Magnetic Resonance Research Facility (MRRF) Resources

The Magnetic Resonance Research Facility (MRRF) has scanners located in both the hospital and research buildings on the campus of the University of Iowa. The clinical research scanner is housed in an 8,000 square foot state-of-the-art MR facility. This facility is on the lower level of the Pappajohn Pavilion within the University of Iowa Hospitals and Clinics. There are five offices housing scientific staff of the MRI Center and a conference room.

The research dedicated 3T scanner is housed in approximately 1,500 square foot facility within the College of Medicine Medical Education Research Facility (MERF). This building is adjacent to the hospital. The MERF facility contains a subject waiting and changing room, animal preparation and wet laboratory, electronics shop, cryogen storage, and 13 seat computer and image processing laboratory.

The MRRF contains numerous workstations for image processing and display. All are equipped with image analysis software that can be applied flexibly to all manner of research studies. The facility computers are also networked to the bioinformatics and computer resources of the Institute for Clinical and Translational Science (ICTS). The ICTS hosts their own extensive RAID server and PACS system (XNAT) to accept data from the research facility and securely share this data among collaborating users.

Clinical:
Participant waiting and changing rooms are available for subject preparation before imaging.

Animal:
The College of Medicine also houses a small animal scanner for mouse and tissue studies. This system is a horizontal bore Varian Unity/INOVA 4.7T unit, with a gradient system having 10 cm bore and capable of gradient amplitudes of 270 mT/m. Four transmit/receive quadrature RF coils, with 3.8 cm and 2.5 cm inner diameters, are provided. The system software includes all of the standard imaging pulse sequences (2D and 3D gradient echo, 2D and 3D fast spin echo, echo planar imaging, diffusion and spectroscopic imaging), as well as its own pulse sequence development environment for specialized application development. The system is primarily applied to MR microscopy for small animal imaging in vitro and in vivo.

Computer:
A number of image processing workstations are available including 8 Linux based workstations, 3 Macintosh, and 10 Windows based systems. The IT core of the ICTS manages these systems. The IDEA/ICE (Siemens) and EPIC (GE) pulse programming environments exist for scanners allowing custom sequence and image reconstructions tools to be developed. The ICTS is supporting the hardware and software for the XNAT software being used as a DICOM server for the MR Research Facility. All research studies are now archived and shared with investigators using XNAT.
3.0T Siemens TIM Trio MRI Scanner (100% Research Dedicated)
Description: This scanner is equipped with the TIM receiver technology and resides in the 1,500 square feet of space within the College of Medicine’s Medical Education Research Facility. It is capable of performing echo-planar imaging, spectroscopic imaging, and is equipped with an 18-channel broadband receivers allowing nuclei other than hydrogen to be imaged. The scanner is equipped with gradient coils of strength of 45 mT/ m and a maximum slew rate of 200 T/m/s. Additionally, the Department of Radiology has research agreements in place with Siemens Medical Solutions to acquire preview and works-in-progress releases that are of mutual interest.

Specialized Sequences:
- Advanced 3D
- Advanced Turbo
- Advanced Angiographic Imaging
- CARE Bolus Imaging
- Echo Planar Imaging
- Neuro Perfusion
- BOLD and Advanced Functional Imaging
- Single Voxel Spectroscopy
- Chemical Shift Imaging (CSI)
- EPSI
- PEPSI
- Arterial Spin Labeling
- Advanced Cardiac Imaging
- High Angular Diffusion Tensor Imaging (DTI)
- T1rho

Coils:
- 12-channel Head Coil
- 8-channel Body Coil
- 12-channel Spine Matrix
- Wrist Coil
- Extremity Coil
- CP Head Coil
- Endorectal Coil
- 1 inch Small Loop Coil
- Dual Tuned Rapid MRI ¹H/³¹P Coil

fMRI Equipment:
- Avotec Silent Scan audio equipment
- Internet radio
- DVD player for subjects to watch movies
- DLP projector - Panasonic 3500
- Stimulus computer with E-prime, Presentation & Matlab
- Psychology Software Tools (PST) fiber optic manipulandums – left and right hand
- Lumina Response Pad
- Avotec RE-5701 Real Eye Tracker
- FOMRI II Dual-channel MRI microphone system
Other Equipment:
- BIOPAC physiological monitoring system - including photoplethysmograph (PPG), respiratory, galvanic skin response (GSR), pulse oximeter, air flow and expired gas analysis.
- JD-Medical Small Animal Anesthesia Machine (VT-110-MRI)
- Metrasens FerroGuard metal detector
- MediGoggles interchangeable prescriptive glasses (range from -6 to +6 diopter in 0.5 diopter increments)
- FOMRI II Dual-channel MRI Microphone System

7.0T GE 950 Whole Body MRI Scanner (100% Research Dedicated)
Description: This actively shielded scanner was just purchased through an ARRA grant. This instrument will be housed in the 200,000 square foot John and Iowa Institute for Biomedical Discovery. It will capable of performing echo-planar imaging, spectroscopic imaging, and is equipped with 8-channel transmit and 64-channel broadband receivers allowing nuclei other than hydrogen to be imaged. The scanner is equipped with gradient coils of strength of 50 mT/ m and a maximum slew rate of 200 T/m/s. The scanner will include all sequences available. Additionally, the Department of Radiology is establishing a collaborative research agreement with GE to acquire preview and works-in-progress releases that are of mutual interest.

