SCMR

Society for Cardiovascular Magnetic Resonance

INTERNATIONAL SOCIETY FOR ISMRM MAGNETIC RESONANCE IN MEDICINE

ONE COMMUNITY FOR CLINICIANS AND SCIENTISTS

International Society for Magnetic Resonance in Medicine

2016 SCMR/ISMRM Co-Provided Workshop

FINAL PROGRAM

Quantitative CMR: From Technique Development to Practical Implementation

January 27-28, 2016

Westside Ballroom | Hyatt Regency Century Plaza | Los Angeles, California

www.scmr.org

www.ismrm.org

SCMR/ISMRM Co-Provided Workshop

Presented by the SCMR and the ISMRM Cardiac MR Study Group

Quantitative CMR: From Technique Development to Practical Implementation

January 27-28, 2016

Hyatt Regency Century Plaza | Los Angeles, California

Letter from Organizers

Dear Colleagues and Friends,

On behalf of the Organizing Committee, we are extremely happy to welcome you to Los Angeles for the 2016 Co-Provided SCMR/ISMRM Workshop entitled: Quantitative CMR: From Technique Development to Practical Implementation. This workshop is the 5th of its kind, and we hope that this continuing collaboration enhances both research and education in Cardiovascular Magnetic Resonance (CMR). We're pleased to have been given the opportunity to construct this year's program and are excited by the excellent speakers that have agreed to participate. We hope that the workshop will provoke many interesting, insightful and educational discussions.

The purpose of this workshop is to bring together basic and clinical researchers to discuss the wide range of Quantitative CMR Techniques and where they all stand in terms of their application in clinical research and/or clinical practice. A major strength of CMR lies in its ability to non-invasively provide quantitative measures of many different parameters. There are, however, still many challenges requiring improvements to the methods of acquisition and analysis, which can only be overcome by a collaborative effort of scientists, engineers and clinicians. We have a diverse program which ranges from techniques far from clinical application to those used in routine practice and those used more for clinical research and trials. The methods of analysis and needs for standardization are also addressed. We are delighted to have a group of excellent speakers including both leaders and younger rising stars in the field. We believe that the multi-disciplinary faculty and range of topics will benefit all participants to advance the field of Quantitative CMR.

The scientific program of this one and a half day workshop includes three plenary lectures, five scientific sessions including four with abstract talks and one with a moderated panel discussion and a wine & cheese poster session/reception. Our plenary speakers and session chairs represent world leaders in quantitative CMR and the speakers will introduce and present broad overviews of the topics that will follow in the more focused sessions. On the first day the sessions will start with techniques that are furthest from clinical application and move through those methods used for clinical research to those now applied clinically. The idea is to get a feel of how far we are from clinical application and what needs to be done to improve those that are already applied. The second day will focus more on methods applied to clinical trials and on standardization to ensure consistency. We sincerely hope that this workshop will provide an exciting opportunity for all of us to learn about the standing and importance of and to explore new ideas and concepts for using Quantitative CMR. By continuing this exchange between clinicians and research scientists we will continue to develop and improve techniques to improve our understanding, early detection and treatment of cardiovascular diseases.

Thank you to all the presenters, organizers and attendees for their effort and support to make this a successful meeting.

Matthias Stuber, PhD and David Firmin, PhD
Co-Chairs, SCMR/ISMRM Co-Provided Workshop

Organizing and Scientific Program Committee:

Co-chairs:

Matthias Stuber, PhD
University of Lausanne
Switzerland

David Firmin, PhD
Royal Brompton Hospital & Imperial College
London, UK

Committee Members:

Philipp Beerbaum, MD (Hannover Medical University)
Marcus Carlsson, MD (Lund University)
Allison Hays, MD (Johns Hopkins Hospital)
Jennifer Keegan, PhD (Royal Brompton Hospital)
Sam Nazarian, MD, PhD (Johns Hopkins University)
Sonia Nielles-Vallespin, PhD (National Institutes of Health)
Michael Salerno, MD, PhD (University of Virginia)
Tobias Schaeffter, PhD (Physikalisch-Technische Bundesanstalt)
Damian Tyler, PhD (University of Oxford)
Jonathan Weinsaft, MD (Cornell University)

