Harvard Medical School

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Education

Year	Degree	Field of Study	Institution
1997	B.S.	Biomedical Engineering	Tsinghua University
2003	Ph.D.	Biomedical Engineering (Fusheng Yang)	Tsinghua University

Postdoctoral Training

Year(s)	Title	Specialty/Discipline	Institution
02/04-06/06	Research Associate	Computer Science (Paul H. Schimpf)	Washington State University
07/06-09/09	Research Fellow	Radiology&Neuroscience (Steven M. Stufflebeam & Randy L. Buckner)	Massachusetts General Hospital

Faculty Academic Appointments

Year(s)	Academic Title	Department	Academic Institution
10/09-03/12	Instructor	Radiology	Harvard Medical School
03/12-02/16	Assistant Professor	Radiology	Harvard Medical School
03/16-	Associate Professor	Radiology	Harvard Medical School

Appointments at Hospitals/Affiliated Institutions

Year(s)	Position Title	Department	Institution
07/06-09/09	Research Fellow	Radiology	Massachusetts General Hospital
10/09-02/16	Assistant in Neuroscience	Radiology	Massachusetts General Hospital
03/16-	Associate in Neuroscience	Radiology	Massachusetts General Hospital

Professional Societies

Year(s) of Membership	Society Name
2002-2007	Member, IEEE
2006-	Member, Society for Neuroscience
2008-	Member, Organization for Human Brain Mapping
2010-	Member, American Physiological Society

Grant Review Activities

Year(s) of Membership	Name of Committee	Organization
	Dates of Roles	Title of Roles
2012 - present	Marsden Fund	Royal Society of New Zealand
	2012	Ad hoc Reviewer
	2014	Ad hoc Reviewer
2014 - present	NSERC Discovery Grants	Natural Sciences and Engineering Research Council of Canada
	2014	Ad hoc Reviewer

Editorial Activities

Ad hoc Reviewer
Nature Neuroscience
Neuron
PNAS
Molecular Psychiatry
JAMA Psychiatry
Neuropsychopharmacology
Journal of Neuroscience
Cerebral Cortex
Neuroimage
Schizophrenia Bulletin
Human Brain Mapping
Brian and Language
Neuroimage: Clinical
Journal of Cognitive Neuroscience
Journal Cognitive Science
Epilepsia
IEEE transactions on Biomedical Engineering
Journal of Neuroengineering and Rehabilitation

Medical & Biological Engineering &Computing
Computer Methods and Programs in Biomedicine
Wires Cognitive Science
Neuromodulation: Technology at the Neural Interface
PLoS One
Brain Connectivity
International Journal of Geriatric Psychiatry
BioMed Research International
Psychiatric Research: Neuroimaging

Other Editorial Roles

Year(s)	Role	Journal Name
2014-	Editorial Board Member	Chinese Journal of Medical Imaging Technology
2016-	Editorial Board Member	Journal of Translational Neuroscience

Honors and Prizes

Year	Name of Honor	Awarding Organization
2015	Travel Award (senior level)	The American College of Neuropsychopharmacology (ACNP)

Report of Funded and Unfunded Projects

Funding Information

Past

Year(s) funded	Grant title Grant type and number Role on Project (total direct cost) Description of the major goals
2011-2016	Task-free Presurgical Evaluation of Lateral, Eloquent Cortex & Epileptic Foci NIH/NINDS 5K25NS069805 ($827,830) PI This project aims to develop methods to determine functional laterality, eloquent cortex and epileptic foci with minimal task requirements.

2013-2015	Intrinsic Brain Hemispheric Interaction as an Intermediate Phenotype of Schizophrenia Risk NARSAD Young Investigator Grant ($60,000) PI The goal of this project is to establish and validate an imaging biomarker for schizophrenia risk based on the intrinsic interactions between brain hemispheres, and explore the genetic underpinnings of this specific imaging biomarker.

