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## Letter From The President

Many members of our Society will soon be observing the 20th anniversary of Magnetic Resonance Imaging in clinical practice. This occasion will provide an excellent opportunity for clinicians and researchers in diagnostic imaging to remind our medical colleagues of the profound contribution to clinical care that has resulted from the introduction of high-tech medical imaging. For example, until the 1980's, surgery for purely exploratory purposes was still a relatively common procedure. With wider use of powerful imaging technologies providing a "window" into the human body, such exploratory surgery is now essentially a thing of the past.

While industry has played an important role in the development of MRI technology, it is remarkable that many of the most critical advances have been pioneered by individual researchers at universities and medical institutions.

It is thus ironic that research in medical imaging technologies has long been regarded by many in the medical research community as somehow less meritorious than traditional disease-oriented research. Historically, these attitudes have placed some researchers in imaging science at a disadvantage in competing for grant funding from federal agencies.

Fortunately, these attitudes are changing. For instance, the National Cancer Institute, one of the largest funding agencies within the US National Institutes of Health has formally recognized imaging research as one of several "Extraordinary Opportunities for Investment" over the last several years and has become a major supporter of such research. In 2001, the new National Institute of Biomedical Imaging and Bioengineering was formed at the NIH. A prominent member of our Society, Dr. Roderic Pettigrew, has recently been appointed as the first permanent Director of this Institute. In addition, another prominent member of our Society, Dr. Elias Zerhouni, has become the first Radiologist to serve as Director of the NIH.

Such events signal an increasing recognition by the medical research community of the importance (and legitimacy) of basic and applied research in imaging and bioengineering. This is a worldwide phenomenon that should contribute to the career success of the many members of the ISMRM who depend on medical research grant funding for their work.

Historically, the ISMRM has been proactive in its advocacy for imaging research. It has provided support to groups such as the Academy of Radiology Research (an alliance of 26 Societies and organizations). We have sent delegates to intersociety meetings focused on research funding and have sponsoring workshops on the topic. These efforts, mandated by our Articles of Incorporation, are bearing fruit, but must be continued.

I would deeply appreciate any comments or suggestions from members of our Society on how we can be more effective in this important mission.

— Richard L. Ehman, ISMRM President

## THE MEETING

The Eleventh Scientific Meeting & Exhibition of the International Society for Magnetic Resonance in Medicine will take place 10-16, May 2003 at the Metro Toronto Convention Centre in Toronto, Ontario, Canada. The program for the ISMRM Scientific Meeting will be available online via the Personal Itinerary Builder provided through the ISMRM Website (<http://www.ismr.org>). Please call the ISMRM office for more information or e-mail [info@ismrm.org](mailto:info@ismrm.org).

## CALL FOR PAPERS

The Scientific Program Committee invites Abstract submissions to be presented in oral and poster sessions at the ISMRM Eleventh Scientific Meeting and Exhibition. Submissions must contain new, previously unpublished material. **The deadline for online receipt of Abstracts is 20 November 2002.**

All Abstracts must be submitted electronically, via the ISMRM Website. No paper forms will be available. Any abstract submitted on an old paper form will not be considered for review.

A 100-word synopsis of each abstract will be printed in the Program Book. This synopsis will also appear at the beginning of the Abstract (i.e., first paragraph). It should include a brief description of the problem, methods, results, and conclusions. It must include text only, with no equations or images and no references or citations to items described in the Abstract. If the submitted synopsis is longer than 100 words, it will be cut short in the Program Book.

The Abstract should be submitted in a single-column format, according to the instructions found online. You will be able to compose your abstract and then upload it for submission.

Detailed instructions for submission are posted on the ISMRM Website. You may also receive submission information by calling, faxing, or writing to the International Society for Magnetic Resonance in Medicine, 2118 Milvia Street, Suite 201, Berkeley, California 94704, USA.

Telephone: +1 510 841 1899

FAX: +1 510 841 2340

E-mail: [info@ismrm.org](mailto:info@ismrm.org)

Website: <http://www.ismr.org>

## Information for Authors

### ABSTRACT SUBMISSIONS

Only online submissions will be accepted. Log on to the ISMRM Website (<http://www.ismr.org/03>). Click on "Online Abstract Submission" and follow the instructions.

### ABSTRACT SUBMISSION WITHDRAWAL

Written requests for withdrawal of Abstract submissions from the scientific program, signed by the first author, must be received by 20 January 2003 at the ISMRM Central Office.

### LETTERS OF NOTIFICATION

Authors will be notified of the decision of the Scientific Program Committee in February 2003.

### VIDEO AND DIGITAL DATA PRESENTATIONS

Digital Data/Video Projection will be available at all oral sessions. If you wish to be considered for single-slide 35mm projection, you must indicate this at the time of submission. A further description will be sent to you following acceptance of your abstract for oral presentation.

## New Features for 2003

### THE 2003 ISMRM SCIENTIFIC MEETING WILL OFFER THE FOLLOWING NEW SERVICES:

- The Proceedings will be published on CD-ROM only. A paper version of the Program Book, including the 100-word synopsis, will be provided.
- The full text of all accepted abstracts will be available online two weeks before the meeting to pre-registered attendees only. If you wish to have access to the Proceedings before the meeting, you must pre-register.
- During the meeting, a wireless network will be provided through which you will be able to read your email and access the Internet with your laptop. A limited number of email kiosks will be available as well.





INTERNATIONAL SOCIETY  
FOR MAGNETIC RESONANCE IN MEDICINE

# Eleventh Scientific Meeting and Exhibition

10-16 MAY 2003

## IMPORTANT DATES

### 20 NOVEMBER 2002

Deadline for online receipt of Abstract submissions.

### 20 NOVEMBER 2002

Deadline for receipt of Student Stipend Applications.

### 20 NOVEMBER 2002

Deadline for receipt of Clinical Resident Stipend Applications.

### 20 NOVEMBER 2002

Deadline for receipt of New Entrant Stipend Applications.

### 20 NOVEMBER 2002

Deadline for receipt of E.K. Zavoisky Stipend Applications.

# Toronto, Ontario, Canada

## NEUROIMAGING

*Yukio Miki and Michael D. Phillips, Organizers*

**Saturday, 10 May, 09:00 - 17:50 and**

**Sunday 11 May, 08:30 -15:00**

### EDUCATIONAL OBJECTIVES

Upon completion of the course, participants should be able to:

- Describe fundamental principles of diffusion MR, diffusion-tensor MR, perfusion MR and BOLD imaging;
- Describe the current status of high-field neuroimaging;
- Apply new techniques in stroke, infection, metabolic disease, white matter disease, seizures, cognitive disorders, and brain tumors;
- Describe strength and weakness of MR perfusion imaging vs. CT perfusion imaging, MR angio-graphy vs. CT angiography, and MR head-and-neck imaging vs. CT head and neck imaging;
- Explain the role of various MR techniques in the diagnosis of diseases of the spine, and head and neck;
- Discuss the role of MR techniques in the workup of patients with stroke, white matter disease, infection/inflammation, brain tumors, vascular malformations, epilepsy and pituitary disorders;
- Apply MR techniques in various pediatric diseases of the central nervous system.

### PROGRAM

**Day 1: Saturday, 10 May**

#### Physics and Techniques

09:00 **fMRI/BOLD: Physics Basics**

*Jonathan Burdette*

09:30 **Physics in Diffusion/DTI/Perfusion Imaging**

*Timothy P.L. Roberts*

10:00 **Imaging at 3T and Beyond**

*A. Gregory Sorensen*

10:30 Break

#### Clinical Applications and Modalities

10:50 **Perfusion Imaging: CT vs. MR**

11:20 **Diffusion Imaging Applications in Stroke, Infection, and Metabolic Disease**

*Michael D. Phillips*

11:50 **DTI Applications in White Matter Disease and Assessment of Neural Networks**

*Susumu M. Mori*

12:20 Break

14:00 **Applications of MRA vs. CTA**

14:30 **Clinical fMRI - Pre-op, Seizures, Cognitive Disorders**

*Vincent Mathews*

15:00 **Diffusion and Perfusion Imaging of Brain Tumors**

*Yukunori Korogi*

15:30 Break

**Spine and Spinal Cord**

- 15:50 **Degenerative Diseases of the Spine**  
*Jeffrey S. Ross*
- 16:10 **Imaging of the Postoperative Spine**  
*Michael T. Modic*
- 16:30 **Intramedullary and Extramedullary Tumors of the Spinal Cord**  
*Yuichi Inoue*

**Head and Neck**

- 16:50 **Head and Neck Tumors**  
*To be announced*
- 17:10 **Postoperation/Post-Radiation Imaging**  
*Suresh Mukherji*
- 17:30 **MR vs. CT in Head and Neck Imaging**  
*To be announced*
- 17:50 Adjournment

**Day 2: Sunday, 11 May****Clinical Topics, Brain: General**

- 08:30 **Stroke (Acute Stroke and Work-up)**  
*William T.C. Yuh*
- 09:00 **White Matter Diseases**  
*Vincent Dousset*
- 09:30 **Infection**  
*Mark A. van Buchem*
- 10:00 Break
- 10:20 **Brain Tumors (General)**  
*To be announced*
- 10:50 **MRI of Intracranial Vascular Malformations**  
*Kazuhiro Tsuchiya*
- 11:20 **MRI of Epilepsy**  
*Kee-Hyun Chang*
- 11:40 **Pituitary and Parasellar Diseases**  
*Yukio Miki*
- 12:00 Break

**Pediatrics**

- 13:30 **Metabolic Diseases of Children**  
*Peter B. Barker*
- 14:00 **Pediatric Tumors**  
*Elias R. Melhem*
- 14:30 **Newborn Brain Injury Imaging**  
*Robert A. Zimmerman*
- 15:00 Adjournment

**ADVANCED BODY MRI**

*Donald G. Mitchell and Caroline Reinhold, Organizers*

**Saturday, 10 May, 08:30 - 17:40 and  
Sunday 11 May, 08:00 - 15:00**

**EDUCATIONAL OBJECTIVES**

Upon completion of the course, participants should be able to:

- Evaluate and recommend pulse sequence strategies that will optimize body MR imaging and MR angiography;
- Describe cost-effective indications for MR imaging throughout the body;

- Evaluate new pulse sequences based on existing knowledge of MRI techniques, allowing continuous improvement of body MRI and MRA protocols;
- Implement modern MR applications for diagnosing chest, abdominal, pelvic and vascular diseases;
- Incorporate into their practices recent developments for MR imaging of the pancreas and biliary tract, including MR cholangiopancreatography, and for comprehensive evaluation of the kidneys;
- Diagnose abdominal vascular disease using state of the art MR angiographic techniques;
- Identify new diagnostic opportunities in MR body imaging.

**PROGRAM****Day 1: Saturday, 10 May**

- 08:30 **MRI Safety– FAQ and Controversies**  
*Frank G. Shellock*
- 09:00 **Body MRI Techniques**  
*Eric Outwater*
- 09:40 **Body MRI at 3.0 T**  
*Neil M. Rofsky*
- 10:20 Break
- 10:40 **Focal Liver Lesions– Pattern Recognition**  
*Richard Semelka*
- 11:15 **Diffuse Liver Disease, Nodules**  
*Donald G. Mitchell*
- 11:50 **Pancreas**  
*Celso A. Matos*
- 12:30 Break
- 14:00 **Biliary System**  
*Riccardo Manfredi*
- 14:45 **Ovaries: Benign Disease**  
*Evan S. Siegelman*
- 15:30 Break
- 15:50 **Uterus: Benign Disease**  
*Caroline Reinhold*
- 16:30 **Gynecologic Malignancy**  
*Lawrence H. Schwartz*
- 17:10 **Breast MRI**  
*Bruce L. Daniel*
- 17:40 Adjournment

**Day 2: Sunday, 11 May**

- 08:00 **Modern Body MRA Techniques**  
*Vincent B. Ho*
- 08:40 **Aortic Dissection and Aneurysm**  
*Thomas M. Grist*
- 09:20 **Peripheral Vascular Disease**  
*Stefan G. Ruehm*
- 10:00 Break
- 10:20 **Comprehensive Renal Imaging**  
*Vivian S. Lee*
- 11:10 **Bowel: Ischemia and Other Diseases**  
*Russell N. Low*
- 12:00 Break
- 13:30 **MRI for Screening**  
*Jörg F. Debatin*

**14:15 Imaging Assessment of Tumor Response**

*Anwar R. Padhani*  
15:00 Adjournment

**BRAIN FUNCTION AND fMRI**

*Peter Jezzard, Douglas C. Noll, and  
Steve C.R. Williams, Organizers*

**Saturday, 10 May, 08:30 - 17:45 and  
Sunday 11 May, 08:40 - 15:10**

**EDUCATIONAL OBJECTIVES**

Upon completion of the course, participants should be able to:

- Identify the principal areas of the brain used in sensory perception, motor activity, language, and cognition;
- Describe the way in which these cortical areas inter-communicate, both at the electrical and chemical level;
- Describe the associated hemodynamic responses of the brain that accompany electrical and metabolic activity;
- Define and compare the various MRI pulse sequences that can be used to map human brain function;
- Identify the sources of artifacts that are inherent in many fMRI procedures and describe methods to minimize these artifacts;
- Design a simple fMRI paradigm, and describe the principles used in data analysis;
- Explain the principles of perfusion based fMRI and the methods used to construct maps of white matter tracts;
- Identify the areas of application of fMRI in neurology, psychiatry and basic neuroscience.

