A. **Lucas Center Magnet Suite & Magnet Room Access**

B. **Lucas Center MR Scanner Contacts**

C. **Scanning at the Lucas MRI Scanners**
   i. Investigational Review Board (IRB) Approval
   ii. Scan Subject/Patient Issues
   iii. Directions/Maps & Parking
   iv. Security Issues
   v. Entering the Magnet Suites
   vi. Scanning Subjects & Patients
   vii. MR Scanner Operation
   viii. MR Image & Data Review
   ix. Possible Abnormalities (Incidental Findings)
   x. Scanning at the Lucas MR Scanners
   xi. Adhere to Scheduled Scan Time
   xii. Exit Forms
   xiii. End of MR Examination
   xiv. MR Scanner Issues
   xv. Lucas Center Computers

D. **MR Safety & Screening**
   i. MR Safety Rules
   ii. MR Safety Risks
   iii. MR Safety Precautions for Researchers
   iv. Projectiles (Missiles)
   v. Testing New Accessories and Equipment
   vi. Use of Handheld Magnets for Testing
   vii. New Accessories & Equipment
   viii. Items in Patient Prep Room Not Allowed in Magnet Room
   ix. Use of Rubbermaid Carts
   x. Retrieving Ferrous Projectiles or Missiles
   xi. Maintain Restricted Access to MR Scanner Rooms
   xii. MR Pre-Procedure Screening
   xiii. Approval for MR Safety & Screening Questions
  xiv. Previous Surgeries
   xv. Scan Subject Preparation for MR Examination
   xvi. Maintain a Closed MR Scanner Room Door
   xvii. Monitor Individuals in the MR Suite
E. RF Electromagnetic Fields (B₁)
   i. Risks of B₁
   ii. First Time Use of RF Coils
   iii. Communication with Scan Subject / Patient
   iv. Operation of RF Coils
   v. Presence & Positioning of Cables within Magnet Bore
   vi. Use of Sponge Pads to Separate & Insulate
   vii. Potential for Induced Electrical Currents in Cables
   viii. Potential for Induced Electrical Currents in Human Scan Subject/Patient Loops
   ix. Inappropriate & Unsafe Use of RF Coils
   x. Tattoos

F. Gradient Magnetic Fields (Gxyz)
   i. Risks of Varying Gradient Magnetic Fields
   ii. Acoustic Noise
   iii. Peripheral Nerve Stimulation

G. Presence of Biomedical Implants & Devices
   i. Screening of Biomedical Implants & Devices
   ii. Necessary Information for Decisions Concerning Biomedical Implants & Devices
   iii. Body Piercing & Decorative Implants

H. Emergency Procedures
   i. Minimum Number of Researchers Scanning Evenings & Weekends
   ii. Emergency Response Procedures
   iii. Emergency Evacuation of Scan Subject/Patient from the MR Scanner
   iv. Magnet Quench Procedures
   v. Emergency Assembly Point (EAP)
   vi. Earthquake
   vii. Fire Alarm is Heard
   viii. Fire (observed in the MR scanner suite or near vicinity)

I. Completion of research MR studies at Lucas or departure from Stanford University

Attachments

Lucas Center Potential Abnormality/Incidental Finding SOP

Lucas Center Potential Abnormality/Incidental Finding Form

Lucas Center Implant Report Form
A. **Lucas Center Magnet Suite & Magnet Room Access**
   **Requirements to gain & maintain access to Lucas MRI scanners**
   - Commitment of a minimum of 6 months using or assisting at the MRI scanners.
   - Complete attendance at the Lucas Safety & Policy Review

   Absence of 3 months or more from scanning or assisting with scans at Lucas Center:
   - Required to complete online Lucas Safety & Policy Review

   One year after completing Lucas MR Safety & Policy Review, researchers are notified via email to take the annually required online training.
   - The online training is accessed under Quick Links at [http://med.stanford.edu/lucasmri.html](http://med.stanford.edu/lucasmri.html)

B. **Lucas Center MR Scanner Contacts**
   - Karla Epperson, RT(ARMRIT), Cell 650.521.7836
   - Kevin Epperson, RT(R)(MR), Cell 650.387.0194; Desk 650.724.9887
   - M. Mehdi Khalighi, PhD, Desk 650.721.1701; Cell 408.828.1041
   - Gary Glover, PhD, Desk 650.723.7577; Cell 650.302.6902
   - Bob Herfkens, MD, Pager 13662; Cell 650.868.8479; Desk 650.723.4733

C. **Scanning at the Lucas MR Scanners**
   **Investigational Review Board (IRB) Approval**
   Scanning Human Subjects at Lucas Center
   - All scan subjects, volunteers & patients required to undergo ‘Informed Consent’ before scanning.
   - No human being is to be scanned without first being enrolled in a research study by undergoing the Informed Consent process.
   - This is required by **Federal law**; Stanford University acts as an accredited agent for the FDA
   Consent form + HIPAA form
   - In a language the human subject can read
   - Scan subject/patient to read & sign (2 places)
   - Researcher conducting informed consent to sign (1 place)
   - Give copy to scan subject (Stanford University requirement)
   - Scan subjects should keep with medical records for future reference
   - Principal investigator keeps signed consent form in locked file with completed screening form

