深圳脑科学论坛

2016 年 11 月 30 日－12 月 2 日

中国 深圳

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会议场地:

深圳南山高新区虚拟大学园大楼 1 楼演示厅
深圳市南山区高新去南区虚拟大学园院校产业化大楼 1 楼
（伞友咖啡创业服务平台）
深圳市南山区粤兴二道 6 号深圳虚拟大学园重点实验室平台大楼 6 楼
（深圳市神经科学研究院）

来宾住宿:

深圳凯宾斯基酒店 南山区海德三道后海滨路

主办单位:

深圳市神经科学研究院
深圳大学心理与社会学院
深圳大学医学部生物医学工程学院

协办单位:

深圳市伞友咖啡创业服务平台

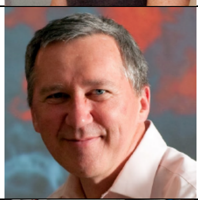
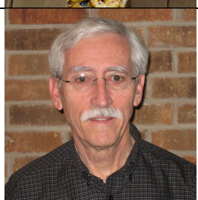
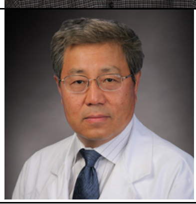
组委会:

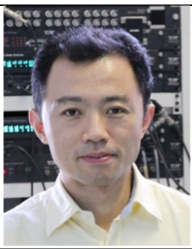
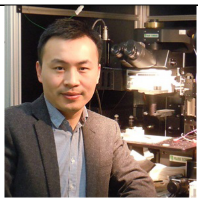
谭力海 罗跃嘉 李红 李平

会议秘书处

深圳市神经科学研究院
深圳市南山区粤兴二道 6 号深圳虚拟大学园重点实验室平台大楼 6 楼
邮箱: office@sions.cn; szions@126.com
研究院网页: http://www.sions.cn

Invited speakers

	**陈思平 教授** 深圳大学医学部生物医学工程学院院长
	**Prof. Marlene Behrmann** 美国科学院院士 美国卡内基梅隆大学教授
	**Prof. Thomas M. Mitchell** 美国工程院院士 美国卡内基梅隆大学教授
	**苏国辉 院士** 暨南大学教授 香港大学教授
	**李平 教授** 教育部长江学者讲座教授 美国宾州州立大学
	**Prof. Peter T. Fox** *Human Brain Mapping* 主编 美国德克萨斯大学教授
	**Prof. Jack Lancaster** *Human Brain Mapping* 主编 美国德克萨斯大学教授
	**杨庆宪 教授** 美国宾州州立大学教授

	**洪波 教授** 清华大学医学院教授
	**薛贵 教授** 长江学者特聘教授 北京师范大学脑与学习科学中心主任
	**孔栋 教授** 美国塔夫茨大学助理教授

Session Chairs

	**谭力海 教授** 国家千人计划入选者 国家 973 计划首席科学家 深圳市神经科学研究院主任 深圳大学医学部生物医学工程学院教授
	**薛贵 教授** 长江学者特聘教授 北京师范大学脑与学习科学中心主任
	**罗跃嘉 教授** 国家杰出青年基金获得者 深圳大学脑疾病与认知科学研究中心主任
	**但果 教授** 深圳大学医学部生物医学工程学院教授

	**金真 教授** 北京 306 医院磁共振室主任 深圳市神经科学研究院

Organizing Committee

	**谭力海 教授** 国家千人计划入选者 国家 973 计划首席科学家 深圳市神经科学研究院主任 深圳大学医学部生物医学工程学院教授
	**罗跃嘉 教授** 国家杰出青年基金获得者 深圳大学脑疾病与认知科学研究中心主任
	**李平 教授** 教育部长江学者讲座教授 美国宾州州立大学教授
	**李红 教授** 教育部长江学者特聘教授 深圳大学

深圳脑科学论坛日程安排

2016 年 11 月 30 日 星期四	
时间	**事项**
12:00-22:00	报到 (酒店大堂办理住宿，领取论坛资料及餐券)
18:30-22:00	接待晚宴