**PROGRAM****Day 1: Saturday, 10 May**

- 08:30 **Introduction**  
*Course Chairs*
- Session I: Functional Anatomy and Connectivity**
- 08:40 **Grey Matter Functional Specialization**  
*Arno Villringer*
- 09:15 **Fiber Tracts and Structural Connectivity in the Human Brain: What Anatomy Can Contribute**  
*Karl Zilles*
- 09:50 **Neuronal Anatomy and Electrical Activity**  
*Nikos Logothetis*
- 10:25 Break



**Session II: Neurochemistry and Metabolic Response**

10:45 **Neurochemistry and Neurotransmitter Systems**  
*Kelvin O. Lim*

11:20 **Neuronal Metabolism**  
*Nicola R. Sibson*

11:55 **Hemodynamic Responses to Neuronal Activity**  
*Richard B. Buxton*

12:30 Break

**Session III: The BOLD Signal**

14:00 **Sources of BOLD Signal/Field Strength Issues**  
*Charles S. Springer*

14:35 **Temporal BOLD Characteristics and Non-Linearity**  
*Douglas C. Noll*

15:10 **Spatial Resolution Limits**  
*Ravi S. Menon*

15:45 Break

**Session IV: fMRI Pulse Sequences and Artifacts**

16:05 **BOLD fMRI Sequences**  
*Peter Jezzard*

16:40 **Susceptibility Artifacts**  
*Lawrence L. Wald*

17:15 **Physiological/Intrinsic Noise and Motion Artifacts**  
*Gunnar Krueger*

17:45 Adjournment

Sunday, 11 May

**Session V: Experimental Design and Data Analysis**

08:40 **Experimental Paradigm Design**  
*Nick F. Ramsey*

09:15 **Pre-Statistics**  
*Stephen M. Smith*

09:50 **Data Modeling, General Linear Model, Statistical Inference**  
*Thomas E. Nichols*

10:25 Break

**Session VI: Non-BOLD Methods**

10:45 **Functional Perfusion MRI**  
*Eric C. Wong*

11:20 **Connectivity Mapping Using DTI**  
*Derek K. Jones*

12:00 Break

**Session VII: Clinical and Neuroscience Applications**

13:30 **Design of a Clinical fMRI Protocol**  
*Steve C.R. Williams*

13:55 **fMRI of Neurological Disorders**  
*Steven C. Cramer*

14:20 **fMRI of Drug Abuse**  
*Thomas Ernst*

14:45 **Neuroscience Applications**  
*John Jonides*

15:10 Adjournment

**MR PHYSICS FOR PHYSICISTS**

*Michael H. Buonocore, Peter M. Jakob, and John P. Mugler, III, Organizers*

Saturday, 10 May, 08:30 - 17:50 and

Sunday, 11 May, 08:00 - 14:50

**EDUCATIONAL OBJECTIVES**

Upon completion of the course, participants should be able to:

- Describe the fundamental properties of the NMR signal;
- Explain the basic physics, signal processing and instrumentation for signal detection and image reconstruction;
- Describe the common and exotic mechanisms for spin polarization;
- Describe the spin physics and dynamic equilibrium that are used to create images;
- Describe advanced image reconstruction methods, including those used in parallel imaging;
- Identify and describe special hardware used in MRI;
- Describe pulse sequence and processing methods for special applications.

**PROGRAM**

Day 1: Saturday, 10 May

**Signal Properties**

08:30 **Quantum Mechanical Description of Spin Dynamics and Magnetization**  
*Robert W. Brown*

08:55 **Transition to the Semi-Classical Description**  
*James Tropp*

09:20 **Multiple-quantum Coherence, Intermolecular Spin Orders**  
*Jianhui Zhong*

**Basic Signal Detection and Image Reconstruction**

09:45 **The MRI Receiver Chain**  
*Steven M. Wright*

10:10 Break

10:35 **Signal Processing for MRI**  
*Richard G.S. Spencer*

11:00 **Measurements of Image Quality: SNR, CNR, Optimization**  
*Dennis L. Parker*

11:25 **Field Dependence of Power Deposition and SNR**  
*Christopher M. Collins*

**Mechanisms of Spin Polarization**

11:50 **Hyperpolarization of Noble Gases: Physical Methods**  
*Gordon Cates*

12:15 Break

13:45 **Imaging Gases Under Non-equilibrium Conditions**  
*Kai Ruppert*

14:10 **Polarization of Carbon-13**  
*Oskar Axelsson*

14:35 **Prepolarized MRI**

*Steven M. Conolly*

**Spin Physics and Dynamic Equilibrium in Imaging**

15:00 **Multidimensional RF Pulse Design**  
*Peter Boernert*

15:25 Break

15:45 **The Phase-graph Concept for Understanding Spin Echoes**  
*Jürgen Hennig*

16:10 **Magnetization Vector Behavior in SSFP Sequences**  
*Klaus Scheffler*

**Advanced Image Reconstruction**

16:35 **Introduction: from K-Space to Image Space**  
*Zhi-Pei Liang*

17:00 **Gridding Procedures for Non-Cartesian K-space Trajectories**  
*Douglas C. Noll*

17:25 **Artifacts and Correction Algorithms**  
*Joseph V. Hajnal*

17:50 Adjournment

Sunday, 11 May

**Advanced Image Reconstruction**

08:00 **Image Reconstruction from Limited Data, General Methods**  
*Xiaoping Hu*

08:25 **Image Reconstruction from Limited Data: MRA Techniques**  
*Walter Block*

**Parallel Imaging Physics**

08:50 **Foundations of Parallel Imaging**  
*Peter Kellman*

09:15 **Advanced Methods for Parallel Imaging (Autocalibration, Adaptive Processing)**  
*Mark A. Griswold*

09:40 **Parallel Imaging Applications**  
*David J. Larkman*

10:05 Break

10:25 **Principles of RF Coil Design for Parallel Imaging**  
*Patrick J. Ledden*

**Hardware**

10:50 **Gradient Coil Design**  
*Richard W. Bowtell*

11:15 **Technical Considerations in Developing High Field (>3T) Systems**  
*J. Thomas Vaughan*

**Applications with Special Pulse Sequences and Processing**

11:40 **Arterial Spin Labeling for Perfusion Measurements**  
*David Alsop*

12:05 Break

13:35 **Diffusion Tensor Imaging**  
*Peter J. Basser*

*continued*

- 14:00 **Velocity Measurement and Flow Quantification**  
*Norbert J. Pelc*
- 14:25 **MR Elastography**  
*Armando Manduca*
- 14:50 Adjournment

## CARDIAC IMAGING

*David A. Bluemke, Vivian S. Lee, and Eike Nagel, Organizers*

**Saturday, 10 May, 08:30 - 18:00**

### EDUCATIONAL OBJECTIVES

Upon completion of the course, participants should be able to:

- Select the basic sequence type used for the assessment of cardiac anatomy, left ventricular function and flow;
- List the current recognized indications in cardiovascular imaging as well as to define those under investigation;
- Appraise and critique the value of MR for the assessment of ischemic heart disease;
- Interpret CMR examinations of cardiac masses and ARVD;
- Describe the current value of MR imaging of the coronary arteries and atherosclerotic plaques and list its limitations;
- Determine left ventricular mass and function.

### PROGRAM

*The final five minutes of each presentation will be reserved for questions.*

- 08:30 **Understanding New Cardiac MR Pulse Sequences**  
*J. Paul Finn*
- 09:05 **MRI of Cardiac Valvular Disease**  
*Christopher M. Kramer*
- 09:40 **MRI of Global and Regional LV Function**  
*Albert C. van Rossum*
- 10:15 Break
- 10:35 **MR Dobutamine Stress Testing**  
*Eike Nagel*
- 11:10 **MR Perfusion Imaging of Ischemia**  
*Jürg Schwitler*
- 11:45 **MRI of Myocardial Viability**  
*Raymond J. Kim*
- 12:20 **Questions/Summary**
- 12:30 Break
- 14:00 **MRI of Cardiac Masses and Pericardium**  
*Scott D. Flamm*
- 14:35 **MRI of ARVD**  
*Dudley J. Pennell*
- 15:05 **MRI of LV Cardiomyopathy**  
*Richard D. White*
- 15:40 Break
- 16:00 **Coronary MR Angiography**  
*Matthias Stuber*

- 16:35 **MRI of Atherosclerotic Disease**  
*Bruce A. Wasserman*
- 17:10 **MRI of Congenital Heart Disease**  
*Philip J. Spevak*
- 17:45 **Questions/Summary**
- 18:00 Adjournment

## RF BOOTCAMP: ESSENTIALS OF RF COIL DESIGN, CONSTRUCTION, AND INTERFACE

*H. Cecil Charles and Michael B. Smith, Organizers*

**Saturday, 10 May, 08:00 - 17:50**

### EDUCATIONAL OBJECTIVES

Upon completion of the course, participants should be able to:

- Define inductance, capacitance, resonance and distributed capacitance with reference to RF coils, their design and operation;
- Describe the basic needs and components of a working RF laboratory;
- Compare design and construction of two important types of coils;
- Explain the fundamentals of RF coil connections to the scanner.

### PROGRAM

- 08:00 **Welcome and Overview**  
*H. Cecil Charles*
- 08:10 **Basic Concepts I: Components**  
*Steven M. Wright*
- 08:40 **Basic Concepts II: Measurements**  
*James R. MacFall*
- 09:10 **The RF Laboratory**  
*Randy Duensing*
- 10:00 **Discussion**  
*Team*
- 10:20 Break
- 10:40 **The Flat Circular Coil: Theory**  
*H. Cecil Charles*
- 11:10 **The Flat Circular Coil: Construction**  
*H. Cecil Charles*
- 12:00 Break
- 13:30 **The Bird Cage Coil: Theory**  
*Michael B. Smith*
- 14:15 **The Bird Cage Coil: Construction**  
*H. Cecil Charles*
- 15:00 **Coil Interface: Theory and Implementation**  
*Randy Duensing*
- 15:45 Break
- 16:05 **Where do We Go From Here?**  
*Michael B. Smith*
- 16:45 **Safety Issues**  
*Daniel J. Schaefer*
- 17:30 **Panel Discussion**  
*Team*
- 17:50 Adjournment

## MR SPECTROSCOPY: BASICS AND CLINICAL APPLICATIONS

*Roland Kreis and Daniel M. Spielman, Organizers*

**Saturday, 10 May, 08:30 - 18:00**

### EDUCATIONAL OBJECTIVES

Upon completion of the course, participants should be able to:

- Describe fundamental principles of clinical MR spectroscopy;
- Explain the crucial steps in performing and evaluating a MRS examination;
- Enumerate potential pitfalls in the clinical application of MR spectroscopy;
- Define diagnostic and patient management situations in which there is a clinically significant justification for a MRS examination;
- Summarize recent clinical uses of *in vivo* MRS.

