule of having at least two MR Personnel/Researchers present when imaging is if (1) a volunteer who is at least Level 1 MR certified is being imaged, and (2) imaging is not part of IRB approved research. Such a situation would occur, for example, when testing equipment or pulse sequences in the MRI. Only in this case is it acceptable for an MRI operator to conduct imaging without additional MR personnel/researchers within FERN.

6.8 Specific Emergencies and Responses

6.8.1 The following specific emergencies and responses are addressed in the FERN Internal Operating Procedures for Response Plans for Specific Emergencies: Distressed or injured individual, and facility emergencies not involving people.

6.8.1.1 In case of emergency, there are several FERN personnel designated as emergency contacts; these are listed in the FERN Emergency Contacts. In case of emergency, at least one of these individuals should be contacted immediately.

6.8.1.2 In case of alarms sounding inside or heard from outside of FERN, or other facility emergencies, there must be contact information for at least two responsible FERN personnel posted in visible locations within the facility. In addition, individuals from the Dean's Office, Campus Police, Department of Environmental Safety, and Facilities Management must be given this information to keep on file.

6.8.1.3 If MR Personnel/Researchers or another person notices smoke or fire, campus 911 should be called. FERN emergency contacts should be notified immediately.

6.8.1.4 If MR Personnel/Researchers or another person notices water leaks, FERN Personnel should be notified immediately.

6.8.1.5 If there is a potentially life-threatening situation, such as fire or smoke, MR Personnel/Researchers and research participants, patients, and their escorts must be removed immediately from the facility and should be escorted to a safe location outside of the building.

6.8.1.6 If it is safe and feasible, MR Personnel/Researchers should accompany emergency personnel into FERN. MR Personnel/Researchers should take all possible steps to ensure the safety of all emergency personnel in the magnet room. If it is necessary for non-MR safe equipment to be introduced into the magnet room, a quench of the magnet should be very seriously considered.

FERN Internal Operating Procedures for Response Plans for Specific Emergencies

7.1 Distressed Subject: Subject indicates distress by pressing the squeeze bulb or verbally conveying distress OR facility staff notice distress and determine that the subject must be removed rapidly from the scanner. Possible scenarios include panic attack, claustrophobia, general fear or extreme discomfort, or a medical emergency.

7.2 Follow these steps:

7.2.1 Stop imaging immediately by pressing the red stop button or stopping the scan on the imaging computer.

7.2.2 Use the intercom to reassure the participant that you are coming in to remove them.

7.2.3 Remove the participant from the magnet room.

7.2.4 Talk with the subject in the waiting room and assess whether emergency personnel are needed; if so, call 911. Tell them the situation and give the address: Psychology and Interdisciplinary Studies Building, Emory University, 36 Eagle Row, Suite 180, Atlanta, Georgia 30322

7.2.5 If first aid is needed, use the First Aid kit mounted on the wall in the control room.

7.2.6 Monitor all emergency personnel to ensure their safety and to prevent them from introducing equipment or medical instruments which may present safety risks into the magnet room.

7.3 Person Trapped in or Injured by Projectile in the Magnet:

7.4 Follow these steps:

7.4.1 Stop imaging immediately by pressing the red button on the console.

7.4.2 Use the intercom to reassure the participant that you are coming in to attend to them.

7.4.3 Assess whether removing the person from the magnet could lead to severe loss of blood.

7.5 For example, if a person is impaled by scissors near an artery or area of large blood supply, such as in the neck, femoral region, or heart, DO NOT REMOVE THE IMPALING OBJECT as more blood loss may occur. Instead, leave the person in a stable position, apply pressure if needed, and let emergency responders decide the most appropriate action.

7.6 Or, for example, if a person has been impaled by scissors in a hand or other extremity, consider removing the impaling object by prying it off the magnet (more than one person may be needed), and then administer first aid.

7.7 If a person is trapped in the magnet or against the magnet by a ferromagnetic object, attempt to pry it off of the magnet.

7.8 If a person is trapped by the magnet or against the magnet, it may be necessary to quench the magnet so that the person can be removed. OPEN THE MAGNET ROOM DOOR FIRST!!

