Focused Ultrasound Surgery Foundation

2011

Brain Program

Workshop 3

Workshop Syllabus

23–26 October 2011

Boar's Head Inn and Conference Center
Charlottesville, VA, USA

Sponsored by Focused Ultrasound Surgery Foundation and UVA Department of Neurosurgery

Welcome Letter

Brain Program Workshop 3, 2011

Dear Colleagues,

Welcome to the Foundation's third workshop on focused ultrasound and the brain. This invitational event is being held at the request of the community with the anticipation of building on the foundation laid by two previous, highly productive workshops.

Our purpose for this workshop is to rapidly advance the development and adoption of reimbursable applications that either fulfill an unmet need or are significantly better than existing therapies in terms of outcomes, cost and convenience. Considerable time as has been set aside for informal discussion, relationship building, establishment of collaborations, and problem solving. Our specific goals for the workshop are to:

1) Produce a white paper documenting the state-of-the-art of MR guided focused ultrasound and the brain.
2) Develop action plans for one to two years including technical projects, preclinical studies, and clinical trials leading to reimbursable indications including essential tremor, Parkinson's disease, temporal lobe epilepsy, and brain tumors.
3) Create a collaborative environment and infrastructure to facilitate achieving the above as rapidly as possible.

We believe that brain indications will be sentinel applications for the clinical use of focused ultrasound. If the brain can be treated safely and effectively with this technology then the road will be paved for the development and adoption of many other clinical applications.

You are here because you are an integral part of this community. We trust that you will take advantage of the great collaborative opportunity this workshop affords. Thank you for being an indispensible part of our efforts to bring hope, healing and better lives to patients around the world.

NEAL F. KASSELL, M.D.
Chairman
Focused Ultrasound Surgery Foundation
Professor of Neurosurgery
University of Virginia

JOHN W. SNELL, PH.D.
Brain Program Technical Director
Focused Ultrasound Surgery Foundation

Focused Ultrasound Surgery Foundation

Today, researchers and manufacturers around the world are developing focused ultrasound therapies for many deadly and debilitating medical conditions. Since its founding in 2006, the Focused Ultrasound Surgery Foundation has been dedicated to accelerating the development and adoption of these new, noninvasive treatments so that they become a standard of care worldwide. Motivating the Foundation's work is the belief that every day without access to focused ultrasound treatments is a day of needless death, disability and suffering for countless patients.

Thanks to the support of philanthropic and corporate donors, the Foundation funds a variety of research and educational initiatives. We also promote collaboration, coordination and communication among researchers, clinicians and others who are pioneering this exciting and rapidly emerging area of medicine.

Our key initiatives include:

- Organizing, coordinating and funding research leading to new applications
- Establishing global collaboration between the research and development initiatives in academia and industry
- Funding training fellowships for clinicians and scientists
- Establishing new Centers of Excellence–luminary sites for research, training and patient care
- Supporting meetings, symposia and workshops
- Facilitating regulatory approval and third-party reimbursement
- Increasing awareness of what has been termed "medicine's best kept secret"

To learn more about focused ultrasound and the Focused Ultrasound Surgery Foundation, visit the Foundation's website: **www.fusfoundation.org**

General Information

Registration

Sunday	6:00-8:00 PM – Hearth Room
Monday	7:00-8:00 AM – Ballroom

Contact Information

The Boar's Head Inn	434.296.2181

FUSF Staff

John Snell	434.326.9836 (m)
Jade Faulkner	434.882.1442 (m)
Chris Faulkner	434.760.1170 (m)

Daily Events

**Please see Overview for detailed schedule*

Sunday, October 23

6:00 PM	Welcome Reception, Hearth Room *Includes drinks and hors d'oeuvres*

Monday, October 24

6:30 AM – 8:15 AM	Breakfast - Old Mill Room
8:30 AM – 3:30 PM	Clinical Sessions - Ballroom
7:00 PM	Dinner – Pavilion

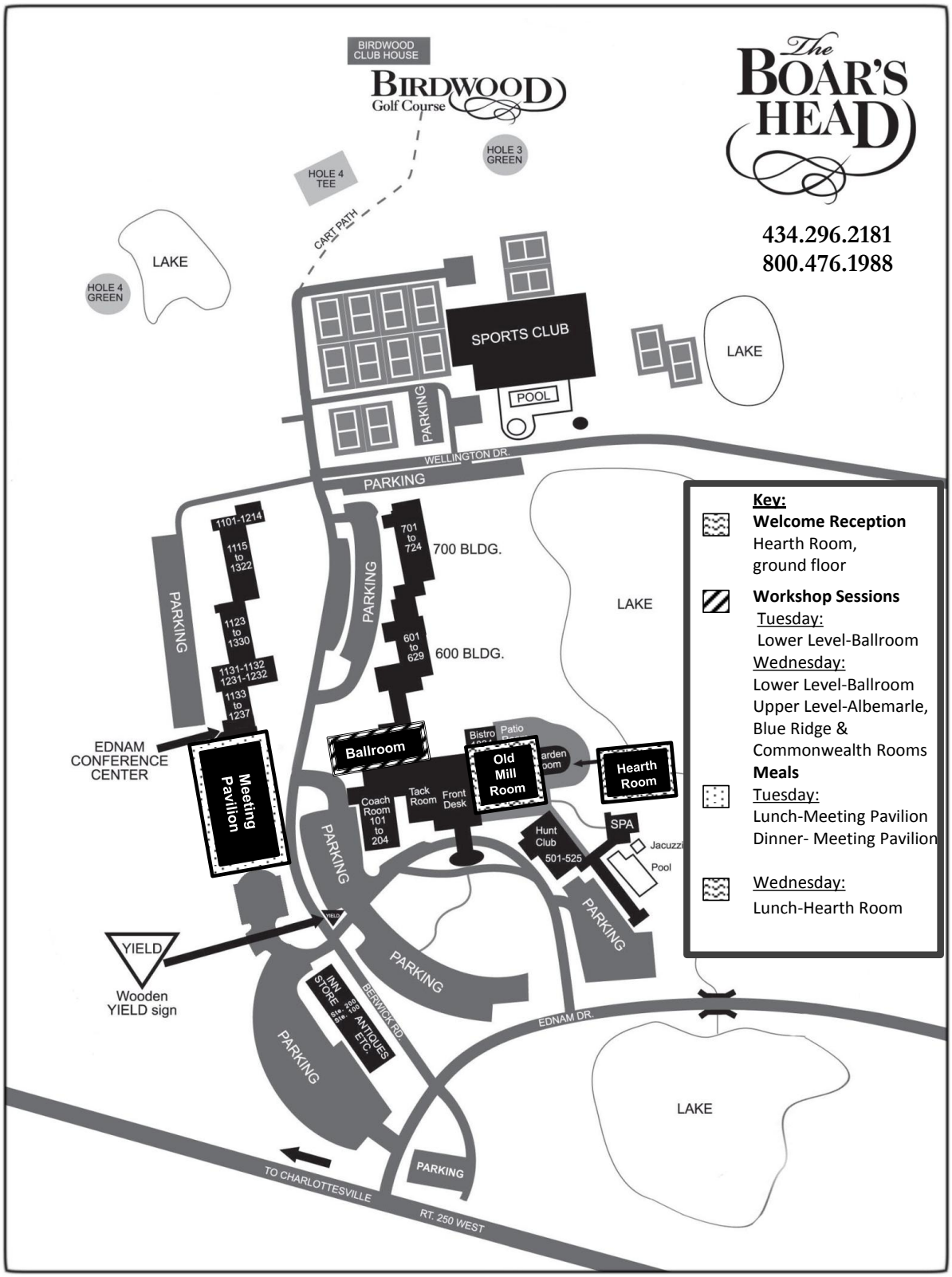
Tuesday, October 25

6:30 AM – 8:15 AM	Breakfast - Old Mill Room
8:30 AM – 3:30 PM	Technical Sessions – Ballroom
7:00 PM	Dinner – Hearth Room

Wednesday, March 23

7:00 AM – 7:45 AM	Breakfast - Old Mill Room

General Information



Technical Challenges

Indications	Treatment Envelope	Cavitation	Remote Effects	Skull Database	Skull Correction without CT	Volumetric MR Thermometry	RF Head Coil	Treatment Planning	Frameless Stereotaxy	Phantoms & Models
Essential Tremor										
Parkinson's Disease										
Neuromodulation										
Brain Tumors										
Temporal Lobe Epilepsy										
Neuropathic & Cancer Pain										
BBB + Drug Delivery										
Intracerebral Hemorrhage										
Ischemic Stroke										
Obsessive Compulsive Disorder										
Trigeminal Neuralgia										

Workshop Overview

Contact Numbers

The Boar's Head	434.296.2181
John Snell	434.326.9836 (m)
Jade Faulkner	434.882.1442 (m)
Chris Faulkner	434.760.1170 (m)

Description of Events

Sunday, October 23

Registration and Welcome Reception will take place in the Hearth Room. Cocktails and hors d'oeuvres will be provided.

Monday, October 24

Clinical Indications - Presentations and discussion of MRgFUS brain indications will take place throughout the day in the Ballroom. Time has been set aside in the afternoon for impromptu discussions and collaborative opportunities. Dinner for all participants concludes the day.

Tuesday, October 25

Technical Issues – Presentations and discussions of high priority MRgFUS technical issues related to brain applications will take place throughout the day in the Ballroom. Time has been set aside in the afternoon for impromptu discussions and collaborative opportunities. Dinner for all participants concludes the day.

Wednesday, October 26

A farewell breakfast closes the program.

Sunday, October 23, 2011

6:00p	Reception	Hearth Room

Monday, October 24, 2011

6:30a	Breakfast	Mill Room
8:30a	Welcome and Introduction	Ballroom
8:45a	Session 1: Clinical Indications	Ballroom
10:30a	Session 2: Clinical Indications	Ballroom
12:00p	Lunch	Hearth Room
1:30p	Session 3: Clinical Indications	Ballroom
3:30p	Free time	
7:00p	Dinner	Pavilion

Tuesday, October 25, 2011

6:30a	Breakfast	Mill Room
8:30a	Session 4: Technical Issues	Ballroom
10:30a	Session 5: Technical Issues	Ballroom
12:00p	Lunch	Hearth Room
1:30p	Session 6: Technical Issues	Ballroom
3:30p	Free time	
6:00p	Summation and Closing	Ballroom
7:00p	Dinner	Hearth Room

Wednesday, October 26, 2011

7:00a	Breakfast	Mill Room

Detailed Agenda

Sunday, October 23, 2011

Time	Discussion Topics	Location
6:00p – 8:00p	**Reception – Cocktails and h'orderves**	Hearth Room
8:00p	Dinner on your own	

Monday, October 24, 2011

Time	Discussion Topics	Location
6:30a – 8:15a Breakfast **Breakout Discussion:** Movement Disorders Steering Committee I (breakout room TBD)		Mill Room
8:30a Welcome and Introduction		Ballroom
Session 1: Clinical Indications		
8:45a	**Essential Tremor** 1) Current Status a. UVa – Jeff Elias b. Solothurn – Daniel Jeanmonod c. Comparative study RF/Gamma Knife/MRgFUS – Mohamad Khaled 2) Technical Barriers/Clinical Requirements a. Treatment Planning Software i. Focal spot localization ii. Power/Temperature titration b. Transducer positioning system c. Stereotactic localization of target d. CT scan necessary e. Targeting technique and accuracy f. Optimal lesion size g. Neurophysiologic assessment of target via neuromodulation h. RF Head Coil requirements 3) Next Steps a. Bilateral lesions, Lesion plus Deep Brain Stimulation b. Continued access post pilot trial c. Pivotal trial design i. Protocol: patients, sites, comparative arm ii. Regulatory iii. Reimbursement iv. Medical Community v. Key opinion leaders vi. Funding sources	Ballroom

Detailed Agenda

9:30a	**Parkinson's Disease** 1) Current Status a. Thalamotomy/Pallidotomy i. Solothurn Experience – Daniel Jeanmonod ii. Rationale for pilot clinical trial protocol 2) Technical Barriers/Clinical Requirements a. Same as ET 3) Next Steps a. Pilot trial design	Ballroom
10:00a – 10:20a Break		
Session 2: Clinical Indications		
10:30a	**Neuromodulation** (Functional Target Verification & Epilepsy) 1) Current Status – Seung-Schik Yoo, Mickael Tanter 2) Technical Barriers 3) Next Steps	Ballroom
10:45a	**Brain Tumors** 1) Current Status a. Sunnybrook – Todd Mainprize b. Zurich – Ernst Martin, Javier Fandino 2) Tumor Types 3) Technical Barriers/Clinical Requirements a. Treatment Envelope i. Whole brain ii. High value targets: location, volume, treatment time b. Treatment Time c. Skull heating and Cranial Nerves d. Cavitation detection, characterization and control i. Enhanced ablation ii. Microbubbles iii. Histotripsy iv. Sonodynamic therapy 4) Next steps a. Treatment envelope evaluation on current devices i. Simulation ii. Hydrophone measurement iii. Thermal measurement b. BBB Opening + Drug Delivery	Ballroom
11:15a	**Temporal Lobe Epilepsy** 1) Current Status a. Preclinical feasibility – Stephen Monteith 2) Technical Barriers/Clinical Requirements	Ballroom

Detailed Agenda

	a. Skull base heating 3) Next Steps	
11:30a	**Neuropathic and Cancer Pain** 1) Current Status a. Zurich: Long term follow-up – Daniel Jeanmonod 2) Technical Barriers/Clinical Requirements a. Same as ET 3) Next Steps a. Pivotal trial design b. Physician acceptance c. Regulatory d. Reimbursement	Ballroom
12:00p – 1:15p Lunch **Breakout Discussion:** Movement Disorders Steering Committee II (breakout room TBD)		Hearth Room
Session 3: Clinical Indications		
1:30p	**Blood Brain Barrier Opening + Drug Delivery** 1) Current Status – Todd Mainprize, Kullervo Hynynen, Fabrice Marquet, Nathan McDannold a. GBM pilot trial b. Parkinson's Disease c. Alzheimer's Disease 2) Technical Barriers/Clinical Requirements a. Non-thermal focal spot verification b. Treatment Envelope c. Cavitation Detection and Control d. Pharmacokinetics 3) Next Steps a. GBM BBB pilot trial	
2:00p	**Intracerebral Hemorrhage** 1) Current Status – Stephen Monteith a. In vitro/in vivo parameter selection b. Preclinical safety and feasibility 2) Technical Barriers/Clinical Requirements a. Non-thermal focal spot verification b. Transducer power c. Cavitation localization 3) Next Steps a. Pilot clinical trial design	Ballroom

Detailed Agenda

2:30p	**Ischemic Stroke** 1) Current Status – Thilo Hoelscher, Stephen Monteith, Kullervo Hynynen 2) Technical Barriers/Clinical Requirements a. Treatment Time, Patient and system preparation time 3) Next Steps a. Pilot trial design	Ballroom
2:45p	**Obsessive Compulsive Disorder** 1) Current Status – Jin Woo Chang 2) Technical Barriers/Clinical Requirements a. Treatment envelope 3) Next steps a. Pilot trial design	Ballroom
3:00p	**Trigeminal Neuralgia** 1) Current Status a. Preclinical safety and feasibility – Stephen Monteith 2) Technical Barriers/Clinical Requirements a. Skull base heating 3) Next Steps	Ballroom
3:15p	**Future Indications** 1) Aneurysm – Daniel Coluccia 2) Vasospasm 3) Epilepsy (other than TLE) 4) Others from the floor time permitting	Ballroom
3:30p	**Unstructured Meeting/Discussion Time** **-Breakout Discussion:** Intracerebral Hemorrhage (Breakout room TBD)	
7:00p	**Dinner**	Pavilion

Detailed Agenda

Tuesday, October 25, 2011

Time	Discussion Topic:	Location
6:30a – 8:15a Breakfast		Mill Room
Session 4: Technical Issues		
8:30a	What is the treatment envelope and how can it be extended (220 kHz, 650 kHz, 1MHz) 1) How should we define the treatment envelope? Definitions/criteria? 2) Simulations – 220kHz, 650kHz, 1MHz – Kullervo Hynynen, Jean-Francois Aubry, Doug Christensen 3) Hydrophone Measurements – 220 kHz – Arne Voie 4) Thermal Measurements 220/650 kHz – Matt Eames 5) Trigeminal Neuralgia/Temporal Lobe Epilepsy targets – Stephen Monteith 6) What is the treatment time for targets of different sizes and locations for each transducer frequency? – Matt Eames, Eyal Zadicario, Jean-François Aubry	Ballroom
	Cavitation: Can it be detected, characterized and controlled? - Thilo Hoelscher, Arne Voie, Nathan McDannold, Jean-François Aubry 1) Detection & Characterization 2) Closed loop cavitation in vivo	
	Are remote effects a significant issue? 1) Measurement – Kullervo Hynynen 2) Simulation – Jean-François Aubry	
	How do skull size, shape and thickness affect the focus? 1) Skull Database – Thilo Hoelscher	
10:00 – 10:20 Break		
Session 5: Technical Issues		
10:30a	Can the need for a CT exam be eliminated? 1) MR-ARFI, MR-based Focusing – Mickael Tanter, Kim Butts-Pauly 2) Can skull correction be accomplished with MR bone imaging? - Max Wintermark 3) How do we detect and handle calcifications? – Kim Butts-Pauly 4) Are cysts an issue? 5) Neurosurgical debris: shunt catheters, clips, screws, etc?	Ballroom

Detailed Agenda

	MR Thermometry – Beat Werner, Dennis Parker, Kim Butts-Pauly 1) Can we monitor temperature in 3D? 2) Is absolute thermometry possible?	Ballroom
	What advantages would a purpose-built MRgFUS RF head coil offer? – Max Wintermark, Beat Werner, Rock Hadley	Ballroom
12:00p – 1:15pm Lunch **-Breakout Discussion:** Brain Tumor Steering Committee (breakout room TBD)		Hearth Room
Session 6: Technical Issues		
1:30p	Remote Monitoring – Eyal Zadicario, Nadir Alikacem, John Snell	Ballroom
	What does the optimal treatment planning system look like? Panel: Jeff Elias, Ernst Martin, Daniel Jeanmonod, Jean-François Aubry, Mickael Tanter, John Snell, Kim Butts-Pauly, Eyal Zadicario, Stephen Monteith, Beat Werner	
	Can we treat without a stereotactic frame?: Head Motion Tracking/Frameless Stereotaxy - Eyal Zadicario, Jean-François Aubry	
	Phantoms – Matt Eames, Arne Voie	
	Cadaver Models – Stephen Monteith, Jean-François Aubry, Sandy Cochran	
	Animal Models – Stephen Monteith, Nathan McDannold, Thilo Hoelscher	
3:30p – 5:30p Unstructured Meeting/Discussion Time **-Breakout Discussion:** Training, Credentialing, Staffing and Logistics for Neurological Indications (Room TBD)		

Detailed Agenda

6:00p	**Summation and Closing** **Deliverables:** 1) White Paper by December 1, 2011 2) Action Plan (1-2 Year): Tasks/Assignment/Metrics a. Essential Tremor b. Parkinson's Disease c. Brain Tumors – Expanded Envelope d. Temporal Lobe Epilepsy e. Intracerebral Hemorrhage f. Pain g. Others 3) Collaborative Environment – FUSF CRN	Ballroom
7:00p	**Dinner**	Hearth Room

Wednesday, October 26, 2011

Time	Discussion Topics	Location
7:00a	**Breakfast**	Mill Room

Brain Program Overview

Program Rationale:

Brain disorders represent a highly crucial treatment area for MR-guided FUS. Key reasons are: 1) these conditions are the most devastating and debilitating ailments afflicting humanity and are increasing in prevalence; 2) clinically, the brain is the most difficult organ to treat safely and effectively, and success of MR guided FUS in this segment will be viewed as proof of its ability to treat other organs; 3) from a societal perspective, the brain is a high-profile topic—there is widespread fascination with its workings and fear of its disorders. Successful, new treatments of brain disorders are likely to attract public interest and increase investment in other MR-guided FUS applications.

Workshops:

The Focused Ultrasound Surgery Foundation assisted in defining a comprehensive R&D roadmap for brain applications by organizing an invitation-only workshop in March 2009. Attended by thought leaders from industry, academia and the NIH, the workshop produced a roadmap of technical, preclinical, and clinical studies needed to escalate development of neurological applications. It also laid the groundwork for collaborations between manufacturers and academic research laboratories. A follow on workshop was in held March 2010 at the request of the first workshop participants and was central to further refinement of the brain program's clinical and technical research roadmaps.

The Brain Program has gotten off to a strong start and now encompasses a robust infrastructure. Components include:

- Brain Advisory Committee
- Data Safety Monitoring Board
- Clinical Trial Steering Committees for Brain Tumors and Movement Disorders (such as Essential Tremor and Parkinson's Disease)
- Core Imaging Laboratory
- Research Working Groups for Intracerebral Hemorrhage, Ischemic Stroke, and Neuromodulation

Brain Program Overview

Brain Advisory Committee

The Brain Program Advisory Committee provides advice and counsel to the Focused Ultrasound Surgery Foundation (FUSF) Brain Program team on both research and development (R&D) and program activities.

Membership

- Neal F. Kassell, MD, **Chairman**, Professor of Neurosurgery, University of Virginia, Charlottesville, VA
- Ferenc Jolesz, MD, B. Leonard Holman Professor of Radiology & Vice Chairman for Research, Brigham & Women's Hospital, Harvard Medical School, Boston, MA
- Dade Lunsford, MD, Lars Leksell Professor & Distinguished Professor of Neurological Surgery, University of Pittsburgh Medical Center, Pittsburgh, PA
- Edward Oldfield, MD, Professor of Neurosurgery and Internal Medicine, University of Virginia Medical Center, Charlottesville, VA
- Jacques Souquet, PhD, CEO, Supersonic Imagine, Aix-en-Provence, France
- Mickael Tanter, PhD, Laboratoire Ondes et Acoustique, E.S.P.C.I, Paris, France
- Eyal Zadicario, BSc, MSc, Director of Neurological Programs, Insightec, Tirat Carmel, Israel

Data Safety Monitoring Board

The DSMB is charged with monitoring adverse event (AE) data from the pilot clinical trials for MR-guided FUS for brain disorders sponsored by industry leaders. The DSMB will conduct an independent, objective review of all AEs to assess their relationship to MR-guided FUS or the procedure. Based on this review the DSMB will advise the sponsor on the appropriateness of continuing the clinical trials as designed.

Membership

- Howard M. Eisenberg, MD, **Chairman**, R.K. Thompson Professor and Chairman, Department of Neurosurgery, University of Maryland School of Medicine and Medical Systems, Baltimore, MD
- William G. Bradley, MD, PhD, FACR, Chairman and Professor of Radiology, University of California at San Diego, San Diego, CA
- Robert Grossman, MD, Chair of Neurosurgery, The Methodist Hospital, Houston, TX

Steering Committees

The Foundation brings together investigators and other key individuals in a collaborative setting that crosses medical disciplines in order to provide oversight and direction to pilot clinical studies for the Brain Program. The goal of these clinical trials is to demonstrate the feasibility and safety of MR-guided FUS for the treatment of various indications in the brain. The resulting data from these early clinical trials will be used to support the development of definitive safety and efficacy trials for submission and approval to the appropriate regulatory agencies and ministries of health as well as to support the needs of the medical and scientific community.

Brain Program Overview

Brain Tumor Steering Committee

- Edward H. Oldfield, MD, **Chairman**, Professor of Neurosurgery and Internal Medicine, University of Virginia Medical Center, Charlottesville, VA
- Jason Sheehan, MD, PhD, **Principal Investigator**, Associate Professor of Neurological Surgery, University of Virginia, Charlottesville, VA
- Javier Fandino, MD, Associate Professor, Department of Neurosurgery, Universities of Berne and Zurich, Switzerland; Vice-Chairman, Department of Neurosurgery Kantonsspital Aarau, Aarau, Switzerland
- Ferenc Jolesz, MD, B. Leonard Holman Professor of Radiology & Vice Chairman for Research, Brigham & Women's Hospital, Harvard Medical School, Boston, MA
- Todd Mainprize, MD, Assistant Professor, Division of Neurosurgery, University of Toronto, Toronto, Ontario, Canada
- David Schiff, MD, Professor of Neurology, University of Virginia Medical Center, Charlottesville, VA
- James C. Torner PhD, Professor and Chairman, Department of Epidemiology, University of Iowa, Iowa City, IA
- J. Pablo Villablanca, MD, Associate Professor of Radiology, Section Chief, Diagnostic Neuroradiology, David Geffen School of Medicine at UCLA, Los Angeles, CA

Movement Disorders Steering Committee

- G. Frederick Wooten Jr., MD, **Chairman**, Professor of Neurology, UVA Medical Center, Charlottesville, VA
- William Jeffrey Elias, MD, **Principal Investigator**, Associate Professor of Neurological Surgery and Neurology, UVA Medical Center, Charlottesville, VA
- Antonio DeSalles, MD, PhD, Director of Functional Neurosurgery, UCLA Medical Center, Los Angeles, CA
- Daniel Jeanmonod, MD, Professor of Neurosurgery, University Hospital, Zurich, Switzerland
- Andres Lozano, MD, PhD, Professor of Surgery (Neurosurgery), Ron Tasker Chair of Stereotactic and Functional Neurosurgery, University of Toronto, Ontario, Canada
- James C. Torner PhD, Professor and Chairman, Department of Epidemiology, University of Iowa, Iowa City, IA
- J. Pablo Villablanca, MD, Associate Professor of Radiology, Section Chief, Diagnostic Neuroradiology, David Geffen School of Medicine at UCLA, Los Angeles, CA

Workshop Attendees

Nadir Alikacem, PhD
InSightec, Ltd., Dallas, Texas
nadira@insightec.com

Nadir Alikacem is VP Global Regulatory Affairs and CRO for InSightec, and was previously North America Pole Manager, Mr. Alikacem is responsible for regulatory strategy, clinical research planning to support the regulatory strategy, research protocols coordinated with the VP Clinical R&D, working with all relevant regulatory bodies, and managing the CRO activities..
Prior to joining InSightec in 2001, Dr. Alikacem was an Assistant Professor at UT Southwestern Medical Center in Dallas, Texas. Previously, he was a Scientist at Saint Francois' D'Assise Hospital in Quebec-City, Canada. Dr. Alikacem received his Postdoctoral fellowship in Physics from the University of Massachusetts at Amherst, Massachusetts. He received a Ph.D & M.Sc in Physics from the University of Sussex, England.

Marie Armbruster, MS
University of Virginia, Charlottesville, Virginia
ma6ua@virginia.edu

Jean-Fracois Aubry, PhD
Institut Langevin, Paris, France
jean-francois.aubry@espci.fr

Jean-Francois Aubry was born in Marseille, France, in May 1973. He graduated in Physics from Ecole Normale Superieure de Cachan and University Paris XI in 1998. In 2002, he received the PhD degree in Physics (acoustics) from the University of Paris VII. Since 2002, he has a permanent position as a researcher for the National French Center of Science (CNRS). He is currently working at the Institut Langevin, Paris, France. He his mainly working on adaptive focusing through bones (transcostal and transcranial focusing), including three clinical applications: ultrasonic brain imaging, and brain and liver therapy with High Intensity Focused Ultrasound. He holds 3 patents on these applications. He published 27 peer reviewed articles, gave 20 invited talks in international conferences. He received the bronze medal of the CNRS (2011 CNRS awards, in Paris, France) and the Frederic Lizzi Early carreer award (11th ISTU symposium, New York, USA)

Stanley Benedict, PhD
University of Virginia, Charlottesville, Virginia
shb4x@virginia.edu

Dr. Benedict received a PhD in Biomedical Physics from UCLA, and an M.S. in Radiological Health Physics from San Diego State University. He is Professor and Director of Radiological Physics in the Department of Radiation Oncology at the University of Virginia, which recently installed the first dedicated MRIgFUS Center in the USA. He is a Diplomat from the ABR in Therapeutic Radiologic Physics, and is a Fellow of the ACMP and the AAPM. He is currently Co-Chair of AAPM Task Group No. 193 on Image Guided Focused Ultrasound.

S. Morry Blumenfeld, PhD
MediTech Advisors, Ltd., Jerusalem, Israel
morry@meditechadvisors.com

Dr. Blumenfeld is a Founding Partner of Meditech Advisors Management, a General Partner in Ziegler Meditech Equity Partners, LP. He was an executive with General Electric for nearly 35 years and served GE in many roles including Managing Director of GE Medical Systems Israel. Dr. Blumenfeld holds five patents and has served on an Institute of Electrical and Electronics Engineers Standards Committee, a National Cancer Institute Advisory Board, the Ontario R&D

Challenge Fund Imaging Advisory Committee, a Scientific Advisory Board of the Ontario Consortium for Image-Guided Therapy and Surgery, and the Imaging Research Centre for Cardiac Intervention at the University of Toronto. He is on the Advisory Board of the Advanced Multimodality Image Guided Operating Suite at Harvard and is on the boards of the Hebrew University and a number of medical device and technology companies including Insightec, MAKO, Dune Medical, Oridion and others. Dr. Blumenfeld received his undergraduate degree and Ph.D. from the University of Toronto.