Specialized Sequences:
- Advanced 3D (CUBE, LAVA-Flex)
- Propeller 2.0
- IDEAL
- Echo Planar Imaging
- Diffusion Tensor Imaging / FiberTrak
- Arterial Spin Labeling
- BOLD Imaging / BrainWave
- Single and Multi-Voxel Spectroscopy
- SWAN
- TRICKS

Coils:
- 32-channel receive / quadrature transmit head array
- 32-channel receive / 8-channel transmit head array
- 32-channel receive / 6-channel transmit body array
- 28-channel receive / quadrature transmit extremity array
- 1-channel receive / quadrature transmit general purpose loop coil
- Rapid $^1$H/$^3$P brain coil
- Rapid $^{23}$Na/$^1$H brain coil

fMRI Equipment:
- Nordic NeuroLab auditory and visual presentation systems
- Stimulus computer with E-prime, Presentation & Matlab
- Psychology Software Tools (PST) fiber optic manipulandums – left and right hand
3.0T Siemens TIM Trio MRI Scanner (50% Research)
Description: The scanner supports echo-planar imaging, spectroscopic and chemical shift imaging. The scanner is equipped with gradient coils of strength of 45 mT/ m and a maximum slew rate of 200 T/m/s. The scanner has an 18 channel receiver system.

Specialized Sequences:
- Advanced 3D
- Advanced Turbo
- Advanced Angiographic Imaging
- CARE Bolus Imaging
- Echo Planar Imaging
- Neuro Perfusion
- Bold and Advanced Functional Imaging
- Single Voxel Spectroscopy
- Chemical Shift Imaging (CSI)
- Advanced Cardiac Imaging

Coils:
- 8-channel Head Array
- CP Head Coil
- 8-channel Body Array
- 12-channel Spine Array
- Wrist Coil
- Extremity Coil
- 15-channel Knee Coil
- Foot & Ankle Coil
- Runoff Coil
- Tx/Rx Head Coil
- Breast Array
- Neck Array

fMRI Equipment:
- Avotec Silent Scan audio equipment
- LCD Projector - InFocus LP840
- Stimulus Computer with E-prime
- Serial response box
- Left & right hand fiber optic manipulandums

1.5T Siemens Avanto MRI Scanner (20% Research)
Description: This scanner is equipped with the total imaging matrix (TIM) receiver technology, echoplanar imaging capability, multi-nuclear option, spectroscopic and chemical shift imaging. The scanner is equipped with gradient coils of strength of 45 mT/ m and a maximum slew rate of 200 T/ m/s and an 18-channel receiver system.

Specialized Sequences:
- Echo-planar Imaging
- Diffusion Tensor Imaging
- Single Voxel Spectroscopy
- Chemical Shift Imaging
- Neuro Functional Imaging
- Advanced Cardiac Imaging
- T1rho
- $^3$He Imaging Sequences

Coils:
- 12-channel Head Array
- Neck Matrix
- Spine Matrix
- Body Matrix
- Peripheral/Angio Matrix
- Large Flex Coil
- Small Flex Coil
- Breast Coil
- CP Extremity Coil
- Endorectal Coil
- Extremity Array coil

fMRI Equipment:
- LCD Projector - InFocus LP840
- Stimulus Computer with E-prime
- Avotec Silent Scan audio equipment

**MRI Simulator**
Description: An MRI Simulator is available free of charge for any researcher participating in MR imaging studies. The MRI Simulator was built by Psychology Software Tools (PST) and provides a realistic approximation of an actual MRI scanner to allow acclimatization and fMRI training of participants in an environment less daunting than a real scanner.

Features:
- 60 cm bore with tapered entry and flat facade
- Integrated control panel
- Lights, fan, speakers and subwoofer
- Motorized participant table with remote control and drag sensing safety stop
- Table and head coil pads
- Siemens style mock head coil
- Psychology Software Tools MoTrak head motion tracking system
- Authentic MRI sounds

fMRI Equipment:
- 15" high-definition LCD monitor
- Rear-facing mirror for fMRI studies
- Stimulus computer with DVD player
- E-Prime 2.0
- Psychology Software Tools (PST) fiber optic manipulandums – left and right hand
- Sennheiser HD 280 professional headphones
- Custom-made memory foam head pillow
- Microphone system