### PROGRAM

*The final five minutes of each presentation will be reserved for questions.*

#### Introduction and Methodology

- 08:30 **Basics of MRS**  
*Chris Boesch*
- 09:00 **Localization Techniques**  
*Markus von Kienlin*
- 09:30 **Pre-scan and Shimming**  
*Daniel M. Spielman*
- 10:00 **Detectable Metabolites and Their Significance**  
*Ognen A.C. Petroff*
- 10:30 Break
- 10:50 **Data Processing + Fitting**  
*Andrew A. Maudsley*
- 11:20 **Quantitation + Artifacts in Clinical MRS**  
*Roland Kreis*
- 11:50 **Discussion**
- 12:00 Break

#### Applications

- 13:30 **Tumors and Masses: Brain**  
*Franklyn A. Howe*
- 14:00 **Tumors and Masses: Prostate and Breast**  
*John Kurhanewicz*
- 14:30 **Clinical MRS: MS and Inflammation**  
*David H. Miller*
- 15:00 **Clinical MRS: Epilepsy**  
*Kenneth D. Laxer*
- 15:30 Break
- 15:50 **Clinical MRS: Psychiatry**  
*Perry F. Renshaw*
- 16:20 **Clinical MRS: Pediatrics**  
*Petra Pouwels*

**16:50 Clinical MRS: Ischemia, Hypoxia, Mitochondrial Disease***Peter B. Barker***17:20 Clinical <sup>31</sup>P MRS***Douglas L. Arnold***17:50 Discussion****18:00 Adjournment****MR SPECTROSCOPY: FRONTIER METHODOLOGY AND APPLICATIONS***Roland Kreis and Daniel M. Spielman, Organizers***Sunday, 11 May, 08:00 - 15:00****EDUCATIONAL OBJECTIVES**

Upon completion of the course, participants should be able to:

- Describe fundamental principles on which advanced uses of MRS are based;
- List state-of-the-art techniques developed for research applications of MR spectroscopy;
- Appraise advantages and pitfalls in the use of statistical tools to analyze MRS data;
- Summarize recent biomedical research activities involving *in vivo* MRS;
- Summarize issues of present-day methodology and applications of high resolution spectroscopy.

**PROGRAM***The final five minutes of each presentation will be reserved for questions.***Methodology****08:00 Fast CSI***Stefan Posse***08:30 (De-)Coupling and Spectral Editing***Peter S. Allen***09:00 Sophisticated RF Pulses for MRS***Robin A. de Graaf***09:30 Statistical Tools for MRS Data Analysis***Wael El-Deredy***10:00 Discussion****10:10 Break****10:30 High Resolution NMR***Christian Griesinger***Advanced Applications****11:20 In Vitro MRS***Stephen R. Williams***11:50 Discussion****12:00 Break****13:30 High Field <sup>1</sup>H-MRS***Rolf Gruetter***14:00 In Vivo <sup>13</sup>C and <sup>15</sup>N MRS and Kinetic Analysis***Douglas L. Rothman***14:30 MR Window on Tumor Metabolism***Risto A. Kauppinen***15:00 Adjournment****SPORTS MEDICINE MRI: CLINICAL AND TECHNICAL UPDATE***Johannes Bloem and Garry E. Gold, Organizers***Sunday, 11 May, 08:00 - 15:10****EDUCATIONAL OBJECTIVES**

Upon completion of the course, participants should be able to:

- Use MRI findings to identify mechanisms of joint injury and improve their diagnosis of sports-related abnormalities;
- Tailor MRI protocols for musculoskeletal injuries;
- Explain the role of MR arthrography in joint imaging;
- Assess the role of MRI in musculoskeletal practice;
- Distinguish trauma-related bone and muscle injuries from neoplastic lesions;
- Determine the significance of findings on post-operative MRI of the joints.

**PROGRAM****08:00 Pulse Sequences and Protocols***Garry Gold***08:25 MRI of the Hip and Pelvis***Juerg Hodler***08:50 MRI of the Elbow***Mark Schweitzer***09:15 MRI of the Ankle***Douglas W. Goodwin***09:40 Panel Discussion****10:10 Break****10:20 MRI of the Shoulder: Rotator Cuff***William E. Palmer***10:50 MRI of the Shoulder: Labrum***Lynne S. Steinbach***11:20 MRI of the Knee: Ligaments and Tendons***Eugene G. McNally***11:50 MRI of the Knee: Menisci and Cartilage***Koenraad L. Verstraete***12:20 Panel Discussion****12:30 Break****13:30 Interventional Sports Imaging***Christopher F. Beaulieu***14:00 Spine Imaging***Victor Pulicino***14:30 Muscle Injuries***Robert D. Boutin***15:00 Panel Discussion****15:10 Adjournment****MR OF TRANSGENIC MOUSE MODELS ("MR OMICS")***R. Mark Henkelman and Alan P. Koretsky, Organizers***Sunday, 11 May, 08:00 - 15:00****EDUCATIONAL OBJECTIVES**

Upon completion of the course, participants should be able to:

- Different ways in which molecular biologists are using mouse models to understand development and disease;
- An overview of small animal imaging; applications of MR to mouse models of cancer, neurological and cardiac diseases;
- How MR and mouse models are being used for drug discovery;
- Different approaches being taken to get molecular information from small animal imaging techniques.

**PROGRAM****08:00 Mouse Models of Human Disease***Alexandra L. Joyner***08:45 Overview of Small Animal Imaging***R. Mark Henkelman***09:30 MR of Mouse Models of Neurological Disorders***Joseph A. Frank***10:15 Break****10:45 MR of Mouse Models of Cardiac Disease***Axel Haase***11:30 MR of Mouse Models of Cancer***Robert J. Gillies***12:15 Break****13:30 MR of Mouse Models for Drug Discovery***Nicholas van Bruggen***14:15 Molecular/Cellular Imaging of Small Animals***Alan P. Koretsky***15:00 Adjournment***continued*

## Opening Session

Monday, 12 May

## Welcome & Awards Ceremony

07:45 - 08:20

## 2003 LAUTERBUR LECTURE:

### "The Legacy of I.I. Rabi"

**Norman F. Ramsey**, Harvard University, Cambridge, Massachusetts, USA

08:20 - 09:00

Each year the ISMRM Scientific Meeting opens with the Lauterbur Lecture in recognition of the contributions of Paul Lauterbur to the field of magnetic resonance. At this 11th Annual Meeting the lecture will focus on the legacy of Isadore Rabi, whose early observations on molecular beam resonance were fundamental to the development of our field and won him the Nobel Physics Prize in 1944. The lecture will discuss the many facets of Isadore Rabi and will be given by his former PhD student and colleague Norman Ramsey, who in 1989, also won the Nobel Prize in Physics.

## The Toronto Keynote Lecture "Future Directions in Funded Biomedical Imaging Research"

**Roderic I. Pettigrew**, National Institute for Biomedical Imaging and Bioengineering, NIH, Bethesda, Maryland, USA

09:00 - 09:25

This year, in recognition of the establishment in the United States of the first dedicated national biomedical imaging institute, Dr. Roderic Pettigrew, the inaugural director, will present a keynote lecture outlining the future development of programs and initiatives for biomedical imaging research.

Monday, 12 May, 09:00 - 10:15

## IMAGING IN CHRONIC DISEASE

*Garry E. Gold, Clifford R. Jack, and James F.M. Meaney, Organizers*

### EDUCATIONAL OBJECTIVES

Upon completion of this session, participants should be able to:

- Recognize the role played by imaging in the treatment and monitoring of chronic diseases such as epilepsy, Alzheimers, and arthritis;
- Evaluate the advances in MRI that allow for improved assessment of chronic disease;
- Recommend new MRI techniques for studying chronic disease at their institution;
- Interpret new techniques, such as spectroscopy and T2-mapping, in the evaluation of chronic disease.

### PROGRAM

- 09:00 **Future Directions in Funded Biomedical Imaging Research**  
*Roderic I. Pettigrew*  
National Institute for Biomedical Imaging and Bioengineering, NIH Bethesda, Maryland, USA
- 09:25 **Neurodegenerative Diseases and Epilepsy**  
*Michael Weiner*  
University of California at San Francisco  
San Francisco, California, USA
- 09:50 **The Burden of (Musculoskeletal) Disease: Challenges in Imaging for Diagnosis and Prognosis**  
*Maarten Boers*  
VU Medical Center,  
Amsterdam, The Netherlands

Tuesday, 13 May, 08:15 - 09:30

## SAFETY AND MRI

*Kim Butts, David J. Lomas, and Michael B. Smith, Organizers*

### EDUCATIONAL OBJECTIVES

Upon completion of this session, participants should be able to:

- Identify the physiological limits of MRI;
- Evaluate an epidemiological study on MRI;
- Identify who makes recommendations on MRI guidelines;
- List MRI regulations.

### PROGRAM

- 08:15 **Physiological Limits of MR**  
*John Schenck*  
General Electric Corporate R&D  
Schenectady, New York, USA
- 08:40 **MR Regulatory Bodies and Regulations**  
*Loren A. Zaremba*  
Food and Drug Administration  
Rockville, Maryland, USA
- 09:05 **Staying Below the Legal Limits at Optimized MR System Performance**  
*Franz Schmitt*  
Siemens Medical Solutions,  
Massachusetts General Hospital  
NMR Center, Charlestown,  
Massachusetts, USA



Wednesday, 14 May, 08:15 - 09:30

**RF COILS**

*Peter S. Allen, Rolf Gruetter, Michael B. Smith, and Daniel K. Sodickson, Organizers*

**EDUCATIONAL OBJECTIVES**

Upon completion of this session, participants should be able to:

- Understand the complexity and diversity of the evolution of coil design;
- Identify and explain the specific requirements and challenges for coil development at high fields;
- Describe the theory and implementation of parallel imaging.

**PROGRAM**

- 08:15 **A History of RF Coils**  
*Eiichi Fukushima*  
New Mexico Resonance  
Albuquerque, New Mexico, USA
- 08:40 **Development and Challenges of High Field Resonators**  
*David I. Hoult*  
National Research Council  
Winnipeg, Manitoba, Canada
- 09:05 **Parallel MRI: Breaking the Acquisition Speed Limit Using RF Coil Arrays**  
*Joseph Hajnal*  
Imperial College  
London, England, UK

Thursday, 15 May, 08:15 - 09:30

**EVALUATION OF ISCHEMIC HEART DISEASE BY MRI**

*Zahi A. Fayad, P.V. Prasad, and Martin R. Prince, Organizers*

**EDUCATIONAL OBJECTIVES**

Upon completion of this session, participants should be able to:

- Define current state of the art in the evaluation of ischemic heart disease by MRI;
- Select appropriate protocols for the evaluation of ischemic heart disease;
- Interpret MRI data used in the evaluation of ischemic heart disease;
- Appraise future developments in MRI applications to the evaluation of ischemic heart disease;
- Recommend appropriate tests for the evaluation of ischemic heart disease by MRI.

**PROGRAM**

- 08:15 **Current State of the Art**  
*Jan Bogaert*  
University Hospitals  
Leuven, Belgium
- 08:40 **What's on the Horizon**  
*Charles B. Higgins*  
University of California at San Francisco  
San Francisco, California, USA
- 09:05 **What Does the Future Behold?**  
*Elliot R. McVeigh*  
Johns Hopkins School of Medicine  
Baltimore, Maryland, USA

Friday, 16 May, 08:15 - 09:30

**THE TUMOR MICROENVIRONMENT**

*Jeffrey L. Evelhoch, John R. Griffiths, and Michal Neeman, Organizers*

**EDUCATIONAL OBJECTIVES**

Upon completion of this session, participants should be able to:

- Describe several key physiological aspects of the tumor microenvironment and explain why it is important to be able to assess them;
- List several MRI, MRS and EPR methods which have been used to examine key aspects of the tumor microenvironmental pathophysiology;
- Explain how results of studies using these magnetic resonance methods have impacted our understanding of tumor microenvironmental pathophysiology.

**PROGRAM**

- 08:15 **Mechanisms Underlying Tumor Microenvironmental Pathophysiology**  
*Mark W. Dewhirst*  
Duke University Medical Center  
Durham, North Carolina, USA
- 08:40 **MRI and MRS Studies of Tumor Pathophysiology**  
*Robert J. Gillies*  
University of Arizona  
Tucson, Arizona, USA
- 09:05 **EPR Studies of Tumor Oxygenation**  
*Bernard Gallez*  
Université Catholique de Louvain  
Brussels, Belgium.

## MORNING CATEGORICAL COURSES

Tuesday, 13 May - Friday 16 May, 07:00 - 08:00

**CONTROVERSIES AND ADVANCES IN MUSCULOSKELETAL MRI**Garry E. Gold and Lawrence M. White,  
Organizers**EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Compare MRI with other advanced imaging modalities;
- Explain the role of interventional MRI in the musculoskeletal system;
- Explain the role of High Field MRI in the musculoskeletal system;
- Describe the technical issues related to high-resolution joint imaging;
- Evaluate options for open MRI scanners for musculoskeletal imaging.