Table of Contents

General Information Overview

The purpose of this workshop is to bring together basic and clinical researchers to discuss the wide range of Quantitative Cardiovascular Magnetic Resonance (CMR) Techniques and where they all stand in terms of their application in clinical research and/or clinical practice. A major strength of CMR lies in its ability to non-invasively provide quantitative measures of many different parameters. There are, however, still many challenges requiring improvements to the methods of acquisition and analysis, which can only be overcome by a collaborative effort of scientists, engineers and clinicians. We have a diverse program which ranges from techniques far from clinical application to those used in routine practice and those used more for clinical research and trials. The methods of analysis and needs for standardization are also addressed. We are delighted to have a group of excellent speakers including both leaders and younger rising stars in the field. We believe that the multi-disciplinary faculty and range of topics will benefit all participants to advance the field of quantitative CMR.

Target Audience

The multidisciplinary faculty and broad target audience will provide a stimulating discussion relevant to cardiologists, radiologists, physicists, engineers, physiologists, trainees, and technologists.

Educational Objectives

Upon completing this workshop, participants should be able to:

- Recognize both the importance and the potential of MRI to quantify heart structure, function & metabolism.
- Distinguish between current and emerging approaches to quantitative CMR.
- Describe steps needed for successful translation.

Continuing Medical Education Credits

The Society for Cardiovascular Magnetic Resonance is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The Society for Cardiovascular Magnetic Resonance designates this live activity for a maximum of *11 AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Agenda

Day 1: Wednesday, January 27, 2016

8:30 am **Welcome**
Matthias Stuber, PhD (University of Lausanne)
David Firmin, PhD (Royal Brompton Hospital & Imperial College London)

8:35 am **Plenary 1: Quantitative Techniques on the Horizon**
Sebastian Kozerke, PhD (Institute for Biomedical Engineering University and ETH Zurich)
At the conclusion of this presentation, participants will be better able to:
- Describe the structure & function of the heart at different scales
- State the potential & challenges of quantitative imaging approaches
- Assess the potential value of microstructural and metabolic imaging and spectroscopy

9:00 am **Plenary 2: CMR Quantification in Clincal Research & Diagnosis**
Raymond Kwong, MD, MPH (Brigham and Women's Hospital)
At the conclusion of this presentation, participants will be better able to:
- Differentiate among the different methods used in clinical research and diagnosis
- Discuss the clinical importance of quantification to CMR
- Describe the strengths and weaknesses of the different methods

9:25 am **Q & A**

9:30 am – 10:00 am **Break**

10:00 am – 12:00 pm **Session 1 - Preclinical and Translational Techniques**
Moderators: Sonia Nielles-Vallespin (National Institutes of Health, USA), Damian Tyler (University of Oxford, UK)
At the conclusion of this presentation, participants will be better able to:
- Compare preclinical and translational techniques
- Discuss how far these techniques are from translation
- Describe how CMR can probe metabolism and microstructure

10:00 am **Cardiac Spectroscopy**
Michael Schär, PhD (Johns Hopkins University)

10:15 am **DNP**
Tyler Damian, PhD (University of Oxford)

10:30 am **cDTI**
Daniel Ennis, PhD (University of California Los Angeles)

10:45 am **Invited Abstract Presentations**

10:45 am **W 01 Cardiac MR Fingerprinting for T1 and T2 Mapping in Four Heartbeats**
Jesse Hamilton (Case Western Reserve University)

11:00 am **W 02 Fast, Heart-Rate Independent, Whole-Heart, Free-Breathing, Three-Dimensional Myocardial BOLD MRI at 3T with Simultaneous 13N-Ammonia PET Validation in Canines**
Hsin-Jung Yang (Cedars Sinai Medical Center)

11:15 am **W 03 Detection of Increased Coronary Microvascular Permeability with MRI T1 Mapping and Gadolinium-labeled Albumin**
Sophia Cui (University of Virginia)

11:30 am **W 04 Automated Removal of Gradient-Induced Voltages from 12-Lead ECG Traces during High-Gradient Duty-Cycle MRI Sequences**
Mikayel Dabaghyan, PhD (Mirtech, Inc.)

