

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Wang, Danhong

eRA COMMONS USER NAME (credential, e.g., agency login): wangdanh

POSITION TITLE: Assistant, Massachusetts General Hospital

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Changchun University of Chinese Medicine; Jilin, China	B.S.	07/1994	Internal medicine
Changchun University of Chinese Medicine; Jilin, China	M.D., Ph.D.	07/2008	Internal medicine
Lioayuan Hospital, Jilin, China	Residency	11/2010	Internal medicine
Massachusetts General Hospital/Harvard Medical School	Postdoctoral	12/2015	Radiology & Psychiatry

A. Personal Statement

My research focuses on understanding the functional organization of the human brain within individual persons. Traditional neuroimaging methods focused on groups cannot be directly translated to clinical arena where the focus is on the individual. My current research primarily encompasses two levels of inquiry that aim to (A) accurately identify important functional systems in individual subjects; and (B) establish reliable links between system-level brain function and neuropsychiatric illness. I have developed a series of analytical tools to characterize the functional systems in individual subjects based on resting-state functional connectivity. For example, we are able to 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. Using these tools we can now explore brain wiring and function associated with normal variation and with disease. I also developed very robust methods to map the functional atlas in the individual subject's brain and have been validating these maps in patients using invasive measures such as electrical cortical stimulation. With these novel technologies targeting individual-level analyses, we will be able to characterize functional networks in each patient with unprecedented precision and reveal network abnormalities related to diseases. The proposed project will take advantage of these technologies to unveil functional connectivity abnormalities in individual patients with psychosis.

1. **Wang D**, Buckner RL, Fox MD, Holt DJ, Holmes A, Mueller S, Langs G, Pan R, Qian T, Li K, Baker J, Wang K, Hong B, Liu H. Parcellating Cortical Functional Networks in Individuals. *Nature Neuroscience* 18: 1853–1860, 2015.
2. Mueller S, **Wang D**, Pan R, Holt DJ, Liu H. Abnormalities In Hemispheric Specialization of Caudate Nucleus Connectivity in Schizophrenia, *JAMA Psychiatry*, 72(6): 552-560, 2015.
3. **Wang D**, Buckner RL, Liu H. Functional Specialization in the Human Brain Revealed by Intrinsic Hemispheric Interaction, *Journal of Neuroscience*, 34(37): 12341-12352, 2014.
4. **Wang D**, Buckner RL, Liu H. Cerebellar asymmetry and its relation to cerebral asymmetry estimated by intrinsic functional connectivity. *Journal of Neurophysiology*, 109(1): 49-57, 2013.

B. Positions and Honors

12/15- Instructor, Dept. of Radiology, Harvard Medical School
12/15- Assistant, Dept. of Radiology, Massachusetts General Hospital
11/10- 12/15 Research Fellow, Harvard Medical School
11/10- 12/15 Research Fellow, Dept. of Psychiatry & Radiology, Massachusetts General Hospital
09/08- 11/10 Resident (**no research component**), Liaoyuan Hospital
02/03- 09/05 Physician, Division of Internal Medicine, Liaoyuan Hospital
07/02- 02/03 Visiting Physician, Fuwai Hospital, Beijing
10/98- 02/01 Visiting Physician, the First Affiliated Hospital of China Medical University, Shenyang
07/94- 9/98 Physician, Liaoyuan Hospital

Awards and Honors:

2010 “Woman in Medicine” Award, Jilin Province
2009 Medical Service Award, Jilin Province
2005 Outstanding Medical Service Award, City of Liaoyuan

C. Contribution to Science

1. I have made contributions to functional mapping at the single-subject level. No two persons are alike, however, the extent to which brain networks can differ between people is often underestimated in many clinical practices. We have systematically investigated the inter-individual variability in functional organization, and found that it is the higher cognitive regions that are most variable between subjects. These areas are known to be activated when the brain performs complex tasks, and when we feel emotions. Besides providing better knowledge of how our brain works, this research has clinical importance, since knowing the individual variability in functional organization is crucial for the development of customized therapeutic approaches. When interventions (surgery, brain stimulation) are provided in areas of high inter-individual variability, doctors could perform specific tests to check the relevance of standardized procedures. Building upon these findings, I recently developed a novel technology that can accurately map the unique functional network organization in each individual subject. This will benefit patients suffering from neurological and psychiatric diseases by providing critical information to determine the optimal treatment strategy for each individual, and to gain a deep understanding of the therapeutic effect in a particular patient.