William Bradley, MD, PhD, FACR
University of California San Diego, San Diego, California
wgbradley@ucsd.edu

William G. Bradley, Jr, is Professor and Chairman, Department of Radiology, at UCSD. He received his BS at Caltech and his PhD at Princeton, both in Chemical Engineering. He received his MD and did his Radiology residency at UCSF where he first became involved in MRI in 1979. He has published over 190 papers, 52 chapters, and 21 textbooks, including Magnetic Resonance Imaging (3rd Edition), coedited with David Stark. He was President of the SMRI (now ISMRM) 1988-89. He was honored with the Gold Medal of the SMRM (now ISMRM) in 1989 and that of the RSNA in 2003 for "pioneering research in MRI". He served on the Board of the Research and Education Foundation of the RSNA 1995-2001 and was Chairman of the RSNA Fund Development Committee from 1996-2007. He was on the Board of Chancellors of the American College of Radiology where he chaired the Commission on Neuroradiology and MRI from 1999 to 2005 and served as Vice President 2005-2006. He is currently on the Boards of the Association of University Radiologists, the Clinical MRI Society, and the International Society for Strategic Studies in Radiology.

Falko Busse, PhD
Philips Healthcare, Vanta, Finland
falko.busse@philips.com

Falko Busse studied Physics at the 'Rheinische Friedrich-Wilhelms-Universität' Bonn. He performed a PostDoc period in Jena (Germany) and Copenhagen. He started his career as Project manager at Philips Research Aachen and continued as Project manager at Philips Medical Systems. After having returned to Philips Research, he headed the Department 'Imaging Systems' in Aachen. Since 2004 he has been Vice President of Philips Research. , responsible for the global research program on medical imaging.

Kim Butts Pauly, PhD
Stanford University School of Medicine, Stanford, California
kbpauly@stanford.edu

Kim Butts Pauly received a BS degree in physics from Duke University, Durham, NC. She received her PhD in biophysical sciences from the Mayo Graduate School in Rochester, MN. In 1996, she joined the faculty at Stanford University's Department of Radiology, where she has been working on MR-guided high intensity focused ultrasound, cryoablation, RF ablation, and biopsy. She has also been involved with the development of a truly integrated X-Ray and MRI system.

Workshop Attendees

Alexander Bystritsky, MD, PhD
University of California Los Angeles, Los Angeles, California
abystritsky@mednet.ucla.edu

Professor Alexander Bystritsky graduated from Pavlov Medical Institute (currently Pavlov Medical University) in St. Petersburg, Russia (former Soviet Union) with MD in 1977 and then his PhD in Pharmacology in 1979. In 1976 his paper won the Gold Medal for the Best Student Scientific Paper and Maria Petrova National Award in Neuroscience. After he arrived to New York, he worked for one year as an Associate Researcher in the NYU Department of Psychiatry prior his admission to the NYU-Belleview residency program in Psychiatry. He completed his residency in 1985 and moved to UCLA as a Robert Wood Johnson Clinical Scholar. Dr. Bystritsky has been on the UCLA Faculty since 1987. He is currently a Professor of Psychiatry and Biobehavioral Sciences in Jane and Terry Semel Institute for Neuroscience and Human Behavior, University of California, Los Angeles where he directs the Anxiety Disorders Program and Brainstimulation Laboratory. Dr. Bystritsky published over 150 peer-reviewed papers and has served as the PI and Co-PI on several NIH, foundations and industry sponsored grants. Over the years he earned several honors and awards including OCD Foundation Research Award and Brain and Behavior Distinguished Investigator Award. He is also listed in the Best Doctors in America for the last 12 years. For the past few years he has been a collaborator with Brigham and Women's Hospital Harvard Medical School Boston, Massachusetts working with Professor Ferenc Jolesz, Professor McDannold and Professor Seung-Schik Yoo investigating Focused Ultrasound Pulsation effects on brain using fMRI. He has authored several patents on image-guided neuromodulation of brain neurons using Low Intensity Focused Ultrasound Pulsation. His current area of interest is neuroimaging guided brain stimulation. He the director of collaborative clinical and research program on image-guided DBS with the department of Neurosurgery at UCLA with Professor Antonio DeSalles.

Bob Carter, MD, PhD
University of California San Diego, San Diego, California
bobcarter@ucsd.edu

Jin Woo Chang, MD, PhD
YUCM Severance Hospital, Seoul, Korea
jchang@yuhs.ac

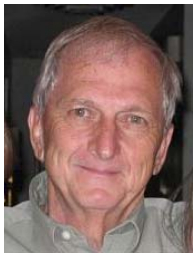
Dr. Jin Woo Chang is a professor of neurosurgery at Yonsei University College of Medicine in Seoul, Korea. He is currently interested in clinical applications of MR-guided focused ultrasound to functional neurosurgery.

Pin-Yuan Chen, MD
Chang University, Taiwan
pinyuanc@gmail.com

Dr. Chen received his MD from the Chang-Gung University in 1998. Subsequently, He completed his medical residency in the Chang-Gung Memorial Hospital in 2006, and now serve as Attending Physician in the Department of Neurosurgery. He is also Director of the Intensive Care Unit in the same hospital. He has received board certifications from the Taiwan Department of Health, Taiwan Surgical Association, Taiwan Neurosurgical Society, Taiwan Society of Critical Care Medicine, and Taiwan Atomic Energy Council. In addition to his medical service and hospital work, Dr. Chen also devotes time to translational and preclinical research and has published several peer-reviewed papers, especially in the area of enhancing drug delivery into brain tumors.

Workshop Attendees

David Chen, MBA
University of Virginia, Charlottesville, Virginia
dc9rk@virginia.edu



Douglas Christensen, PhD
University of Utah, Salt Lake City, Utah
christen@ee.utah.edu

Douglas A. Christensen received the BSEE degree from Brigham Young University in 1962, the MS degree from Stanford University in 1963, and the PhD degree from the University of Utah in 1967. During 1972-74, he held a Special NIH postdoctorate position in biomedical engineering at the University of Washington. He has been a faculty member at the University of Utah since 1971. He currently holds a joint appointment as Professor of Bioengineering and Professor of Electrical and Computer Engineering. His major research interests are in the area of waves in medical diagnosis and therapy, including therapeutic ultrasound, ultrasonic bioinstrumentation, optical biosensors, and numerical modeling of acoustic fields. He is the author of the books Ultrasonic Bioinstrumentation in 1988 and Introduction to Biomedical Engineering: Biomechanics and Bioelectricity in 2010, and co-author of Basic Introduction to Bioelectromagnetics, 2nd edition in 2010.

Gregory Clement, PhD
Surgical Planning Laboratory, Boston, Massachusetts
gclement@hms.harvard.edu

Greg Clement's research concentrates on the propagation of ultrasound for both the detection and treatment of cancerous and benign tumors. He received his BS (Ohio State 92), MS, and PhD (Rhode Island, 96, 99) degrees, all in physics. While a postdoctoral fellow at Brigham and Women's Hospital, Boston (1998-2000) he developed a method for noninvasive focusing of ultrasound through the human skull for treatment of brain tumors. Dr. Clement is presently the Technical Director of the Brigham Focused Ultrasound Laboratory, which participates in simulation, experimental and clinical studies of ultrasound for novel therapeutic or diagnostic use. His present research interests include noninvasive transskull focusing of ultrasound in the brain for cancer treatment, shear-mode brain imaging, perfusion imaging, high-resolution (super-resolution) methods, ultrasound coded excitation, phase-contrast ultrasound imaging, and automated diagnosis of ischemia and perfusion.

Sandy Cochran, MBA, PhD
University of Dundee, Dundee, United Kingdom
s.cochran@dundee.ac.uk

Sandy Cochran has been working in ultrasound for more than 25 years. The core of his activity is the ultrasonic transducer and array, and he has complemented this with many other related topics, both upstream, in materials and fabrication techniques, and downstream, in instrumentation and applications. He is presently with the Institute for Medical Science and Technology (IMSaT) at the University of Dundee, Scotland, where he leads the Ultrasound Team as well as holding the role of Deputy Director. Ultrasound has three faculty, two research staff, and twelve PhD students. Its research includes new piezoelectric materials, imaging devices, and therapeutic ultrasound. In the latter, both focused ultrasound surgery and focal drug delivery are covered. A particular topic of interest is the use of the Thiel cadaver for ex vivo testing of human anatomy. This type of cadaver maintains flexibility and colour, in turn translating into the possibility for use in MRI and ultrasound imaging and therapy, as well as intensive use for training. Both breathing motion and pulsatile vascular flow have been demonstrated empirically, and a program of elastographic imaging and monitoring has begun.

Workshop Attendees

Daniel Coluccia, MD
Kantonsspital Aarau (KSA), Zurich, Swtizerland
daniel.coluccia@ksa.ch

Jacques Coumans, PhD
GE Healthcare, Waukesha, Wisconsin
jacobus.coumans@ge.com

Matt Eames, PhD
Focused Ultrasound Surgery Foundation, Charlottesville, Virginia
meames@fusfoundation.org

Matt Eames is the Brain Program Senior Project Engineer and joined the Focused Ultrasound Surgery Foundation in December 2009. Dr. Eames earned his PhD in Biomedical Engineering at the University of Virginia performing research in the design, modeling, fabrication, and characterization of combined diagnostic/therapeutic ultrasound transducers. In conjunction with John Snell PhD, he supports the technical component of the Brain R&D Program and establishes and maintains collaborative relationships with members of the ultrasound industry and research communities who share a common interest in advancing the Foundation's Research Programs.

W. Jeffrey Elias, MD
University of Virginia, Charlottesville, Virginia
wje4r@hscmail.mcc.virginia.edu

Dr. Elias was born in Durham, NC. He graduated Phi Beta Kappa from Wake Forest University. He attended the University of Virginia for Medical School and Neurosurgical training. He completed intramural fellowships in neuropathology and spinal surgery before spending a year in Plymouth England as a senior registrar. Following his neurosurgical residency, he pursued additional training in stereotactic and functional neurosurgery at the Oregon Health Sciences University. Dr. Elias returned to the University of Virginia where he is currently the Director of Stereotactic and Functional Neurosurgery with a large multidisciplinary program in the surgical treatment of movement disorders and epilepsy. For this, he was awarded the School of Medicine's Excellence in Clinical Medicine Award. He has been named to Best Doctors in America by Best Doctors, Inc. His clinical practice also includes minimally-invasive spine surgery, peripheral nerve surgery, spasticity, and neuropsychiatric procedures. His clinical research interests are in the fields of movement disorder and intracranial monitoring for epilepsy. His laboratory research is focused upon thalamic physiology in epilepsy. He is currently the principal investigator of the first clinical trial for the treatment of essential tremor using MR-guided focused ultrasound.

Javier Fandino, MD
University Children's Hospital, Zurich, Switzerland
javier.fandino@ksa.ch

Javier Fandino is Chairman at the Department of Neurosurgery, Kantonsspital Aarau, Switzerland. After his neurosurgical residency at the Universities of Bern and Zurich, Switzerland, Dr. Fandino completed his training at the Universities of Virginia, VA, and Cincinnati, OH. Before moving to Aarau, Dr. Fandino was on the faculty at the Department of Neurosurgery, University Hospital Bern. He has an active clinical practice specializing in patients with cerebral vascular disease, including aneurysms and arteriovenous malformations, and spine surgery. His research interests focus on intracranial aneurysms, experimental SAH models, aneurysms models for the research of

endovascular technologies, and new therapeutic method for brain tumors. In addition, Dr. Fandino concentrate his effort in the development and optimization of intraoperative imaging technologies in cerebrovascular and brain tumor surgery, such as the setup of hybrid Ors and intraoperative MRI. Dr. Fandino is member of numerous national and international societies and serves actively in the training or neurosurgeons in Switzerland.

Keyvan Faranhani, PhD
National Cancer Institute, Rockville, Maryland
farahani@nih.gov

Dr. Farahani is a Program Director in the Image-Guided Interventions (IGI) Branch, Cancer Imaging Program, National Cancer Institute. In this capacity he is responsible for the development of NCI initiatives that address diagnosis and treatment of cancer through integration of advanced imaging and minimally invasive technologies. Since 2002 Dr. Farahani has lead the NCI initiatives in Oncologic IGI with programs focused on industrial developments, early phase clinical trials, and image-guided drug delivery using nanotechnologies. He has led a series of NCI workshops that promote an open science model to develop, optimize and validate platforms for IGI. These initiatives have engaged other agencies of the federal government namely other institutes of the NIH, FDA, NIST and CMS. Prior to joining NCI in fall of 2001, Dr. Farahani was a faculty of the department of Radiological Sciences at the University of California, Los Angeles, where he obtained his MS ('89) and PhD ('93) degrees in Biomedical Physics. Dr. Farahani is a member of the American Association of Physicists in Medicine, the Scientific Program Committee of the Radiological Society of North America, and a past president of the Interventional MR study group of the International Society of Magnetic Resonance in Medicine.

Jessica Foley, PhD
AAAS Science & Technology Policy Fellowships
jlfoley8@gmail.com

Jessica Foley is currently serving as a 2011-2012 Science & Technology Policy Fellow through the American Association for the Advancement of Science. During this year she will be based at the National Science Foundation, in the Division of Chemical, Bioengineering, Environmental, and Transport Systems. Prior to the fellowship, Jessica worked at InSightec as the Neuro Projects Manager for North America. She received her BSE in Biomedical Engineering from Duke University and her PhD in Bioengineering from the University of Washington. Her doctoral dissertation research investigated the biological and physiological effects of focused ultrasound on peripheral nerves.

Robert Frysinger, PhD
University of Virginia, Charlottesville, Virginia
rf3y@virginia.edu

Robert C. Frysinger is an electrophysiologist with a 20 year history of helping neurosurgeons treat movement disorders, beginning with radio-frequency lesions, moving to deep brain stimulation, and currently excited at the prospects of FUS thalamotomy. Dr. Frysinger is a Research Professor of Neurological Surgery at the University of Virginia.

Rock Hadley, PhD
University of Utah, Salt Lake City, Utah
rock@ucair.med.utah.edu

Workshop Attendees

Arik Hananel, MD, MBA
Focused Ultrasound Surgery Foundation, Charlottesville, Virginia
ahananel@fusfoundation.org

Arik Hananel is the Scientific and Medical Director of the Focused Ultrasound Surgery Foundation. Prior to joining the Foundation, Dr. Hananel worked at InSightec for more than 12 years, doing research and development in multiple applications of MR-guided focused ultrasound. Dr. Hananel has numerous publications, presentations at academic conferences, and patents in the field of MR-guided focused ultrasound.

Sagi Harnof, MD
Sheba Medical Center, Ramat Gan, Israel
sagi.harnof@sheba.health.gov.il

Dr. Harnof graduated the Tel-Aviv University School of Medicine in 1997 (including an internship in Wolfson Medical Center). He completed his Neurosurgery residency in Sheba Medical Center in Israel, including a short rotation at the Cerebro-Vascular service with Dr. M. Lowton in UCSF. He was involved in the research of ICH – by developing MR guided minimal invasive approach for the treatment of ICH. His basic research focused on the utilizing of PN-277 for the treatment of stroke – animal models. Dr. Harnof spent two years with Dr. Neal Kassell in the University of Virginia, performing Cerebro-Vascular clinical fellowship along with vasospasm research and developing the MR Guided Focus Ultrasound research included performing preclinical experiments. Dr. Harnof is an attending Vascular Neurosurgeon at Sheba Medical Center department of Neurosurgery, running the Cerebro-vascular service; as well as the Deputy Director of the Department of Neurosurgery at Chaim Sheba Medical Center. He also serves on the Board of EURONICH. His clinical interests are focused on Vascular Neurosurgery of the brain and spine, benign tumors of the brain and spinal cord and minimal approach techniques. His research projects include: MR Guided focus Ultrasound for the treatment of ICH, Stroke, and for the treatment of Facet related pain. Immune-modulation of CNS repair – in vitro studies with Monocyts after stoke and spinal cord injury; image analysis of anti brain edema treatment and response to treatment by novel MRI methods – animal studies and feasibitliy human clinical stud; and more.

Thilo Hoelscher, MD
University of California San Diego, San Diego, California
thoelscher@ucsd.edu

Thilo Hoelscher Assistant Professor UCSD Departments of Radiology, Neurosciences, Mechanical and Aerospace Engineering. UCSD faculty since 08/2002 leading scientists in the field of contrast-enhanced ultrasound imaging of the human brain. Research (last 3 years mainly) on therapeutic ultrasound (sonothrombolysis, drug carrier systems). Research activities in Engineering: flow mechanics (bubble tracking, echoPIV), transcranial sound field characterization, effects of primary/secondary radiation force on acoustically active drug carriers. Since June '08 main research focus on transcranial sonothrombolysis using High Intensity Focused Ultrasound. M.D. degree in 1995 at the University of Esseen/Germany. Stroke fellowship training under Prof. H.-C. Diener, Department of Neurology, University of Essen. Specialization in clinical neurology and neurosonology under Prof. U. Bogdahn, Department of Neurology, University of Regensburg/Germany. Published: 25 peer reviewed articles, 5 book chapters, 20 abstracts for scientific meetings, holds 5 U.S. patents (assignee: University of California, San Diego)

Workshop Attendees

Thomas Huerta
University of Virginia, Charlottesville, Virginia
teh6f@virginia.edu

Thomas E Huerta is an MRI tech at the University of Virginia. He does clinical MR at the UVA Medical Center and, clinical and research MR at the MRgFU center. He has 18 years experience as an MRI tech and has experience in both private practice and academic settings. He can perform MR scans in all disciplines', Cardiac, MR angio, fMRI, MR Spec. He's a member of the ISMRM/SMRT organization. He has presented lectures, written abstracts, presented posters and co-authored MR related articles in major radiology journals.

Diane Huss, PT, DPT, NCS
University of Virginia, Charlottesville, Virginia
dsh6z@virginia.edu

Diane Huss is a Board Certified, Neurologic Physical Therapist Clinical Specialist. Dr. Huss serves as the physical therapist consultant with the functional neurosurgery team with Dr. Jeffery Elias at the University of Virginia. She developed and conducts the intra-procedure monitoring protocol and the pre and post procedure assessments that are in use with the FDA Clinical Trial for MRgFUS Thalamotomy for treatment of Essential Tremor. Dr. Huss has extensive expertise in the evaluation and treatment of individuals with Essential Tremor, Parkinson's Disease, Dystonia, Spasticity and other neurological impairments. She determined the functional outcome measures in use for the functional neurosurgery procedures at UVA for movement disorders, conducts these assessments, and maintains these outcomes in an on-line database. She is interested in the development of uniform assessment protocols across centers to facilitate communication and the advancement of these clinical applications.

Kullervo Hynynen, PhD
Sunnybrook Health Sciences Centre, Toronto, Canada
khynynen@sri.utoronto.ca

Dr. Hynynen received his Ph.D. from the University of Aberdeen, United Kingdom. After completing his postdoctoral training in biomedical ultrasound also at the University of Aberdeen, he accepted a faculty position at the University of Arizona in 1984. He joined the faculty at the Harvard Medical School, and Brigham and Women's Hospital in Boston, MA 1993. There he reached the rank of full Professor, and founded and directed the Focused Ultrasound Laboratory. In 2006 he moved to University of Toronto. He is currently the Director of Imaging Research at the Sunnybrook Research Institute and a Professor in the Department of Medical Biophysics at University of Toronto, Toronto, Ontario, Canada. He holds a Canada Research Chair in Imaging Systems and Image-Guided Therapy awarded by the Government of Canada. Dr. Hynynen served as the General Chairman for the 5th International Symposium on Therapeutic Ultrasound in Boston, MA, USA in October 2005 and served as the president of the International Society of the Therapeutic Ultrasound in 2006-9.

Daniel Jeanmonod, MD
Center of Ultrasound Functional Neurosurgery, Solothurn, Switzerland
daniel.jeanmonod@gmail.com

Dr. Daniel Jeanmonod graduated from the faculty of medicine at the University of Lausanne in 1978. His doctoral thesis in 1982 was in the field of neuroplasticity. He trained in neurosurgery in Lausanne, then in Queen's Square (London) and Lyon, obtaining his swiss title in neurosurgery in 1989. He was head of the Department of Functional Neurosurgery at the University Hospital Zürich between 1989 and 2009, and holds the titular professoral chair for functional neurosurgery at the University of Zürich since 1993. He holds since 1998 an adjunct assistant professorship in the Department of Physiology and Neurosciences at New York University

School of Medicine (Dr. R. Llinas). His interest and expertise are focused on the field of functional neurosurgery, with research accents on neuroanatomy and neurophysiology, and covering the treatment of chronic and therapy-resistant functional brain disorders including movement disorders, neuropathic pain and tinnitus, epilepsy and neuropsychiatric disorders. He received in 1998 the Pfizer Research Prize in the domain of neurosciences and diseases of the nervous system. He has described together with Dr. Llinas the mechanisms, at thalamic and cortical levels, of the thalamocortical dysrhythmia. He developed the concept of selective regulatory symptom control, centering therapeutic action on dysfunctional regulators of the thalamocortical system. He performed in 2008 and 2009,together with his colleague Prof. Ernst Martin, the first series of focused ultrasound interventions against neuropathic pain. He is now head of the Center for Ultrasound Functional Neurosurgery (Solothurn, Switzerland), where he leads the project, Transcranial MR-guided Functional Ultrasound Neurosurgery" against neuropathic pain, Parkinson's disease and essential tremor.

Soren Johansson, MSc
Elekta, Stockholm, Sweden
soren.johansson@elekta.com

Ferenc Jolesz, MD
Brigham and Women's Hospital, Boston, Massachusetts
jolesz@bwh.harvard.edu

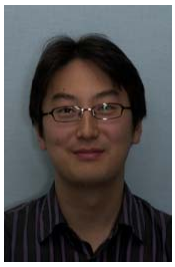
Ferenc Jolesz has achieved international recognition as one of the great innovators and leaders in radiological research. He continues to distinguish himself with ongoing cutting edge research in magnetic resonance imaging and image-guided therapy. In 1998, Dr. Jolesz was appointed B.Leonard Holman Professor of Radiology at Harvard Medical School and Vice Chairman for Research at the Department of Radiology of Brigham and Women's Hospital in 2000; he has been Director of the Division of Magnetic Resonance Imaging since 1988. In 1993, Dr. Jolesz established the Image-Guided Therapy Program at the Brigham and Women's Hospital, which includes an internationally recognized intraoperative MRI facility, the Surgical Planning Laboratory, and the Therapeutic Ultrasound Laboratory-the center of ground breaking therapeutic technology development. In 2002, Dr. Jolesz was appointed Director of the Neuroimaging Core of the Harvard Center for Neurodegeneration and Repair. Dr. Jolesz maintains a research focus in basic and clinical neurosciences, magnetic resonance imaging, and image guided therapy. Along with a highly trained and dedicated research staff of over 100, Dr. Jolesz spearheads the development and implementation of innovative image processing methods and has brought several minimally invasive therapies into successful clinical application. Dr. Jolesz is also credited with developing, refining, and introducing into clinical practice the idea of direct, real time MR image-guided surgical interventions. In collaboration with key industrial partners, Dr. Jolesz has driven the development of various image-guided therapy delivery systems in current use in several sites around the world. Among these, interventional an interoperative MRI, MRI-guided laser, cryoablation, and MRI-guided brachytherapy are the most significant. Dr. Jolesz is further recognized for perfecting the use of high in intensity-focused ultrasound as a tissue ablation tool and integrating it with MR imaging guidance systems. Dr. Jolesz' pioneering research in image-guided brain surgery in particular has had an enormous impact on the fields of modern Radiology and Neurosurgery. His contributions are widely acknowledged in the literature and in medical curricula throughout the world. Dr. Jolesz' substantial research support comes from a variety of public and private sources, including several NIH grants of which he is principle Investigator, corporate-sponsored clinical trials, and industry supported research efforts. He belongs to several professional societies and serves on the editorial boards of prestigious peer review journals. Commensurate with his prolific research, Dr. Jolesz has published over 300 articles in scholarly, peer reviewed journals and has contributed many chapters and review articles in the fields of surgery, computer science, neurology, and radiology.

Workshop Attendees

Neal Kassell, MD
University of Virginia, Charlottesville, Virginia
nfk8g@hscmail.mcc.virginia.edu

Dr. Neal Kassell is a Distinguished Professor of Neurosurgery at the University of Virginia, and the Founder and Chairman of the Focused Ultrasound Surgery Foundation. Prior to UVA, Dr. Kassell served on the faculty at the University of Iowa. Dr. Kassell is a founder of numerous private ventures including Interax, Inc, the Virginia Neurological Institute, Multimedia Medical Systems, the Neuroclinical Trials Center, Neuroventure Fund, and MedSpecialist. He currently serves as a director of the Virginia National Bank and the La Gesse Foundation, and is on the editorial board of Neurosurgery and Stroke. Dr. Kassell has been a recipient of the McKenzie Memorial Award of the Canadian Neurosurgical Society and the Grass Award of the Society of Neurological Surgeons. He has published over 450 scientific papers. Dr. Kassell received his undergraduate and medical education at the University of Pennsylvania.

Mohamad Khaled, MD
University of Virginia, Charlottesville, Virginia
mak6j@virginia.edu



Hyungmin Kim, PhS
Harvard Medical School, Boston, Massachusetts
Hkim34@rics.bwh.harvard.edu

Dr. Kim is currently a Research Fellow in Radiology Department at Harvard Medical School, Brigham and Women's Hospital. He received his M.S. degree from the School of Mechanical and Aerospace Engineering at Seoul National University in 2001. After that, he entered himself into the medical industry for developing various medical imaging softwares (Vworks, Vceph, Vimplant, OnDemand3D) and surgical navigation system (In2Vision) at Cybermed, Inc., Korea. Then, he continued his academic career in biomedical engineering at the University of Bern, Switzerland, and completed his Ph.D. degree on soft-tissue simulation for cranio-maxillofacial surgery in 2011. His research focus lies on developing planning and image-guided navigation systems for various surgical environments.

Manabu Kinoshita, MD, PhD
Osaka University Graduate School of Medicine, Osaka, Japan
m-kinoshita@nsurgmed.osaka-u.ac.jp

Walter Koroshetz, MD
National Institute of Health, Bethesda, Maryland
koroshetzw@ninds.nih.gov

Walter J. Koroshetz is the Deputy Director of NINDS. Working with Dr. Story Landis, the NINDS Director, he oversees extramural and intramural research programs of the Institute. At the NIH, he led the trans-NIH Task Force on Research in the Emergency setting and was instrumental in the establishment of the joint intramural NIH-Uniformed Services University program in Traumatic Brain Injury research (The Center for Neuroscience and Regenerative Medicine). He is a member of the trans-NIH comparative effectiveness committee, Global Health Committee, Health Economics Committee, Alzheimer's disease Neuroimaging Initiative proteomics workgroup, and the Foundation for NIH neuroscience biomarkers consortium. Before joining NINDS, Dr. Koroshetz served as vice chair of the neurology service and director of stroke and neurointensive care services at Massachusetts General Hospital (MGH). He was also a professor of neurology at Harvard Medical School and led neurology resident training at

MGH from 1990-2007. His work in stroke concentrated on the intensive care of the stroke patient and the use of MRI and advanced CT imaging to define the vascular lesion and the various stages in the process of infarction. A native of Brooklyn, New York, Dr. Koroshetz graduated from Georgetown University and received his medical degree from the University of Chicago. He trained in internal medicine at the University of Chicago and Massachusetts General Hospital. Dr. Koroshetz trained in neurology at MGH, after which he did post-doctoral studies in cellular neurophysiology at MGH and the Harvard neurobiology department. He joined the neurology staff, first in the Huntington's Disease/Movement Disorders unit and then in the stroke and neurointensive care service.

Nir Lipsman, MD, PhD
Sunnybrook Health Sciences Centre, Toronto, Canada
nir.lipsman@utoronto.com

Nir Lipsman is a neurosurgery resident and PhD graduate student at the University of Toronto. He completed his medical training at Queen's University and his undergraduate work at the University of Toronto. He is currently the Toronto study-coordinator for the FUS Essential Tremor Trial at Sunnybrook Health Sciences Center, with Principle Investigator, Dr. Michael Schwartz and supervisor Dr. Andres Lozano. He has an interest in minimally invasive and functional neurosurgery, including deep brain stimulation, radiosurgery and focused ultrasound, and how these techniques can be applied to disorders of motor, mood and behaviour.