11:45 am **Panel Discussion**

12:00 pm – 1:00 pm **Lunch (On Own)**

1:00 pm – 3:00 pm **Session 2: Clinical Research Approaches**
Moderators: Allison Hays, MD (Johns Hopkins Hospital, USA) , Jenny Keegan, PhD (Royal Brompton Hospital, London, UK)
At the conclusion of this presentation, participants will be better able to:
- Explain how quantitative myocardial perfusion analysis is performed and the potential benefits for clinical and research studies
- Analyze the current and potential applications of 4D flow
- Describe approaches to the CMR assessment of diastolic dysfunction and the clinical and research applications of cardiac strain imaging

1:00 pm **Perfusion Quantification**
Andrew Arai, MD (National Institutes of Health)

1:15 pm **4D Flow**
Ann Bolger, MD (University of California San Francisco)

1:30 pm **Strain CMR: Techniques and Applications**
Fredrick Epstein, PhD (University of Virginia)

1:45 pm **Invited Abstract Presentations**

1:45 pm **W 05 Black-Blood T1 Mapping at 3T: Reduced Partial-Voluming using Adiabatic MSDE Preparation**
Sebastian Weingaertner, PhD (Computer Assisted Clinical Medicine)

2:00 pm **W 06 An Efficient Fat Suppression Technique for Stimulated-Echo Based CMR**
El-Sayed Ibrahim, PhD (University of Michigan)

2:15 pm **W 07 Characterization of Both Myocardial Extracellular Volume Expansion and Myocyte Mypertrophy by CMR Detect Early Signs of Myocardial Tissue Remodeling in Friedreich's Ataxia Patients without Heart Failure**
Otavio Coelho-Filho, MD, MPH, PhD (State University of Campinas – UNICAMP)

2:30 pm **W 08 Inline Quantitative Myocardial Perfusion Flow Mapping**
Hui Xue, PhD (National Institutes of Health)

2:45 pm **Panel Discussion**

3:00 pm – 3:30 pm **Break**

3:30 pm – 5:00 pm **Session 3: Techniques Used in Routine Practice**
Moderators: Philipp Beerbaum, MD (Hannover Medical University, Germany), Jonathan Weinsaft, MD (Cornell University, USA)
At the conclusion of this presentation, participants will be better able to:
- Summarize a comprehensive overview of quantification in routine CMR
- Describe the strengths and weaknesses of the different measurements
- Discuss the limitations of quantitative CMR in routine practice

3:30 pm **Left and Right Ventricular Function**
Andreas Schuster, MD, PhD (University of Gottingen, Germany)

Agenda

Wednesday, January 27, 2016 (Cont'd)

3:45 pm **2D Flow/Velocity Measurement & Valves**
Vanessa Ferreira, MD, DPhil (University of Oxford)

4:00 pm **Myocardial LGE Quantification**
Igor Klem, MD (Duke University Medical Center)

4:15 pm **Myocardial T1, T2 and T2* Quantification**
Michael Jerosch-Herold, PhD (Brigham and Women's Hospital, Harvard Medical School)

4:30 pm **Invited Abstract Presentations**

4:30 pm **W 09 A Novel Analytical Approach to Quantitative Myocardial Edema Imaging in Acute Myocarditis Using T2-Mapping**
Bettina Baessler, MD (University Hospital of Cologne)

4:45 pm **W 10 In-Vivo Carotid T2 Mapping Can Accurately Quantify Plaque Lipid Content to Discriminate between Symptomatic and Asymptomatic Patients: Histological Validation, Scan-Rescan Reproducibility and Clinical Study**
Luca Biasiolli (University of Oxford)

5:00 pm **W 11 A Preliminary Investigation towards Automated Computation of Multiparametric Strain Z-Score in Dilated Cardiomyopathy Using Navigator-gated Spiral DENSE MRI and Radial Point Interpolation Method**
Julia Kar, PhD (Washington University)

5:15 pm **Panel Discussion**

5:30 pm **Poster Session and Reception**

Day 2: Thursday, January 28, 2016

8:30 am **Welcome**
Matthias Stuber, PhD (University of Lausanne)
David Firmin, PhD (Royal Brompton Hospital & Imperial College London)

8:35 am **Plenary 3: Quantification in Trials, Analysis & Standardisation**
Sven Plein, MD, PhD (University of Leeds)
At the conclusion of this presentation, participants will be better able to:

- Indicate the importance of quantitative endpoints in clinical trials
- List the challenges of defining quantitative endpoints for trials including standardisation
- Compare the value of MRI relative to other endpoints in clinical trials

