Announcements

1. We are requesting that everyone who wants staff-support for their imaging study submit an online imaging request. The request form can be accessed from BRIC Scheduling webpage by clicking the quick link “Scheduling” on the BRIC home page, or you can use the following direct link:

   http://www.med.unc.edu/bric/services/schedule-a-study

2. A dual energy x-ray absorptiometry (DEXA) system (GE Lunar PIXImus II) is now available through BRIC SAI facility. Dedicated for small animal research, this densitometer provides bone mineral and body composition results from total body x-ray imaging on live animals. The system is currently located in the Mary Ellen Jones animal facility. Interested users can contact us (bricsa@med.unc.edu) or Dr. Ted Bateman (bateman@unc.edu) for detailed information.

3. A cyclotron from Advanced Biomarker Technologies Inc. (ABT, Inc.) was installed, and has started to provide [18]F-fluodeoxyglucose ([18]F-FDG) for research usage. The new cyclotron is nearly 10 times smaller than conventional PET cyclotrons and produces 7.5 MeV positive ions to make F-18 radio-tracers. On-demand [18]F-FDG dose can be produced within an hour daily for PET imaging research applications. This on-site cyclotron will greatly enhance our PET imaging capability. The cyclotron is located in the cyclotron facility behind the Genetic Medicine Building.

4. New BRIC faculty Dr. Rosa Tamara Branca has established a hyperpolarized gas MR imaging lab focusing on using hyperpolarized Xe-129 to image small animal or human subjects for structural and functional information that cannot be obtained with conventional proton-based MRI methods.

5. Dr. Ian Shih joined BRIC earlier last year, and he has been appointed as the Director of the SAI MRI section. He has brought unique expertise on functional MRI (fMRI) on small animal research, and initiated a series of fMRI studies focusing on deep brain stimulation, peri-infarct spreading depolarization, and neurovascular coupling/uncoupling.
Featured Animal Imaging Technique—Carbon Nanotube micro-CT Imaging System

Overview of features and benefits

- Focal spot size: 93 µm x 109 µm
- 50KVP anode voltage, 1.5 mA current
- 76 µm nominal resolution
- Real time respiratory and cardiac gating
- Longitudinal mice CT imaging

Carbon nanotube micro-CT (CNT-CT) details

A new high resolution (<100 µm) micro-CT imaging system (Figure 1) was installed in the Small Animal Imaging facility at the end of 2011. The system was designed and manufactured at UNC Chapel Hill by Dr. Otto Zhou’s group in the Physics Department, with support from the NIH and UCRF funds. The major difference between the CNT-CT system versus other commercially available micro-CT systems is the source of X-rays for CT imaging. Conventional CT systems usually use a thermionic emission based X-ray tube to generate X-rays, while the CNT-based CT system utilizes carbon nanotubes as field emitters to generate X-rays. A field emission source does not require heat to generate electrons. The cold nature of this emission also prevents thermal drift of the cathode, providing better and more stable electron focusing. More importantly, the field emission source can be switched on and off quickly and efficiently, which allows prospective, real-time respiratory and cardiac gating in animal imaging. The direct benefit is a dramatically reduced radiation dose. The reduction of radiation exposure enables longitudinal lung imaging on small animals without significant side effects.

Imaging Applications

Lung imaging — Conventional retrospectively gated CT imaging acquires projection images continuously, with respiratory signal recorded during acquisition and the motion analyzed in post processing. It can result in a large amount of radiation dose exposure. With the CNT CT, we are able to do the prospective gating during acquisition, which only acquires X ray projections when triggered by the desired respiration signal. This could reduce the radiation dose by more than 10 times. We have successfully acquired gated lung images on normal and lung tumor mice (Figure 2, upper).

Cardiac Imaging — with a vascular contrast agent, cardiac CT imaging becomes possible with the CNT-CT system. Figure 2 bottom panel showed CT images obtained at 15 msec temporal resolution and 76 µm isotropic voxel size.
We have also successfully conducted CT colonography on transgenic mice with colon cancer. The animals were carefully prepared prior to imaging. In Figure 3, a colon tumor was detected by air enhanced CT imaging. The imaging time was about 5 min for each animal.

This CNT microCT system is currently located in room 125 at the BRIC building. If you have any interest using the system, please contact Dr. Hong Yuan (yuanh@med.unc.edu) to discuss your study.

Notes for Imaging Users

1. When you bring animals to the imaging facility for MRI, PET, SPECT, CT, or Ultrasound imaging, please bring them in clean cages. These animals may need to stay the whole day in the facility. Clean cages are beneficial to both animals and people working in the facility. We also recommend turning all water bottles so that the spouts are pointing in the upward direction. This will keep the bedding dry during transport.

2. If you are planning to do CT or MR imaging on your animal, please avoid using metal ear tags as the animal identification method. Instead, you can use either the ear punch or animal tattoo system. We can now help you with the animal tattoo method. Please inform us if you need assistance with animal identification.

3. Researchers who want to use the IVIS optical systems are required to obtain official training from the imaging facility. Training on the IVIS systems is provided on the first Monday afternoon each month. Training on Ultrasound imaging is also available. Detailed schedules and information can be found in the following link: http://www.med.unc.edu/bric/Training

4. When you finish an optical imaging study, please double check the oxygen tank and isoflurane vaporizer to make sure they are both turned off. Reckless users could be denied use of the imaging system.
Imaging Study Highlights

- **Micro-CT Imaging Study on mouse lung vasculature**

  High resolution CT imaging was used to depict lung vasculature and its network structure on a mouse lung specimen. Images were acquired with 6 micron resolution with the Scanco uCT40 system. The vasculature was filled with CT contrast agent for better delineation. The image is a 3D projection image on one of the lung lobes. (PI: Dr. Sean McLean)

- **In-111 SPECT/CT Imaging on tumor mice**

  Longitudinal SPECT imaging was performed on a tumor-bearing mouse injected with In-111 labeled nanoparticle. Imaging has provided efficient biodistribution and pharmacokinetic study on nanoparticles (PI: Dr. Leaf Huang). SPECT/CT imaging was done with the GE speCZT/CT120 system using mouse 7-pinhole collimator with resolution of 1mm in SPECT imaging.

- **High Resolution quantitative CBF MR Imaging of peri-infarct spreading depolarization**

  A model inducing photothrombotic stroke in MRI was recently developed and high resolution cerebral blood flow (CBF) data were acquired using continuous arterial spin labeling (CASL) technique at a 9.4 Tesla MRI to depict peri-infarct spreading depolarization after stroke. This technique allows quantitative imaging of whole brain CBF with 3 s temporal resolution (PI: Dr. Yen-Yu Ian Shih).
Imaging service list

- 9.4T MRI
- PET/CT
- SPECT/CT
- Optical Imaging
- Ultrasound Imaging
- microCT on live animal
- microCT on specimens
- Imaging Study Design
- Image data processing

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