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FOR BIOLOGICAL STUDIES

January 20, 2004

Biocomplexity Faculty Search Committee
c/o Prof. Rob de Ruyter
Department of Physics
Swain West 117
727 East Third Street
Indiana University
Bloomington, IN 47405-7105

Dear Prof. de Ruyter:

I am writing an enthusiastic letter on behalf of Dr. Sidney Lehky, who is being considered for a faculty position at Indiana University. Sidney was a postdoctoral fellow in my laboratory at the Johns Hopkins University and we have continued to collaborate on several scientific problems.

Sidney has a remarkable set of skills that make him nearly unique. He worked on a thesis under Hugh Wilson at the University of Chicago in visual psychophysics. In my laboratory he worked on two modeling projects, one on characterizing properties of neurons in visual cortex that could participate in processing shape information from surface shading, and a second project on modeling stereo-hyperacuity using physiological data. With Bob Desimone and John Maunsell he learned experimental techniques for recording from neurons in awake and behaving monkeys. AT RIKEN he has completed a brilliant series of psychophysical studies and with Keiji Tanaka he recorded from single units in the inferotemporal cortex and perirhinal cortex of awake monkeys. Most recently he has focused on braining imaging at NIH.

Sidney pioneered a new approach to a difficult problem while he was a postdoctoral fellow at NIH after leaving my laboratory. The properties of single neurons in the visual cortex are traditionally assessed by taking a set of favorite set of stimuli, such as spots and bars of light, or spatial frequency gratings, and to plotting tuning curves to find the maximal response. It is now clear, in part from some of Sidney's own modeling studies, that the responses of cells characterized this way may be quite misleading. The approach Sidney developed depended first on using a much wider range of visual stimuli than is typical (including shaded images of 3-D objects and complex scenes). A network model was then trained to predict the response for an individual neuron, a model that could then be tested for its ability to generalize to data that were not used to construct the model.

10010 North Torrey Pines Road, La Jolla, CA 92037-1099
PO Box 85800, San Diego, CA 92186-5800
Tel 858.453.4100 Fax 858.552.8285
www.salk.edu

It was not clear when Sidney started this project with Bob Desimone that this was feasible: the amount of data required to so characterize the cell might be enormous (equivalent to all possible visual stimuli). Sidney managed to overcome this problem in a very creative way, by taking advantage of known smoothness properties of neural responses. His results for cells in V1 were quite promising and he was able to characterize the nonlinear response properties of visual neurons with greater quantitative accuracy than was previously possible. This new technique can be used to probe subtle receptive field properties and to compare neurons in different layers and areas of visual cortex.

Sidney is also working on the properties of neurons in the inferotemporal cortex. It has been know for some time that some IT neurons are selective for faces. However, these selectivities have not been carefully quantified. Sidney has used face morphing and psychophysical testing to determine the thresholds for facial discrimination, and he is also beginning to apply techniques that he pioneered in modeling stereo hyperacuity to estimate the amount of information contained in a group of IT neurons that respond selectively to these stimuli.

Most recently, Sidney completed a study of illusory conjunctions and finds a fivefold increase at isoluminance. His results have important implications for the pathways that are responsible for feature binding and the role of attention. This is the best study I have seen on this subject in many years.

Sidney has a deep understanding of the visual system from several different experimental and theoretical perspectives. I am impressed with his ability to constrain neural models using both psychophysical data and physiological data. He thinks clearly and picks good problems. He is a thoughtful writer and each of his papers is a gem. In short, he is almost unique in being able to combine insights from physiology, psychophysics and modeling.

Sidney is an accomplished scientist who has an impressive range of skills. He has quantitative modeling skills and is also a superb biologist. It has taken a long time for him to master all of these different techniques and he is now able to bring them to bear on important problems. Sidney is shy in person but articulate and expresses himself well. His lectures are models of clarity and he is also a good teacher.

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Sidney Lehky has exceptional promise for making a major breakthrough and for achieving something important and unexpected. I highly recommend him for a faculty position at Indiana University.

Sincerely,

Terrence J. Sejnowski

Professor, Salk Institute
Investigator, Howard Hughes Medical Institute

Professor of Biology and Neurosciences,
University of California, San Diego

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