

Translational & Molecular Imaging Institute

September, 2014
Issue 4

tmii.mssm.edu

Message from the Director

Hope you all had an exciting Summer with some time for rest and rejuvenation. In this edition of the TMII newsletter we announce the 5th annual symposium, TMII 2015, scheduled on July 24. The speaker list includes: Rod Pettigrew, Director of NIBIB; Susumu Mori from Johns Hopkins; Dick Ehman from Mayo; Matthias Stuber from Lausanne; and Chrit Moonen Utrecht. The themes are big innovations and blue sky research in imaging sciences. This promises to be a very exciting

and stimulating meeting. In addition to this yearly Symposium, we plan to continue our different seminar series. One particular program will focus on the use microimaging (small animal imaging) in the different disease disciplines. We also will be announcing a school wide Town Hall meeting focused on small animal imaging current status and needs. More on these in the next Newsletter. Finally, please join me in welcoming Dr. Prantik Kundu, PhD as a new faculty in TMII and BIC. Dr. Prantik work

is focused on advanced image processing and analysis methods. In an upcoming issue we will feature Dr. Kundu's laboratory. I look forward to hearing from you on any issue and wish all of you a good start for the last quarter of 2014.



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WHAT'S NEW?

TMII News & Updates

SAVE THE DATE! The 5th Annual TMII Symposium [#TMII2015](https://tmii2015.org) has been scheduled for Friday July 24th, 2015 in the Davis Auditorium in the Hess Center for Science and Medicine. See figure below for more details.

Congratulations Octavia Bane, PhD! Dr Bane has received a postdoctoral appointment to the NCI Training Program in Cancer Biology at Mount Sinai, funded by the Ruth L Kerchstein National Research Service Award (T32) Training Grant. The training program brings together ten Mount Sinai postdoctoral fellows and 48 training faculty from 9 departments and 4 institutes for weekly seminars and journal clubs in cancer biology, as well as an annual research-focused retreat. In addition to teaching concepts in cancer biology, the program encourages postdoctoral researchers to consider how their research can be translated to the treatment and diagnosis of cancer.

The Small Animal Imaging Core (SAIC) will hold a Town

Hall meeting this fall. SAIC director, Cheuk Tang and TMII director Zahi Fayad will give updates on the current state of the SAIC and future plans. Anyone who is currently using the facility or might want to use the facility are invited to attend.

Starting September 1st, Prantik Kundu, PhD became the newest member of TMII and

BIC. Dr. Kundu recently completed his post-doctoral fellowship in Peter Bandettini's Laboratory of Brain and Cognition at the National Institute of Mental Health. He will be giving a talk titled "Studying Task Activation and Resting State Connectivity Using Multi-Echo fMRI at 3T and 7T" on Tuesday, September 9th, 2014 in Conference Room B in Hess as part of the BIC users meeting group (convening on alternate Tuesdays).



Icahn
School of
Medicine at
Mount
Sinai

Translational and
Molecular Imaging
Institute

July 24th, 2015

Keynote Speaker:
[Roderic I. Pettigrew, PhD, MD](#)
Director, National Institute of
Biomedical Imaging and Bioengineering
National Institutes of Health

5th Annual TMII Symposium

[#TMII2015](https://tmii2015.org)

Location:
Davis Auditorium
Hess Center for Science and Medicine
Icahn School of Medicine at Mount Sinai

Neuroimaging
[Susumu Mori, PhD](#)
Professor, Radiology
Johns Hopkins University School of Medicine

Cardiovascular Imaging
[Matthias Stuber, PhD](#)
Professor, Center for Biomedical Imaging (CIBM)
University Hospital of Lausanne (CHUV)

Nanomedicine
[Chrit Moonen, PhD](#)
Professor, Radiotherapy
University Medical Center Utrecht

