Icahn School of Medicine at Mount Sinai

Translational & Molecular Imaging Institute

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Issue 3
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Message from the Director

Summer is here and I am excited about the nice weather, the outdoor fun, the TMII Summer Camp and all the current TMII initiatives presented in this 3rd TMII 2014 newsletter.

We continue to have a fantastic 2014. We just wrapped up the TMII annual symposium which continues to be a great success as you will be able to read below. Some of us came back from attending the ISMRM meeting in Milan with new innovative ideas in MRI techniques and some TMII members came back happy with awards in recognition for their work and service.

I am happy to announce the initiation of a seminar series focused on preclinical micro-imaging and the appointment of Dr. Gustav Strijkers from the Academic Medical Center in Amsterdam as TMII Visiting Professor with extensive expertise in preclinical imaging. We expect that this new initiative and the appointment of Gustav will demonstrate to our Sinai community the impact that these preclinical imaging tools and expertise available within TMII can have on biomedical science and discovery.

Finally, with the help of Dr. Bachir Taouli, Director of Cancer and Body Imaging within TMII and a collaboration with Siemens Healthcare Ultrasound, we acquired a state of the art ultrasound system that is available to all researchers within the TMII Imaging Core, check the details below.

I wish all of you a fun and productive Summer and thanks again for your commitment and support. I look forward to hearing your comments and suggestions.

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WHAT'S NEW?

TMII News & Updates

News

Highlights from ISMRM: Hardien Dyvorne, PhD was given the summa cum laude award for his submission, "Highly Accelerated 4D Flow using Spiral Sampling and Dynamic Compressed Sensing for Flow Quantification in Abdominal Vessels"

Claudia Calcagno, MD PhD won second place in the Great Italian Art & Food Challenge for her submission, "The Last Supper- An Homage to da Vinci & Warhol". For more information visit: mriscanart.com

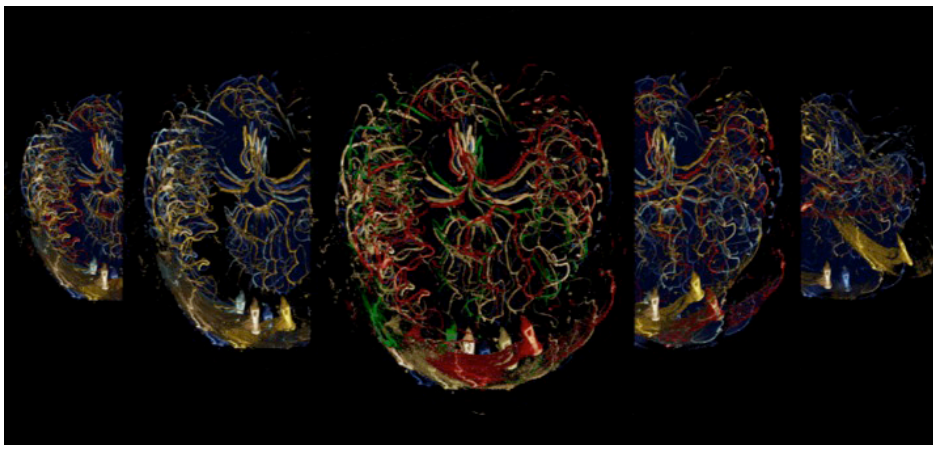
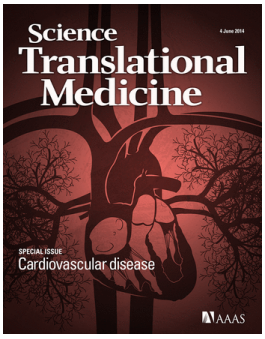


Figure: Great Italian Art & Food Challenge submission by Rebecca Feldman, PhD. "Firefly Trails" was inspired by both a time of flight MRI image and the art of Italian Futurist Giacomo Balla whose abstract work captured the essence of motion and urgency as well as dynamic depictions of light.