Johanna Loomba
University of Virginia, Charlottesville, Virginia
jjl4d@virginia.edu

Todd Mainprize, MD
Sunnybrook Health Sciences Centre, Toronto, Canada
todd.mainprize@sunnybrook.ca

Dr. Todd Mainprize is an Arthur and Sonia Labatt Brain Tumour Research Centre Associate Scientist at Sunnybrook Health Centre in Toronto. His clinical and academic focus is Neuro-Oncology. Currently, he is focusing on the translational applications of MRI-guided focused ultrasound in the treatment of both primary and metastatic brain tumours. He is also looking at the role of blood brain barrier disruption for the delivery of novel therapeutic agents in recurrent glioblastoma.

Fabrice Marquet, PhD
Columbia University, New York, New York
Fm2364@columbia.edu

Fabrice Marquet received an BS/MS engineering degree in physics from Ecole Superieure de Physique et de Chimie Industrielles de Paris (ESPCI-ParisTech) in 2005. He then received his MS and his PhD degrees from University Paris VII for his work on transcranial and transcostal HIFU at the Langevin Institute in 2005 and 2009 respectively. Fabrice has been a postdoctoral research scientist at the Ultrasound and Elasticity Imaging Laboratory at Columbia University, New York, NY since 2009. His current research interests include drug delivery using ultrasound induced blood-brain barrier opening and biomechanical tissue characterization, cancer therapy, and therapy monitoring.

Workshop Attendees

Ernst Martin, MD
University Children's Hospital, Zürich, Switzerland
ernst.martin@kispi.uzh.ch

Dr. Ernst Martin became a professor in Pediatrics and Pediatric Neuroradiology in 1996. In addition, he managed several research projects on higher cognitive brain functions in children using multimodal imaging techniques, e.g. EEG and functional MRI. His current experimental and clinical research interests include BBB opening and targeted drug delivery, and neurosurgical interventions for brain tumors and for various functional brain disorders, such as neuropathic pain, movement disorders, epilepsy and neuro-psychiatric disorders, in children and adults using transcranial MR-guided FUS.

Jaime Mata, PhD
University of Virginia, Charlottesville, Virginia
jfm4q@virginia.edu

Jaime F. Mata is an Assistant Professor of Radiology & Medical Imaging and the Assistant Director of the Center for In-Vivo HPG MRI at the University of Virginia. He has been an active researcher in the development of magnetic resonance imaging (MRI) techniques for over 13 years and holds two patents in MR pulse sequence design. Dr. Mata has been the lead researcher in developing animal models for his Center, which has made numerous pioneering contributions to the development and application of MRI techniques, including in neuroimaging. In the past two years, his work in neuroimaging and respective collaborations with the local division of neuroradiology, have contributed for his 2011 Research Scientist Award from the American Society of Neuroradiology (ASNR) and for his grant from the Neuroradiology Education & Research Foundation (NERF), in the area of non-invasive targeted delivery of brain therapy using MRgFUS.

Nathan McDannold, PhD
Brigham & Women's Hospital, Harvard Medical School, Boston, Massachusetts
njm@bwh.harvard.edu

Dr. Nathan McDannold received his BS in Physics from the University of Virginia in Charlottesville and his PhD in Physics from Tufts University in Boston. He is currently an Associate Professor in Radiology at Harvard University. He has been working in the Focused Ultrasound Laboratory at Brigham & Women's Hospital since June 1996. His work has been primarily concerned with the development and implementation of MRI-based thermometry methods, animal experiments testing MRI and ultrasound related work, and clinical focused ultrasound treatments of breast tumors, uterine fibroids, and brain tumors. In recent years, a main focus of his work has been studying the use of ultrasound for temporary disruption of the blood-brain barrier, which may allow for targeted drug delivery in the brain.

Stephen Meairs,MD
University of Heidelberg, Mannheim, Germany
meairs@neuro.ma.uni-heidelberg.de

Stephen Meairs is an American citizen and currently Professor of Neurology at the University of Heidelberg in Mannheim. He graduated from Stanford University and studied medicine at Stanford and Heidelberg. He received training in internal medicine at the German Diagnostic Center and in neurology at the University of Heidelberg in Mannheim. His research interests center around ultrasound applications for diagnosis and therapy of stroke. Stephen Meairs has carried out studies on sonothrombolysis, perfusion imaging, drug delivery through the blood-brain-barrier, molecular imaging, ultrasound-enhanced viral gene therapy to the brain, and recently, angiogenesis using a novel human BBB model. He worked on the German government

project evaluating the potentials of the first MRI scanner in Germany for characterization of brain tumors. Within the realms of this project, he represented the European consortium for multimodal imaging, primarily a project for brain navigation combining PET, CT and MRI. Professor Meairs coordinated the European Union project entitled "Ultrasonographic Monitoring and Early Diagnosis of Stroke" from 2002-2006. In 2005 he chaired the European Stroke Workshop in Brussels and recently hosted the "First International Sonothrombolysis Conference 2008" in Mannheim. Stephen Meairs is Associate Editor of Cerebrovascular Diseases and reviewer for 20 scientific journals. He is coordinator of the European Stroke Network financed by the European Union (2008-2013). This is the largest stroke research project ever undertaken in Europe, which is composed of 30 research and industrial partners, patient groups from 22 countries represented by the Stroke Alliance for Europe and a clinical trial platform boasting over 350 European stroke units (www.europeanstrokenetwork.eu).

Ricky Medel, MD
University of Virginia, Charlottesville, Virginia
rm5qk@hscmail.mcc.virginia.edu

Ricky Medel is a fifth year neurosurgery resident who has worked on focused ultrasound projects for the last two years with a focus on sonothrombolysis.

Stephen Monteith, MD
University of Virginia, Charlottesville, Virginia
sjm9n@virginia.edu

Stephen Monteith was born in the United Kingdom and completed his undergraduate and Medical School training at the University of Auckland, New Zealand. After internship and initial neurosurgery training in Auckland, he joined the residency program at the University of Virginia in 2007. His clinical and research interests are in the area of cerebrovascular neurosurgery. Dr Monteith has begun basic training in endovascular neurosurgery and intends on completing an endovascular fellowship post residency. He will begin his chief residency in July 2010 after completion of his dedicated laboratory time. His current research in FUS is in sonothrombolysis for intracerebral hemorrhage and he is conducting experiments with the team at the University of Virginia Focused Ultrasound Surgery Center in Charlottesville, Virginia.

David Moser
SoniModul AG, Solothurn, Switzerland
david.moser@sonimodul.ch

David Moser was born in August 1980 in Nyon, near Geneva (CH). He studied electrical engineering at the High School of Engineering in Yverdon-les-Bains (CH) where he obtained his Electrical Engineer's Degree in January 2007 with a specialization in power electronics.
From February 2007 to December 2010, he worked at the Institute of Electrical Systems and Energy (IESE) of the High School of Engineering, for applied research and development in the field of power converters. His developments included realization (electronic boards: power and microprocessor control) and programming of power converters ranging from 3 to 30kW.
Since January 2011, he works for the Center for Ultrasound Functional Neurosurgery in Solothurn as chief engineer, involved in MR-guided focused ultrasound neurosurgery. He is also responsible for quantitative EEG recordings and analysis.

Workshop Attendees

Edward Oldfield, MD
University of Virginia, Charlottesville, Virginia
eho4u@virginia.edu

Dr. Oldfield received his MD from the University of Kentucky Medical School, training in general surgery and neurosurgery at Vanderbilt University and in neurology at the National Hospital for Nervous Disease, London, England. Until 2007, when he joined the Department of Neurosurgery at the University of Virginia, he lead a laboratory and clinical research effort in neurosurgery at the National Institutes of Health, where he was chief of the Surgical Neurology Branch, National Institutes of Neurological Disorders and Stroke. His interests include brain and pituitary tumors, syringomyelia, the development of new drug delivery techniques for the central nervous system, neural transplantation and regeneration, Von Hippel-Lindau disease, and certain types of vascular disorders of the central nervous system, particularly arteriovenous malformations affecting the spinal cord, dural arteriovenous fistulas, and the pathophysiology and treatment of cerebral vasospasm. In addition to his clinical interests, he has sought to use new information and techniques of basic science to develop new treatment approaches for disorders of the brain and spinal cord. Dr. Oldfield is former chairman of the Editorial Board of the Journal of Neurosurgery. In 1995 he was awarded the Grass Medal from the Society of Neurological Surgeons and in 1999 he received the Farber Award of the American Association of Neurology Surgeons. He is currently president of the Society of Neurological Surgeons.

Dennis Parker, PhD
University of Utah, Salt Lake City, Utah
parker@ucair.med.utah.edu

Dr. Parker a medical physicist with over 30 years experience in research in physics applied to medical imaging. In about 1979, while developing a CT scanner for radiation therapy planning, he performed early experiments to test whether MRI could be used to measure temperature and published the first papers showing that MRI could be used to create images of temperature in the early 1980's. Dr. Parker came to the University of Utah in 1982, and has ever since been involved in developing medical imaging research programs, with an emphasis on MRI research. He has supervised a large number of students who have obtained PhD's and have taken productive careers in academics and industry. He has worked with several other faculty and the Chairs of Radiology to develop the Utah Center for Advanced Imaging Research (UCAIR), which functions to provide imaging infrastructure to support research throughout the campus. We have established several interdisciplinary research programs in conjunction with UCAIR, including the collaboration between Radiology, Mechanical, Electrical, and Bio-Engineering, Oncology and Surgery, to develop our program in MRI guided High Intensity Focused Ultrasound (HIFU). In this program he has been able to continue to work with students and post docs in developing improved MRI temperature measurement methods. Their research has received support from Siemens Medical Solutions, and three R01 grants from the NIH. The two active grants include an academic / industrial collaboration (R01 CA 134599) to develop a system for MRI guided focused ultrasound treatment of breast lesions. The second active MRgHIFU NIH grant (R01 EB013433) is a collaboration with centers in the US, Toronto, and Paris, France to develop rapid, high spatial resolution, temperature imaging throughout the brain for monitoring the safety and efficacy of transcranial MRgHIFU.

Joy Polefrone, PhD
Focused Ultrasound Surgery Foundation, Charlottesville, Virginia
jpolefrone@fusfoundation.org

Dr. Joy Polefrone is the Program Director for the Foundations internally driven research initiative in focal drug delivery, which was launched in early 2010. Prior to filling this role, Dr. Polefrone served as the Director of Patient Support Organizations at the FUS Foundation, a

position she held from May 2008 to January 2010. While in this role, Dr. Polefrone founded the Foundation's first patient support organization, Fibroid Relief, and served as its Executive Director from October 2008 - February 2010. Prior to joining the Foundation, Dr. Polefrone worked as a biotech equity analyst at CRT Capital Group in Stamford, Connecticut. She earned her PhD in Chemistry at the University of Virginia in the fall of 2006 in the Laboratory of Donald F. Hunt, PhD. The focus of her doctoral dissertation was the use of mass spectrometry to interrogate research questions related to cancer immunology and immunotherapy.

Nader Pouratian, MD, PhD
UCLA Ronald Reagan Medical Center, Los Angeles, California
npouratian@mednet.ucla.edu

Paul Prentice, PhD
University of Dundee, Dundee, United Kingdom
p.a.prentice@dundee.ac.uk

Dr. Paul Prentice's research is largely focused on optical approaches to predetermine the location and instant of acoustic cavitation occurrence associated with therapeutic ultrasound. This permits the incorporation of high speed cameras for direct imaging, critically, at the temporal and spatial resolutions required to characterize inception and evolution, with parallel monitoring via acoustical detection techniques. The overall aim is to develop a fundamental understanding of the phenomenon, and associated effects, ultimately for control and manipulation techniques.

Rich Price, PhD
University of Virginia, Charlottesville, Virginia
rjp2z@virginia.edu

Dr. Richard Price is an Associate Professor of Biomedical Engineering at the University of Virginia and the Research Director of the UVa Focused Ultrasound Center. His primary research interests are in the regulation of microvascular growth and remodeling by hemodynamics and bone marrow-derived cells and in the development of therapeutic approaches based on interactions between focused ultrasound and microbubbles. Within the ultrasound-microbubble field, Dr. Price has studied the molecular mechanisms through which ultrasonic microbubble destruction stimulates skeletal muscle angiogenesis. He has also developed methods that use ultrasound and microbubbles for stimulating therapeutic arteriogenesis through growth factor-bearing nanoparticle delivery. More recent work has focused on using ultrasound and microbubbles for brain tumor therapy, including targeted drug-bearing nanoparticle delivery and mechanical tumor ablation.

Mark Quigg, MD
University of Virginia, Charlottesville, Virginia
msq6g@unix.mail.virginia.edu

Mark Quigg is an Associate Professor of Neurology Director of Clinical EEG, EP, and Neurological Sleep Labs at University of Virginia. Trained in medicine and engineering, he is the Director of Clinical EEG, EP, and Neurological Sleep Labs. Research interests include the hormonal regulation of epilepsy, EEG monitoring techniques, and epilepsy surgery.

Workshop Attendees

Viola Rieke, PhD
Stanford University, Stanford, California
vrieke@stanford.edu

Viola Rieke received her PhD in Electrical Engineering in 2005 from Stanford University. She currently is Senior Research Associate in the Department of Radiology at Stanford University. Viola Rieke has research experience in interventional MRI and MR-guided focused ultrasound therapy. Her research interests include the technical development of magnetic resonance imaging methods and advanced image processing algorithms. In particular, her research focuses on pulse sequence development and reconstruction methods for guiding and monitoring focused ultrasound therapy in real-time.

David Schlesinger, PhD
University of Virginia, Charlottesville, Virginia
djs9c@virginia.edu

David Schlesinger is an Assistant Professor and Medical Physicist in the Departments of Radiation Oncology and Neurological Surgery at the University of Virginia. He serves as the chief physicist for the University of Virginia Gamma Knife center and helps to oversee treatment quality assurance at the UVA Focused Ultrasound Center. Dr. Schlesinger is board-certified in Therapeutic Medical Physics by the American Board of Radiology.

Michael Schwartz, FRCSC, MD
Sunnybrook Health Sciences Centre,Toronto, Canada
m.schwartz@utoronto.ca

Jason Sheehan, MD, PhD
University of Virginia, Charlottesville, Virginia
jps2f@hscmail.mcc.virginia.edu

Jason Sheehan is an alumni professor of neurosurgery and radiation oncology at the University of Virginia. He also serves as one of the directors of the UVA FUS Center. He has completed neurosurgical training at the University of Virginia with a fellowship in stereotactic and functional neurosurgery at the University of Pittsburgh. He also completed graduate training in the fields of biomedical engineering and biological physics. Dr. Sheehan's clinical interests include image guided neurosurgical procedures. He has active research in the areas of radiosurgery of the brain and spine.

John Snell, PhD
Focused Ultrasound Surgery Foundation, Charlottesville, Virginia
jsnell@fusfoundation.org

Dr. John Snell is the Technical Director of the FUS Foundation's Brain Program, having joined the Foundation in October 2009. He received a PhD in Biomedical Engineering from the University of Virginia in 1994 and brings a depth of academic and commercial experience in the areas of medical image analysis, neurosurgical planning, surgical navigation, radiation therapy and radiosurgery planning. He has served on the faculty of the University of Virginia Neurological Surgery Department and has made contributions to commercial medical device development with several companies including Multimedia Medical Systems, Medical Numerics and Varian Medical Systems. Dr. Snell is responsible for the definition and coordination of Brain Program technical research projects as well as providing engineering support to participating research sites.

Workshop Attendees

Sham Sokka, PhD
Philips Healthcare, Andover, Massachusetts
sham.sokka@philips.com

Dr. Sham Sokka is currently the CTO & Director of Research & Clinical Science for the Philips Healthcare MR-HIFU group. In this role, he has responsibility for all research, clinical activities, and business development in the MR-guided HIFU area. He received his masters in Electrical Engineering from the Massachusetts Institute of Technology (MIT) in 1999 and then his PhD in 2004 in Electrical & Medical Engineering from the Harvard-MIT Health Sciences & Technology Program. His dissertation topic was in the area of MR-guided HIFU, specifically on cavitation and heating mechanism critical to thermal ablation and HIFU-mediated drug delivery. In 2003, he joined Philips Research as a Senior Scientist in the area of ultrasound-mediated drug delivery. This work focused more specifically on ultrasound methods with bubble and nanoparticle agents for drug delivery. While at Philips Research, he also managed projects in the area of multi-modality imaging for clinical electrophysiology interventions. Dr. Sokka has over 20 publications and pending patents in the area of HIFU, ultrasound imaging, and multi-modality image guidance for interventions.

Jacques Souquet, PhD
Supersonic Imagine, Aix-en-Provence, France
jacques.souquet@supersonicimagine.fr

From 2000 to 2005 Dr. Souquet served as Chief Scientific and Technology Officer (CTO) and Senior Vice President of Philips Medical Systems. From 1993 to 2000 he was CTO and Senior Vice President for Product Generation at ATL Ultrasound. From 1989 to 1993, Dr. Souquet served as Director of Strategic Marketing and Product Planning and Vice President for Product Generation of ATL Ultrasound. He joined ATL Ultrasound in August 1981 as a principal scientist in the cardiology division. Dr. Souquet holds a Higher Engineering Degree from the Ecole Superieure d'Electricite of Paris, France, a PhD in the field of optical memory, from Orsay University, France, and a PhD in the field of new acoustic imaging techniques for medical ultrasound applications and nondestructive testing from Stanford University. Dr. Souquet is a member of the board of Directors of SonoSite, Inc., an ultrasound imaging company and world leader in the field of hand-carried ultrasound systems. He is also on the board of Directors of Median Technologies, a French company in medical computer aided detection systems. He is the inventor of the multiplane transesophageal echo probe, which is now used in 30% of all ultrasound echocardiography examinations. Dr. Souquet is the owner of 10 patents in the field of ultrasound imaging. He is also the author of more than 50 technical papers and is a keynote speaker at major technical and clinical meetings worldwide.

Mickael Tanter, PhD
Institut Langevin, Paris, France
mickael.tanter@espci.fr

Mickaël Tanter is a Research Professor of the French Institute for Medical Research (INSERM). He is currently heading the team Inserm U979 "Wave Physics for Medicine" at Institut Langevin, from Ecole Supérieure de Physique et Chimie Industrielles (ESPCI ParisTech), France. He received a Diplôme d'Ingénieur (High Engineering Degree) from Ecole Supérieure d'Electricité in 1994 and was awarded in 1999 a PhD degree from Paris VII University in Physics. His main activities are centered around the development of new approaches in wave physics for medical imaging and therapy. His current research interests a wide range of topics: transcranial ultrasonic therapy, elasticity imaging of organs using ultrafast ultrasound scanners, adaptive focusing, functional brain imaging. In 2009, he received the Frederic Lizzi Early Career Award of the International Society of Therapeutic Ultrasound and the Montgolfier Prize of the National Society for Industry valorization (S.E.I.N.). In 2010, he received the Leon Brillouin Prize of the

Institute of Electrical and Electronics Engineers (IEEE) and SEE society. In 2011, he received the Yves Rocard Prize from the french Society of Physics. M. Tanter is the recipient of 17 patents in the field of ultrasound imaging. He is the author of more than 100 technical peer reviewed papers. In 2005, along with M. Fink, J. Souquet and C. Cohen-Bacrie, he founded Supersonic Imagine, an innovative French company (72 M€ capital venture) positioned in the field of medical ultrasound imaging and therapy. This company launched in 2009 a revolutionary Ultrasound imaging platform called Aixplorer™ with a unique shear wave imaging modality. Recently, his team published the first article on functional imaging of brain activity with ultrasonic waves.

Nicholas Tustison, PhD
University of Virginia, Charlottesville, Virginia
njt4n@virginia.edu

Nick Tustison is currently an assistant professor in the radiology department at the University of Virginia. Theoretical interests include image analysis (including registration and segmentation), and the dissemination of robust, open source tools which includes development of the Insight Toolkit (http://www.itk.org) and the Advanced Normalization Tools package

---

Arne Voie, PhD
University of California San Diego, San Diego, California
avoie@ucsd.edu

Dr. Voie earned his PhD in Bioengineering at the University of Washington in 1996, where the focus of his work was quantitative 3D reconstruction and measurement of anatomical structures. He was the director of research at Spencer Technologies in Seattle for 12 years, conducting research to use ultrasound to measure cochlear blood flow, characterize otitis media, enhance thrombolysis, and detect changes in the brain during and after ischemic events. In 2010 he left private industry to join Dr. Thilo Hoelscher at the Brain Ultrasound Research Laboratory at UCSD in San Diego, where he is now the director of research. Current research efforts, supported by NIH and FUSF, include sonothrombolysis, detection and characterization of cavitation, transcranial focused ultrasound, and measurement of acoustic fields. He has published several peer-reviewed articles, with more either in submission or in preparation.

Kobi Vortman, PhD
InSightec, Ltd., Haifa, Israel
kobiv@insightec.com

Dr. Vortman is Founder, President, and Chief Executive Officer InSightec Ltd. He is the former president and CEO of Diasonics Vingmend Ultrasound. Dr. Vortman has also held research and development management positions at Elscint Ultrasound Imaging and RAFAEL (the Israeli Armament Development Authority). Dr. Vortman received his undergraduate degree from Hebrew University and his Ph.D. from Technion, the Israeli Institute of Technology.

Tiffani Voss, MD
University of Virginia, Charlottesville, Virginia
tv4e@virginia.edu

Dr. Voss is Assistant Professor of Neurology at the University of Virginia. She completed medical school and residency training in Neurology at the University of Pennsylvania and completed her fellowship in Movement Disorders and Experimental Therapeutics at the University of Rochester. Current research interests include the development of outcome measures in movement disorders, clinical trials and trial methodology, and fall reduction in Parkinson's disease.

Workshop Attendees

Urvi Vyas, PhD
Stanford University School of Medicine, Stanford, California
urvivyas@gmail.com

Urvi Vyas is a postdoctoral fellow at Stanford University. She earned her PhD working with Professors Douglas Christenson, Robert Roemer, and Dennis Parker at the University of Utah. Her work entailed developing rapid techniques for modeling ultrasound beam propagation in 3D inhomogeneous tissue geometries. She also developed a parameter estimation technique using optimization routines to probe changes in acoustic properties of tissues after MRgFUS treatments and demonstrated this non-invasive technique for the first time *in-vivo*. She was the recipient of the Young Investigator Award at the 2nd International Symposium on MR-guided Focused Ultrasound and the New Investigator Award at the Society of Thermal Medicine for this work.

Natalia Vykhodtseva, PhD
Focus Ultrasound Laboratory, Boston, Massachusetts
natalia@bwh.harvard.edu

Natalia Vykhodtseva received her MS in Physics and Electrical Engineering at Moscow State Pedagogical Institute and her PhD in Biological Sciences at the Institute of Higher Nervous Activity and Neurophysiology, All-Union Academy of Sciences in Moscow. She began studies on HIFU in the brain in late 1960s at the Moscow Brain Research Institute, where she developed a technique to produce sharply defined lesions in the brain using a hemispherical transducer. Following this, Dr Vykhodtseva became a PI of numerous studies and head of the Bioacoustic Group at Brain Research Institute in Moscow. In 1989 she became a permanent researcher in Focused Ultrasound Laboratory at Brigham and Women's Hospital and Harvard Medical School. Throughout her career her studies have concentrated on non-invasive interventions for treating brain disorders, such as tumors, neurodegenerative diseases, and vascular malformations using FUS methods.

Beat Werner, PhD
University Children's Hospital, Zürich, Switzerland
beat.werner@kispi.uzh.ch

Beat Werner graduated from the faculty of physics of ETH Zurich, Switzerland in 1988 and started working at University Children's Hospital Zurich on C-13 MR-spectroscopy. He left MR-research in 1990 and worked for several years in software development and marketing communication with new media. In 2002 he joined again the MR-Center at University Children's Hospital. Since 2005 he has been involved in the brain project for technical and physical aspects of the related research activities. Research Focus: Physical and technical aspects of clinical application of tcMRgFUS in brain for ablation and drug delivery.

Max Wintermark, MD
University of Virginia, Charlottesville, Virginia
mw4vh@virginia.edu

Dr. Max Wintermark is a graduate of medicine from Lausanne University in Switzerland. He received his professional training in radiology from Lausanne University Hospital, as well as from the University of California San Francisco. A pioneer in the development of Perfusion-CT and CT-Angiography with patented work pertaining to the technique, Dr. Wintermark is a published author of numerous articles and text chapters in the field of cerebrovascular imaging. He has been involved in a number of clinical trials of image-guided stroke therapy. Dr. Wintermark is currently the Chief of Neuroradiology at the University of Virginia.

Workshop Attendees

Seug-Schik Yoo, MBA, PhD
Brigham and Women's Hospital, Brookline, Massachusetts
yoo@bwh.harvard.edu

Dr. Yoo graduated from the Johns Hopkins University in 1994 majoring in Biomedical Engineering. He later completed his Ph.D. in 2000 for the development of adaptive real-time functional magnetic resonance imaging method at Harvard-MIT Division of Health Science and Technology and Nuclear Engineering department at MIT. While he was pursuing his Ph.D., Dr. Yoo also received MBA degree in Marketing from the University of Massachusetts Boston in 1999. He continued his research at Brigham and Women's Hospital (BWH) in Boston as postdoctoral fellow, and joined faculty at Harvard Medical School in 2004. He is currently an associate professor in Radiology, and serves as director of Functional MRI Service at BWH. Dr. Yoo has pioneered the real-time functional MRI method for the neurofeedback and brain-computer-interface through multi-modal imaging approaches. His recent research also extends to the development of robot-driven three-dimensional cell printing technology for the application in tissue engineering and regenerative medicine using stem cells. His laboratory, with the collaboration of Focused Ultrasound Laboratory at Brigham and Women's Hospital and UVA, investigates the mechanism of focused ultrasound-mediated non-invasive modulation of the brain function and its clinical applications. Research Focus: Multi-modal real-time functional brain mapping; Focused ultrasound; Non-invasive neuromodulation; Neurofeedback; Medical imaging processing; Brain tumor; Epilepsy; Tissue engineering; Stem cell engineering; Cell tracking and homing.

Eyal Zadicario, MSc
InSightec, Ltd., Haifa, Israel
eyalz@insightec.com

Eyal Zadicario is VP R&D and Director of Neuro Programs in InSightec. InSightec is the leader in MRgFUS technology and has developed the first and only clinical MRgFUS system. Eyal has been with InSightec since it has been founded in 1999 and held various positions in its research and development team. As Director of Neuro Programs in InSightec, Eyal has been leading the program from its early design, development and preclinical phase throughout its initial clinical trials to date. Recently Eyal has been assigned the role of VP R&D. In his responsibilities he manages the R&D team and oversees the technological and product development programs in InSightec.