- a. **Wang D**, Buckner RL, Fox MD, Holt DJ, Holmes AJ, Mueller S, Langs G, Pan R, Qian T, Li K, Baker J, Stufflebeam SM, Wang K, Wang X, Hong B, Liu H. “Parcellating Cortical Functional Networks in Individuals”. *Nature Neuroscience* 18:1853–1860, 2015
- b. 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
- c. **Wang D.**, Liu H., “Functional Connectivity Architecture of the Human Brain: Not All the Same”. *The Neuroscientist*, 20 (5), 432-438, 2014.
- d. 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

2. I have made contributions to the study of individual differences in brain lateralization using functional connectivity MRI. It is well established that the human brain possesses a number of systems that are specialized between the two hemispheres. Recently, I developed a general data-driven approach to map the specialization of brain systems. We found a gradient of specialization across different functional regions and discovered that one specific association network, called the frontoparietal network, possesses a unique pattern that may suggest how specialization may emerge in the human brain. What we discovered is that the

frontoparietal network is differentially coupled to distinct systems in each hemisphere. Thus, differentiation between the hemispheres may arise by how networks interact with distinct partner networks in each of the hemispheres. This discovery and the novel approach developed during the study were then immediately translated to clinical research. In a group of patients with schizophrenia, we found aberrant hemispheric specialization in the caudate nucleus that may relate to the development of illness.

- a. **Wang D.**, Buckner R.L., Liu H., “Functional Specialization in the Human Brain Estimated By Intrinsic Hemispheric Interaction”. *Journal of Neuroscience*. 34 (37):12341-12352, 2014.
- b. **Wang D.**, Buckner R.L., Liu H., “Cerebellar asymmetry and its relation to cerebral asymmetry estimated by intrinsic functional connectivity”, *Journal of Neurophysiology* 109(1): 49-57, 2013
- c. 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.
- d. 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

3. I have made contributions to functional connectivity MRI method development for studying clinical populations. For example, data quality is usually lower in patients compared to healthy controls. Functional connectivity estimates are generally biased downward in patients due to unreliable signal measurement, a phenomenon known as “correlation attenuation”. We have performed a thorough analysis of this systematic mis-estimation of functional connectivity, and developed a technique to mitigate this bias. In another project, we showed that spontaneous and task-based mapping can be performed together, provide complimentary information for functional localization, and can be combined to improve identification of critical functional circuitry relevant to diseases. I have been validating functional connectivity MRI technology in patients with brain lesions and demonstrated that functional connectivity MRI is very sensitive to the integrity of specific functional circuits.

- a. 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-first author)
- b. Mueller S, **Wang D**, Fox MD, Pan R, Lu J, Li K, Sun W, Buckner RL, Liu H. “Reliability Correction for Functional Connectivity: Theory and Implementation”. *Human Brain Mapping* 36 (11): 4664-4680, 2015.
- c. Fox MD, Qian T, Madsen JR, **Wang D**, Li M, Ge M, Zuo H, Groppe DM, Mehta AD, Hong B, Liu H. “Combining task-evoked and spontaneous activity to improve pre-operative brain mapping with fMRI”. *Neuroimage*, 124:714-723, 2015
- d. Lu, J.*, Liu, H.*, Zhang, M., **Wang, D.**, Cao, Y., Ma, Q., Rong, D., Wang, X., Buckner, R.L., and Li, K. “Focal pontine lesions provide evidence that intrinsic functional connectivity reflects polysynaptic anatomical pathways. *Journal of Neuroscience* 31:15065–15071, 2011.

Complete List of Published Work in My Bibliography:

<https://scholar.google.com/citations?user=8DzinLAAAAAJ&hl=en&oi=ao>

D. Research Support

None