

Harvard Medical School Curriculum Vitae

Date Prepared: June 14, 2018
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Place of Birth: New York, NY

Education

| | | | |
|------|----------|---------------------------------|---------------------|
| 1989 | BA | Physics & Philosophy, cum laude | Yale University |
| 1995 | MD | Medicine | Stanford University |
| 2017 | MA (Hon) | Medicine | Harvard University |

Postdoctoral Training

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|-------------|--|-------------------------|---|
| 01/95-12/96 | Resident | Surgery | Stanford University |
| 01/96-12/00 | Resident | Neurosurgery | Stanford University |
| 01/98-12/98 | Clinical Attachment | Neurosurgery | Queen Square Hospital for Neurology & Neurosurgery, London, UK |
| 01/99-12/01 | Visiting Scholar | Psychology | Stanford University |
| 07/99-06/01 | Research Fellow | Radiology | Stanford University Medical Center |
| 07/01-06/02 | Chief Resident | Neurosurgery | Brigham & Women's Hospital (BWH) and Children's Hospital Boston (CHB) |
| 09/02-12/02 | Congress of Neurological Surgeons Dandy Fellow | Functional Neurosurgery | Centre Hospitalier de Grenoble, France |
| 09/15-05/16 | | Leadership | Harvard Business School Boston, MA |

Faculty Academic Appointments

| | | | |
|-------------|---------------------|--------------|--|
| 02/03-06/05 | Instructor | Surgery | Harvard Medical School (HMS), Boston, MA |
| 07/05-08/10 | Assistant Professor | Surgery | HMS |
| 07/08-08/10 | Assistant Professor | Radiology | HMS |
| 09/10-09/13 | Associate Professor | Surgery | HMS |
| 09/10- | Associate Professor | Radiology | HMS |
| 10/13-10/16 | Associate Professor | Neurosurgery | HMS |
| 10/16- | Professor | Neurosurgery | HMS |
| 06/17- | Professor | Radiology | HMS |

Appointments at Hospitals/Affiliated Institutions

| | | | |
|-------------|--|-------------------------|-------------------------------------|
| 01/03- | Associate Surgeon | Neurosurgery | BWH |
| 03/05-09/08 | Research Associate | Radiology | BWH |
| 09/08- | Radiology Associate | Radiology | BWH |
| 2012- | Attending | Surgical Neuro-Oncology | Dana Farber Cancer Institute (DFCI) |
| 2/17- | Haley Distinguished Chair in the Neurosciences | | BWH |

Other Professional Positions

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|-------|--------|---|
| 2008- | Member | Brigham Research Institute, Neuroscience Research Center, BWH, Boston, MA |
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Major Administrative Leadership Positions

Local

| | | |
|-------|--|-----|
| 2007- | Director of Image-Guided Neurosurgery | BWH |
| 2009- | Co-Director, Clinical fMRI Service | BWH |
| 2011- | Clinical Co-Director Advanced Multi-modality Image-Guided OR (AMIGO) | BWH |
| 2015- | Co-Director Advanced Multi-modality Image-Guided OR (AMIGO) | BWH |

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|-------|---|-----|
| 2011- | Program Director, Image-Guided Neurosurgery Fellowship | BWH |
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National and International

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|------|---------------|--|
| 2012 | Session Chair | 9 th International Interventional MRI, Boston, MA |
| 2017 | Session Chair | Intraoperative Imaging Society, Hannover, Germany |

Committee Service

Local

| | | |
|-----------|--|--|
| 2005-2008 | OR Capital Committee | BWH |
| 2005-2011 | BWPO Physician's Council | Brigham & Women's Physicians Organization (BWPO) |
| 2005-2008 | fMRI Steering Committee | BWH |
| 2006- | Brigham Research Institute Neurosciences Working Group | BWH |
| | | 2006- Member |
| | | 2011- Co-Director |
| 2008 | Clinical MRI Oversight Committee, | BWH |
| 2008-2010 | Neurosciences Institute Clinical Working Group | BWH |
| 2009-2012 | Imaging Research Working Group | DFCI and BWH |

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|-------|---|-----|
| 2011- | Biomedical Research Institute Oversight Committee | BWH |
| 2013- | Clinical Investigation Committee | BWH |
| 2011- | BRI Center/Program leaders (BRICP) | BWH |
| 2017- | BWPO Board of Trustees | BWH |
| 2017- | Plastic Surgery Division Chief Search committee | BWH |

Regional

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National and International

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|------|--|--|
| 2013 | Thesis Defense Committee (Ph.D – Amyric Stamm) | Institut National de Recherche en Informatique et en Automatique, (INRIA) Rennes, France |
| 2016 | Advisory Board | Horizon2020 project EDEN 2020 (Enhanced Delivery Ecosystem for Neurosurgery in 2020) |

Professional Societies

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|-----------|--|--|
| 1997- | Women in Neurosurgery | |
| 2001-2010 | Cognitive Neuroscience Society | |
| 2001- | Society for Neuroscience | |
| 2002- | American Association of Neurological Surgeons (AANS) | |

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|-----------|---|----------------------------|
| 2003- | American Epilepsy Society | |
| 2005-2008 | Société de Neurochirurgie de Langue Française | |
| 2006- | Congress of Neurological Surgeons | |
| 2006-2010 | International Brain Mapping & Intra-Operative Surgical Planning Society | Member, Board of Directors |
| 2009- | Joint Section on Tumors, CNS/AANS | |
| 2010- | American Association of Neurology Guideline Development Subcommittee: Use of fMRI in the Presurgical Evaluation of Patients with Epilepsy | |
| 2012- | Medical Image Computing and Computer Assisted Intervention Society (MICCAI) | |
| | | 2012 Conference Organizer |
| | | 2014 Conference Organizer |
| 2015- | Intra-operative Imaging Society | Member |

Grant Review Activities



| | | |
|-----------|---|--|
| 2004- | NIH Mail Reviewer | National Institute of Health, Washington, DC |
| | | 2004 Reviewer |
| | | 2010 Reviewer |
| | | 2012-2015 Reviewer |
| 2004-2005 | NIH Biomedical Imaging Technology Study Section | National Institute of Health, Washington, DC Ad Hoc Member |
| 2008-2010 | Review Section | Center for Integration of Medicine and Innovative Technology (CIMIT) Reviewer |
| 2008 | Neurofibromatosis Research Integration Panel | Department of Defense Ad hoc Member |

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| 2010-2011 | Neuroprosthesis Small Business Study Section | NIH Neurophysiology, Devices, Auditory Devices Ad Hoc Member |
| 2010-2015 | BWH Institute for the Neurosciences | BWH, Boston, MA Reviewer |
| 2010-2014 | NIH (varied study sections) | National Institute of Health, Washington, DC Mail Reviewer |
| 2015 | NIH Director's Program | National Institute of Health, Washington, DC Mail Reviewer |
| 2016 | Neuroprosthesis Small Business Study Section | NIH Neurophysiology, Devices, Auditory Devices Ad Hoc Member |
| 2016 | NIH US-China Program for Collaborative Biomedical Research | Reviewer |
| 2018 | NIH ZRG1 SBIB- Z (03) | Reviewer |

Editorial Activities

Ad hoc Reviewer

Neurosurgery
 Neurology
 Epilepsia
 Brain
 Brain and Language
 Cerebral Cortex
 Radiology
 Cognitive Neuropsychology
 Hippocampus
 IJMRCAS
 Brain and Behavior Research
 Human Brain Mapping
 Expert Review of Medical Devices
 NeuroImage
 NeuroImage: Clinical
 Neuroscience Letters
 PLoSOne
 Frontiers in Human Neuroscience
 Journal of Neuro-oncology
 Epilepsy and Behavior
 Journal of Neuroscience Methods
 Journal of Neurosurgery
 Journal of Neurology
 Journal Watch Neurology

Journal of Neuroimaging
 Journal of Neurology, Neurosurgery and Psychiatry
 World Neurosurgery
 Canadian Journal of Experimental Psychology
 IEEE Transaction on Medical Imaging
 Journal of Alzheimer's Disease
 Journal of Neuroscience Methods
 JAMA Surgery

Other Editorial Roles

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|-------|------------------|--|
| 2006- | Editorial Board | Brain Imaging and Behavior |
| 2009- | Associate Editor | Neurosurgery |
| 2015- | Editorial Board | Journal of Neuroimaging |
| 2015- | Editorial Board | Journal of Cancer Translational Medicine |
| 2015- | Editorial Board | NeuroImage: Clinical |
| 2016 | Guest Editor | Neurosurgical Focus |

Honors and Prizes

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|------|--|--|
| 1985 | National Merit Scholar | Yale University |
| 1985 | Scholl Foundation Scholarship | Yale University |
| 1991 | Stanford Medical Scholars Program | Stanford University |
| 1991 | Foreign Traveling Scholars Program | Stanford University |
| 1992 | Emge Traveling Scholars Program | Stanford University |
| 1992 | Foreign Language Area Studies Fellowship | US Department of Education, Stanford University |
| 1993 | Student Scholarship in Cerebrovascular Disease | American Heart Association |