Intracerebral Hemorrhage Roadmap

Parameters

- Develop in vitro clot model ✓
- Determine provisional sonothrombolytic parameters ✓
- Lyse in vitro clots ✓
- Can MR be used to visualize clot lysis? ✓
- Develop transcranial in vitro clot model ✓
- Lyse in vitro clots transcranially ✓
- Develop in vivo clot model ✓
- Lyse in vivo clots ✓
- Optimize sonothrombolytic parameters ✓

Safety

- Develop animal safety model ✓
- Determine safety of sonothombolytic parameters in normal brain

Clinical Research

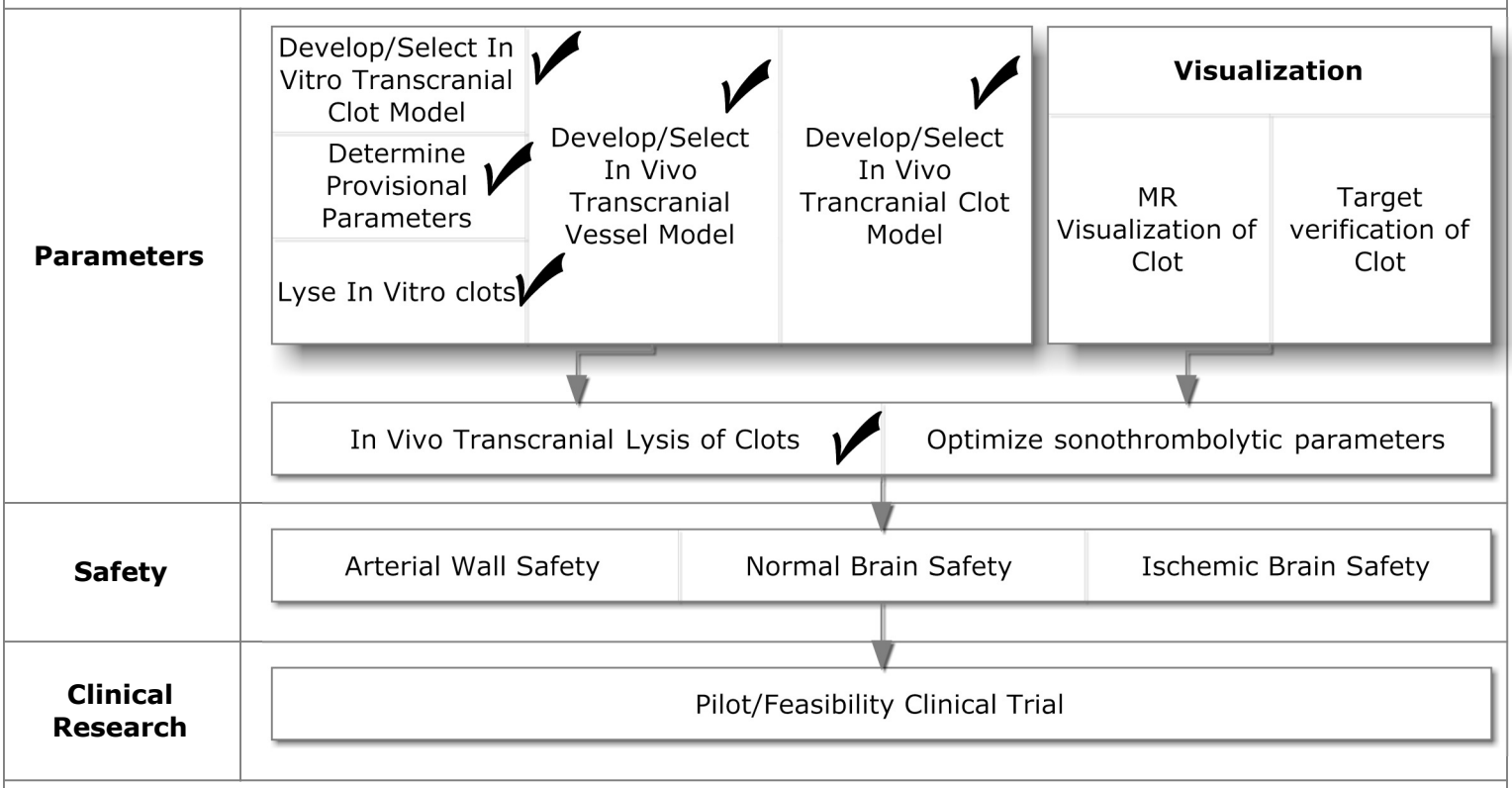
- Pilot/Feasibility Clinical Trial

Research Questions:

- Can focused ultrasound lyse intracerebral hemorrhage transcranially?
- What is the speed of clot lysis? Can microbubbles accelerate lysis?
- Does sonothrombolysis precipitate rebleeding?
- What is the nature of the hemolysate produced by focused ultrasound compared to the naturally occuring hemolysate and the hemolysate resulting from tissue plasminogen activator?
- What are the optimal parameters for sonothrombolysis of intracerebral hemorrhage?
- Are these parameters safe in terms of normal brain?

FOCUSED ULTRASOUND SURGERY FOUNDATION

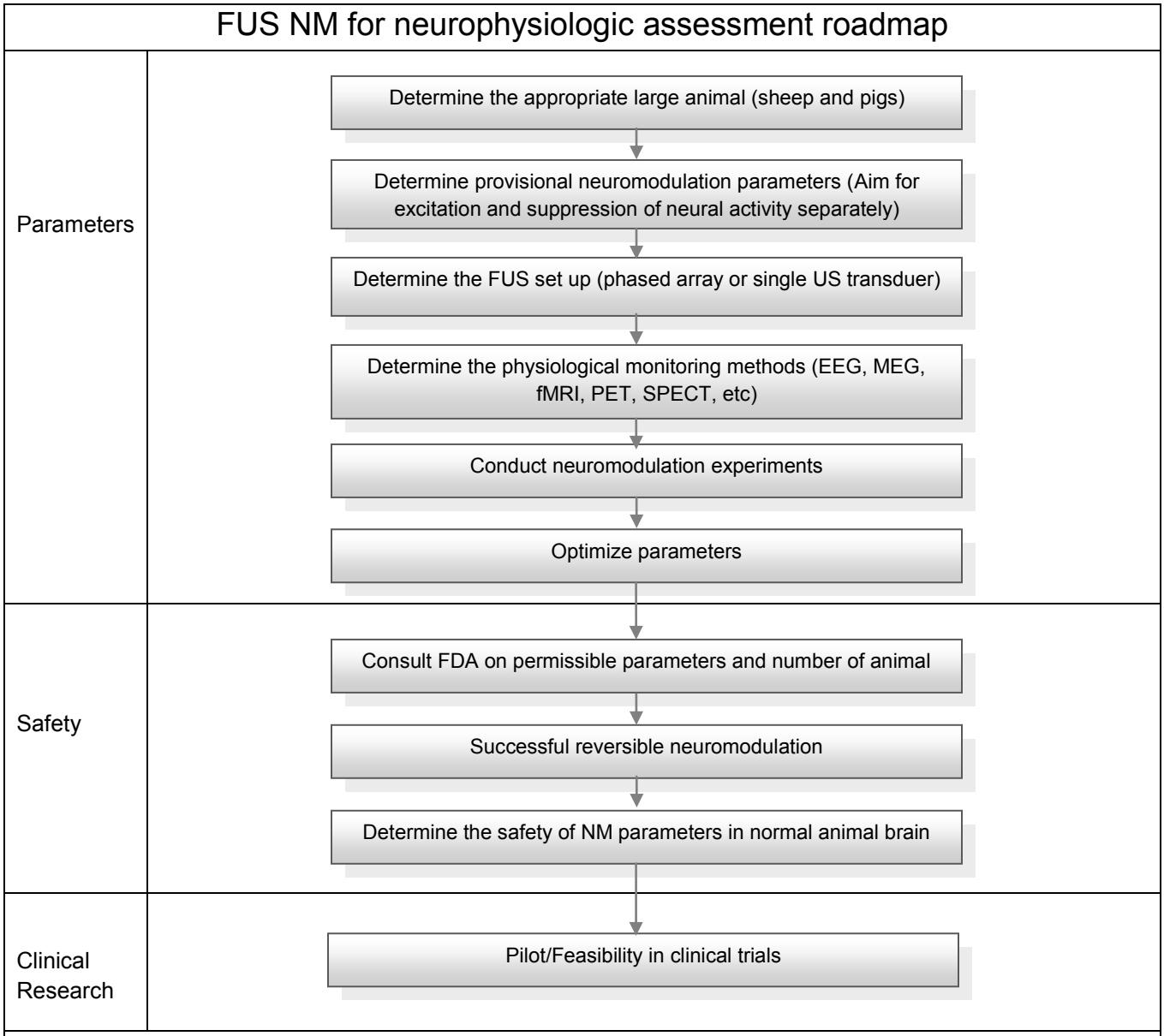
Acute Ischemic Stroke Roadmap



Research Questions:

- Can focused ultrasound lyse intravascular clots transcranially?
- What is the speed of clot lysis?
- What are the optimal parameters for sonothrombolysis of intravascular clots?
- Are these parameters safe in terms of normal brain, ischemic brain and arterial wall?
- Can the clot be visualized and targeted?
- Can focused ultrasound be used to lyse intravascular clots in humans in a timely manner?

FUS NM for neurophysiologic assessment roadmap



Research Questions and :

<Parameters>

- Fundamental FUS frequency: 350 or 700KHz? Higher or lower? – Currently lower frequency seems to favor the successful neuro-modulation at lower acoustic intensities. However, one should be careful that lower frequency tends to increase the risk of mechanical damage, i.e. consideration of MI.
- Type of FUS transducer, multi-array or single transducer ? Both multi-array or single FUS transducer system can be used. However, the single-FUS transducer may suffer from typical problems with acoustic distortion by the skull. The tolerance of the study will depend on frequency, treatment area and depth, imaging-guidance method etc. Multi-array system is advantageous is proposed deep brain stimulation and subsequent ablation.
- Tone burst duration (TDB), pulse repetition frequency (PRF; determining the duty cycle), acoustic intensity in terms of SPPA (SPTA can be calculated from the duty cycle), sonication duration (SD)
- Excitation or suppression/ both? For stimulation, 0.5ms-1ms TBD, 0.5-1Khz PRF, SD 100-300msec, Ispta < 3 W/cm2 (adjust Isppa according to the Duty factor). For suppression, apply only 30-50% of the acoustic intensity that elicited the activation, give lower PRF such as 100Hz, increase the SD to > 20 secs and more. Make sure that you will not heat the tissue by applying low Ispta.
- Dimension of the focus? Few millimeters in diameters would be sufficient as most of the FUS equipments can reasonably achieve this.
- Dimension of the treatment area (Thalamic area? Anywhere else): examine the sonication parameters that results in the modulation of electrophysiological signals (the amplitude and latencies in VEP, MEP,

and SSEP) by sonicating lateral geniculate nucleus (LGN: for VEP), internal capsule (IC: for MEP), and ventral posterolateral nucleus (VPN: for SSEP).

- Intra operative MRI guidance: Slight increase of the temperature (1ºC) and subsequent detection of the temperature profile using temperature-sensitive MR sequence can be used. Optionally, ARFI type of technique as well as less accurate separate extra-operative image-guidance can be used.
- Accuracy/reliable of the guidance ARFI would provide the best performance in accuracy, however, the method is still in development.,

<Safety>

- MI and I_{spta} considerations: MI less than M<0.9; Ispta < 3 w/cm^2
- FDA limitation on clinical systems? the upper regulatory limit for non-obstetric ultrasound imaging (720 mW/cm^2; AIUM Clinical Standards Committee, 2004) guidelines (*i.e.*, 1.9 for all applications except ophthalmic (maximum 0.23); FDA, 2008). Cavitation-related brain tissue damage, in the absence of air bubbles, is rare at pressures less than 40 MPa (Dalecki, 2004)
- Short and long-term biological effects (acute, intermediate and long term: what is the period that are favored by FDA?) Upto 2-3 months post survival
- BBB disruption (via Gad injection or Trypan/Evan's blue injection); Gad injection and MR exam right after the sonication or Trypan/Evan's blue injection right before at the short-term effect sacrifice. Cavitation-related brain tissue damage, in the absence of air bubbles, is rare at pressures less than 40 MPa (Dalecki, 2004), and the neuromodulation can typically occur less than 1Mpa.
- Record Behavioral changes: As needed according to the species.
- Over excitation needs to be monitored by EEG: VEP measuring can be also used to EEG. However, long-term monitoring may be indicated.
- Temperature consideration: MR thermometry? See above. 1 C increase for the targeting purpose. MR thermometry will be needed.
- Types of histological study: Caspase3 for apoptosis, DNA defragmentation kit, glial infiltration). Electron microscopy
- Different animal species (larger animal or even human application?) Would FUS be applied to the species of choice ? (pigs has more difficult cranial structure) Sheep at BWH and Pig at UVA
- In addition to evaluations of neuronal damage, assessment of glia may be needed due to its high population. Oxidative stress in glial cultures: Detection by DAF-2 fluorescence
- Number of animal species? 10 minimum
- Acoustic Radiation Force imaging (ARFI)? On-going.. maybe collaboration with Stanford group?

<Clinical Research>

- Optimization of the FUS application and its modulatory effects on In vivo fMRI mapping (PET mapping?)
- Use anatomical as well as functional information from the brain? fMRI and DTI mapping in separate sessions, Imaging registration would be necessary.
- EEG monitoring : Yes. A pair of thin (~200 µm in diameter) Ag/AgCl electrodes (SWE Ives EEG Solution, Canada) will be subdermally introduced into skin to enable single-montage EEG recordings.
- EMG monitoring (for motor task?) A pair of thin (~200 µm in diameter) Ag/AgCl electrodes (SWE Ives EEG Solution, Canada) will be subdermally introduced into skin to enable single-montage EMG recordings. The signal will be amplified (PowerLab 8/30, AD Instrument, CO) and recorded (LabChart 7, AD Instrument, CO) at a sampling rate of 1000 Hz. The data acquisition system will be situated outside of the 5 guass line in MRI suite (in case of intra MR guidance)
- PET imaging to examine the functional metabolism: On going on rats, using FDG PET (at BWH)
- Application in human study as a part of functional neurosurgery in motion/pain disorder? While FUS-mediated functional neurosurgery emerged as potential non-invasive treatment modalities for neurological disorders such as essential tremor and pain, the on-site validation of the brain function of the targeted sonication prior to thermal ablation would greatly increase the accuracy of the treatment.
- Would sonication in non-thalamic area be sufficient for thalamic modulation? We will modulate the thalamic area.
- Would be need to include animal model ? such as MPTP model of Parkinson's Disease or essential tremor model (or… does such thing exist?) Further collaboration may be needed.

<references>

- Dalecki D: **Mechanical bioeffects of ultrasound**. *Annu Rev Biomed Eng* 2004, **6**:229-248.
- NEMA: **Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment.**

Washinton, D.C.: National Electrical Manufactures Association; 2004

- FDA: **Guidance for Industry and FDA Staff - Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers**. Rockville, MD: U.S. Department of Health and Human Services, Food and Drug Administration, Center for Devices and Radiological Health; 2008

Brain Cancer Draft Roadmap

Project Leads: Kullervo Hynynen, Nathan McDannold & Todd Mainprize

Parameters	Identify the appropriate preclinical animal model of brain cancer for studying BBB opening & drug delivery* ↓ Identify candidate chemotherapeutic agent(s) and microbubble(s) Doxil + Definity/Optison ↓ Determine ultrasound parameters to perform initial *in vivo* studies ↓ Optimize ultrasound parameters in small animal model ↓ Determine FUS targeting and monitoring parameters without thermometry (not a requirement for "this" trial) ↓ Determine drug delivery and monitoring parameters ↓	Completed Experiments and Supporting Citations • Rabbit model and delivery • Rat model and Glioma • Primate Studies - NJM Research Questions • What is the cavitation threshold in FUS system with chosen microbubbles? • What is the behavior of bubble mediated cavitation below safety threshold? • How large a volume can be practically treated? In what time? • How will dose delivery be monitored? Quantitatively? In preclinical models as well as in clinical applications (ex. drug and contrast within same drug delivery system?) Additional questions • Does treatment planning go in here – seems critical part of the roadmap if our goal is patient treatment? • Would survival studies be necessary?
Safety	Develop preclinical safety model(s) ↓ Determine safety of BBB opening parameters in large animal model in normal brain ↓ Determine safety of BBB opening parameters combined with dose escalation in neoplastic brain ↓	
Clinical Research	Pilot clinical trial – BBB opening with MRgFUS in GBM -Safety Delivered Drug Enhancement	

Bibliographies

Literature searches were performed through September 2011 with the qualifiers "focused ultrasound" and "brain." The output of these searches can be found on the following pages as well as on the FUSF Website. We greatly appreciate your assistance in pointing out any missing references and aiding us in providing the most up-to-date bibliographic content.

Search output has been segmented by the topics listed below:

Bibliographies

Brain Tumors

1. Zhou T, Meaney PM, Hoopes PJ et al. Microwave thermal imaging of scanned focused ultrasound heating: animal experiments. In Ryan TP (ed) 1 Edition. San Francisco, California, USA: SPIE 2011; 79010N-79017.
2. Yang FY, Wang HE, Lin GL et al. Micro-SPECT/CT-based pharmacokinetic analysis of 99mTc-diethylenetriaminepentaacetic acid in rats with blood-brain barrier disruption induced by focused ultrasound. Journal of nuclear medicine : official publication, Society of Nuclear Medicine 2011; 52: 478-484.
3. Yang FY, Lin GL, Horng SC et al. Pulsed high-intensity focused ultrasound enhances the relative permeability of the blood-tumor barrier in a glioma-bearing rat model. IEEE transactions on ultrasonics, ferroelectrics, and frequency control 2011; 58: 964-970.
4. Shang X, Wang P, Liu Y et al. Mechanism of low-frequency ultrasound in opening blood-tumor barrier by tight junction. J Mol Neurosci 2011; 43: 364-369.
5. Martin E, Jolesz FA. Noninvasive Treatment for Brain Tumors: Magnetic Resonance-Guided Focused Ultrasound Surgery, Tumors of the Central Nervous system, Volume 3. In Hayat MA (ed). Springer Netherlands 2011; 227-236.
6. Burke CW, Klibanov AL, Sheehan JP, Price RJ. Inhibition of glioma growth by microbubble activation in a subcutaneous model using low duty cycle ultrasound without significant heating. Journal of Neurosurgery 2011; 114: 1654-1661.
7. Burke CW, Klibanov AL, Sheehan JP, Price RJ. Inhibition of glioma growth by microbubble activation in a subcutaneous model using low duty cycle ultrasound without significant heating. J Neurosurg 2011.
8. Avedian RS, Gold G, Ghanouni P, Pauly KB. Magnetic resonance guided high-intensity focused ultrasound ablation of musculoskeletal tumors. Current Orthopaedic Practice 2011; 22: 303-308 310.1097/BCO.1090b1013e318220dad318225.
9. Alongi F, Russo G, Spinelli A et al. Can magnetic resonance image-guided focused ultrasound surgery replace local oncology treatments? A review. Tumori 2011; 97: 259-264.
10. Zhang WB, Wang Z, Shu F et al. Activation of AMP-activated protein kinase by temozolomide contributes to apoptosis in glioblastoma cells via p53 activation and mTORC1 inhibition. The Journal of biological chemistry 2010; 285: 40461-40471.
11. Zhan C, Gu B, Xie C et al. Cyclic RGD conjugated poly(ethylene glycol)-co-poly(lactic acid) micelle enhances paclitaxel anti-glioblastoma effect. Journal of controlled release : official journal of the Controlled Release Society 2010; 143: 136-142.
12. Wang ZX, Chen YY, Li BA et al. Decreased pygopus 2 expression suppresses glioblastoma U251 cell growth. Journal of neuro-oncology 2010; 100: 31-41.
13. Wang B, Xie Q, Huang Q et al. Post-operative meningitis: patients with glioblastoma multiforme might profit from it? Medical hypotheses 2010; 74: 616-617.
14. Ulrich NH, Bozinov O. Effect of high-intensity focused ultrasound on daily practice in neurosurgery. World neurosurgery 2010; 74: 12-13.
15. Sjostrom S, Andersson U, Liu Y et al. Genetic variations in EGF and EGFR and glioblastoma outcome. Neuro-oncology 2010; 12: 815-821.

Bibliographies

16. Schwartzbaum JA, Xiao Y, Liu Y et al. Inherited variation in immune genes and pathways and glioblastoma risk. Carcinogenesis 2010; 31: 1770-1777.

17. Robinson CG, Palomo JM, Rahmathulla G et al. Effect of alternative temozolomide schedules on glioblastoma O(6)-methylguanine-DNA methyltransferase activity and survival. British journal of cancer 2010; 103: 498-504.

18. Olbricht WL, Neeves KB, Foley CP. Microfluidic probes in the treatment of brain-related diseases. Drug News Perspect 2010; 23: 491-497.

19. Nishikawa R. Standard therapy for glioblastoma--a review of where we are. Neurologia medico-chirurgica 2010; 50: 713-719.

20. Muhammad AK, Puntel M, Candolfi M et al. Study of the efficacy, biodistribution, and safety profile of therapeutic gutless adenovirus vectors as a prelude to a phase I clinical trial for glioblastoma. Clinical pharmacology and therapeutics 2010; 88: 204-213.

21. Mohs AM, Provenzale JM. Applications of nanotechnology to imaging and therapy of brain tumors. Neuroimaging Clin N Am 2010; 20: 283-292.

22. McDannold N, Clement GT, Black P et al. Transcranial magnetic resonance imaging- guided focused ultrasound surgery of brain tumors: initial findings in 3 patients. Neurosurgery 2010; 66: 323-332; discussion 332.

23. McDannold N, Clement GT, Black P et al. Transcranial magnetic resonance imaging- guided focused ultrasound surgery of brain tumors: initial findings in 3 patients. Neurosurgery 2010; 66: 323-332; discussion 332.

24. Mahringer A, Karamustafa S, Klotz D et al. Inhibition of P-glycoprotein at the blood-brain barrier by phytochemicals derived from traditional Chinese medicine. Cancer Genomics Proteomics 2010; 7: 191-205.

25. Lu HF, Lai TY, Hsia TC et al. Danthron induces DNA damage and inhibits DNA repair gene expressions in GBM 8401 human brain glioblastoma multiforms cells. Neurochemical research 2010; 35: 1105-1110.

26. Liu Y, Shete S, Etzel CJ et al. Polymorphisms of LIG4, BTBD2, HMGA2, and RTEL1 genes involved in the double-strand break repair pathway predict glioblastoma survival. Journal of clinical oncology : official journal of the American Society of Clinical Oncology 2010; 28: 2467-2474.

27. Liu Y, Li C, Lin J. STAT3 as a Therapeutic Target for Glioblastoma. Anti-cancer agents in medicinal chemistry 2010; 10: 512-519.

28. Liu HL, Pan CH, Ting CY, Hsiao MJ. Opening of the blood-brain barrier by low-frequency (28-kHz) ultrasound: a novel pinhole-assisted mechanical scanning device. Ultrasound in Medicine & Biology 2010; 36: 325-335.

29. Liu HL, Pan CH, Ting CY, Hsiao MJ. Opening of the blood-brain barrier by low-frequency (28-kHz) ultrasound: a novel pinhole-assisted mechanical scanning device. Ultrasound Med Biol 2010; 36: 325-335.

30. Liu HL, Hua MY, Yang HW et al. Magnetic resonance monitoring of focused ultrasound/magnetic nanoparticle targeting delivery of therapeutic agents to the brain. Proceedings of the National Academy of Sciences of the United States of America 2010; 107: 15205-15210.

Bibliographies

31. Liu HL, Hua MY, Yang HW et al. Magnetic resonance monitoring of focused ultrasound/magnetic nanoparticle targeting delivery of therapeutic agents to the brain. Proc Natl Acad Sci U S A 2010; 107: 15205-15210.

32. Liu HL, Hua MY, Chen PY et al. Blood-brain barrier disruption with focused ultrasound enhances delivery of chemotherapeutic drugs for glioblastoma treatment. Radiology 2010; 255: 415-425.

33. Liu HL, Hua MY, Chen PY et al. Blood-brain barrier disruption with focused ultrasound enhances delivery of chemotherapeutic drugs for glioblastoma treatment. Radiology 2010; 255: 415-425.

34. Li R, Li G, Deng L et al. IL-6 augments the invasiveness of U87MG human glioblastoma multiforme cells via up-regulation of MMP-2 and fascin-1. Oncology reports 2010; 23: 1553-1559.

35. Colen RR, Kekhia H, Jolesz FA. Multimodality intraoperative MRI for brain tumor surgery. Expert review of neurotherapeutics 2010; 10: 1545-1558.

36. Colen RR, Kekhia H, Jolesz FA. Multimodality intraoperative MRI for brain tumor surgery. Expert Rev Neurother 2010; 10: 1545-1558.

37. Colen RR, Jolesz FA. Future potential of MRI-guided focused ultrasound brain surgery. Neuroimaging clinics of North America 2010; 20: 355-366.

38. Colen RR, Jolesz FA. Future potential of MRI-guided focused ultrasound brain surgery. Neuroimaging Clin N Am 2010; 20: 355-366.

39. Chen PY, Liu HL, Hua MY et al. Novel magnetic/ultrasound focusing system enhances nanoparticle drug delivery for glioma treatment. Neuro-oncology 2010; 12: 1050-1060.

40. Chen PY, Liu HL, Hua MY et al. Novel magnetic/ultrasound focusing system enhances nanoparticle drug delivery for glioma treatment. Neuro Oncol 2010; 12: 1050-1060.

41. Chen PY, Liu HL, Hua MY et al. Novel magnetic/ultrasound focusing system enhances nanoparticle drug delivery for glioma treatment. Neuro Oncol 2010; 12: 1050-1060.

42. Burke CW, Price RJ. Contrast ultrasound targeted treatment of gliomas in mice via drug-bearing nanoparticle delivery and microvascular ablation. J Vis Exp 2010.

43. Ahluwalia MS, de Groot J, Liu WM, Gladson CL. Targeting SRC in glioblastoma tumors and brain metastases: rationale and preclinical studies. Cancer letters 2010; 298: 139-149.

44. Yoshino S, Fukushima T, Hayashi S et al. Effects of focused ultrasound sonodynamic treatment on the rat blood-brain barrier. Anticancer Research 2009; 29: 889-895.

45. Yoshino S, Fukushima T, Hayashi S et al. Effects of focused ultrasound sonodynamic treatment on the rat blood-brain barrier. Anticancer Res 2009; 29: 889-895.

46. Xiao W, Yao N, Peng L et al. Near-infrared optical imaging in glioblastoma xenograft with ligand-targeting alpha 3 integrin. European journal of nuclear medicine and molecular imaging 2009; 36: 94-103.

47. Wakimoto H, Kesari S, Farrell CJ et al. Human glioblastoma-derived cancer stem cells: establishment of invasive glioma models and treatment with oncolytic herpes simplex virus vectors. Cancer research 2009; 69: 3472-3481.

48. Schilling SH, Hjelmeland AB, Radiloff DR et al. NDRG4 is required for cell cycle progression and survival in glioblastoma cells. The Journal of biological chemistry 2009; 284: 25160-25169.

Bibliographies

49. Pirzkall A, McGue C, Saraswathy S et al. Tumor regrowth between surgery and initiation of adjuvant therapy in patients with newly diagnosed glioblastoma. Neuro-oncology 2009; 11: 842-852.

50. Nonaka M, Yamamoto M, Yoshino S et al. Sonodynamic therapy consisting of focused ultrasound and a photosensitizer causes a selective antitumor effect in a rat intracranial glioma model. Anticancer Research 2009; 29: 943-950.

51. Nonaka M, Yamamoto M, Yoshino S et al. Sonodynamic therapy consisting of focused ultrasound and a photosensitizer causes a selective antitumor effect in a rat intracranial glioma model. Anticancer Res 2009; 29: 943-950.

52. Nghiemphu PL, Liu W, Lee Y et al. Bevacizumab and chemotherapy for recurrent glioblastoma: a single-institution experience. Neurology 2009; 72: 1217-1222.

53. Mou KJ, Mao Q, Chen MN et al. [AQP4 expression in the brains of patients with glioblastoma and its association with brain edema]. Sichuan da xue xue bao. Yi xue ban = Journal of Sichuan University. Medical science edition 2009; 40: 651-654.

54. Marepaily R, Micheals D, Sloan A et al. Octreotide uptake in intracranial metastasis of pancreatic ductal adenocarcinoma origin in a patient with a prolonged clinical course. Digestive diseases and sciences 2009; 54: 188-190.

55. Ma X, Lv Y, Liu J et al. Survival analysis of 205 patients with glioblastoma multiforme: clinical characteristics, treatment and prognosis in China. Journal of clinical neuroscience : official journal of the Neurosurgical Society of Australasia 2009; 16: 1595-1598.

56. Liu HL, Pan CH, Ting CY, Hsiao MJ. Opening of the blood-brain barrier by low-frequency (28-kHz) ultrasound: a novel pinhole-assisted mechanical scanning device. Ultrasound Med Biol 2009; 36: 325-335.

57. Ito K, Ishizaka S, Sasaki T et al. Safe and minimally invasive laminoplastic laminotomy using an ultrasonic bone curette for spinal surgery: technical note. Surgical Neurology 2009; 72: 470-475; discussion 475.

58. Hirschberg H, Zhang MJ, Gach HM et al. Targeted delivery of bleomycin to the brain using photo-chemical internalization of Clostridium perfringens epsilon prototoxin. Journal of neuro-oncology 2009; 95: 317-329.

59. Groves MD, Puduvalli VK, Gilbert MR et al. Two phase II trials of temozolomide with interferon-alpha2b (pegylated and non-pegylated) in patients with recurrent glioblastoma multiforme. British journal of cancer 2009; 101: 615-620.

60. Drane DL, Ojemann GA, Ojemann JG et al. Category-specific recognition and naming deficits following resection of a right anterior temporal lobe tumor in a patient with atypical language lateralization. Cortex 2009; 45: 630-640.

61. Damianou C, Ioannides K, Hadjisavvas V et al. In vitro and in vivo brain ablation created by high-intensity focused ultrasound and monitored by MRI. IEEE transactions on ultrasonics, ferroelectrics, and frequency control 2009; 56: 1189-1198.

62. Damianou C, Ioannides K, Hadjisavvas V et al. In vitro and in vivo brain ablation created by high-intensity focused ultrasound and monitored by MRI. IEEE Trans Ultrason Ferroelectr Freq Control 2009; 56: 1189-1198.

