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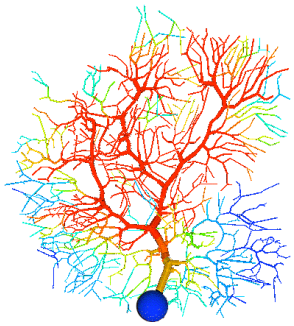

May 1, 2012

Recommendation for Dr. Sungho Hong

To Whom It May Concern,

I hereby strongly recommend Dr. Sungho Hong, a senior postdoc in my unit, for a tenure-track faculty appointment at the Department of Neuroscience at Brown University.

After undergraduate studies in physics at the Korea Advanced Institute of Science and Technology Sungho moved to the USA and obtained a PhD in high energy physics at the University of Pennsylvania, which resulted in 4 publications. He then switched fields to neuroscience and did a first postdoc with Prof. Adrienne Fairhall at the University of Washington. There he developed a strong interest in understanding neural excitability and his with Dr. Fairhall resulted in two publications in Neural Computation and one in PLoS Computational Biology. Sungho then joined my new unit at OIST, a few months after I moved here myself.

I recruited Sungho to contribute to the Purkinje cell modeling effort in my unit but, as this was his second postdoc, there was also an agreement that he would develop his own projects. In both he has done excellent work which I will describe in more detail after discussing his general strengths.

Sungho's physics background has given him a strong mathematical training which he puts to excellent use. In all his projects he has developed innovative mathematical approaches and applied them very wisely. Because I, conversely, have only limited mathematical skills my interaction with him has been very stimulating. Based on journal review of his work and our interaction with outside collaborators I am convinced that he has always been correct in his derivations and that his mathematical thinking is very astute and deep. Importantly, his use of advanced mathematics is not gratuitous but gives strong added value, mostly at the level of data analysis. This brings me to his second strength: Sungho's work and interests are very data-driven. He is fascinated by real biological data, whether to fit accurate models to the data or to develop more advanced methods to analyze it. So while he is definitely a theoretician, he is not a reductionist as many of his colleagues are. He fully appreciates that biology is complex and that any analysis and description of real data has to reflect this. This view was already apparent in some of the work he did with Dr. Fairhall, emphasizing different excitability modes in neurons, and has been further expanded in my unit. Finally, Sungho is a very outgoing and friendly person who interacts well with people. This has been very helpful in his interactions with students and postdocs in the unit, while tutoring students at the Okinawa Computational Neuroscience Course and in collaborating with many colleagues in Japan and abroad. He often spontaneously helps people in my lab and he has developed his own outside collaborations.

Sungho has contributed to the ongoing Purkinje cell modeling effort in my unit in many diverse ways which I will not itemize completely. Much of the work he contributed to is still unpublished because our goals are very ambitious. His largest contribution has been in fitting models for the voltage and calcium gating of ionic channels, based on experimental data we obtained from collaborators in the USA and Canada. Part of this work is reflected in our Cerebellum paper (Anwar et al., Cerebellum 2010 doi 10.1007/s12311-010-0224-3) but has been ongoing since then, with Sungho continuously refining the models as new data becomes available. He has

also contributed to the image analysis of large confocal imaging stacks containing many Purkinje cells and more recently to relating local field potential to Purkinje cell firing properties in cerebellar recordings from monkeys that we obtained from Germany. Because of his contributions to many projects in the lab Sungho will be a co-author on many papers that my unit will submit in the coming years.

His main recent paper output, however, has been on his own projects. The first one "Single neuron firing properties impact correlation-based population coding" (Journal of Neuroscience 2012) is an excellent example of the strengths I described earlier. The project started when a Nature paper by De la Rocha et al. ("Correlation between neural spike trains increases with firing rate" 2007) was presented in our journal club. This paper generated a lot of questions and discussion and Sungho decided to check the claims it made. Initially he used his previous experience in analyzing neural excitability to demonstrate with computational methods that the results of the Nature study applied only to type 1 neurons, but not to type 2 or 3 neurons. Next he extended the mathematical theory of the Nature paper to show that these discrepancies were due to second order correlations that were ignored in the Nature paper. FInally, we agreed that it would be better to add experimental data to a paper on this topic and he suggested Steve Prescott (University of Pittsburgh) as collaborator, who turned out to be an excellent choice. Sungho contributed extensively to designing and analyzing these experiments. Because we were refuting the main conclusions of a Nature paper, we worked on making this also a high impact publication. It was extensively reviewed by Nature Neuroscience, but after more than a year of going back and forth it was finally rejected. This rejection had more to do with the presentation of the paper than with the content, which did not raise concerns with the reviewers. It is my personal belief that Sungho's work did not get into Nature Neuroscience because it did not have simple conclusions that one could explain in a few sentences. Unfortunately, real neurons are not simple… as described in detail in our Journal of Neuroscience paper and favorably commented on by one of the reviewers as "I consider this study to be of high importance in providing a counterweight to the more simplistic view presented in de la Rocha et al. 2007".

The next two projects are still unpublished. Sungho has been developing a new method to obtain phase-response curves (PRC) from neural spiking data. His inspiration came from work by experimental PhD students of mine at the University of Antwerp, Belgium, who are interested in the PRCs of cerebellar neurons. Sungho realized that the current methods to generate PRCs from noisy data leave much to be desired and developed a completely new approach to the problem. His methods is based on signal processing techniques called compressive sensing, that until now have been completely ignored by neuroscientists. So while Sungho did not invent the method, he did follow the literature outside of his domain and recognized its relevance to neural data. He also did a lot of optimization of the method and matlab coding to apply it to neural data. In the paper, which is currently resubmitted at the Journal of Neurophysiology, he very neatly presents the mathematical framework used by current methods (all based on averaging) and compares this with the compressive sensing approach. He clearly identifies the problems with averaging and shows, using simulation and analysis from experimental data, how indeed these problems pop up when averaging methods are used to generate PRCs. Conversely, the compressive sensing method works extremely well and is very robust. A reviewer described it as "This is an elegant and important paper with respect to determining the phase resetting characteristics of noisy biological neurons from limited experimental data."

The last project was done in collaboration with a Korean colleague at Hiroshima University and studies diurnal cycles in suprachiasmatic nucleus neurons. I have been much less involved in this work. Sungho again developed a new analysis approach, this time a grid approach to analyzing imaging data of gene activity in explant cultures. This new analysis method allowed for spatial correlation analysis which revealed unexpected intrinsic oscillations. The paper which is now at the stage of minor revision with the Journal of Neuroscience completely depends on Sungho's analysis method. It is a nice example of his breadth of interests and the ease with which he establishes new and fruitful collaborations.

As we all know the biological sciences, including neuroscience, face a problem of data explosion and Sungho is extremely well positioned to contribute to improving our methods to make sense of this data. His keen interest in applying diverse innovative mathematical methods to data analysis and modeling and his easy interaction with experimentalists will make him a great asset to any department that recruits him. I will be sorry to see him

leave my unit, but am confident that he will excel at Brown University and that the mathematical methods he will develop in the future will affect the research of many neuroscientists around the world.

Sincerely yours,

Erik De Schutter, MD PhD