

# Scientific Report

November 22, 2007

**Title:** Noise in Life 2007: Stochastic Dynamics in the Neurosciences

**Dates and duration:** 7-9 of November, 2007

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*Noise in Life 2007* brought together statistical and nonlinear physicists with computational neuroscientists and neurophysiologists, and presented a wide overview of the influence of random fluctuations in the behavior of neuronal systems. We were happy to welcome a number of great and well-known speakers on this general problem — among them Wulfram Gerstner, Peter Jung, Alexander Neiman, Nestor Parga, Arkady Pikovsky, Luigi Ricciardi, Nigel Stocks, and Henry Tuckwell.

A number of talks were concerned with noise in single neurons and discussed in this context the following problems: the faithful modeling of the neuron's nonlinearity (W. Gerstner, M. Richardson); novel methods to calculate interval histograms for spiking cells (L. Ricciardi, T. Engel, A. Porporato) or the response to periodic stimulation (N. Brunel, P. Talkner); noise-induced effects in neural models (A. Torcini); detailed models of intrinsic channel noise (G. Schmid, M. Falcke), synaptic noise (P. Jung), and external conductance fluctuations (L. Wolff); effects of the spatial extension of the neuron (H. Tuckwell); the quantification, the theoretical calculation, and the biological function of interval correlations in neural spike trains (M. P. Nawrot, E. Müller, A. Neiman).

The questions of how precisely and how strongly correlated different neurons respond to a stimulus, and the details of this response on a fine temporal scale, were addressed in the talks by A. Pikovsky, G. Schneider, and J. Ritt. There were a number of excellent talks on noisy neural networks devoted to one or more of the following issues: the detection of synchronous spikes in a neural population and the question of what these synchronous spikes code for (J. Benda, G. Pipa); the spontaneous and evoked stochastic activity in biological neural networks (N. Parga, M. V. Sanchez-Vives); the function of spike-timing dependent plasticity in the developmental phase of a network (O. Chibirova); experimental evidence for traveling waves in various extended neural systems (E. Manjarrez); and task performance by means of populations of spiking neurons (M. Mattia, R. Moreno-Bote).

There was also a lively Poster session of the remaining participants of the workshop (mostly students and younger scientists), including short oral presentation of the posters. The various topics of the posters were all related to stochastic neural dynamics and discussed specific models in detail.

In general there was a good connection of the various theoretical approaches (for instance, the spike train analysis and theorems on point processes, but also approximate solutions of the Fokker-Planck and Master equations as well as linear response theory) with exciting experimental findings (for instance, the emergence of oscillations in the spontaneous and evoked activity of single resonant cells and of networks on various time scales).

In summary, the workshop *Noise in Life 2007* provided a fruitful forum for the presentation and exchange of ideas in the interdisciplinary community studying noise and fluctuations in neural systems.

Benjamin Lindner, Lutz Schimansky-Geier, Jordi Garcia-Ojalvo (the organizers)