9:00 am – 11:00 am **Session 4 - Quantitative CMR Methods in Trials of Medical Intervention**
Moderators: Marcus Carlsson (Lund University, Sweden), Sam Nazarian (Johns Hopkins University, USA)
At the conclusion of this presentation, participants will be better able to:

- Discuss the pathophysiology and prognostic implications of area at risk, salvage, microvascular obstruction and hemorrhage in myocardial infarction
- Quantify these measures using CMR and understand the benefits and caveats of these measures and have an insight into how they have been used in randomized controlled clinical trials
- Describe how CMR can contribute to interventional electrophysiology trials

9:00 am **AAR and Salvage**
Henrik Engblom, MD, PhD (Lund University)

9:15 am **Microvascular Obstruction and Hemorrhage**
Ingo Eitel, MD (University of Leipzig)

9:30 am **CMR Parameters to Guide EP Interventions**
Graham Wright, PhD (University of Toronto)

9:45 am **Invited Abstract Presentations**

9:45 am **W 12 Two RR Myocardial Perfusion Acquisition Achieves Unbiased Myocardial Blood Flow (MBF) Estimates**
Hui Xue, PhD (National Institutes of Health)

10:00 am **W 13 Assessment of T1Rho Relaxation Times after Reperfused Myocardial Infarction**
Walter Witschey, PhD (University of Pennsylvania)

10:15 am **W 14 A T1 and ECV Phantom for Global T1 Mapping Quality Assurance: The T1 Mapping and ECV Standardisation in CMR (T1MES) Program**
Gaby Captur, MD, MRCP (UCL Institute of Cardiovascular Science, University College London, Barts Heart Centre. St Bartholomew's Hospital)

10:25 am **W 15 Pressure Gradient Measurement Using Phase Contrast (PC)-MRI in Stenotic Phantom Models: Towards Noninvasive Quantification of Fractional Flow Reserve in the Coronary Arteries**
Zixin Deng, MS (Cedars Sinai Medical Center, University of California, Los Angeles)

10:45 am **Panel Discussion**

11:00 am – 11:30 am **Refreshment Break**

11:30 am – 12:45 pm **Session 5 - Quantitative CMR Analysis and Standardization**
Moderators: Michael Salerno, MD, PhD (University of Virginia, USA), Mark Hofman, PhD (VU University Medical Center)
At the conclusion of this presentation, participants will be better able to:

- Explain the importance of phantoms and comparable analysis algorithms to perform clinical multi-centre studies
- Recognize the need for physical standards (phantoms) for traceability of cross-platform measurements
- Explain the need for comparative studies of different analysis algorithms using common datasets

11:30 am **Clinical Need for Standards in CMR-Acquisition and Data Analysis**
Jenette Schulz-Menger, MD (Charite Universitatsmedizin Berlin and HELIOS-Clinics)

11:45 am **Developing Standards with National Institutes**
Katy Keenan (National Institute of Standards and Technology)

12:00 pm **Comparability of Data Analysis Algorithms**
Alistair Young, PhD (Auckland University)

12:15 pm **Moderated Panel Discussion**

12:45 pm **Adjourn**

Program Committee and Faculty Disclosures

The SCMR and ISMRM are committed to:

- Ensuring balance, independence, objectivity and scientific rigor in all Continuing Medical Education (CME) programs; and
- Presenting CME activities that promote improvements or quality in healthcare and are independent of commercial interests.

Therefore it is the policy of both societies that any person who has influence over the content of a program designated for *AMA PRA Category 1 Credits™* must disclose any real or apparent financial interest or other relationship (i.e., grants, research support, consultant, honoraria) that the individual may have with the manufacturers, distributors or providers of any commercial products or services that may be discussed in the presentation.

Such financial interests or relationships must be identified in advance so that potential conflicts can be resolved before the program, and participants at the CME activity may have these facts fully disclosed at the outset.

Neither the ISMRM nor the SCMR implies that such financial interests or relationships are inherently improper or that such interests or relationships would prevent the speaker or organizer from making an objective contribution. However, it is imperative that such financial interests or relationships be identified so that potential conflicts can be resolved before the program, and participants at the CME activity may have these facts fully disclosed in advance. It then remains for the audience to determine whether an individual's outside interests may reflect a possible bias in either the exposition or the conclusions presented.