Current

Year(s) funded	Grant title Grant type and number Role on Project (total direct cost) Description of the major goals
2015-2020	Translating The Individualized Functional Connectome To Surgical Planning NIH/NINDS 1R01NS091604 ($1,489,286) PI The goal of this project is to translate cutting-edge connectivity-based imaging technology to the clinical arena by developing and validating a set of tools that can accurately map an individual subject's brain and guide surgical intervention.
2016-2019	Presurgical Brain Functional Evaluation in Glioma Patients Beijing Brain Initiative Project (RMB 2,400,000) PI The project aims to develop a multi-modal functional mapping system to assist surgical treatments in glioma patients.
2015-2020	Neurcircuitry of OCD: Effects of Neuromodulation NIH/NIMH Conte Center P50MH106435 ($2,800,000) Co-PI of Project 3 (Project Leaders: Buckner & Liu) The overall goals of this Conte Center are to explore the circuitry of OCD in humans and develop methods for productively modulating that circuitry to alleviate symptoms. Project 3 seeks to develop methods to image networks at the level of individual subjects.
2016-2021	1U01AG052564-01 (Van Essen PI WASHU) NIHAG Salat PI MGH SC ($1,622,380) Role: Co-I (17% effort)

Mapping the Human Connectome During Typical Aging
This project will use structural and functional imaging methods to characterize brain circuitry in a large
population of health older adults, from ages 36 to 100+. It will enable assessment of changes in brain circuits and brain behavior relationships during typical aging.

2016-2021

Impact of Amyloid on the Aging Brain
NIH 1R01AG053509 ($2,443,700)
Role: Co-I (3% effort)
Tau, amyloid, & white matter burden interact to impact brain networks in preclinical Alzheimer's disease
This project investigates the regional impact of tau and amyloid associated with Alzheimer's disease and of white matter hyperintensities of presumed vascular origin on the function of brain networks and associated cognitive abilities.

2016-2019

Neural Correlates of Cognitive Prodromes in Neurodegenereative dementias
NIH 5P50AG005134-33 Project 3 ($625,000)
Role: Co-I (7% effort)
The project focus is on subjects with subjective cognitive concerns or mild cognitive impairment exhibiting a phenotype of predominant executive dysfunction or of predominant memory deficits.

2017-2022

Role of age, dopamine, and tau related network disruption in setting a context for progression toward Alzheimer's Disease
NIH R01AG054110-01A1 ($2,495,095)
Role: Co-I (2% effort)

This project investigates the impact of tau associated with Alzheimer's disease and of dopaminergic changes in aging on the function of brain networks and associated cognitive abilities. This work will benefit public health by providing evidence of how these markers of brain dysfunction set a context for vulnerability to progression of Alzheimer's disease in humans.

2018-2023

Individual-level brain connectivity analyses in patients with epilepsy
Chinese National Natural Science Foundation (RMB 3,300,000)
Role: PI

This project will take advantage of the big data in multi-modal neuroimaging and explore functional characteristics of epilepsy at the individual level.

Report of Local Teaching and Training

Teaching of Students in Courses

Year(s)	Course Title	Location
	Type of Students	Level of Effort
2008	HST Course 563: Imaging Biophysics and Clinical Applications	Martinos Center MGH
	Harvard/MIT undergraduate and graduate students	2 hours/year
2010- 2015	Harvard Psychology Course Psych1352	Harvard University
	Harvard undergraduate and graduate students	1.5 hours/year
2016	Functional MRI Visiting Fellowship Program Martinos Center MGH	
	40 Faculty members, Postdocs and clinicians from about 10 countries	1.5 hours/year
2016	Connectivity Course: Structural and Functional Brain Connectivity via MRI and fMRI Martinos Center MGH	Martinos Center MGH
	40 Faculty members, Postdocs and clinicians	1.5 hours/year

Local Invited Presentations

Year(s)	Title of presentation/ Type of presentation
	Department and Institution where presented
2006	Brief Introduction to MEG/EEG Inverses Department of Neurosurgery, Brigham& Women's Hospital
2007	Functional Mapping on Normal Subjects and Epilepsy Patients Department of Neurosurgery, Brigham& Women's Hospital
2008	Functional Mapping Using fMRI, fcMRI, iEEG, and MEG/EEG

Department of Radiology, Massachusetts General Hospital

2008   Robust Decoding of Visual Information From the Human Brain
Department of Neurobiology, Harvard Medical School

2010   Brain Asymmetry: the What, How and Why
Department of Psychology, Harvard University

2012   Individual Variability in Functional Connectivity Architecture of the Human Brain
Department of Psychiatry, Massachusetts General Hospital

2014   Dynamic Brain States in Rest, Task Performance and Diseases
Department of Psychology, Harvard University

2017   Mapping Functional Connectivity Networks in Individual Patients For the Study of DBS
effects, Radcliff seminar, Harvard University

Report of Regional, National and International Invited Teaching and Presentations

Invited Presentations and Courses
No presentations below were sponsored by outside entities.