Updates

On June 2nd, 2014 Jun Tang successfully defended his PhD thesis, "Develop Anti-inflammatory Nanotherapies to Treat Cardiovascular Disease". Congratulations Dr. Tang!

Also from the Nanomedicine program, on June 4, 2014, Willem Mulder PhD, Zahi Fayad PhD and two renowned MGH investigators



published a state of the art review about promising bioengineering and drug delivery approaches aimed at treating atherosclerotic disease in Science Translational Medicine. In this Special Issue about cardiovascular disease renowned investigators in the field also contributed perspectives, editorials and reviews. Dr. Mulder's state of the art review entitled "Imaging and Nanomedicine in Inflammatory Atherosclerosis" served as the cover story for this Special Issue.

Lastly, Dr. Fayad has been recognized by ISMRM for his distinguished service as reviewer for the journal *Magnetic Resonance in Medicine* from 2012-2013.

FACULTY SPOTLIGHT

Accelerated Cardiovascular MRI

Gustav Strijkers, PhD

Dr. Strijkers is associate professor at the Academic Medical Center (AMC) in Amsterdam, the Netherlands. At the AMC he leads a team of researchers, which develop novel cardiovascular MRI protocols to study the remodeling processes in the heart as a consequence of myocardial pathology.

As of January 2014, Dr. Strijkers regularly visits the Translational and Molecular Imaging Institute. During these 3 to 4 one-week visits per year he joins the research team of Prof. Fayad, Prof. Mulder and Dr. Calcagno to provide lectures, expert advice, and hands-on training on preclinical cardiovascular MRI.

Dr. Strijkers specializes in the use of advanced acceleration techniques to speed up the MRI acquisition and enable dynamic cardiovascular imaging with higher temporal and spatial resolution. Traditionally cardiac MRI is a slow technique because it requires the repeated acquisitions of a small portion of the image or movie distributed over multiple heartbeats. Accurate synchronization to the heartbeat via ECG triggering in the high magnetic field of the MR scanner and suppression of breathing artifacts pose a challenge. Moreover, high blood velocities in the heart and its great vessels may lead to image artifacts.

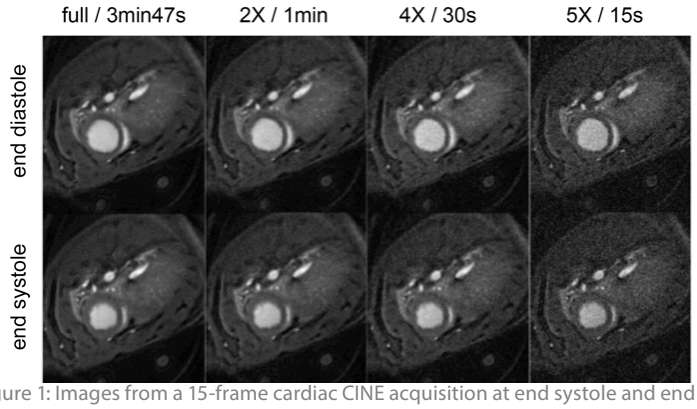


Figure 1: Images from a 15-frame cardiac CINE acquisition at end systole and end diastole. The left column is the full non-accelerated acquisition. Columns 2-4 are images from accelerated acquisitions with varying degree of undersampling and scan time per slice.

For more reliable synchronization the team of Dr. Strijkers has developed self-gating technology, which derives synchronization from the MRI signals themselves instead of ECG leads. Scans can be accelerated by the use of mathematical reconstruction techniques that require less acquisition data (undersampling) while still providing similar or even improved image quality. The use of radial sampling techniques considerably reduces the echo time of the cardiac MRI sequence leading to less flow-related artifacts.

