DESCRIPTION
This symposium will discuss recent advances in physiological and functional MRI techniques, challenges and limitations, and their applications in basic and clinical neuroscience.

WHO SHOULD ATTEND
This activity is intended for scientists and clinicians interested in MRI imaging techniques for brain function, physiology and diseases.

OBJECTIVES
After attending this activity, the participant will demonstrate the ability to:

- List typical brain physiological and functional parameters that can be obtained with advanced MRI.
- Describe available approaches to measure brain blood supply using MRI and their potential strengths and limitations.
- Explain techniques to probe brain function, both under resting-state and under a task.
- Outline MRI techniques to probe molecular properties of the brain.
- Illustrate clinical applications of physiological and functional MRI techniques.

ACCREDITATION STATEMENT
The Johns Hopkins University School of Medicine is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

CREDIT DESIGNATION STATEMENT
The Johns Hopkins University School of Medicine designates this live activity for a maximum of 9.5 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

OTHER CREDITS
The Johns Hopkins University has approved this activity for 9.5 contact hours for non-physicians.
POLICY ON SPEAKER AND PROVIDER DISCLOSURE
It is the policy of the Johns Hopkins University School of Medicine that the speaker and provider globally disclose conflicts of interest. The Johns Hopkins University School of Medicine OCME has established policies in place that will identify and resolve conflicts of interest prior to this educational activity. Detailed disclosure will be made prior to presentation of the education.

GENERAL INFORMATION
REGISTRATION
September 13, 2019 • 8:00 a.m. – 8:30 a.m.

LOCATION
Chevy Chase Bank Conference Center
The Sheikh Zayed Tower
The Johns Hopkins Hospital
1800 Orleans Street, Main Level
Baltimore, Maryland 21287

The Sheikh Zayed Tower is located on Orleans Street between Broadway and Wolfe Streets. Directions and campus parking information are available on our website under the Contact Us tab at https://HopkinsCME.cloud-cme.com. The closest garage is the Orleans Street Garage, which is located on Orleans Street (Route 40) between Wolfe Street and Broadway. Handicapped parking is also available in the McElderry Street Garage. Johns Hopkins is smoke free.

FEES
Register Online: https://hopkinscme.cloud-cme.com/aph.aspx?P=5&EID=18027

Methods of Payment: We require full payment prior to the start of the activity. On-site payments by credit card only. The registration fee includes continental breakfasts, refreshment breaks, lunches, and one dinner.

Faculty/Physicians/Scientists/Staff..................................................................................$300

Residents/Fellows/Students/Postdocs/Other Trainees..............................................$100

You will receive a confirmation by e-mail. If you have not received it by September 7, 2019, call (410) 502-9636 to confirm that you are registered. A transcript of attendance will be available upon attestation of your credit hours and submission of the post activity online evaluation. The Johns Hopkins University reserves the right to cancel or postpone any activity due to unforeseen circumstances. In this event, the University will refund the registration fee but is not responsible for travel expenses. Additionally, we reserve the right to change the venue to a comparable venue. Under such circumstances registrants will be notified as soon as possible.
LATE FEE AND REFUND POLICY
A $50 late fee applies to registrations received after 5:00 p.m. ET on September 7, 2019. A handling fee of $50 will be deducted for cancellation. Refund requests must be received by fax or mail by September 7, 2019. No refunds will be made thereafter. Transfer of registration to another Johns Hopkins activity in lieu of cancellation is not possible.

HOTEL AND TRAVEL INFORMATION
Residence Inn Baltimore at the Johns Hopkins Medical Campus
Phone: (443) 524-8400
800 North Wolfe Street
Baltimore, Maryland 21205

HOTEL RESERVATION CUT-OFF DATE: August 13, 2019
The Residence Inn Baltimore is located on the Johns Hopkins Medical Campus. Make your reservation by clicking here or call the hotel directly and specify that you are attending the Johns Hopkins ICP Network Symposium to receive the special group rate of $149.00 for one bedroom king suite, plus tax. On-site parking is available at the hotel at an additional charge. Check-in time is 4:00 p.m. Check-out time is 12:00 p.m.