Regional

Year(s)	Title of presentation or name of course/ Type of presentation
	Location
2014	Current Work in Clinical Psychology / Graduate Course Department of Psychology, Yale University, New Haven, USA

National

Year(s)	Title of presentation or name of course/ Type of presentation
	Location
2009	Intrinsic Functional Laterality in Human Brain / Invited Lecture Department of Psychology, University of California, Berkeley, USA
2016	Identifying Individualized Targets for TMS using fMRI / Invited Lecture New York State Psychiatric Institute, Columbia University, New York, USA

2016   Parcellating Cortical Functional Networks in Individuals/ Invited Lecture

        School of Medicine, Stanford University, Stanford, USA

2016   Identifying OCD-relevant Circuitry in Individual Subjects / Invited Lecture

        Department of Pharmacology and Physiology, University of Rochester, Rochester, USA

International

Year(s)   Title of presentation or name of course/ Type of presentation

        Location

2008   Fast Decoding of Visual Information in ECoG / Invited Lecture
        School of Medicine, Tsinghua University, Beijing

2008   Pre-surgical Mapping using Resting State fMRI / Invited Lecture
        SanBo Hospital, Beijing

2009   Functional Laterality in the Resting Brain /Grand Rounds
        Xuanwu Hospital, Beijing

2009   Epileptic Foci Localization Based on fcMRI / Grand Rounds
        GuangAnMen Hospital, Beijing

2009   Brain Lateralization and Diseases / Grand Rounds
        Chinese Medical University, Shenyang

2010   Hemispheric Interaction in Resting Brain / Invited Lecture
        MNI, McGill University, Montreal

2011   Focal Pontine Lesions Disrupt Intrinsic Functional Connectivity / Keynote Lecture
        ISMRM International Workshop, Beijing

2011   Functional Specialization in the Human Brain / Invited Lecture
        MNI, McGill University, Montreal

2013   Functional Connectivity in the Human Brain / Keynote Lecture
        XXVIth International Symposium on Cerebral Blood Flow, Metabolism & Function, Shanghai

2013   Imaging-guided Brain Stimulation / Invited Lecture
        National Engineering Laboratory for Neuromodulation, Beijing

2013   Translational Neuroscience / Grand Rounds

Capital Medical University, Beijing

2014   An Evolutionary Account of Individual Differences / Keynote Lecture
Third Beijing Capital Medical Imaging Summit, Beijing

2014   Individual Differences in Functional Connectivity Explored by fMRI / Invited Lecture
Chinese Academy of Sciences, Beijing

2015   New Research Methods in Cognitive Neuroscience / Graduate Course
Anhui Medical University, Hefei

2015   Individual Differences In Brain Connectivity / Invited Lecture
McGovern Institute, Tsinghua University, Beijing

2017   Mapping Functional Networks in Individuals For Personalized Medicine / Keynote Lecture
2nd European Conference on Brain Stimulation in Psychiatry (ECBSP), Munich, Germany

Report of Technological and Other Scientific Innovations

Innovation	Patent Information
	Description of Innovation
Measuring brain functional lateralization based on connectivity without being confounded by anatomical asymmetry	US Patent Application, filed March 31, 2015
	My colleagues and I have created a system for measuring the brain functional specialization in the human brain with high reliability. The system can be used to determine the dominant hemisphere before neurosurgical treatments
Mapping functional organization of individual brains using an iterative approach guided by population-wide brain parcellation and individual variability map	US Patent Application, filed March 28, 2015
	My colleagues and I have invented a system to map brain functional networks in a single subject's brain with high accuracy. The system can provide useful information regarding the eloquent cortices

of surgical patients.

Systems and methods for combined functional brain mapping

US Patent Application, filed March 31, 2015

My colleagues and I have designed a system to improve the accuracy of brain functional mapping by combining traditional fMRI technology with novel intrinsic functional connectivity mapping technology.

Report of Scholarship

Peer Reviewed Publications in Print or Other Media

Research investigations

1. **Liu H.**, Yang F., "Preliminary screening of epileptiform waves in EEG", *Chinese J Biomed Eng*, 20(2):97-103, 2001.