   **Scan Subject/Patient Issues**
   - Researchers must discontinue scanning at the subject's request (per informed consent)
   - Please report any unusual or distressful events to Lucas contact(s)
     - Includes seizures and/or loss of consciousness
   - Please report all complaints to Karla Epperson

   **Directions/Maps & Parking**
   - Please provide contact names, phone numbers & maps to your scan subjects
   - Please provide more than one name & phone number

   Parking slips are located in magnet suites
   - Scan subject use only (not for researchers)
   - Use at 3 marked parking spaces on Welch Road Monday-Friday, 8am-5pm
Security Issues
Please follow Lucas policies regarding security issues
 Valid Lucas card access required to enter Lucas building & magnet suites
 Do not allow anyone to enter through locked doors without a valid Lucas access card
 Please report any suspicious behavior immediately to:
  Stanford Security (650.723.7222)
  Stanford University Deputy (650.329.2413)
 Lucas Center contacts

Entering the Magnet Suites
Courteous behavior is required at all times
Obtain permission to enter all magnet suites
Call from Lucas lobby to obtain approval to enter magnet suites before your scheduled scan time
Magnet suite phone numbers
  3T1: 498-5159, 723-2828
  3T2: 721-2270, 721-2284
  3T3: 723-8693, 723-8692, 498-4651
  7T: 724-7515
Obey signs posted for confidential or animal model studies being conducted.

Scanning Subjects & Patients
Human scan subjects must be ambulatory (ie. able to walk unassisted)
No lifting of scan subjects
If scan subject population cannot walk into magnet room & climb up onto table, please contact Karla for procedures to ensure safety for researchers and subjects/patients

Only outpatients are scanned at Lucas Center
Lucas is not licensed by state to scan in-patients from any facility including Stanford Hospital

REQUIRES SPECIAL APPROVAL
Injection or administration of any drug NOT allowed by anyone at any time including PIs and/or MDs unless pre-approved by Stanford IRB and Lucas Safety Committee (Karla, Gary, Bob)
No sedatives, sedation or conscious sedation given or taken by scan subjects at Lucas Center unless:
  (1) approved by Stanford IRB and Lucas Safety Committee;
  (2) Anesthesiologist/MD and MR Technologist are present for the entire examination; and
  (3) physiologic monitoring is used (Heart rate, SpO2, and blood pressure).

Use of MR contrast media (IV & oral)
Please see Karla for policies & procedures including MD and MR Technologist present

Scans of human subjects are NEVER to be conducted for health issues not part of IRB-approved research studies.
Strictly prohibited:
  Scanning friends and/or family requesting MR examinations
  Scanning to investigate injuries or pain

Scans conducted at Lucas Center do not include image interpretation by radiologist or physician (unless study conducted by Radiology or for incidental findings).
MR images on a CD or DVD are **NEVER** to be given to scan subjects or volunteers for their physician or surgeon, or for personal use.
One or two images printed from scanner may be given to the scan subject as a souvenir.

To prevent the spread of disease:
- Wash hands or use anti-bacterial sprayers, before positioning subject and immediately after positioning subject.
- Use gloves with bite-bars
- Use sanitary covers for auditory ear phones & ear muffs
- Wipe all positioning pads & sponges used with scan subject using antibacterial Sani-Cloths

Scan subject preparation
- Change out of street clothes into Lucas scrubs
- Remove all bras including sports bras
- Remove underwear that is not 100% cotton material
- Please use foot covers over socks & bare feet
- Please use denture cups for any removable dentures or dental implants

Use underpads (Underpads/chux = absorbent tissue on one side & plastic on the other):
- To prevent the spread of disease
- To prevent damage to equipment & sponge pads
- Use with these subjects and scans:
  - Children, Elderly, Confused
  - Animal models
  - Cadavers & tissues
  - Phantoms (fluid-filled bottles)
  - Meat, fruit, vegetables
- Table set up for children, elderly & compromised subjects includes overlapping underpads (chux) on table pad first then place sheet over.

Prior to scanning, check all equipment & accessories (you will be using) for damage including:
(if damaged do NOT use – contact Karla immediately)
- RF coils
- Cables
- Mirrors & projection screens
- Physiologic monitoring
- Eye tracker, EEG
- Response boxes
- Thermode
- Etc.

First time use of equipment at the Lucas Center magnets requires training by the MR Technologists including:
- GE Equipment
  - ECG cable
  - Plethysmograph
  - Respiratory bellows
- Lucas ancillary equipment
  - EEG
  - GSR/EDA
  - Optoacoustics earphones
At end of exam, coil all cables neatly & hang on shroud (magnet covering) on hooks present
(Cables are very expensive and very fragile so please use gently)
Plethysmograph
Respiratory bellows
ECG cable
Squeeze ball
Response boxes

To prevent injuries as the scan subject moves in and out of the bore of the magnet, please
instruct ALL scan subjects they are not to touch or rearrange any equipment at any time
including:
Mirror
Projection screen
RF coil
Cables
Respiratory bellows
Monitoring devices

