SPECIAL ISSUE ON
STOCHASTIC NETWORK MODELS IN NEUROSCIENCE

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In conjunction with the workshop Stochastic Network Models of Neocortex (a Festschrift for Jack Cowan) the Journal of Mathematical Neuroscience is pleased to announce a special issue on Stochastic Network Models in Neuroscience.

Jack Cowan’s remarkable career has spanned, and molded, the development of mathematical neuroscience as a quantitative and mathematical discipline, combining deep theoretical contributions, rigorous mathematical work and groundbreaking biological insights. His achievements include an enormously successful mathematical theory for the patterning of spontaneous activity in neural networks of the human visual cortex, which underly a rich panoply of well documented geometric visual hallucinations. This theory exemplifies how neuroscience can inspire new mathematics.

Jack Cowan’s quest to formulate a self-consistent statistical treatment of the mammalian cortex began with the formulation in the mid-1960s of the firing-rate model of individual neural activity, which led eventually to the well-known Wilson-Cowan neural field equations. He and his students were the first to apply dynamical systems and bifurcation theory to the analysis of neural field equations. He was also among the first to think about the developmental mechanisms of how the cerebral cortex is organized into what are known as cortical maps, and did early work applying neural field models to clinically important problems such as the generation of robust breathing rhythms in the mammalian brainstem.

Recent developments in mathematical neuroscience indicate that reformulating neural field equations in a stochastic framework leads to a richer range of dynamics and affords closer agreement with experimental observations. It also raises a number of difficult mathematical questions in the fields of stochastic calculus, mean-field analysis, and stochastic bifurcations.

The goal of this special issue is to bring together the key experimental and theoretical research linking state-of-the-art knowledge about stochastic network models of neural systems, particularly the neocortex, with current forefront research in probability theory and statistics in the general area of stochastic nonlinear dynamical systems.

We hope to shed new light on the question of the role of noise in the activity of the neocortex and other neural systems. We are certain that such an endeavor is timely and is presently missing, and that it will be attractive to a wide community of brain researchers and of mathematicians in probability, statistics, and dynamical systems.

For more information about this special issue of JMN, including deadlines and guides for authors, please see http://www.mathematical-neuroscience.com/(details).