2. **Liu H.**, Yang F., "An improved automated epileptic EEG detection system", *J Tsinghua Univ (Sci&Tech)*, 42(3): 304-308, 2002.

3. **Liu H.**, Gao X., Yang F., "Theory of Hidden Markov Modeling and its implementation", *Foreign Med Sci (Biomed Eng Fascicle)* , 25(6):253-259, 2002.

4. **Liu H.**, Zhang T., Yang F., "A multistage multimethod approach for automatic detection and classification of epileptiform EEG", *IEEE trans Biomed Eng* , 49(12): 1557-1566, 2002.

5. **Liu H.**, Yang F., Gao X., "Studies on spatio-temporal pattern of 3-D EEG", *Prog Nat Sci,* 13(4): 41-45, 2003.

6. **Liu H.**, Gao X., Yang F., "A 3-Dimensional spatio-temporal EEG pattern analyzing system", *Prog Nat Sci,* 11(13): 590-595, 2003.

7. **Liu H.**, Gao X., Schimpf P., Yang F., Gao S., "A recursive algorithm for the 3-dimensional imaging of brain electric activity: Shrinking LORETA-FOCUSS", *IEEE trans Biomed Eng* 51(10): 1794-1802, 2004.

8. Dong G.，**Liu H.，** Yang F.，Bayford R., Yerworth R., Gao S.，Holder D., Yan W., "The spatial resolution improvement of EIT images by GVSPM-FOCUSS", *Physiol Meas,* 25: 209-225, 2004 .

9. Li Y., Gao X., **Liu H.**, Gao S., "Classification of single-trial electroencephalogram during finger movement*", IEEE trans Biomed Eng*, 51(6): 1019-25, 2004.

10. **Liu H.**, Schimpf P., Dong G., Gao X., Yang F., Gao S., "Standardized Shrinking LORETA-FOCUSS (SSLOFO): a new algorithm for spatio-temporal EEG source reconstruction", *IEEE trans Biomed Eng*, 52(10): 1681-1691, 2005.

11. Dong G**., Liu H.**, Bayford R., Yerworth R., Schimpf P., Holder D., Yan W., "Spatial resolution improvement of 3D EIT images by Shrinking sLORETA-FOCUSS algorithm", *Physiol Meas*, 26: s199-s208, 2005.

12. Schimpf P., **Liu H.**, Ramon C., Haueisen J., "Spatial refinement of standardized low resolution electromagnetic tomography in an anatomically realistic EEG model," *IEEE trans Biomed Eng,* 52(5):901- 908. 2005.

13. **Liu H.**, Schimpf P., "Efficient localization of synchronous EEG source activities using a modified RAP-MUSIC algorithm", *IEEE trans Biomed Eng*, 53(4): 652-661, 2006.

14. Jia W., Kong N, Ma J., **Liu H.**, GAO X., Gao S., Yang F., "Detection of the short-term preseizure changes in EEG recordings using complexity and synchrony analysis", *Prog Nat Sci,* 16(7): 691-700, 2006.

15. Vandervert L., Schimpf P.,**Liu H.**, "How working memory and the cerebellum collaborate to produce creativity and innovation ", *Creativ Res J*, 19(1): 1-18, 2007.

16. Schimpf P., **Liu H.,** "Localizing sources of the P300 using ICA, SSLOFO, and latency papping", *J Biomech Biomed Biophys Eng*, 2(1):1-11, 2008.

17. **Liu H.**, Buckner R.L., Talukdar T., Tanaka N., Madsen J.R., Stufflebeam S.M., "Task-free presurgical mapping using fMRI intrinsic activity", *J Neurosurg* 111: 746-754, 2009.

18. **Liu. H.**, Agam Y., Madsen J.R., Kreiman G., "Timing, timing, timing: fast decoding of object information from intracranial field potentials in human visual cortex", *Neuron* , 62: 281-290, 2009.

19. **Liu H**., Stufflebeam S.M., Sepulcre J., Hedden T., Buckner R.L., "Evidence from Intrinsic Activity that Asymmetry of the Human Brain is Controlled by Multiple Factors", *Proc. Natl. Acad. Sci. USA,* 106: 20499-20503, 2009.

20. Wetterling F., Liehr M, Schimpf P., **Liu H**., and Haueisen J., "The localization of focal heart activity via body surface potential measurements: tests in a heterogeneous torso phantom", *Phys Med Biol* 54: 5395-5409, 2009.