SOCIAL EVENT
A dinner for registrants and faculty will be held at the Residence Inn Baltimore at the Johns Hopkins Medical Campus on Friday, September 13, 2019 from 6:00 p.m. – 8:00 p.m. Please indicate your attendance on the registration form.

HOW TO OBTAIN CREDIT
Post activity, an online evaluation will be available to attendees to evaluate the activity and individual presentations and to identify future educational needs. Upon completion of the evaluation, the learner must attest to the number of hours in attendance. Credits earned will be added to the learner’s transcript and immediately available for print. The last day to access the evaluation and attest to your credits is October 30, 2019.

An outcome survey will be sent to all physician attendees within two months post activity to assist us in determining what impact this activity had on the learner’s practice.

EMERGENCY CALLS
On September 13-15, 2019, direct emergency calls to the Hopkins registration desk, (443) 287-5426. Messages will be posted for participants.

AMERICANS WITH DISABILITIES ACT
The Johns Hopkins University School of Medicine fully complies with the legal requirements of the ADA and the rules and regulations thereof. Please notify us if you have any special needs.
SYLLABUS
The syllabus will be accessible online and via your mobile device in the CloudCME App prior to the activity. All registrants will receive a program and paper for note-taking.

TO REGISTER OR FOR FURTHER INFORMATION
Register by Phone..............................(410) 502-9636
Register by Fax..............................(866) 510-7088
Confirmation/Certificates/Transcripts..............................(410) 502-9636
General Information..............................(410) 955-2959
E-mail the Office of CME..............................cmenet@jhmi.edu

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Facebook: http://www.facebook.com/HopkinsCME

Check out our mobile app CloudCME.
Organization Code: HopkinsCME

For website and CloudCME mobile app technical difficulties, email:
cmetechsupport@jhmi.edu

For general information, please visit the activity webpage at
SPEAKERS

ACTIVITY DIRECTOR
Hanzhang Lu, PhD
Professor of Radiology and Radiological Science
Johns Hopkins University School of Medicine

JOHNS HOPKINS SPEAKERS
Jun Hua, PhD
Associate Professor of Radiology
Kennedy Krieger Institute

Peiying Liu, PhD
Assistant Professor of Radiology and Radiological Science
Johns Hopkins University School of Medicine

Jiadi Xu, PhD
Assistant Professor of Radiology
Kennedy Krieger Institute

Peter Van Zijl, PhD
Professor of Radiology and Radiological Science
Director, F.M. Kirby Research Center
Johns Hopkins University School of Medicine

GUEST SPEAKERS
John Detre, MD
Professor of Neurology and Radiology
Director of the Center for Functional Neuroimaging in the Department of Radiology, Vice Chair for Research in Neurology
University of Pennsylvania Perelman School of Medicine

Bruce Pike, PhD
Professor of Radiology and Clinical Neuroscience
CAIP Chair in Healthy Brain Aging
Head of Image Science
Hotchkiss Brain Institute
University of Calgary

Nicholas Blockley, PhD
Assistant Professor of Physiology
School of Life Sciences
University of Nottingham

Manus Donahue, PhD
Associate Professor of Radiology, Neurology, Psychiatry, and Physics
Vanderbilt University
Peter Bandettini, PhD  
Principal Investigator  
Chief of Section on Functional Imaging Methods  
Director of FMRI Core Facility 
NIMH, NIH

Molly Bright, PhD  
Assistant Professor of Physical Therapy, Human Movement Sciences and Biomedical Engineering  
Feinberg School of Medicine  
Northwestern University

Kevin Murphy, PhD  
Wellcome Trust Senior Research Fellow  
Head of Brain Imaging Group  
School of Physics and Astronomy  
Cardiff University

Dan Bulte, PhD  
Associate Professor of Engineering Science  
The Institute of Biomedical Engineering  
University of Oxford

Jean Chen, PhD  
Senior Scientist, Associate Professor of Medical Biophysics  
Rotman Research Institute  
Baycrest Health Sciences

Richard Hoge, PhD  
Associate Professor of Neurology and Neurosurgery  
Director of the Human Magnetic Resonance (MRI) Program  
Montreal Neurological Institute and Hospital

Yulin Ge, MD  
Professor of Radiology  
New York University School of Medicine

Larry Ward, PhD  
Professor of Radiology  
Director, MGH NMR Core, Martinos Center  
Harvard Medical School

