

Foreword

On behalf of the organizing committee, I would like to welcome you to *The Second International Workshop on Polarized Carbon-13 and its Applications in Metabolic Imaging*. Over the course of this three-day workshop, leading experts from a variety of fields will present their current research and discuss how significant biological problems can be probed with polarized carbon-13 technology.

The academic sessions of this workshop will cover a wide range of clinically relevant topics including, but not necessarily limited to, molecular pathways, systems biology of the mitochondria, and metabonomics utilizing both hyperpolarized and thermally polarized carbon-13 MRI/MRS. In addition, discussion of the most recent advances in hardware development and pulse sequence design will be included.

In planning this workshop, the organizing committee has sought to unify aspects of molecular biology, medicine, physical chemistry, and engineering with the intention of appealing to a broad audience of investigators, post-doctoral fellows, clinical fellows, and students at all levels interested in metabolic imaging. This workshop will bring its audience to the forefront of cutting edge research involving a new and exciting technological breakthrough and emphasize the power of modern interdisciplinary science.

It is my utmost pleasure to welcome you to our campus.

Rahim R. Rizi, Ph.D.
Associate Professor of Radiology

Program Schedule

Wednesday, July 22, 2009

6:00 – 8:00 PM Registration

Thursday, July 23, 2009

7:30 – 8:00 AM Breakfast

8:00 – 8:15 AM **Welcome and Introduction**
Rahim R. Rizi
University of Pennsylvania

Special Lecture

8:15 – 9:00 AM **¹³C MRS of Modular Pathways**
Robert Shulman
Yale University

General Session

Moderator: Jerry Glickson, Ph.D.

9:00 – 9:40 AM **Systems Biology of the Mitochondria**
Robert Balaban
National Institutes of Health

9:40 – 9:55 AM **Refreshment Break**

9:55 – 10:30 AM **¹³C MRS Studies of Neurotransmitter Metabolism in Humans**
Douglas Rothman
Yale University

10:30 – 11:05 AM **Causes and Consequences of Acid pH in Tumors**
Robert Gillies
University of South Florida

11:05 – 11:40 AM **pH Mapping with Hyperpolarized ¹³C-Bicarbonate**
Ferdia Gallagher
University of Cambridge

11:40 – 12:10 PM **Discussion**

12:10 – 1:00 PM **Lunch**

Applications of Carbon-13 in Metabolism - Session I

Moderator: R. Nick Bryan, M.D., Ph.D.

1:00 – 1:40 PM **Preclinical Studies in Animal Models using Hyperpolarized ¹³C MR**
Daniel Vigneron
University of California - San Francisco

1:40 – 2:15 PM **Imaging TCA Cycle Metabolism by PHIP Hyperpolarization of ¹³C Succinate *In Vivo***
Brian Ross
Huntington Medical Research Institute

2:15 – 2:50 PM **Following the Flow: Revealing Brain Metabolic Pathways and Cellular Compartmentation using MRS with Different ¹³C-labeled Substrates**
Kevin Behar
Yale University

2:50 – 3:10 PM **Discussion**

3:10 – 3:25 PM **Break**

3:25 – 4:00 PM **¹³C MRS and Metabolic Modeling in the Brain**
Pierre-Gilles Henry
University of Minnesota Medical School

4:00 – 4:35 PM **State-of-the-Art ¹³C and ¹H-[¹³C] NMR Methods to Study Cerebral Metabolism**
Robin de Graaf
Yale University

4:35 – 5:10 PM

***In Vivo* ¹³C, ¹⁵N, and ⁶Li Rat Brain Studies using DNP-enhanced tracers**

Arnaud Comment

Ecole Polytechnique Fédérale de Lausanne, Switzerland

5:10 – 6:00 PM

Panel Discussion

6:00 – 8:00 PM

Poster Session

Friday, July 24, 2009

7:30 – 8:00 AM

Breakfast

Technological Advances in Hyperpolarized Carbon-13 - Session I

Moderator: Joachim Bargon, Ph.D.