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| 1998 | Henry Newman Award | San Francisco Neurological Society |
| 1999 | National Research Service Award, 1 F32 NS10925-01 | National Institutes of Health |
| 2002 | Dandy Clinical Fellowship | Congress of Neurological Surgeons |
| 2008 | Young Clinician Award | CIMIT |
| 2010-2011 | Inaugural Recipient, New Investigator Award | Klarman Family Foundation, BWH, Boston, MA |
| 2011 | Partners in Excellence Team Award | Partners Healthcare |
| 2014 | Winner, Clinical Innovation Day | BWH |
| 2015 | Partners in Excellence Team Award | Partners Healthcare |

Report of Funded and Unfunded Projects

Funding Information

Past

| | |
|-----------|---|
| 1995-2012 | Image-Guided Therapy NIH-NCI / P01-CA67165 Project 1 Leader (PI: Jolesz) The long-term objective of the application is to provide the scientific, medical, and technical infrastructure for the development of interventional and intraoperative MRI for the treatment of brain and prostate cancer. Project 1: develop computational methods that account for anatomical changes during neurosurgical intervention and optimize the frequency of serial imaging |
| 1999-2001 | Functional MRI of Memory in Temporal Lobe Epilepsy NIH / F32 PI This study was one of the first to use fMRI to localize and lateralize memory function in patients undergoing anterior temporal lobectomy for medically refractory epilepsy. |
| 2003-2010 | Functional Imaging for Neurosurgical Planning Brain Science Foundation |

- PI
This study aimed to translate fMRI from a technique used in neuroscientific studies of groups of subjects to a tool to be used in individual patients for surgical planning. fMRI was collected and compared against clinical gold standards.
- 2003-2005 Functional imaging and electrocorticography-guided surgery in the motor cortex
BWH Institute for the Neurosciences
PI
This project aimed to develop and validate fMRI as a tool for motor mapping in patients with tumors or epileptogenic foci in the motor cortex.
- 2004-2009 Brain Basis of Memory Studied by fMRI & Intracranial EEG
NIH / K08 NS48063-01
PI
This study aims to use multiple brain mapping techniques to better understand the neuroanatomical basis of human declarative memory.
- 2007-2011 Intracranial EEG system for the intraoperative MRI
CIMIT / Massachusetts General Hospital (USAMRAA Agreement)
PI
The goal of this study is to develop simultaneous intracranial EEG and MRI recordings in intraoperative MRI.
- 2009-2010 A Hybrid Optic-Electromagnetic Surgical Tool Tip Tracking System for Neurosurgery
CIMIT
PI
The major goal of this project is to develop a hybrid system for intra-operative neuronavigation which capitalizes on the complementary strengths of optical and electromagnetic localization and mitigates their respective weaknesses.
- 2009-2010 A Robot-Guided Positron-Probe System for Tumor Resection with Enhanced Accuracy at the Surgical Margins
Harvard Catalyst Pilot Grant
Co-PI
This collaborative project with radiology and nuclear medicine aimed to develop a protocol for using a handheld probe to detect residual tumor deposits during brain surgery.
- 2009-2015 Image Registration for Ultrasound-Based Neurosurgical Navigation
NIH-NIBIB / R01CA138419
Co-Investigator (PI: Wells)
This project aims to construct registration algorithms for neurosurgical navigation and deliver them to the research and commercial community in an open source toolkit. These capabilities may eventually lead to improved outcomes in tumor resection.
- 2010-2011 Semi-Automatic Identification of Neurosurgically Important White Matter Tracts Using fMRI + DTT Atlas

Brain Science Foundation

PI

In this project we will harness emerging methods to improve the sensitivity and specificity of fMRI and DTI for delineation of functional organization in individual patient brains.

2010

Validation of a positron probe in glioma surgery

Brigham Radiology Research and Education Foundation

PI

This project aimed to deploy the handheld beta probe we have been developing in both phantoms and in human surgical specimens.

2011-2014

Rapid Analysis of intraoperatively acquired DTI for identification of key white matter tracts
NIH-NCI / R21 CA156943

Co-PI

The goal of this project is to quickly provide an updated accurate map of the brain's white matter connections to the neurosurgeon during brain surgery. We will develop a software system which uses anatomic and functional landmarks in an individual patient brain to help localize critical white matter tracts based on intra-operative Diffusion Tensor Imaging.

2012-2014

Pre-surgical Language Mapping with fMRI using a natural viewing condition

NIH NINDS R21NS075728-02

PI (\$215,316)

The aim of the proposed research is to develop a novel, robust, and easy to perform and administer fMRI paradigm using a natural viewing condition and an associated analysis strategy for pre-surgical language mapping. This approach will be applied and validated in neurosurgical patients for practical clinical application.

Current

2000-2018

Multidisciplinary Training in Image-guided Therapy (IGT) at the Brigham and Women's Hospital

5R25CA089017-12

Faculty (PI: Fennessy)

The Image-Guided Therapy Fellowship, provides a unique program to allow for the expansion and learning of image guided therapy of cancer for the broad healthcare community. Image-guided therapy of cancer requires the training of medical doctors and scientists, who can work with the complex advanced technology that can diagnose, localize and treat tumors in the same clinical setting. By providing multidisciplinary training to many different individuals, we can expand the pool of experts with new treatment modalities in IGT across other centers and various clinical settings.

2003-2018

Neuroimaging Training Program

T32-EB001680-10

Faculty (PI: Rosen)

The Neuroimaging Training Program (NTP), funded by a grant from the National Institute of Biomedical Imaging and Bioengineering, provides a cohesive curriculum and

topic-specific mentorship for PhD students focused on neuroscience and biomedical imaging.

- 2005-2020 National Center for Image Guided Therapy
NIH/NCRR, NIBIB / P41EB015898
Neurosurgery Core Leader (Tempany) (\$421,583)
The primary goal of our proposed P41 program is to use imaging to improve target definition, localization and targeting of diseased tissue and using image guidance to optimize treatments, improving outcomes and decreasing invasiveness. In the next cycle, we propose to address open challenges in image-guided therapy (IGT) related to ill defined target definition, inaccurate localization and targeting.
- 2012-2016 Transforming Brain Tumor Surgery through Coherent Raman Microscopy
Harvard Catalyst / UL1 RR 025758
PI (\$350,000)
The goal of this project is to show that SRS imaging is a reliable method for evaluating surgical specimens for the presence of tumor and to yield a workflow in which SRS imaging data could be rapidly analyzed to generate a probability for the presence of tumor in a region of interest.
- 2013-2018 MRI-guided focused ultrasound for drug delivery and ablation of brain tumors.
NIH/NCI / 1P01CA174645-01
Co-Investigator (PI: McDannold)
The major goal of this project is to develop non-thermal applications of MRgFUS for the non-invasive treatment of brain tumors using image guided drug delivery or non-thermal tissue ablations. The main objective is to bring these potentially high-impact FUS technologies from the laboratory to pre-clinical stage.
- 2014-2016 CTA: Surgical Object Optical Tracking System
Koh Young Technology
Co-PI
Our goal is to develop and clinically validate novel neuro-navigation system applying Koh Young's newly developed optical tracking sensor with less line-of-sight issues than the currently available products in the market.
- 2014-2019 Multimodal Registration of the Brain's Cortical Surface
Vanderbilt University / NINDS R01NS049251
Co-PI
Our goal is to collect intra-operative MRI and cortical surface clinical data in order to quantitatively evaluate a low-cost deformation correction approach for image-guided brain tumor resection.

- 2015-2017 Resting-state fMRI for Language Mapping in Brain Tumor Patients
NIH-NCI / 1R21CA198740-01
Contact PI: (Golby/Tie)
The goal of this project is to develop an improved method to map critical language areas in brain tumor patients using functional Magnetic Resonance Imaging (fMRI) to help neurosurgeons perform more effective and safer brain surgeries.
- 2015-2020 Stimulated Raman imaging for label-free histology to guide brain tumor surgery
NIH K99 EB020749-01
Primary Mentor (PI: Fake Lu)
This NIH Pathway to Independence Award (K99/R00) seeks support to advance the candidate's career and the research project aimed to establish the methodology and practice for label-free histopathology with Stimulated Raman imaging (SRI) for brain-tumor diagnosis, and ultimately develop it into a clinical device for ambient SR imaging of fresh tissue in the operating room in real time.

