The Neural Interfaces research community consists of investigators, supported by grants or contracts, who are working in areas that include functional neuromuscular/ electrical stimulation, auditory prosthesis, cortical prosthesis, neuromodulation, microelectrode array technology, brain computer/ machine interfaces and other related areas. The NIH DBS Consortium is an integral part of the Neural Interfaces research community and is a core group of multidisciplinary researchers funded under a series of NIH-sponsored programs to advance technological innovation and further understand the sites and/or mechanisms of action of Deep Brain Stimulation.

The general structure of the conference calls for a focus on the DBS for day one; day two will focus on neural prostheses for restoration of motor and sensory function; and day three, finishing at 3:30pm, will describe advances in cochlear prostheses and therapeutic effects of stimulation. Similar to last year, there will be a limited number of Platform Presentations; brief, oral reports designed to allow selected poster presentations additional visibility as well as stimulate discussions.

Attendance is anticipated by a diverse group of scientists, engineers, and clinicians, representing the basic and applied science aspects of neural interfaces. The integration of the Neural Prosthesis community and the DBS Consortium during this conference is expected to facilitate the sharing of knowledge and experience among groups involved in various stages of neural interface development.

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Development of Hybrid Neural Prosthetic Devices

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The convergence of neuroscience and nanotechnology holds promise for the successful development of electronic devices capable of interfacing with the central nervous system (CNS). In recent years, considerable progress has been made in the fabrication of electronic devices at the micro- and nanoscales. In particular, micro-fabricated neural prosthetic devices have been used to stimulate and record specific areas of the CNS. Neural prosthetic devices have the potential to restore function to people suffering from a diverse range of neurological disabilities. However, the functions of these devices have been limited due to an inability to effectively and chronically interface with host nervous tissue. It is envisaged that the next generation of implantable devices will comprise both electrical and biological components - “hybrid devices” - to enhance biocompatibility and long-term performance \textit{in vivo}. \textit{Ex vivo} integration of neurons with these devices is expected to promote their functional incorporation into the mammalian CNS. The initial design paradigm for hybrid devices will involve the use of optically transparent, microporous, neural prosthetic devices, each containing a series of recording and stimulating electrodes. The location of each electrode has been derived at by using biologically-inspired design principles. Hybrid devices were constructed using a novel bio-mimetic polymer to encapsulate primary hippocampal neurons, in each device. Hybrid devices containing transfected, hydrogel-encapsulated neurons, were inserted into the neocortex of adult Sprague-Dawley rats. Organotypic cortical slice cultures, each containing a single inserted device, were used to assess device integration \textit{in vivo}. The rate and extent of neurite outgrowth from encapsulated neurons, along with the number and distribution of synaptic contacts formed, was determined using laser scanning confocal microscopy. 3-D image sets were analyzed using automated image analysis software employing advanced tracing algorithms. Hybrid devices were functionally assessed using electrophysiological, cyto-chemical, and morphological experiments to confirm neuron-device, and neuron-neuron connectivity. The rationale for these studies is that, once we can reliably integrate biological components with neural prosthetic devices, these basic design features will permit the rational construction of devices with additional biological units, each of which possessing greater complexity.

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