An example of this approach is in figure 1 with still cardiac images from a 15-frame movie at end diastole and end systole of a rat heart with myocardial infarction. The movies were acquired using a 2D self-gated center-out radial CINE acquisition. The fully sampled non-accelerated acquisition is shown on the left, and from left to right movie frames with varying degrees of acceleration and total acquisition times. Artifact free cardiac CINE MRI could be acquired in these rats with a scan time of

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SCIENCE SPOTLIGHT

TMII 14

4th Annual TMII Symposium

On May 29th, TMII hosted the 4th Annual TMII Symposium at the New York Academy of Medicine. The TMII Symposium continued its mission giving researchers and medical professionals an opportunity to gain insight into the current translational imaging research at Mount Sinai and other institutions in and outside the New York metropolitan area.

Pioneers in imaging science were invited from around the world to talk to about the crossroads of big data, imaging and neuroinformatics; multi-modality, ultra-high field neuroimaging; advance techniques for cardiovascular imaging; multi-parametric imaging models in prostate cancer; and therapeutic applications of nanoparticles in cancer. With 138 people who pre-registered and 27 registering on-site, 16 different universities and industry were represented. The program can be found at tmii.mssm.edu/symposium.

Out of 35 submissions, one abstract from each section was chosen to be an oral presentation.

Neuroimaging - Zafer Iscan, PhD (Stony Brook University)

Cardiovascular - Philip M. Robson, PhD (ICSMMS)

Cancer & Body Imaging - Guido H. Jajamovich, PhD (ICSMMS)

Nanomedicine - Tina Binderup, PhD (ICSMMS)

Awards were also given for outstanding poster from each session:

Neuroimaging - Rebecca Feldman, PhD (ICSMMS)

Cardiovascular - Nadia Alie, BA (ICSMMS)

Cancer & Body Imaging - Hadrien Dyvorne, PhD (ICSMMS)

Nanomedicine - Jun Tang, PhD (ICSMMS)

IMAGING SPOTLIGHT

Training the Next Generation of Imaging Scientists

TMII Science Camp

Every summer TMII runs a summer science camp where 8 high school and college students are selected from a group of applicants from across the country to work in TMII. TMII Science Camp mainly focuses on neurological or psychiatric disorders and related technologic developments in imaging. There is a strong emphasis on technology development in the lab including principles of Magnetic Resonance Imaging (MRI) on human as well as animal models of disease.

The first year that a summer student comes, he/she mainly learns about the technology, and principles of the science behind a number of imaging modalities. The program consists of lectures and quizzes as well as training on animal handling and running imaging experiments.

Students help out with various projects that are ongoing and they will learn how to acquire and analyze data.

All students are asked to do a presentation on a topic of their choice at the end of the session to the group. For those students who have computer skills and interests, TMII also has a programming group where they can help with software development.

Students who have mastered the basics and return the second year, have a strong background to be able to devote their time to one dedicated project..

The program can only receive students who can commit full time, i.e. m-f/9-5 to maximize the training in a short amount of time. The program usually starts around the first week of July and runs through end of summer. It is critical that interested students attend full time during the first 6 weeks but by the end of summer they tend to be working more independently.

The program is flexible and nothing is fixed, the above is just a rough description what we have been doing for the past several years.

For more information contact Dr. Cheuk Tang.

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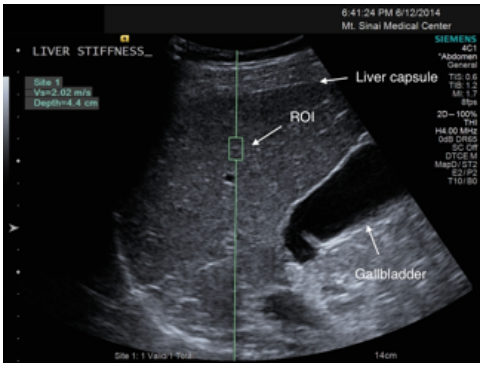
CORE SPOTLIGHT

New Tools

Siemens Acuson S3000 Ultrasound

A new method for the evaluation of the elastic properties of tissues is now available in the Cancer/Body Core. Acoustic radiation force impulse elastography is performed with a Siemens Acuson S3000TM (Siemens AG, Erlangen, Germany) ultrasound system. The principle of this method is that of the shearing of the examined tissue, which induces a smaller strain in hard tissues than in soft ones. The ultrasound probe automatically produces an acoustic 'push' pulse that generates shear-waves, which propagate into the tissue. Using image-based localization and a proprietary implementation of ARFI technology, shear wave speed may be quantified, in a precise anatomical region, focused on a region of interest, with a predefined size, provided by the system. Measurement value and depth are also reported, and the results of the elasticity are expressed in m/s. Clinical applications of ARFI imaging include: liver fibrosis quantification, breast, colorectal and prostate tumor imaging.