2016 年 12 月 1 日 星期五			
时间	**题目**	**主讲嘉宾 / 报告人**	**主持人**
09:00-09:10	开幕辞	**陈思平 教授** 深圳大学	**谭力海 教授** 深圳市神经科学研究院 深圳大学
09:10-09:45	Uncovering the representation of individual faces from patterns of neural and behavioral data in normal and prosopagnosic individuals	**Prof. Marlene Behrmann** 美国科学院院士 美国卡内基梅隆大学教授	**薛贵 教授** 长江学者特聘教授 北京师范大学
09:45-10:20	Physical exercise prevents loss of spines and improves working memory through the BDNF-TrKB signal pathway	**苏国辉 院士** 暨南大学 香港大学	
10:20-10:55	Metanalytic interpretation of brain images Mango/BrainMap interactions	**Prof. Jack Lancaster** *Human Brain Mapping* 主编 美国德克萨斯大学	**罗跃嘉 教授** 深圳大学
10:55-11:30	Cortical representation of speech units	**洪波 教授** 清华大学医学院教授	
11:30-12:00	In searching functional markers for AD and PD: olfactory deficits	**杨庆宪** 美国宾州州立大学	

时间	题目	主讲嘉宾 / 报告人	主持人
14:25-15:00	How does the brain represent meanings of words, phrases, and sentences?	**Prof. Thomas Mitchell** 美国工程院院士 美国卡内基梅隆大学教授	
15:00-15:30	Genetic and optic dissection of neuron-metabolism	**孔栋** 美国塔夫茨大学	**但果 教授** 深圳大学
15:30-16:00	The neural mechanisms of effective learning: A neural activation pattern reinstatement hypothesis	**薛贵 教授** 长江学者特聘教授 北京师范大学	
16:00-16:30	Identifying and promoting learning-induced brain changes through technology	**李平 教授** 教育部长江学者讲座教授 美国宾州州立大学	**金真 教授** 北京 306 医院 深圳市神经科学研究院
16:30-17:00	Meta-connectomics: modeling functional and structural connectivity networks for biomarker discovery	**Prof. Peter Fox** *Human Brain Mapping* 主编 美国德克萨斯大学	

2016 年 12 月 2 日 星期六 （伞友咖啡分会场）	
时间	**事项**
09:00-12:00	小组讨论前半段 （题目：神经元纪录技术和动物模型研究的发展与未来）
12:00-14:00	午餐 ＊请所有参会人士留在伞友咖啡用餐
14:30-18:00	小组讨论后半段、总结会议

2016 年 12 月 2 日 星期六 （深圳市神经科学研究院分会场）	
时间	**事项**
09:00-12:00	小组讨论前半段 （题目：脑成像技术研究的现在与未来）
12:00-14:00	午餐 ＊请所有参会人士在伞友咖啡用餐
14:30-18:00	小组讨论后半段、总结会议

INVITED SPEECHES

Uncovering the representation of individual faces from patterns of neural and behavioral data in normal and prosopagnosic individuals

Marlene Behrmann
Professor, Carnegie Mellon University
Member of the National Academy of Sciences

Face recognition is probably the most developed visual perceptual skill in humans, most likely as a result of its unique evolutionary and social significance. Much recent research has converged to identify a host of relevant underlying mechanisms that support face recognition, most notably, a broadly distributed neural circuit, comprised of multiple nodes whose joint activity supports face individuation. An ongoing question, however, concerns the nature of the representations that permit individuation with speed and accuracy. In this talk, I will present findings from a novel approach that permits us to estimate the structure of human face space as encoded by high-level visual cortex, extract image-based facial features from this structure and use such features for the purpose of facial image reconstruction. fMRI and MEG data enable us both to decode and reconstruct the neural signature for individual faces dynamically over time and the functional value of these neural signatures is validated by their absence in individuals with prosopagnosia. The derivation of visual features from empirical data provides an important step in elucidating the nature and the specific content of face representations. Further, the integrative character of this work sheds new light on the existing concept of face space by rendering it instrumental in image reconstruction. Finally, these results have important implications for understanding the rapid emergence of fine-grained, high-level representations of object identity, a computation essential to human visual expertise.

