Icahn School of Medicine at Mount Sinai

Translational & Molecular Imaging Institute

tmii.mssm.edu

Summer 2015

CANCER IMAGING

The Imaging Research Center is the backbone of the Translational & Molecular Imaging Institute at Mount Sinai Health System. Housed on four floors of the Leon and Norma Hess Center for Science and Medicine, the Imaging Research Center enhances the use of seamless diagnostics and treatment methods for our patients. Under the directorship of Zahi A. Fayad, PhD, the Imaging Research Center provides physicians and scientists with previously unavailable images of patients' internal organs, necessary for noninvasive diagnostics to treat cancer, brain, and cardiovascular diseases.

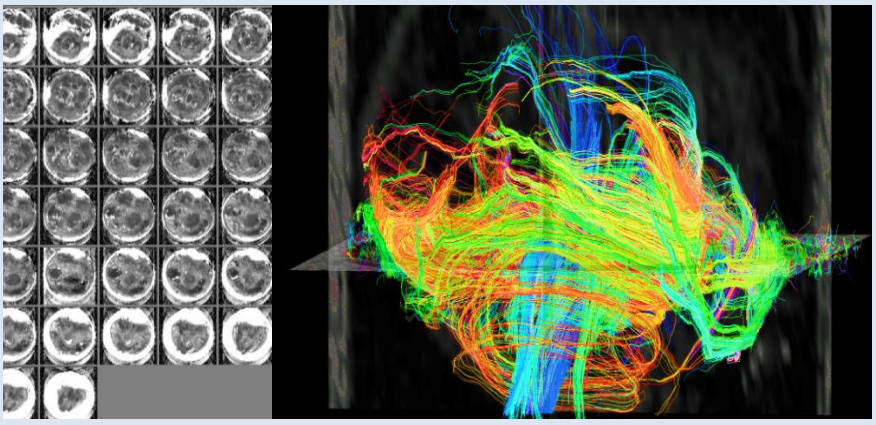
One of the disease models currently under study within the **Cancer Imaging Research Program** is liver cancer and chronic liver disease—often a precursor to cancer. Primary liver cancer has significantly increased in incidence over the last 10 years in the United States. In addition, the incidence in New York City is much higher than the rest of the country, with *17 out of 100,000 men in NYC affected*, compared to approximately 5 out of 100,000 men in North America.

Dr. Bachir Taouli's Laboratory Team

Researchers at the Imaging Research Center are currently undertaking groundbreaking studies in the use of imaging for the early detection and treatment assessment of primary liver cancer and liver damage in patients with chronic hepatitis. Early results validate the use of noninvasive imaging tools for the detection of liver damage and for liver cancer screening.

The ultimate success of this model will enable scientists to apply these approaches to other cancers such as prostate, breast, and lung. It also lays the groundwork for related studies in at-risk populations using faster imaging methods and assessing the cost effectiveness of cancer imaging screening on a larger scale.

The long-term goal for the Imaging Research Center in terms of cancer is the early detection and management of the disease.



7T: Prostate Cancer (T2W, DWI) Drs. Pisipati, Tewari , Tang, Taouli

New imaging methods are being developed that will allow clinicians not only to see where a tumor is located in the body, but also to visualize the expression and activity of specific molecules that influence tumor behavior and/or response to therapy. This information is expected to have a major impact on cancer detection, individualized treatment, and drug development, as well as on our understanding of how cancer arises.

STATE-OF-THE-ART EQUIPMENT

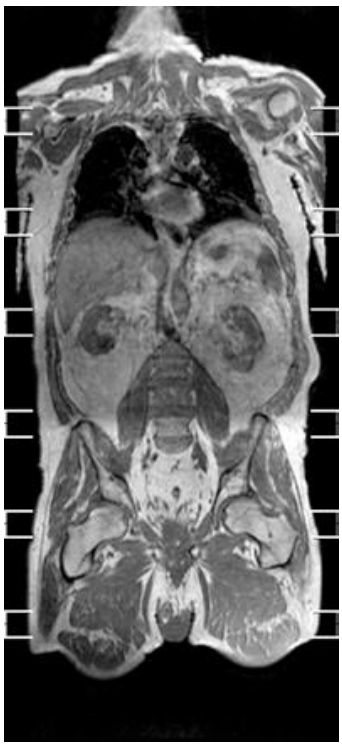
3T Skyra | **PET/MR** | **7T** | **Force CT** | **MR Simulator**