7.9 If the subject can be safely removed from the magnet environment without further injury, escort the subject to the control room and assess whether emergency personnel are needed. If so, call campus 911. Explain the situation and give them the address: 36 Eagle Row, Suite 180.

7.10 If first aid is needed, use the First Aid kit mounted on the south wall in the control room.

7.11 If emergency personnel are called, monitor them to ensure their safety and to prevent them from introducing equipment or medical instruments which may present safety risks into the magnet room.

7.12 If the subject CANNOT be safely removed from the magnet without inciting further injury, contact emergency services by calling 911. Explain the situation and give them the address: 36 Eagle Row, Suite 180.

7.13 Stay in constant contact with the subject over the intercom system or by having another safety screened individual stand in the room with them. When emergency personnel arrive they MUST be safety screened and made to remove all ferrous objects on their person. Failure to do so may cause injury to the responding emergency personnel, other individuals present in the MRI room, and may cause further injury to the subject trapped in the MRI!

7.14 Call Siemens service at: 1-888-7436 (1-888-SIEM), Functional Location # 429050.

7.15 Facility emergencies: Staff member or other person notices fire, water leaks, foreign objects in magnet with or without subject present, but no one is in grave danger.

7.16 Call campus 911 if there is a fire.

7.17 Remove subject if one is present.

7.18 Attempt to contact someone from the FERN Emergency Contact List

7.19 Call Siemens service at: 1-888-7436 (1-888-SIEM), Functional Location # 429050.

FERN Emergency Contacts (in contact order)

1. 911 (for medical emergencies)
2. Kate Revill (404-727-5446; mobile: 404-276-7804)
3. Gregory Berns (404-727-2556; mobile: 404-561-8551)

Emergency Contacts will be posted in the Control Room.

INFORMATIONAL HANDOUT FOR EMERGENCY PERSONNEL

Facility for Education & Research in Neuroscience (FERN)
Emory University, Atlanta, Georgia

Located in the PAIS Building, #180, 36 Eagle Row, Emory University, Atlanta, Georgia 30322.

This document contains information for safety and emergency personnel (police, fire, EMT) about the MRI (magnetic resonance imaging) magnet in FERN located in the PAIS Building, Suite 180, 36 Eagle Row, Emory University, Atlanta, Georgia 30322.

The FERN is located on the west side of the PAIS Building. Attached is a drawing showing the relative location of the facility within the building.

The FERN is composed of several rooms, see attached floor plan.

These several rooms and their uses are:

Room 188A: Interview and screening area.
Room184B: Dressing room
Room183: Restroom.
Room186: The Mock MRI scanner room.
Room 192: Control room for MRI Scanner
Room 190: MRI Scanner Magnet Room
Room 188: Equipment Room

Only one room in the FERN suite requires special consideration/action by emergency personnel. **Room 190, which contains the MRI magnet itself, has special risks and safety precautions associated with it.**

The MRI is a very strong magnet. This magnet is so strong that it creates a magnetic pull throughout the entire room. The magnet can actually cause some metal objects to fly through the air toward the magnet, with the potential to injure anyone in the path of the flying object. Also, if an individual who has any metal object in their body enters the magnet room it is possible for that metal object inside the body to move and possibly injure the person. **THE MAGNET IS ALWAYS ON!** No person, safety/emergency personnel or other, should enter the MRI magnet room if they have any of the following medical/surgical conditions:

- have a pacemaker or defibrillator,
- have a stent,
- have an aneurism clip
- have been injured by a metallic object that was not removed
- have a cochlear (ear) or middle ear implant
- have had surgery involving a metallic implant (e.g. knee or hip replacement)
- is a woman and has an intra-uterine device (IUD)
- have dental braces or dentures containing metal
- have body piercings (e.g. navel ring, ear rings, etc.)

- have a deep brain stimulator implant.

None of the following items should be on or be worn by any person entering the MRI magnet room:

- jewelry (e.g. wristwatch, rings, necklace, etc.)
- hair accessories (e.g. bobby pins, burettes, hair elastic, etc.)
- wallet, credit cards
- any medical objects (e.g. hearing aid, etc.)