**PROGRAM****Tuesday, 13 May**

- 07:00 **High Field MRI: Technical Issues**  
William E. Palmer
- 07:25 **High Field MRI: Clinical Issues**  
Timothy J. Mosher
- 07:50 **Questions and Discussion**

**Wednesday, 14 May**

- 07:00 **Interventional MRI: Technical Issues**  
Kim Butts
- 07:25 **Interventional MRI: Clinical Issues**  
John A. Carrino
- 07:50 **Questions and Discussion**

**Thursday, 15 May**

- 07:00 **CT vs MRI in the Postoperative Joint: Technical Issues**  
Joshua M. Farber
- 07:25 **CT vs MRI in the Postoperative Joint: Clinical Issues**  
Lawrence M. White
- 07:50 **Questions and Discussion**

**Friday, 16 May**

- 07:00 **Cartilage MRI: Technical Issues**  
Brian A. Hargreaves
- 07:25 **Cartilage MRI: Clinical Evaluation**  
Russell C. Fritz
- 07:50 **Questions and Discussion**

**PARALLEL IMAGING**Neil M. Rofsky and Daniel K. Sodickson,  
Organizers**EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Explain the basic principles of parallel imaging, including elements both of RF coil array design and image reconstruction;
- Survey promising applications of parallel MRI in cardiovascular imaging and body imaging;
- Describe new developments in image reconstruction and coil array design, and outline emerging parallel imaging applications;
- Identify the key steps in a practical parallel imaging examination, and compare the nuts-and-bolts features of various MR vendors' existing implementations.

**PROGRAM****Tuesday, 13 May**

- Basics**
- 07:00 **Introduction**  
Daniel K. Sodickson
- 07:05 **Coil Arrays (The Technological Tools)**  
Josef H. Duyn
- 07:30 **Image Reconstruction (The Mathematical Tools)**  
Klaas Prüssmann
- 07:55 **Discussion**

**Wednesday, 14 May Applications**

- 07:00 **Recap of Basics**  
Daniel K. Sodickson
- 07:05 **Cardiovascular Imaging**  
Peter Boesiger
- 07:30 **Body Imaging**  
Neil M. Rofsky
- 07:55 **Discussion**

**Thursday, 15 May**

- New Developments**
- 07:00 **Recap of Basics and Applications**  
Daniel K. Sodickson
- 07:10 **New Developments in Image Reconstruction and Sequence Design**  
Charles A. McKenzie
- 07:35 **New Developments in Array Design and New Applications**  
David J. Larkman

**Friday, 16 May**

- Vendor Implementations**
- 07:00 **Recap of Basics, Applications, and New Developments**  
Daniel K. Sodickson
- 07:10 **Philips Medical Systems**  
Scott D. Flamm
- 07:25 **GE Medical Systems**  
Robert R. Edelman
- 07:40 **Siemens Medical Solutions**  
Stefan O. Schoenberg
- 07:55 **Discussion and Conclusion**

**EMERGING BODY MR: FROM STRUCTURE TO FUNCTION**Vivian S. Lee and Riccardo Manfredi,  
Organizers**EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Recognize and implement recent technical advances in body MRI including BOLD and perfusion techniques, fast T2-weighted imaging methods, and new contrast agents;
- Describe recent advances in the assessment of liver and breast for tumor, structural and functional studies of the biliary system, and MR measurements of renal function;
- Identify applications of MR to the evaluation of large and small bowel disease;
- Compare the information provided by MR elastography in the assessment of organ pathologies, such as in the breast and prostate, against conventional MR imaging techniques.

**PROGRAM****Tuesday, 13 May**

- Technical Developments**
- 07:00 **Perfusion MRI and BOLD Techniques**  
P.V. Prasad
- 07:20 **Fast T<sub>2</sub> Imaging Techniques**  
Stefan G. Ruehm
- 07:40 **New Contrast Agents**  
Carlo Bartolozzi

**Wednesday, 14 May**

- Hepatobiliary Imaging**
- 07:00 **Liver MRI: Anatomic and Perfusion Imaging**  
Glenn A. Krinsky
- 07:30 **MRCP/Pancreas MRI**  
Carlo Procacci

**Thursday, 15 May**

- Genitourinary**
- 07:00 **Functional Kidney MRI**  
Thomas M. Grist
- 07:30 **MR Elastography: Prostate and Breast**  
Richard L. Ehman

**Friday, 16 May**

- Breast and Bowel**
- 07:00 **Breast**  
Christiane K. Kuhl
- 07:20 **MRI of the GI Tract: Small Bowel**  
Taro Takehara
- 07:40 **MRI of the GI Tract: Colon**  
Jörg F. Debatin

## MORNING CATEGORICAL COURSES

Tuesday, 13 May - Friday 16 May, 07:00 - 08:00

**fMRI EXPERIMENTAL METHODS***R. Todd Constable and Mathias Hoehn, Organizers***EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Explain the latest developments in fMRI with respect to understanding the underlying physiology leading to the BOLD response and its relationship to neuronal activity, and the influence of pharmacological substances on activation;
- Describe the factors influencing paradigm design and the optimum acquisition strategy for event related versus block designs;
- Recognize which analysis approach is most appropriate for a particular experimental design;
- Describe the spatial limits of fMRI and factors influencing resolution.

**PROGRAM***The final five minutes of each presentation will be reserved for questions.***Tuesday, 13 May****Physiological Changes**07:00 **Physiological Changes Associated with Neuronal Activation***Richard Hoge*07:30 **Neuronal Activity/Temporal Resolution and fMRI***Nikos Logothetis***Wednesday, 14 May****Experimental Design****(Paradigms/Acquisition Strategies)**07:00 **Paradigm Design Issues: Event-related vs. Block Design***Rasmus M. Birn*07:30 **Acquisition Strategies/Pulse Sequences***Xiaoping P. Hu***Thursday, 15 May****Data Analysis**07:00 **Model-Driven Analysis***Keith J. Worsley*07:30 **Exploratory Data Analysis***James J. Pekar***Friday, 16 May****Spatial Temporal Resolution Limitations**07:00 **Pharmacological Modulations of fMRI***Mathias Hoehn*07:30 **Spatial Resolution Issues***R. Todd Constable***DIFFUSION TENSOR IMAGING***Gareth J. Barker and Scott D. Swanson, Organizers***EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Describe how and why the proton diffusion pathway in tissue can be explained by a tensor;
- Explain how the tensor is acquired, measured and mapped;
- Understand the limitations of such diffusion tensor imaging;
- Describe more advanced diffusion measurement techniques such as q-space and diffusion spectrum imaging;
- Appreciate the multi-exponential and/or multi-compartmental nature of diffusion;
- List and describe important clinical applications of DTI.

**PROGRAM****Tuesday, 13 May**07:00 **Introduction and Background***Peter Basser***Wednesday, 14 May**07:00 **Dealing With Tensors***Derek K. Jones***Thursday, 15 May****Research Frontiers in DTI**07:00 **Multiexponential Decay***Greg J. Stanisz*07:30 **Beyond Tensor Imaging***Daniel Alexander***Friday, 16 May**07:00 **Clinical and Medical Applications of DTI***Carlo Pierpaoli***ADVANCED MR ANGIOGRAPHY TECHNIQUES***James F.M. Meaney, Martin R. Prince, and Stefan O. Schoenberg, Organizers***EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Identify the challenges of MRA implementation in anatomic areas with high technical demands;
- Compare the advantages and disadvantages of different technical approaches in these areas;
- Recognize the clinical benefit of advanced MRA protocols for a comprehensive non-invasive work-up of vascular disease.

**PROGRAM****Tuesday, 13 May****Optimizing MRA in the Feet**07:00 **2D Projection MRA***Neil Khilani*07:10 **3D Tricks***Barry Stein*07:20 **Moving Table: Sagittal Feet***Jeffrey H. Maki*07:30 **Moving Table: Coronal Feet***James F.M. Meaney*07:40 **Discussion****Wednesday, 14 May****Renal Artery Stenosis Grading Shoot-Out**07:00 **3D Phase Contrast***Martin R. Prince*07:10 **2D Cine PC Flow Curves***Stefan O. Schoenberg*07:20 **Gadolinium Clearance Rate***Thomas M. Grist*07:30 **Captopril MR Renography***P.V. Prasad*07:40 **Discussion****Thursday, 15 May****Approaches to Total Body MRA**07:00 **Angiosurf***Stefan G. Ruehm*07:15 **Continuous Table Motion***David G. Kruger*07:30 **Jumping VIPR with Continuous Table Motion***Sean B. Fain*07:45 **Discussion****Friday, 16 May****Coronary Shoot-Out**07:00 **Navigator***Warren J. Manning*07:15 **Radial Image Breath-Hold***Debiao Li*07:30 **Multi-Detector CTA Versus MRA of the Coronaries***Konstantin Nikolaou*07:45 **Discussion**



Tuesday, 13 May - Friday 16 May, 07:00 - 08:00

## SPECTROSCOPY BEYOND NAA

Peter S. Allen, John R. Griffiths, Rolf Gruetter, and Stephen R. Williams, Organizers

### EDUCATIONAL OBJECTIVES

Upon completion of this course, participants should be able to:

- List the major metabolites in addition to NAA, Cr, Cho that can be detected *in vivo* in the brain by MRS;
- Describe the biological and clinical importance of these metabolites;
- List the key factors to achieve good spectra;
- Describe the principles of data analysis in both frequency and time domain;
- Explain how MRS can be used to measure metabolic fluxes as well as steady state concentrations;
- List the advantages and disadvantages of  $^{13}\text{C}/^{15}\text{N}$  with respect to  $^1\text{H}$ .

### PROGRAM

Tuesday, 13 May

07:00 Introduction

Stephen R. Williams

07:30 Macromolecules, GABA and Editing

Kevin L. Behar

Wednesday, 14 May

07:00 Time-Domain Based Analysis

Danielle Graveron-Demilly

07:30 LC Model Applications at High Field

Ivan Tkac

Thursday, 15 May

07:00  $^1\text{H}$  MRS at 1.5/2T

Petra Pouwels

07:30 Potential and Promise of  $^{15}\text{N}$  NMR

Keiko Kanamori

07:45  $^{13}\text{C}$  MRS at 1.5T

Stefan Bluml

Friday, 16 May

07:00  $^{13}\text{C}$  NMR: Past and Present

Peter G. Morris

07:30 Indirect Detection of  $^{13}\text{C}$

Label/Editing at 3T

Gilles F. Bloch

## CARDIOVASCULAR MRI

Zahi A. Fayad, Christopher Kramer and P.V. Prasad, Organizers

### TWO-SESSION COURSE:

Monday, 12 May, 11:00 - 13:00 and

Thursday, 15 May, 10:30 - 12:30

### EDUCATIONAL OBJECTIVES

Upon completion of this course, participants should be able to:

- Describe basic areas of routine and promising clinical use of MR in assessing cardiovascular disease;
- Apply MR protocols for determination of cardiac morphology, dynamic function, flow, and physiologic status;
- Describe methodologies that help in the interpretation of results for cardiac MR assessment of acquired and congenital cardiac disease;
- Compare approaches for optimal presentation and analysis of cardiac MR results.

### PROGRAM

Monday, 12 May

Session I

11:00 Introduction to Cardiac MR

Jörg Barkhausen

11:25 Assessment of Myocardial

Function, Rest, and Stress

Eike Nagel

11:50 MR Coronary Angiography

Albert de Roos

12:15 Atherosclerotic Plaque

Characterization

Chun Yuan

12:40 Discussion

13:00 Adjournment

Thursday, 15 May

Session II

10:30 Fast Imaging and Real-Time

Cardiac MRI

Frederick H. Epstein

10:55 Assessing Myocardial Perfusion

Steven D. Wolff

11:20 Cardiovascular MRI in Pulmonary

Hypertension

Michael Poon

11:45 Determining Myocardial Viability

Joao A.C. Lima

12:10 Discussion

12:30 Adjournment

## HIGH FIELD NEUROIMAGING

Clifford R. Jack and Christiane K. Kuhl, Organizers

Tuesday, 13 May, 10:30 - 12:30

### EDUCATIONAL OBJECTIVES

Upon completion of this course, participants should be able to:

- List the advantages and disadvantages of high field (3-4T) vs. systems  $\leq 1.5\text{T}$  for clinical neuroimaging;
- Describe which clinical neuroimaging applications are likely to benefit substantially from high field (3-4T);
- Recognize which clinical neuroimaging applications are unlikely to see a major performance improvement at 3-4T vs.  $\leq 1.5\text{T}$ .

