LABORATORY OF COMPUTATIONAL NEUROSCIENCE (LCN)

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Reference Letter for Claudia Clopath

Dear Colleagues,
Dear Dr. Sheinberg

EFPL Lausanne, April 2012

Claudia Clopath has been a PhD student in my lab from 2005 to 2009. After her PhD in fall 2009, she started a PostDoctoral stay in the lab of Nicolas Brunel in Paris. I assume that Nicolas will tell you about his impressions regarding the Paris-time so that I can limit my letter to the period she spent in my lab.
Claudia is clearly amongst the top PhD students I have had during my 15 years at the EPFL and arguably simply the top one. She is scientifically very creative, she is productive and able to turn her results into nice papers, and she is socially very interactive. I can recommend her without any hesitation for the position of Assistant Professor in the Department of Neuroscience at Brown University.

After a master-degree in Physics, Claudia Clopath has been working in the field of computational and theoretical neuroscience. In this field, conceptual top-down models of how the brain 'could' work are as influential as bottom-up models derived from an analysis of experimental data. Claudia's work in my lab has been inspired by experimental data on neurons and synapses, but it really is of a conceptual nature which makes it very attractive. Claudia is excellent in working out mathematical arguments (she just finished a paper with Nicolas Brunel which shows her excellent mathematical skills) and equally excellent with simulations (she routinely develops programs for her computer simulations from scratch), but where she really stands out of her peers and what she enjoys most is working towards the conceptual understanding of a problem, so as to develop a model that is tractable. This conceptual part is, in my opinion, really the hardest part of the work in my field; and this is where she is more creative and imaginative than most other people I know.

Claudia has worked on a couple of projects in my lab. As many other students in my lab, she started with fitting integrate-and-fire neurons to data. She then got interested in plasticity and worked in two directions. First, based on her own initiative and completely independently, she developed a new way of extracting independent components using a novel biologically plausible, albeit abstract rate-based, learning rule. This work, which is completely hers, has appeared in a first version in NIPS, a top conference in machine learning and computational neuroscience. I should mention that in the machine learning community, NIPS is considered one of the two or three most highly ranked conferences and getting a paper into NIPS counts as a full publication (and more than a journal publication).

The other plasticity project is more in the main line of the lab: She extended the STDP triplet rule of Jean-Pascal Pfister so as to include the dependence of plasticity on the postsynaptic voltage. This part has first gone into the TagTriC model (*PLOS Comput. Biol.)* that appeared in Dec. 2008. The LTP induction part is completely hers, while consolidation part of the paper in PLOS Comput. Biol. is due to Lorric Ziegler (joint first-author).

Her plasticity induction model has led to a further big paper where she showed that the interaction between voltage and spike-timing that Jesper Sjoestroem found in his experiments can be explained by the model. It is a multi-author paper, but Claudia was really the one doing the work (simulations, model development etc). The paper came out in *Nature Neuroscience* at the beginning of 2010 and got honored by a *News and Views* by N. Spruston and J. Cang and has in a short time already achieved a considerable impact in the field.

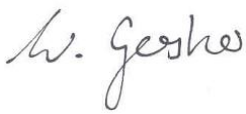
The latest paper that still stems from her PhD time in my lab is a model of inhibitory plasticity which appeared in December in *SCIENCE*. When she worked during the summer for a couple of weeks with Tim Vogels (who joined the lab only last year, after Claudia had already left), Claudia discovered some

unexpected features of inhibitory plasticity that stabilized large-scale network simulations, a problem that was known to be notoriously hard. The results re-emerged some time later in discussions between Tim Vogels and Henning Sprekeler, when both were PostDocs in my lab. Henning and Tim really pushed that project, Henning did the theory, Tim the simulations so as to show biological relevance, but Claudia was at the origin of the discovery of the network stability. The paper was honored with a *Perspective* article by Ernst and Pawelzik in the Dec. 16, 2011, issue of *Science.*

In my opinion Claudia has been an absolutely outstanding PhD student and I strongly encouraged her to continue in the Academic Environment. Recently, she was an invited speaker at a workshop with 35 top-notch international synaptic plasticity experts and reported her results on a model of Cerebellar Plasticity from her PostDoctoral time with Nicolas Brunel. I did not know the material and was really impressed. In the first part she uses a method of mathematical analysis (replicas) that comes from the statistical physics community and had been applied to neural problems before, and extends it so that she can treat temporal correlations in the input and output of a neural network. While this part if of a more mathematical nature, the second part of her work with Nicolas Brunel is highly creative: here she reformulates the learning in cerebellum into a spiking neuron problem and was able to connect, in simulations, data from slice experiments to animal behavior.

I am absolutely convinced that Claudia has the right mix of competences that will make her a widely respected faculty member at an excellent university, and a very nice colleague, too. I think she would be a nice catch for any department in a top university prepared to hire people at a rather young age. She is currently working as a PostDoc at Columbia University in New York, but I think that after her highly successful first PostDoc with Nicolas Brunel, she is ready to apply for faculty positions. I can most strongly recommend her for the faculty position in Computational Neuroscience at Brown University.

Kind regards



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