Massachusetts Institute of Technology

Department of Brain and Cognitive Sciences
Cambridge, Massachusetts 02139

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Biocomplexity Faculty Search Committee
c/o Prof. Rob de Ruyter van Steveninck
Biocomplexity Institute
Indiana University
Swain Hall West 117
Bloomington, IN 47405-7105

Dear Dr. Rob de Ruyter van Steveninck:

It is a pleasure to write on behalf of **Dr. Jessica Reeves Newton**, who has applied for a faculty position in your department. Jessica has been a postdoctoral fellow in my laboratory since September 2001, and I recommend her with the highest enthusiasm.

Jessica came to my laboratory after receiving her PhD from the Department of Psychology at Northeastern University. She started her graduate research at Northeastern with Alex Skavenski studying cross-modal plasticity in the adult brain. She showed that removal of visual inputs caused neurons of the primary visual cortex to respond to tactile stimuli. After Skavenski's untimely death in 1998, she persevered and completed her experiments and her Master's thesis with Bob Sikes. It is a mark of her exceptional commitment and discipline that she has now published, on her own initiative, a paper on the findings. After 1998, she worked with Rhea Eskew on mechanisms of color vision, including possible higher order color mechanisms and comparison of peripheral with foveal mechanisms. This work has been presented at several meetings and been published. She wished to come to my laboratory to study visual processing in the rewired auditory cortex, as a logical extension of her previous interest in cortical plasticity and vision. She wrote a NRSA (NIH postdoctoral) application which was immediately funded.

My laboratory examines the role of activity in shaping functional plasticity in the developing and adult cortex, using a range of approaches. We showed several years ago that routing retinal projections to the auditory thalamus in neonatal animals causes visual driving of the auditory thalamus and cortex, and creates visual processing networks in the auditory cortex. In one set of behavioral experiments, we showed that rewired ferrets interpret visual activation of the auditory cortex as a visual stimulus. Thus, the behavioral role of a cortical area appears to be strongly influenced by its inputs during development. Jessica decided to ask a complementary question in rewired mice – whether a rewired projection can shape emotional responses as much as sensory-perceptual ones. Normal mice show rapid auditory cued fear conditioning; i.e., a single trial in which a tone is paired with a shock causes an animal to freeze in fear when a tone is presented next. Many more trials are needed for visual fear conditioning. The substrate for rapid auditory fear conditioning is a monosynaptic pathway from the auditory thalamus to the basolateral nucleus of the amygdala. We wondered whether the rewired projection from the retina to the auditory thalamus would lead to rapid visual cued fear conditioning. In a set of beautiful experiments, Jessica has demonstrated that rewired mice indeed show rapid visual fear conditioning. Thus, pathways (such as that from the auditory thalamus to the amygdala) derive function from their inputs, and a cued fear response is not intrinsically associated with a sensory modality.

I should note that Jessica had never done behavioral experiments in mice before: she learned all the techniques with minimal help from local experts, and carried out the experiment together with a graduate student. Many control experiments were done, along with immunocytochemical labeling of activitydependent markers (such as c-fos) to demonstrate visual activation of the amygdala. This is a first-rate study that should appear soon in a top journal.

Over the past several months, Jessica has been leading experiments using optical imaging and single unit recording to examine the organization of multiple stimulus features (such as orientation, ocular dominance, spatial frequency, and direction) in normal and rewired cortex. These are again cutting-edge experiments with a clear question: to what extent do the various stimulus feature maps observed in visual cortex depend on patterns of electrical activity in inputs? Jessica has learned state-of-the-art methods of optical imaging, and is now proficient in their use. It is a mark of her exceptional experimental skills that she obtained data and submitted an abstract to the Society for Neuroscience within a couple of months after starting the study. These experiments are now quite advanced.

Jessica has begun to think ahead about her own lab and its future research directions. One exciting possibility is to examine cross-modal plasticity in humans using behavioral and imaging approaches. She will start a collaboration soon with Chris Moore, a young faculty member in our department who uses fMRI to study cortical plasticity involved in tactile and visual motion processing. I am extremely confident that she will rapidly learn techniques of fMRI, and will be able to combine them with psychophysical measurement tools she acquired during her PhD to do innovative work in humans. Importantly, there are few people who have the range of skills that Jessica has acquired and is using for asking fundamental questions about brain organization and plasticity.

Jessica is an exceptional candidate for a faculty position. In addition to her smarts and ability to work hard, she is a very pleasant individual who also contributes a great deal to the morale and unity of the lab. She has the potential to be an outstanding researcher, teacher and faculty member at a first rate university, and her potential for success is virtually limitless.

Yours Sincerely,

Mriganka Sur

Mriganka Sur, PhD
Fairchild Professor of Neuroscience
Head, Department of Brain and Cognitive Sciences