63. Dai S, Hu S, Wu C. Apoptotic effect of sonodynamic therapy mediated by hematoporphyrin monomethyl ether on C6 glioma cells in vitro. Acta Neurochir (Wien) 2009; 151: 1655-1661.

Bibliographies

64. Bidros DS, Vogelbaum MA. Novel drug delivery strategies in neuro-oncology. Neurotherapeutics : the journal of the American Society for Experimental NeuroTherapeutics 2009; 6: 539-546.

65. Singh VR, Singh K. Wireless Sensor Networks for biomedical applications in cancer hyperthermia. Conference proceedings : ... Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Conference 2008; 2008: 5160-5163.

66. Li JH, Song DY, Xu YG et al. In vitro study of haematoporphyrin monomethyl ether-mediated sonodynamic effects on C6 glioma cells. Neurol Sci 2008; 29: 229-235.

67. King GD, Muhammad AK, Curtin JF et al. Flt3L and TK gene therapy eradicate multifocal glioma in a syngeneic glioblastoma model. Neuro-oncology 2008; 10: 19-31.

68. Hynynen K. Ultrasound for drug and gene delivery to the brain. Advanced Drug Delivery Reviews 2008; 60: 1209-1217.

69. Hynynen K. Ultrasound for drug and gene delivery to the brain. Adv Drug Deliv Rev 2008; 60: 1209-1217.

70. Hirschberg H, Uzal FA, Chighvinadze D et al. Disruption of the blood-brain barrier following ALA-mediated photodynamic therapy. Lasers in surgery and medicine 2008; 40: 535-542.

71. Bansal M, Boyle T, Ehsan A, Mott FE. Brain metastases in N2-positive non-small-cell lung cancer: implications for prophylactic cranial irradiation. Clinical lung cancer 2008; 9: 227-229.

72. Vogelbaum MA. Convection enhanced delivery for treating brain tumors and selected neurological disorders: symposium review. J Neurooncol 2007; 83: 97-109.

73. Treat LH, McDannold N, Vykhodtseva N et al. Targeted delivery of doxorubicin to the rat brain at therapeutic levels using MRI-guided focused ultrasound. International journal of cancer. Journal international du cancer 2007; 121: 901-907.

74. Treat LH, McDannold N, Vykhodtseva N et al. Targeted delivery of doxorubicin to the rat brain at therapeutic levels using MRI-guided focused ultrasound. Int J Cancer 2007; 121: 901-907.

75. Tanter M, Pernot M, Aubry JF et al. Compensating for bone interfaces and respiratory motion in high-intensity focused ultrasound. International journal of hyperthermia : the official journal of European Society for Hyperthermic Oncology, North American Hyperthermia Group 2007; 23: 141-151.

76. Tanter M, Pernot M, Aubry JF et al. Compensating for bone interfaces and respiratory motion in high-intensity focused ultrasound. Int J Hyperthermia 2007; 23: 141-151.

77. Pernot M, Aubry JF, Tanter M et al. In vivo transcranial brain surgery with an ultrasonic time reversal mirror. Journal of Neurosurgery 2007; 106: 1061-1066.

78. Pernot M, Aubry JF, Tanter M et al. In vivo transcranial brain surgery with an ultrasonic time reversal mirror. J Neurosurg 2007; 106: 1061-1066.

79. Hynynen K, Clement G. Clinical applications of focused ultrasound-the brain. International journal of hyperthermia : the official journal of European Society for Hyperthermic Oncology, North American Hyperthermia Group 2007; 23: 193-202.

80. Hynynen K, Clement G. Clinical applications of focused ultrasound-the brain. Int J Hyperthermia 2007; 23: 193-202.

81. Salomir R, Delemazure AS, Palussiere J et al. Image-based control of the magnetic resonance imaging-guided focused ultrasound thermotherapy. Topics in magnetic resonance imaging : TMRI 2006; 17: 139-151.

Bibliographies

82. Salomir R, Delemazure AS, Palussiere J et al. Image-based control of the magnetic resonance imaging-guided focused ultrasound thermotherapy. Top Magn Reson Imaging 2006; 17: 139-151.

83. Ram Z, Cohen ZR, Harnof S et al. Magnetic resonance imaging-guided, high-intensity focused ultrasound for brain tumor therapy. Neurosurgery 2006; 59: 949-955; discussion 955-946.

84. Ram Z, Cohen ZR, Harnof S et al. Magnetic resonance imaging-guided, high-intensity focused ultrasound for brain tumor therapy. Neurosurgery 2006; 59: 949-955; discussion 955-946.

85. Jolesz FA. Magnetic Resonance Image-Guided Neurosurgery. Hungarian Studies 2006; 19: 233-242.

86. Forsberg F. Will the combination of US contrast microbubbles and high-intensity focused ultrasound enable noninvasive brain surgery? Radiology 2006; 241: 1-2.

87. Forsberg F. Will the combination of US contrast microbubbles and high-intensity focused ultrasound enable noninvasive brain surgery? Radiology 2006; 241: 1-2.

88. Dimaio SP, Archip N, Hata N et al. Image-guided neurosurgery at Brigham and Women's Hospital. IEEE Eng Med Biol Mag 2006; 25: 67-73.

89. Zou KH, Resnic FS, Talos IF et al. A global goodness-of-fit test for receiver operating characteristic curve analysis via the bootstrap method. J Biomed Inform 2005; 38: 395-403.

90. Yu CS, Li KC, Xuan Y et al. Diffusion tensor tractography in patients with cerebral tumors: a helpful technique for neurosurgical planning and postoperative assessment. Eur J Radiol 2005; 56: 197-204.

91. Warfield SK, Haker SJ, Talos IF et al. Capturing intraoperative deformations: research experience at Brigham and Women's Hospital. Med Image Anal 2005; 9: 145-162.

92. Wang L, Li KC, Chen L et al. Perfusion MR imaging and proton MR spectroscopy in a case of dysembryoplastic neuroepithelial tumor. Chin Med J (Engl) 2005; 118: 1134-1136.

93. Renner C, Lindner D, Schneider JP, Meixensberger J. Evaluation of intra-operative ultrasound imaging in brain tumor resection: a prospective study. Neurological Research 2005; 27: 351-357.

94. Kim MS, Pyo SY, Jeong YG et al. Gamma knife surgery for intracranial cavernous hemangioma. J Neurosurg 2005; 102 Suppl: 102-106.

95. Claus EB, Horlacher A, Hsu L et al. Survival rates in patients with low-grade glioma after intraoperative magnetic resonance image guidance. Cancer 2005; 103: 1227-1233.

96. Clatz O, Delingette H, Talos IF et al. Robust nonrigid registration to capture brain shift from intraoperative MRI. IEEE Trans Med Imaging 2005; 24: 1417-1427.

97. Clatz O, Delingette H, Talos IF et al. Hybrid formulation of the model-based non-rigid registration problem to improve accuracy and robustness. Med Image Comput Comput Assist Interv Int Conf Med Image Comput Comput Assist Interv 2005; 8: 295-302.

98. Liu G, Ying H, Zeng G et al. HER-2, gp100, and MAGE-1 are expressed in human glioblastoma and recognized by cytotoxic T cells. Cancer research 2004; 64: 4980-4986.

99. Linskey ME. The changing role of stereotaxis in surgical neuro-oncology. Journal of neuro-oncology 2004; 69: 35-54.

100. Connor CW, Hynynen K. Patterns of thermal deposition in the skull during transcranial focused ultrasound surgery. IEEE transactions on bio-medical engineering 2004; 51: 1693-1706.

101. Connor CW, Hynynen K. Patterns of thermal deposition in the skull during transcranial focused ultrasound surgery. IEEE Trans Biomed Eng 2004; 51: 1693-1706.

Bibliographies

102. Barnholtz-Sloan JS, Sloan AE, Davis FG et al. Incidence proportions of brain metastases in patients diagnosed (1973 to 2001) in the Metropolitan Detroit Cancer Surveillance System. Journal of clinical oncology : official journal of the American Society of Clinical Oncology 2004; 22: 2865-2872.

103. Wellis G, Nagel R, Vollmar C, Steiger HJ. Direct costs of microsurgical management of radiosurgically amenable intracranial pathology in Germany: an analysis of meningiomas, acoustic neuromas, metastases and arteriovenous malformations of less than 3 cm in diameter. Acta Neurochir (Wien) 2003; 145: 249-255.

104. Jolesz FA. Future perspectives in intraoperative imaging. Acta neurochirurgica. Supplement 2003; 85: 7-13.

105. Jaaskelainen J. Non-invasive transcranial high intensity focused ultrasound (HIFUS) under MRI thermometry and guidance in the treatment of brain lesions. Acta neurochirurgica. Supplement 2003; 88: 57-60.

106. Jaaskelainen J. Non-invasive transcranial high intensity focused ultrasound (HIFUS) under MRI thermometry and guidance in the treatment of brain lesions. Acta Neurochir Suppl 2003; 88: 57-60.

107. Aubry JF, Tanter M, Pernot M et al. Experimental demonstration of noninvasive transskull adaptive focusing based on prior computed tomography scans. The Journal of the Acoustical Society of America 2003; 113: 84-93.

108. Aubry JF, Tanter M, Pernot M et al. Experimental demonstration of noninvasive transskull adaptive focusing based on prior computed tomography scans. J Acoust Soc Am 2003; 113: 84-93.

109. Wrensch M, Minn Y, Chew T et al. Epidemiology of primary brain tumors: current concepts and review of the literature. Neuro-oncology 2002; 4: 278-299.

110. Vaughan TE, Hynynen K. Effects of parameter errors in the simulation of transcranial focused ultrasound. Physics in Medicine and Biology 2002; 47: 37-45.

111. Vaughan TE, Hynynen K. Effects of parameter errors in the simulation of transcranial focused ultrasound. Phys Med Biol 2002; 47: 37-45.

112. Jolesz FA, Talos IF, Schwartz RB et al. Intraoperative magnetic resonance imaging and magnetic resonance imaging-guided therapy for brain tumors. Neuroimaging clinics of North America 2002; 12: 665-683.

113. Li KC. Beyond "radiologic-pathologic correlation". Acad Radiol 2001; 8: 375-376.

114. Kurita H, Suzuki I, Shin M et al. Successful radiosurgical treatment of lesional epilepsy of mesial temporal origin. Minim Invasive Neurosurg 2001; 44: 43-46.

115. Alexander E, 3rd. Optimizing brain tumor resection. Midfield interventional MR imaging. Neuroimaging clinics of North America 2001; 11: 659-672.

116. Koch S, Pohl P, Cobet U, Rainov NG. Ultrasound enhancement of liposome-mediated cell transfection is caused by cavitation effects. Ultrasound Med Biol 2000; 26: 897-903.

117. Clement GT, Sun J, Giesecke T, Hynynen K. A hemisphere array for non-invasive ultrasound brain therapy and surgery. Phys Med Biol 2000; 45: 3707-3719.

118. Regis J, Bartolomei F, Metellus P et al. Radiosurgery for trigeminal neuralgia and epilepsy. Neurosurg Clin N Am 1999; 10: 359-377.

Bibliographies

119. Kurihara A, Deguchi Y, Pardridge WM. Epidermal growth factor radiopharmaceuticals: 111In chelation, conjugation to a blood-brain barrier delivery vector via a biotin-polyethylene linker, pharmacokinetics, and in vivo imaging of experimental brain tumors. Bioconjugate chemistry 1999; 10: 502-511.

120. Deguchi Y, Kurihara A, Pardridge WM. Retention of biologic activity of human epidermal growth factor following conjugation to a blood-brain barrier drug delivery vector via an extended poly(ethylene glycol) linker. Bioconjugate chemistry 1999; 10: 32-37.

121. Bartolomei F, Regis J, Kida Y et al. Gamma Knife radiosurgery for epilepsy associated with cavernous hemangiomas: a retrospective study of 49 cases. Stereotact Funct Neurosurg 1999; 72 Suppl 1: 22-28.

122. Tanter M, Thomas JL, Fink M. Focusing and steering through absorbing and aberrating layers: application to ultrasonic propagation through the skull. The Journal of the Acoustical Society of America 1998; 103: 2403-2410.

123. Schrottner O, Eder HG, Unger F et al. Radiosurgery in lesional epilepsy: brain tumors. Stereotact Funct Neurosurg 1998; 70 Suppl 1: 50-56.

124. Hynynen K, Vykhodtseva NI, Chung AH et al. Thermal effects of focused ultrasound on the brain: determination with MR imaging. Radiology 1997; 204: 247-253.

125. Hynynen K, Vykhodtseva NI, Chung AH et al. Thermal effects of focused ultrasound on the brain: determination with MR imaging. Radiology 1997; 204: 247-253.

126. Regis J, Mangin JF, Frouin V et al. Generic model for the localization of the cerebral cortex and preoperative multimodal integration in epilepsy surgery. Stereotact Funct Neurosurg 1995; 65: 72-80.

127. Vaupel P. Blood flow and metabolic microenvironment of brain tumors. Journal of neuro-oncology 1994; 22: 261-267.

128. Pardridge WM, Boado RJ, Black KL, Cancilla PA. Blood-brain barrier and new approaches to brain drug delivery. The Western journal of medicine 1992; 156: 281-286.

129. Quan KM, Watmough DJ, Mallard JR. Theoretical considerations in relation to the treatment of brain tumours by means of local hyperthermia generated by ultrasound fields. European journal of surgical oncology : the journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology 1991; 17: 454-465.

130. Kihlstrom L, Karlsson B, Lindquist C et al. Gamma knife surgery for cerebral metastasis. Acta Neurochir Suppl (Wien) 1991; 52: 87-89.

131. Guthkelch AN, Carter LP, Cassady JR et al. Treatment of malignant brain tumors with focused ultrasound hyperthermia and radiation: results of a phase I trial. Journal of neuro-oncology 1991; 10: 271-284.

132. Guthkelch AN, Carter LP, Cassady JR et al. Treatment of malignant brain tumors with focused ultrasound hyperthermia and radiation: results of a phase I trial. J Neurooncol 1991; 10: 271-284.

133. Patrick JT, Nolting MN, Goss SA et al. Ultrasound and the blood-brain barrier. Advances in experimental medicine and biology 1990; 267: 369-381.

134. Patrick JT, Nolting MN, Goss SA et al. Ultrasound and the blood-brain barrier. Adv Exp Med Biol 1990; 267: 369-381.

135. Hynynen K, Lulu BA. Hyperthermia in cancer treatment. Investigative radiology 1990; 25: 824-834.

Bibliographies

136. Wallner KE, Galicich JH, Krol G et al. Patterns of failure following treatment for glioblastoma multiforme and anaplastic astrocytoma. International journal of radiation oncology, biology, physics 1989; 16: 1405-1409.

137. Tobias J, Hynynen K, Roemer R et al. An ultrasound window to perform scanned, focused ultrasound hyperthermia treatments of brain tumors. Medical Physics 1987; 14: 228-234.

138. Tobias J, Hynynen K, Roemer R et al. An ultrasound window to perform scanned, focused ultrasound hyperthermia treatments of brain tumors. Med Phys 1987; 14: 228-234.

139. Britt RH, Lyons BE, Enzmann DR et al. Correlation of neuropathologic findings, computerized tomographic and high-resolution ultrasound scans of canine avian sarcoma virus-induced brain tumors. J Neurooncol 1987; 4: 243-268.

140. Pia HW. The future role of neurosurgery in the case of vascular diseases of the central nervous system. Neurosurg Rev 1986; 9: 51-68.

141. Koivukangas J, Koivukangas P. Treatment of low-grade cerebral astrocytoma: new methods and evaluation of results. Annals of clinical research 1986; 18 Suppl 47: 115-124.

142. Heimburger RF. Ultrasound augmentation of central nervous system tumor therapy. Indiana Med 1985; 78: 469-476.

143. Britt RH, Pounds DW, Lyons BE. Feasibility of treating malignant brain tumors with focused ultrasound. Progress in experimental tumor research 1984; 28: 232-245.

144. Britt RH, Pounds DW, Lyons BE. Feasibility of treating malignant brain tumors with focused ultrasound. Prog Exp Tumor Res 1984; 28: 232-245.

145. Sachs TD, Janney CD. A two-beam acoustic system for tissue analysis. Physics in Medicine and Biology 1977; 22: 327-340.

146. Shealy CN, Crafts D. Selective alteration of the blood-brain barrier. J Neurosurg 1965; 23: 484-487.

147. Fry WJ, Meyers R. Ultrasonic method of modifying brain structures. Confin Neurol 1962; 22: 315-327.

Bibliographies

Functional Neurosurgery

1. Torres CV, Moro E, Lopez-Rios AL et al. Deep Brain Stimulation of the Ventral Intermediate Nucleus of the Thalamus for Tremor in Patients With Multiple Sclerosis. Neurosurgery 2010.
2. Lozano AM, Snyder BJ, Hamani C et al. Basal ganglia physiology and deep brain stimulation. Mov Disord 2010; 25 Suppl 1: S71-75.
3. Lozano AM. Deep brain stimulation for Parkinson disease. J Neurosurg 2010; 112: 477; discussion 477-478.
4. Hamani C, Diwan M, Isabella S et al. Effects of different stimulation parameters on the antidepressant-like response of medial prefrontal cortex deep brain stimulation in rats. J Psychiatr Res 2010; 44: 683-687.
5. Follett KA, Weaver FM, Stern M et al. Pallidal versus subthalamic deep-brain stimulation for Parkinson's disease. N Engl J Med 2010; 362: 2077-2091.
6. Elias WJ, Lozano AM. Deep brain stimulation: the spectrum of application. Neurosurg Focus 2010; 29: Introduction.
7. Chang EF, Schrock LE, Starr PA, Ostrem JL. Long-Term Benefit Sustained after Bilateral Pallidal Deep Brain Stimulation in Patients with Refractory Tardive Dystonia. Stereotact Funct Neurosurg 2010; 88: 304-310.
8. Sillay KA, Sani S, Starr PA. Deep brain stimulation for medically intractable cluster headache. Neurobiol Dis 2009; 38: 361-368.
9. Sani S, Shimamoto S, Turner RS et al. Microelectrode recording in the posterior hypothalamic region in humans. Neurosurgery 2009; 64: 161-167; discussion 167-169.
10. Moro E, Piboolnurak P, Arenovich T et al. Pallidal stimulation in cervical dystonia: clinical implications of acute changes in stimulation parameters. Eur J Neurol 2009; 16: 506-512.
11. Martin E, Jeanmonod D, Morel A et al. High-intensity focused ultrasound for noninvasive functional neurosurgery. Ann Neurol 2009; 66: 858-861.
12. Lim AS, Moro E, Lozano AM et al. Selective enhancement of rapid eye movement sleep by deep brain stimulation of the human pons. Ann Neurol 2009; 66: 110-114.
13. Hamani C, Mayberg H, Snyder B et al. Deep brain stimulation of the subcallosal cingulate gyrus for depression: anatomical location of active contacts in clinical responders and a suggested guideline for targeting. J Neurosurg 2009; 111: 1209-1215.
14. Hamani C, Andrade D, Hodaie M et al. Deep brain stimulation for the treatment of epilepsy. Int J Neural Syst 2009; 19: 213-226.
15. Giacobbe P, Mayberg HS, Lozano AM. Treatment resistant depression as a failure of brain homeostatic mechanisms: implications for deep brain stimulation. Exp Neurol 2009; 219: 44-52.
16. Fontaine D, Hamani C, Lozano A. Efficacy and safety of motor cortex stimulation for chronic neuropathic pain: critical review of the literature. J Neurosurg 2009; 110: 251-256.
17. Sillay KA, Larson PS, Starr PA. Deep brain stimulator hardware-related infections: incidence and management in a large series. Neurosurgery 2008; 62: 360-366; discussion 366-367.
18. Shields DC, Asaad W, Eskandar EN et al. Prospective assessment of stereotactic ablative surgery for intractable major depression. Biol Psychiatry 2008; 64: 449-454.

Bibliographies

19. Richter EO, Davis KD, Hamani C et al. Cingulotomy for psychiatric disease: microelectrode guidance, a callosal reference system for documenting lesion location, and clinical results. Neurosurgery 2008; 62: 957-965.

20. Papavassiliou E, Rau G, Heath S et al. Thalamic deep brain stimulation for essential tremor: relation of lead location to outcome. Neurosurgery 2008; 62 Suppl 2: 884-894.

21. Ostrem JL, Starr PA. Treatment of dystonia with deep brain stimulation. Neurotherapeutics 2008; 5: 320-330.

22. McNeely HE, Mayberg HS, Lozano AM, Kennedy SH. Neuropsychological impact of Cg25 deep brain stimulation for treatment-resistant depression: preliminary results over 12 months. J Nerv Ment Dis 2008; 196: 405-410.

23. Lozano AM, Mayberg HS, Giacobbe P et al. Subcallosal cingulate gyrus deep brain stimulation for treatment-resistant depression. Biol Psychiatry 2008; 64: 461-467.

24. Johansen-Berg H, Gutman DA, Behrens TE et al. Anatomical connectivity of the subgenual cingulate region targeted with deep brain stimulation for treatment-resistant depression. Cereb Cortex 2008; 18: 1374-1383.

25. Hamani C, Richter E, Schwalb JM, Lozano AM. Bilateral subthalamic nucleus stimulation for Parkinson's disease: a systematic review of the clinical literature. Neurosurgery 2008; 62 Suppl 2: 863-874.

26. Hamani C, Moro E, Zadikoff C et al. Location of active contacts in patients with primary dystonia treated with globus pallidus deep brain stimulation. Neurosurgery 2008; 62: 217-223; discussion 223-215.

27. Hamani C, McAndrews MP, Cohn M et al. Memory enhancement induced by hypothalamic/fornix deep brain stimulation. Ann Neurol 2008; 63: 119-123.

28. Elias WJ, Cosgrove GR. Psychosurgery. Neurosurg Focus 2008; 25: E1.

29. Allendes FE, Lozano AM, Hutchison WD. Attenuation of long-term depression in human striatum after anterior capsulotomy. Stereotact Funct Neurosurg 2008; 86: 224-230.

30. Abosch A, Cosgrove GR. Biological basis for the surgical treatment of depression. Neurosurg Focus 2008; 25: E2.

31. Lanteaume L, Khalfa S, Regis J et al. Emotion induction after direct intracerebral stimulations of human amygdala. Cereb Cortex 2007; 17: 1307-1313.

32. Hung SW, Hamani C, Lozano AM et al. Long-term outcome of bilateral pallidal deep brain stimulation for primary cervical dystonia. Neurology 2007; 68: 457-459.

33. Hodaie M, Neimat JS, Lozano AM. The dopaminergic nigrostriatal system and Parkinson's disease: molecular events in development, disease, and cell death, and new therapeutic strategies. Neurosurgery 2007; 60: 17-28; discussion 28-30.

34. Hamani C, Stone S, Laxton A, Lozano AM. The pedunculopontine nucleus and movement disorders: anatomy and the role for deep brain stimulation. Parkinsonism Relat Disord 2007; 13 Suppl 3: S276-280.

35. Gildenberg PL. Evolution of Basal Ganglia Surgery for Movement Disorders. Stereotactic and Functional Neurosurgery 2006; 84: 131-135.

36. Lindquist C, Kihlstrom L, Hellstrand E. Functional neurosurgery--a future for the gamma knife? Stereotact Funct Neurosurg 1991; 57: 72-81.

Bibliographies

Epilepsy

1. Rieke V, B. Werner, N. McDannold, W. Grissom, E. Martin, and K. Butts Pauly. Hybrid referenceless and multi-baseline thermometry for MRgFUS brain applications. Proc. Intl. Soc. Mag. Reson. Med. 2011; 19: 521.
2. Min B-K, Bystritsky A, Jung K-I et al. Focused ultrasound-mediated suppression of chemically-induced acute epileptic EEG activity. BMC Neuroscience 2011; 12: 23.
3. Min BK, Bystritsky A, Jung KI et al. Focused ultrasound-mediated suppression of chemically-induced acute epileptic EEG activity. BMC Neuroscience 2011; 12: 23.
4. Miller KJ, Sorensen LB, Ojemann JG, den Nijs M. Power-law scaling in the brain surface electric potential. PLoS Comput Biol 2009; 5: e1000609.
5. Hamani C, Andrade D, Hodaie M et al. Deep brain stimulation for the treatment of epilepsy. Int J Neural Syst 2009; 19: 213-226.
6. Drane DL, Ojemann GA, Ojemann JG et al. Category-specific recognition and naming deficits following resection of a right anterior temporal lobe tumor in a patient with atypical language lateralization. Cortex 2009; 45: 630-640.
7. Darvas F, Scherer R, Ojemann JG et al. High gamma mapping using EEG. Neuroimage 2009; 49: 930-938.
8. Quigg M, Barbaro NM. Stereotactic radiosurgery for treatment of epilepsy. Arch Neurol 2008; 65: 177-183.
9. Lanteaume L, Khalfa S, Regis J et al. Emotion induction after direct intracerebral stimulations of human amygdala. Cereb Cortex 2007; 17: 1307-1313.
10. Regis J, Scavarda D, Tamura M et al. Epilepsy related to hypothalamic hamartomas: surgical management with special reference to gamma knife surgery. Childs Nerv Syst 2006; 22: 881-895.
11. Mathieu D, Kondziolka D, Niranjan A et al. Gamma knife radiosurgery for refractory epilepsy caused by hypothalamic hamartomas. Stereotact Funct Neurosurg 2006; 84: 82-87.
12. Guye M, Regis J, Tamura M et al. The role of corticothalamic coupling in human temporal lobe epilepsy. Brain 2006; 129: 1917-1928.
13. Shih YH, Pan DH. Management of supratentorial cavernous malformations: craniotomy versus gammaknife radiosurgery. Clin Neurol Neurosurg 2005; 107: 108-112.
14. Selch MT, Gorgulho A, Mattozo C et al. Linear accelerator stereotactic radiosurgery for the treatment of gelastic seizures due to hypothalamic hamartoma. Minim Invasive Neurosurg 2005; 48: 310-314.
15. Liu KD, Chung WY, Wu HM et al. Gamma knife surgery for cavernous hemangiomas: an analysis of 125 patients. J Neurosurg 2005; 102 Suppl: 81-86.
16. Liscak R, Vladyka V, Simonova G et al. Gamma knife surgery of brain cavernous hemangiomas. J Neurosurg 2005; 102 Suppl: 207-213.
17. Kim MS, Pyo SY, Jeong YG et al. Gamma knife surgery for intracranial cavernous hemangioma. J Neurosurg 2005; 102 Suppl: 102-106.
18. Barajas MA, Ramirez-Guzman MG, Rodriguez-Vazquez C et al. Gamma knife surgery for hypothalamic hamartomas accompanied by medically intractable epilepsy and precocious puberty: experience in Mexico. J Neurosurg 2005; 102 Suppl: 53-55.

Bibliographies

19. Srikijvilaikul T, Najm I, Foldvary-Schaefer N et al. Failure of gamma knife radiosurgery for mesial temporal lobe epilepsy: report of five cases. Neurosurgery 2004; 54: 1395-1402; discussion 1402-1394.

20. Schauble B, Cascino GD, Pollock BE et al. Seizure outcomes after stereotactic radiosurgery for cerebral arteriovenous malformations. Neurology 2004; 63: 683-687.

21. Regis J, Rey M, Bartolomei F et al. Gamma knife surgery in mesial temporal lobe epilepsy: a prospective multicenter study. Epilepsia 2004; 45: 504-515.

22. Regis J, Hayashi M, Eupierre LP et al. Gamma knife surgery for epilepsy related to hypothalamic hamartomas. Acta Neurochir Suppl 2004; 91: 33-50.

23. McDonald CR, Norman MA, Tecoma E et al. Neuropsychological change following gamma knife surgery in patients with left temporal lobe epilepsy: a review of three cases. Epilepsy Behav 2004; 5: 949-957.

24. Bartolomei F, Wendling F, Regis J et al. Pre-ictal synchronicity in limbic networks of mesial temporal lobe epilepsy. Epilepsy Res 2004; 61: 89-104.

25. Wellis G, Nagel R, Vollmar C, Steiger HJ. Direct costs of microsurgical management of radiosurgically amenable intracranial pathology in Germany: an analysis of meningiomas, acoustic neuromas, metastases and arteriovenous malformations of less than 3 cm in diameter. Acta Neurochir (Wien) 2003; 145: 249-255.

26. Ferland RJ, Williams JP, Gross RA, Applegate CD. The effects of brain-irradiation-induced decreases in hippocampal mitotic activity on flurothyl-induced epileptogenesis in adult C57BL/6J mice. Exp Neurol 2003; 179: 71-82.

27. Unger F, Schrottner O, Feichtinger M et al. Stereotactic radiosurgery for hypothalamic hamartomas. Acta Neurochir Suppl 2002; 84: 57-63.

28. Kurita H, Suzuki I, Shin M et al. Successful radiosurgical treatment of lesional epilepsy of mesial temporal origin. Minim Invasive Neurosurg 2001; 44: 43-46.