Report of Local Teaching and Training

Teaching of Students in Courses

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| 2009 | Introduction to Surgical Brain Mapping 3 rd and 4 th year Medical Students | Harvard Medical School One session per course |
| 2010-2016 | Neuroanatomy Course 1 st /2 nd year Medical Students | Harvard Medical School One session per course |

Clinical Supervisory and Training Responsibilities

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| 2004-2005 and 2013 | Instructor, 1 Medical Student / Harvard Medical School, Pasteur Program | 100 hours per year |
| 2003- | Clinical Supervisor & Mentor, Neurosurgery Resident Training Program | 4 hours per week |

Laboratory and Other Research Supervisory and Training Responsibilities

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|-------|--|--------------------|
| 1992 | Teaching Assistant in Neurobiology and Neuroanatomy for 20 Graduate Students / Stanford University School of Medicine | 100 hours per year |
| 2003- | Supervisor, Variable medical students, undergraduate and graduate | 200 hours per year |

students, residents and 2-3 post-doctoral fellows / Golby Lab, Brigham & Women's Hospital

Formally Supervised Trainees

- 2003-2004 Ian Johnson, MD / Neurosurgeon, Central California Faculty Medical Group Medical Director, University Neurosciences Institute Clinical Instructor, UCSF Spent research year in laboratory. Investigating sensori-motor mapping. Findings presented with oral presentations.
- 2003-2004 Kyle Knierim, M.D. / UNC Chapel Hill, Attending in Family Medicine at University of Colorado. Research Assistant/Lab manager. Co-Author 3 peer reviewed publications.
- 2003-2005 Hillary Rolls, MD, / Instructor in Radiology, HMS, MGH Radiology Assistant Radiologist, MGH, Assistant Radiologist, MEEI Medical student researcher. First author one peer reviewed publication regarding functional localization.
- 2003-2005 Daniel Branco, M.D./ MBA Wharton School of Business, University of Pennsylvania Strategic Planning Manager, Hospital Israelita Albert Einstein São Paulo, Brazil Founder of DM Branco and a healthcare business specialist for PwC and Angra Partners, a Sao Paulo-based private equity fund. Post-doctoral student, investigating fMRI for memory mapping in surgical patients. 1st author in one publication, co-author in one publication
- 2003-2006 James O'Shea, Ph.D. / Engineering Specialist -- Software Development, Albany Engineered Composites, Graduated from UC Berkeley in 2012 Programmer, research assistant. Developed method for importing functional data into the operating room. Developed method for localization of subdural electrodes located beyond the craniotomy. 1st author in publication and co-author in four publications.
- 2003-2004 Nicole Petrovich Brennan B.S. / Department of Radiology, Memorial Sloan Kettering Cancer Center. Neurodiagnostic fMRI specialist. Researcher in laboratory. 1st author on 1 publication and co author on 1 publication.
- 2004 David Wallace, Ph.D. / Student at Vanderbilt Undergraduate Student who worked as a student-in-research for the summer.
- 2004 Gregory Walker./ General Surgery/ Medical student University of British Columbia Undergraduate Student who worked in research.
- 2004-2008 Steven Whalen / Research Administrator, Radiology Boston Children's Hospital Lab manager/Research Assistant. Learned fMRI acquisition and analysis. Co-author on 16 manuscripts

- 2004-2009 Ralph Suarez PhD / Instructor in Radiology at Boston Children's Hospital
Research Associate in Radiology, Instructor in Radiology, Harvard Medical School
Post doctoral fellow, investigated lateralization of language function metrics in healthy subjects and patients with epilepsy or brain tumors. Investigated brain organization of music versus language processing. 1st author for two publications and co-author for five.
- 2005-present Yan Mei Tie, Ph.D./ Instructor in Neurosurgery HMS, Research Associate, Department of Neurosurgery, Brigham and Women's Hospital
Post-doctoral Fellow, Instructor, investigating novel methods for functional mapping of language with fMRI. Directly supervised for nearly 10 years. Three 1st author papers and three co-author papers. Awarded MHS Shore Fellowship. Co-PI on pending R21 with impact score of 20, percentile 6.
- 2005 David Hwang, M.D/ Neurocritical Care, Assistant Professor of Neurology, Staff Neurointensivist at YNHH Neuroscience Intensive Care Unit
HMS student. Under my supervision researched and wrote review article on memory localization in the brain.
- 2005-2006 Malti Sharma, R.N, BSN./ Clinical Research Nurse at Boston Medical Center
Teaching Assistant at MGH Institute of Health Professions
Undergraduate at Boston University summer student in laboratory, presentations at DFCI, and CURE program.
- 2006- Lauren O'Donnell, Ph.D./ Assistant Professor in Radiology at HMS and BWH
Post-doctoral Fellow promoted to Instructor and to Assistant Professor. Investigations of diffusion tensor imaging, particularly analytic strategies for application to brain tumor patients. Seven 1st author publications, co-PI on NIH funding, with numerous other presentations.
- 2006-2007 Monica Lemmond. M.D./ Pediatric Neurology Resident at Johns Hopkins
HMS Medical student, Pasteur fellow on HMS in laboratory. Investigated scalar measurements of tracts.
- 2006 Karen Buch, M.D./ University of Massachusetts Worcester, MA graduated 2010
Research Fellow at Boston VA (Traumatic brain injuries) 2013-present
Medical student summer researcher. Investigated metrics for assessing memory lateralization using fMRI.
- 2006 Georgia Wells / Multimedia producer, the Wall Street Journal.
Summer student in laboratory.
- 2007 Rebecca Moore
Medical student at Tulane University Medical School in New Orleans
Summer student in lab.

- 2007-2008 Michelle Monje Deisseroth / Assistant Professor of Neurology and Neurosurgery of Pediatrics and Pathology, Chair of Brainstem Glioma Working Group, Pediatric Brain Tumor Consortium 2013
Neurology Resident performed research in lab and co-investigator on BWH grant. Investigated effect of childhood cranial irradiation on memory function in hippocampus.
- 2007-2009 Aliréza Râdmanésh M.D. / Resident in Radiology Washington University in St. Louis. Research Assistant studying DTI of motor system.
- 2008-2009 Jean Jacques Lemaire, M.D., / Neurosurgeon (senior practitioner), University Hospital of Clermont-Ferrand, Professor of Neurosurgery (since 1995), Auvergne University, in France. Head of the Department of Neurosciences at Clermont-Ferrand University Hospital, France
Visiting research sponsored by home institution learning advanced DTI/fMRI for clinical applications. Results published in joint authored peer reviewed publication.
- 2008-2010 Wentao Wu, M.D. / Neurosurgeon, West China Hospital, Sichuan University
Visiting postdoctoral researcher sponsored by home institution. Studied visual system white matter using DTI, 1st author publication. Now Director of Advanced Imaging Laboratory at Department of Radiology, West China Hospital, Sichuan University.
- 2008-2010 Sargent Shriver, B.S., Doctoral Student. Temple University, University of Pennsylvania MS, Statistics, Measurement, Assessment, and Research Technology
2013 – 2015 (expected)
Research Assistant. Investigated passive movement paradigm for motor mapping in patients. 1st author one publication. Co-author 1 publication.
- 2009-2010 Lijun Hou, M.D., Vice-chairman, Professor of Neurosurgery, Shanghai Changzheng Hospital, Shanghai, China
Visiting researcher sponsored by home institution. Learning advanced imaging and brain mapping.
- 2009-2010 Nina Walker B.A./ Colgate University Bachelor of Arts (B.A.), History
Summer student in laboratory for 2 years.
- 2009-2010 Carl Glaser / Biophysics, Perelman School of Medicine University of Pennsylvania 2014
Summer student in laboratory under DFCI CURE program. Oral presentation of work.
- 2010 Jolia Raymond B.S. / Tulane University, Neuroscience and Psychology 2013
Social Worker New Orleans, Louisiana
Summer student in laboratory
- 2010 Naveed Jooma Master of Science (M.Sc.), Software Engineer at Pymetrics June 2014
at Brown University Bioengineering and Biomedical Engineering 2013-2014
Brown University undergraduate student
- 2011-2012 Jillian Plonsker B.S./ Rush Medical College of Rush University Medical Center
2013 – 2017 (expected)

- University of Michigan, Neuroscience 2012
Worked with data relating to brain changes in patients undergoing face transplant.
- 2011-2012 Feysal Said / Brandeis University 2013 – 2018 (expected)
Summer student in DFCI CURE Program for two years
Learning fMRI (2011) and DTI (2012) and prepared a case study.
- 2011 Michael Hughes / Harvard College class of 2015
Summer student prior to entering Harvard College. Investigated laterality changes of language organization in patients with epilepsy
- 2011 Eugenia White/ Louisiana State University School of Medicine in Shreveport
Doctor of Medicine (M.D.) 2013 – 2017 (expected)
Wellesley College BA 2013 Honors in Chemistry
Investigated fMRI language maps in bilingual patients with brain tumors. Presented poster at ASFNR
- 2011-12 Jialong Cui, Ph.D. / Postdoctoral Research Fellow Harvard Medical School
The University of Hong Kong 2009 – 2013, summer student in laboratory working on DTI/fMRI atlas construction.
- 2011-2012 Daniel Orringer, MD / Assistant Professor of Neurosurgery at University of Michigan
Image Guided Neurosurgery Fellow. Helped to develop workflow in AMIGO. Helped to build collaboration with Professor Sunney Xie at Harvard Department of Chemistry.
Investigated intraoperative imaging. Investigated use of Raman spectroscopy for label free imaging of brain tumor specimens.
- 2011 Ahmed El-Beltagi, MD / Neuro-Radiologist from Kuwait. Consultant Neuroradiologist
Al-Sabah Med. Complex.
Visitor to laboratory to learn clinical fMRI
- 2012-2013 Ilyss Hamdi M.S./ MA, Bioimaging (candidate) - Boston University School of Medicine
MS, Computer Science - Boston University, BSE, Electrical Engineering - Suffolk University
Developed software for translation of advanced tractography tools.
- 2012 Fabio Grassia M.D. / Medical Doctor at Catania Guardia Medical
University of Catania Medicine and Surgery Doctor of Medicine 2013, HMS Armenise Foundation funded summer student.
- 2012 Ting Liu / Neuroradiologist, China
Master of Science, Stanford University, BIOM-MS Ph.D. student in Biomedical Informatics
- 2012-2013 Emam Saleh, MD. / Neurosurgeon, Functional Neurosurgery Fellow at Ohio State
Clinical fellow in Image-Guided Neurosurgery. Development of AMIGO Protocols.
Co-author on two publications.