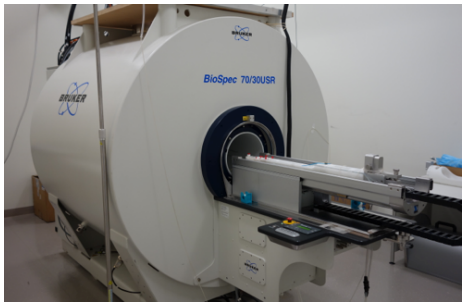


Right: ARFI imaging measurement in liver of 56-year-old man with liver cirrhosis. ROI = region of interest.

Core Equipment

Bruker Biospec 7T MRI

This is a high-resolution MR scanner for small animals. The maximum bore diameter for imaging is 15.4cm. This system is equipped with two gradient choices, a large built-in gradient system with up to 200 mt/m and a slew rate of 640 T/m/s. This gradient in combination with a large circular polarized coil will allow imaging of animals up to 15.4cm in diameter. The system is also equipped with a high performance gradient insert with 440mT/m and slew rate of 3,440 T/m/s for high-resolution imaging. The system has 2 transmit and 4 receive channels.



There is a 35mm ID circular polarized coil for in-vivo mouse imaging as well as a 4-channel phased array for mouse brain and a 4 channel phased array for mouse cardiac imaging. There are also 3 other dual tuned 20mm surface coils for 31P, 13C and 19F. The 7T Bruker is equipped with the Autopac system, a fully integrated animal handling, laser guided positioning system. Animal warming holders are available for rats and mice as well as a full spectrum of monitoring peripherals for ECG, triggering and respiratory monitoring etc

BIC CORNER

BIC wants to thank all applicants of the 14 proposals, and all the reviewers, for their excellent contributions to the inauguration of the Brain Imaging Center pilot research funding awards. Based on the commendably thoughtful and thorough reviewers' recommendations, the BIC science steering committee selected the three best scored projects to receive support. Congratulations to the awardees:

1) Effect of Methadone Maintenance Therapy on Neuroinflammation in HIV: A Pilot Study. (PI: Susan Morgello, MD; Co-Investigators: Matilde Inglese, MD, PhD, Desiree Byrd, PhD, Thomas Kraus, PhD)

2) Virtual tract tracing in the non-human primate brain using high field-strength MRI. (PI: Paula Croxson, PhD; Co-Investigators: Rafael O'Halloran, PhD, Priti Balchandani, PhD)

3) Using Oxytocin to Increase Self-Awareness in Drug Addiction. (PI: Scott Moeller, PhD; Co-Investigators: Mercedes Perez-Rodriguez, MD, PhD)

All others are encouraged to reapply to the next round (TBD). Please also keep reading our BIC tech meetings minutes for weekly updates.

Other news: Natalie S. Massenburg, M.A., joined the BIC team in mid-April. Natalie is BIC's new Senior Clinical Research Coordinator. Natalie has a Master's degree in Sociology with an emphasis on Women's Health. Her background includes years at Mount Sinai working in the Department of Pathology as a Project Manager for the Manhattan HIV Brain Bank. She has also worked as a Clinical Coordinator in the Department of Health Evidence and Policy on Mount Sinai's CHIPRA Centers of Excellence Collaboration for Advancing Pediatric Quality Measures (CAPQuaM).

UPCOMING EVENTS

- TMII Micro-Imaging Seminar Series, third Thursday of the month
- BIC Day - Tuesday October 28th. More details to follow

For more information on these and other events go to: http://tmii.mssm.edu/events/

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