### PROGRAM

The final five minutes of each talk will be reserved for questions.

10:30 3T Neuro MRI in a Clinical Setting:

Benefits and Limitations

Christiane K. Kuhl

11:00 Clinical 3T Neuroimaging: MRA

Matt A. Bernstein

11:30 BOLD Surgical Planning at 3T

Keith R. Thulborn

12:00 Clinical DTI at 3T

Xiaohong J. Zhou

12:30 Adjournment

## INTERVENTIONAL MRI

Kim Butts and Thomas Kahn, Organizers

Wednesday 14 May, 10:30 - 12:30

### EDUCATIONAL OBJECTIVES

Upon completion of this course, participants should be able to:

- List procedures that can be enabled or improved with MRI guidance;
- List devices that are MR-compatible and commercially available;
- Recognize desired areas of further technical innovation.

### PROGRAM

Wady M. Gedroyc and Ferenc Jolesz, Co-Moderators

10:30 Percutaneous Procedures

Jonathan Lewin

10:55 Intraoperative Procedures

Charles L. Truwit

11:20 Thermal Ablations

Thomas Vogl

11:45 Vascular Interventions

Jörg F. Debatin

12:10 Panel Discussion: Requirements for Widespread Adoption

12:30 Adjournment

**IMAGING IN DRUG DEVELOPMENT**

Jeffrey L. Evelhoch and John R. Griffiths,  
Organizers

Wednesday, 14 May, 10:30 - 12:30

**EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Identify the key objectives of an MR study in development of a given drug;
- Explain why MR methodology studies (e.g. reproducibility, validation) should precede deployment of MR in clinical trials of novel therapy;
- Recommend MR protocols for use in drug development; explain how and why these differ from protocols used in routine diagnostic practice;
- Recognize the impact of Good Clinical Practice regulations in the MR study, and advise physicist and physician co-workers accordingly.

**PROGRAM**

David S. Lester and Steve C.R. Williams,  
Moderators

- 10:30 **The Emerging Role of MR in Drug Development**  
*John C. Waterton*
- 10:50 **Imaging and Neurological Drug Development**  
*Steven Warach*
- 11:10 **Imaging and Cardiovascular Drug Development**  
*Chun Yuan*
- 11:30 **Imaging and Oncologic Drug Development**  
*Patricia Cole*
- 11:50 **Imaging and Arthritis Drug Development**  
*Charles G. Peterfy*
- 12:10 **What Radiologists Need to Know About Roles and Rules in Clinical Trials**  
*Richard P. Jacobs*
- 12:30 Adjournment

**SMRT FORUM:  
MR PURCHASE DECISIONS**

Nanette Keck, Organizer

Monday, 12 May, 14:00 - 16:00

**EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Describe the various types of MR systems available today;
- List the major differences between systems;
- Describe the advantages and disadvantages of each;
- Explain how various system components impact MR image quality;
- Explain the system requirements for various types of MR procedures.

**PROGRAM TOPICS**

1. Analytic Approach to Equipment, Finances, Compatibility, Site Preparation, PACs, and Delivery.
2. High- vs. Low-field.
3. Coil Considerations.
4. Dedicated vs. Whole Body Systems.
5. 3T.

**Speakers:** William Faulkner, Gary C. Glover, Herbert Y. Kressel, and James J. Stuppino.

**MR PHYSICS AND TECHNIQUES FOR CLINICIANS**

Frank R. Korosec and Joseph G. McGowan,  
Organizers

Monday, 12 May, 16:30 - 18:30,

Tuesday, 13 May, through

Thursday, 15 May, 16:00 - 18:00

**EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Define and describe the fundamental principles of MR imaging, including the definition of spin magnetization, the Larmor relationship, relaxation phenomena, and the process of using the spin magnetization to produce an image;
- Explain imaging pulse sequences based upon spin and gradient echoes, including fast spin echo and echo planar techniques;
- Design MR imaging protocols for diagnostic applications considering image contrast, spatial resolution, acquisition time, signal-to-noise ratio, and artifacts;
- Describe the principles and capabilities of various advanced MR techniques including diffusion, cardiac and functional MRI, and spectroscopy.

**PROGRAM**

Monday, 12 May

- 16:30 **Spin Gymnastics I**  
*Walter Kucharczyk and Donald B. Plewes*
- 17:10 **Spin Gymnastics II**  
*Walter Kucharczyk and Donald B. Plewes*
- 17:50 **Spectroscopy**  
*Jack Knight-Scott*

Tuesday, 13 May

- 16:00 **Spin Echo Imaging**  
*Bruce Pike*
- 16:40 **Gradient Echo Imaging**  
*John P. Mugler, III*
- 17:20 **Fast Spin Echo Imaging**  
*Joseph C. McGowan*

Wednesday, 14 May

- 16:00 **Image Quality and Acquisition Speed**  
*Norbert J. Pelc*
- 16:40 **Ultrafast Imaging**  
*Marcus Alley*
- 17:20 **Diffusion Imaging**  
*Konstantinos Arfanakis*

Thursday, 15 May

- 16:00 **Cardiac MRI**  
*Frank R. Korosec*
- 16:40 **Functional MRI**  
*M. Elizabeth Meyerand*
- 17:20 **Hardware**  
*Richard G.S. Spencer*

**HOT TOPICS FOR CLINICAL PRACTICE**

Thomas M. Grist and Clifford R. Jack,  
Organizers

Tuesday, 13 May, 13:30 - 15:30

**EDUCATIONAL OBJECTIVES**

Upon completion of this course, participants should be able to:

- Describe five points that can be used to improve imaging strategies in important areas of clinical practice;
- Assess the applicability to clinical practice of three newer imaging techniques.

**PROGRAM**

It is the intention of the organizers that this course cover the most current clinical questions and controversial areas, and include the most up-to-date information available. Therefore, the final selection of subjects and speakers for the Hot Topics Course is not made until a date much later than for the other courses at the meeting, and at this time we don't yet have specific details. Please check the ISMRM Website periodically for news of the course program.

# Educational Stipends for Students and Postdoctoral Trainees

The ISMRM invites applications for educational stipends that offer support for the attendance of students, postdoctoral and clinical trainees to present abstracts at the Eleventh Scientific Meeting. To be eligible for support, an applicant should either be (1) enrolled in a full-time under-graduate or graduate program or (2) a medical intern, first-, second-, or third-year resident, or a postdoctoral trainee who received a doctorate or equivalent degree after 31 July 1999. Those applicants who are first authors on the abstract will be given priority. Recipients of educational stipends who are not members of the ISMRM will be required to submit an application for membership before the funds are disbursed. Stipend recipients are limited to three years of support.

## HOW TO APPLY:

Applicants for support should submit the following:

- Printout of the electronically submitted abstract;
- Copy of email confirming online submission;
- A letter from the applicant requesting student/postdoctoral support and confirming his/her intention to attend the meeting;
- A *curriculum vitae* of the applicant;
- A supervisor's or sponsor's letter confirming the applicant's eligibility for a student stipend. The Committee requests that the letter include comments on available funds for support. If a number of applicants from the same group are applying, the Committee would appreciate a unique comment on each applicant, since funding might be limited in this situation;
- Completed check sheet.

## WHERE TO APPLY:

Joseph V. Hajnal, Ph.D., *Chair*  
International Society for Magnetic Resonance in Medicine  
Subcommittee on Student Stipends  
2118 Milvia Street, Suite 201  
Berkeley, California 94704, USA

## DEADLINE:

Applications must be received no later than **20 November 2002**.

FOR OFFICE USE ONLY

CONFIRMATION NO.

DATE RECEIVED

## Student Stipend Check Sheet

### SEND COMPLETED CHECK SHEET AND ALL MATERIALS TO:

Joseph V. Hajnal, Ph.D., *Chair*  
International Society for Magnetic Resonance in Medicine  
Subcommittee on Student Stipends  
2118 Milvia Street, Suite 201  
Berkeley, California 94704, USA

Applicant Name \_\_\_\_\_

Degree \_\_\_\_\_

Mailing Address \_\_\_\_\_

\_\_\_\_\_

City \_\_\_\_\_

State/Province \_\_\_\_\_

Country \_\_\_\_\_

Postal Code/Zip+4 \_\_\_\_\_

Contact Phone Number \_\_\_\_\_

Home Phone Number \_\_\_\_\_

E-mail Address \_\_\_\_\_

Supervisor \_\_\_\_\_

I have previously applied for a student stipend. ☐ YES ☐ NO

If yes, state the year(s) you have received support \_\_\_\_\_

\_\_\_\_\_

Have you submitted an Abstract to the ISMRM as the first author?

☐ YES ☐ NO

What is the typical lowest airfare from your city to Toronto?

(US\$) \_\_\_\_\_

☐ DO NOT release my CV to corporate sponsors.

Recipients of Student Stipends will be required to submit an application for membership in the ISMRM before the funds are disbursed.

### ENCLOSED:

- ☐ Student's Application Letter
- ☐ Student's *Curriculum Vitae*
- ☐ Abstract and confirmation of online submission
- ☐ Supervisor's Letter
- ☐ Eligibility Verification
- ☐ Membership Application (for nonmembers only)



# Clinical Resident Stipend Award

Recognizing the need to involve greater numbers of newly trained physicians in the science and clinical application of magnetic resonance, this stipend award has been set up to encourage young clinicians in this field of study. Each awardee will receive US\$400 toward the costs of attending the Eleventh Scientific Meeting in Toronto, Ontario, Canada. In addition, each awardee will be paired with a senior member of the ISMRM who will be the awardee's mentor during the Scientific Meeting, providing the opportunity for daily reviews and discussions of important scientific and clinical developments presented at the meeting. Recipients of stipends who are not members of the ISMRM will be required to submit an application for membership before funds are disbursed.

## ELIGIBILITY CRITERIA:

- Applicants must be actively enrolled in a clinical residency (i.e., clinical training) program;
- Applicants cannot be first or presenting authors on abstracts submitted to the ISMRM program and do not need to submit an abstract to the meeting;
- Applicants are required to attend at least 4 days of the ISMRM meeting, including at least one day of the weekend educational courses.

## PROGRAM DESCRIPTION:

- Awardees will be paired with a clinical mentor from the ISMRM community, with whom they will meet on a daily basis.
- Awardees will prepare a review of their meeting experiences that will be sent to the mentor within six weeks of the Scientific Meeting.
- Mentors will subsequently be available to the awardees for advice and discussion regarding scientific and career issues in the field of magnetic resonance.

## APPLICATION PROCEDURE:

- Applicants should send a letter including a brief statement of their interest in attending the Scientific Meeting and explaining why they are interested in the field of magnetic resonance;
- A letter of support from the Department Chair is required stating that the resident either will be given the time off from clinical duties to attend and be supported for the remaining cost of the meeting, or will use vacation time and personal funds as needed;
- A *curriculum vitae* of the applicant must accompany the application;
- Completed check sheet.

## WHERE TO APPLY:

Joseph V. Hajnal, Ph.D., *Chair*  
International Society for Magnetic Resonance in Medicine  
Clinical Resident Stipend Committee  
2118 Milvia Street, Suite 201  
Berkeley, California 94704, USA

## DEADLINE:

Applications must be received no later than **20 November 2002**.

FOR OFFICE USE ONLY

ID NO.

DATE RECEIVED

# Clinical Resident Stipend Check Sheet

## SEND COMPLETED CHECK SHEET AND ALL MATERIALS TO:

Joseph V. Hajnal, Ph.D., *Chair*  
International Society for Magnetic Resonance in Medicine  
Clinical Resident Stipend Committee  
2118 Milvia Street, Suite 201  
Berkeley, California 94704, USA

Applicant Name \_\_\_\_\_

Degree \_\_\_\_\_

Mailing Address \_\_\_\_\_

City \_\_\_\_\_

State/Province \_\_\_\_\_

Country \_\_\_\_\_

Postal Code/Zip+4 \_\_\_\_\_

Contact Phone Number \_\_\_\_\_

Home Phone Number \_\_\_\_\_

E-mail Address \_\_\_\_\_

Supervisor \_\_\_\_\_

Recipients of Clinical Resident stipends will be required to submit an application for membership in the ISMRM before the funds are disbursed.

