Cold Spring Harbor Laboratory
Dmitri Chklovskii, Ph.D.
Assistant Professor

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Re: Armen Stepanyants

Dear Committee Members:

I am writing in support of Armen Stepanyants's application for a faculty position in your department.

Armen has joined my group in 2000 after getting his Ph.D. in theoretical physics from URI (and a short postdoc at MIT) and made a spectacular transition to theoretical neurobiology. Although he is a highly qualified theoretical physicist, this does not guarantee a success in theoretical neurobiology. It is crucial to learn enough neurobiology to realize which theoretical problems are important and which theories can be tested experimentally. Armen has successfully met this challenge. By attending neurobiological seminars, meetings, workshops and courses, reading papers and communicating with experimentalists, he has formed a broad, insightful, and up-to-date view of the field.

Combination of Armen's talent as a theorist and interest in neurobiology resulted in his high productivity. His first and, perhaps, best known work in neurobiology was evaluating how much spine remodeling can contribute to circuit re-organization (Stepanyants et al. Neuron 34, 275, 2002). By applying geometrical statistical analysis he was able to show that spine remodeling can contribute significantly to circuit re-organization and, hence, to memory capacity. This result has been validated by the subsequent observation of spine plasticity in adult neocortex by new in vivo imaging technique (Trachtenberg et al. Nature 420, 788, 2002). In addition, this theoretical work coined the term "potential synapse", which became a foundation for further studies. By calculating numbers of potential synapses in 3D reconstructions of neuronal pairs, Armen has found specificity in the layout of axons belonging to GABAergic (but not pyramidal) neurons (Stepanyants et al. submitted, 2003). In turn, this work set the stage for assembling a potential wiring diagram using single-neuron reconstructions from different animals. Through multiple collaborations between my group and experimental laboratories we have assembled sufficient data for constructing a quantitative description of the canonical cortical circuit. Completing this project will have several important implications. In particular, it will allow one to evaluate the specificity of local cortical connections, an unresolved and hotly debated issue. Also, the potential wiring diagram may be converted to actual by multiplying by

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the fraction of actual to potential synapses. This will provide an approximate, yet concrete foundation for realistic theoretical models, which, so far, have been using highly simplistic view of cortical connectivity.

Although Armen has not done "wet" experiments himself, he realizes the importance of collecting data. For example, in his current project, the bottleneck in data collection is 3D reconstruction of neurons with the Neurolucida system. As soon as Cold Spring Harbor Laboratory acquired such system, Armen has been enthusiastically learning how to make reconstructions, and has been generating some of the data for his analysis.

Today, getting funding is a crucial component of scientific research. While being in my laboratory, Armen applied for an NIH training grant, which he is likely to get. Although his first experience with grant writing was not easy, he has learned a lot and should be able to secure his funding in the future.

Last but not least, I should say that Armen is a very nice, considerate and warm person. He is highly respected and well liked by his colleagues.

Please don't hesitate to contact me if you have any further questions.

Sincerely,

Dmitri "Mitya" Chklovskii