- 2012-2014 Aysegul Ozdemir Ovaluiglu M.D. / Istanbul University, Cerrahpasa School of Medicine (Eng.) Doctor of Medicine (MD), Neurosurgery
Postdoctoral Research Fellow-Harvard Medical School, Turkish Neurosurgical Society funded research fellowship. Investigated utility of fMRI in high grade glioma.
- 2012-2014 Olutayo Olubiyi MD, MPH / Medical School Obafemi Awolowo University Ife 2008
MPH degree from Harvard School of Public Health in 2013
Student in research, later Research Assistant
- 2012 Galia Tsarfaty M.D. / Radiologist at Sheba Medical Center, Israel
Visiting radiologist from Israel learning presurgical brain mapping techniques
- 2012-2013 Fatih Incekara / Editorial Board Member at Erasmus Journal of Medicine
Medical Student at Erasmus MC
- 2013-14 Parviz Dolati, MD / Clinical Fellowship BIDMC Brain Aneurysm Institute
Clinical Fellow in Image-Guided Neurosurgery.
- 2013- 2014 Jarlin Perez. / Senior at John D. O'Bryant School of Math and Science, Roxbury MA
DFCI CURE Summer Student
- 2013 Jacqueline Matczak, B.S. / Simmons College, Senior
Neuroscience and Behavior & Public Health, summer student
- 2013 Liesl Matzka / Associate of Arts from Oxford College of Emory University in Atlanta, Ga.in 2013
Summer student
- 2013-2014 (Jerry) Zhenrui Chen M.D. / Graduated from Southern Medical University, Guangzhou, in 2007
Ph.D. student in laboratory investigating diffusion imaging for white matter mapping. Several 1st authors' manuscripts.
- 2014 William Liu / High school Junior-Buckingham Brown & Nichols
Summer student in laboratory learning presurgical brain mapping. Observed surgery in AMIGO.
- 2014 Marine Coste / Undergraduate at Northwestern University
Summer student in laboratory learning presurgical brain mapping. Observed surgery in AMIGO.
- 2014 Arielle Silbersweig / Matriculated at Amherst College
Summer student in laboratory learning presurgical brain mapping. Observed surgery in AMIGO.
- 2014-2016 Rahul Sastry B.S. / Harvard Medical School Doctor of Medicine 2017 (expected)
Stanford University BS, Mechanical Engineering 2013

- HMS Scholar in Medicine Student. Investigated 3D reconstruction of intraoperative US. Presented poster at Soma Weiss day and contributed material to other presentations.
- 2014-2015 Daniel Green Eichberg / Medical Student at University of Maryland
Visiting student. Participated in clinical outcomes research regarding image guided neurosurgery. Co-author on several papers and abstracts. Applying to neurosurgery resident match.
- 2014 Cassandra Marie Chruscielski / Sophomore at Emmanuel College
Spring Internship in laboratory.
- 2014 Neshalette Marcs / Senior undergraduate at Simmons College
Student internship in the laboratory.
- 2014- Fake (Frank) Lu, Ph.D./ Post-doctoral Fellow investigating use of Raman spectroscopy for near real time tissue diagnosis to guide brain tumor surgery. Awarded K99/R00 grant with Dr. Golby as mentor.
- 2014-2015 Roy Torcuator, M.D. / Image guided Neurosurgery Fellow.
Clinical Fellow in Image-Guided Neurosurgery. Learning techniques in neuro navigation, focused ultrasound, functional brain mapping and intra-operative imaging in AMIGO. First author on book chapter and on several pending papers.
- 2014 Zeng Chun, MD / Neurosurgeron at Beijing Tiantan Hospital Beijing, China
Peking Union Medical Collage 2005
- 2014-2016 Mohammad Fakhri / Post Doctoral research fellow
Post doctoral research Fellow investigating use of fMRI in high grade glioma.
- 2014-2015 Bonnie Ferreira / Simmons College Internship Project
Student internship in laboratory
- 2015 Angela Albi. Masters student University of Trento, Center for Mind/Brain Sciences
Armenise Fellowship to study effect of field distortion on diffusion tractography.
- 2015-2016 Prashin Unadkat, M.B.B.S. Post-doctoral Research Fellow in Image Guided
Neurosurgery.
- 2015-2016 Antonio Meola, M.D./ Image Guided Neurosurgery Fellow.
Clinical and Research Fellow in Image-Guided Neurosurgery. Learning techniques in neuro navigation, diffusion tensor imaging, functional brain mapping, and intra-operative imaging in AMIGO.
- 2016 Melina More Bertotti, MD. Neurosurgeon Santa Caterina, Brazil. Observership in Image
Guided Neurosurgery.
- 2016 Habiba Noamany, rising freshman at Massachusetts Institute of Technology. DFCI
CURE (Continuing Umbrella of Research Experiences) summer student.

- 2016 Claire Karekezi, MD. Neurosurgeon, Rabat, Monaco and Kigali, Rwanda. Observership in Neurosurgery funded by the AANS 2016 International Visiting Surgeon Fellowship.
- 2016, 2017 Luca Fumagalli. Medical Student University of Milano-Bicocca. Summer internship in laboratory (2016) and medical school thesis project in laboratory (2017)
- 2017 Laura Leung: MBChB Medicine, The Chinese University of Hong Kong September
- 2017 Maria Kristine Mendoza, MD (Observer) Radiologist at St. Luke's Medical Center: Global City, Taguig, Metro Manila, Philippines
- 2017 Ron C. Pilotin, MD (Observer) Radiologist at St. Luke's Medical Center: Global City, Taguig, Metro Manila, Philippines
- 2017 Rayna Hata: The Rivers School: High School Sophomore
- 2017 Karena Groff - Weston High School 2018
- 2017 Sophie Gibson -University of Vermont 2020
- 2017 Morgane Bonnevey, Paris Descartes University
- 2017 Joanne Charles: (Dana Farber CURE Program) John D. O'Bryant High School 2017 (Matriculated at Boston University)
- 2016-17 Walid Ibn Essayed, MD. Clinical and Research Fellow in Image Guided Neurosurgery Learning techniques in neuro navigation, diffusion tensor imaging, functional brain mapping, and intra-operative imaging in AMIGO.
- 2017-18 Melina More Bertotti, MD. Clinical and Research Fellow in Image Guided Neurosurgery Learning techniques in neuro navigation, diffusion tensor imaging, functional brain mapping, and intra-operative imaging in AMIGO. Attending neurosurgeon Hospital Infantil Joana de Gusmão

Formal Teaching of Peers (e.g., CME and other continuing education courses)

No presentations below were sponsored by outside entities

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| 2004-2009 | "CT/MR Update" BWH Department of Radiology | Lecture Boston, MA |
| 2006-2009 | Lecture on presurgical and intra-operative brain mapping "Tumors of the Central Nervous System" BWH, MGH, HMS, DFCI | Lecture Boston, MA |
| 2007 | Brain Mapping in Surgical Management of Gliomas | Lecture |

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| | International Workshop on Glioma Research and Therapy | Boston, MA |
| 2004 | “Functional Imaging in Neurosurgery” DFCI/BWH Multidisciplinary Neuro-Oncology Conference | Lecture Boston, MA |
| 2010 | “Image and function guided Neurosurgery” DFCI/BWH Multidisciplinary Neuro-Oncology Conference | Lecture Boston, MA |
| 2011 | “Image-guided Neurosurgery in the AMIGO Suite” DFCI/BWH Multidisciplinary Neuro-Oncology Conference | Lecture Boston, MA |
| 2012 | “AMIGO: Operating Room as a Transitional Research Laboratory” DFCI/BWH Multidisciplinary Neuro-Oncology Conference | Lecture Boston, MA |
| 2013 | “Tumors of the CNS: Practical Advances in the Care of Primary and Metastatic Brain Tumor Patients” Dana-Farber Cancer Institute | Lecture Boston, MA |
| 2013 | Advanced Multimodality Image Guided Operating Suite BWH Research day | Boston, MA |
| 2013 | Neuronavigation Pearls and Pitfalls BWH Neurosurgery Grand Rounds | Lecture Boston, MA |