## ENCLOSED:

- ☐ Clinical Resident's Application Letter
- ☐ Clinical Resident's *Curriculum Vitae*
- ☐ Department Chair's Letter
- ☐ Eligibility Verification
- ☐ Membership Application (for nonmembers only)

## New Entrant Stipend Award

To encourage new entrants to research in areas of interest to the ISMRM, the Society invites applications for a New Entrant Stipend Award. This program is aimed at students or researchers who are new to the field and might not be funded under the main educational stipend program. Each awardee will receive US\$400 toward the costs of attending the Eleventh Scientific Meeting in Toronto, Ontario, Canada. In addition, each awardee will be paired with a senior member of the ISMRM who will be the awardee's mentor during the Scientific Meeting, providing the opportunity for reviews and discussions of important scientific and clinical developments presented at the meeting. Recipients of stipends who are not members of the ISMRM will be required to submit an application for membership before funds are disbursed.

### ELIGIBILITY CRITERIA:

- Applicants must be already actively involved or about to be actively involved in some aspect of research related to the ISMRM;
- Applicants cannot be first or presenting authors on abstracts submitted to the ISMRM program and do not need to submit an abstract to the meeting;
- Applicants are required to attend at least 4 days of the ISMRM meeting, including at least one day of the weekend educational courses.

### PROGRAM DESCRIPTION:

- Awardees will be paired with a mentor from the ISMRM community, with whom they will meet on a daily basis.
- Awardees will prepare a review of their meeting experiences that will be sent to the mentor within six weeks of the Scientific Meeting.
- Mentors will subsequently be available to the awardees for advice and discussion regarding scientific and career issues in the field of magnetic resonance.

### APPLICATION PROCEDURE:

- Applicants should send a letter including a brief statement of their interest in attending the Scientific Meeting and explain how this will relate to their own work;
- A letter of support from the Department Chair is required stating that the student either will be given the time off to attend and be supported for the remaining cost of the meeting, or will use vacation time and personal funds as needed;
- A *curriculum vitae* must accompany the application;
- Completed check sheet.

### WHERE TO APPLY:

Joseph V. Hajnal, Ph.D., *Chair*  
International Society for Magnetic Resonance in Medicine  
New Entrant Stipend Committee  
2118 Milvia Street, Suite 201  
Berkeley, California 94704, USA

### DEADLINE:

Applications must be received no later than **20 November 2002**.

FOR OFFICE USE ONLY

ID NO.

DATE RECEIVED

## New Entrant Stipend Check Sheet

### SEND COMPLETED CHECK SHEET AND ALL MATERIALS TO:

Joseph V. Hajnal, Ph.D., *Chair*  
International Society for Magnetic Resonance in Medicine  
New Entrant Stipend Committee  
2118 Milvia Street, Suite 201  
Berkeley, California 94704, USA

Applicant Name \_\_\_\_\_

Degree \_\_\_\_\_

Mailing Address \_\_\_\_\_

City \_\_\_\_\_

State/Province \_\_\_\_\_

Country \_\_\_\_\_

Postal Code/Zip+4 \_\_\_\_\_

Contact Phone Number \_\_\_\_\_

Home Phone Number \_\_\_\_\_

E-mail Address \_\_\_\_\_

Supervisor \_\_\_\_\_

Recipients of clinical New Entrant stipends will be required to submit an application for membership in the ISMRM before the funds are disbursed.

### ENCLOSED:

- ☐ New Entrant's Application Letter
- ☐ New Entrant's *Curriculum Vitae*
- ☐ Department Chair's Letter
- ☐ Eligibility Verification
- ☐ Membership Application (for nonmembers only)

## E.K. Zavoisky Stipend Program

The ISMRM invites applications for stipends from the E.K. Zavoisky Program, established to support the attendance of scientists and clinicians at the ISMRM Eleventh Scientific Meeting. The program is named in honor of E.K. Zavoisky, pioneer in MR research from the former USSR (see below). The purpose of the program is to support scientists and clinicians who do not have access to the financial means to attend the ISMRM Eleventh Scientific Meeting. Applicants eligible for the Educational Stipend Program (undergraduate and graduate students and postdoctoral and medical trainees) are not eligible for the Zavoisky Program. Those applicants who are first authors on the Abstract submission will be given priority.

### APPLICATION PROCEDURE:

Applicants for support should submit the following:

- A printout of the electronically submitted abstract;
- Copy of email confirming online submission;
- A letter of application;
- A *curriculum vitae*;
- A letter from an appropriate person at their institution (supervisor, head of department, etc.) certifying that no alternative funds are available. If a number of applicants from the same institution are applying, the Committee would appreciate a unique comment on each, since funding might be limited in this situation.
- Completed check sheet.

### WHERE TO APPLY:

Donald M. Hadley, M.B., Ch.B., Ph.D., *Chair*  
International Society for Magnetic Resonance in Medicine  
E.K. Zavoisky Stipend Committee  
2118 Milvia Street, Suite 201  
Berkeley, California 94704, USA

### DEADLINE:

Applications must be received no later than **20 November 2002**.

### About E.K. Zavoisky

E.K. Zavoisky, from Kazan, Tatarstan, is nowadays acknowledged as the inventor of Electron Spin Resonance. There is also strong support for the thesis that he was the first to observe a NMR signal as early as 1941, but he could not detect the signal reproducibly with the very basic apparatus he was able to build with the limited means available to him.

Due to the political situation at that time, Zavoisky's work remained largely unnoticed in the west. Although unquestionably the first to observe spin resonance, the Nobel Prize Committee did not further consider his contribution due to the lack of follow-up papers and his move to other fields.

It is interesting to note that the CV of Zavoisky explicitly reports his first trip to an international conference (1961). There is little doubt that the history of spin resonance would be seen from a different perspective if Zavoisky had been able to pursue his work within the awareness of an international scientific community.

It seems, therefore, to be more than appropriate to name a program established to help scientists from around the world to communicate their achievements in the memory of E.K. Zavoisky.

FOR OFFICE USE ONLY

CONFIRMATION NO.

DATE RECEIVED

## E.K. Zavoisky Stipend Check Sheet

### SEND COMPLETED CHECK SHEET AND ALL MATERIALS TO:

Donald M. Hadley, M.B., Ch.B., Ph.D., *Chair*  
International Society for Magnetic Resonance in Medicine  
E.K. Zavoisky Stipend Committee  
2118 Milvia Street, Suite 201  
Berkeley, California 94704, USA

Applicant Name \_\_\_\_\_

Degree \_\_\_\_\_

Mailing Address \_\_\_\_\_

City \_\_\_\_\_

State/Province \_\_\_\_\_

Country \_\_\_\_\_

Postal Code/Zip+4 \_\_\_\_\_

Contact Phone Number \_\_\_\_\_

Home Phone Number \_\_\_\_\_

E-mail Address \_\_\_\_\_

Supervisor \_\_\_\_\_

Have you submitted an Abstract to the ISMRM as the first author?

☐ YES ☐ NO

What is the typical lowest airfare from your city to Toronto?

(US\$) \_\_\_\_\_

### ENCLOSED:

- ☐ E.K. Zavoisky Program Application Letter
- ☐ *Curriculum Vitae*
- ☐ Abstract and confirmation of online submission
- ☐ Supervisor's Letter



## From The SMRT President

The SMRT Policy Board and Executive Committee have been quite busy since our Annual Meeting in Hawai'i. After gathering comments and suggestions from the SMRT meeting attendees, we are in the process of implementing new ideas into the SMRT.

In this "SMRT Update," I would like to introduce the ISMRM members to the SMRT Committees.

The SMRT Executive Committee is comprised of John Koveleski, President (Pennsylvania); Heidi Berns, Past-President (Iowa); Maureen Ainslie, President Elect (North Carolina); Anne Sawyer-Glover, Treasurer (California); Bill Faulkner, Secretary (Tennessee); Maureen Hood, Executive Liaison (Maryland); and Nanette Keck, Executive Member (Utah). The Executive Committee has a wealth of knowledge and experience involving MRI and all of the SMRT activities.

Anne Sawyer-Glover, from Stanford University, as SMRT Treasurer is the Chair of the Finance Committee. Anne's attention to detail is outstanding. As treasurer there are many aspects of detail in the budgeting process, as well as all the oversight needed in order to meet SMRT financial goals. Anne was very successful in raising funds necessary to offset the expenses of the SMRT Annual Meeting in Hawai'i. We are looking forward to her expertise in fundraising for the Toronto meeting.

Maureen Hood, from the Uniformed Services University, in Bethesda, Maryland, heads our External Relations Committee. Maureen is busy interacting with other organizations as the SMRT representative. The SMRT is a member of the Health Professions Network, Maureen will be representing SMRT at the upcoming meeting in Madison, Wisconsin. In addition, we've recently created a subcommittee focused on Global Development. Muriel Cockburn, from Glasgow, Scotland, is working with Maureen on this newly developed subcommittee. Muriel is the Past-President of the British Association of MR Radiographers (BAMRR) and will act as a liaison between the SMRT and other MR technologist organizations throughout the world.

Laurian Rohoman, from Montreal General Hospital, Montreal, Canada, is our Program Chair for the 2003 Annual Meeting to be held in Toronto. Laurian and the Program Committee have been hard at work since the Honolulu Annual Meeting developing the agenda and speaker list for the Toronto meeting. Topics will be presented on the latest updates in cardiac

imaging, breast imaging, pelvic imaging, contrast agents, musculoskeletal imaging, pediatrics, stroke/DWI/PWI, functional imaging, pulse sequences, and sedation. SMRT is fortunate to have outstanding faculty willing to donate their time and share their knowledge with MR technologists.

Julie Lowe, from Indianapolis, Indiana, is the Education Committee Chair. Julie has taken on an enormous task and has done very well with this extremely busy committee. She is working with Laurian in developing the Toronto program, as well as preparing her committee for the process of the abstract review and scoring. The SMRT is strongly encouraging technologists to submit abstracts and to be a part of the program in Toronto. We are looking forward to having total electronic abstract submission again this year.

Heidi Berns, from Iowa City, Iowa, is the Chair of the Nominations and Awards Committee. Heidi has solicited the names of candidates for the SMRT Policy Board elections, to be held this fall. She has received an overwhelmingly positive response of technologists who are interested in running for the SMRT Policy Board. Heidi and her committee are also preparing a list of nominees for the Cruces and Kressel Award for outstanding contributions to the education of MR technologists.

Cindy Comeau, from New York, New York, is the Chair of our Regionals Committee. The SMRT goal is to host at least six Regional Seminars each year. For this fiscal year, the SMRT has held four Regional Seminars. Past-President Heidi Berns held the first Regional Seminar in Iowa City, Iowa. The SMRT then presented a Regional Seminar in Utica, New York, with an excellent program and great attendance. Central New York was thrilled to have a Regional here and we look forward to visiting again soon. In September the SMRT hosted two Regional Seminars. The SMRT Atlanta Local Chapter hosted a Regional Seminar in conjunction with the SMRT. The Atlanta Chapter seminars always have a great turnout of attendees. We also were very excited to host our first Canadian Regional Seminar, in Montreal, Quebec, Canada. For the fiscal year 2002-2003 SMRT held a very successful Regional Seminar in Pittsburgh, Pennsylvania. Hosting a Regional is a very demanding but rewarding experience. Cindy assists the local organizer throughout the process of presenting the Regional Seminar. In exchange, the local organizer receives a one-year waived SMRT membership for their efforts.

Bobbie Burrow, from Atlanta, Georgia, is the Local Chapters Committee Chair. Bobbie indicates that there are currently eight SMRT Local Chapters: Atlanta, Georgia; Iowa City, Iowa; Springfield, Illinois; Kansas City, Missouri; Wichita, Kansas; Central Pennsylvania; Providence, Rhode Island; and Australia/New Zealand. Local chapters are an excellent way for technologists to be introduced to the SMRT in their local area. Bobbie has future plans to expand the number of SMRT Local Chapters.

Scott Kurdilla, from Pittsburgh, Pennsylvania, heads our By-Laws Committee. Scott is serving his second year on the Policy Board and has gathered his committee to review and update, if needed, the SMRT by-laws.

Raymond Cruz, from the state of Washington, is returning for his second year as Membership Committee Chair. Ray reports that the SMRT currently has 1,181 members. Ray and his committee have developed a member questionnaire, which has been mailed to those who have canceled their membership in the past year. The non-renewal rate has dropped to 5% this year. For US \$75 per year, the SMRT has many benefits to offer, including reduced registration fees for all ISMRM/SMRT meetings, workshops, and seminars; reduced subscription fees to ISMRM journals, JMRI and MRM; quarterly SMRT *Signals* newsletter, and the ever-popular quarterly accredited SMRT Educational Seminars Home Studies.

