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To whom it may concern

Date	Your reference	Our reference
April 24, 2012		
Behandeld door	Telephone	E-mail
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Subject
Letter of recommendation, Dr. Sandro Romani

Dear Sirs,

I am writing in support of Dr. Sandro Romani's application for a faculty position in Computational Neuroscience in your department. Dr. Romanies a theoretical physics and he carried out his Master, PhD and first postdoctoral research work under the supervision of two leaders in the field computational neuroscience, such as Dr. Daniel Amit and Dr. Misha Tsodyks. His work focused on realistic models of attractor neural networks. In some of his work, Dr. Romani investigated the network-level consequences of synaptic dynamics as it has been experimentally characterized, including e.g. synaptic depression and long-term plasticity. This has produced results on the learning dynamics in the network, for example in the context of familiarity memory.

Recently, Dr. Romani and Dr. Tsodyks published a very interesting paper on models of spatial representation in hippocampal place cells. They explored a novel dynamical regime of the so-called "continuous attractor" network, which can be used to reproduce experimental results as the directional selectivity of place cells, as well as the remapping phenomenon, the observation that the hippocampus can rapidly switch between two different arrangement of place cells receptive fields (or "maps"). I was very impressed by this paper, which was my first motivation in approaching Dr. Romani to explore possible collaboration. This contact resulted in a application for a Human Frontier Science Program Long-term fellowship to do computational work in my lab, in close contact with our experimental activities. The project he presented for this application was highly innovative. Based on his previous work, in particular, his results on synaptic depression and on rapid switching in continuous attractor networks, he proposed to formulate a theory of CA3 dynamics, providing a unified framework in which both activity during animal movement, characterized by theta oscillations and precise temporal relationships between theta phase, cell firing, and location on one hand, and, on the other hand, the highly synchronized, bursty pattern called the "sharp wave", which dominates hippocampal activity during sleep, or during restful periods.

Theta activity and sharp waves are really two faces of the same medal, as the same activity sequences encoded in theta phase during behavior are spontaneously replayed during sharp waves, both during sleep and wakefulness (the so-called `awake-replay'). Yet, while data are in recent years accumulating very fast, our theoretical understanding of these phenomena, which we think are key to neural coding and processing, is still very rudimentary, and based on somewhat dated theoretical ideas. Dr. Romani's work is a great example of how adding realistic features to a network model (e.g. synaptic depression) may result in completely new behaviors, which could in fact be a better fit

to experimental data than older ideas.

While we were waiting for the outcome of this fellowship application (which was granted in the end), Dr. Romani was offered a post-doctoral fellowship at the Center for Neural Theory at Columbia University, to work with Stefano Fusi and Larry Abbott. Quite understandably, he decided to take this opportunity to work in one of the world's top environments for computational neuroscience.

We decided to pursue the common goals we delineated and to that purpose I provided Dr. Romani with data from the very large library of high-density electrophysiology recordings that I collected through the year.

In his more recent work, Dr. Romani, in collaboration with the group of Dr. Tsodyks, addresses the issue of voluntary memory recall. Memory recall is grossly underrepresented in neuroscience research due to methodological difficulties, as recall experiments can only be performed with human subjects. Psychological literature on 'free recall' paradigm provided a wealth of experimental results on statistics of recall of lists of randomly selected words, but these results were not systematically organized, did not propagate to the mainstream of neuroscience research and are now largely forgotten. Dr. Romani work revisits these results, partly with novel analysis of experimental data, and provides a general theoretical framework inspired by the widely supported neuronal population-coding hypothesis. More specifically, he studied the retrieval of information from long-term memory in absence of specific cues, deriving some general results about the scaling of the retrieval with the total number of items in memory. This work complements the results of Dr. Amit on storage capacity of neural networks, by introducing the novel concept of "retrieval capacity".

From my point of view (as an experimental neuroscientist who has worked extensively on theoretical subjects), Dr. Romani's skills look at top levels among his peers. For somebody like me who is interested in neural ensemble dynamics, and in the mechanisms of learning and memory, his approach is much more relevant and interesting than many of the mainstream research lines in computational neuroscience.

While I supported Dr. Romani's choice to move to Columbia University, I did regret not having him in my lab. As somebody who participated in several search committees for the hiring of junior faculty members in my department, I can tell that, if we had a opening for a computational neuroscientist, he would have a serious chance to get an offer, and I would be delighted to have him as a colleague.

Please do not hesitate contacting me if you have any further question.

Sincerely,

Francesco Battaglia