Cancer & Body Imaging
[Richard L. Ehman, MD](#)
Professor, Radiology
Mayo Clinic

Translational and Molecular Imaging Institute - TMII
Leon and Norma Hess Center for Science and Medicine
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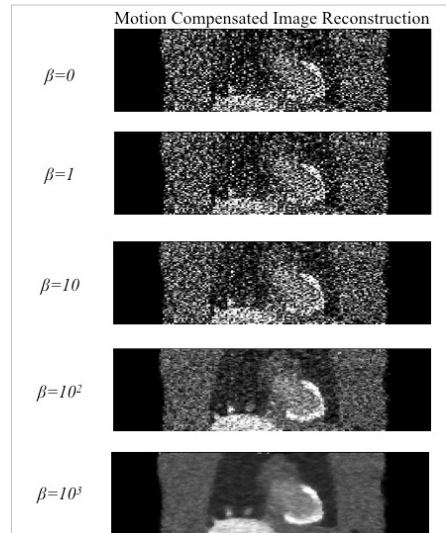
Check back soon for more information:
tmii.mssm.edu/symposium/

New Advances in MR/PET Reconstruction

Charalampos Tsoumpas, PhD

Doctor Charalampos (Harry) Tsoumpas is lecturer at the Leeds Institute of Cardiovascular and Metabolic Medicine, University of Leeds (UK) where he leads a research team in Radionuclide Imaging. Harry's research focuses on quantitative image reconstruction for Positron Emission Tomography (PET) and he develops novel methods for the improvement of PET images in terms of quality, resolution and quantitative accuracy. For example, among his recent research work he demonstrated the potential improvement that can be achieved with the use of regularized motion compensated image reconstruction as illustrated in the accompanying figure originally presented at the 2011 IEEE Medical Imaging Conference, Valencia, Spain. The resulted image rather than providing a purely smoothed and lower resolution version of the initial noisy image, regularization can provide an image with substantial reduction of noise without necessarily degrading image resolution (at least for $\beta=100$). The visual recovery of the right-hand side tumor becomes apparent at $\beta = 100$ and prominent

with $\beta = 1000$. On the other hand, the lesion in the left-hand side is distinguishable from the noisy background with $\beta = 100$, but cannot be detected



for $\beta=1000$. Further investigation is necessary to define robustly the optimal weights and kernel sizes of the β parameter. In a similar context regularized reconstruction (but without including

motion compensation) has been recently announced as part of the reconstruction software for the commercial GE PET scanners.

Harry joined the faculty at TMII for a collaborative effort along with Professor Fayad, Drs Calcagno and Robson the other team members to tackling the critical challenges of hybrid MR/PET imaging and help translate state of the art research in clinic. Emphasis will be given on several research areas related to MR/ PET Imaging with particular emphasis on the compensation of motion-induced confounds and partial volume effects with the aspiration to help materialise MR/PET as an established screening tool for the monitoring and assessment of potential therapeutic pathways.

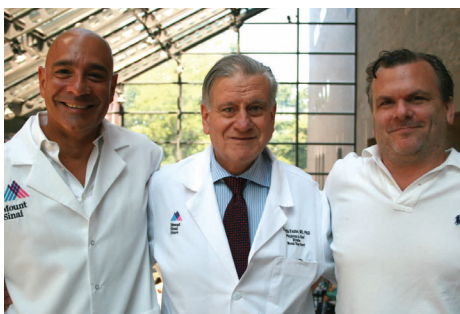


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SCIENCE SPOTLIGHT

AHA Awards Grant for High-Risk Children Prevention Study

Drs. Fuster, Fayad & Schadt



The grant's principal investigators are, from left: Zahi A. Fayad, PhD, Valentin Fuster, MD, PhD, Dr; and Eric E. Schadt, PhD. (Courtesy of Inside Mount Sinai)

Dr. Zahi Fayad, Director of the TMII, is a principle investigator on a recently awarded \$3.8 million grant from the American Heart Association (AHA) to study at-risk children and their parents in Harlem and the Bronx.

