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Biocomplexity Faculty Search Committee
c / o Prof. Rob de Ruyter van Steveninck
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Indiana University
Swain Hall West 117
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Dear Colleagues,

It is my great pleasure to recommend Dr. Youping Xiao who is applying for a faculty position at your institution. Dr. Xiao has joined our department as a research faculty and started working independently in my laboratory in 2002. Since then, he has made significant contributions to my laboratory and the field of visual neuroscience.

When he was working in Dr. Daniel Felleman's laboratory as a postdoctoral fellow, he discovered that macaque V2 has color maps in which different colors elicit neural responses that are peaked at different locations. More interestingly, these color maps seem to reflect our perceptual organization of color, that is, perceptually close colors are represented by nearby sites in these maps. Previous studies of the neural coding of color were mostly focused on the behavior of individual neurons. While it is widely accepted that any visual feature should be encoded in the activity patterns of a large ensemble of neurons, none of previously published studies had addressed the *ensemble* encoding of color. The work by Dr. Xiao and his colleagues, published in *Nature* in 2003, was the first to visualize the ensemble encoding of color in primate cortex, and represents a breakthrough in our understanding of the neural mechanism underlying color perception.

In addition, by directly demonstrating the unique role of the cytochrome oxidase thin stripes of V2 in color representation, Dr. Xiao's work has been the most compelling study addressing the highly controversial topic of whether V2

is composed of different functional compartments. His study will also contribute to the resolution of one of the central questions in visual neuroscience, that is, whether different visual features are processed in separate neural substrates, which is tightly related to the binding problem derived from psychophysical studies.

In order to determine how the color maps in V2 are generated, Dr. Xiao and I have been studying the representation of color in the primary visual cortex, V1, of primates. This work employs optical imaging of intrinsic signal, electrode recording and anatomical techniques. With his extensive experience and superb skill in these techniques and in engineering, he finished setting up a new imaging system and has collected valuable data since then. Our data show that, like V2, V1 also has color maps that could be the origin of the color maps in V2. In each V1 color map, the peaks of the responses to 9 different colors formed a band of about 250 um long, in an order mirroring the perceptual order of the stimulus colors. Although the color processing in V1 has been extensively studied before (often with conflicting results), we have-- for the first time-- shown that the full gamut of color is represented in an orderly spatial arrangement in V1. Since V1 is the first stage of the cortical processing of visual information, our finding of V1 maps will help us to understand the generation of color perception. The finding of color maps in V1 and V2 also provides a platform on which we can study more complex computations, such as color constancy. An understanding of the neural computation of color will help to illuminate the computations responsible for other visual, or even non-visual, functions. Therefore, Dr. Xiao's outstanding work on color vision contributes significantly to the general field of neuroscience.

Our results of V1 color maps also demonstrate Dr. Xiao's ability to image functional structures at very high resolution, which I attribute to his mastery of optical imaging technique, and especially his striving to optimize each experimental parameter. During the same period, he has been the major driving force of preparing our lab for imaging the brain of awake behaving monkeys. Based on his experience of imaging surviving monkeys, he has successfully adopted the imaging protocol that has been used on behaving monkeys by Grinvald's group. His ongoing collaboration with Ralph Siegel at the Rutgers University Medical School will enable our laboratory to image behaving monkeys in near future, and will drastically enhance our ability to address important questions directly related to perception.

I have been working on visual system for more than three decades, including more than twenty years at The Rockefeller University. My experience with Dr. Xiao shows him to be one of the most intelligent and creative young scientists I have ever met. He is familiar with the literature of modern

neuroscience, and has a deep understanding of the important issues of the field. This clear grasping of previous studies enables him to identify specific questions that are important to the field, and to independently design studies to address these questions. His design of experiments and data analysis is scientifically sound and innovative. I am especially impressed by his emphasis on *quantitative* data analysis. For example, the recently published quantitative anatomic work by Xiao and Felleman has revealed that a significant percentage of V1 cells projecting to V2 thin stripes are located outside blobs, something that had been missed in previous, qualitative studies. His surgical skill is outstanding, which contributes not only to the success of his own projects, but also to other projects carried out in my laboratory. He never hesitates to learn and use new techniques useful to his projects. He also shows talent in managing independently a whole project, including coordinating and communicating with people in or between different laboratories. His communication skills in both spoken and written English are excellent. He gladly collaborates with other scientist, and his generosity in offering help wins him respect among his colleagues. He works extremely hard, sometimes to the limit of human physiology during acute experiments.

In summary, I have no doubt that his intelligence, creativity and dedication will ensure that he shall continue to be a successful independent neuroscientist. I recommend him to you with the greatest enthusiasm and without any reservations. Your favorable consideration of his application will be appreciated. If you have any question, please do not hesitate to reach me at (212)241-9607 or ehud.Kaplan@mssm.edu.

Sincerely,

E. Kaplan

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