About the speaker:

Marlene Behrmann received her undergraduate and M.A. degree from the University of the Witwatersrand, Johannesburg, South Africa and her Ph.D. from the University of Toronto. She is currently a Professor in the Department of Psychology and the Center for the Neural Basis of Cognition at Carnegie Mellon University, Pittsburgh. Her research is concerned with the psychological and neural bases of visual processing, with particular focus on the mechanisms by which the signals from the eye are transformed into meaningful and coherent percepts by the brain. She adopts an interdisciplinary approach using a combination of computational, neuropsychological and functional brain imaging studies with normal and brain-damaged individuals as well as with individuals with neurodevelopmental disorders. Dr. Behrmann has received many awards including the Presidential Early Career Award for Engineering and Science and the APA Distinguished Scientific Award for Early Career Contributions, and she was elected to the National Academy of Sciences in 2015.

Physical exercise prevents loss of spines and improves working memory through the BDNF-TrKB signal pathway

Kwok-Fai So
Director, GHM Institute of CNS Regeneration, Jinan University
Professor, Department of Ophthalmology, The University of Hong Kong
Member of Chinese Academy of Sciences

Stress-related memory deficit is correlated with dendritic spine loss. Physical exercise improves memory function and promotes spinogenesis. However, no studies have been performed to directly observe exercise-related effects on spine dynamics, in associated with memory function. This study utilized transcranial two-photon in vivo microscopy to investigate dendritic spine plasticity in barrel cortex of stressed mice, in conjunction with memory performance in a whisker-dependent novel texture discrimination task. We found that stressed mice had elevated spine elimination rate in mouse barrel cortex plus deficits in memory retrieval, both of which can be rescued by chronic exercise on treadmill. Exercise also elevated brain derived neurotrophic factor (BDNF) expression in barrel cortex after. Those rescuing effects for both spinognesis and memory function were abolished after inhibiting BDNF/tyrosine kinase B (TrkB) pathway. In summary, this study demonstrated the improvement of stress-associated memory function by exercise via facilitating spine retention in a BDNF/TrkB-dependent manner.

About the speaker:

Kwok-Fai So received his Ph.D. degree at MIT. He is a Director of the Guangdong-Hong Kong-Macau Institute of CNS Regeneration at Jinan University and a Professor in the Department of Ophthalmology at The University of Hong Kong. He is currently using multiple approaches to promote axonal regeneration in the optic nerve and spinal cord, including: trophic factors, herbal extracts, other small molecules, immune responses and environmental manipulation.

Metanalytic interpretation of brain images Mango/BrainMap interactions

Jack Lancaster
Professor, Research Imaging Institute, University of Texas Health Science Center at San Antonio
Editor of Human Brain Mapping

Mango is a freely distributed Java application for viewing, analysis and interpretation of brain images. The basis of the Mango/BrainMap interaction is the Talairach coordinate system. The first coordinate-based application integrated into Mango was the Talairach Daemon, an anatomical labeling system with a hierarchical scheme conceived for the 1988 Talairach Atlas.

To support brain images spatially normalized using the MNI152 template we developed and tested a transform between the MNI152 and Talairach 1988 brain coordinates. This transform is integrated into Mango and is used to convert MNI to Talairach coordinates for the BrainMap database.

The BrainMap database includes data from a large number of published functional neuroimaging studies. Each experiment in BrainMap includes coordinates, behaviors, and an experimental paradigm. Behavior and paradigm analysis tools were recently integrated into Mango. Binary images of coordinates for each behavior and paradigm class are analyzed using Mango's region of interest (ROI) tool and those matching the spatial distribution of the ROI are ranked. Results are presented graphically and as an ordered list of z-scores. These labels are useful in assessing behaviors for ROIs such as those determined from task based or resting state fMRI studies.

About the speaker:

Jack Lancaster received his Ph.D. in University of Texas Health Science Center at Dallas in 1978. He is currently a professor and Chief of the Biomedical Image Analysis Division (BIAD) at the Research Imaging Institute at University of Texas Health Science Center, San Antonio. Professor Lancaster is also founding co-editor of *Human Brain Mapping* with Peter Fox. He is an expert in spatial normalization techniques and developed the coordinate conversion algorithm, icbm2tal (Lancaster transform), to accurately compare Talairach and MNI coordinates archived in BrainMap.