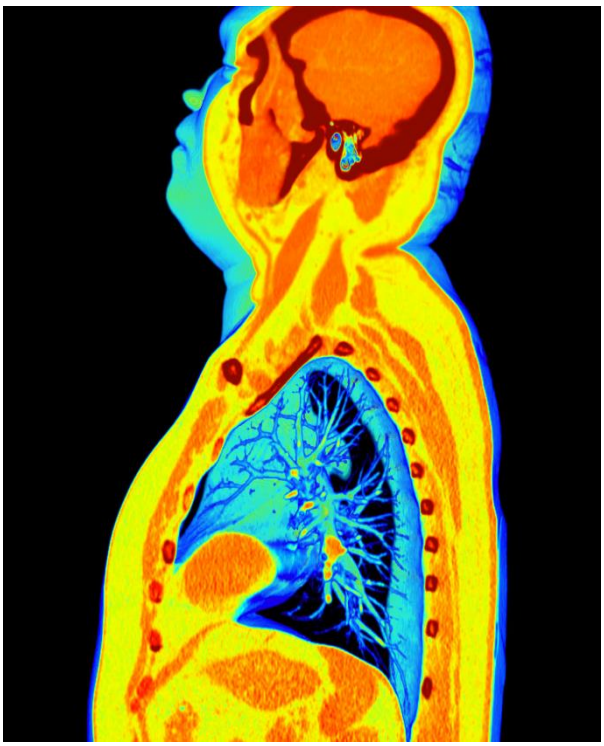




The Translational and Molecular Imaging Institute (TMII) is responsible for providing support for all in vivo imaging research at The Mount Sinai Medical Center. TMII Imaging Core is the backbone of the Translational and Molecular Imaging Institute and is responsible for coordinating, supporting and executing imaging research at Mount Sinai including, neuroimaging, cardiovascular imaging, cancer imaging, nanomedicine (molecular imaging and drug delivery), and image processing in the preclinical and clinical settings.

CLINICAL IMAGING CORE

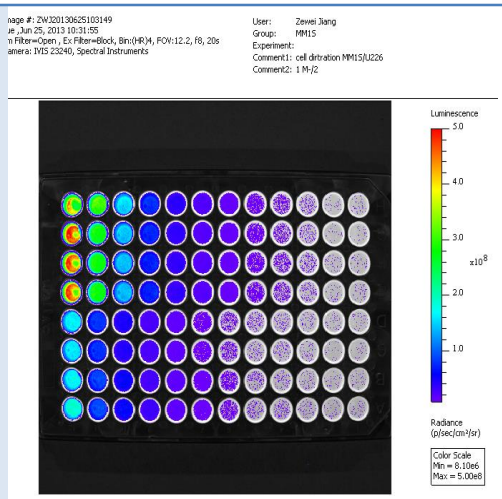




Low-dose CT

PRE-CLINICAL IMAGING CORE


7T: Lung Tumor (T2W) ***Dr. Goutham Narla***



Bioluminescent image with Firefly luciferase tumor cells in 96 wells plate from Zewei Jiang (Dr. Samir Parekh's lab)

RESEARCH HIGHLIGHT:
ASSESSMENT OF LIVER DAMAGE USING ELASTOGRAPHY METHODS

All chronic liver insults—viral, toxic, genetic, or autoimmune—can cause typical hepatic inflammation that ultimately leads to hepatic scarring and cirrhosis, with a high risk factor of liver dysfunction, gastrointestinal bleeding, and liver cancer. The assessment of fibrosis in chronic liver disease is pivotal for assessing prognosis and guiding management. Liver biopsy is considered the best technique for fibrosis assessment and stage classification. However, it is an invasive procedure with possible complications that limit its repeated uses.