29. Kawai K, Suzuki I, Kurita H et al. Failure of low-dose radiosurgery to control temporal lobe epilepsy. J Neurosurg 2001; 95: 883-887.

30. Jenrow KA, Ratkewicz AE, Elisevich KV. Enhanced excitability induced by ionizing radiation in the kindled rat. Exp Neurol 2001; 169: 96-104.

31. Cmelak AJ, Abou-Khalil B, Konrad PE et al. Low-dose stereotactic radiosurgery is inadequate for medically intractable mesial temporal lobe epilepsy: a case report. Seizure 2001; 10: 442-446.

32. Chen ZF, Kamiryo T, Henson SL et al. Anticonvulsant effects of gamma surgery in a model of chronic spontaneous limbic epilepsy in rats. J Neurosurg 2001; 94: 270-280.

33. Regis J, Bartolomei F, de Toffol B et al. Gamma knife surgery for epilepsy related to hypothalamic hamartomas. Neurosurgery 2000; 47: 1343-1351; discussion 1351-1342.

34. Mori Y, Kondziolka D, Balzer J et al. Effects of stereotactic radiosurgery on an animal model of hippocampal epilepsy. Neurosurgery 2000; 46: 157-165; discussion 165-158.

35. Maesawa S, Kondziolka D, Dixon CE et al. Subnecrotic stereotactic radiosurgery controlling epilepsy produced by kainic acid injection in rats. J Neurosurg 2000; 93: 1033-1040.

36. Regis J, Semah F, Bryan RN et al. Early and delayed MR and PET changes after selective temporomesial radiosurgery in mesial temporal lobe epilepsy. AJNR Am J Neuroradiol 1999; 20: 213-216.

Bibliographies

37. Regis J, Bartolomei F, Rey M et al. Gamma knife surgery for mesial temporal lobe epilepsy. Epilepsia 1999; 40: 1551-1556.

38. Regis J, Bartolomei F, Metellus P et al. Radiosurgery for trigeminal neuralgia and epilepsy. Neurosurg Clin N Am 1999; 10: 359-377.

39. Pendl G, Eder HG, Schroettner O, Leber KA. Corpus callosotomy with radiosurgery. Neurosurgery 1999; 45: 303-307; discussion 307-308.

40. Bartolomei F, Wendling F, Vignal JP et al. Seizures of temporal lobe epilepsy: identification of subtypes by coherence analysis using stereo-electro-encephalography. Clin Neurophysiol 1999; 110: 1741-1754.

41. Bartolomei F, Regis J, Kida Y et al. Gamma Knife radiosurgery for epilepsy associated with cavernous hemangiomas: a retrospective study of 49 cases. Stereotact Funct Neurosurg 1999; 72 Suppl 1: 22-28.

42. Sun B, DeSalles AA, Medin PM et al. Reduction of hippocampal-kindled seizure activity in rats by stereotactic radiosurgery. Exp Neurol 1998; 154: 691-695.

43. Schrottner O, Eder HG, Unger F et al. Radiosurgery in lesional epilepsy: brain tumors. Stereotact Funct Neurosurg 1998; 70 Suppl 1: 50-56.

44. Kurita H, Kawamoto S, Suzuki I et al. Control of epilepsy associated with cerebral arteriovenous malformations after radiosurgery. J Neurol Neurosurg Psychiatry 1998; 65: 648-655.

45. Karlsson B, Kihlstrom L, Lindquist C et al. Radiosurgery for cavernous malformations. J Neurosurg 1998; 88: 293-297.

46. Jeanmonod D, Magnin M, Morel A. Low-threshold calcium spike bursts in the human thalamus - Common physiopathology for sensory, motor and limbic positive symptoms. Brain 1996; 119: 363-375.

47. Gerszten PC, Adelson PD, Kondziolka D et al. Seizure outcome in children treated for arteriovenous malformations using gamma knife radiosurgery. Pediatr Neurosurg 1996; 24: 139-144.

48. Regis J, Peragui JC, Rey M et al. First selective amygdalohippocampal radiosurgery for 'mesial temporal lobe epilepsy'. Stereotact Funct Neurosurg 1995; 64 Suppl 1: 193-201.

49. Regis J, Mangin JF, Frouin V et al. Generic model for the localization of the cerebral cortex and preoperative multimodal integration in epilepsy surgery. Stereotact Funct Neurosurg 1995; 65: 72-80.

50. Barcia-Salorio JL, Barcia JA, Hernandez G, Lopez-Gomez L. Radiosurgery of epilepsy. Long-term results. Acta Neurochir Suppl 1994; 62: 111-113.

51. Barcia JA, Barcia-Salorio JL, Lopez-Gomez L, Hernandez G. Stereotactic radiosurgery may be effective in the treatment of idiopathic epilepsy: report on the methods and results in a series of eleven cases. Stereotact Funct Neurosurg 1994; 63: 271-279.

52. Lindquist C, Kihlstrom L, Hellstrand E. Functional neurosurgery--a future for the gamma knife? Stereotact Funct Neurosurg 1991; 57: 72-81.

53. Heikkinen ER, Konnov B, Melnikov L et al. Relief of epilepsy by radiosurgery of cerebral arteriovenous malformations. Stereotact Funct Neurosurg 1989; 53: 157-166.

54. Umanskii KG, Rudometov Iu P, Dekonenko EP et al. [Acute necrotic encephalitis in adults]. Zh Nevropatol Psikhiatr Im S S Korsakova 1983; 83: 696-703.

Bibliographies

Intracerebral Hemorrhage

1. Shi Y, Li Z, Zhang S et al. Establishing a model of supratentorial hemorrhage in the piglet. Tohoku J Exp Med 2010; 220: 33-40.
2. Monteith S, Harnof, S., Wintermark, M., Kassell, N., Snell, J., Eames, M., Zadicaro, E., Foley, J., Sheehan, J. Transcranial MRI Guided Focused Ultrasound Surgery for Intracerebral Hemorrhage. In Current and Future Applications of MR-guided Focused Ultrasound Chantilly, VA: Focused Ultrasound Surgery Foundation 2010.
3. Mayer SA. Recombinant Activated Factor VII for Acute Intracerebral Hemorrhage. Stroke 2007; 38: 763-767.
4. Broderick J, Connolly S, Feldmann E et al. Guidelines for the management of spontaneous intracerebral hemorrhage in adults: 2007 update: a guideline from the American Heart Association/American Stroke Association Stroke Council, High Blood Pressure Research Council, and the Quality of Care and Outcomes in Research Interdisciplinary Working Group. Stroke 2007; 38: 2001-2023.
5. Stroick M, Alonso A, Fatar M et al. Effects of simultaneous application of ultrasound and microbubbles on intracerebral hemorrhage in an animal model. Ultrasound in Medicine & Biology 2006; 32: 1377-1382.
6. Vespa P, McArthur D, Miller C et al. Frameless stereotactic aspiration and thrombolysis of deep intracerebral hemorrhage is associated with reduction of hemorrhage volume and neurological improvement. Neurocritical Care 2005; 2: 274-281.
7. Mendelow AD, Gregson BA, Fernandes HM et al. Early surgery versus initial conservative treatment in patients with spontaneous supratentorial intracerebral haematomas in the International Surgical Trial in Intracerebral Haemorrhage (STICH): a randomised trial.[see comment]. Lancet 2005; 365: 387-397.
8. Mayer SA, Brun NC, Begtrup K et al. Recombinant Activated Factor VII for Acute Intracerebral Hemorrhage. N Engl J Med 2005; 352: 777-785.
9. Barrett RJ, Hussain R, Coplin WM et al. Frameless stereotactic aspiration and thrombolysis of spontaneous intracerebral hemorrhage. Neurocritical Care 2005; 3: 237-245.
10. Alexandrov AV, Molina CA, Grotta JC et al. Ultrasound-enhanced systemic thrombolysis for acute ischemic stroke.[see comment]. New England Journal of Medicine 2004; 351: 2170-2178.
11. Teernstra OPM, Evers SMAA, Lodder J et al. Stereotactic treatment of intracerebral hematoma by means of a plasminogen activator: a multicenter randomized controlled trial (SICHPA). Stroke 2003; 34: 968-974.
12. Pouratian N, Kassell NF, Dumont AS. Update on management of intracerebral hemorrhage. Neurosurgical Focus 2003; 15: E2.
13. Fewel ME, Thompson BG, Jr., Hoff JT. Spontaneous intracerebral hemorrhage: a review. Neurosurgical Focus 2003; 15: E1.
14. Qureshi AI, Tuhrim S, Broderick JP et al. Spontaneous intracerebral hemorrhage.[see comment]. New England Journal of Medicine 2001; 344: 1450-1460.
15. Broderick JP, Adams HP, Jr., Barsan W et al. Guidelines for the management of spontaneous intracerebral hemorrhage: A statement for healthcare professionals from a special writing group of the Stroke Council, American Heart Association. Stroke 1999; 30: 905-915.

Bibliographies

16. The NINDS t-PA Stroke Study Group. Intracerebral Hemorrhage After Intravenous t-PA Therapy for Ischemic Stroke. Stroke 1997; 28: 2109-2118.

17. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue Plasminogen Activator for Acute Ischemic Stroke. N Engl J Med 1995; 333: 1581-1588.

Bibliographies

Ischemic Stroke

1. Weiss HL, Ahadi G, Hoelscher T, Szeri AJ. Cavitation damage during sonothrombolysis using high intensity focused ultrasound. The Journal of the Acoustical Society of America 2011; 129: 2576-2576.
2. Hadjisavvas VaCD. Temperature estimation of focused ultrasound exposures for stroke treatment. J. Biomedical Science and Engineering 2011; 4: 407-414.
3. Willis CL, Meske DS, Davis TP. Protein kinase C activation modulates reversible increase in cortical blood-brain barrier permeability and tight junction protein expression during hypoxia and posthypoxic reoxygenation. J Cereb Blood Flow Metab 2010; 30: 1847-1859.
4. Tsivgoulis G, Molina CA, Eggers J et al. Safety and efficacy of ultrasound-enhanced thrombolysis: a comprehensive review and meta-analysis of randomized and nonrandomized studies. Stroke 2010; 41: 280-287.
5. Neven K, Schmidt B, Metzner A et al. Fatal end of a safety algorithm for pulmonary vein isolation with use of high-intensity focused ultrasound. Circulation. Arrhythmia and electrophysiology 2010; 3: 260-265.
6. Neven K, Schmidt B, Metzner A et al. Fatal end of a safety algorithm for pulmonary vein isolation with use of high-intensity focused ultrasound. Circ Arrhythm Electrophysiol 2010; 3: 260-265.
7. Moumouh A, Barentin L, Tranquart F et al. Fibrinolytic effects of transparietal ultrasound associated with intravenous infusion of an ultrasound contrast agent: study of a rat model of acute cerebral stroke. Ultrasound in Medicine & Biology 2010; 36: 51-57.
8. Moumouh A, Barentin L, Tranquart F et al. Fibrinolytic effects of transparietal ultrasound associated with intravenous infusion of an ultrasound contrast agent: study of a rat model of acute cerebral stroke. Ultrasound Med Biol 2010; 36: 51-57.
9. Hoelscher TF, D., Schendel, C., Zadicario, E., Voie, A. Transcranial Sonothrombolysis in Ischemic Stroke Using HIFU: Introduction of an In Vivo Efficacy and Safety Model - First Results. . In Current and Future Applications of MR-guided Focused Ultrasound. Chantilly, VA, USA: Focused Ultrasound Surgery Foundation 2010.
10. Barrett KM, Meschia JF. Acute ischemic stroke management: medical management. Seminars in neurology 2010; 30: 461-468.
11. Barrett KM, Meschia JF. Acute ischemic stroke management: medical management. Semin Neurol 2010; 30: 461-468.
12. Allen C, Srivastava K, Bayraktutan U. Small GTPase RhoA and its effector rho kinase mediate oxygen glucose deprivation-evoked in vitro cerebral barrier dysfunction. Stroke 2010; 41: 2056-2063.
13. Smith DA, Vaidya SS, Kopechek JA et al. Ultrasound-triggered release of recombinant tissue-type plasminogen activator from echogenic liposomes. Ultrasound Med Biol 2009; 36: 145-157.
14. Moumouh A, Barentin L, Tranquart F et al. Fibrinolytic effects of transparietal ultrasound associated with intravenous infusion of an ultrasound contrast agent: study of a rat model of acute cerebral stroke. Ultrasound Med Biol 2009; 36: 51-57.
15. Medel R, Crowley RW, McKisic MS et al. Sonothrombolysis: an emerging modality for the management of stroke. Neurosurgery 2009; 65: 979-993; discussion 993.

Bibliographies

16. Meairs S, Culp W. Microbubbles for thrombolysis of acute ischemic stroke. Cerebrovascular diseases 2009; 27 Suppl 2: 55-65.

17. Martinez-Sanchez P, Tsivgoulis G, Lao A et al. [Ultrasound in acute ischemic stroke]. Neurologia 2009; 24: 59-68.

18. Barreto AD, Sharma VK, Lao AY et al. Safety and dose-escalation study design of Transcranial Ultrasound in Clinical SONolysis for acute ischemic stroke: the TUCSON Trial. Int J Stroke 2009; 4: 42-48.

19. Baron C, Aubry JF, Tanter M et al. Simulation of intracranial acoustic fields in clinical trials of sonothrombolysis. Ultrasound Med Biol 2009; 35: 1148-1158.

20. Alexandrov AV. Ultrasound enhancement of fibrinolysis. Stroke 2009; 40: S107-110.

21. Tsivgoulis G, Culp WC, Alexandrov AV. Ultrasound enhanced thrombolysis in acute arterial ischemia. Ultrasonics 2008; 48: 303-311.

22. Segura T, Calleja S, Jordan J. Recommendations and treatment strategies for the management of acute ischemic stroke. Expert opinion on pharmacotherapy 2008; 9: 1071-1085.

23. Rosamond W, Flegal K, Furie K et al. Heart Disease and Stroke Statistics--2008 Update: A Report From the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation 2008; 117: e25-146.

24. Ribo M, Molina CA, Rubiera M et al. Microcatheter-Guided Intra-clot Administration of Microbubbles During External Continuous 2-MHz Ultrasound Isonation Safely Enhances Thrombolysis in Acute Stroke [abstract]. Stroke 2008; 39: 595.

25. Perren F, Loulidi J, Poglia D et al. Microbubble potentiated transcranial duplex ultrasound enhances IV thrombolysis in acute stroke. Journal of Thrombosis and Thrombolysis 2008; 25: 219-223.

26. Millan M, Grau L, Castellanos M et al. Body temperature and response to thrombolytic therapy in acute ischaemic stroke. Eur J Neurol 2008; 15: 1384-1389.

27. ImaRX Therapeutics Inc. ImaRx Provides Update on TUCSON Phase I/II Clinical Trial in Acute Ischemic Stroke. In. COMTEX News Network 2008.

28. Dinia L, Rubiera M, Ribo M et al. Timing of Microbubble-enhanced Sonothrombolysis Strongly Predicts Intracranial Hemorrhage in Acute Ischemic Stroke [abstract]. Stroke 2008; 39: 559.

29. Ammi AY, Mast TD, Huang IH et al. Characterization of ultrasound propagation through ex-vivo human temporal bone. Ultrasound in Medicine & Biology 2008; 34: 1578-1589.

30. Alexandrov AV, Mikulik R, Ribo M et al. A pilot randomized clinical safety study of sonothrombolysis augmentation with ultrasound-activated perflutren-lipid microspheres for acute ischemic stroke. Stroke 2008; 39: 1464-1469.

31. van der Worp HB, van Gijn J. Clinical practice. Acute ischemic stroke. New England Journal of Medicine 2007; 357: 572-579.

32. Tsivgoulis G, Alexandrov AV. Ultrasound-enhanced thrombolysis in acute ischemic stroke: potential, failures, and safety. Neurotherapeutics 2007; 4: 420-427.

33. Truelsen T, Heuschmann PU, Bonita R et al. Standard method for developing stroke registers in low-income and middle-income countries: experiences from a feasibility study of a stepwise approach to stroke surveillance (STEPS Stroke). Lancet neurology 2007; 6: 134-139.

Bibliographies

34. The IMS II Trial Investigators. The Interventional Management of Stroke (IMS) II Study. Stroke 2007; 38: 2127-2135.

35. Sacco RL, Chong JY, Prabhakaran S, Elkind MSV. Experimental treatments for acute ischaemic stroke. Lancet 2007; 369: 331-341.

36. Molina CA, Alexandrov AV. Transcranial ultrasound in acute stroke: from diagnosis to therapy. Cerebrovasc Dis 2007; 24 Suppl 1: 1-6.

37. Mehdiratta M, Caplan LR. Stroke thrombolysis 2006: an update progress in cardiovascular diseases. Progress in Cardiovascular Diseases 2007; 49: 430-438.

38. Mayer SA. Recombinant Activated Factor VII for Acute Intracerebral Hemorrhage. Stroke 2007; 38: 763-767.

39. Marsh JN, Senpan A, Hu G et al. Fibrin-targeted perfluorocarbon nanoparticles for targeted thrombolysis. Nanomedicine (Lond) 2007; 2: 533-543.

40. Larrue V, Viguier A, Arnaud C et al. Transcranial Ultrasound Combined with Intravenous Microbubbles and Tissue Plasminogen Activator for Acute Ischemic Stroke: A Randomized Controlled Study [abstract]. Stroke 2007; 38: 472.

41. Broderick J, Connolly S, Feldmann E et al. Guidelines for the management of spontaneous intracerebral hemorrhage in adults: 2007 update: a guideline from the American Heart Association/American Stroke Association Stroke Council, High Blood Pressure Research Council, and the Quality of Care and Outcomes in Research Interdisciplinary Working Group. Stroke 2007; 38: 2001-2023.

42. Blakeley JO, Llinas RH. Thrombolytic therapy for acute ischemic stroke. Journal of the Neurological Sciences 2007; 261: 55-62.

43. Topcuoglu MA, Saka E, Onal MZ. Hyperoxia potentiated sonothrombolysis as a method of acute ischemic stroke therapy. Medical Hypotheses 2006; 66: 59-65.

44. Stroick M, Alonso A, Fatar M et al. Effects of simultaneous application of ultrasound and microbubbles on intracerebral hemorrhage in an animal model. Ultrasound in Medicine & Biology 2006; 32: 1377-1382.

45. Smith WS. Safety of mechanical thrombectomy and intravenous tissue plasminogen activator in acute ischemic stroke. Results of the multi Mechanical Embolus Removal in Cerebral Ischemia (MERCI) trial, part I. Ajnr: American Journal of Neuroradiology 2006; 27: 1177-1182.

46. Shaw GJ, Bavani N, Dhamija A, Lindsell CJ. Effect of mild hypothermia on the thrombolytic efficacy of 120 kHz ultrasound enhanced thrombolysis in an in-vitro human clot model.[see comment]. Thrombosis Research 2006; 117: 603-608.

47. Molina CA, Ribo M, Rubiera M et al. Microbubble administration accelerates clot lysis during continuous 2-MHz ultrasound monitoring in stroke patients treated with intravenous tissue plasminogen activator. Stroke 2006; 37: 425-429.

48. Martini SR, Hill MD, Alexandrov AV et al. Outcome in hyperglycemic stroke with ultrasound-augmented thrombolytic therapy. Neurology 2006; 67: 700-702.

49. Krejza J, Weigele JB, Alokaili R et al. Sonothrombolysis in acute ischemic stroke for patients ineligible for rt-PA. Neurology 2006; 66: 154-155; author reply 154-155.

50. Kasner SE, Chimowitz MI, Lynn MJ et al. Predictors of ischemic stroke in the territory of a symptomatic intracranial arterial stenosis. Circulation 2006; 113: 555-563.

Bibliographies

51. Higashida RT, Meyers PM. Intracranial angioplasty and stenting for cerebral atherosclerosis: new treatments for stroke are needed! Neuroradiology 2006; 48: 367-372.

52. Datta S, Coussios CC, McAdory LE et al. Correlation of cavitation with ultrasound enhancement of thrombolysis. Ultrasound Med Biol 2006; 32: 1257-1267.

53. Alexandrov AV. Ultrasound enhanced thrombolysis for stroke. Int J Stroke 2006; 1: 26-29.

54. Abels L, Lequin M, Govaert P. Sonographic templates of newborn perforator stroke. Pediatric radiology 2006; 36: 663-669.

55. Viguier A, Petit R, Rigal M et al. Continuous monitoring of middle cerebral artery recanalization with transcranial color-coded sonography and Levovist. Journal of Thrombosis & Thrombolysis 2005; 19: 55-59.

56. Smith WS, Sung G, Starkman S et al. Safety and efficacy of mechanical embolectomy in acute ischemic stroke: results of the MERCI trial.[see comment]. Stroke 2005; 36: 1432-1438.

57. Sauvageau E, Ecker RD, Levy EI et al. Recent advances in endoluminal revascularization for intracranial atherosclerotic disease. Neurological Research 2005; 27 Suppl 1: S89-94.

58. Eggers J, Seidel G, Koch B, Konig IR. Sonothrombolysis in acute ischemic stroke for patients ineligible for rt-PA.[see comment]. Neurology 2005; 64: 1052-1054.

59. Douglas VC, Tong DC, Gillum LA et al. Do the Brain Attack Coalition's criteria for stroke centers improve care for ischemic stroke? Neurology 2005; 64: 422-427.

60. Chimowitz MI, Lynn MJ, Howlett-Smith H et al. Comparison of warfarin and aspirin for symptomatic intracranial arterial stenosis.[see comment]. New England Journal of Medicine 2005; 352: 1305-1316.

61. Anonymous. Priorities for clinical research in intracerebral hemorrhage: report from a National Institute of Neurological Disorders and Stroke workshop. Stroke 2005; 36: e23-41.

62. Tsutsui JM, Grayburn PA, Xie F, Porter TR. Drug and gene delivery and enhancement of thrombolysis using ultrasound and microbubbles. Cardiol Clin 2004; 22: 299-312, vii.

63. Polak JF. Ultrasound energy and the dissolution of thrombus.[comment]. New England Journal of Medicine 2004; 351: 2154-2155.

64. Matz K, Tatschl C, Sebek K et al. Dyslipidemia, elevated LDL cholesterol and reduced nocturnal blood pressure dipping denote lacunar strokes occurring during nighttime. European journal of neurology : the official journal of the European Federation of Neurological Societies 2004; 11: 742-748.

65. Gobin YP, Starkman S, Duckwiler GR et al. MERCI 1: a phase 1 study of Mechanical Embolus Removal in Cerebral Ischemia.[see comment]. Stroke 2004; 35: 2848-2854.

66. Daffertshofer M, Huang Z, Fatar M et al. Efficacy of sonothrombolysis in a rat model of embolic ischemic stroke. Neuroscience Letters 2004; 361: 115-119.

67. Culp WC, Porter TR, Lowery J et al. Intracranial Clot Lysis With Intravenous Microbubbles and Transcranial Ultrasound in Swine. Stroke 2004; 35: 2407-2411.

68. Cintas P, Nguyen F, Boneu B, Larrue V. Enhancement of enzymatic fibrinolysis with 2-MHz ultrasound and microbubbles. Journal of Thrombosis and Haemostasis 2004; 2: 1163-1166.

69. Alexandrov AV, Wojner AW, Grotta JC. CLOTBUST: design of a randomized trial of ultrasound-enhanced thrombolysis for acute ischemic stroke. J Neuroimaging 2004; 14: 108-112.

Bibliographies

70. Alexandrov AV, Molina CA, Grotta JC et al. Ultrasound-enhanced systemic thrombolysis for acute ischemic stroke.[see comment]. New England Journal of Medicine 2004; 351: 2170-2178.

71. Alexandrov AV, Molina CA, Grotta JC et al. Ultrasound-enhanced systemic thrombolysis for acute ischemic stroke. N Engl J Med 2004; 351: 2170-2178.

72. Alexandrov AV, Demchuk AM, Burgin WS et al. Ultrasound-enhanced thrombolysis for acute ischemic stroke: phase I. Findings of the CLOTBUST trial. J Neuroimaging 2004; 14: 113-117.

73. Mahon BR, Nesbit GM, Barnwell SL et al. North American clinical experience with the EKOS MicroLysUS infusion catheter for the treatment of embolic stroke. Ajnr: American Journal of Neuroradiology 2003; 24: 534-538.

74. Fewel ME, Thompson BG, Jr., Hoff JT. Spontaneous intracerebral hemorrhage: a review. Neurosurgical Focus 2003; 15: E1.

75. Feigin VL, Lawes CMM, Bennett DA, Anderson CS. Stroke epidemiology: a review of population-based studies of incidence, prevalence, and case-fatality in the late 20th century.[see comment]. Lancet Neurology 2003; 2: 43-53.

76. Denti L, Cecchetti A, Annoni V et al. The role of lipid profile in determining the risk of ischemic stroke in the elderly: a case-control study. Archives of gerontology and geriatrics 2003; 37: 51-62.

77. Daffertshofer M, Hennerici M. Ultrasound in the treatment of ischaemic stroke. Lancet Neurology 2003; 2: 283-290.

78. Culp WC, Erdem E, Roberson PK, Husain MM. Microbubble potentiated ultrasound as a method of stroke therapy in a pig model: preliminary findings. Journal of Vascular & Interventional Radiology 2003; 14: 1433-1436.

79. Chaturvedi S, Caplan LR. Angioplasty for intracranial atherosclerosis: is the treatment worse than the disease?[comment]. Neurology 2003; 61: 1647-1648.

80. Alexandrov AV. Ultrasound and angiography in the selection of patients for carotid endarterectomy. Curr Cardiol Rep 2003; 5: 141-147.

81. Mead GE, Lewis SC, Wardlaw JM, Dennis MS. Comparison of risk factors in patients with transient and prolonged eye and brain ischemic syndromes. Stroke; a journal of cerebral circulation 2002; 33: 2383-2390.

82. Ishibashi T, Akiyama M, Onoue H et al. Can transcranial ultrasonication increase recanalization flow with tissue plasminogen activator? Stroke 2002; 33: 1399-1404.

83. Gerriets T, Goertler M, Stolz E et al. Feasibility and validity of transcranial duplex sonography in patients with acute stroke. J Neurol Neurosurg Psychiatry 2002; 73: 17-20.

84. Felberg RA, Okon NJ, El-Mitwalli A et al. Early Dramatic Recovery During Intravenous Tissue Plasminogen Activator Infusion: Clinical Pattern and Outcome in Acute Middle Cerebral Artery Stroke. Stroke 2002; 33: 1301-1307.

85. Daffertshofer M, Fatar M. Therapeutic ultrasound in ischemic stroke treatment: experimental evidence. Eur J Ultrasound 2002; 16: 121-130.

86. Alexandrov AV. Ultrasound-enhanced thrombolysis for stroke: clinical significance. Eur J Ultrasound 2002; 16: 131-140.

87. Krieger DW, De Georgia MA, Abou-Chebl A et al. Cooling for acute ischemic brain damage (cool aid): an open pilot study of induced hypothermia in acute ischemic stroke. Stroke 2001; 32: 1847-1854.

Bibliographies

88. Behrens S, Spengos K, Daffertshofer M et al. Potential use of therapeutic ultrasound in ischemic stroke treatment. Echocardiography 2001; 18: 259-263.

89. Caplan LR. Acute stroke: seeing the full picture. Hospital practice 2000; 35: 65-71; discussion 71-62; quiz 113.

90. Burgin WS, Malkoff M, Felberg RA et al. Transcranial doppler ultrasound criteria for recanalization after thrombolysis for middle cerebral artery stroke. Stroke 2000; 31: 1128-1132.

91. Brott T, Bogousslavsky J. Treatment of Acute Ischemic Stroke. N Engl J Med 2000; 343: 710-722.

92. Furlan A, Higashida R, Wechsler L et al. Intra-arterial prourokinase for acute ischemic stroke. The PROACT II study: a randomized controlled trial. Prolyse in Acute Cerebral Thromboembolism.[see comment]. JAMA 1999; 282: 2003-2011.

93. Clark WM, Wissman S, Albers GW et al. Recombinant Tissue-Type Plasminogen Activator (Alteplase) for Ischemic Stroke 3 to 5 Hours After Symptom Onset: The ATLANTIS Study: A Randomized Controlled Trial. JAMA 1999; 282: 2019-2026.

94. Broderick JP, Adams HP, Jr., Barsan W et al. Guidelines for the management of spontaneous intracerebral hemorrhage: A statement for healthcare professionals from a special writing group of the Stroke Council, American Heart Association. Stroke 1999; 30: 905-915.

95. Behrens S, Daffertshofer M, Spiegel D, Hennerici M. Low-frequency, low-intensity ultrasound accelerates thrombolysis through the skull. Ultrasound in Medicine & Biology 1999; 25: 269-273.