Mirrors & Projection Screens on RF coils
1 - Closely watch mirrors & screens as scan subject is ADVANCED INTO magnet bore
Keep a finger on 'Stop Table' button located on control panel on front of magnet
Press 'Stop Table' button to prevent injury or damage
2 - Closely watch mirrors & screens as scan subject is MOVED OUT OF magnet bore
Keep a finger on 'Stop Table' button located on control panel on front of magnet
Press 'Stop Table' button to prevent injury or damage

MR Scanner Operation
Make prints of scan screens at MR scanner of your scan protocols including all scan parameters
Bring prints of your scan parameters with you every time you scan
(will be needed in the event of a software issue)

MR Image & Data Review
Please check reconstructed images at MR scanner for:
Subject motion
Artifacts (if metal artifacts present in images, STOP scanning immediately)
Potential abnormalities/Incidental Findings

Check all other data as soon as possible to identify:
MR system problems
Scan parameter problems
Scan subject motion

Possible Abnormalities (Incidental Findings)
Please review all images reconstructed at scanner & during your post-processing
Please keep confidential from scan subject & family members
Please contact Karla or Kevin -or- send email to Kevin with cc to Karla
Please review Lucas abnormality (Incidental Findings) policy (attachment)
Scanning at the Lucas MRI scanners

At the completion of your scanning session, please clean up:

- Magnet room
- Control room
- All areas of the magnet suite used by you & your scan subjects
- Wipe all sponges and equipment used with Sani-Cloths

Adhere to Scheduled Scan Time

Please do NOT request additional time from researchers following you as it affects the magnet schedule and compromises studies being conducted by other labs.

Scanning MUST END with enough time to clean up the magnet room appropriately without affecting the lab whose researchers follow you on the schedule.

**A minimum of 10 minutes** must be included at the end of the scheduled scan time to allow for proper magnet room cleaning and organization.

Please use cell phone for time reference (do NOT use wall clocks or scanner clock)

Exit Forms

All human scan subjects complete Lucas ‘Exit Form’ at completion of MR scan

Please leave completed Exit form in wall file in the control room of magnet suite

End of MR Examination

Please escort ALL scan subjects to the lobby of the Lucas Center

MR Scanner Issues

- Call Lucas contact(s) for support
- Make entry at Scanner Reports website
  - Find under Quick Links at [http://med.stanford.edu/lucasmri.html](http://med.stanford.edu/lucasmri.html)
  - Please include as much detail as possible

Lucas Center Computers

- Return to default orientation
- Do not load software (contact Karla first)
- Please do not use for email or checking random websites
- Dell PCs in magnet suites are used for temporary storage (maximum 2 weeks)
- iMacs in magnet suites are used for temporary storage (maximum 1 week)
- Ensure images & raw files (P files) saved before leaving the magnet suit
  - **P files are deleted automatically when 12 hours old**

D. MR Safety & Screening

**MR Safety Rules**

- Use every time you are in the MR environment
  1. Make no assumptions
  2. Trust no one
  3. Ask questions
  4. Screen 4 times
  5. Know your RF coils
  6. No loops (in cables or humans)
  7. Keep the magnet room door closed
  8. Remain vigilant; watchful & alert, especially to danger or something that is wrong
MR Safety Risks

Main MR risks are due to:
- Static main magnetic field ($B_0$)
- RF electromagnetic fields ($B_1$)
- Varying gradient magnetic fields ($G_{xyz}$)

Metal in a magnetic field can do one or more of the following:
1. Move (Translational attraction)
2. Turn (Torque)
3. Heat
4. Cause artifacts in images & data

MR Safety Precautions for Researchers

Dress code for RESEARCHERS working around magnets (includes faculty, researchers, students, post-docs, research associates, etc.)
- Remove all hairpins, barrettes, loose earrings, body piercing(s)
- Remove all analog watches, hearing aids, credit cards
- Remove all jackets with metal buttons
- Check all metal closures & buttons on clothing to ensure they are securely fixed
- Check hair extensions for metal attachments
- Empty ALL pockets on shirts & pants of ALL items; stick hands inside of pockets to check
OK: eyeglasses, digital watches, belts, secured earrings & necklaces

Projectiles (Missiles)

Common projectiles ($B_0$) not to be taken into the magnet room at any time
- Paper clips & staples
- Hairpins
- Barrettes & hair accessories
- Jewelry (earrings)
- Coins (non-USA) Ferrous coins include Canadian, Euro, Chinese, etc.
- Keys
- Metal buttons & hook/eye
- Batteries
- Hearing aids
- Scissors
- Pocket knives
- Flashlight
- Cell phones
- Tools
- Notebooks
- Pens & pencils (Retractable pens and pencils have tiny springs which are very ferrous)
- Safety pins
- Stapled papers/magazines

Additional items cannot be taken into the magnet room
- No stuffed toys from home
- No pillows from home

Testing New Accessories and Equipment

Please do NOT test any new accessories or equipment for magnet safety
Please contact Karla for testing
Use of Handheld Magnets for Testing
Contact Karla for use and testing
Neodymium magnet, 1200 Gauss (0.12T), www.mrimagnet.com
Magmedix magnet, 22 lb., 1000 Gauss (0.10T)
For equipment testing only
Remember: these handheld magnets are not as strong as the Lucas magnets

New Accessories & Equipment
All new accessories, equipment & RF coils must be approved by Karla before taken into the magnet room.
All items will be safety tested for ferrous metal parts & the presence of electronic noise that would affect image data.