Local Invited Presentations

No presentations below were sponsored by outside entities

| | |
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| 2003 | “Structural and Functional Image-guided Neurosurgery” / Grand Rounds Department of Neurosurgery, Brigham & Women’s Hospital, Boston, MA |
| 2004 | “Functional MRI: Update and New Directions” / Grand Rounds Department of Neurosurgery, Brigham & Women’s Hospital, Boston, MA |
| 2004 | “Mapping the Human Brain” / Seminar Series Behavioral Neuroscience Seminar, Harvard Medical School, Boston, MA |
| 2005 | “Functional Imaging in Brain Tumor Surgery” / Grand Rounds Department of Neurosurgery, Brigham & Women’s Hospital, Boston, MA |

- 2005 "Functional Brain Mapping for Epilepsy Surgery" / Lecture
Epilepsy Teaching Conference, Brigham & Women's Hospital, Boston, MA
- 2005 "Neurosurgical Brain Mapping" / Grand Rounds
Department of Neurosurgery, Brigham & Women's Hospital, Boston, MA
- 2006 "Function and Image-Guided Neurosurgery" / Forum
CIMIT Forum, Massachusetts General Hospital, Boston, MA
- 2007 "Brain Imaging and Pre-operative Planning" / Speaker
Meningioma Awareness Day, Brigham & Women's Hospital, Boston, MA
- 2009 "Brain Imaging and Pre-operative Planning" / Speaker
Meningioma Awareness Day, Brigham & Women's Hospital, Boston, MA
- 2009 "Clinical fMRI: Presurgical brain mapping" / Lecture
Radiology Resident Teaching Conference, Brigham & Women's Hospital, Boston, MA
- 2010 "Functional and Structural Imaging to Optimize Brain Tumor Resection" / Forum
CIMIT Forum, Massachusetts General Hospital, Boston, MA
- 2010 "Structure and Function Guided Neurosurgery" / Grand Rounds
Department of Neurosurgery, Brigham & Women's Hospital, Boston, MA
- 2010 "Current and future imaging techniques for neurosurgical planning and intra-operative decision making" / Speaker
Meningioma Awareness Day, Brigham & Women's Hospital, Boston, MA
- 2010 Demystifying Promotions Seminar / Panelist
BWH Office of Faculty Development and Diversity, Brigham & Women's Hospital, Boston, MA
- 2010 "Introduction to Surgical Brain Mapping" / Lecture
Epilepsy Research Conference, Boston Children's Hospital, Boston, MA
- 2011 "Neurosurgery in the AMIGO Suite" / Grand Rounds
Department of Anesthesia, Brigham & Women's Hospital, Boston, MA
- 2012 "Current and future imaging techniques for neurosurgical planning and intra-operative decision making" / Speaker
Meningioma Awareness Day, Brigham & Women's Hospital, Boston, MA
- 2012 Brigham Research Day Symposium / Moderator
Brigham Research Institute, Brigham & Women's Hospital, Boston, MA
- 2012 "Neurosurgery in the AMIGO Suite" / Grand Rounds
Department of Neurosurgery, Brigham & Women's Hospital, Boston, MA

- 2012 “Living with Brain Tumors: Focus on Gliomas” / Lecture
Center for Neuro-Oncology, Dana-Farber Cancer Institute, Boston, MA
- 2012 “Entering the Mind Zone” / Lecture
Neuroscience Nursing Conference, Brigham & Women’s Hospital, Boston, MA
- 2013 “A users guide to Neuro-navigation & Image guidance” / Grand Rounds
Department of Neurosurgery, Brigham & Women’s Hospital, Boston, MA
- 2013 “Advanced Imaging: Imaging in Neuroscience for Clinical/Translational Research”/
Lecture
Harvard Catalyst, Cambridge, MA
- 2013 “AMIGO translational research laboratory” / Grand Rounds
Department of Surgery, Brigham & Women’s Hospital, Boston, MA
- 2013 Innovation Grand Rounds / Panelist
Brigham Research Institute, Brigham & Women’s Hospital, Boston, MA
- 2014 “Developing image guided neurosurgery approaches for brain tumor surgery” / Grand
Rounds
Harvard Joint Program in Nuclear Medicine, Harvard Medical School, Boston, MA
- 2014 “Neuro-Imaging” / Lecture
Brigham Research Institute, Brigham & Women’s Hospital, Boston, MA
- 2015 AMIGO: An OR lab for developing novel surgical approaches. Anesthesia Grand Rounds.
BWH, Boston, MA.
- 2017

Report of Regional, National and International Invited Teaching and Presentations

[Invited Presentations and Courses](#)

No presentations below were sponsored by outside entities

Regional

- 2003 “Functional MRI Investigations of Memory” / Grand Rounds
Memory Disorders Research Center, Boston University School of Medicine, Boston, MA
- 2005 “Epilepsy Surgery: Update and Future Directions” / Lecture
Boston Chapter of Neuroscience Nurses, Boston, MA
- 2007 “Functional and Structural MR-Guided Neurosurgery” / Lecture
New England Chapter, International Society for Magnetic Resonance in Medicine,
Boston, MA

- 2010 “Structural and functional image-guided neurosurgery” / Grand Rounds
Neurosurgical Grand Rounds, Yale University School of Medicine, New Haven, CT
- 2012 “Pre-Surgical fMRI” / Lecture
Neuroimaging Center Speaker Seminar Series, McLean Hospital, Belmont, MA
- 2012 “Development of novel functional and structural imaging approaches to optimize surgery for brain tumors” / Grand Rounds
Neuroscience Grand Rounds, Tufts Medical Center, Boston, MA
- 2013 “Image-guided Neurosurgery” / Invited Lecture
Neuroscience Lecture Series, South Shore Hospital, Weymouth, MA
- 2013 “Presentation of clinical challenges and directions for neurotechnology” / Panelist
Neurotechnology Ventures, MIT, Cambridge, MA
- 2013 “Image- and Function-guided Neurosurgery” / Invited Lecture and visiting Professor
Institute for Medical Engineering and Science, MIT, Cambridge, MA
- National**
- 2005 “Pre-surgical Functional Brain Mapping” / Invited Lecture
Congress of Neurological Surgeons Annual Meeting, Boston, MA
- 2009 “Practical Clinic – Review of Brain Tumors” / Invited Lecture
American Association of Neurological Surgeons (AANS) Annual Meeting, San Diego, CA
- 2010 “Practical Clinic – Review of Malignant Brain Tumors” / Invited Lecture
American Association of Neurological Surgeons (AANS) Annual Meeting, Philadelphia, PA
- 2011 “Practical Clinic – Review of Malignant Brain Tumors” / Invited Lecture
American Association of Neurological Surgeons (AANS) Annual Meeting, Denver, CO
- 2011 “Image and Function Guided Brain Tumor Surgery” / Visiting Professor
Department of Neurosurgery, Stanford University, Stanford, CA
- 2011 “Development of novel functional and structural imaging approaches to optimize surgery for brain tumors” / Visiting Professor and inaugural speaker
Vanderbilt Initiative for Surgery and Engineering Seminar Series, Nashville, TN
- 2012 “Surgical Management of tumors in eloquent regions” / Invited Lecture (10/7/12)
Congress of Neurological Surgeons (CNS) Annual Meeting, Chicago, IL
- 2013 “Practical Clinic – Review of Malignant Brain Tumors” / Invited Lecture
American Association of Neurological Surgeons (AANS) Annual Meeting, New Orleans, Louisiana

- 2014 “Neuroimaging to optimize brain tumor resection” in Update on Malignant Brain tumors. / Lecture
American Association of Neurological Surgeons (AANS) Annual Meeting, San Francisco, CA
- 2014 “Thoughts on being a woman in neurosurgery” / Keynote Speaker
AANS/CNS Joint Section on Women in Neurosurgery, Boston, MA
- 2015 Image Guided Neurosurgery: Giving surgeons tools to optimize treatment of brain tumors. NINDS Grand Rounds Invited Speaker. NIH, Bethesda, Maryland
- 2015 “Multi-modality imaging: optimizing your imaging before surgery” in Update on Malignant Brain tumors. / Lecture
American Association of Neurological Surgeons (AANS) Annual Meeting, Washington, DC
- 2015 “Experience with transcranial focused ultrasound as Brigham and Women’s Hospital”
Focused Ultrasound Foundation workshop for FUS in treatment of glioblastoma multiforme. Charlottesville, VA
- 2016 Personalizing surgical treatment for patients with brain tumors. 2nd annual BMES/FDA Frontiers in Medical Devices Conference: Innovations in Modeling and Simulation: Patient-Centered Healthcare. Hyattsville, Maryland
- 2016 Advanced Diffusion Imaging for White Matter Tract Tracing and Identification. American Academy of Neurological Surgery. Jackson Hole, WY
- 2016 Intraoperative MRI for Neurosurgery. Invited Guest. 28th Annual Pan Philadelphia Neurosurgery Conference. Philadelphia, PA
- 2016 Pre-operative brain mapping. Invited Guest. 28th Annual Pan Philadelphia Neurosurgery Conference. Philadelphia, PA
- 2017 MR guided Focused Ultrasound Blood Barrier Disruption for Drug Delivery to Recurrent GBM. Adult Brain Tumor Consortium, Baltimore, Maryland

International

- 2006 “Multi-modality Brain Mapping for Pre- and intra-operative Image-guided Neurosurgery” / Invited Lecture
International Brain Mapping and Intraoperative Planning Society. Clermond-Ferrand, France
- 2007 “Advanced White Matter Tractography” / Invited Lecture
International Brain Mapping and Intraoperative Planning Society, Washington, DC