Dr. Fayad will join Dr. Valentin Fuster, Director of Mount Sinai Heart and Dr. Eric Schadt, Director of the Icahn Institute for Genomics

and Multiscale Biology to study the genes and lifestyles of 600 preschoolers and their parents or guardians who live in these communities, which are associated with high rates of obesity, cardiovascular disease, stroke, and type 2 diabetes. The investigators will track whether the interventions lead to healthier eating habits and additional exercise. They will also examine the participants' DNA and RNA to understand how genetics plays a role in the development of cardiovascular disease.

Dr. Fayad's project will be focused on the findings of imaging technology and the promotion of health in the parents and caregivers of the children being studied. They too may be at higher-risk of cardiovascular diseases or have barriers to maintaining a heart healthy lifestyle. Researchers hope to show that low-cost and family-based lifestyle changes will improve diet and increase physical activity.

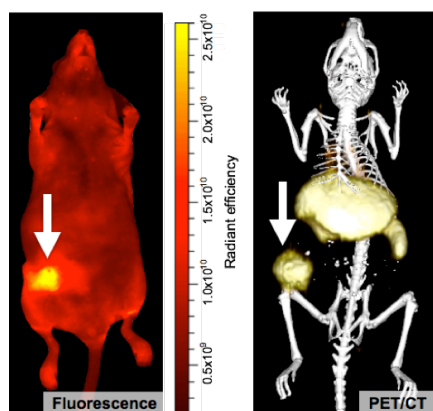
The primary project will measure the impact of promoting early childhood heart health education of 3-5 year olds in pre-schools. This preschool intervention will be partly based on Sesame Street's "Health Habits for Life" educational bilingual initiative, a multi-platform program featuring Muppet characters, designed to engage and improve the healthy nutritional and lifestyle habits of young children and their families in the United States and around the world.



Nanoparticle Tumor Targeting using Micro PET and Near-Infrared Fluorescence

Carlos Pérez-Medina

Nanotherapeutics – particulate drug formulations sized a few to a few hundred nanometers – are slowly finding their way into clinical practice. These formulations improve the pharmacokinetic profile of the drug and its performance in terms of stability, bioavailability, accumulation in the desired site of action and reduction of systemic, off-target side effects. In particular, liposomal formulations like Doxil have been approved for a long time now by the FDA. Liposomes are nanosized vesicles made of the same fatty materials that are present in cell membranes. Doxil, for instance, is a formulation of doxorubicin loaded inside this kind of vesicles. Thus, this highly cytotoxic drug is caged and efficiently delivered to tumors,



Accumulation of fluorophore-loaded, radiolabeled liposomes in tumor tissue -indicated by arrow - as observed by near-infrared fluorescence imaging (left) and PET/CT (right)

where it can exert its deadly effects without affecting other vital organs, especially the heart.

However, not all patients benefit equally from nanotherapy, since not all tumors show equal nanoparticle (NP) uptake. Therefore, a tool to evaluate non-invasively the accumulation and biodistribution of NPs would be of tremendous value in drug development settings as well as in the clinic. Lots of resources could be saved by monitoring the nanotherapeutic's performance prior to treatment. A way to solve this unmet clinical need would be to develop a "tracking" technique that could provide information on the fate of the NPs within the body.

In a recent article in [The Journal of Nuclear Medicine](#), Dr. Pérez-Medina and colleagues present an efficient and widely applicable strategy to label liposomes with a positron-emitting isotope that enables their tracking by PET (Positron Emission Tomography) imaging. PET allows the monitoring of the isotope without any limitation in tissue depth and offers unmatched sensitivity when compared to other imaging techniques, as very low amounts of the isotope are necessary to obtain high quality images. This way, radiation exposure and potential toxicity are reduced. In a mouse model of breast cancer, they were able to demonstrate that their radiolabeled liposomes accumulated in tumor tissues to

a high extent, and that most other organs, except liver and spleen, were spared of NP accumulation. Moreover, by loading their radiolabeled liposomes with a fluorescent dye (fluorophore), they were able to detect both signals -radioactivity and fluorescence- with an excellent degree of co-localization. This suggests that the structure of the liposomes remains largely intact over long periods of time after injection and that the fate of the load can be monitored by use of their radiolabeling technology.