Items in Patient Prep Room Not Allowed in Magnet Room
Anything with this sticker on it: ‘Not MR Safe’ is not to be taken into magnet room(s) at any time for any reason

Use of Rubbermaid Carts
Rubbermaid carts may be taken into magnet room (casters are ferrous)
  AFTER all shelves checked for metal items
  AFTER all metal items removed from cart & shelves
Cart is kept a safe distance away from magnet (eg. length of patient table)

Retrieving Ferrous Projectiles or Missiles
If a ferrous metal item is pulled into bore of magnet:
  Do NOT ATTEMPT TO REMOVE IT no matter how small the item or object may be
  GE service is required to remove item from magnet
  Please contact Karla, Kevin, Mehdi or Gary immediately
Ferrous items are to be removed by GE service ONLY in order:
  To ensure minimal damage to the magnet, RF coil & enclosure (shroud)
  To ensure injuries do not occur to you, other researchers or scan subject.

Maintain Restricted Access to MR Scanner Rooms
No visitors or tours in magnet rooms at any time for any reason
All others require approval from Karla AND completion of Visitor Screening forms
Contact Karla for ALL tours, classes, videos or pictures for TV, web casts, presentations, papers, journals, magazines, etc.
Maintenance personnel are screened by Karla, Kevin, Mehdi, Gary or John Mendoza (Lucas Building Manager)

MR Pre-Procedural Screening
Lucas Center scans NOT clinically-ordered MR exams
Human subjects are “volunteers” enrolled in research studies
No formal image interpretation conducted by a board-certified radiologist
Lucas screening procedures do NOT include ‘Benefits vs. Risks’ assessment as do clinical counterparts such as hospitals & clinics
Previous MR scan does not mean the scan subject will be allowed to be scanned at the Lucas Center
Please screen 4 times for each scan subject
1. Telephone or email screening
2. Scan subject completes printed screening form on day the of the scan and researcher reviews completed form with the scan subject/patient.
   **Must use forms provided by Lucas at the Lucas Center – do not copy forms at any time**
3. Visual & verbal screening at the dressing room
4. Visual & verbal screening at magnet room door BEFORE entering magnet room

Telephone pre-screening includes the following instructions to ALL scan subjects:
- No makeup, no lipstick, no eye shadow, etc.
- No wet hair; no hair products or treatments, hairspray, etc.
- No hair extensions, wigs, toupees, etc.
- No hair pins or barrettes (all subjects must run fingers through hair)
- Please leave all hair accessories, jewelry and body piercing at home

**MR Screening Form**
Use current Lucas Center screening forms (Revision “18_0816”)
Completed ON-SITE at Lucas Center on the day of the subject's scan
Scan subjects & volunteers complete a screening form each & every time they are scanned at Lucas Center

**Must use forms provided by Lucas at the Lucas Center – do not copy forms at any time**
Screening form is completed in its entirety including ‘patient identifiers’ such as Name, Birthdate, Gender, Height, Weight, Address, primary care physician, and medical history to ensure accuracy, patient safety and in the event of a loss of consciousness and other event requiring 9-911 to be called

After scan subject/patient completes screening form, individual who is to take the scan subject/patient in the magnet room, is to verbally review the completed form with the scan subject/patient to ensure accuracy in reporting current physical conditions; that person then PRINTS their name at bottom of screening form in field provided **before** the scan subject/patient is taken into the magnet room.
Completed & signed screening form is attached to signed Consent form
All signed forms kept in a locked file with Principal Investigator
Please stress importance of MR screening form to scan subjects.
Please remind scan subjects that accuracy in completion of screening form is crucial to their safety

**Approval for MR Safety & Screening Questions**
For all MR safety & screening questions concerning any implant, device or condition:
Contact **ONLY** Karla or Bob.

**ONLY** Karla or Bob can approve human subjects to undergo MR scans at Lucas Center
- or - for a researcher, patient spouse or parent, to enter magnet room
Cannot reach either Karla or Bob?
Do **NOT** take the scan subject into magnet room
Do **NOT** put scan subject/patient in MR scanner nor scan him/her

For all implants & devices that potential scan subjects or patients report prior to the MRI scan being conducted, please complete Lucas Implant Report form found at Lucas website http://med.stanford.edu/lucasmri/current-users.html
(see page 21 of this document)
**Previous Surgeries**
If a scan subject has had previous surgery on any part of their body or brain, please contact Karla or Bob before taking the scan subject into the magnet room.
If a scan subject tells you the device that was implanted during their surgery is made from plastic, you are required to contact Karla or Bob before taking the scan subject into the magnet room.
There are no exceptions to this policy.