- 2007 “Multimodality Brain Mapping and Intra-operative Imaging for Gliomas” / Invited Lecture
International Workshop on Glioma Research and Therapy, Boston, MA USA
- 2007 “Functional and Structural MR-Guided Neurosurgery” / Invited Lecture
International Society for Magnetic Resonance in Medicine, Berlin, Germany
- 2008 “Advanced Approaches for Pre-operative Language Mapping” / Invited Lecture
International Brain Mapping and Intraoperative Planning Society, Los Angeles, CA
- 2008 “Preoperative Planning” / Invited Lecture
6th International Congress on Meningioma and Cerebral Venous System, Boston, MA
- 2009 “Neurosurgical Insights into Brain and Mind” / Keynote Speaker
Progress in Systems Biology Symposium, Ottawa Institute for Systems Biology and
National Research Council of Canada, Ottawa, Canada
- 2009 “Neurosurgical Insights into Brain Organization” / Visiting Professor
University of Calgary, Hotchkiss Brain Institute. Calgary, Canada
- 2009 “Strategies for localizing language function in patients” / Grand Rounds
University of Calgary, Department of Neurosurgery grand rounds. Calgary, Canada
- 2009 “Multi-modality Approach to the Surgery Of Gliomas in Eloquent Areas” / Invited Lecture
14th Annual Meeting of the Japanese Congress for Brain Tumor Surgery, Tokyo, Japan
- 2012 “Brain Tumor Resection in the AMIGO Suite” / Invited Lecture
9th International Interventional MRI Symposium, Boston, MA
- 2012 “Challenge on DTI tractography” / Invited Lecture
MICCAI (15th International Conference on Medical Image Computing and Computer
Assisted Intervention), Nice, France
- 2013 “Advances in Image-Guided Neurosurgery” / Invited Lecture
Tiantan Hospital Beijing, China
- 2013 “Innovation in Image-Guided Neurosurgery” / Keynote Speaker
Chinese Congress of Neuro-Oncology, Xiamen, China
- 2013 “Advanced Brain Mapping for glioma surgery” / Invited Lecture
Chinese Congress of Neuro-Oncology, Xiamen, China
- 2013 “Advances in Image Guided Neurosurgery: Development and validation of new
technology for glioma surgery” / Invited Lecture
Chinese Brain Tumor Association Meeting, Sanya, Hainan, China.
- 2014 DTI Tractography in the AMIGO Suite / Invited Lecture

DTI Challenge - 17th International Conference on Medical Image Computing & Computer Assisted Interventions, Boston MA

- 2014 “Current Role of DTI Tractography in the Clinical Practice: The Neurosurgeon’s Perspective” / Invited Lecture
DTI Challenge - 17th International Conference on Medical Image Computing & Computer Assisted Interventions, Boston MA
- 2014 “Intraoperative MRI” / Invited Lecture
Annual Congress of Neurological Surgery Society of Buenos Aires "NEUROPINAMAR 2014" Carilo City, Buenos Aires.
- 2014 “Management of High Grade Gliomas” / Invited Lecture
Annual Congress of Neurological Surgery Society of Buenos Aires "NEUROPINAMAR 2014" Carilo city, Buenos Aires.
- 2014 “Awake Mapping”/ Invited Lecture
Annual Congress of Neurological Surgery Society of Buenos Aires "NEUROPINAMAR 2014" Carilo City, Buenos Aires.
- 2014 “Cortical Mapping with fMRI” / Invited Lecture
Annual Congress of Neurological Surgery Society of Buenos Aires "NEUROPINAMAR 2014" Carilo City, Buenos Aires.
- 2014 “MR-guided neurosurgery and brain tumor laser ablation” / Invited Speaker
10th International Interventional MRI Symposium, Leipzig, Germany
- 2014 “MR-guided tumor sampling using mass spectrometry” / Invited Lecture
10th International Interventional MRI Symposium, Leipzig, Germany
- 2015 “Multi-Modality Image-guided Neurosurgery in the AMIGO Suite” / Invited Lecture
IOIS 2015 Conference, Delhi, India
- 2015 “Multi-Modality Image-guided Neurosurgery in the AMIGO Suite: Challenges and opportunities”/ Invited Lecture
Imaging and Interaction in Medical Practice - An Interdisciplinary Workshop on Image-guided Clinical Settings, Department of Neurosurgery at the Charité University Hospital, Berlin, Germany
- 2015 “Pre-operative brain mapping with fMRI and DTI” / Invited Lecture
XXV International Symposium of Neurosurgery - Cartagena Colombia
- 2015 “Intraoperative imaging and image guided therapies: laser hyperthermia and focused ultrasound” / Invited Lecture
XXV International Symposium of Neurosurgery - Cartagena Colombia
- 2015 “High Grade Glioma Surgery” / Invited Lecture

- World Federation of Neurosurgical Societies Annual Meeting, Rome, Italy
- 2015 “Treatment of recurrent gliomas” / Invited Lecture
World Federation of Neurosurgical Societies Annual Meeting, Rome, Italy
- 2015 “Non-invasive Brain mapping with fMRI and DTI” / Invited Lecture
World Federation of Neurosurgical Societies Annual Meeting, Rome, Italy
- 2015 “Image-Guided Neurosurgery”/Invited lecture
12th Meeting of the Asian Society for Neuro-Oncology, Manila, Philippines
- 2016 fMRI mapping for speech and sensorimotor function. 1st International Brain Mapping Course AANS. Chicago, IL
- 2016 “Multi-modality intraoperative imaging to guide brain tumor resection” International course Ultrasound in Neurosurgery. Norwegian National Advisory Unit for Ultrasound and Image-Guided Therapy (USIGT). Trondheim Norway
- 2016 Challenges in translating technology for neurosurgery. NCIGT Project week invited speaker. Heidelberg, Germany
- 2016 “AMIGO: a surgical innovation laboratory”. Interventional Oncology Sans Frontiers Conference. Milan Italy.
- 2016 Development and validation of intraoperative tissue biomarkers in the AMIGO suite. 11th International iMRI symposium. Baltimore, Maryland
- 2017 Development and Validation of Intraoperative Tissue Biomarkers in the AMIGO Suite. Intraoperative Imaging Society, Hannover, Germany
- 2017 Advanced functional imaging in surgery for gliomas. 6th Annual World Course in Advanced Brain Tumour Surgery, London, UK
- 2017 Invited Round table: What I have learned from my complications. 6th Annual World Course in Advanced Brain Tumour Surgery, London, UK
- 2017 Non-invasive functional brain mapping: from neuroscience to patients. Keynote speaker. 4th Iranian Congress on Human Brain Mapping, Tehran, Iran

Report of Clinical Activities and Innovations

Current Licensure and Certification

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| 1996 | California State Medical License |
| 1996 | National Board of Medical Examiners |
| 1999 | American Board of Neurological Surgery Written Examination |
| 2002 | Massachusetts Medical License |
| 2007 | American Board of Neurological Surgery Diplomate |

Practice Activities

List all clinical activities, both those at Harvard and its affiliates and those outside Harvard, and for each indicate:

| | | | |
|-----------|-------------------|-------------------|---|
| 2003- | Ambulatory Care | Neurosurgery, BWH | 1 Session per week 6 hours per session |
| 2003- | Surgery | Neurosurgery, BWH | 2 sessions per week 10 hours per session |
| 2003-2015 | Neurosurgery Call | Neurosurgery, BWH | 3-6 weeks a year |

If you have no current clinical activities, but have practiced in the past you may provide a brief (1-2 sentence) description of those prior activities

Clinical Innovations

| | |
|--|---|
| Development of pre-surgical fMRI (2003-present) | From initial faculty appointment in 2003 developed initial presurgical fMRI brain mapping including development of scanning protocols, behavioral paradigms, analysis, and quality assurance for transfer of technology to clinical realm. |
| Incorporation of fMRI into commercial neuronavigation systems (2003-2005) | Worked with commercial vendor (VTI, later purchased by General Electric and became GE navigation) to add functionality to their system so that we could import fMRI datasets to guide 3-D functional neuronavigation. This approach has now been widely adopted by all the navigation vendors and is known as multi-modal or functional neuronavigation. |
| Development of intraoperative point annotation into commercial neuronavigation systems (2003-2005) | Worked with VTI engineers to be able to annotate the 3-D imaging dataset with data acquired during surgery, specifically with results from electrocortical stimulation mapping. This functionality was necessary in order to validate fMRI as a pre-surgical mapping tool. This idea has since been expanded on to mark sites of tissue sampling, to note intra-operative tumor margins, and to make measurements of brain shift. |
| Validation of surface matching algorithms for image-to-patient | Worked with VTI engineers to compare results of standard (fiducial-based) registration with surface matching registration for image-to-patient registration in the operating room. Surface matching has become the standard for most situations presently as it allows the imaging scans to be acquired at any time |