Cortical representation of speech units

Bo Hong
Professor, Department of Biomedical Engineering,
IDG/McGovern Institute for Brain Research, Tsinghua University

A finite set of phonetic units is used in human speech. How our brain recognizes these units from speech stream, as we do in visual object recognition, is largely unknown. In this study, using intracranial EEG (iEEG) from human auditory cortex, we identified neural populations over Heschl gyrus (HG), superior temporal gyus (STG) and superior temporal gyrus (STS) that showed selective response to specific Chinese vowel complex or its constituent parts. The neural clustering organization over STS/STG is more biased toward the perceptual discriminability of vowel complex, while that over HG are more close to the clustering in acoustic feature space. STS areas also showed stronger speaker invariance in their selective response. These findings suggest a hierarchical organization of phoneme encoding in human brain. In tonal languages such as Chinese, lexical tone with varying pitch contours serves as a key feature to provide contrast in word meaning. Similar to phoneme processing, behavioral studies have suggested that Chinese tone is categorically perceived. With iEEG, we revealed the brain network and its dynamics responsible for this categorical perception. Based on an oddball paradigm, we found amplified neural distances between cross-category tone pairs, rather than between within-category tone pairs, over cortical sites covering both the ventral and dorsal streams of speech processing. In addition, the bilateral motor cortices were also found to be involved in categorical processing. Moreover, the motor cortex received enhanced Granger causal influence from the semantic hub, the anterior temporal lobe (ATL), in the right hemisphere. These unique data suggest that there exists a distributed cortical network supporting the categorical processing of lexical tone in tonal language speakers, not only embracing a bilateral temporal hierarchy that is shared by categorical processing of phonemes but also involving intensive speech-motor interactions over the right hemisphere.

About the speaker:

Dr. Bo Hong received his Ph.D. of biomedical engineering from Tsinghua University in 2001. From 2004 to 2005, he was a visiting faculty in the department of biomedical engineering and the center for neural engineering at Johns Hopkins University. He is now a professor with department of biomedical engineering, School of Medicine, and investigator of McGovern Institute for Brain Research at Tsinghua University. He is currently the Associate Editor of IEEE Transactions on Neural Systems and Rehabilitation Engineering. His research interests are neural information decoding of auditory system and speech brain computer interface.

In searching functional markers for AD and PD: olfactory deficits

Qing X. Yang
Professor, Department of Pennsylvania State University

The central factory system is biologically dynamic in the brain, which makes it most vulnerable to neurodegenerative diseases. Olfactory deficit is shown an earliest symptom in both Alzheimer's disease (AD) and Parkinson's diseases (PD). We do not know, however, the pathological basses that lead to this early clinical presentation for these two very distinctively different neurodegenerative diseases, and it is impossible to differentiate these common deficits clinically. We investigated the functional and pathological differences in AD and PD with olfactory fMRI and MRI. With novel olfactory fMRI paradigms, our research provide data that allow for differentiating the functional pathology of the two diseases and developing specific diagnostic tools for early detection and monitoring AD and PD.

About the speaker:

Qing X. Yang, Ph.D. is a Professor (Tenured) of Radiology, Neurosurgery, Bioengineering and Engineering Sciences and Mechanics. He is the Director of Center for NMR Research, Penn State College of Medicine. He received his B.A. from Peking University and Ph.D. from the Institute of Georgia Technology. Since his postdoctoral training at the Center for NMR Research at Penn State College of Medicine, he worked at the rank of Assistant Professor 2014 and Full Professor until now. His research interests include MRI metrology development in MRI at high field (magnetic susceptibility effects and dielectric effects on the radiofrequency field) and applications of MRI and fMRI in human brain functions and brain diseases (PD, AD and TBI). For more information about his research visit http://www.pennstatehershey.org/web/nmrlab/

How does the brain represent meanings of words, phrases, and sentences?

Thomas M. Mitchell
Professor, Carnegie Mellon University
Member of National Academy of Engineering

How does the human brain use neural activity to create and represent meanings of words, phrases, sentences and stories? One way to study this question is to give people text to read, while scanning their brain. We have been doing such experiments with fMRI (1 mm spatial resolution) and MEG (1 msec time resolution) brain imaging. As a result, we have learned answers to questions such as "Are the neural encodings of word meaning the same in your brain and mine?", "Are neural encodings of word meaning built out of recognizable subcomponents, or are they randomly different for each word?," "What sequence of neurally encoded information flows through the brain during the half-second in which the brain comprehends a word?," "How are meanings of multiple words combined when reading phrases, sentences, and stories?" This talk will summarize some of what we have learned, and newer questions we are currently working on.