**Scan Subject Preparation for MR Examination**
3T1, 3T2, 3T3 & 7T:
- Required for ALL BRAIN and BODY scans including extremities (arms & legs)
- Change out of street clothing into Lucas scrubs
  - Includes all scans of anatomy below brain Including neck, shoulder & chest

**Street Clothing Dangers**
Beware of hidden dangers in street clothes (will result in patient burns)
- Metal buttons
- Metal hooks and eyes
- Metal threads
- Metal in underwear
- Antimicrobial solutions (will result in fiber burns)

Before scanning the scan subject or volunteer is to remove:
- all jewelry & hair accessories
- eyeglasses
- contact lenses (if concerned about artifacts & eye motion)
- all clothing with metal buttons or fibers, or special material treatment (eg. antimicrobial)
- all items from all pockets
- all bras (brassieres) including exercise
- their shoes (use foot covers)

Scan subjects (male & female) must run fingers through hair before entering magnet room

All personal items belonging to ALL scan subjects to be secured in patient locker

Before you (the researcher) enter the magnet room:
- Visually & physically screen YOURSELF & hands are placed INSIDE of all pockets
- Visually screen your CO-WORKERS
- Visually & verbally screen your SCAN SUBJECT

** Maintain a Closed MR Scanner Room Door**
Keep magnet room door closed at all times.
Unless it is being ‘closely’ monitored by someone standing in it to prevent access by inappropriate individuals.

**Monitor Individuals in the MR Suite**
Please monitor all individuals present in MR suite including:

- Spouse of patient
- Parents of patient
- Family members of patient

Only individuals allowed to enter the MR Scanner room include:

- Researchers completed Lucas MR safety & policy course
- Scan subject (after completion & review of Lucas screening form)
- One spouse/parent to accompany scan subject (after completion & review of screening form)

E. RF Electromagnetic Fields ($B_1$)

Risks of $B_1$

- Heating of metal or device, associated components, and/or surrounding tissues
- Heating occurs due to:
  1. Exposure (close proximity) to transmit RF coil or focus in area (antenna effect)
  2. Currents induced in conductive devices
     - Cable forms loop with itself
     - Cable forms loop with other cable
     - Cable forms loop with human body
     - Human body forms a loop with itself
  3. Cable or human touches magnet bore wall
  4. Inappropriate use of a RF coil
  5. Use of equipment not ‘MR safe’

To prevent injuries (burns) to scan subjects & damage to equipment, researchers must know:

- Operation of the RF coil(s)
- Safe utilization of RF coil(s)
- Correct coil selection in MR scanner software
- Thorough pre-procedure screening & change out of street clothes

First Time Use of RF Coils & all other equipment (ECG, Plethysmograph, EEG, eye trackers, etc.)

All first-time use of any RF coil & equipment at all Lucas Center magnets requires the training & approval from either Karla, Kevin or Gary Glover.

There are no exceptions to this policy.

Communication with the Scan Subject / Patient

- Provide instruction before the exam
- Explain use of the squeeze ball
- Researcher verbally checks in with subject at end of each scan AND immediately before each scan
- Researcher maintains CONSTANT visual contact with scan subject

Operation of RF Coils

- Receive-only RF coils utilize Body Coil to transmit RF (located within shroud covering of magnet)
- Using the RF Body Coil as transmit RF coil, transmission of RF occurs along the entire length of Body Coil, not only in the area of the receiving RF coil.
- Any cables or human body located within area of transmitting RF coil are at risk for burns if a loop is present (due to induced currents) or if arms or cables are touching magnet bore wall.
Presence & Positioning of Cables with Magnet Bore
Loops of cables cannot be present inside the bore of the MR scanner
   This includes U-shaped loops, S-shaped loops and crossing of cables
   Cables must be routed out of the magnet bore directly out from the patient without loops &
   without touching patient or magnet bore wall

Use of Sponge Pads to Separate & Insulate
Sponge pads are required to separate & insulate with ¼ inch (0.635 cm) of air GUARANTEED
   Absolute requirement to scan human subjects
Sponge pads are REQUIRED between arms & magnet bore walls, and to provide insulation
   and separation for:
      Physiologic Monitoring
      Response Boxes
      EEG (electroencephalography)
      Eye Trackers
If you cannot guarantee insulation of ¼ inch of air between body and body wall, **DO NOT SCAN.**

Potential for Induced Electrical Currents in Cables
Presence of metal, conductors, loops of cable, and the human body increase the risk for induced
electrical currents.
Induced electrical currents result in excessive heating which causes patient burns & equipment
damage
This includes product ECG cables and RF coil cables
To prevent, pad the arms & any other anatomy that touches the bore walls & ceiling of the
magnet.

Potential for Induced Electrical Currents in Human Scan Subject/Patient Loops
The potential exists for a scan subject to form a loop by touching another part of his/her body.
Instruct scan subjects not to clasp hands, cross ankles, place a hand against their forehead, etc.
during the scan.