Kelly Baron, from Indiana, is the Chair of the Publications Committee and has worked extremely hard in developing our home studies program. Julie Strandt-Peay, from Wisconsin, is the *Signals* newsletter editor. Kelly and Julie deserve a round of applause for their diligent work in these two extremely busy areas of the SMRT. *Signals* made its debut on the SMRT website with the latest issue.

For those ISMRM members who are not familiar with the SMRT or its activities, I feel it is important for you to hear what the SMRT is all about and what it has to offer MR technologists worldwide. If you have any questions or comments, please feel free to contact me at jak3264@aol.com.

In the next issue of *MR Pulse* I will have more details about the upcoming SMRT Annual Meeting in Toronto, as well as program information on the SMRT Forum to be held Monday at the ISMRM Scientific Meeting. I will also announce the election results for the SMRT Policy Board and the Cruces/Kressel Award.

— John A. Koveleski, SMRT President

## Report on the ISMRM Workshop on Diffusion MRI (Biophysical Issues: What Do We Really Measure?)

The ISMRM Workshop "Diffusion MRI– Biophysical Issues: What Do We Really Measure?" was held 10-12 March 2002 at the French site of the Palais du Grand Large lying at the foot of the ramparts of the City of the Corsairs, Saint-Malo, facing the open seas, a perfect venue for a "Diffusion Brainstorming Workshop by the Sea." This first international workshop of the ISMRM Diffusion/Perfusion Study Group brought together 135 attendees including 20 invited speakers and moderators.

For the last 15 years, diffusion MRI has enjoyed a tremendous growth, from basic science to major clinical applications, such as brain ischemia. Diffusion MRI is now a popular topic in major meetings, especially the annual ISMRM meeting. Still, there remain many questions about what we really measure in biological tissues with diffusion MRI. Tissues are complex, organized structures where the diffusion process largely differs from what is observed in free, infinite, homogeneous media. There is a growing body of knowledge in the literature, sometimes controversial, about diffusion measurement in biological tissues (not only from MRI), and time had come to bring together experts in the field to share their views on what they believe is really measured with diffusion MRI.

This timely workshop was organized as an open-minded, brainstorming meeting between physicists, biologists and clinicians with the hope to address controversies and reach consensus on new directions to be pursued. The topics covered included:

- Tools to assess diffusion in tissues: diffusion MRI, MRS, Q-space, non MR measurements,
- Diffusion in multiple compartments and exchange effects,
- Relationship between diffusion measurements and tissue geometry: anisotropy, restriction, hindrance, cell volume effects,
- Using diffusion concepts to understand the normal and diseased brain (connectivity studies, clinical applications).

Drs. Le Bihan from CEA, Orsay, Van Zijl from Johns Hopkins, Baltimore and Basser from NIH, Bethesda, Workshop Chairs, organized the program around six sessions. Each session consisted of 20-minute talks given either by invited speakers or participants whose abstracts had been selected, and was followed by an ample discussion period. In addition, two

key-note lectures (1 hour) were delivered by well-known speakers. There were also three poster sessions to accommodate proffered papers and stimulate discussion. To this purpose, posters were installed in the coffee break area. Lunches and dinners were arranged on-site to allow continued, informal discussion.



PALAIS DU  
GRAND LARGE  
SAINT-MALO



Workshop audience and participants enjoyed discussions ranging from Q-space to connectivity.



Keynote speaker, Eva Syková, provides an enlightening presentation on "Extracellular Space Diffusion Parameters in CNS."





At the Welcoming Ceremony the Saint-Malo Mayor's representative, Mme. Taillander, addresses Denis LeBihan (r) and the ISMRM Workshop participants.

Social events were also offered daily to provide additional opportunities for participants to interact in a pleasant, relaxing atmosphere. A welcome cocktail on the evening preceding the workshop allowed participants to check in with their posters, as well as to check out local culinary delights. On Sunday night, champagne was offered by the City Mayor in an old tower of the City Hall, a beautiful castle. Champagne continued to flow the next evening at a gathering in a renovated mansion in the Saint-Malo area. Guests were given a chance to "exercise" before enjoying a fine gourmet dinner thanks to a local group of musicians who performed for one hour. Live Celtic music was very

entertaining, and guests were invited to join an exciting lesson of popular dances from Brittany. The last day a special break gave the participants a chance to taste local oysters, which had been freshly collected in the early morning hours, traditionally served with Muscadet wine and Brittany salty butter. Finally, the participants staying over the next day were offered a trip to Mont-Saint-Michel ("the 8<sup>th</sup> Wonder of the World").

After a short introduction from Dr. Le Bihan, the workshop started on Sunday morning with a series of talks on the "physics background" chaired by Drs. Basser and Cohen. Dr. Springer introduced a concept of the "shutter speed" to explain how it was possible to play with the diffusion contrast and its tissue relationship through sequence parameters. Several speakers discussed q-space measurements, showing their great potential for the characterization of tissue architecture and anisotropy. They also pointed out some difficulties in the interpretation of q-space data, especially when displacement distributions are not Gaussian and gradient pulses are not short enough compared to the diffusion time.

The afternoon session, chaired by Drs. Mulkern and Stanisiz, touched a very controversial issue: diffusion in multiple compartments and exchange effects. Although most speakers acknowledged that at least two diffusion pools, slow and fast diffusing, contributed to the diffusion decay curves, the physical origin and the compartments corresponding to those pools remain a mystery. Earlier suggestions to ascribe these pools to the intra- and extracellular spaces were questioned. No agreement has been reached on the actual diffusion coefficients of the extra- and intracellular compartments. Heterogeneity and exchange effects probably play an important role in the observed diffusion patterns. The effect of intracellular flow (cytosolic streaming) on the measured ADCs was also discussed.

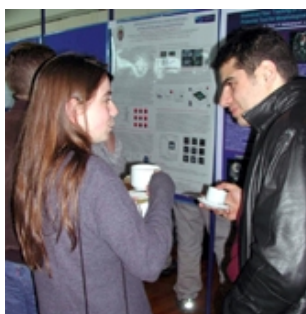
See Diffusion MRI page 21



Stefan C.A. Steens and Mark van Buchem at Malouinière de la Ville Gilles.



Poster sessions provided an opportunity for further scientific discussions.



Student participants at the Monday night gala dinner.



Michael E. Moseley and Peter Van Zijl with Marcel Pouchelet (center).



Participants were treated to sumptuous meals in Saint-Malo, including a luncheon pictured at left and an oyster break shown above.





Standing up for a discussion session (from l to r): Lawrence Latour, D. Jones, Nicol s Lori, Robert Welsh, Van Wedeen, and Charlie Springer.

Clearly there is no clear picture of what is going on, and the only agreement was that a "unified model" had still to be found to explain tissue water diffusion.

On Monday morning Drs. Sotak and Leibfritz chaired and lectured to introduce the field of tissue geometry and its relationship with water diffusion. The speakers showed experimentally and theoretically how changes in cell volume (especially swelling) could modulate the ADC. Here also several mechanisms and theories were proposed dealing either with intracellular or extracellular water. It was agreed that several mechanisms likely contribute to explain the ADC decrease that has been observed in acute brain ischemia, some brain disorders and normal cortical activation. An outstanding lecture by Dr. Sykov , key-note speaker, provided a stimulating "outside" view to the problem. Dr. Sykov , who has years of experience in diffusion measurements of ions in tissue preparations, clearly showed that diffusion MRI data obtained *in vivo* were in close agreement with her own measurements. She also pointed out the existence of dynamic changes in neural tissue structure, which could perhaps be observed with diffusion MRI.

In the afternoon the issue of diffusion anisotropy was brought up. Drs. Van Zijl and Neil moderated the session. The origin of water diffusion anisotropy in white matter was deeply discussed, while the evidence for

diffusion anisotropy in the brain cortex was shown, especially at high resolution and in the developing brain. The session was followed by a key-note address by Dr. Pouchelet, who introduced his movie, "The Neuron Times." After a short presentation on the technical tricks used to make the movie, all participants were astonished by what they saw: Neurons and associated cells of a tissue preparation are filmed continuously for several days using a special microscope linked to a camera. Images are then mounted with an 100-fold or 1000-fold acceleration factor, enabling us to witness part of the life of the neurons and observe how neurons form synapses or die.

The morning of the last day was dedicated to fiber tracking, a popular and fast-growing application of diffusion tensor MRI. Drs. Wedeen and Alexander managed the session. New algorithms to increase the accuracy of the tracking, especially in regions where several bundles may cross, were presented. The problem of the validation of the results was also raised, and the potential of manganese-enhanced  $T_1$ -weighted MRI was clearly outlined in animal models. Finally, the potential of combining DTI and fMRI was demonstrated. The use of MRI microscopy combined with DTI was demonstrated to have potential for new types of 3D "stains" of the brain. The afternoon session, chaired by Drs. Moseley and Conturo, addressed clinical issues. The idea was to suggest how diffusion MRI could help in understanding brain

disorders, for instance in terms of tissue structure changes in the cortex or white matter fiber anomalies. Examples were shown in brain and spinal cord.

The success of the workshop, both scientifically and socially, was signified by the many participants who indicated a desire to meet again in the near future to review research progress in the field.

## ACKNOWLEDGEMENTS

The workshop organizers are grateful to the workshop participants for their very active contribution to the talks, poster and discussion session, as well as to the invited speakers and session moderators for their dedication: C. Beaulieu, S. Blackband, Y. Cohen, J. Pfeuffer, C. M. Ellis, G. Stanisz, T. Klingberg, L.L. Latour, D. Leibfritz, T.H. Mareci, M. Moseley, J.J. Neil, C.H. Sotak, C.S. Springer, G.J. Stanisz, V. Wedeen, and the key-note speakers E. Sykov , and M. Pouchelet (P.T. Callaghan was not able to attend).

Many thanks to the workshop sponsors: Siemens Medical Solutions, Bruker Biospin MRI, Inc., GE Medical Systems, the French Atomic Energy Commission, Life Science Division (CEA/DSV), the Centre national de la Recherche Scientifique (CNRS), the Neurofunctional Imaging Federative Research Institute (IFR49, Orsay). The workshop would not have been a success without their generous support.

The organizers would also like to congratulate Mrs. Sophie Pell  and the staff of the Palais du Grand Large at Saint-Malo for their wonderful support and dedication, as well as the team of the Saint-Malo Mayor for their hospitality. Roberta Kravitz and Bob Goldstein from the ISMRM office deserve a magna cum laude for making the preparation and the organization of the workshop so smooth and flawless.

– Denis Le Bihan, Workshop Chair and Organizer  
Peter J. Basser and Peter C.M. van Zijl, Co-Chairs

## ISMRM Workshop on Current Issues in MR Safety

23-24 February 2003

ArabellaSheraton Grand, München, Germany

*Endorsed by the German Radiological Protection Commission  
Strahlenschutzkommission (SSK)*



This workshop is the latest in a series designed to keep ISMRM members abreast of developments in the field of MR Safety. The introduction of high field human imaging systems (3-8 T), the development of rapidly switched gradient coils, the evolution of radio frequency coils, the use of interventional MR, the proliferation of invasive devices in the MR environment, the increased use of contrast agents, the development of new MR safety standards, and the need to harmonize international standards should make this safety workshop timely. The workshop will be held in Europe in an effort to expand participation in the discussion of scientific and regulatory safety issues. The Strahlenschutzkommission, one of the major regulatory organizations, has endorsed the workshop.

### SESSION TOPICS

- Session 1: B<sub>0</sub> Safety
- Session 2: Gradient-Induced Stimulation Safety
- Session 3: Acoustic Noise Safety
- Session 4: RF Safety
- Session 5: Other Safety Issues  
(including invasive devices) - I
- Session 6: Other Safety Issues  
(including contrast agents & interventional MR) - II
- Session 7: Harmonization of World Wide Standards  
(including panel discussion)
- Session 8: MR Clinical Safety  
(including pediatric safety & safe practices recommendations)

### EDUCATIONAL OBJECTIVES

Upon completion of this workshop, participants should be able to:

- Recognize MR safety concerns involving static magnetic fields, time-varying gradients, and radio-frequency fields;
- Recommend methods to minimize patient heating from surface coils and other conductors;
- Implement procedures to minimize patient and operator safety concerns;
- Compare various national and international safety standards and limits;
- Identify potential safety flaws in their current clinical scanning procedures;
- Evaluate safety aspects of new MR technologies currently under development.