About the speaker:

Tom M. Mitchell is the E. Fredkin University Professor at Carnegie Mellon University, where he founded the world's first Machine Learning Department. His research uses machine learning to develop computers that are learning to read the web (http://rtw.ml.cmu.edu), and uses brain imaging to study how the human brain understands what it reads. Mitchell is a member of the U.S. National Academy of Engineering, the American Academy of Arts and Sciences, a Fellow of the American Association for the Advancement of Science (AAAS), and a Fellow and Past President of the Association for the Advancement of Artificial Intelligence (AAAI). In 2015 he received an honorary Doctor of Laws degree from Dalhousie University for his contributions to machine learning and cognitive neuroscience.

Genetic and optic dissection of neuron-metabolism

Dong Kong
Assistant Professor, Tufts University

Growing evidence has recently shown that neurons, particularly those in the hypothalamus, play important roles in regulating whole body metabolic balance and blood glucose homeostasis, and their dysfunctions contribute to the pathogenesis of human diseases including obesity and diabetes. However, the complexity of the nervous system and difficulties in probing neuronal functions in vivo leave us with an incomplete understanding of both the molecular mechanisms and neural circuitry of brain-mediated metabolic dysfunctions. Our recent studies thus focused on hypothalamic neurons and securitized their control of whole body metabolism by combining a battery of genetic and optic approaches. Specifically, we are currently leveraging and combining a cornucopia of cutting-edge technologies, from genetically engineered mouse models, recombinant viral vectors and viral tracing system, optogenetic and pharmacogenetic approaches, patch-clamp electrophysiology, to 2-photon laser scanning microscopy and 2-photon laser uncaging methods (2PLSM/2PLU), to explore the molecular and circuit mechanisms underlying feeding related behaviors and glucose homeostasis. Our findings will provide novel insights in the prevention and treatment of human metabolic diseases.

About the speaker:

Dong Kong received his Ph.D. from Nanjing University. He is currently an Assistant Professor in School of Medicine at Tufts University. The long-term interest of Dong's laboratory is to bridge molecular, cellular, and system approaches to understand the neuronal modulation and circuitry involved in the pathogenesis of neurological diseases. Specifically, they are currently leveraging and combining a cornucopia of cutting-edge technologies, from genetically engineered mouse models, recombinant viral vectors and viral tracing system, optogenetic and pharmacogenetic approaches, patch-clamp electrophysiology, to 2-photon laser scanning microscopy and 2-photon laser uncaging methods (2PLSM/2PLU), to explore the molecular and circuit mechanisms underlying feeding related behaviors and metabolic homeostasis.

The neural mechanisms of effective learning: A neural activation pattern reinstatement hypothesis

Gui Xue
Professor, State Key Laboratory of Cognitive Neuroscience and Learning
Beijing Normal University
Chang Jiang Scholar Distinguished Professor

Practice makes perfect, but not all repetitions are equal. Although more than one-century behavioral and computational research has revealed many manipulations during studies that could lead to more effective learning, the exact cognitive and neural mechanisms are still under hot debate. These debates focus on one fundamental question in learning and memory, that is, how does repeated practice enhance memory. Using functional MRI and a novel representation similarity analysis, our recent work has provided neural evidence to suggest that successful encoding of episodic memory occurs when the same neural representations are more precisely reactivated across study episodes, rather than when patterns of activation are more variable across time. We further found that brain stimulation and behavioral manipulations such spacing and variable encoding that could enhance episodic memory, are associated with greater pattern similarity across repetitions. Together, our result challenges the encoding variability hypothesis and lead to a neural activation pattern reinstatement hypothesis of the practice effect in learning and memory.

About the speaker:

Dr. Gui Xue is a Chang Jiang Scholar Distinguished Professor and the director of the Center for Brain and Learning Sciences (CBLS) in the State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University. He received his Ph. D. in cognitive neuroscience from Beijing Normal University in 2004. Dr. Xue studies the cognitive and neural mechanisms of learning and memory, language, executive control and decision making, mainly using functional neuroimage techniques. He has published more than 60 peer-reviewed papers on academic journals such as Science, PNAS, Current Biology, Journal of Neuroscience, and Cerebral Cortex. His research is support by the 973 Program, the Natural Science Foundation of China, the Thousand Young Talents Program, and the New Century Excellent Talents Program.