Inappropriate & Unsafe Use of RF Coils
Please do **NOT** use cardiac array coil or abdominal array coil to wrap around a joint
Do **NOT** overlap cardiac array coil or abdominal array coils
Do **NOT** position one RF coil inside another
Do **NOT** leave unplugged RF coil on magnet table or in magnet bore during scanning
Please contact Kevin, Karla or Gary Glover for assistance

Tattoos
Please warn scan subjects/patients with tattoos that the pigment in their tattoos may be
ferromagnetic which if in the area of the transmitting RF coil could result in a localized, short
term cutaneous reaction including skin reddening, irritation, pain and swelling which could
last one to three days.
Please contact Karla for any scan subjects with tattooed eyeliner planning to undergo an MR scan
of the brain at the Lucas Center.
F. Gradient Magnetic Fields (Gxyz)

Risks of Varying Gradient Magnetic Fields
Risks due to rapid switching of varying gradient magnetic fields determined by:
1. Size (maximum amplitude)
2. Speed (slew rate)

High speed systems
120-200 mT/m/msec (slew rate)
20-50 mT/m or 2-5 gauss/cm (amplitude)

Gradient magnetic fields larger at ends of magnet
Concerns:
Induce currents in conductive material or body (although power significantly less than RF)
Auditory effects (≥ 0.3 Tesla)
Peripheral nerve stimulation (ΔB/Δt)

Acoustic Noise
Hearing protection (earplugs or headphones) is required for everyone being scanned or present in MR scanner room during MR scan
No exceptions to this policy.
Earplugs must be 'NRR' rated.
If earplugs cannot be positioned correctly and other hearing protection cannot be employed, do NOT scan the subject
Please instruct your scan subject to notify you immediately during scanning:
If earplugs become loose or fall out
If noise of scanner becomes bothersome or irritating
Please refer to instructions posted in the magnet suites to assist in the proper placement of earplugs.
Audio delivery headphones do not require additional hearing protection (e.g. earplugs) with the exception of the ‘flat’ Optoacoustics earphones which do require earplugs
Earmuffs used on scan subjects in the bore of the magnet MUST be used with earplugs.

Peripheral Nerve Stimulation
Peripheral Nerve Stimulation is not life-threatening but can be uncomfortable or painful
To avoid Peripheral Nerve Stimulation in your scan subjects, select “Normal” under dB/dt
Please contact Kevin, Karla, Mehdi or Gary for assistance

G. Presence of Biomedical Implants & Devices

Screening of Biomedical Implants & Devices
Presence of biomedical device or implant, submit information to Karla or Bob
The presence of implants or devices is not dependent upon the age, apparent condition or health of the scan subject/patient
Implants can be located on the inside or on outside of the body
ALL scan subjects with implants and/or require approval from Karla or Bob BEFORE scan subject may be taken into magnet room and/or scanned.
This includes ALL DEVICES & IMPLANTS despite what the scan subject or their physician or surgeon tells him/her or you.
Contraindicated implants & devices for Lucas MR scans (examples, not an all-inclusive list)
- Pacemakers & implanted defibrillators
- Aneurysm clips
- Neurostimulator or Deep Brain Stimulator
- Insulin pump
- Acupuncture beads or needles
- Envoy Medical ‘Esteem’ Hearing Implant
- Vagal Nerve Stimulator (VNS)
- Internal cardiac pacing wires
- Carotid artery vascular clamp
- Spinal or bone fusion stimulator
- Tissue expander
- Shanghai Ring IUDs
- Shrapnel, buckshot, bullets
- Electrodes on the brain

Necessary Information for Decisions Concerning Biomedical Implants & Devices
Specific information must be supplied to Karla or Bob regarding device or implant:
- Name of manufacturer of device or implant
- Type, model #, serial #
- Material composition
- Date surgically placed
- Name of surgeon & hospital
- ‘Conditions’ set down by device manufacturer
  (Devices not FDA-approved with ‘Conditions’ will not be considered for scans at Lucas)

Accurate documentation is required
- Patient cards provided to patient by manufacturer for implant or device
- Original package information from surgeon
- Contact manufacturer directly or visit their website
- Do NOT accept verbal reply

Body piercing & decorative implants are included in this category.

H. Emergency Procedures

Minimum Number of Researchers Scanning Evenings & Weekends
Scanning evenings, nights & weekends, it is recommended a minimum 2 researchers are present to ensure safety in the event the scan subject experiences difficulties

Emergency Response Procedures
Scan subject loses consciousness or other (e.g., heart attack, stroke, shortness of breath, syncope)
REQUIRES 2 PEOPLE TO COMPLETE THIS PROCEDURE
Call 9-911 (response time = 3 minutes)
One person goes to lobby to receive paramedics at Lucas lobby & lead to magnet suite
A second person quickly moves scan subject/patient out of magnet room on magnet table
No emergent care performed in magnet room
Close & monitor the magnet room door to prevent entry by paramedics
Call contact(s) for assistance (Karla, Kevin, Mehdi, Gary Glover)

Emergency Evacuation of Scan Subject/Patient from the MR Scanner
Using the cradle release and undocking of the MR scanner table
Rotate handle backwards to release the cradle (top of the MR scanner table)
Rotate handle backwards & pull 'cradle' (top of the table) out of magnet bore
Step on Undock Pedal to release table from dock at MR Scanner
If Undock Pedal fails to release table from magnet, pull RED HANDLE located on lower right side of the MR scanner.
**Magnet Quench Procedures**