Emergency and safety personnel should be especially mindful that absolutely no medical equipment, tools or weapons should ever enter the MRI magnet room:

- ladders containing any metal
- fire extinguishers
- fire axe
- weapons
- non MR safe gurney
- metal medical instruments
- tools (e.g. wrench, pliers, hammer, etc.)

The magnet room (room 190) is locked whenever an MR Operator is not present. Except in cases of extreme urgency, it is advisable to contact one of the emergency contact personnel listed below to escort emergency personnel into the magnet room.

Gregory Berns, 404-727-2556, gberns@emory.edu, cell: 404-561-8551
Kate Revill, 404-727-5446, kate.revill@emory.edu, cell: 404-276-7804

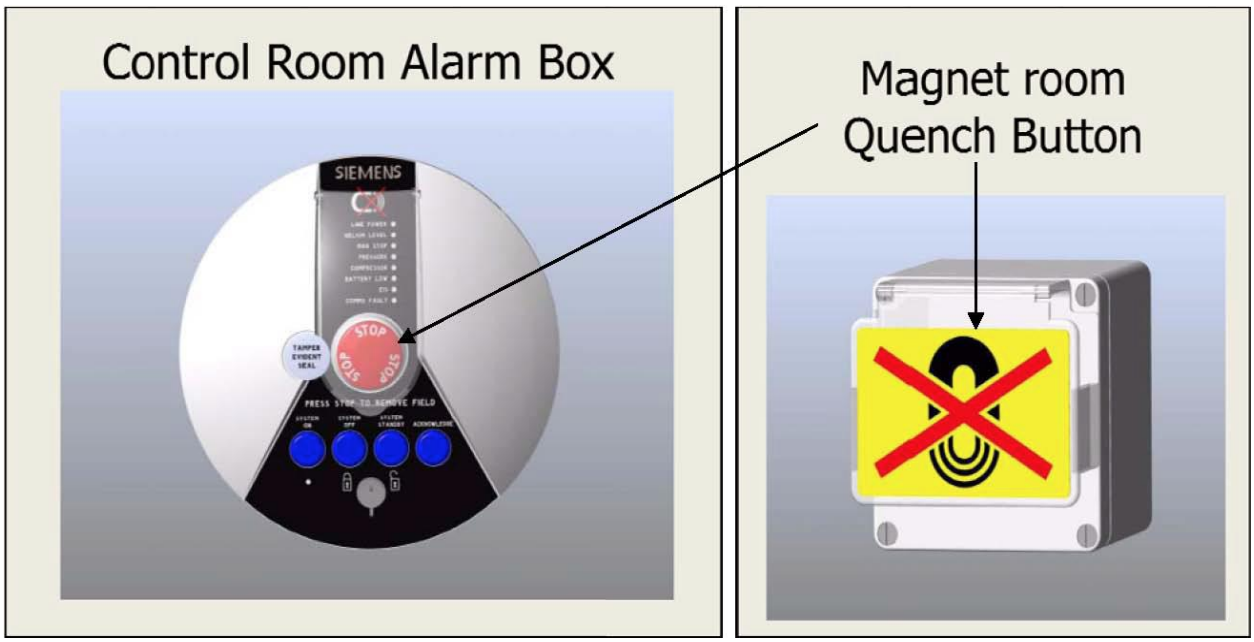
If an accident occurs (for instance someone is pinned against the magnet by a metal object) the following emergency procedures should be used. The worst case would be that additional personnel enter the room to aid the victim of the accident without first screening themselves for

metal objects, thus causing further accidents. Assess the level urgency involving the victim and act based on the following guidelines.

a) If there is no serious injury to the victim, remove the victim from the magnet room.

b) If the victim is pinned by a metal object, enlist the aid of several individuals to help remove the object (all personnel entering the magnet room should be free of metallic objects).

c) If the victim has sustained a life threatening injury from a metallic projectile and remains pinned to the magnet, then magnet can be shut down (or "quenched"). Quenching a magnet is a **VERY** serious response and should **ONLY** be performed in the case of serious bodily injury to a victim due to projectile ferromagnetic objects. A quench button is located in the magnet room (room 190) and in the control room (room 192). Importantly, a quench results in the emission of large amounts of helium, which can cause cryogen burns. The release of helium also quickly displaces the air from the room, resulting in a deadly low oxygen environment if the ventilation system fails and the magnet door is closed.