96. Szakall S, Boros I, Balkay L et al. Cerebral effects of a single dose of intravenous vinpocetine in chronic stroke patients: a PET study. J Neuroimaging 1998; 8: 197-204.

97. Hacke W, Kaste M, Fieschi C et al. Randomised double-blind placebo-controlled trial of thrombolytic therapy with intravenous alteplase in acute ischaemic stroke (ECASS II). The Lancet 1998; 352: 1245-1251.

98. del Zoppo GJ, Higashida RT, Furlan AJ et al. PROACT: a phase II randomized trial of recombinant pro-urokinase by direct arterial delivery in acute middle cerebral artery stroke. PROACT Investigators. Prolyse in Acute Cerebral Thromboembolism. Stroke 1998; 29: 4-11.

99. Goldberg MP. Stroke Trials Registry. In Internet Stroke Center web site. 1997-2008.

100. The NINDS t-PA Stroke Study Group. Intracerebral Hemorrhage After Intravenous t-PA Therapy for Ischemic Stroke. Stroke 1997; 28: 2109-2118.

101. Sudlow CL, Warlow CP. Comparable studies of the incidence of stroke and its pathological types: results from an international collaboration. International Stroke Incidence Collaboration. Stroke 1997; 28: 491-499.

102. Giroud M, Lemesle M, Madinier G et al. Stroke in children under 16 years of age. Clinical and etiological difference with adults. Acta neurologica Scandinavica 1997; 96: 401-406.

103. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue Plasminogen Activator for Acute Ischemic Stroke. N Engl J Med 1995; 333: 1581-1588.

104. Iannuzzi A, Wilcosky T, Mercuri M et al. Ultrasonographic correlates of carotid atherosclerosis in transient ischemic attack and stroke. Stroke; a journal of cerebral circulation 1995; 26: 614-619.

105. Hacke W, Kaste M, Fieschi C et al. Intravenous thrombolysis with recombinant tissue plasminogen activator for acute hemispheric stroke. The European Cooperative Acute Stroke Study (ECASS). JAMA 1995; 274: 1017-1025.

Bibliographies

106. Goldstein LB, Bonito AJ, Matchar DB et al. US national survey of physician practices for the secondary and tertiary prevention of ischemic stroke. Design, service availability, and common practices. Stroke; a journal of cerebral circulation 1995; 26: 1607-1615.

Bibliographies

Movement Disorders

1. Rieke V, B. Werner, N. McDannold, W. Grissom, E. Martin, and K. Butts Pauly. Hybrid referenceless and multi-baseline thermometry for MRgFUS brain applications. Proc. Intl. Soc. Mag. Reson. Med. 2011; 19: 521.
2. Rajadhyaksha M, Boyden T, Liras J et al. Current advances in delivery of biotherapeutics across the blood-brain barrier. Current drug discovery technologies 2011; 8: 87-101.
3. Rajadhyaksha M, T. Boyden, J. Liras, A. El-Kattan, J. Brodfuehrer. Current Advances in Delivery of Biotherapeutics across the Blood-Brain Barrier. Current Drug Discovery Technology 2011.
4. Bystritsky A, Korb AS, Douglas PK et al. A review of low-intensity focused ultrasound pulsation. Brain Stimulation 2011; 4: 125-136.
5. Torres CV, Moro E, Lopez-Rios AL et al. Deep Brain Stimulation of the Ventral Intermediate Nucleus of the Thalamus for Tremor in Patients With Multiple Sclerosis. Neurosurgery 2010.
6. Lozano AM, Snyder BJ, Hamani C et al. Basal ganglia physiology and deep brain stimulation. Mov Disord 2010; 25 Suppl 1: S71-75.
7. Lozano AM. Deep brain stimulation for Parkinson disease. J Neurosurg 2010; 112: 477; discussion 477-478.
8. Hamani C, Diwan M, Isabella S et al. Effects of different stimulation parameters on the antidepressant-like response of medial prefrontal cortex deep brain stimulation in rats. J Psychiatr Res 2010; 44: 683-687.
9. Follett KA, Weaver FM, Stern M et al. Pallidal versus subthalamic deep-brain stimulation for Parkinson's disease. N Engl J Med 2010; 362: 2077-2091.
10. Deffieux T, Konofagou EE. Numerical study of a simple transcranial focused ultrasound system applied to blood-brain barrier opening. IEEE transactions on ultrasonics, ferroelectrics, and frequency control 2010; 57: 2637-2653.
11. Deffieux T, Konofagou E. Numerical study of a simple transcranial focused ultrasound system applied to blood-brain barrier opening. IEEE Trans Ultrason Ferroelectr Freq Control 2010; 57: 2637-2653.
12. Deffieux T, Konofagou E. Numerical study of a simple transcranial focused ultrasound system applied to blood-brain barrier opening. IEEE Trans Ultrason Ferroelectr Freq Control 2010; 57: 2637-2653.
13. Chang EF, Schrock LE, Starr PA, Ostrem JL. Long-Term Benefit Sustained after Bilateral Pallidal Deep Brain Stimulation in Patients with Refractory Tardive Dystonia. Stereotact Funct Neurosurg 2010; 88: 304-310.
14. Pardridge WM, Boado RJ. Pharmacokinetics and safety in rhesus monkeys of a monoclonal antibody-GDNF fusion protein for targeted blood-brain barrier delivery. Pharmaceutical research 2009; 26: 2227-2236.
15. Lim AS, Moro E, Lozano AM et al. Selective enhancement of rapid eye movement sleep by deep brain stimulation of the human pons. Ann Neurol 2009; 66: 110-114.
16. Hwang TL, Lin YK, Chi CH et al. Development and evaluation of perfluorocarbon nanobubbles for apomorphine delivery. J Pharm Sci 2009; 98: 3735-3747.

Bibliographies

17. Giacobbe P, Mayberg HS, Lozano AM. Treatment resistant depression as a failure of brain homeostatic mechanisms: implications for deep brain stimulation. Exp Neurol 2009; 219: 44-52.

18. Weinberger M, Hamani C, Hutchison WD et al. Pedunculopontine nucleus microelectrode recordings in movement disorder patients. Exp Brain Res 2008; 188: 165-174.

19. Strafella AP, Lozano AM, Ballanger B et al. rCBF changes associated with PPN stimulation in a patient with Parkinson's disease: a PET study. Mov Disord 2008; 23: 1051-1054.

20. Sillay KA, Larson PS, Starr PA. Deep brain stimulator hardware-related infections: incidence and management in a large series. Neurosurgery 2008; 62: 360-366; discussion 366-367.

21. Rezai AR, Machado AG, Deogaonkar M et al. Surgery for Movement Disorders. Neurosurgery 2008; 62: SHC 809-839.

22. Phillips MI, Tang YL. Genetic modification of stem cells for transplantation. Adv Drug Deliv Rev 2008; 60: 160-172.

23. Papavassiliou E, Rau G, Heath S et al. Thalamic deep brain stimulation for essential tremor: relation of lead location to outcome. Neurosurgery 2008; 62 Suppl 2: 884-894.

24. Ostrem JL, Starr PA. Treatment of dystonia with deep brain stimulation. Neurotherapeutics 2008; 5: 320-330.

25. Moro E, Volkmann J, Konig IR et al. Bilateral subthalamic stimulation in Parkin and PINK1 parkinsonism. Neurology 2008; 70: 1186-1191.

26. Lozano AM. Cell-based therapy for Parkinson disease. Neurosurg Focus 2008; 24: E7; discussion E7.

27. Hamani C, Richter E, Schwalb JM, Lozano AM. Bilateral subthalamic nucleus stimulation for Parkinson's disease: a systematic review of the clinical literature. Neurosurgery 2008; 62 Suppl 2: 863-874.

28. Hamani C, Moro E, Zadikoff C et al. Location of active contacts in patients with primary dystonia treated with globus pallidus deep brain stimulation. Neurosurgery 2008; 62: 217-223; discussion 223-215.

29. Guridi J, Obeso JA, Rodriguez-Oroz MC et al. L-dopa-induced dyskinesia and stereotactic surgery for Parkinson's disease. Neurosurgery 2008; 62: 311-323; discussion 323-315.

30. Boado RJ, Zhang Y, Wang Y, Pardridge WM. GDNF fusion protein for targeted-drug delivery across the human blood-brain barrier. Biotechnology and bioengineering 2008; 100: 387-396.

31. Hodaie M, Neimat JS, Lozano AM. The dopaminergic nigrostriatal system and Parkinson's disease: molecular events in development, disease, and cell death, and new therapeutic strategies. Neurosurgery 2007; 60: 17-28; discussion 28-30.

32. Hamani C, Stone S, Laxton A, Lozano AM. The pedunculopontine nucleus and movement disorders: anatomy and the role for deep brain stimulation. Parkinsonism Relat Disord 2007; 13 Suppl 3: S276-280.

33. Dorsey ER, Constantinescu R, Thompson JP et al. Projected number of people with Parkinson disease in the most populous nations, 2005 through 2030. Neurology 2007; 68: 384-386.

34. Paluzzi AA, Belli AP, Bain P et al. Operative and hardware complications of deep brain stimulation for movement disorders. Brit J Neurosurg 2006; 20: 290-295.

35. Gildenberg PL. Evolution of Basal Ganglia Surgery for Movement Disorders. Stereotactic and Functional Neurosurgery 2006; 84: 131-135.

Bibliographies

36. Fiacro Jiménez FV, José D. Carrillo-Ruiz, Luis García, Adrián, Madrigal ALV, Irma Márquez. Comparative Evaluation of the Effects of Unilateral Lesion versus Electrical Stimulation of the Globus Pallidus Internus in Advanced Parkinson's Disease. Stereotactic & Functional Neurosurgery 2006; 84: 64-71.

37. Constantoyannis C, Berk C, Honey CR et al. Reducing Hardware-Related Complications of Deep Brain Stimulation. Can J Neurol Sci 2005; 32: 194-200.

38. Castino R, Isidoro C, Murphy D. Autophagy-dependent cell survival and cell death in an autosomal dominant familial neurohypophyseal diabetes insipidus in vitro model. FASEB J 2005; 19: 1024-1026.

39. Binder DK, Rau GM, Starr PA. Risk Factors for Hemorrhage during Microelectrode-guided Deep Brain Stimulator Implantation for Movement Disorders. Neurosurgery 2005; 56: 722-732.

40. Terao T, Takahashi H, Yokochi F et al. Hemorrhagic complication of stereotactic surgery in patients with movement disorders. J Neurosurg 2003; 98: 1241-1246.

41. Jordan-Sciutto KL, Dorsey R, Chalovich EM et al. Expression patterns of retinoblastoma protein in Parkinson disease. Journal of neuropathology and experimental neurology 2003; 62: 68-74.

42. Henningson CT, Jr., Stanislaus MA, Gewirtz AM. 28. Embryonic and adult stem cell therapy. J Allergy Clin Immunol 2003; 111: S745-753.

43. Ferrucci M, Gesi M, Lenzi P et al. Noradrenergic loss enhances MDMA toxicity and induces ubiquitin-positive striatal whorls. Neurological sciences : official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology 2002; 23 Suppl 2: S75-76.

44. Yoshor D, Hamilton WJ, Ondo W et al. Comparison of Thalamotomy and Pallidotomy for the Treatment of Dystonia. Neurosurgery 2001; 48: 818-826.

45. Pahwa R, Lyons KE, Wilkinson SB et al. Comparison of Thalamotomy to Deep Brain Stimulation of the Thalamus in Essential Tremor. Movement Disorders 2001; 16: 140-143.

46. Group D-BSfPsDS. Deep brain stimulation of the subthalamic nucleus or the pars interna of the globus pallidus in Parkinson's disease. New England Journal of Medicine 2001; 345: 956-963.

47. Aleksandar B, Kelly PJ, Rezai A et al. Complications of Deep Brain Stimulation Surgery. Stereotact Funct Neurosurg 2001; 77: 73-78.

48. Schuurman PR, Bosch DA, Bossuyt PMM et al. A comparison of continuous thalamic stimulation and thalamotomy for suppression of severe tremor. New England Journal of Medicine 2000; 342: 461-468.

49. Tasker RR. Deep brain stimulation is preferable to thalamotomy for tremor suppression. Surgical Neurology 1998; 49: 145.

50. Tasker RR. The outcome of thalamotomy for tremor. In Textbook of Stereotactic & Functional Neurosurgery. New York: McGraw-Hill 1998.

51. Lim JY, DeSalles AA, Bronstein J et al. Delayed internal capsule infarctions following radiofrequency pallidotomy. Report of three cases. J Neurosurg 1997; 87: 955-960.

52. Jankovic J, Cardoso F, Grossman RG, Hamilton WJ. Outcome after Stereotactic Thalamotomy for Parkinsonian, Essential, and Other Types of Tremor. Neurosurgery 1995; 37: 680-687.

53. Cardoso F, Jankovic J, Grossman RG, Hamilton WJ. Outcome after stereotactic Thalamotomy for Dystonia and Hemiballismus. Neurosurgery 1995; 36: 501-508.

Bibliographies

54. Goldman MS, Kelly PJ. Symptomatic and functional outcome of stereotactic ventralis lateralis thalamotomy for intention tremor. J Neurosurg 1992; 77: 223-229.

55. Tomlinson FH, Jack CR, Kelly PJ. Sequential magnetic resonance imaging following stereotactic radiofrequency ventralis lateralis thalamotomy. J Neurosurg 1991; 74: 579-584.

56. Lindquist C, Kihlstrom L, Hellstrand E. Functional neurosurgery--a future for the gamma knife? Stereotact Funct Neurosurg 1991; 57: 72-81.

57. Fox MW, Ahlskog JA, Kelly PJ. Stereotactic ventrolateralis thalamotomy for medically refractory tremor in post-levodopa era Parkinson's disease patients. J Neurosurg 1991; 75: 723-730.

58. Nagaseki Y, Shibazaki T, Hirai T et al. Long-term follow-up results of selective VIM-thalamotomy. J Neurosurg 1986; 65: 296-302.

59. Chen HR, Heimburger RF, Lu CS, Cheng CS. [The stereotactic thalamotomy in parkinsonism]. Taiwan Yi Xue Hui Za Zhi 1985; 84: 423-428.

60. Meyers R. Current neurosurgical researches and treatment referable to the hyperkinetic disorders. N Y State J Med 1962; 62: 2150-2167.

61. Fry WJ, Meyers R. Ultrasonic method of modifying brain structures. Confin Neurol 1962; 22: 315-327.

62. Krayenbühl H, Wyss OAM, Yaşargil MG. Bilateral thalamotomy and pallidotomy as treatment for bilateral parkinsonism. J Neurosurg 1961; 18: 429-444.

63. Meyers R, Fry WJ, Fry FJ et al. Early experiences with ultrasonic irradiation of the pallidofugal and nigral complexes in hyperkinetic and hypertonic disorders. J Neurosurg 1959; 16: 32-54.

Bibliographies

Neuromodulation

1. Yoo SS, Kim H, Min BK, Franck E, Park S (2011) Transcranial focused ultrasound to the thalamus alters anesthesia time in rats. Neuroreport 22: 783-787.
2. Yoo SS, Bystritsky A, Lee JH, Zhang Y, Fischer K, et al. (2011) Focused ultrasound modulates region-specific brain activity. Neuroimage.
3. Tufail Y, Yoshihiro A, Pati S, Li MM, Tyler WJ (2011) Ultrasonic neuromodulation by brain stimulation with transcranial ultrasound. Nat Protoc 6: 1453-1470.
4. Min B-K, Bystritsky A, Jung K-I, Fischer K, Zhang Y, et al. (2011) Focused ultrasound-mediated suppression of chemically-induced acute epileptic EEG activity. BMC Neuroscience 12: 23.
5. Min BK, Yang PS, Bohlke M, Park SS, Maher TM, et al. (2011) Focused Ultrasound Modulates the Level of Cortical Neurotransmitters: Potential as a New Functional Brain Mapping Technique. Int J Imaging Syst Technol 21.
6. Krasovitski B, Frenkel V, Shoham S, Kimmel E (2011) Intramembrane cavitation as a unifying mechanism for ultrasound-induced bioeffects. Proc Natl Acad Sci U S A 108: 3258-3263.
7. Bystritsky A, Korb AS, Douglas PK, Cohen MS, Melega WP, et al. (2011) A review of low-intensity focused ultrasound pulsation. Brain Stimul 4: 125-136.
8. Yoo SS, Jung K, Zhang Y, McDannold N, Bystritsky A, et al. (2010) Non-invasive Suppression of Animal-model Chronic Epilepsy using Image-guided Focused Ultrasound. International Imaging Conference, Stockholm.
9. Tyler WJ, Tufail Y, Pati S (2010) Pain: Noninvasive functional neurosurgery using ultrasound. Nat Rev Neurol 6: 13-14.
10. Tyler WJ (2010) Noninvasive Neuromodulation with Ultrasound? A Continuum Mechanics Hypothesis. Neuroscientist.
11. Tufail Y, Matyushov A, Baldwin N, Tauchmann ML, Georges J, et al. (2010) Transcranial pulsed ultrasound stimulates intact brain circuits. Neuron 66: 681-694.
12. Shang X, Wang P, Liu Y, Zhang Z, Xue Y (2010) Mechanism of Low-Frequency Ultrasound in Opening Blood-Tumor Barrier by Tight Junction. J Mol Neurosci.
13. Sachs F (2010) Stretch-activated ion channels: what are they? Physiology (Bethesda) 25: 50-56.
14. Liu HL, Hua MY, Chen PY, Chu PC, Pan CH, et al. (2010) Blood-brain barrier disruption with focused ultrasound enhances delivery of chemotherapeutic drugs for glioblastoma treatment. Radiology 255: 415-425.
15. Hertzberg Y, Naor O, Volovick A, Shoham S (2010) Towards multifocal ultrasonic neural stimulation: pattern generation algorithms. J Neural Eng 7: 056002.
16. Heikkila J, Curiel L, Hynynen K (2010) Local harmonic motion monitoring of focused ultrasound surgery--a simulation model. IEEE Trans Biomed Eng 57: 185-193.
17. Yoo SS, Lee JH, Fischer K, Zhang Y, Bystritsky A, et al. Non-invasive regional modulation of brain function by focused ultrasound; 2009. Proceedings of Society for Neuroscience. pp. 105.111.
18. Martin E, Jeanmonod D, Morel A, Zadicario E, Werner B (2009) High-intensity focused ultrasound for noninvasive functional neurosurgery. Ann Neurol 66: 858-861.

Bibliographies

19. Hynynen K (2009) Macromolecular delivery across the blood-brain barrier. Methods Mol Biol 480: 175-185.

20. El-Brawany MA, Nassiri DK, Terhaar G, Shaw A, Rivens I, et al. (2009) Measurement of thermal and ultrasonic properties of some biological tissues. J Med Eng Technol 33: 249-256.

21. Curiel L, Huang Y, Vykhodtseva N, Hynynen K (2009) Focused ultrasound treatment of VX2 tumors controlled by local harmonic motion. Phys Med Biol 54: 3405-3419.

22. Colucci V, Strichartz G, Jolesz F, Vykhodtseva N, Hynynen K (2009) Focused ultrasound effects on nerve action potential in vitro. Ultrasound Med Biol 35: 1737-1747.

23. Barreto AD, Sharma VK, Lao AY, Schellinger PD, Amarenco P, et al. (2009) Safety and dose-escalation study design of Transcranial Ultrasound in Clinical SONolysis for acute ischemic stroke: the TUCSON Trial. Int J Stroke 4: 42-48.

24. Yoo SS, Lee JH, Zhang Y, Lee H, Fischer K, Bystritsky A, Golby A, McDannold N, Jolesz FA p10. (2008) FUS-mediated reversible modulation of region-specific brain function. Proceedings of MRgFUS, Washington DC: p10.

25. Tyler WJ, Tufail Y, Finsterwald M, Tauchmann ML, Olson EJ, et al. (2008) Remote excitation of neuronal circuits using low-intensity, low-frequency ultrasound. PLoS One 3: e3511.

26. McDannold N, Vykhodtseva N, Hynynen K (2008) Effects of acoustic parameters and ultrasound contrast agent dose on focused-ultrasound induced blood-brain barrier disruption. Ultrasound Med Biol 34: 930-937.

27. McDannold N, Vykhodtseva N, Hynynen K (2008) Blood-brain barrier disruption induced by focused ultrasound and circulating preformed microbubbles appears to be characterized by the mechanical index. Ultrasound Med Biol 34: 834-840.

28. McDannold N, Maier SE (2008) Magnetic resonance acoustic radiation force imaging. Medicial Physics 35: 3748-3758.

29. ter Haar G (2007) Therapeutic applications of ultrasound. Progress in biophysics and molecular biology 93: 111-129.

30. Hynynen K, Clement G (2007) Clinical applications of focused ultrasound-the brain. Int J Hyperthermia 23: 193-202.

31. Hynynen K (2007) Focused ultrasound for blood-brain disruption and delivery of therapeutic molecules into the brain. Expert Opin Drug Deliv 4: 27-35.

32. Foley JL, Little JW, Vaezy S (2007) Image-guided high-intensity focused ultrasound for conduction block of peripheral nerves. Ann Biomed Eng 35: 109-119.

33. Alexandrov AV (2007) Therapeutic applications of transcranial ultrasound devices. Expert Rev Med Devices 4: 1-3.

34. White P, Clement G, Hynynen K (2006) Local frequency dependence in transcranial ultrasound transmission. Physics in Medicine and Biology 51: 2293-2305.

35. McDannold N, Vykhodtseva N, Hynynen K (2006) Targeted disruption of the blood-brain barrier with focused ultrasound: association with cavitation activity. Phys Med Biol 51: 793-807.

36. Kinoshita M, McDannold N, Jolesz FA, Hynynen K (2006) Targeted delivery of antibodies through the blood-brain barrier by MRI-guided focused ultrasound. Biochem Biophys Res Commun 340: 1085-1090.

Bibliographies

37. Tsui PH, Wang SH, Huang CC (2005) In vitro effects of ultrasound with different energies on the conduction properties of neural tissue. Ultrasonics 43: 560-565.

38. Hynynen K, McDannold N, Sheikov N, Jolesz F, Vykhodtseva N (2005) Local and reversible blood-brain barrier disruption by noninvasive focused ultrasound at frequencies suitable for trans-skull sonications. Neuroimage 24: 12-20.

39. Seiffert E, Dreier JP, Ivens S, Bechmann I, Tomkins O, et al. (2004) Lasting blood-brain barrier disruption induces epileptic focus in the rat somatosensory cortex. J Neurosci 24: 7829-7836.

40. Hynynen K, McDannold N, Vykhodtseva N, Raymond S, Jolesz FA, et al. Large volume blood-brain barrier disruption by low frequency focused ultrasound: a method for targeted drug delivery and molecular imaging; 2004 23-27 Aug. 2004. pp. 994-997 Vol.992.

41. Hynynen K, Clement G, McDannold N, Vykhodtseva N, King R, et al. (2004) 500-element ultrasound phased array system for noninvasive focal surgery of the brain: a preliminary rabbit study with ex vivo human skulls. Magnetic Resonance in Medicine 52: 100-107.

42. Foley JL, Little JW, Starr FL, 3rd, Frantz C, Vaezy S (2004) Image-guided HIFU neurolysis of peripheral nerves to treat spasticity and pain. Ultrasound Med Biol 30: 1199-1207.

43. Dalecki D (2004) MECHANICAL BIOEFFECTS OF ULTRASOUND. Annual Review of Biomedical Engineering 6: 229-248.

44. Clement GT (2004) Perspectives in clinical uses of high-intensity focused ultrasound. Ultrasonics 42: 1087-1093.

45. Hynynen K, McDannold N, Vykhodtseva N, Jolesz FA (2003) Non-invasive opening of BBB by focused ultrasound. Acta Neurochir Suppl 86: 555-558.

46. Hynynen K, McDannold N, Vykhodtseva N, Jolesz F (2001) Noninvasive MR Imaging–guided Focal Opening of the Blood-Brain Barrier in Rabbits1. Radiology 220: 640.

47. Daum D, Hynynen K (1999) A 256-element ultrasonic phased array system for the treatment oflarge volumes of deep seated tissue. IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control 46: 1254-1268.

48. Cornford EM, Hyman S (1999) Blood-brain barrier permeability to small and large molecules. Adv Drug Deliv Rev 36: 145-163.

49. Bachtold MR, Rinaldi PC, Jones JP, Reines F, Price LR (1998) Focused ultrasound modifications of neural circuit activity in a mammalian brain. Ultrasound Med Biol 24: 557-565.

50. Naumann M, Becker G, Toyka KV, Supprian T, Reiners K (1996) Lenticular nucleus lesion in idiopathic dystonia detected by transcranial sonography. Neurology 47: 1284-1290.

51. Gavrilov LR, Tsirulnikov EM, Davies IA (1996) Application of focused ultrasound for the stimulation of neural structures. Ultrasound Med Biol 22: 179-192.

52. Bailey MR, Dalecki D, Child SZ, Raeman CH, Penney DP, et al. (1996) Bioeffects of positive and negative acoustic pressures in vivo. J Acoust Soc Am 100: 3941-3946.

53. Heckman JD, Ryaby JP, McCabe J, Frey JJ, Kilcoyne RF (1994) Acceleration of tibial fracture-healing by non-invasive, low-intensity pulsed ultrasound. J Bone Joint Surg Am 76: 26-34.

54. Rinaldi PC, Jones JP, Reines F, Price LR (1991) Modification by focused ultrasound pulses of electrically evoked responses from an in vitro hippocampal preparation. Brain Res 558: 36-42.

55. Dinno MA, Crum LA, Wu J (1989) The effect of therapeutic ultrasound on electrophysiological parameters of frog skin. Ultrasound Med Biol 15: 461-470.

Bibliographies

56. Tsirulnikov E, Vartanyan I, Gersuni G, Rosenblyum A, Pudov V, et al. (1988) Use of amplitude-modulated focused ultrasound for diagnosis of hearing disorders. Ultrasound in medicine & biology 14: 277-285.

57. Gavrilov LR (1984) Use of focused ultrasound for stimulation of nerve structures. Ultrasonics 22: 132-138.

58. Adrianov OS, Vykhodtseva NI, Fokin VF, Avirom VM (1984) [Method of local action by focussed ultrasound on deep brain structures in unrestrained unanesthetized animals]. Biull Eksp Biol Med 98: 115-117.

59. Fry F, Goss S (1980) Further studies of the transkull transmission of an intense focused ultrasonic beam: Lesion production at 500 kHz. Ultrasound in medicine & biology 6: 33-35.

60. Foster KR, Wiederhold ML (1978) Auditory responses in cats produced by pulsed ultrasound. The Journal of the Acoustical Society of America 63: S27-S28.

61. Gavrilov LR, Gersuni GV, Ilyinsky OB, Tsirulnikov EM, Shchekanov EE (1977) A study of reception with the use of focused ultrasound. II. Effects on the animal receptor structures. Brain Res 135: 279-285.

62. Gavrilov LR, Gersuni GV, Ilyinski OB, Tsirulnikov EM, Shchekanov EE (1977) A study of reception with the use of focused ultrasound. I. Effects on the skin and deep receptor structures in man. Brain Res 135: 265-277.

63. Gavrilov LR, Gersuni GV, Ilyinsky OB, Sirotyuk MG, Tsirulnikov EM, et al. (1976) The effect of focused ultrasound on the skin and deep nerve structures of man and animal. Prog Brain Res 43: 279-292.

64. Fry WJ (1958) Intense ultrasound in investigations of the central nervous system. Advances in biological and medical physics 6: 281.

65. Allegranza A (1956) [Ultrasonics and the central nervous system.]. Minerva Fisioter Radiobiol 1: 26-32.

66. Fry WJ, Barnard JW, Fry FJ, Brennan JF (1955) Ultrasonically produced localized selective lesions in the central nervous system. Am J Phys Med 34: 413-423.

