CENTER FOR NANOSCALE SCIENCE AND TECHNOLOGY

University of Illinois at Urbana Champaign

Center for Nanoscale
Chemical-Electrical-Mechanical
Manufacturing Systems

Engineering Cultured Neuronal Networks

We culture embryonic rat hippocampal neurons in order to gain insights into how small networks of neurons interact. We design the networks by using microlithography to control surface chemistry that in turn controls the initial position of the neurons and strongly influences subsequent growth. The lithography also permits us to guide neurons preferentially to electrodes of a microelectrode array, with a resultant increase in recordability and excitability of the cultured neurons. Geometric control also allows us to begin to investigate the question as to whether the geometric pattern of a neuronal network influences the patterns of its neuroelectric activity. The appearance of robust functional activity appears to depend on the development of glia. Various neuronal network behaviors can be demonstrated, including propagation of both action potential and synaptically coupled activity, graded activation of networks, and elementary learning phenomena.

Wednesday, November 2, 2005
4:00 pm
B02 Coordinated Science Lab

Bruce C. Wheeler
Department of Bioengineering
Department of Electrical and Computer Engineering
University of Illinois

Bruce Wheeler is the Interim Head of the brand new (Dec 2003) Department of Bioengineering at the University of Illinois at Urbana-Champaign. He is also a Professor of Electrical and Computer Engineering, a faculty member at the Beckman Insitute and a member and former chair of the Neuroscience Program. He received the B.S. degree from MIT and later the M.S. and Ph.D. in Electrical Engineering from Cornell University and has been with the University of Illinois since 1980. He has also served as Associate Head of the Electrical and Computer Engineering Department at Illinois. Prof. Wheeler's research interests lie in the application of electrical engineering methodologies, signal processing and microfabrication, to the study of the nervous system, including the microlithographic control of the patterns of growth of neurons in vitro so as to permit stimulation and recording with microelectrode arrays. Hopefully this work will lead to better understanding of the behavior of small populations of neurons and lead to better insights into the functioning of the brain.