The FERN suite is equipped with fire detection equipment, fire pull stations, and ceiling mounted sprinklers.

Incidental Findings (IFs)

Detection and Disclosure of Incidental Findings in Neuroimaging Research

8.1 FERN is a research facility at Emory University. FERN is a part of the Emory College, and is not affiliated with the medical school or the university hospital.

8.2 Structural Magnetic Resonance Imaging (MRI) scans are one of the imaging technologies used in research at the center. As with the other imaging done at this center, MRI scans are undertaken for research purposes only and not for diagnostic or therapeutic purposes.

8.3 FERN does not have medical or radiological staff that interprets MRI scans, thus no information regarding normal or abnormal findings will be routinely provided to research subjects or their physicians.

8.4 Variations from expected brain morphology can be seen in many research participants undergoing MRI scans. In light of such variations, and given the rapidly increasing number of research MRIs conducted, significant ethical questions about responsibilities and procedures for detecting and disclosing incidental findings have been raised. Variations may or may not have medical implications.

8.5 FERN, a non-medical facility, has established the following policy for structural MRI scans obtained for research purposes based on the recommendations of National Institute of Neurological Disorders and Stroke:

> **8.5.1** In neuroimaging research, scientists and clinicians should anticipate the potential for Incidental Findings (IFs) in experimental design and follow the established procedure when an incidental finding is discovered.

8.5.2 In a neuroimaging research protocol, the subject or surrogate is first in line for disclosure of an incidental finding..

8.5.3 Verbal communication of an incidental finding should be done in a timely fashion, and documented in writing by a letter that draws on the informed consent language.

8.5.4 The possibility of Incidental Findings should be addressed specifically in consent forms and should be addressed in the IRB review.

8.5.5 IF considerations may not be relevant for some neuroimaging modalities that, by nature of the protocol, do not generate images that are clinically interpretable. These include imaging protocols that are not designed to acquire clinically useful morphological data such as functional magnetic resonance imaging (fMRI) and other non-morphologic data (PET, SPECT, MRS).

8.5.6 PIs should inspect all participants' structural images for Incidental Findings. Report all incidental findings to: Gregory Berns, MD PhD (404-727-2556) before discussing them with the participant. If deemed necessary, Dr. Berns will have the scans reviewed by a neuroradiologist and will contact the PI and patient with the results.

Training for Operators of the MRI Instrument

9.1 MRI operator trainees must be certified Level 1 MR personnel. Before certification as an MRI Operator, the trainee must have extensive Level 1 experience. The FERN Director and Facilities Manager must approve training of MRI operators. The FERN Director must approve certification of MRI operators. This approval is documented on the form included in Appendix A.

9.2 MRI operator trainees undergo training with other qualified FERN Operators. Training will progress through three phases.

9.2.1 Observer phase: Trainees observe the training Operator for a minimum of 4 hours of imaging. This phase of training is meant to familiarize the trainee with operating procedures. Trainees do not conduct safety screening during this phase. Trainees move on the next phase at the discretion of the training Operator.

9.2.2 Assistant phase: The trainee assists the training Operator for a minimum of 10 hours of imaging, with the training Operator taking the lead. This phase of training is meant to give the trainee hands-on experience with the operating procedures, and allow them to gradually begin to perform the duties of a certified Operator. Trainees may conduct safety screening at this phase, but only under the supervision of the training Operator. Trainees move on to the next phase at the discretion of the training Operator and the Facilities Manager.

9.2.3 Probation phase: Trainees operate the MRI device under the supervision of the training Operator for a minimum of 10 hours of imaging. This phase allows the trainee to build confidence in their ability to perform operating procedures, and develops the level of skill and responsibility necessary to be certified Operators. Trainees perform all operating procedures during imaging, using the training Operator as an information resource only. Trainees may conduct safety screening, but must have the form inspected

and signed by the training Operator. Trainees may apply for certification from the FERN Director at the joint discretion of the training Operator and the Facilities Manager.

10.1 Safety Training Course

10.1.1 The FERN SOPs require that all MR personnel/researchers to update their safety training biannually. The FERN Facilities Manager holds a Safety Training Course at the beginning each academic semester and on an as-needed basis.