21. Tanaka N., Hamalainen M.S., Ahlfors S.P., **Liu H**., Madsen J.R., Bourgeois B.F., Lee J.W., Dworetzky B.A., Belliveau J.W., Stufflebeam S.M., "Propagation of epileptic spikes reconstructed from spatiotemporal magnetoencephalographic and electroencephalographic source analysis", *Neuroimage*, 50(1): 27-222, 2009.

22. Buckner R.L., Sepulcre J., Talukdar T., Krienen F., **Liu H.**, Hedden T., Sperling R., Johnson K., "Cortical hubs revealed by intrinsic functional connectivity: mapping, assessment of stability, and relation to Alzheimer's disease", *J Neurosci*, 29(6): 1860-73, 2009.

23. Tanaka N., Cole A.J., von Pechmann D., Wakeman D.G., Hämäläinen M.S., **Liu H.**, Madsen J.R., Bourgeois B.F., Stufflebeam S.M., "Dynamic statistical parametric mapping for analyzing ictal magnetoencephalographic spikes in patients with intractable frontal lobe epilepsy." *Epilep Res* 85(2): 279-286, 2009.

24. **Liu H**., Tanaka N., Stufflebeam S.M., Ahlfors S.P., Hamalainen M.S., "Functional mapping with simultaneous MEG and EEG", *J Vis Exp,* Vol 40, pp. 1668, 2010

25. Sepulcre J., **Liu H.**, Talukdar T., Martincorena I., Yeo B.T. and Buckner R.L.,"The organization of local and distant functional connectivity in the human brain", *PLoS Comput Biol*, 6(6):e1000808, 2010

26. Agam Y., **Liu H.,** Papanastassiou A., Buia C., Golby A., Madsen J.R., Kreiman G., "Robust selectivity to two-object images in human visual cortex", *Curr Biol*, 20(9):872-9, 2010.

27. **Liu H.***, Lu J.*, Zhang M., Wang D., Cao Y., Ma Q., Rong D., Wang X., Buckner R.L., Li K.,

"Focal pontine lesions provide evidence that intrinsic functional connectivity reflects polysynaptic anatomical pathways", *J Neurosci.* 42(31):15065-71, 2011.

28. Stufflebeam S.M., **Liu H.**, Sepulcre J., Tanaka N., Buckner R.L., Madsen J.R. "Localization of focal epileptic discharges using functional connectivity magnetic resonance imaging", *J Neurosurg*, 114(6):1693-7, 2011.

29. Yeo B.T., Krienen F.M., Sepulcre J., Sabuncu M.R., Lashkari D., Hollinshead M., Roffman J.L., Smoller J.W., Zöllei L., Polimeni J.R., Fischl B., **Liu H.**, Buckner R.L., "The organization of the human cerebral cortex estimated by intrinsic functional connectivity", *J Neurophysiol.*, 106(3):1125-65, 2011.

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31. Fang J., Wang X., **Liu H.**, Wang Y., Zhou K., Hong Y., Liu J., Wang L., Xue C., Song M., Liu B., Zhu B., "The limbic-prefrontal network modulated by electroacupuncture at CV4 and CV12", *Evid Based Complement Alternat Med*. 515893-516903, 2012.

32. Gallagher A., Tanaka N., Suzuki N.; **Liu H.**, Thiele E., Stufflebeam S.M., "Decreased language laterality in tuberous sclerosis complex: a relationship with tuber location and history of epilepsy", *Epilepsy & Behavior*, 25(1):36-41, 2012.

33. Sepulcre J., Sabuncu M.R., Yeo B.T., **Liu H.**, Johnson K.A., "Stepwise connectivity of the modal cortex reveals the multimodal organization of the human brain", *J Neurosci.* 32(31):10649-61,2012.

34. Gallagher A., Tanaka N., Suzuki N., **Liu H.**, Thiele E.A., Stufflebeam S.M., "Diffuse cerebral language representation in tuberous sclerosis complex", *Epilepsy Res.* 104:125-133, 2013.

35. Sweet A., Venkataraman A., Stufflebeam S. M., **Liu H.**, Tanaka N., Madsen J., Golland, P. "Detecting Epileptic Regions Based on Global Brain Connectivity Patterns". *Medical Image Computing and Computer-Assisted Intervention–MICCAI,* 98-105, 2013.