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| <p>registration in the operating room (2004-2006)</p> | <p>before surgery whereas fiducial-based scans needed to be performed within a day or two prior to surgery in order to avoid the fiducials falling off.</p> |
| <p>Development of novel fMRI strategies targeted for mapping language in patients with neurologic deficits</p> | <p>Language mapping with fMRI can provide critical information for planning surgery for brain tumors, epilepsy and other conditions. However, the standard fMRI paradigms require that the patient perform repeated and precisely timed language tasks (e.g. antonym generation, noun categorization). Many patients cannot perform these tasks adequately since they have existing language, attention, executive or other deficits. Our novel approach uses complex analysis of resting state brain activity or activity during movie watching to define language areas in patients who are unable to perform standard fMRI language tasks.</p> |
| <p>Co-founding and development of clinical fMRI service at BWH (2007-present)</p> | <p>After instituting fMRI as an investigational brain mapping tool in 2003, a CPT code was created in late 2006 for billing these studies recognizing the importance of this new modality. Together with Dr. Srinivas Mukundan, in 2007 we put in place an integrated system for scheduling, acquiring and analyzing scans in a robust clinical workflow. Since then the clinical fMRI service has grown rapidly, now performing studies on over 150 patients per year.</p> |
| <p>Design and development of the AMIGO (advanced multi-modality image-guided operating) suite at BWH (2003-2011)</p> | <p>Starting in 2003 an extended process of designing and development was undertaken to create the next generation image guided operating room (as a follow on to the world's first intra-operative MRI sited at BWH in the early 1990s). Working with hospital leadership, architects, engineers, industry, and clinical leaders a unique translational OR was designed and eventually built. I performed the first case in AMIGO in August 2011 and presently serve as the co-director. Over 900 cases have been performed in AMIGO.</p> |
| <p>Developed and deployed clinical diffusion tensor imaging protocols (2005-present)</p> | <p>Diffusion tensor imaging is a non-invasive MRI technique able to map white matter tracts <i>in vivo</i>. Developed workflow for acquisition and analysis of DTI for clinical patients. Developed software for preparing tractography (3_D reconstructions of data) and importing to clinical navigation platforms. Adopted and translated advances in acquisition by MRI physics and image analysis for better resolution, faster acquisition, and better tracking through edema.</p> |
| <p>Developed and supported method for routinely importing fMRI and DTI data into the operating room</p> | <p>In order to maximize the utility of fMRI and DTI, the results need to be able to be visible in the operating room during the surgery and integrated with the procedure. We developed workflow and protocols for importing these data sets into the navigation system. This allows optimal selection of approaches. In some cases intra-operative mapping can be avoided. In cases in which intraoperative mapping is used, it can be deployed more efficiently. This also provides a fallback for cases in which intra-operative mapping fails.</p> |
| <p>Developed software which allows clinicians to interactively</p> | <p>DTI tractography produces complex 3-D images which can be difficult for the clinician to interpret. We developed a software module in the open source platform 3D Slicer which allows the clinician to view tracts of interest. Tools include a dynamic fiducial to seed tracts, seeding tracts from a shell of different diameters</p> |

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| view DTI tractography data (2011-12) | around the lesion, seeding from fMRI or other functional mapping results, and seeding from intraoperative landmarks. |
| First use of commercial laser interstitial therapy for ablation of brain tumor in New England (2011) | Developed workflow in operating room and MRI suite for deployment of minimally invasive treatment for brain tumors. Coordinated with Neuroradiology, MRI physics, laser safety, MRI technologists, and OR staff to treat first patient with inoperable recurrent brain tumor. Later this program was transitioned to the AMIGO suite where a number of different neurosurgical conditions have been treated including: primary brain tumor, brain metastases, meningioma, and epilepsy. |
| First use of in-bore intra-operative MRI targeting for laser thermal ablation. | Led a team which was the first in the world to combine two minimally invasive technologies to all treatment of a difficult to access brain tumor. The procedure integrated real time targeting using the Clearpoint system with laser hyperthermia ablation with MRI thermometry in the bore of the MRI. http://www.imris.com/news-articles/brain-cancer-lesion-treated-with-precisely-aimed-laser-catheter-using-clearpoint-neuro-intervention-s |
| Clinician on earliest US human use of focused ultrasound for minimally invasive transcranial thermal ablation of brain tumors | Performed MRI guided transcranial focused ultrasound in one of the first 5 human patients at BWH. Worked extensively with MR and US physics. Worked with company to resolve safety issues that led to closure of initial trial. New trials with adapted device and new parameters developed. Presently PI of Phase I clinical trial to establish safety of mgFUS in patients with recurrent brain metastases. |
| Clinical lead on first use of mass spectrometry for intra-operative tissue characterization. | Collaboration with Nathalie Agar PhD to perform mass spectrometry tissue analysis on specimens from the operating room. PI of human research protocol. Developed method for performing stereotactic sampling to correlate tissue histopathology and imaging metrics with mass spectrometry. About to launch phase II in which the results of mass spectrometry will be made available to me to guide surgical decision-making. |
| Clinical lead on first use of stimulated Raman Spectroscopy from human brain tumor specimens. | Collaboration with Sunney Xie Ph.D. of FAS Department of Chemistry to translate stimulated Raman Spectroscopy technology developed by Professor Xie to guide surgical decision making. I am the PI of the human subjects protocol and obtain tissue samples for evaluation of the technology. |

[Report of Technological and Other Scientific Innovations](#)

“Integrated Surgical Sampling Probe”

U.S. Provisional Patent Application No.: 61/136190, Filing Date: August 18, 2009

Jolesz, F.A., Golby, A.J., and Agar, N. Y. R.
Brigham & Women’s Hospital, Boston, MA

This invention proposes devices for collecting tissue samples from patients during interventions. The devices create tissue fragments which are then collected by aspiration. The devices include signal emitters that indicates the exact position where a biopsy sample was obtained. Such a device could revolutionize brain surgery or other surgeries, especially for cancer, by guiding the resection based on tissue level information and linking this to imaging findings.

“Implantable Electrode System”.

US patent # 9486168, November 8, 2016

U.S. Provisional Patent Application No.: 21428, Filing Date: April 30, 2012.
Bonmassar G., and Golby, A.

Massachusetts General Hospital, Boston, MA

An electrode array is configured for implantation into subjects. The electrode array includes an organic substrate material configured to be implanted into an in vivo environment and to optionally dissolve after implantation into the in vivo environment and be absorbed by the in vivo environment, and an electrode mounted to the organic substrate material and configured to acquire signals generated by the in vivo environment. The conductive traces are fabricated from conductive ink that is MRI-compatible. The entire assembly is designed to be MRI compatible and MRI and CT-invisible. This technology could allow many more patients to benefit from implantable electrodes for brain recording or stimulation and could also be applied in the spinal cord, peripheral nerve or to electrocardiology applications. Patients would still be able to have MR imaging which is increasingly important in the diagnosis and management of many illnesses.

Report of Education of Patients and Service to the Community

Activities

No activities below were sponsored by outside entities

May include a brief, one-sentence description of each role if needed (optional)

2005-2007 Brigham & Women’s Hospital / Groundhog Day Job Shadow Host
Hosted a local high school student for the day to introduce them to the hospital, medicine, research, and possible career opportunities.

2005 Brigham & Women’s Hospital Patient Education Series / Speaker
Managing Epilepsy

2007- Partners in Health / Neurosurgical Consult and Intervention
Have served as informal consultant to PIH for neurosurgical questions for many years. Coordinated referral to BWH of patient from Port au Prince with a massive meningioma. Performed very complex surgical resection and post operative care.

- 2009 Yale College Spring Break Externship / Host
Hosted Yale undergraduate for two week externship/shadowing opportunity.
- 2005-2017 Dana Farber Cancer Institute / CURE Mentor
- 2009-2015 Brigham & Women's Hospital Leader for Madaktari / Neurosurgery Training in Tanzania
Led three trips to Tanzania for educational mission to train local medical professionals in neurosurgical evaluation and treatment. Supervised several US residents on these trips. Continue to serve as liaison for consultation.
- 2010-2015 Brigham Research Institute / Judge for Excellence Awards
Reviewed abstracts and posters for BRI research events.
- 2014 Brigham Research Institute Shark Tank Research Competition / "Shark"
Served as judge for competition to choose promising new science projects pitched by BWH teams.
- 2017 American Brain Tumor Association Annual Patient Conference

Educational Material for Patients and the Lay Community

Patient educational material

| | | | |
|---------|----------------------------|-----------------|---------------------------|
| 06/2007 | Brain Tumors and Aneurysms | Editor/Reviewer | Krames Medical Publishers |
| 10/2011 | Brain Tumors and Aneurysms | Editor/Reviewer | Krames Medical Publishers |

Recognition

| | | |
|-----------|-------------------|--------------------------|
| 2011-2012 | Top Doctors Award | US News and World Report |
| 2011-2016 | Top Doctors Award | Boston Magazine |
| 2011-2016 | Top Doctors Award | Castle Connolly |