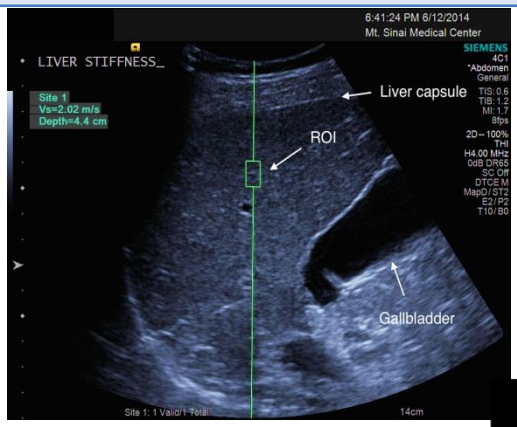
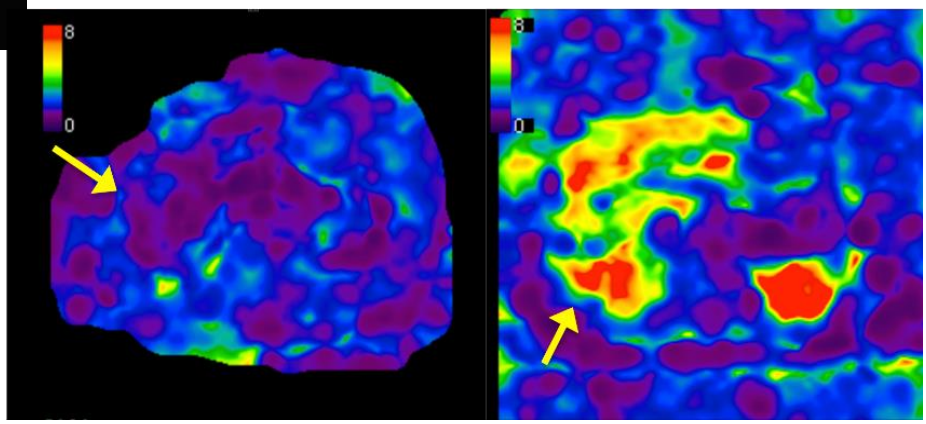


Fig. 1: ARFI ultrasound liver imaging measurement in a 56-year-old man with liver cirrhosis.

ROI = region of interest.

Liver stiffness was high, at 2.2 m/s.



Normal liver ***Cirrhosis***

Fig. 2: Two examples of MR elastography in a patient with normal liver and a patient with liver cirrhosis.

The normal liver appears blue (arrow), while the cirrhotic liver demonstrates yellow and red colors (arrow), in relation with higher liver stiffness.

In addition, there is potential variability at microscopic evaluation between different pathologists. Unfortunately, conventional imaging techniques such as ultrasound, magnetic resonance imaging (MRI), and computed tomography (CT) are not able to correctly identify liver damage except when advanced. Therefore, non-invasive methods for assessment of liver damage have been an intense field of research, and several non-invasive imaging methods have been developed. These include:

- ❖ Ultrasound-Based Techniques—FibroScan and Acoustic Radiation Force Impulse Imaging (ARFI)
- ❖ Magnetic Resonance (MR) Techniques—MR Elastography (MRE)

Both methods evaluate liver fibrosis measuring the velocity of “vibration waves,” induced in the liver that increases in the abnormal liver.