8:00 – 8:45 AM

High Frequency Dynamic Nuclear Polarization in Solids and Liquids

Robert Griffin

Massachusetts Institute of Technology

8:45 – 9:25 AM

A Liquid-State Shuttle DNP Spectrometer for 600 MHz High-Resolution NMR: Construction and Results for ¹H and ¹³C Sensitivity Enhancement

Christian Griesinger

9:25 – 10:05 AM

Long-Lived Nuclear Spin States: Opportunities for Hyperpolarized NMR

Malcolm H. Levitt

Southampton University, UK

10:05 – 10:20 AM

Discussion

10:20 – 10:35 AM

Refreshment Break

Technological Advances in Hyperpolarized Carbon-13 - Session II

Moderator: Mitchell Schnell, M.D., Ph.D.

10:35 – 11:15 AM

Breaking the T₁ Barrier with Hyperpolarized Disconnected Eigenstates

Warren S. Warren

Duke University

11:15 – 11:55 AM

Probing Heart Metabolism by Hyperpolarized ¹³C

Craig Malloy

University of Texas, Southwestern

11:55 – 12:35 PM

Proton-Mediated ¹³C and ¹⁵N Dynamic Nuclear Polarization in Solution State

Song-I Han

University of California - Santa Barbara

12:35 – 12:50 PM

Discussion

12:50 – 1:30 PM

Lunch

Applications of Carbon-13 in Metabolism - Session II

Moderator: Morris Birnbaum, M.D., Ph.D.

1:30 – 2:00 PM

Advances in Hyperpolarized ¹³C-Metabolic Imaging - Prospects for Neuro Studies

Ralph Hurd

GE Healthcare

2:00 – 2:30 PM

Mechanism of Action of Hyperpolarized 1,4-¹³C₂ Fumarate *In Vivo*: A New Diagnostic Agent for Oncology

Mathilde Lerche

Imagnia AB, Sweden

2:30 – 3:00 PM

Probing Cardiac Metabolism with DNP-MR

Damian Tyler

University of Oxford, United Kingdom

3:00 – 3:30 PM

Detection of Glutaminolysis and Cell Proliferation with Hyperpolarized ^{13}C Glutamine

Anthony Mancuso
University of Pennsylvania

3:30 – 3:45 PM

Discussion

3:45 – 4:15 PM

Break

**Pulse Sequences and Hardware for NMR of Hyperpolarized Nuclei
Moderator: John P. Mugler, Ph.D.**

4:15 – 4:40 PM

MRI of Hyperpolarized Magnetization: Opportunities and Challenges

John P. Mugler
University of Virginia

4:40 – 5:05 PM

Xenon Biosensors for *In Vivo* Magnetic Resonance Imaging

Ivan Dmochowski
University of Pennsylvania

5:05 – 5:30 PM

Hyperpolarized ^{13}C : Data Acquisition Strategies

Charles Cunningham
University of Toronto

5:30 – 5:55 PM

Accelerated Spectroscopic Imaging with Polarized ^{13}C Using Radial Acquisition and IDEAL

Sean Fain
University of Wisconsin

5:55 – 6:20 PM

Compressed Sensing for Rapid MRSI Acquisitions

Michael Lustig
Stanford University

6:20 – 6:45 PM

Coil Development for Parallel MRI of Hyperpolarized Nuclei

Charles McKenzie
Robarts Research Institute

6:45 – 7:00 PM

Discussion

Saturday, July 25, 2009

7:30 – 8:00 AM

Breakfast

**Techniques for Carbon-13 NMR Spectroscopy
Moderator: Douglas Rothman, Ph.D.**

8:00 – 8:40 AM

Conventional Magnetic Resonance Spectroscopic Techniques

Peter Barker
Johns Hopkins University

8:40 – 9:20 AM

Reaction Kinetics and Mechanisms by Hyperpolarized ^{13}C NMR

Christian Hilty
Texas A&M University

9:20 – 9:35 AM

Discussion

9:35 – 9:50 AM

Refreshment Break

**Other Applications of Carbon-13 NMR
Moderator: Masaru Ishii, M.D., Ph.D.**

9:50 – 10:30 AM

Steady and Non-Steady State Measurements of Pyruvate Dehydrogenase (PDH) Flux in the Physiologically Performing Heart