10.2 The Safety Training course consists of four steps.

10.2.1 Read the SOPs. This step is required of all personnel who are updating their training, or who are new trainees. Reading should be completed before attending the training lecture. SOPs can be found on the FERN Website online course site under resources.

10.2.2 Watch the Siemens safety video. This step is required only of new trainees. The video will be shown during the first 25 minutes of the training session. Personnel updating their training may arrive at 25 minutes past the start time, and skip the video step.

10.2.3 Attend a safety lecture given by the FERN Facilities Manager or their designee. This step is required of all personnel. The lecture will follow the presentation of the safety video. A question and answer period will follow.

10.2.4 Attend a tour of the FERN given by the FERN Facilities Manager or their designee in which emergency equipment is pointed out. This step is required of all personnel. The tour will follow the lecture.

10.2.5 When these steps are performed for a smaller group, they do not need to follow directly one after the other. However, it is important that the steps be followed in the order shown.

Operator Training

[Italicized sections are copied and repeated from SOPs]

11.1 *MRI operator trainees must be certified Level 1 MR personnel. Training of MRI operators must be approved by the FERN Director and Facilities Manager.*

11.2 Operator training is usually reserved for only a few individuals. FERN employs Operators during its operating hours. Because these Operators use the technology every day, they are efficient, understand how all of the equipment in the FERN is used, and are vigilant with regard to safety procedures. It is recommended that most users take advantage of the FERN Operators as a resource, allowing the user to focus on running their experiment, increasing the chances of success.

11.3 However, because we are a research and teaching facility, we believe that Operator training should be available to FERN users. For instance, new core faculty and research scientists may wish to undergo Operator training. Also, in cooperation with the FERN Director and Facilities Manager, PIs may nominate individuals from their research groups whom they feel are ready for the responsibilities associated with being an Operator. These individuals are usually nominated for two reasons, 1) because training provides an educational experience, and/or 2) to facilitate collection of research data.

11.4 Although the final decision about each individual's qualifications to be a certified Operator is largely subjective, the FERN Director has approved some objective guidelines for selecting nominees.

> **11.4.1** Undergraduates may undergo Operator training as an educational experience only. Undergraduates will only be allowed to advance to the probationary trainee phase, and will not be certified MR Operators.

11.4.2 Graduate students may undergo Operator training. The purpose of training graduates is twofold, 1) for the educational experience that it offers, and 2) to allow them to collect data for their dissertation outside the normal operating hours of the facility.

11.4.3 Non-core faculty, research scientists, post-docs, full-time research assistants, lab technicians, and lab managers may undergo Operator training.

11.4.4 It is suggested that nomination be restricted to individuals who either have extensive previous experience with MR environments, or who the PI has worked with in a research setting for an extended period, such that the PI is able to reliably gauge the nominee's ability. It is helpful if nominees have interacted with members of FERN staff prior to nomination.

11.4.5 Full-time FERN Operators are hired by the FERN Director.

11.5 *Certification of MRI operators must be approved by the FERN Director. This approval is documented on the form included in Appendix A.*

11.6 *MRI operator trainees undergo intensive personal training with a certified FERN Operator. Training progresses through three phases.*

11.7 Minimum times are purposefully low. Trainees who have extensive previous experience with MRI may only require the minimum times for each phase. For trainees with no previous experience those times may have to be doubled, for instance. The training Operator should be a full-time FERN Operator.

11.8 *Observer phase: Trainees observe the training Operator for a minimum of 4 hours of imaging. This phase of training is meant to familiarize the trainee with operating procedures. Trainees do not conduct safety screening during this phase. Trainees move on to the next phase at the discretion of the training Operator.*

11.9 Trainees should observe all actions of the training Operator. The training Operator should explain their actions as they are performed. This is especially important when putting subjects in the MRI device.

11.10 *Assistant phase. The trainee assists the training Operator for a minimum of 10 hours of imaging, with the training Operator taking the lead. This phase of training is meant to give the trainee hands-on experience with the operating procedures, and allow them to gradually begin to perform the duties of a certified Operator. Trainees may conduct safety screening at this phase, but only under the supervision of the training Operator. Trainees move on to the next phase at the discretion of the training Operator and the Facilities Manager.*

11.11 Trainees should gain hands-on experience with every action required of an Operator. During this phase, the trainee must become confident with their ability to operate the console, to put subjects in the MRI device, and to multitask during the execution of an experimental protocol.