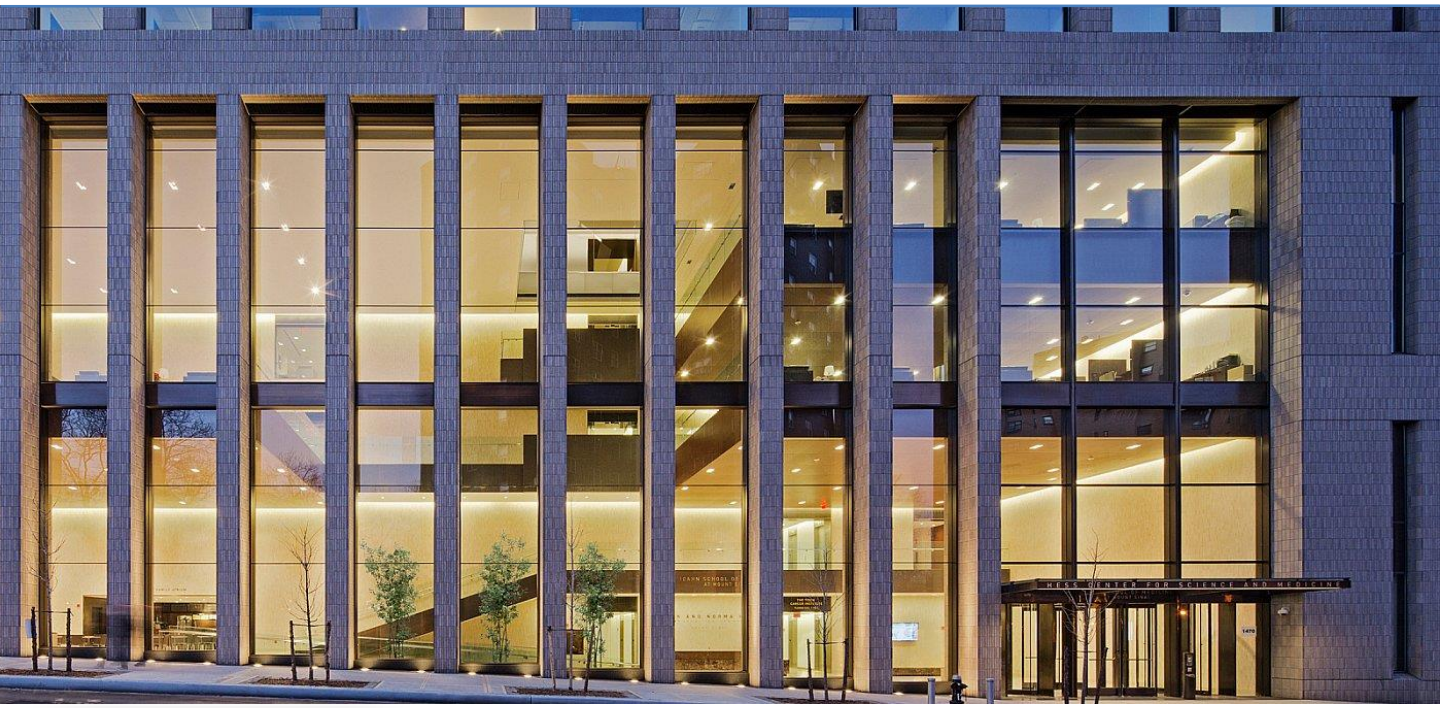
Bachir Taouli, MD, Professor of Radiology and Director of Body MRI and Cancer Imaging at the Icahn School of Medicine at Mount Sinai, leads a team of researchers dedicated to evaluating and developing these new techniques. Thanks to the Mount Sinai state-of-the-art magnetic resonance and ultrasounds systems, his group is trying to achieve an accurate and safe method for the diagnosis of liver fibrosis, in order to get a better management of these patients, reducing the need for liver biopsies.

TAOULI LABORATORY

Bachir Taouli, MD
Professor of Radiology and Medicine
Director, Cancer Imaging

The Quantitative Body Imaging Group develops, tests and validates quantitative MR imaging techniques applied to body imaging. Our current research includes the optimization and validation of novel functional MRI techniques applied to diffuse and focal liver diseases, including diffusion-weighted MRI, dynamic contrast enhanced MRI, MR Elastography, flow quantification, spectroscopy and multi echo Dixon methods.

LEADERSHIP



Dr. Zahi Fayad is Director of the Imaging Research Center and the Translational and Molecular Imaging Institute, Director and Founder of the Eva Morris Feld Imaging Science Laboratories, and Director of Cardiovascular Molecular Imaging Research at the Icahn School of Medicine at Mount Sinai. He is a world leader in the development and use of multimodality cardiovascular imaging including: cardiovascular magnetic resonance (CMR), computed tomography (CT), positron emission tomography (PET). He holds twelve U.S. and worldwide patents and/or patent applications.

Dr. Fayad is the recipient of multiple prestigious awards and was recently honored with the John Paul II Medal from the City of Krakow, Poland, in recognition of the potential positive impact of his work on humankind and he holds the title of Honorary Professor in Nanomedicine at Aarhus University in Denmark. In 2013, he was elected Fellow of the International Society of Magnetic Resonance In Medicine, Magnetic Resonance Imaging, received a Distinguished Reviewer from Magnetic Resonance in Medicine, and was selected as an Academy of Radiology Research, Distinguished Investigator.

In 2014 his alma mater, Bradley University, awarded him its highest honor, the Centurion Society Award, for bringing national and international credit to his university. Dr. Fayad has authored more than 300 peer-reviewed publications, 50 book chapters, and more than 400 meeting presentations. He is currently the principal investigator of four federal grants/contracts funded by the National Institutes of Health's National Heart, Lung and Blood Institute and the National Institute of Biomedical Imaging and Bioengineering, with a recent large award from NHLBI to support the Program of Excellence in Nanotechnology. In addition, he serves as principal investigator of the Imaging Core of the Mount Sinai National Institute of Health (NIH)/Clinical and Translational Science Awards.

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If you wish to make a donation to support the Translational & Molecular Imaging Institute, please contact:
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646.605.8742 or victoria.medford@mountsinai.org