Rolf Bunger
Uniformed Services University of the Health Sciences

10:30 – 10:55 AM	High Time Resolution Kinetics as Measured by Hyperpolarization and NMR Matthew Merritt University of Texas - Southwestern
10:55 – 11:20 AM	Correlation between Tumor Oxygen Status and Metabolism of Hyperpolarized Pyruvic Acid Murali Cherukuri National Institutes of Health
11:20 – 11:45 AM	¹³C - Mamma Mia! Per Åkeson Copenhagen University
11:45 – 12:10 PM	Fast Enzyme-Specific Exchange Reactions for ¹³C MRS and MRI Jun Shen National Institutes of Health
12:10 – 12:30 PM	FLT-PET as a Measure of Response Prediction in Lung Cancer Sharyn Katz University of Pennsylvania
12:30 – 12:45 PM	Discussion
12:45 – 1:30 PM	Lunch

A Series of Short Presentations on Hyperpolarized Carbon-13 - Session I
Moderator: Robert Lenkinski, Ph.D.

1:30 – 1:42 PM	Using Hyperpolarized Pyruvate to Assess Tumor Response to Therapies Based on LDH-A Inhibition Aaron Grant Beth Israel Deaconess Medical Center
1:42 – 1:54 PM	¹³C DNP NMR of Nanomoles of Metabolic Tracers Debadeep Bhattacharyya Oxford Instruments - Magnetic Resonance
1:54 – 2:06 PM	Measuring Michaelis-Menten Enzyme Kinetics Using Hyperpolarized ¹³C-pyruvate Daniel Spielman Stanford University
2:06 – 2:18 PM	T₁ Measurements of Contrast-Agent-Enhanced Hyperpolarised [¹⁻¹³C]-Pyruvic Acid Lanette F. Waldner Robarts Research Institute, Canada
2:18 – 2:30 PM	Improved Stimulated Echo Method for Hyperpolarized ¹³C Peder E.Z. Larson University of California - San Francisco
2:30 – 2:42 PM	Probing the <i>In Vivo</i> Compartmentalization of Hyperpolarized Pyruvate using Gadodiamide-induced T₁ Relaxation Eric T. Peterson University of Wisconsin – Madison
2:42 – 2:54 PM	Effects of UCP3 Overexpression on Mouse Muscle Mitochondrial Function <i>In Vivo</i> Douglas E. Befroy Yale University
2:54 – 3:10 PM	Break

A Series of Short Presentations on Hyperpolarized Carbon-13 - Session II
Moderator: Charles Cunningham, Ph.D.

- 3:10 – 3:22 PM** **Substitution of Protons by Deuterons in Choline and Dopamine for Hyperpolarized MRSI**
Hyla Allouche-Arnon
Hebrew University of Jerusalem, Israel
- 3:22 – 3:34 PM** **^{13}C MRS During [$3\text{-}^{13}\text{C}$]-Lactate Infusion Under Hyperinsulinemic-Hypoglycemic Conditions Reveals Compartmentalized Lactate Metabolism in Human Brain**
Henk M. De Feyter
Yale University
- 3:34 – 3:46 PM** **Hyperpolarized ^{13}C MR Metabolic Imaging: Application to Brain Tumors**
Ilwoo Park
University of California - San Francisco
- 3:46 – 3:58 PM** **PHIP Studies on Ethyl Propiolate Using an Effective Para-Hydrogen Generator**
Ayelet Gamliel
Hebrew University of Jerusalem, Israel
- 3:58 – 4:10 PM** **^{19}F -MRI and Field Cycling Experiments using Hyperpolarized Substrates**
Ute Bommerich
Leibniz Institute for Neurobiology, Germany
- 4:10 – 4:22 PM** **Dynamic ^{13}C Metabolic Modeling as a Tool for Analysis of Cancer Metabolism with Combined ^{13}C NMR/Bioreactor Technique**
Alexander A. Shestov
University of Minnesota
- 4:22 – 4:50 PM** **Discussion**
- 4:50 – 5:00 PM** **Final Remarks**
Masaru Ishii
Johns Hopkins University