Cryogens (liquid helium)
- Used in superconductive magnets
- Helium maintains temperature of -270°Celsius (4°Kelvin)
- Maintains electrical current due to zero resistance
- At room temperature, helium becomes a gas (1:700)

During a quench, the magnet expels cryogens (liquid helium) in form of gas
- Normally, cryogens exit building through exhaust pipe

3 situations in which a quench occurs:
1. Controlled (by service engineers)
2. Deliberate (in a life-or-death situation)
3. Spontaneous (earthquake)

Researchers may be responsible to deliberately activate a quench in a ‘life-or-death’ situation eg. individual pinned to magnet by large metal object and has life-threatening injuries
Deliberate quench conducted **ONLY** in life threatening situation

Quench results in:
- Magnet downtime
- Financial loss
- Potential equipment damage
- Possible personal injury

**Magnet Quench Devices Location & Operation**
- 3T1, 3T2, 3T3 located just inside of the MR scanner room door on the wall
- 7T quench box located in the control room

Magnet may quench during an earthquake
- Listen >> loud noise (helium being expelled)
- Look >> damage to helium exhaust pipe
- Look >> gaseous helium forming cloud

If a helium cloud forms in MR scanner room during a quench:
- Turn on exhaust fans
- Quickly move scan subject out of magnet room
- If necessary, open doors to vent cloud outside
- See floor plans & pictures
- Closely monitor area in which helium cloud is located to prevent people from entering it.
- Call Lucas contact(s) (Karla, Kevin, Mehdi, Gary Glover)

Switches for exhaust fans at 3T1, 3T2 & 3T3
- Two locations, in magnet room & outside
Switches for exhaust fans at 7T
- One location, in control room next to magnet room door
**Emergency Assembly Point (EAP)**

Located in grassy area south of the Lucas Center between the MSLS and Redwood buildings.

**Earthquake**

Procedures depend upon severity of quake
- Monitor magnet for quench & helium exhaust pipe for damage
- **During the earthquake**
  - Scan subject should remain in magnet
  - Researchers should stand in door way away from windows or under desk
- **After the earthquake**
  - Check MR scanner exhaust pipe for escape of helium gas (in the event of quench)
  - Remove scan subject from magnet room
  - CLOSE magnet room door
  - Proceed to Emergency Assembly Point

**Fire Alarm is Heard**

- Remove scan subject from magnet room
- CLOSE magnet room door
- Evacuate MR scanner suite
- Exit Lucas Center through closest door
- Go to Emergency Assembly Point
- Remain there until approval is given that it is safe to enter building

**Fire (observed in the MR scanner suite or near vicinity)**

- Remove scan subject from magnet room
- CLOSE magnet room door
- Activate the closest fire alarm
- Evacuate magnet suite
- Exit Lucas Center through closest door
- Go to Emergency Assembly Point
- Remain there until approval is given that it is safe to enter building

**I. Completion of research MR studies at Lucas or departure from Stanford University**

Notify Karla to be removed from distribution lists
Return your Lucas access card to Karla
Lucas Policy for Incidental Findings Seen on MR images during Research Studies

1 - Initiate Lucas contact:
   a) Send an email to kevine3@stanford.edu (Kevin Epperson) with cc to Karla Epperson or
   b) Call Karla Epperson, Lucas Magnet Manager (Cell 650.521.7836)
   c) Call Kevin Epperson, Lucas MR Research Technologist (Cell 650.387.0194)
   d) Call Gary Glover, PhD (Desk 650.723.7577, Cell 650.302.6902)
   e) If no Lucas contacts are available, call the Stanford paging operator (650.723.6661):
      To contact the Neuroradiologist MD on call for brain & spine MR scans
      To contact the Body Radiologist MD on call for all other scans
      (Images are networked to hospital or clinical scanner for viewing by Radiologist on call)

2 - Please do not speak to scan subject about possible abnormality or show images with abnormality to scan subject or scan subject’s family members

3 - Ensure that scan subject includes primary care physician’s name & phone number on completed MR Pre-procedure Screening Form

4 - If Lucas contacts are not available, researcher conducting the scan completes Lucas Form for Possible Abnormality (leave in hot file on wall in suite with Exit Form)

5 - If the subject must leave before contact is made with Karla, Kevin or Gary:
   a) Do not alarm the scan subject or scan subject’s family
   b) Ensure that you have the scan subject’s current phone numbers
   c) Contact your Principal Investigator or advisor with status of the situation

6 - If the subject must leave before contact is made with Karla, Kevin or Gary:
   a) Do not alarm the scan subject or scan subject’s family
   b) Ensure that you have the scan subject’s current phone numbers
   c) Contact your Principal Investigator or advisor with status of the situation

7 - Images on CD or DVD cannot be given to subject as scans conducted at Lucas are research studies (i.e., have not been clinically ordered nor prescribed by a radiologist); see Karla for details

8 - Radiologist who reviews images will contact Principal Investigator with interpretation of images; if necessary, Principal Investigator and/or Radiologist will contact scan subject to discuss suggested follow-up

9 - Follow-up MR scans are to be done only if the scan subject’s primary care physician formally orders MR scan at a hospital or clinical MR facility under the direction of an attending radiologist