67. Fry W (1955) Neurosonic surgery. Trans Am Neurol Assoc: 86-88.

68. Fry WJ (1954) Intense ultrasound; a new tool for neurological research. J Ment Sci 100: 85-96.

69. Fry EJ (1950) An ultrasonic projector design for a wide range of research applications. Rev Sci Instrum 21: 940-941.

Bibliographies

MR-ARFI

1. Kaye EA, Chen J, Pauly KB. Rapid MR-ARFI method for focal spot localization during focused ultrasound therapy. Magnetic resonance in medicine : official journal of the Society of Magnetic Resonance in Medicine / Society of Magnetic Resonance in Medicine 2011; 65: 738-743.
2. Holbrook AB, Ghanouni P, Santos JM et al. In vivo MR acoustic radiation force imaging in the porcine liver. Medical Physics 2011; 38: 5081-5089.
3. Ergün AS. Analytical and Numerical Calculations of Optimum Design Frequency for Focused Ultrasound Therapy and Acoustic Radiation Force. Ultrasonics 2011; In Press, Accepted Manuscript.
4. Kaye EA, Chen J, Pauly KB. Rapid MR-ARFI method for focal spot localization during focused ultrasound therapy. Magnetic resonance in medicine : official journal of the Society of Magnetic Resonance in Medicine / Society of Magnetic Resonance in Medicine 2010.
5. Kaye EA, Chen J, Pauly KB. Rapid MR-ARFI method for focal spot localization during focused ultrasound therapy. Magn Reson Med 2010.
6. Hertzberg Y, Volovick A, Zur Y et al. Ultrasound focusing using magnetic resonance acoustic radiation force imaging: application to ultrasound transcranial therapy. Medical Physics 2010; 37: 2934-2942.
7. Hertzberg Y, Volovick A, Zur Y et al. Ultrasound focusing using magnetic resonance acoustic radiation force imaging: application to ultrasound transcranial therapy. Med Phys 2010; 37: 2934-2942.

Bibliographies

Cavitation

1. Yoo S-S, Bystritsky A, Lee J-H et al. Focused ultrasound modulates region-specific brain activity. Neuroimage 2011; In Press, Accepted Manuscript.
2. Weiss HL, Ahadi G, Hoelscher T, Szeri AJ. Cavitation damage during sonothrombolysis using high intensity focused ultrasound. The Journal of the Acoustical Society of America 2011; 129: 2576-2576.
3. Tung Y-S, Marquet F, Teichert T et al. Feasibility of noninvasive cavitation-guided blood-brain barrier opening using focused ultrasound and microbubbles in nonhuman primates. Applied Physics Letters 2011; 98: 163704-163703.
4. Tung YS, Marquet F, Teichert T et al. Feasibility of noninvasive cavitation-guided blood-brain barrier opening using focused ultrasound and microbubbles in nonhuman primates. Applied Physics Letters 2011; 98: 163704.
5. Hsieh C-y, Probert Smith P, Mayia F, Ye G. An Adaptive Spectral Estimation Technique to Detect Cavitation in HIFU With High Spatial Resolution. Ultrasound in Medicine & Biology 2011; 37: 1134-1150.
6. Choi JJ, Selert K, Vlachos F et al. Noninvasive and localized neuronal delivery using short ultrasonic pulses and microbubbles. Proceedings of the National Academy of Sciences 2011.
7. Tung YS, Vlachos F, Choi JJ et al. In vivo transcranial cavitation threshold detection during ultrasound-induced blood-brain barrier opening in mice. Physics in Medicine and Biology 2010; 55: 6141-6155.
8. Tung YS, Choi JJ, Baseri B, Konofagou EE. Identifying the inertial cavitation threshold and skull effects in a vessel phantom using focused ultrasound and microbubbles. Ultrasound in Medicine & Biology 2010; 36: 840-852.
9. Tung YS, Choi JJ, Baseri B, Konofagou EE. Identifying the inertial cavitation threshold and skull effects in a vessel phantom using focused ultrasound and microbubbles. Ultrasound Med Biol 2010; 36: 840-852.
10. Tang SC, Clement GT. Standing-wave suppression for transcranial ultrasound by random modulation. IEEE transactions on bio-medical engineering 2010; 57: 203-205.
11. McLaughlan J, Rivens I, Leighton T, Ter Haar G. A study of bubble activity generated in ex vivo tissue by high intensity focused ultrasound. Ultrasound Med Biol 2010; 36: 1327-1344.
12. Liang HD, Tang J, Halliwell M. Sonoporation, drug delivery, and gene therapy. Proceedings of the Institution of Mechanical Engineers. Part H, Journal of engineering in medicine 2010; 224: 343-361.
13. King DA, Malloy MJ, Roberts AC et al. Determination of postexcitation thresholds for single ultrasound contrast agent microbubbles using double passive cavitation detection. J Acoust Soc Am 2010; 127: 3449-3455.
14. Gateau J, Marsac L, Pernot M et al. Transcranial ultrasonic therapy based on time reversal of acoustically induced cavitation bubble signature. IEEE transactions on bio-medical engineering 2010; 57: 134-144.
15. Burke CW, Price RJ. Contrast ultrasound targeted treatment of gliomas in mice via drug-bearing nanoparticle delivery and microvascular ablation. J Vis Exp 2010.
16. Yoshizawa S, Ikeda T, Ito A et al. High intensity focused ultrasound lithotripsy with cavitating microbubbles. Med Biol Eng Comput 2009; 47: 851-860.

Bibliographies

17. Baron C, Aubry JF, Tanter M et al. Simulation of intracranial acoustic fields in clinical trials of sonothrombolysis. Ultrasound Med Biol 2009; 35: 1148-1158.

18. Sheffield P, Trehan A, Boyd B, Wong OL. Microbubbles as ultrasound contrast agents and in targeted drug delivery. Critical reviews in biomedical engineering 2008; 36: 225-255.

19. Prokop AF, Soltani A, Roy RA. Cavitational Mechanisms in Ultrasound-Accelerated Fibrinolysis. Ultrasound in Medicine & Biology 2007; 33: 924-933.

20. Marsh JN, Senpan A, Hu G et al. Fibrin-targeted perfluorocarbon nanoparticles for targeted thrombolysis. Nanomedicine (Lond) 2007; 2: 533-543.

21. Coussios CC, Farny CH, Haar GT, Roy RA. Role of acoustic cavitation in the delivery and monitoring of cancer treatment by high-intensity focused ultrasound (HIFU). Int J Hyperthermia 2007; 23: 105-120.

22. Vykhodtseva N, McDannold N, Hynynen K. Induction of apoptosis in vivo in the rabbit brain with focused ultrasound and Optison. Ultrasound in Medicine & Biology 2006; 32: 1923-1929.

23. Vykhodtseva N, McDannold N, Hynynen K. Induction of apoptosis in vivo in the rabbit brain with focused ultrasound and Optison. Ultrasound Med Biol 2006; 32: 1923-1929.

24. Tu J, Matula TJ, Brayman AA, Crum LA. Inertial cavitation dose produced in ex vivo rabbit ear arteries with Optison by 1-MHz pulsed ultrasound. Ultrasound Med Biol 2006; 32: 281-288.

25. Tu J, Hwang JH, Matula TJ et al. Intravascular inertial cavitation activity detection and quantification in vivo with Optison. Ultrasound Med Biol 2006; 32: 1601-1609.

26. Rabkin BA, Zderic V, Crum LA, Vaezy S. Biological and physical mechanisms of HIFU-induced hyperecho in ultrasound images. Ultrasound Med Biol 2006; 32: 1721-1729.

27. Meairs S, Hennerici M. Future developments in neurovascular ultrasound. Front Neurol Neurosci 2006; 21: 261-268.

28. McDannold N, Vykhodtseva N, Hynynen K. Targeted disruption of the blood-brain barrier with focused ultrasound: association with cavitation activity. Physics in Medicine and Biology 2006; 51: 793-807.

29. Hwang JH, Tu J, Brayman AA et al. Correlation between inertial cavitation dose and endothelial cell damage in vivo. Ultrasound Med Biol 2006; 32: 1611-1619.

30. Datta S, Coussios CC, McAdory LE et al. Correlation of cavitation with ultrasound enhancement of thrombolysis. Ultrasound Med Biol 2006; 32: 1257-1267.

31. Bailey MR, Pishchalnikov YA, Sapozhnikov OA et al. Cavitation detection during shock-wave lithotripsy. Ultrasound Med Biol 2005; 31: 1245-1256.

32. Porter TM, Crum LA, Stayton PS, Hoffman AS. Effect of polymer surface activity on cavitation nuclei stability against dissolution. J Acoust Soc Am 2004; 116: 721-728.

33. Sapozhnikov OA, Khokhlova VA, Bailey MR et al. Effect of overpressure and pulse repetition frequency on cavitation in shock wave lithotripsy. J Acoust Soc Am 2002; 112: 1183-1195.

34. Poliachik SL, Chandler WL, Mourad PD et al. Activation, aggregation and adhesion of platelets exposed to high-intensity focused ultrasound. Ultrasound Med Biol 2001; 27: 1567-1576.

35. Koch S, Pohl P, Cobet U, Rainov NG. Ultrasound enhancement of liposome-mediated cell transfection is caused by cavitation effects. Ultrasound Med Biol 2000; 26: 897-903.

36. Hynynen K, Freund WR, Cline HE et al. A clinical, noninvasive, MR imaging-monitored ultrasound surgery method. Radiographics 1996; 16: 185-195.

Bibliographies

37. Holland CK, Deng CX, Apfel RE et al. Direct evidence of cavitation in vivo from diagnostic ultrasound. Ultrasound Med Biol 1996; 22: 917-925.

38. Deng CX, Xu Q, Apfel RE, Holland CK. In vitro measurements of inertial cavitation thresholds in human blood. Ultrasound Med Biol 1996; 22: 939-948.

39. ter Haar G. Ultrasound focal beam surgery. Ultrasound in Medicine & Biology 1995; 21: 1089-1100.

40. Hill CR, ter Haar GR. Review article: high intensity focused ultrasound--potential for cancer treatment. The British journal of radiology 1995; 68: 1296-1303.

41. Rinaldi PC, Jones JP, Reines F, Price LR. Modification by focused ultrasound pulses of electrically evoked responses from an in vitro hippocampal preparation. Brain research 1991; 558: 36-42.

42. Rinaldi PC, Jones JP, Reines F, Price LR. Modification by focused ultrasound pulses of electrically evoked responses from an in vitro hippocampal preparation. Brain Res 1991; 558: 36-42.

43. Frizzell LA. Threshold dosages for damage to mammalian liver by high intensity focused ultrasound. IEEE transactions on ultrasonics, ferroelectrics, and frequency control 1988; 35: 578-581.

44. Vykhodtseva NI, Adrianov OS, Konopatskaia, II, Solontsova LV. [Characteristics of the formation of local destructive foci in brain tissues exposed to focused ultrasound]. Biulleten' eksperimental'noi biologii i meditsiny 1985; 99: 689-693.

45. Vykhodtseva NI, Adrianov OS, Konopatskaia, II, Solontsova LV. [Characteristics of the formation of local destructive foci in brain tissues exposed to focused ultrasound]. Biull Eksp Biol Med 1985; 99: 689-693.

46. Vykhodtseva NI, Gavrilov LR, Mering TA, Iamshchikova NG. [Use of focused ultrasound for local destruction of different brain structures]. Zhurnal nevropatologii i psikhiatrii imeni S.S. Korsakova 1976; 76: 1810-1816.

47. Vykhodtseva NI, Gavrilov LR, Mering TA, Iamshchikova NG. [Use of focused ultrasound for local destruction of different brain structures]. Zh Nevropatol Psikhiatr Im S S Korsakova 1976; 76: 1810-1816.

48. McLaughlan J, Rivens I, Leighton T, Ter Haar G. A study of bubble activity generated in ex vivo tissue by high intensity focused ultrasound. Ultrasound Med Biol 36: 1327-1344.

Bibliographies

Drug Delivery

1. Yang FY, Lin YS, Kang KH, Chao TK. Reversible blood-brain barrier disruption by repeated transcranial focused ultrasound allows enhanced extravasation. Journal of controlled release : official journal of the Controlled Release Society 2011; 150: 111-116.
2. Yang FY, Lin GL, Horng SC et al. Pulsed high-intensity focused ultrasound enhances the relative permeability of the blood-tumor barrier in a glioma-bearing rat model. IEEE transactions on ultrasonics, ferroelectrics, and frequency control 2011; 58: 964-970.
3. Rajadhyaksha M, Boyden T, Liras J et al. Current advances in delivery of biotherapeutics across the blood-brain barrier. Current drug discovery technologies 2011; 8: 87-101.
4. Rajadhyaksha M, T. Boyden, J. Liras, A. El-Kattan, J. Brodfuehrer. Current Advances in Delivery of Biotherapeutics across the Blood-Brain Barrier. Current Drug Discovery Technology 2011.
5. Huang Y, Hynynen K. MR-guided focused ultrasound for brain ablation and blood-brain barrier disruption. Methods Mol Biol 2011; 711: 579-593.
6. Choi JJ, Selert K, Vlachos F et al. Noninvasive and localized neuronal delivery using short ultrasonic pulses and microbubbles. Proceedings of the National Academy of Sciences 2011.
7. Choi JJ, Selert K, Gao Z et al. Noninvasive and localized blood-brain barrier disruption using focused ultrasound can be achieved at short pulse lengths and low pulse repetition frequencies. J Cereb Blood Flow Metab 2011; 31: 725-737.
8. Serwer L, Hashizume R, Ozawa T, James CD. Systemic and local drug delivery for treating diseases of the central nervous system in rodent models. J Vis Exp 2010.
9. Olbricht WL, Neeves KB, Foley CP. Microfluidic probes in the treatment of brain-related diseases. Drug News Perspect 2010; 23: 491-497.
10. Mohs AM, Provenzale JM. Applications of nanotechnology to imaging and therapy of brain tumors. Neuroimaging Clin N Am 2010; 20: 283-292.
11. Madsen SJ, Hirschberg H. Site-specific opening of the blood-brain barrier. Journal of biophotonics 2010; 3: 356-367.
12. Madsen SJ, Hirschberg H. Site-specific opening of the blood-brain barrier. J Biophotonics 2010; 3: 356-367.
13. Loch-Neckel G, Koepp J. [The blood-brain barrier and drug delivery in the central nervous system]. Rev Neurol 2010; 51: 165-174.
14. Liu HL, Hua MY, Yang HW et al. Magnetic resonance monitoring of focused ultrasound/magnetic nanoparticle targeting delivery of therapeutic agents to the brain. Proceedings of the National Academy of Sciences of the United States of America 2010; 107: 15205-15210.
15. Liu HL, Hua MY, Yang HW et al. Magnetic resonance monitoring of focused ultrasound/magnetic nanoparticle targeting delivery of therapeutic agents to the brain. Proc Natl Acad Sci U S A 2010; 107: 15205-15210.
16. Colen RR, Kekhia H, Jolesz FA. Multimodality intraoperative MRI for brain tumor surgery. Expert Rev Neurother 2010; 10: 1545-1558.

Bibliographies

17. Choi JJ, Wang S, Tung YS et al. Molecules of various pharmacologically-relevant sizes can cross the ultrasound-induced blood-brain barrier opening in vivo. Ultrasound in Medicine & Biology 2010; 36: 58-67.

18. Choi JJ, Wang S, Tung YS et al. Molecules of various pharmacologically-relevant sizes can cross the ultrasound-induced blood-brain barrier opening in vivo. Ultrasound Med Biol 2010; 36: 58-67.

19. Choi JJ, Selert K, Gao Z et al. Noninvasive and localized blood-brain barrier disruption using focused ultrasound can be achieved at short pulse lengths and low pulse repetition frequencies. J Cereb Blood Flow Metab 2010.

20. Choi JJ, Feshitan JA, Baseri B et al. Microbubble-size dependence of focused ultrasound-induced blood-brain barrier opening in mice in vivo. IEEE transactions on bio-medical engineering 2010; 57: 145-154.

21. Choi JJ, Feshitan JA, Baseri B et al. Microbubble-size dependence of focused ultrasound-induced blood-brain barrier opening in mice in vivo. IEEE Trans Biomed Eng 2010; 57: 145-154.

22. Chen PY, Liu HL, Hua MY et al. Novel magnetic/ultrasound focusing system enhances nanoparticle drug delivery for glioma treatment. Neuro-oncology 2010; 12: 1050-1060.

23. Chen PY, Liu HL, Hua MY et al. Novel magnetic/ultrasound focusing system enhances nanoparticle drug delivery for glioma treatment. Neuro Oncol 2010; 12: 1050-1060.

24. Chen PY, Liu HL, Hua MY et al. Novel magnetic/ultrasound focusing system enhances nanoparticle drug delivery for glioma treatment. Neuro Oncol 2010; 12: 1050-1060.

25. Burke CW, Price RJ. Contrast ultrasound targeted treatment of gliomas in mice via drug-bearing nanoparticle delivery and microvascular ablation. J Vis Exp 2010.

26. Britton GL, Kim H, Kee PH et al. In vivo therapeutic gas delivery for neuroprotection with echogenic liposomes. Circulation 2010; 122: 1578-1587.

27. Baseri B, Choi JJ, Tung YS, Konofagou EE. Multi-modality safety assessment of blood-brain barrier opening using focused ultrasound and definity microbubbles: a short-term study. Ultrasound in Medicine & Biology 2010; 36: 1445-1459.

28. Baseri B, Choi JJ, Tung YS, Konofagou EE. Multi-modality safety assessment of blood-brain barrier opening using focused ultrasound and definity microbubbles: a short-term study. Ultrasound Med Biol 2010; 36: 1445-1459.

29. Baseri B, Choi JJ, Tung YS, Konofagou EE. Multi-modality safety assessment of blood-brain barrier opening using focused ultrasound and definity microbubbles: a short-term study. Ultrasound Med Biol 2010; 36: 1445-1459.

30. Alonso A, Reinz E, Fatar M et al. Neurons but not glial cells overexpress ubiquitin in the rat brain following focused ultrasound-induced opening of the blood-brain barrier. Neuroscience 2010; 169: 116-124.

31. Pardridge WM, Boado RJ. Pharmacokinetics and safety in rhesus monkeys of a monoclonal antibody-GDNF fusion protein for targeted blood-brain barrier delivery. Pharmaceutical research 2009; 26: 2227-2236.

32. Hynynen K. Macromolecular delivery across the blood-brain barrier. Methods in molecular biology 2009; 480: 175-185.

33. Hynynen K. Macromolecular delivery across the blood-brain barrier. Methods Mol Biol 2009; 480: 175-185.

Bibliographies

34. Hui EK, Boado RJ, Pardridge WM. Tumor necrosis factor receptor-IgG fusion protein for targeted drug delivery across the human blood-brain barrier. Molecular pharmaceutics 2009; 6: 1536-1543.

35. Hirschberg H, Zhang MJ, Gach HM et al. Targeted delivery of bleomycin to the brain using photo-chemical internalization of Clostridium perfringens epsilon prototoxin. Journal of neuro-oncology 2009; 95: 317-329.

36. Choi JJ, Feshitan JA, Baseri B et al. Microbubble-size dependence of focused ultrasound-induced blood-brain barrier opening in mice in vivo. IEEE Trans Biomed Eng 2009; 57: 145-154.

37. Bidros DS, Vogelbaum MA. Novel drug delivery strategies in neuro-oncology. Neurotherapeutics : the journal of the American Society for Experimental NeuroTherapeutics 2009; 6: 539-546.

38. Xie F, Boska MD, Lof J et al. Effects of transcranial ultrasound and intravenous microbubbles on blood brain barrier permeability in a large animal model. Ultrasound Med Biol 2008; 34: 2028-2034.

39. Vykhodtseva N, McDannold N, Hynynen K. Progress and problems in the application of focused ultrasound for blood-brain barrier disruption. Ultrasonics 2008; 48: 279-296.

40. Vykhodtseva N, McDannold N, Hynynen K. Progress and problems in the application of focused ultrasound for blood-brain barrier disruption. Ultrasonics 2008; 48: 279-296.

41. McDannold N, Vykhodtseva N, Hynynen K. Blood-brain barrier disruption induced by focused ultrasound and circulating preformed microbubbles appears to be characterized by the mechanical index. Ultrasound in Medicine & Biology 2008; 34: 834-840.

42. McDannold N, Vykhodtseva N, Hynynen K. Blood-brain barrier disruption induced by focused ultrasound and circulating preformed microbubbles appears to be characterized by the mechanical index. Ultrasound in medicine & biology 2008; 34: 834-840.

43. Hynynen K. Ultrasound for drug and gene delivery to the brain. Advanced Drug Delivery Reviews 2008; 60: 1209-1217.

44. Hynynen K. Ultrasound for drug and gene delivery to the brain. Adv Drug Deliv Rev 2008; 60: 1209-1217.

45. Choi JJ, Wang S, Brown TR et al. Noninvasive and transient blood-brain barrier opening in the hippocampus of Alzheimer's double transgenic mice using focused ultrasound. Ultrasonic imaging 2008; 30: 189-200.

46. Choi JJ, Wang S, Brown TR et al. Noninvasive and transient blood-brain barrier opening in the hippocampus of Alzheimer's double transgenic mice using focused ultrasound. Ultrason Imaging 2008; 30: 189-200.

47. Boado RJ, Zhang Y, Wang Y, Pardridge WM. GDNF fusion protein for targeted-drug delivery across the human blood-brain barrier. Biotechnology and bioengineering 2008; 100: 387-396.

48. Boado RJ, Zhang Y, Wang Y, Pardridge WM. IgG-paraoxonase-1 fusion protein for targeted drug delivery across the human blood-brain barrier. Molecular pharmaceutics 2008; 5: 1037-1043.

49. Vogelbaum MA. Convection enhanced delivery for treating brain tumors and selected neurological disorders: symposium review. J Neurooncol 2007; 83: 97-109.

50. Treat LH, McDannold N, Vykhodtseva N et al. Targeted delivery of doxorubicin to the rat brain at therapeutic levels using MRI-guided focused ultrasound. International journal of cancer. Journal international du cancer 2007; 121: 901-907.

Bibliographies

51. Treat LH, McDannold N, Vykhodtseva N et al. Targeted delivery of doxorubicin to the rat brain at therapeutic levels using MRI-guided focused ultrasound. Int J Cancer 2007; 121: 901-907.

52. Pardridge WM. Blood-brain barrier delivery. Drug discovery today 2007; 12: 54-61.

53. Meairs S, Alonso A. Ultrasound, microbubbles and the blood-brain barrier. Progress in biophysics and molecular biology 2007; 93: 354-362.

54. Jain KK. Nanobiotechnology-based drug delivery to the central nervous system. Neurodegenerative Diseases 2007; 4: 287-291.

55. Hynynen K. Focused ultrasound for blood-brain disruption and delivery of therapeutic molecules into the brain. Expert opinion on drug delivery 2007; 4: 27-35.

56. Hynynen K. Focused ultrasound for blood-brain disruption and delivery of therapeutic molecules into the brain. Expert Opin Drug Deliv 2007; 4: 27-35.

57. Choi JJ, Pernot M, Small SA, Konofagou EE. Noninvasive, transcranial and localized opening of the blood-brain barrier using focused ultrasound in mice. Ultrasound in Medicine & Biology 2007; 33: 95-104.

58. Choi JJ, Pernot M, Small SA, Konofagou EE. Noninvasive, transcranial and localized opening of the blood-brain barrier using focused ultrasound in mice. Ultrasound Med Biol 2007; 33: 95-104.

59. Choi JJ, Pernot M, Brown TR et al. Spatio-temporal analysis of molecular delivery through the blood-brain barrier using focused ultrasound. Physics in Medicine and Biology 2007; 52: 5509-5530.

60. Choi JJ, Pernot M, Brown TR et al. Spatio-temporal analysis of molecular delivery through the blood-brain barrier using focused ultrasound. Phys Med Biol 2007; 52: 5509-5530.

61. Boado RJ, Zhang Y, Pardridge WM. Genetic engineering, expression, and activity of a fusion protein of a human neurotrophin and a molecular Trojan horse for delivery across the human blood-brain barrier. Biotechnology and bioengineering 2007; 97: 1376-1386.

62. Alexandrov AV. Therapeutic applications of transcranial ultrasound devices. Expert Rev Med Devices 2007; 4: 1-3.

63. Pardridge WM. Molecular Trojan horses for blood-brain barrier drug delivery. Current opinion in pharmacology 2006; 6: 494-500.

64. McDannold N, Vykhodtseva N, Hynynen K. Targeted disruption of the blood-brain barrier with focused ultrasound: association with cavitation activity. Physics in Medicine and Biology 2006; 51: 793-807.

65. Kinoshita M, McDannold N, Jolesz FA, Hynynen K. Targeted delivery of antibodies through the blood-brain barrier by MRI-guided focused ultrasound. Biochemical and Biophysical Research Communications 2006; 340: 1085-1090.

66. Kinoshita M, McDannold N, Jolesz FA, Hynynen K. Noninvasive localized delivery of Herceptin to the mouse brain by MRI-guided focused ultrasound-induced blood-brain barrier disruption. Proceedings of the National Academy of Sciences of the United States of America 2006; 103: 11719-11723.

67. Kinoshita M, McDannold N, Jolesz FA, Hynynen K. Noninvasive localized delivery of Herceptin to the mouse brain by MRI-guided focused ultrasound-induced blood-brain barrier disruption. Proceedings of the National Academy of Sciences of the United States of America 2006; 103: 11719-11723.

Bibliographies

68. Kinoshita M, McDannold N, Jolesz FA, Hynynen K. Targeted delivery of antibodies through the blood-brain barrier by MRI-guided focused ultrasound. Biochem Biophys Res Commun 2006; 340: 1085-1090.

69. Kinoshita M. Targeted drug delivery to the brain using focused ultrasound. Topics in magnetic resonance imaging : TMRI 2006; 17: 209-215.

70. Kinoshita M. Targeted drug delivery to the brain using focused ultrasound. Top Magn Reson Imaging 2006; 17: 209-215.

71. Hynynen K, McDannold N, Vykhodtseva N et al. Focal disruption of the blood-brain barrier due to 260-kHz ultrasound bursts: a method for molecular imaging and targeted drug delivery. Journal of Neurosurgery 2006; 105: 445-454.

72. Hynynen K, McDannold N, Vykhodtseva N et al. Focal disruption of the blood-brain barrier due to 260-kHz ultrasound bursts: a method for molecular imaging and targeted drug delivery. Journal of neurosurgery 2006; 105: 445-454.

73. Guccione S, Li KC, Bednarski MD. Vascular-targeted nanoparticles for molecular imaging and therapy. Methods Enzymol 2004; 386: 219-236.

74. Begley DJ. Delivery of therapeutic agents to the central nervous system: the problems and the possibilities. Pharmacology & Therapeutics 2004; 104: 29-45.

75. Hynynen K, McDannold N, Vykhodtseva N, Jolesz FA. Non-invasive opening of BBB by focused ultrasound. Acta neurochirurgica. Supplement 2003; 86: 555-558.

76. Hynynen K, McDannold N, Vykhodtseva N, Jolesz FA. Non-invasive opening of BBB by focused ultrasound. Acta Neurochir Suppl 2003; 86: 555-558.

77. Wu D, Song BW, Vinters HV, Pardridge WM. Pharmacokinetics and brain uptake of biotinylated basic fibroblast growth factor conjugated to a blood-brain barrier drug delivery system. Journal of drug targeting 2002; 10: 239-245.

78. Bickel U, Yoshikawa T, Pardridge WM. Delivery of peptides and proteins through the blood-brain barrier. Advanced drug delivery reviews 2001; 46: 247-279.

79. Terasaki T, Pardridge WM. Targeted drug delivery to the brain; (blood-brain barrier, efflux, endothelium, biological transport). Journal of drug targeting 2000; 8: 353-355.

80. Pardridge WM. Non-invasive drug delivery to the human brain using endogenous blood-brain barrier transport systems. Pharmaceutical science & technology today 1999; 2: 49-59.

81. Deguchi Y, Kurihara A, Pardridge WM. Retention of biologic activity of human epidermal growth factor following conjugation to a blood-brain barrier drug delivery vector via an extended poly(ethylene glycol) linker. Bioconjugate chemistry 1999; 10: 32-37.

82. Pardridge WM, Wu D, Sakane T. Combined use of carboxyl-directed protein pegylation and vector-mediated blood-brain barrier drug delivery system optimizes brain uptake of brain-derived neurotrophic factor following intravenous administration. Pharmaceutical research 1998; 15: 576-582.

83. Wu D, Pardridge WM. Central nervous system pharmacologic effect in conscious rats after intravenous injection of a biotinylated vasoactive intestinal peptide analog coupled to a blood-brain barrier drug delivery system. The Journal of pharmacology and experimental therapeutics 1996; 279: 77-83.

Bibliographies

84. Wu D, Boado RJ, Pardridge WM. Pharmacokinetics and blood-brain barrier transport of [3H]-biotinylated phosphorothioate oligodeoxynucleotide conjugated to a vector-mediated drug delivery system. The Journal of pharmacology and experimental therapeutics 1996; 276: 206-211.

85. Pardridge WM. New approaches to drug delivery through the blood-brain barrier. Trends in biotechnology 1994; 12: 239-245.

86. Pardridge WM, Boado RJ, Black KL, Cancilla PA. Blood-brain barrier and new approaches to brain drug delivery. The Western journal of medicine 1992; 156: 281-286.

Focused Ultrasound Surgery Foundation

1230 Cedars Court, Suite F
Charlottesville, VA 22903
434.220.4993
www.fusfoundation.org