Program Committee

Firmin, David has nothing to disclose.
Stuber, Matthias has nothing to disclose
Nielles-Vallespin, Sonia has nothing to disclose.
Tyler, Damian has nothing to disclose.
Hays, Allison has nothing to disclose.
Hofman, Mark has nothing to disclose.
Keegan, Jennifer has nothing to disclose.
Beerbaum, Philipp has nothing to disclose.
Weinsaft, Jonathan has nothing to disclose.
Carlsson, Marcus has nothing to disclose.
Nazarian, Sam has has disclosed the following relationships:
Research grants from Biosense Webster; Consulting fees/ honoraria from Biosense Webster; Consulting fees from Medtronic; Consulting fees from CardioSolve
Salerno, Michael has nothing to disclose.
Schaeffter, Tobias has nothing to disclose.

Faculty

Arai, Andrew has disclosed the following relationships:
Other financial benefits from Siemens and Toshiba; Research Grants from Bayer
Bolger, Ann has nothing to disclose.
Eitel, Ingo has nothing to disclose.
Engblom, Henrik has nothing to disclose.
Ennis, Daniel has disclosed the following relationships:
Research grants from Siemens
Epstein, Frederick has disclosed the following relationships:
Research grants from Siemens
Ferreira, Vanessa has nothing to disclose.
Firmin, David has nothing to disclose.
Jerosch-Herold, Michael has nothing to disclose.
Keenan, Katy has nothing to disclose.
Klem, Igor has nothing to disclose.
Kozerke, Sebastian has nothing to disclose.
Kwong, Raymond has nothing to disclose.
Plein, Sven has nothing to disclose.
Schär, Michael has nothing to disclose.
Schulz-Menger, Jeanette has nothing to disclose.
Schuster, Andreas has nothing to disclose.
Stuber, Matthias has nothing to disclose.
Wright, Graham has disclosed the following relationships:
Research grants from GE Healthcare, HeartVista and Imricor Medical Systems
Young, Alistair has disclosed the following relationships:
Consulting fees/honoraria from Siemens Healthcare

Oral Abstract Presenters

Baessler, Bettina has nothing to disclose.
Biasiolli, Luca has nothing to disclose.
Captur, Gabriella has nothing to disclose.
Coelho-Filho, Otavio has nothing to disclose.
Cui, Sophia has nothing to disclose.
Dabaghyan, Mikayel has disclosed the following relationship:
Research grants from E-TROLZ
Deng, Zixin has nothing to disclose.
Hamilton, Jesse has nothing to disclose.
Ibrahim, El-Sayed has nothing to disclose.
Kar, Julia has nothing to disclose.
Weingärtner, Sebastian has disclosed the following relationships:
Royalty income from Samsung
Witschey, Walter has nothing to disclose.
Xue, Hui has nothing to disclose.
Yang, Hsin-Jung has nothing to disclose.

Staff

Berkowitz, Deborah has nothing to disclose.
Moyer, Stephanie has nothing to disclose.
Pomilio, Pete has nothing to disclose.
Ramos, Maria has nothing to disclose.
Rehmann, Kearstin has nothing to disclose.

Poster Directory

SCMR/ISMRM Co-Provided Workshop - Posters

W 16 Comparison of Three Diffusion Encoding Schemes for Cardiac Imaging Under Free Breathing Conditions.
Kévin Moulin (University of Lyon, Siemens Healthcare)

W 17 Can We Predict the Diffusion "Sweet-Spot" Based on a Standard Cine?
Andrew Scott (The Royal Brompton Hospital, Imperial College)

W 18 Right-Ventricular Assessment Using a Segmented Cine Acquisition Employing Iterative Sense Reconstruction with Spatio-Temporal L1 Regularization: Initial Clinical Experience
Abraham Bogachkov (Northwestern University, Feinberg School of Medicine)

W 19 In-Vivo Cardiac Dti: An Initial Comparison of M012 Compensated Spin-Echo and Steam
Andrew Scott (The Royal Brompton Hospital, Imperial College London)

W 20 Evaluation of Infarct Size and Microvascular Reperfusion On Angiography and Cardiac Magnetic Resonance in Patients with St-Segment Elevation Myocardial Infarction
Justyna Rajewska-Tabor, MD (University of Medical Sciences in Poznan)