Identifying and promoting learning-induced brain changes through technology

Ping Li
Professor, Pennsylvania State University
Chang Jiang Scholar Chair Professor

How can we identify, predict, and promote learning-induced brain changes? In this talk I present studies that address this question by combining fMRI/sMRI with cyber-enabled technologies for learning and discovery. First, rapid brain changes during concept formation are detected in a study in which participants read expository science texts while their eye-movement and fMRI data were collected. We identified a brain network that likely reflects the reader's integration of linguistic and visual features of words within the sensorimotor-temporo-parietal neural circuit. Individual differences in cognitive and linguistic abilities further modulated the interaction between the language-processing network and the executive-function network. Second, in a short-term training study in which American students learned Mandarin Chinese vocabulary in 3D virtual environments, we identified rapid fucntional and structural brain changes, particularly with increased gray matter and cortical thickness in the inferior parietal lobule. Individual differences in working memory were further correlated with gray matter structure after L2 training. Finally, in a recent study we attempted to uncover the underlying brain correlates of spatial abilities by training students to learn neuroanatomical structures on 3D digital learning platforms, and further identify cross-domain transfer effects in the learning of astronomy and phases of the moon. Together, findings from these studies provide insights into issues of neuroplasticity (e.g., how learning leads to domain-specific and domain-general neural changes), individual differences (e.g., how cognitive capacity impacts and predicts learning success), and knowledge representation (e.g., how brain networks reflect knowledge and understanding).

About the speaker:

Ping Li received his Ph.D. from the University of Leiden in 1990. He is currently at Penn State University as Professor of Psychology, Linguistics, & Information Sciences & Technology, Co-Director of the Center for Brain, Behavior, & Cognition, and Associate Director of the Institute for CyberScience, and is a visiting scientist at the Shenzhen Institute of Neuroscience, China. Ping Li is Editor-in-Chief of *Journal of Neurolinguistics* and Associate Editor of *Frontiers in Psychology: Language Sciences*. His research focuses on the neural and computational bases of language representation and learning in both native and non-native contexts. For more information about his research visit http://blclab.org/.

Meta-connectomics: modeling functional and structural connectivity networks for biomarker discovery

Peter T. Fox
Research Imaging Institute, University of Texas Health Science Center at San Antonio
South Texas Veterans Health Care System,
Shenzhen Institute of Neuroscience
Editor of Human Brain Mapping

Connectivity is a fundamental property of the human brain, underlying its role as a highly efficient but as yet poorly understood information-processing system. Connectivity among brain regions can be quantified using a variety of functional and structural neuromaging approaches incluuding inter-regional functional covariance (fCoV) during task performance, fCoV duing neuromodulatory stimulation, fCoVin the resting state, and various analyses applied to diffusion tensor imaging (DTI). Computational frameworks applied to functional and structural connectivity analyses include independent components analysis (ICA), path analysis using either structural equation modeling (SEM) or dynamic causal modeling (DCM), a variety of graph theortic modeling (GTM) approaches, and tractographic methods applied to DTI. Abnormal brain connectivity is being widely explored as a paradigm for describing information-processing abnormaliteis in neurologic and psychiatric disorders. Collectively, this discipline is referenced to as human connectomics. A newly emerging addition to the human connectomics literature computes network models by meta-analytic application of several of these same computational strategies as well as meta-analysis-specific strateggies. Specifically, ICA, GTM, and SEM are being applied to the coordinate-based literature and cross-validated by comparisons to more established connectomic methods. Meta-analytic connectomic methods can compute both fCoV, using the task-activation literature and structural covariance (sCoV) using each of these several methods. We here review the use of meta-analytic approaches in brain connectivity studies that go beyond a summarizing role, and which have provided novel insights into brain function and dysfunction.

About the speaker:

Peter T Fox received his M.D. from Georgetown University School of Medicine. He is a Professor in the Department of Radiology, Founding Director of Research Imaging Institute at the University of Texas Health Science Center at San Antonio, and founding co-editor of *Human Brain Mapping* with Jack Lancaster. Peter helped develop the Talairach Daemon, a commonly used template for brain normalization. He initiated the BrainMap database which stores results from functional and structural human neuroimaging studies for coordinate-based meta-analysis, and has overseen the development of Scribe, Sleuth, and GingerALE, a pipeline of freely available software for coding, searching, and meta-analyzing the BrainMap Database.