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37. Tanaka N., **Liu H.,** Reinsberger C., Madsen J.R., Bourgeois B.F., Dworetzky B.A., Hämäläinen M.S., Stufflebeam S.M., "Language lateralization represented by spatiotemporal mapping of magnetoencephalography", *Am J Neuroradiol ,* 34:558-563, 2013

38. Qian T., Zhou W., Ling Z., Gao S., **Liu H.**, Hong B., "Fast presurgical functional mapping using task-related intracranial high gamma activity", *J Neurosurg.* 119(1): 26-36, 2013

39. Fox M.D., **Liu H**, Pascaul-Leone A., "Identification of reproducible individualized targets for treatment of depression with TMS based on intrinsic connectivity", *Neuroimage*, 66:151-160, 2013.

40. Ge M*., Wang D*., Dong G*., Guo B., Gao R., Sun W., Zhang J., **Liu H.**, "Transient impact of spike on theta rhythm in temporal lobe epilepsy". *Exper Neurol* 250:136-42, 2013

41. Wang D., Buckner R.L., **Liu H**., "Cerebellar asymmetry and its relation to cerebral asymmetry estimated by intrinsic functional connectivity", *J Neurophysiol.* 109(1): 49-57, 2013

42. Mueller S., Wang D., Fox M.D., Yeo B.T.T., Sepulcre J., Sabuncu M.R., Shafee R., Lu J., **Liu H.,** **"**Individual variability in functional connectivity architecture of the human brain", _Neuron_, 77(3): 586-595, 2013 (**Highlighted in _Trends In Cognitive Sciences, 2013_**).

43. Fox M.D., Buckner R.L., **Liu H.**, Chakravarty M.M., Lozano A.M., Pascual-Leone A. Resting-state networks link invasive and noninvasive brain stimulation across diverse psychiatric and neurological diseases. _Proc Natl Acad Sci U S A._ 11(41): E4367-E4375, 2014.

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45. DeSalvo M.N., Douw L., Takaya S., **Liu H.**, Stufflebeam S.M. Task-dependent reorganization of functional connectivity networks during visual semantic decision making. _Brain and Behavior._ 4 (6): 877-885, 2014.

46. Wang D., **Liu H.,** "Functional Connectivity Architecture of the Human Brain: Not All the Same". _Neuroscientist_, 20 (5): 432-438

47. Wang D., Buckner R.L., **Liu H.,** "Functional Specialization in the Human Brain Estimated By Intrinsic Hemispheric Interaction". _J Neurosci._ 34 (37):12341-12352, 2014.

48. Zeng L., Wang D., Fox M.D., Sabuncu M., Hu D., Ge M., Buckner R.L., **Liu H.,** "Neurobiological basis of head motion in brain imaging". _Proc Natl Acad Sci U S A._ 111(16):6058-62, 2014. (**Highlighted in _Proc Natl Acad Sci U S A, 2014_**)

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50. Takaya S., Kuperberg G., **Liu H.,** Greve D., Makris N., Stufflebeam S.M., "Asymmetric projections of the arcuate fasciculus to the temporal cortex underlie lateralized language function in the human brain". _Frontiers in Neuroanatomy_ , 9: 119, 2015.

51. Fang J, Wang D, Zhao Q, Hong Y, Jin Y, Liu Z, Zhou K, Jing X, Yu X, Pan R, Chang A, **Liu H**[#]**,** Zhu B[#]. Brain-Gut Axis Modulation of Acupuncture in Functional Dyspepsia: a preliminary resting-state fcMRI study. _Evid. Based Complement. Alternat. Med_. 2015. (# co-corresponding authors).

52. Boes A.D., Prasad S., **Liu H.,** Liu Q., Pascual-Leone A., Caviness V.S., Fox M.D., "Network localization of neurological symptoms from focal brain lesions", _Brain_, 138 (10):3061-3075, 2015.

53. Mueller S., Wang D., Fox M.D., Pan R., Lu J., Li K., Sun W., Buckner R.L., **Liu H.,** "Reliability Correction for Functional Connectivity: Theory and Implementation", _Human Brain Mapping_, 36 (11): 4664-4680, 2015.

54. Langs G., Wang D., Golland P., Mueller S., Pan R., Sabuncu M., Sun W., Li K., **Liu H.**, "Identifying Shared Brain Networks in Individuals by Decoupling Functional and Anatomical Variability", _Cerebral Cortex,_ bhv189, 2015.