10 - Principal Investigator is responsible for reporting the incident to the IRB.
<table>
<thead>
<tr>
<th>Lucas Policy</th>
<th>Possible Abnormalities Seen on MR Images during Research Studies</th>
<th>2018_1206</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Send email to Kevin Epperson @ <a href="mailto:kevine3@stanford.edu">kevine3@stanford.edu</a></td>
<td>• Please cc Karla Epperson @ <a href="mailto:karlae@stanford.edu">karlae@stanford.edu</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Email should include the following information:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ MR scanner (3T1, 3T2, 3T3 or 7T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Date &amp; time of scan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Scan subject’s initials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Group ID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Name of Principle Investigator + Email address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Name of Researcher scanning + Email address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Name of Scan subject’s primary care physician</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Exam, series &amp; image number(s) on which potential abnormality is seen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Brief description of the potential abnormality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• If reason for immediate concern:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Call Karla Epperson, Lucas Magnet Manager, Cell (650) 521-7836</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DO NOT PUSH images to PACS</td>
<td></td>
</tr>
<tr>
<td>2 - Please DO NOT communicate information concerning the potential abnormality nor show images with the potential abnormality to the scan subject or scan subject’s family members.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 - Ensure that scan subject’s screening form includes their contact information and their primary care physician's name &amp; phone number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - Please have the scan subject complete a Lucas Exit Form before leaving the magnet suite &amp; leave in wall or desk file.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - Do not give images on CD to the scan subject as scans conducted at Lucas are research studies &amp; against policy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(see Karla Epperson for details)</td>
<td></td>
</tr>
<tr>
<td>6 - Contact your Principal Investigator or faculty advisor with status of the situation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 - Follow-up MR scans ordered by the scan subject’s primary care physician are NOT to be conducted at the Lucas Center.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 - Kevin or Karla uses completed form or submitted information to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check for the presence of a Stanford medical record number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• If no Stanford medical record number present, then generates one</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Generates accession number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Generates documentation</td>
<td></td>
</tr>
<tr>
<td>9 - Final documentation is generated by Kevin or Karla</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - Image data is modified at scanner &amp; pushed to PACS by Kevin or Karla</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 - Kevin or Karla complete and verify in PACS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 - Kevin or Karla sends SECURE email to Radiologist identified on form &amp; cc to Principal Investigator &amp; researcher requesting image interpretation &amp; report on the research study.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Email includes information listed above in #1</td>
<td></td>
</tr>
</tbody>
</table>
Lucas Form for
Possible Abnormality or Incidental Findings seen on MR Images
during Research Studies

Submit to Lucas Contact person or call Karla at (650) 521-7836

Date:       Time:       Exam #:
Lucas MR System:   ☐3T1   ☐3T2   ☐3T3   ☐7.0T
Name of researcher conducting MR scans:
Title of research study being conducted:

Name of Principle Investigator: Dr.
Anatomy Scanned:
Name of scan subject:
Gender:
Date of Birth:
Subject age at Scan:
Subject's Physician:

Parent/spouse/other present for scan: ☐Yes ☐No
Name of parent/spouse/other present for scan:
Images to review:

<table>
<thead>
<tr>
<th>Exam #</th>
<th>Series #</th>
<th>Image(s) #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam #</td>
<td>Series #</td>
<td>Image(s) #</td>
</tr>
<tr>
<td>Exam #</td>
<td>Series #</td>
<td>Image(s) #</td>
</tr>
</tbody>
</table>

Description of possible abnormality seen:

Name of Lucas Contact: Karla Epperson
Title of Lucas Contact: Lucas Magnet Manager
Lucas Center Implant & Device Investigation Report Form
Lucas Contacts: Karla Epperson (karlae@stanford.edu)
Kevin Epperson (kevine3@stanford.edu)

Planned Date of Scan:____________________  Group ID:____________________

Anatomy to be Scanned:____________________  Age of patient:____________________

Lucas Magnet:  ___3T1 PET-MR  ___3T2  ___3T3  ____7.0T

Researchers Name:____________________________________________________________________

Patient implant & device cards are often provided to the patient by the manufacturer. Please make copies of both sides of this card to assist us in determining if the MR safety conditions will allow the patient to be scanned at the Lucas Center. Original package information from the surgeon is also sometimes provided. For additional information, contact the manufacturer directly or visit their website.

* Do Not Accept a Verbal Reply – You must get obtain details in print or writing.*

*The decision for the patient to undergo a scan at the Lucas Center made by Karla Epperson.*

1. Name of Implant / Device:___________________________________________________________

   Name of Manufacturer:________________________________________________________________

   Type, model, serial #:_______________________________________________________________

   Material Composition:________________________________________________________________

   Date Surgically placed:_______________________________________________________________

   Name of Surgeon:___________________________________________________________________

   Hospital:_________________________________________________________________________

2. Name of Implant / Device:___________________________________________________________

   Name of Manufacturer:________________________________________________________________

   Type, model, serial #:_______________________________________________________________

   Material Composition:________________________________________________________________

   Date Surgically placed:_______________________________________________________________

   Name of Surgeon:___________________________________________________________________

   Hospital:_________________________________________________________________________

2019_0108 KE