BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
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NAME	POSITION TITLE
Kechen Zhang	Assistant of Professor of Biomedical Engineering and Neuroscience
eRA COMMONS USER NAME KZHANG4	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Beijing University, Beijing, China	B.S.	1985	Physiology & Biophysics
Beijing University, Beijing, China	M.S.	1988	Neurobiology
University of California, San Diego	Ph.D.	1996	Cognitive Science
Salk Institute for Biological Studies, La Jolla, CA	Postdoctoral	1996-2002	Computational Neurobiology

A. Positions and Honors. List in chronological order previous positions, concluding with your present position. List any honors. Include present membership on any Federal Government public advisory committee.

Professional Experience

1988-1990: Lecturer of mathematics, Henan Medical University, Zhengzhou, China.
2002-present: Assistant Professor, Department of Biomedical Engineering and Department of neuroscience, Johns Hopkins University School of Medicine, Baltimore, Maryland.

Professional Services

A member of *Faculty of 1000* (www.facultyof1000.com) in the section of Theoretical Neuroscience, 2002-2005.

NSF Computational Neuroscience Program advisory panel, April 2005.

Reviewed over 200 papers for academic journals including Journal of Cognitive Neuroscience, Journal of Computational Neuroscience, Journal of Neurophysiology, Journal of Neuroscience, Journal of Neuroscience Methods, Journal of the Acoustical Society of America, Nature, Nature Neuroscience, Neural Computation, Neuron, NeuroReport, Physical Review, Physical Review Letters, PLoS Computational Biology, plus dozens of conference papers, and several grant applications for NSF.

B. Selected peer-reviewed publications (in chronological order).

Peer-reviewed Journals:

Kechen Zhang (1990): Uniform distribution of initial states: The physical basis of probability. *Physical Review A*, 41: 1893-1900.

Pei-ai Zhou, Kechen Zhang and Huiwen Cheng (1991): Responses of the single thread-hair sensillum of the cercus of the cockroach Periplaneta americana to mechanical stimuli. *Acta Biophysica Sinica*, 7: 54-58.

Kechen Zhang and Kezhao Zhang (1992): Mechanical models of Maxwell's demon with noninvariant phase volume. *Physical Review A*, 46: 4598-4605.

Kechen Zhang, Martin I. Sereno and Margaret E. Sereno (1993): Emergence of position-independent detectors of sense of rotation and dilation with Hebbian learning: An analysis. *Neural Computation*, 5: 597-612.

Kechen Zhang (1996): Representation of spatial orientation by the intrinsic dynamics of the head-direction cell ensemble: A theory. *Journal of Neuroscience*, 16: 2112-2126.

Alexandre Pouget, Kechen Zhang, Sophie Deneve and Peter E. Latham (1998): Statistically efficient estimation using population code. *Neural Computation*, 10: 373-401.

Kechen Zhang, Iris Ginzburg, Bruce L. McNaughton and Terrence J. Sejnowski (1998): Interpreting neuronal population activity by reconstruction: Unified framework with application to hippocampal place cells. *Journal of Neurophysiology*, 79: 1017-1044.

Kechen Zhang and Terrence J. Sejnowski (1999): Neuronal tuning: To sharpen or broaden? *Neural Computation*, 11: 75-84.

Kechen Zhang and Terrence J. Sejnowski (1999): A theory of geometric constraints on neural activity for natural three-dimensional movement. *Journal of Neuroscience*, 19: 3122-3145.

Kechen Zhang and Terrence J. Sejnowski (2000): A universal scaling law between gray matter and white matter of cerebral cortex. *Proceedings of the National Academy of Sciences USA*, 97: 5621-5626.

Huge T. Blair, Adam C. Welday, and Kechen Zhang (2007): Scale-invariant memory representations emerge from moiré interference between grid fields that produce theta oscillations: A computational model. *Journal of Neuroscience*, 27:3211-3229.

Christopher DiMattina and Kechen Zhang (2008): How optimal stimuli for sensory neurons are constrained by network architecture. *Neural Computation*, 20: 668-708.

Huge T. Blair, Kishan Gupta, and Kechen Zhang (2008): Conversion of a phase-coded to a rate-coded position signal by a three-stage model of theta cells, grid cells, and place cells. *Hippocampus*, 18:1239-1255.

Christopher DiMattina and Kechen Zhang (2008): How to modify a neural network gradually without changing its input-output functionality. *Neural Computation*, under revision.

Book Chapters:

Kechen Zhang, Martin I. Sereno and Margaret E. Sereno: Emergence of position-independent detectors of sense of rotation and dilation with Hebbian learning: An analysis. In: *Unsupervised Learning: Foundations of Neural Computation*, edited by Geoffrey Hinton and Terrence J. Sejnowski, Cambridge, Mass.: MIT Press, 1999, pages 47-62.

Alexandre Pouget, Kechen Zhang, Sophie Deneve and Peter E. Latham: Statistically efficient estimation using population code. In: *Neural Codes and Distributed Representations: Foundations of Neural Computation*, edited by Laurence Abbott and Terrence J. Sejnowski, Cambridge, Mass.: MIT Press, 1999.

Kechen Zhang and Terrence J. Sejnowski: Accuracy and learning in neuronal populations. In: Progress in Brain Research, Vol. 130, *Advances in Neural Population Coding*, edited by Miguel A. L. Nicolelis, Elsevier Science, 2001, pages 333-342.

Kechen Zhang: Theoretical and Computational Neuroscience: Models of place cells in the hippocampus and head direction cells. *New Encyclopedia of Neuroscience*, edited by Larry R. Squire, Tom Albright, Floyd Bloom, Fred Gage, and Nick Spitzer: Elsevier, to appear in 2008.

C. Research Support. List selected ongoing or completed (during the last three years) research projects (federal and non-federal support). Begin with the projects that are most relevant to the research proposed in this application. Briefly indicate the overall goals of the projects and responsibilities of principal investigator identified above.

NSF/NIH CRCNS (Collaborative Research in Computational Neuroscience)
Grant Number: NIH-NEI R01 EY017205
Title: Specialization of ventral visual cortex for shape statistics of natural scenes and objects

PI: Charles E. Connor (Johns Hopkins), co-PI: Kechen Zhang
Award period: 9/15/2005-8/31/2009
The goal of this project is to quantify the statistical relationship between geometric features of natural visual objects and neuronal population responses to complex shapes in the inferotemporal cortex of macaque monkey.

NSF/NIH CRCNS (Collaborative Research in Computational Neuroscience)
Grant Number: NIH-NIMH R01 MH079511-02
Title: Path integration by the grid cell network
PI: Hugh T. Blair (UCLA), co-PI: Kechen Zhang
Award period: 9/15/2006-8/31/2009
In this project we study how entorhinal cortical grid cells perform path integration using hexagonal firing patterns in cooperation with thalamic head-direction cells and hippocampal place cells in freely behaving rats.

NSF/NIH CRCNS (Collaborative Research in Computational Neuroscience)
Grant Number: NSF IIS-0827695
Title: Characterizing nonlinear auditory computations
PI: Kechen Zhang, co-PIs: Eric D. Young and Xiaoqin Wang (Johns Hopkins)
Award period: 10/1/2008-9/30/2011
In this project we will develop online algorithms that can generate sound stimuli adaptively to accurately characterize nonlinear stimulus-response properties of neurons in the auditory system of the marmoset monkey.