W 21 Cardiac T1 Mapping in Congenital Heart Disease: Bolus versus Infusion Protocol for Measurement of Myocardial Extracellular Volume
Bettina Baessler, MD (University Hospital of Cologne)

W 22 Highly Accelerated Phase-Contrast Mri-Based Multi-Directional Flow Imaging for Peak Velocity Estimation in Aortic Stenosis Patients.
Juliana Serafim da Silveira, MD (The Ohio State University)

W 23 Initial Experience with Isotropic 3D Cardiac T2 Mapping for the Monitoring of Cardiac Allograft Rejection
Ruud van Heeswijk, PhD (University Hospital (CHUV) and University of Lausanne (UNIL))

W 24 Cardiac Function Analysis with Cardiorespiratory-Synchronized CMR
Lennart Tautz (Fraunhofer MEVIS)

W 25 Myocardial Tissue Characteriation with Native Myocardial T1 Mapping in SLE Patients with Chest Pain
Jaime Shaw (Cedars-Sinai Medical Center)

W 26 Efficient Right Ventricular Shape Modeling Using a Dual Active Shape Model
El-Sayed Ibrahim (University of Michigan)

W 27 BOLD Contrast: A Challenge for Cardiac Image Analysis
Sotirios Tsaftaris (The University of Edinburgh, IMT Lucca)

W 28 Validation of a T1 and T2 Mapping Software for Quantitative Mri
Sebastian Bidhult, MSc (Lund Cardiac MR Group, Department of Biomedical Engineering)

W 29 Venous Oxygen Saturation Estimation from Multiple T2 Maps with Varying Inter-Echo Spacing
Juliet Varghese, MSc (The Ohio State University, The Ohio State University Wexner Medical Center)

W 30 Myocardial Strain Analysis with CMR in Cardiotoxicity Patients Using Deformation Field Analysis: Comparison to Healthy Volunteers and Heart Transplant Patients
Abraham Bogachkov (Northwestern University, Feinberg School of Medicine)

W 31 Multi-Echo, Multi-Slice, Cardiovascular T2* Spiral Imaging in a Single Breath-Hold
Nii Addy, PhD (HeartVista, Inc)

W 32 Inter-Study Reproducibility of Cardiac MRI in Free Breathing Patients at Rest for the Evaluation of Regional Myocardial Perfusion
Travis DeSa (Northwestern University Feinberg School of Medicine)

W 33 A MRI-Based Open Source Tool for Quantitative Measurement of Relaxation Times and Perfusion in Cardiac Tissues
Ehsan Yazdanparast, PhD (National Center of Cardiovascular Investigations(CNIC))

W 34 Towards Joint Segmentation and Registration of the Myocardium in CP-BOLD MRI at Rest
Ilkay Oksuz (IMT Institue for Advanced Studies Lucca)

W 35 Quantification of Coronary Vessel Wall Thickness Using a Flexible Time-resolved Golden Angle Dual-Inversion Recovery Acquisition for Facilitated Sequence Timing at 3T
Giulia Ginami, MSC (CIBM/CHUV/UNIL Lausanne)

W 36 T2-Mapping- Influence of Arrhythmia and Heart Rate A Phantom Experiment
Marcel Prothmann (Charité Medical Faculty of Humboldt-University Berlin ECRC and HELIOS Clinics)