55. Mueller S., Wang D., Pan R., Holt D., **Liu H.,** "Abnormalities in hemispheric specialization of caudate nucleus connectivity in schizophrenia". _JAMA Psychiatry._ 72(6): 552-560, 2015.

56. Wang D., Buckner R.L., Fox M.D., Holt D.J., Holmes A.J., Mueller S., Langs G., Pan R., Qian T., Li K., Baker J., Stufflebeam S.M., Wang K., Wang X., Hong B., **Liu H.** "Parcellating Brain

Functional Networks in the Individual", *Nature Neuroscience* , 18: 1853–1860, 2015.

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61. Nenning K., **Liu H.,** Ghosh S., Sabuncu M., Schwartz E., Langs G., "Diffeomorphic Functional Brain Surface Alignment: Functional Demons", *Neuroimage,* 2017 (in press)

62. Shine J., Kucyi A., Foster B., Bickel S., Wang D., **Liu H.,** Poldrack R., Hsieh L.T., Hsiang J.C., Parvizi J., "Distinct patterns of temporal and directional connectivity among intrinsic networks in the human brain", *J. Neurosci.,* 2017 (in press)

63. Tang W.[#], **Liu H.**[#], Douw L., Kramer M.A., Eden U.T., Hämäläinen M.S., Stufflebeam S.M., "Dynamic connectivity modulates local activity in the core regions of the default-mode", *Proc Natl Acad Sci U S A.*, 2017 (in press, # co-corresponding authors).

Thesis

   Liu H. Spatio-temporal Analysis of EEG, Tsinghua University

Narrative Report

My research focuses on individual differences in brain function. I study functional network structure at the level of the individual and aim to understand the functional organization that differs in individuals with neurological and psychiatric illnesses. Traditional neuroimaging methods have focused on groups and may not be directly translatable to the clinical arena, where the focus is on the individual; thus there is an urgent need to develop individual-based neuroimaging technologies in an effort to guide and facilitate

personalized medicine. While the majority of my time is spent executing research projects, I also spend about 25% of my time teaching courses and mentoring postdoctoral fellows and graduate students.

Obtaining a precise map of the individual's system-level brain organization has tremendous clinical value and is one of the "holy grails" in brain imaging. For example, a long-standing challenge in brain surgery has been pre-operatively mapping the eloquent cortex to better predict risk and plan the surgical approach, which requires very precise mapping of each patient's network structure. Over the past five years, I have been developing a platform to integrate information from different neuroimaging modalities to improve the accuracy of subject-level functional mapping. Recently, my team discovered that functional connectivity varies substantially across individuals, especially in the brain regions responsible for higher order cognition (Mueller, Neuron 2013). Such knowledge has inspired the development of novel technologies that can accurately identify a subject's unique functional organization according to functional connectivity measured at rest (Wang, Nat Neurosci, 2015; Langs, Cereb Cortex 2015; Fox, Neuroimage 2015). With the support of an NIH R01 grant, we aim to translate these cutting-edge imaging technologies to the clinical arena by establishing tools that can guide surgical intervention.

My work has also yielded a number of novel methods to study brain disorders. For example, we can now reliably quantify the degree of functional lateralization in all brain structures, including the cerebral cortex, the cerebellum and the striatum in individual subjects at rest (Wang, J Neurophysiol. 2013; Wang, J Neurosci. 2014; Zeng, PNAS 2014; Mueller, Hum Brain Mapp. 2015). Using these technologies, we have discovered that functional lateralization in the caudate nucleus is abnormal in schizophrenic patients and may represent a deficit in neurodevelopment (Mueller, JAMA Psychiatry 2015). Supported by an NIH Conte Center grant, we are now translating these techniques into clinical applications by identifying the personalized neuromodulation targets for obsessive-compulsive disorder.

I also have a major focus and commitment to teaching and education. Since I joined the faculty of HMS, I have served as the primary mentor for seven postdoctoral fellows, six graduate students and co-mentored two postdoctoral research fellows. Most of them have published their work in leading journals and seven of them have become faculty members in research universities.

In summary, I am committed to excellence in the academic domain and have repeatedly shown my ability to deliver this both in terms of my output of high impact research and my successful teaching and mentoring engagements. Going forward, my current research questions have the potential to further revolutionize the field of neuroimaging by allowing more personalized measures of brain organization to guide and facilitate personalized medicine.