Report of Scholarship

Publications

Research Investigations

1. Portoles P, Rojo J, **Golby AJ**, Bonneville M, Gromkowski S, Greenbaum L, Janeway CA, Murphy DB, Bottomly K. Monoclonal Antibodies to Murine CD3 Define Distinct Epitopes, One of Which May Interact with CD4 During T-Cell Activation. *J Immunol*. 1989 Jun 15;142(12):4169-75. PMID: 2470817.
2. Comess KA, DeRook FA, Beach KW, Lytle NJ, **Golby AJ**, Albers GW. Transesophageal echocardiography and carotid ultrasound in patients with cerebral ischemia: prevalence of findings and recurrent stroke risk. *J Am Coll Cardiol*. 1994;23(7):1598-603. PMID: 8195520.
3. Chang YJ, **Golby AJ**, Albers GW. Detection of Carotid Stenosis: From NASCET results to clinical practice. *Stroke*. 1995 Aug;26(8):1325-8. PMID: 7631330.
4. **Golby AJ**, Bracci PM, Comess KA, DeRook FA, Albers GW. Low Yield of Clinically Significant Transesophageal Echocardiographic Findings in Patients with Lacunar Stroke. *J Stroke Cerebrovasc Dis*. 1995;5:39-43.
5. **Golby AJ**, Poen JC, Forster KM, Martin DP, Adler JR. Three-fraction stereotactic radiosurgery for treatment of vestibular schwannoma in patients with Neurofibromatosis type II. *Journal of Radiosurgery*. 1999;2:215-221.
6. **Golby AJ**, Marks MP, Thompson RC, Steinberg GK. Direct and combined revascularization in pediatric moyamoya disease. *Neurosurgery*. 1999;45(1):50-8; discussion 58-60. PMID: 10414566.
7. Poen JC, **Golby AJ**, Forster KM, Martin DP, Chinn DM, Hancock SL, Adler JR. Fractionated stereotactic radiosurgery and preservation of hearing in patients with vestibular schwannoma: a preliminary report. *Neurosurgery*. 1999;45(6):1299-305; discussion 1305-7. PMID: 10598696.
8. **Golby AJ**, Gabrieli JD, Chiao JY, Eberhardt JL. Differential responses in the fusiform region to same-race and other-race faces. *Nat Neurosci*. 2001;4(8):845-50. PMID: 11477432.
9. Kemper CA, Talos IF, **Golby AJ**, Black PM, Kikinis R, Grimson WEL, Warfield SK. An Anisotropic Material Model for Image Guided Neurosurgery. *MICCAI 2004: 7th International Conference, Proceedings, Part II; September 26-29, 2004; Saint-Malo, France* p.267-275.
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Narrative Report (limit to 500 words)

- A final paragraph that integrates and summarizes the contributions described above

My Area of Excellence is Clinical Excellence and Innovation with other significant supporting activities in Investigation. I practice clinical neurosurgery with a focus on the treatment of brain tumors, epilepsy, hydrocephalus, and radiosurgery. My clinical expertise is in the treatment of patients with lesions in eloquent cortex and the use of imaging and functional brain mapping techniques to improve patient outcomes. I have been at the forefront of the development and validation of numerous novel approaches to improve neurosurgical precision for maximizing extent of resection and minimizing surgical neurologic deficits. My clinical caseload averages 2-3 neurosurgical cases per week focused strongly on surgery for patients with brain tumors and epilepsy.

My research focuses on the translation of a broad range of neuroimaging techniques to the clinical realm. The overarching goal of this work is to help surgeons perform optimal brain surgery by defining what tissue is critical and what tissue is pathologic.

I led the development and validation of fMRI for the pre-operative evaluation of patients with lesions in and near motor and language areas of the brain. This has been a translational research effort which adapted fMRI, initially developed as a neuroscience technique to be applied in groups of subjects to make statistical inferences about populations, to the vastly different scenario of clinical decision-making for individual patients. Since my research program began at BWH in 2003, my group has developed new techniques for the use of fMRI in single subject analyses necessary for surgical planning. In addition we have developed numerous acquisition strategies geared towards accommodating the limited function of some patients as well as analytic approaches to maximize the utility of fMRI for surgical planning. Presurgical fMRI has the potential to bring meaningful pre-operative individualized functional anatomy mapping to neurosurgeons around the world as an alternative to awake mapping, a technique which is limited to very specialized centers. We have published extensively on this topic and I am invited internationally to present this work. At BWH pre-surgical fMRI was implemented as an entirely new clinical service, the clinical fMRI service for which I serve as Co-Director, together with Dr. Mukundan Chief of Neuroradiology. This service provides advanced clinical functional brain mapping which can be ordered for pre-surgical evaluation of patients. We have experienced exponential growth in numbers of clinical fMRI studies ordered since

its inception in 2007. This partnership with radiology also underscores my commitment to working collaboratively and across traditional lines of Division and Department.

I have also worked extensively on the translation of diffusion tensor imaging (DTI) to map white matter anatomy in neurosurgical patients. DTI is another MRI technique which allows the *in vivo* depiction of the location, course and integrity of macroscopic white matter tracts in the brain. As with fMRI, the translation of this technology to clinical decision-making has required numerous fundamentally novel approaches. We have developed segmentation approaches for defining tracts based on high dimensional clustering as well as statistical atlases which allow labeling of individual patient tracts even in the setting of mass effect and peritumoral edema. My group works collaboratively with MRI physics and MRI analysis groups to continue to be at the forefront of technical innovation. We have released many of our tools to the public via 3D Slicer (slicer.org) and since 2011 have led an annual international challenge workshop to apply diffusion techniques to real world clinical data.

With both these methods, translation of the technology required understanding of clinical needs, constraints, and opportunities for improved clinical care. Specific analysis techniques needed to be developed to adopt these techniques so that they were applicable to single subject data, and in particular to subjects who are neurologic patients and have structural lesions and often neurological deficits. In these efforts, I work closely and collaboratively with scientists in radiology and computer science to translate emerging technical innovations into the operating room.

Another major area of translational investigation is in the development of intraoperative imaging techniques. I was the lead surgeon in developing the AMIGO (Advanced Multi-modality Image-Guided Operating Suite) at BWH and serve as the Co-director of AMIGO. AMIGO is one of the key resources of the National Center for Image Guided Therapy funded by NIH of which I am the neurosurgery core leader. This suite contains all contemporary imaging methods within an operating room environment and was specifically designed to support translational research. The suite is the site of many of surgical procedures in which we are developing strategies for intraoperative imaging and guidance. As Co-director, I work with my partner, Clare Tempany to ensure that the Suite is serving its primary goal as a test bed for innovative surgical techniques. These applications extend far beyond the original conception of intraoperative MRI as a tool for neurosurgery. Presently in AMIGO a large group of interventionalists across a wide range of specialties works with technical leaders and engineers to develop novel treatments targeting diseases throughout the body.

In my own work several important research efforts are built on the AMIGO platform. These include the intra-operative use of high field MRI including development of intra-operative DTI. We have also leveraged the resources of the AMIGO suite to develop novel strategies to simplify intraoperative imaging using techniques such as ultrasound and stereovision to give surgeons information in near real time to guide surgery. We have received funding from NIH for these efforts. Another area of research leveraging the resources of AMIGO is the development of tissue level molecular imaging. We have funded collaborative projects using mass spectrometry, Raman spectroscopy, and a handheld nuclear probe under active investigation. We are developing novel optical strategies for tissue characterization intra-operatively. Our eventual goal is to give surgeons in most settings tools that will help them to perform safer and more effective surgery. As a clinician, I am driving the dissemination and adoption of these techniques, and I lecture broadly on these topics around the world as well as hosting many visitors to AMIGO and to our laboratory. Reflecting these efforts I have been the Director of Image-Guided Neurosurgery at BWH since 2007. I conceived and edited a textbook, *Image Guided Neurosurgery*, published in 2015, which brings together in a single volume the broad spectrum of

advances in imaging and technology which can inform and guide neurosurgery across a wide range of clinical applications.

Through both my research and clinical work I teach extensively on these topics to students, postdoctoral students, and residents as well as lecturing widely on these topics nationally and internationally. In addition, I am the founding Program Director for the Fellowship in Image Guided Neurosurgery since 2011, taking on one Clinical Fellow per year. Currently, in my laboratory, there are two research scientists who have advanced to Assistant Professor and Instructor (with further promotion actively in progress). In addition, there are three visiting post-doctoral students working on research projects. Over the summers numerous students (medical students, undergraduate students, high school students) have worked in the lab, including students through the Dana Farber Cancer Institute CURE program. In addition, I am involved in supervising graduate students and post-docs involved in collaborative research efforts with investigators in Radiology, Computer Science, Psychology and Neuroscience. I participate in educational conferences in the Neurosurgery Department as well as multi-disciplinary conferences related to epilepsy and brain tumors. I lead a weekly meeting on Neurosurgical brain mapping which is attended by students, post-docs, and faculty from multiple departments as well as from other institutions (MIT, MGH, etc).

As a clinician innovator and investigator I have been a leader in developing novel approaches to guide some of the most complex brain surgery which helps patients who have lesions in critical brain regions. My work involves the translation of technology into the operating room and the development of tools and approaches which are part of a profound advancement in neurosurgery based on improved visualization which has allowed much more effective and safer surgery.