The implications of this study are manifold. Firstly, the radiolabeling strategy can be readily applied to other lipid-based nanoparticles with potential therapeutic use. Secondly, the use of this technology in early stages of nanotherapeutic development may help to improve the nanoparticle's properties by allowing proper assessment of their in vivo performance. And lastly, in a clinical setting, it may serve as a tool to stratify patients into their appropriate treatment group based on their amenability to nanotherapy, a real step towards personalized medicine.



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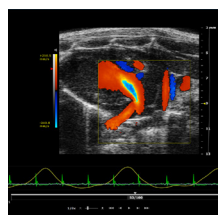
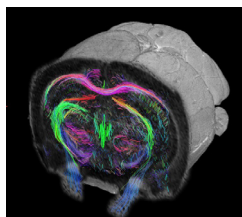
CORE SPOTLIGHT

Micro Imaging Core

Molecules to Mice

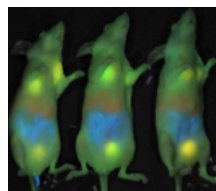
The preclinical micro imaging core provides in-vivo and ex-vivo small animal imaging services. Modalities available include micro-MRI, micro-Ultrasound and Biophotonic imaging.

The core is fully staffed and operates a Bruker 9.4T and 7T (Figure 1) micro MRI scanner for rodents up to small rabbit imaging. The micro-Ultrasound (Figure 2) lab operates a Visualsonics Vevo2100 scanner with a variety of



The biophotonic lab is equipped with a Xenogen Spectrum scanner (Figure 3) with filters covering 400nm through 850nm.

probes for hi-resolution and fast screening imaging of anatomy and cardiac function etc. An ultrasound guided injection system is also available.



Current applications include;

- Neovascularization in stroke models (7T MRI)
- Lung Tumor models (7T MRI)
- Luciferase imaging in breast cancer models (Fluorescence)
- Detecting exposure levels in teeth (9.4T MRI)



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BIC CORNER

The Brain Imaging Center will host its first Annual Symposium this fall. The BIC facilitates optimized research use of ISMMS's state-of-the-art brain imaging facilities at TMII. Adopting a translational and developmental approach, investigators at ISMMS and collaborating research institutions use BIC's standardized processing pipelines to acquire, analyze and manage a comprehensive set of brain scans across a myriad of neuropsychiatric disorders. The Symposium will provide an opportunity for everyone at Mount Sinai, and visiting

scholars from local institutions, to learn about innovative research being conducted at the Brain Imaging Center and share ideas about fostering novel collaborations to accelerate development of large-scale gene-brain-behavior datasets.

The day-long Symposium will be hosted by the BIC chief, Dr. Rita Goldstein, and begin with a keynote lecture by Dr. Gregory K. Farber, Ph.D., Director of the NIH Office of Technology Development and Coordination. Seminar

presentations by select faculty and guest speakers will precede an afternoon poster session accompanied by a wine-and-cheese reception. Informal opportunities to discuss and interact with attendees will be possible throughout the day during several breaks for provided refreshments and lunch. The BIC Day event will take place at the new Hess Center for Science and Medicine, Davis Auditorium (1470 Madison Avenue, second floor) on October 28th, 2014. Please mark your calendar.

UPCOMING EVENTS

- BIC Day - Tuesday October 28th. More details to follow
- 5th Annual TMII Symposium - July 24, 2015. 8 am - 5 pm Davis Auditorium Hess Center for Science and Medicine

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

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