

## **Safety in the AMRIS Facility**

The Advanced Magnetic Resonance Imaging and Spectroscopy (AMRIS) Facility is located at the south end of the [McKnight Brain Institute](#) on the University of Florida campus. The Facility houses eight state-of-the-art magnetic resonance spectrometers and imagers. The main Facility houses five vertical bore instruments (one 11.7 Tesla/500 MHz, two 14.1 Tesla/600 MHz, one 17.6 Tesla/750 MHz, and one 18.8 Tesla/800MHz) and two horizontal bore imagers (one 4.7 Tesla/200 MHz, and one 11.1 Tesla/470 MHz). In addition, two 3 Tesla/128 MHz human scanners are housed in separate, restricted-access rooms inside adjacent space in the McKnight Brain Institute. One vertical bore 14.1 Tesla/600MHz spectrometer is also located in the Department of Chemistry (CLB-100).

Upon entering the AMRIS Facility, you and others around you are at risk of certain hazards. Safety is a serious issue and must be a prominent concern for everyone entering the Facility. Each individual must be diligent in learning about the hazards of working in the Facility and how to safeguard against them. Every Facility user must attend a safety training session run by an AMRIS Facility employee before working in the facility. Our safety procedures, when followed, will minimize risk to you and others. Questions about the Facility and any safety issue may be directed to any of the following staff members of the AMRIS Facility:

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## **IMPORTANT**

Certain medical devices implanted in the body will not work properly in a strong magnetic field. This can be a life-threatening situation and must be addressed before entering the AMRIS Facility. For example, the FDA contraindicates the use of pacemakers in magnetic environments above 5 Gauss. This level is exceeded in the hallways leading to many of the magnet rooms. Entering areas with large magnetic fields can also aggravate certain conditions. For instance, ferromagnetic aneurysm clips can be displaced by magnetically induced forces, gunshot victims can have bullet fragments dislodged, or more commonly, metal filings in the eye can cause damage by unpredictable rotation of the metal filings by the magnetic field.

People entering the AMRIS Facility must stop at the screening station just outside the entrance doors to the AMRIS Facility, where a bar magnet is located for testing materials. Everyone with known magnetic objects should consult a staff member before entering. Additionally, those entering the AMRIS Facility must be aware of magnetic objects they might be carrying or wearing, which might pose a significant hazard because these object may become flying projectiles (see Severe Hazards below). Before entering the facility, you **must** make sure that you or anyone with you is free of magnetic materials that they might be carrying on the outside or have inside their body.

Unauthorized visitors who are not part of a guided tour by an AMRIS Facility staff member are not allowed into the AMRIS Facility. Users are not permitted to give tours of the Facility nor are they allowed to bring guests into the Facility without first contacting an AMRIS Facility staff member. A "guest" is any person who is not an authorized AMRIS Facility user – even scientific collaborators or assistants.

**If you have any questions about whom or what is approved, ask AMRIS Facility staff!**

The following objects are not allowed in the Facility without prior approval: scissors, hair clippers, gas cylinders, common hand tools.

## **Mild Hazards**

Magnetic fields can have an adverse effect on devices with magnetic storage such as GatorOne cards, credit/ATM cards, and flash drives. A large magnetic field will reorient the media, erasing previously stored information. Also, the movement of analog watches and electric motors in pagers, cell phones, and digital cameras can be affected. The induction of magnetism will inhibit the motion of internal parts, even after leaving the AMRIS area. Most small electronic devices (cell phones, pagers, PDA's, digital multimeters, etc.) have not been manufactured with magnetic field compatibility in mind and may be adversely affected by the magnetic field. Batteries are also magnetic. Any of these objects may become a flying object (see below) due to a magnetic component on or in the device (i.e. a battery).

The best way to prevent these hazards is to avoid bringing these objects into the magnet rooms or the Facility. If you must bring these items, there are free lock boxes for use directly down the main corridor when you enter, which will safeguard them while you are in the AMRIS Facility. If taking a device with you near a magnet ruins the device, your only recourse would be to replace it.