David Feinberg, PhD  
Adjunct Professor of Neuroscience  
President of Advanced MRI Technologies  
University of California Berkeley
Jack Wells, PhD  
Principle Investigator  
Sir Henry Dale Wellcome Trust/ Royal Society Research Fellow  
Centre for Advanced Biomedical Imaging  
University College London

Danny Wang, PhD  
Professor of Neurology and Radiology  
Director of Imaging Technology Innovation  
Keck School of Medicine  
University of Southern California

Felix Wehrli, PhD  
Professor of Radiologic Science, Biochemistry and Biophysics  
University of Pennsylvania Perelman School of Medicine

John Wood, MD, PhD  
Professor of Pediatrics and Radiology,  
Divisions of Pediatric Cardiology and Radiology, Keck School of Medicine, University of  
Southern California

Ze Wang, PhD  
Associate Professor of Radiology  
Director of the MRI Lab  
Lewis Katz School of Medicine  
Temple University
### PROGRAM
**Friday, September 13, 2019**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:00-8:30 a.m.</td>
<td>Registration and Breakfast</td>
</tr>
<tr>
<td>8:30-8:45 a.m.</td>
<td><strong>Opening Session</strong>&lt;br&gt;<strong>Hanzhang Lu, PhD&lt;br&gt;Karen Horton, MD</strong>&lt;br&gt;Welcome and Conference Goals</td>
</tr>
<tr>
<td>8:45-9:05 a.m.</td>
<td><strong>Session 1: Perfusion and Permeability</strong>&lt;br&gt;<strong>John Detre, MD</strong>&lt;br&gt;Recent Progress in Arterial Spin Labeling (ASL) MRI</td>
</tr>
<tr>
<td>9:05-9:25 a.m.</td>
<td><strong>Danny Wang, PhD</strong>&lt;br&gt;Contrast Agent and Non-Contrast Agent Imaging of Blood-Brain Barrier (BBB) Permeability</td>
</tr>
<tr>
<td>9:25-9:45 a.m.</td>
<td><strong>Jun Hua, PhD</strong>&lt;br&gt;MRI Techniques for Cerebral Blood Volume (CBV) Mapping</td>
</tr>
<tr>
<td>9:45-10:30 a.m.</td>
<td><strong>Proffered Talks</strong>*</td>
</tr>
<tr>
<td>10:30-10:45 a.m.</td>
<td>Refreshment Break</td>
</tr>
<tr>
<td>10:45-11:05 a.m.</td>
<td><strong>Session 2: Oxygenation and Metabolism</strong>&lt;br&gt;<strong>Felix Wehrli, PhD</strong>&lt;br&gt;Quantification of Cerebral Oxygen Consumption</td>
</tr>
<tr>
<td>11:05-11:25 a.m.</td>
<td><strong>John Wood, MD, PhD</strong>&lt;br&gt;Oxygenation and Metabolism in Sickle Cell Disease (SCD)</td>
</tr>
<tr>
<td>11:25-11:45 a.m.</td>
<td><strong>Bruce Pike, PhD</strong>&lt;br&gt;BOLD Response to Hyperoxia Challenge</td>
</tr>
<tr>
<td>11:45-12:30 p.m.</td>
<td><strong>Proffered Talks</strong>*</td>
</tr>
<tr>
<td>12:30-1:00 p.m.</td>
<td>Lunch</td>
</tr>
<tr>
<td>1:00-3:00 p.m.</td>
<td>Poster Session***</td>
</tr>
<tr>
<td>3:00-4:00 p.m.</td>
<td><strong>Peter Van Zijl, PhD</strong>&lt;br&gt;Keynote Lecture</td>
</tr>
<tr>
<td>4:00-5:00 p.m.</td>
<td>Guided Tour of the MRI Facilities (Hanzhang Lu, Peter van Zijl)</td>
</tr>
<tr>
<td>6:00-8:00 p.m.</td>
<td><strong>Dinner at Residence Inn Baltimore</strong></td>
</tr>
</tbody>
</table>