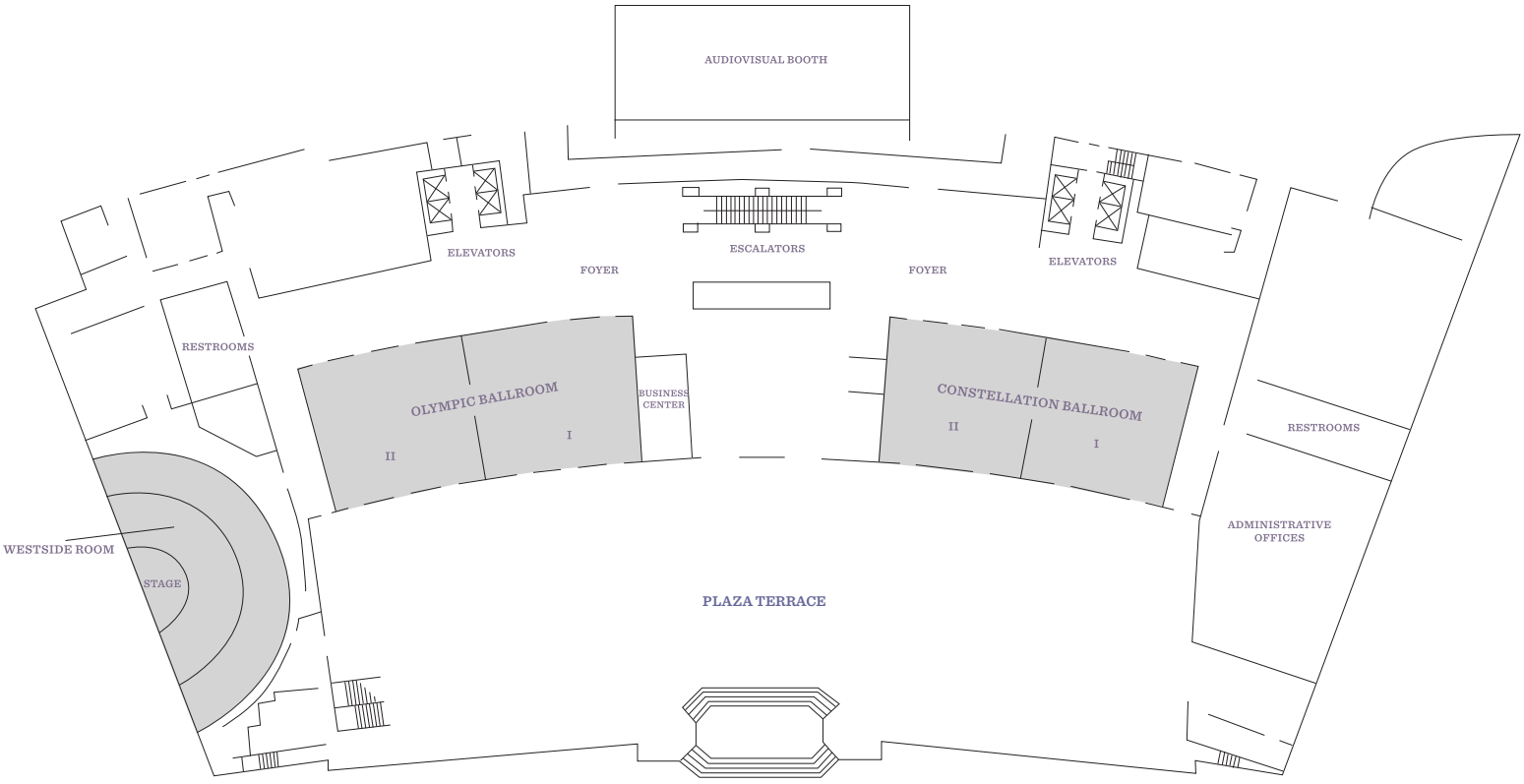
W 37 Relaxation Time Mapping Technique Development Improves Disease Detectability
Walter Witschey, PhD (University of Pennsylvania)

W 38 Reducing Variability in Dual Bolus Cardiac MRI by Using Empirical Contrast Ratios
Neil Chatterjee, BS (Northwestern University, Northwestern University)

W 39 Simultaneous VO2 and Cardiac Output Measurement to Estimate Oxygen Extraction (a-v)O2
Richard Alan LaFountain, (The Ohio State University)

Author Index

HYATT REGENCY CENTURY PLAZA FLOOR PLAN - PLAZA LEVEL



SCMR

20th Annual SCMR SCIENTIFIC SESSIONS

Gaylord National Resort & Convention Center at National Harbor | Washington, DC

FEBRUARY 1–4, 2017

— INTERNATIONAL SOCIETY FOR —

ISMRM

MAGNETIC RESONANCE IN MEDICINE

ONE COMMUNITY FOR CLINICIANS AND SCIENTISTS

24th Annual Meeting & Exhibition • 07–13 May 2016

SMRT 25th Annual Meeting • 07–08 May

SINGAPORE

www.ismrm.org • www.smrt.org

REDUCED REGISTRATION FEES & BEST HOTEL RATES IF PAID BY:

21 MARCH 2016