## Severe Hazards

### Flying Objects

Common everyday objects like cell phones can become projectiles under the influence of magnetic fields. Any object that is attracted to a bar magnet will be attracted to an MR magnet. One thing to remember is that the magnetic field is always on, day or night, 24 hours a day. The possibility of an object becoming a projectile is proportional to the amount of magnetic material and the intensity of the magnetic field, which is determined by the magnet and how close you are to it. If an object is close enough to a magnet, it will move on its own toward the magnet and will continue to accelerate toward the magnet. At some point this object will be an unstoppable projectile.

To prevent this from happening, no magnetic material may be taken into the magnet rooms. Do not assume that an object is non-magnetic. Use the bar magnet that is located at the screening station at the Facility entrance doors to test objects before entering a magnet room. **ALL items must be checked.** This includes times such as carts, cages, and gas cylinders. There are no exceptions.

Once inside the room, spending less time near the magnet can further minimize the possibility of projectile accidents. Planning which procedures need to be performed close to the magnet and testing the equipment before entering the room is essential.

**If an incident occurs involving a projectile,  
you must contact AMRIS Facility staff immediately!**

### 11 Tesla Horizontal Bore Magnet Room

Because the magnetic field of this magnet reaches exceptionally far, extra precautions must be taken when working in the 11 T room. The hallway door should be closed at all times and the inner magnet room door should remain closed unless someone is inside. If someone is in the inner-shielded magnet area of the 11 T, it is **REQUIRED** that another person be present in the 11 T room. To protect the person working in the inner magnet room, the second person should be either in front of the magnet or in the outer room. An AMRIS Facility staff member must approve all procedures performed in the 11 T magnet room prior to execution.

### Cryogen Hazards

Cryogenics are extremely cold liquids used to maintain the magnets in a superconducting state. The liquid Helium and liquid Nitrogen inside the magnets must be replenished on a regular basis. Avoid direct contact with these liquids because they will burn on contact. If contact occurs, seek medical attention immediately and contact AMRIS Facility staff. If you believe there is a problem with a cryogen containing dewar, or any other safety concern, contact an AMRIS Facility staff member immediately.

If the current carrying coils in the magnet that create the static magnetic field exceed a critical temperature, the coil wire will not be superconducting. The heat produced by the electrical current in the coil windings when the wire is not superconducting will quickly turn the cryogenic liquid into gas. This is commonly called a quench of the magnet because the field goes to zero. This gas will fill the room and may displace the oxygen. If a quench occurs, quickly evacuate the area and warn others in the area of the hazard. Do not take time to remove animals or equipment. Contact AMRIS Facility staff as soon as possible.

## **Biological Effects**

High magnetic fields may have effects on the human body. A high rate of change of magnetic field can cause possible short-term effects that include light-headedness, stimulation of magnetophosphenes (seeing stars), nausea, and a metallic taste in the mouth. The largest change in magnetic field occurs closest to the bore of the magnet. Quickly moving your head, bending down, or turning may cause these reactions. These symptoms are transient and will subside quickly. Communicate these symptoms to others nearby and sit down until you feel better.

There are no proven long-term health effects from exposure to high magnetic fields, but some adverse claims have been made and more research is needed in this area. Please consult the references in Web Resources listed below for more information about the health effects of magnetic fields.

## **Laboratory, Live Subject, and Drug Precautions**

The AMRIS Facility is a working laboratory environment. As such, you should use good laboratory practice and take normal laboratory precautions when in the Facility. These procedures include the proper clean up and storage of materials. The Facility area should be left clean and orderly in such a way that the next user can perform their work without the delay of cleaning from the previous user.

All procedures performed in the Facility that involve animals must have full IACUC approval prior to the initiation of a procedure and the IACUC approval documentation and description of the procedures must be presented upon request. These documents must be available each time an animal procedure (including MR measurements) is performed in the AMRIS Facility. All drugs are the responsibility of the individual researcher and may not be stored in the AMRIS Facility.

**If you have any concerns about animal welfare, contact the Director's Office of University of Florida Animal Care Services (<http://acs.ufl.edu>)**

## **Web Resources**

- Frank Shellock's Information Resource on MRI Safety and Bioeffects; [www.MRIsafety.com](http://www.MRIsafety.com)
- Institute for Magnetic Resonance Safety, Education, and Research; [www.imrser.org](http://www.imrser.org)