*This session is not eligible for *AMA PRA Category 1 Credit™*.**

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*ICP Network Symposium<br>Physiological and Functional MRI of the Brain: Emerging Techniques and Clinical Applications<br>September 13-15, 2019<br>80048694/18027*
<table>
<thead>
<tr>
<th>Time</th>
<th>Session 3: Cerebrovascular Reactivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-8:30 a.m.</td>
<td>Breakfast</td>
</tr>
</tbody>
</table>
| 8:30-8:50 a.m. | Nicholas Blockley, PhD  
Cerebrovascular Reactivity (CVR) Mapping with Gas Challenges |
| 8:50-9:10 a.m. | Peiying Liu, PhD  
Cerebrovascular Reactivity (CVR) Mapping Without Gas Challenges |
| 9:10-9:30 a.m. | Manus Donahue, PhD  
Applications of Cerebrovascular Reactivity (CVR) in Aging and Brain Diseases |
| 9:30-10:15 a.m. | Proffered Talks*                                                     |
| 10:15-10:30 a.m. | Refreshment Break                                                   |

**Session 4: Neurovascular Coupling**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 4: Neurovascular Coupling</th>
</tr>
</thead>
</table>
| 10:30-10:50 a.m. | Peter Bandettini, PhD  
Neurovascular Coupling at Laminar Level |
| 10:50-11:10 a.m. | Molly Bright, PhD  
Noise Versus Signal in fMRI Data |
| 11:10-11:30 a.m. | Kevin Murphy, PhD  
Neurovascular Coupling in Advanced Physiology Maneuvers |
| 11:30-12:15 p.m. | Proffered Talks*                                                     |
| 12:15-1:00 p.m. | Lunch                                                               |
| 1:00-3:00 p.m. | Poster session*                                                     |

**Session 5: Calibrated fMRI**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 5: Calibrated fMRI</th>
</tr>
</thead>
</table>
| 3:00-3:20 p.m. | Dan Bulte, PhD  
Recent Progress in Calibrated fMRI |
| 3:20-3:40 p.m. | Jean Chen, PhD  
Physiological Considerations and Normalization of Resting-State fMRI |
| 3:40-4:00 p.m. | Richard Hoge, PhD  
Application of Calibrated fMRI in Alzheimer's Disease |
| 4:00-4:45 p.m. | Proffered Talks*                                                     |
| 4:45-5:00 p.m. | Award Ceremony  
Best poster award  
Best presentation award |

*This session is not eligible for *AMA PRA Category 1 Credit™*. 
## PROGRAM
### Sunday, September 15, 2019

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-8:30 a.m.</td>
<td>Breakfast</td>
</tr>
<tr>
<td>8:30-8:50 a.m.</td>
<td>Jiadi Xu, PhD, Glucose-CEST: potentials and challenges</td>
</tr>
<tr>
<td>8:50-9:10 a.m.</td>
<td>Yulin Ge, PhD, Quantitative Susceptibility Mapping of the Cerebral Vasculature Using Ferumoxytol</td>
</tr>
<tr>
<td>9:10-9:30 a.m.</td>
<td>Larry Ward, PhD, Magnetic Particle Imaging (MPI): Potentials for Functional Brain Imaging</td>
</tr>
<tr>
<td>9:30-10:00 a.m.</td>
<td>Refreshment Break</td>
</tr>
<tr>
<td>10:00-10:20 a.m.</td>
<td>David Feinberg, PhD, Next-generation MRI Brain Scanner for High Resolution Imaging of Brain Function</td>
</tr>
<tr>
<td>10:20-10:40 a.m.</td>
<td>Jack Wells, PhD, Novel and Non-Invasive MRI Techniques to Assess Brain Clearance Pathways: Aquaporin-4 Dependent Water Flux Across the Blood Brain Barrier and CSF-ISF Exchange via Perivascular Fluid Movement</td>
</tr>
<tr>
<td>10:40-11:00 a.m.</td>
<td>Ze Wang, PhD, Machine Learning in Physiological MRI</td>
</tr>
<tr>
<td>11:00-11:55 a.m.</td>
<td>Panel Discussion</td>
</tr>
<tr>
<td>11:55-12:10 p.m.</td>
<td>Hanzhang Lu, PhD, Closing Remarks</td>
</tr>
<tr>
<td>12:10 p.m.</td>
<td>Adjourn</td>
</tr>
</tbody>
</table>