### CREDIT HOURS AVAILABLE

The International Society for Magnetic Resonance in Medicine designates this continuing medical education activity for up to **14.5** hours in Category 1 of the Physician's Recognition Award of the American Medical Association. Each physician should claim only those hours of credit actually spent in the educational activity.

### FOR FURTHER INFORMATION, PLEASE CONTACT ISMRM

Phone: +1 510-841-1899 FAX: +1 510-841-2340 E-mail: [info@ismrm.org](mailto:info@ismrm.org) Website: <http://www.ismrm.org>

### WORKSHOP ORGANIZERS

#### Scientific Program Committee

- Gunnar Brix, Ph.D., Federal Office for Radiation Protection, Oberschleissheim, Germany
- Hans Engels, Ph.D., Philips Medical Systems, Best, Netherlands
- Joel Felmlee, Ph.D., Mayo Clinic, Rochester, New York, USA
- Georg Frese, Siemens Medical Solutions, Erlangen, Germany
- Axel Haase, Ph.D., University of Würzburg, Würzburg, Germany
- Dietbert Hahn, M.D., Kurnach, Germany
- Jürgen Hennig, Ph.D., Universität Freiburg, Freiburg, Germany
- David G. Norris, Ph.D., FC Donders Centre, Nijmegen, Netherlands
- Daniel J. Schaefer, Ph.D., G.E. Medical Systems, Milwaukee, Wisconsin, USA
- Loren Zaremba, Ph.D., Food and Drug Administration, Rockville, Maryland, USA

#### Local Organising Committee

- Gunnar Brix, Ph.D., Federal Office for Radiation Protection, Oberschleissheim, Germany
- Michael Peller, Ph.D., University of Munich, Munich, Germany
- Maximilian F. Reiser, M.D., University of Munich, Munich, Germany

### CALL FOR PAPERS

Prospective participants are invited to submit abstracts for poster or oral presentation. Digital submission is encouraged in Word, WordPerfect, or simple text format; however, hard copy submission is allowed. The deadline for receipt of abstract submissions for both digital and paper abstracts is **15 December 2002**.

Abstracts should be no more than 1 page in length, including all images, tables, graphs, and references, and no smaller than 10pt font should be used. An accompanying cover letter should indicate whether the abstract is to be considered for a talk or poster, and whether the presentation could be a poster if it cannot be accommodated in an oral session (all unspecified abstracts will be considered for posters). The cover letter should include title of the abstract, name, affiliation, postal address, e-mail address, telephone number, and fax number for each author. The cover letter should also include the name of the author who will be presenting the abstract, if accepted.

The abstracts will be reviewed and selected by the workshop organizing committee. Acceptance will be based on scientific merit, relevance to the field, clarity, soundness, and space availability. Early submission is encouraged!

Notification of acceptance will be made by e-mail by 3 January 2003. All accepted abstracts are expected to be presented at the workshop and will be published in the workshop syllabus, which will be distributed to all workshop participants.

Abstracts should be sent to:  
International Society for Magnetic Resonance in Medicine  
Attn: Current Issues in MR Safety Workshop  
2118 Milvia Street, Suite 201  
Berkeley, CA 94704 USA  
E-Mail: [MR\\_Safety@ismrm.org](mailto:MR_Safety@ismrm.org)



*Presented by the Dynamic NMR Study Group:*

## ISMRM Workshop on Metabolic Imaging of Ischemia

**23-25 March 2003**

**Westin Grand Bohemian Hotel, Orlando, Florida, USA**

The purpose of the workshop is to explore the potential of MR spectroscopy and other modalities to provide new information on metabolic and physiological processes that take place following ischemia, and recovery from ischemia and to increase our understanding of mechanisms of cell death, the signaling pathways involved in ischemia, and metabolic strategies for protection against and enhancement of recovery from ischemia. MRS allows one to examine high-energy phosphate metabolism, tissue pH, and changes in different metabolites such as lactate, lipid metabolism, and Na<sup>+</sup> concentration. MRI can be used to study changes in tissue perfusion, diffusion, T<sub>1</sub> and T<sub>2</sub>, distribution of contrast agents, and function. PET provides information on glucose metabolism and oxygen consumption, and SPECT on perfusion and thallium uptake.

This workshop should be of interest to spectroscopists and MRI experts who may wish to learn about metabolism and physiology of ischemia, as well as to clinicians who may be interested in how different metabolic imaging approaches may contribute to a better understanding of ischemia.

### ORGANIZING COMMITTEE

- Jan A. den Hollander, Ph.D., Co-Chair, University of Alabama at Birmingham, Birmingham, Alabama, USA
- Peter G. Morris, M.A., Ph.D., Co-Chair, Nottingham University, Nottingham, England, UK
- E. Douglas Lewandowski, Ph.D., University of Illinois College of Medicine, Chicago, Illinois, USA
- James W. Prichard, M.D., Yale University School of Medicine, New Haven, Connecticut, USA
- Robert G. Weiss, M.D., Johns Hopkins Hospital, Baltimore, Maryland, USA
- Stephen R. Williams, D.Phil., University of Manchester, Manchester, England, UK

## ISMRM Workshop on Cellular and Molecular Imaging in Diagnostics and Therapy

**June 2003 Bordeaux, France**

Preliminary list of topics to be addressed:

- New technologies in molecular and cellular imaging targeted to specific biological pathways;
- The role of the major imaging modalities in cellular and molecular imaging;
- The (potential) role of molecular imaging in advanced therapies, notably gene therapy;
- The (potential) role of cellular imaging in cell repair therapy, notably via stem cells;
- The basic principles of imaging of key biological processes such as angiogenesis, apoptosis, inflammation.

### FOR FURTHER INFORMATION, PLEASE CONTACT ISMRM

Phone: +1 510-841-1899  
FAX: +1 510-841-2340  
E-mail: [info@ismrm.org](mailto:info@ismrm.org)  
Website: <http://www.ismrm.org>



## 2002

### DECEMBER

Meeting: **RSNA**  
Date: 1-6 December 2002  
Where: McCormick Place, Chicago, Illinois, USA  
Contact: Radiological Society of North America  
820 Jorie Boulevard, Oak Brook, IL 60523  
Phone: +1 630 571 7852  
Fax: +1 630 571 7837  
Website: [www.rsna.org](http://www.rsna.org)

#### Endorsed by ISMRM:

Meeting: **First Eastern Mediterranean Congress and Second National Congress of Magnetic Resonance Imaging**  
Date: 12-14 December 2002  
Where: Izmir, Turkey  
Contact: E. Turgut Tali, M.D.  
Phone: +90-(312) 212 4040  
Fax: +90-(312) 212 4040 / +90-(312) 212 1940  
E-mail: [turgut.tali@med.gazi.edu.tr](mailto:turgut.tali@med.gazi.edu.tr)  
Website: [www.mrder.org.tr](http://www.mrder.org.tr)

## 2003

### JANUARY

Meeting: **10th International MRI Symposium  
MR 2003 MRI— Reinventing its Novelty**  
Date: 30 January - 1 February 2003  
Where: Garmisch-Partenkirchen, Germany  
Contact: Eurokongress  
GmbH, Isartoplatz 3, D- 80331 München, Germany  
Phone: ++49 0 89 210 98 60  
Fax: ++49 0 89 210 98 698  
E-mail: [info@eurokongress.de](mailto:info@eurokongress.de)  
Website: [www.mr2003.org](http://www.mr2003.org)

#### Endorsed by ISMRM:

Meeting: **Biomedical Imaging Research Opportunities Workshop**  
Date: 31 January - 1 February 2003  
Where: Hyatt Regency, Bethesda, Maryland, USA  
Contact: BIROW  
One Physics Ellipse, College Park, Maryland, 20740 USA  
Phone: +1 301 209 3350  
Fax: +1 301-209-0862  
E-mail: [birow@aapm.org](mailto:birow@aapm.org)  
Website: [www.birow.org](http://www.birow.org)

### FEBRUARY

Meeting: **Special Symposium MRI 2003:  
Clinical Update and Practical Applications**  
Date: 17-21 February 2003  
Where: Maui, Hawai'i, USA  
Contact: Danielle Klette, Harvard MED-CME  
P.O. Box 825, Boston, Massachusetts, 02117-0825 USA  
Phone: +1 617 525 3310  
Fax: +1 617  
E-mail: [dpokorski@partners.org](mailto:dpokorski@partners.org)  
Website: [www.radcm.harvard.edu](http://www.radcm.harvard.edu)

Workshop: **ISMRM Workshop on Current Issues in MR Safety**  
Date: 23-24 February 2003  
Where: ArabellaSheraton Grand, München, Germany  
Contact: Registrar, ISMRM  
2118 Milvia Street, Suite 201, Berkeley, CA 94704 USA  
Phone: +1 510 841 1899  
Fax: +1 510 841 2340  
E-mail: [info@ismrm.org](mailto:info@ismrm.org)  
Website: [www.ismrm.org](http://www.ismrm.org)





Mark Your Calendar!

## ISMRM IMPORTANT DATES AND DEADLINES

### 20 NOVEMBER 2002

Deadline for online receipt of Abstract submissions.

### 20 NOVEMBER 2002

Deadline for receipt of Student Stipend Applications.

### 20 NOVEMBER 2002

Deadline for receipt of Clinical Resident Stipend Program Applications.

### 20 NOVEMBER 2002

Deadline for receipt of New Entrant Stipend Program Applications.

### 20 NOVEMBER 2002

Deadline for receipt of E.K. Zavoisky Stipend Program Applications.

### 17 JANUARY 2003

Deadline for receipt of Proffered Papers for the SMRT 12th Annual Meeting.

### 23-24 FEBRUARY 2003

ISMRM Workshop on Current Issues in MR Safety München, Germany

### 28 MARCH 2003

Deadline for Advance Registration for the ISMRM Tenth Scientific Meeting & Exhibition.

10 - 16 MAY 2003

## ELEVENTH SCIENTIFIC MEETING AND EXHIBITION

Toronto, Ontario, Canada

### FRIDAY, 9 MAY 2003

On-site Registration open from 14:00 - 20:00.  
SMRT Poster Tour & Reception 18:30 - 20:00.

### SATURDAY, 10 MAY 2003

Weekend Educational Programs begin.  
On-site Registration open from 06:30 - 18:00.  
SMRT 12th Annual Meeting begins 07:45.

### SUNDAY, 11 MAY 2003

Weekend Educational Programs continue.  
On-site Registration open from 07:30 - 18:00.  
SMRT 12th Annual Meeting continues.

### MONDAY, 12 MAY 2003

On-site Registration open from 06:30 - 18:30.  
Scientific Sessions begin at 07:45.  
Technical Exhibition open at 10:00.

### TUESDAY - THURSDAY, 13-15 MAY 2003

On-site Registration open from 06:30 - 18:00.  
Morning Categorical Courses begin at 07:00.  
Scientific Sessions begin at 08:15.  
Technical Exhibition open at 09:30.

### FRIDAY, 16 MAY 2003

On-site Registration for Scientific Meeting from 06:30 - 12:30.  
Morning Categorical Courses begin at 07:00.  
Scientific Sessions begin at 08:15.  
Scientific Meeting adjourns at 12:30.

### Bill Negendank Award Fund

In memory of William George Negendank, M.D., his colleagues in the ISMRM MR of Cancer Study Group have established the **Bill Negendank Award Fund** to recognize outstanding young investigators in the field of Cancer MR (see *MR Pulse*, Vol. 3, No. 3, page 6). To make your tax-deductible contribution, please send your check made payable to the ISMRM or submit your Visa, MasterCard, American Express, or Eurocard number, expiration date, and amount you wish to donate to the following address:

Bill Negendank Award Fund  
International Society for  
Magnetic Resonance in Medicine  
2118 Milvia Street, Suite 201  
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Magnetic Resonance in Medicine  
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MAGNETIC RESONANCE IN MEDICINE

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### ISMRM Members: Let us hear from you so that you can hear from us!

Make sure the ISMRM has your current contact information on file, including your email address, so that you don't miss out on important ISMRM news updates! To update your information online, visit the members only page of the ISMRM Website, <http://www.ismrm.org>, and click on membership directory. Or, you may send changes to [info@ismrm.org](mailto:info@ismrm.org).