11.12 *Probation phase. Trainees operate the MRI device under the supervision of the training Operator for a minimum of 10 hours of imaging. This phase allows the trainee to build confidence in their ability to perform operating procedures, and develops the level of skill and responsibility necessary to be certified Operators. Trainees perform all operating procedures during imaging, using the training Operator as an information resource, only. Trainees may conduct safety screening, but must have the form inspected and signed by the training Operator. Trainees may apply for certification from the FERN Director at the joint discretion of the training Operator and the Facilities Manager.*

11.13 Trainees effectively perform all of the tasks expected of an Operator, but with supervision (i.e., the training Operator is in the FERN suite). During this phase, the trainee gains independence; therefore, the training Operator should be sure to allow the trainee to attempt to handle problems on their own. To apply for certification, trainees should show knowledge for all the tasks and actions required of an Operator, show evidence of an ability to put subjects and

patients at ease during imaging, and show thorough knowledge of the safety procedures. Before certification, trainees must show thorough knowledge of the subject safety screening questionnaire protocol. Full-time FERN Operators must also take a CPR course as part of their training. Training can be arranged through the local Red Cross.

11.14 Imaging Outside Standard Operating Hours

11.14.1 FERN is a shared facility; therefore, changes to the equipment made by one user affect many users. For this reason, and for reasons of safety, if a user is operating outside of standard operating hours (i.e., outside of the hours when an FERN Operator is available), and there is a problem with the MRI device or any other equipment, the Operator should NOT attempt to fix the problem. Instead, they should report the problem to the FERN staff, so that they may attend to it. If the problem has the potential to damage the equipment, then they should contact the FERN staff immediately. Contact information is posted on the FERN bulletin board and can also be found in the SOPs. If a problem occurs with the MRI device or the equipment that does not prevent the user from completing their imaging session, the problem should still be reported to the FERN staff. This will allow the staff to effectively track problems with the equipment and keep them working better for everyone.

Appendix A.1

Documentation of Safety Training for Level 1 MR Personnel/Researcher

Facility for Education & Research in Neuroscience (FERN)
Emory University, Atlanta, Georgia

Name: _____

Department: _____ E-mail Address: _____

Phone Number: _____ Office Address: _____

FERN Position (circle): Faculty Post Doc Grad Student Staff Other:_____

Non-FERN Position (please describe): _____

Name of FERN Principal Investigator with whom your MRI research is associated:
_____

Name of Safety Trainer: _____

Read Version ____ (insert version #) of the FERN Standard Operating Procedures (SOPs)

Viewed MR Safety Video ____

Attended FERN MR safety training lecture and tour ____

I agree to comply with the FERN SOPs during the course of my work at the Facility for Education & Research in Neuroscience (FERN)

Signature: _____ Date: _____

I hereby confirm that this individual has completed the requirements to work as a Level 1 MR Personnel/Researcher at the Facility for Education & Research in Neuroscience (FERN). I will provide adequate supervision and any additional training necessary to ensure that all safety procedures are observed during the course of his/her work.

FERN Director Signature: _____ Date: _____

Appendix A-2

Documentation of Operator Training for the Siemens Trio

Facility for Education & Research in Neuroscience (FERN)
Emory University, Atlanta, Georgia

Name: _____

Office Address: _____

Phone Number: _____

Trainer's Signature: _____ Date: _____

PI's Signature: _____ Date: _____

I agree to comply with the FERN SOPs during the course of my work at the Facility for Education & Research in Neuroscience.

Trainee's Signature: _____ Date: _____

I hereby confirm that this individual has completed the requirements to operate the Siemens Trio at the Facility for Education & Research in Neuroscience. I will provide adequate supervision and any additional training necessary to ensure that this individual's operator skills are up to date with any changes in hardware or software in the imaging system.

FERN Director Signature: _____ Date: _____

Maintain this form on file at the Facility for Education & Research in Neuroscience.