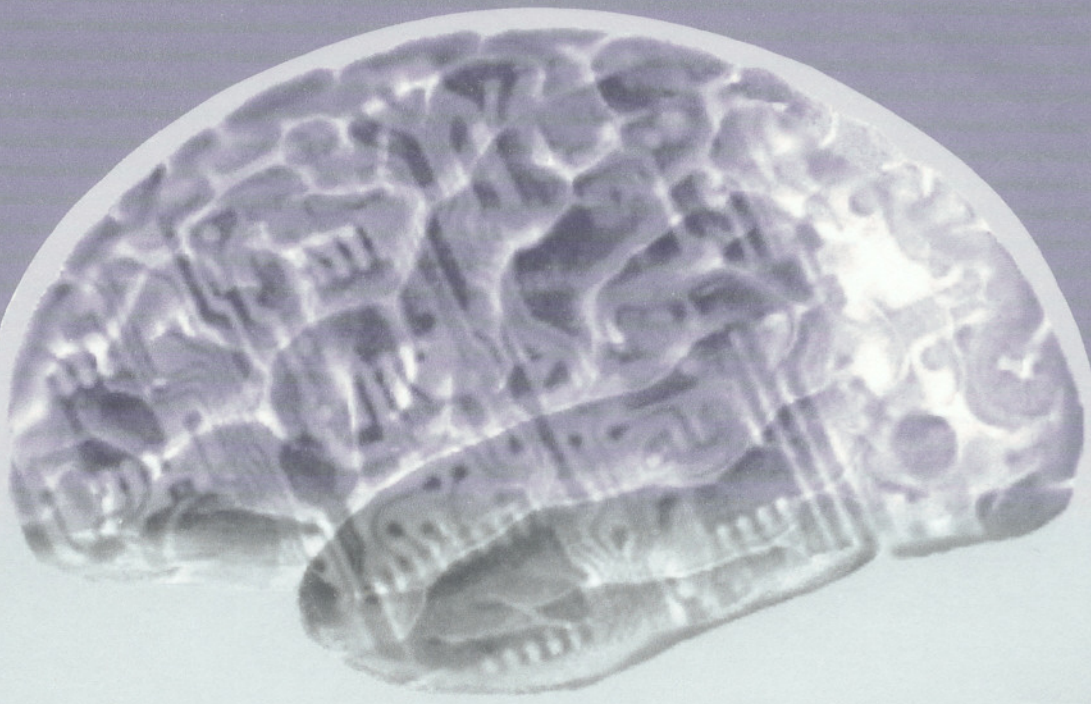
National Institute of Neurological Disorders and Stroke



Neural Interfaces Workshop

November 15-17, 2004

Hyatt Regency Bethesda Hotel • Bethesda, Maryland

NATIONAL INSTITUTES OF HEALTH

NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE

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AGENDA

Poster Board Numbers	Primary Presenters	Poster Abstract Titles
22	Hyun-Jung Lee	Biomechanical Analysis of the Effect of Neurointegrative Coating on Si-Microelectrode-Induced Strain in the Brain
7	Kendall Lee	Abolition of Spindle Oscillations and 3 Hz Absence-Seizure-Like Activity in the Thalamus by High Frequency Stimulation: Potential Mechanism of Action
8	Zachary Levine	Tardive Opisthotonos Treated with Bilateral gpi DBS
9A	Duncan Lowne	A Practical Laboratory Course for Introducing Brain-Computer Interfaces
23	Kip Ludwig	Chronic Neural Recordings Using Silicon Micro-Electrode Arrays Electrochemically Deposited With a Conductive Polymer
24	Karen Moxon	Nanostructured Porous Silicon Scaffolds for Enhanced Biocompatibility of Multichannel Microelectrodes
9B	Barbara Nguyen-Vu	Carbon Nanotube Nanoelectrode Array for Electrophysiology
36	Richard North	Implanted Stimulator Adjustment to Maximize Battery Longevity: A Randomized, Controlled Trial Using a Computerized, Patient-Interactive Programmer
37A	Seung Jae Oh	In Vitro Assessment of Tissue Damage Following Insertion of Micromachined Neural Prosthetic Devices
37B	Sung Jae Oh	Measurement of Tissue-Deformation Force by Insertion of Multi-Shank Silicon Neural Probes into Rat Brain
38	William O'Shaughnessy	Neural Implant Passivation Coating by Hot Wire CVD
25	Ryan Pope	Bioprinting for Multi-site, Micro-Drug Delivery with Implantable Microelectrode Arrays and Selective Cellular Binding on Plnar MEA's
39	Scott Retterer	Device Fluidics for Direct Brain Delivery - A Tool for Studying Brain Injury

In vitro Assessment of Tissue Damage Following Insertion of Micromachined Neural Prosthetic Devices

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The full potential of neuroprosthetic devices is presently limited by biological reactive responses that begin immediately upon insertion. The size of these responses may be impacted by many insertion-associated parameters (e.g. insertion speed, device size, tip design, etc.). To investigate these parameters, we developed an *in vitro* system that permits qualitative observations and quantitative analysis. Live 500-μm thick cortical brain slices with pre-labeled vasculature were mounted in a recording chamber. Time-lapse images were collected during both insertion and withdrawal of devices into the slices. Single and multi-shank devices were microfabricated with different tip geometries. An automated drive controlled insertion rates. Comparisons of videos collected provided qualitative assessments of the effects of tip design and insertion speed. Quantitative analyses were performed using videos with automated image analysis software that traced vascular elements, recognized discrete objects, and tracked the movement of these objects. Qualitative observations permitted descriptions of specific vascular damage events including displacement of luminal contents, cutting, rupture, and vessel dragging. Tissue compression and movement were observed extending >100 μm from insertion sites. Faster insertion speeds caused less compression and penetrated the pia more efficiently, but introduce more cellular shearing. All tip shapes caused breakage, rupture, and dragging of neurovasculature. If pial blood vessels were caught and dragged, significant compression occurred. Quantitative image analysis of insertion videos provided data for describing tissue compression during insertion. These results demonstrate the utility of this experimental model and indicate its value for guiding future device designs insertion methods.

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