

# EPSRC Symposium Challenges in Scientific Computing

*“Computational Neuroscience”  
8-11 Dec 2008, University of Warwick*

## Organizers

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## **Introduction**

Current progress in Neuroscience, apart from the direct use of modern experimental methodologies and the accumulation of empirical data derived from the application of these methodologies, requires contributions from various aspects of modern applied mathematics. Theoretical approaches in Neuroscience play an important role in elucidating fundamental principles and mechanisms governing the function of the mammalian nervous system (including the brain) and this is fully demonstrated in the widespread application of the Hodgkin-Huxley formalism (a PDE or a multi-compartment model often consisting of thousands of ODEs) in the Neuroscience literature. In recent years, there have been intensive efforts to model intracellular biochemical pathways, second messenger cascades and neuronal electrical activity at the single neuron and neuronal network levels, as well as to integrate over different scales. Up to this day, Systems Neuroscience is one of the best examples of Systems Biology. A related exciting field is the analysis of experimental data including multi-electrode data (local-field-potential and spike data), image data and related omic data.

## **Aim**

The direct aim of the workshop was to bring scientists (both theoreticians and experimentalists) together in order to provide, through a series of lectures, an overview of research activities currently taking place at the interface between experimental and theoretical Neuroscience. Moreover, it was desirable to identify key areas where future developments are likely to take place and to promote the establishment of collaborations between experts in the field and scientists in Warwick with common interests.

## **Scientific content**

The workshop took the form of a four-day meeting, starting on Monday morning (Dec 8) and ending on Thursday afternoon (Dec 11). A total of twenty-six 45-min lectures took place covering topics from the following broad categories or themes: a) construction of and parameter estimation in models of cellular physiology (specifically protein trafficking) and electrical activity at the single-neuron level. This category included both biophysically detailed and abstract models. Lectures in this theme took place during the first day (Mon, Dec 8) of the workshop. b) Biologically plausible models of cortical networks. The lectures in this theme covered the second day of the workshop (Tue, Dec 9) and part of the third and fourth day. The research presented here had a focus on rhythm generation in the brain under normal or pathological (e.g. epilepsy) circumstances, sensory information processing and the expression of other cognitive phenomena (attention, memory). c) The last two days of the workshop (Wed and Thu, Dec 10 and 11) were devoted to various theoretical and methodological aspects of interest to the Computational Neuroscience community, which do not clearly fall within a single category.

## **Participation**

A total of 81 individuals attended the meeting, which included the 26 speakers, 18 “post-doctoral” researchers and 37 PhD students from various UK and overseas universities. Institutions from the following countries (apart from the UK) were represented: USA, Canada, Japan, Germany, Denmark, Austria, Switzerland, France and Russia.

## **Dissemination**

The presentations that took place (or abstracts of them, in case the actual presentation was not available) are published on the website of the conference: [http://www2.warwick.ac.uk/fac/sci/math/research/events/2008\\_2009/symposium/wks1/](http://www2.warwick.ac.uk/fac/sci/math/research/events/2008_2009/symposium/wks1/)