

JJ: Stretchable Electronics and Conformal Biointerfaces

April 8 - 9, 2010

Proceedings to be published in electronic-only format
(see MRS Online Proceedings Library at www.mrs.org/opl)
as volume 1271E
of the Materials Research Society
Symposium Proceedings Series.
Symposium Support
Army Research Office



11:30 AM *JJ2.4 Improving Neural Implant Biocompatibility via Biomimetic Design.

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Micro-fabricated neural electrode array, placed in the nervous system to directly interface with neurons, have tremendous clinical and research significance. Current arrays are mostly made of stiff metal and semiconductor materials, and they experience chronic failure due to the inflammatory tissue responses characterized by neuronal loss and glial scarring around the implant. Several biomimetic strategies are being investigated to improve their biocompatibility and long-term performance within the host brain tissue. The first strategy is immobilization of biomolecules (obtained from brain) onto the implant surface to promote attachment and growth of neurons while suppressing the adsorption of plasma protein and glia. These modifications have been characterized in vivo and showed improved neuronal health and reduced reactive glial response around the implant. The chronic neural recording performance of the modified probes is being evaluated currently. Secondly, a on-command release coating that can actively deliver anti-inflammatory or neuroprotective drugs is being developed. A number of drug molecules have been incorporated in the polymer coating and electrical stimuli can trigger the drug release repeatedly. This command driven release may be combined with a real time monitoring system so that once an onset of tissue inflammation is detected, an electrical stimulus will be given to trigger the release of the drug at a controlled dose. Thirdly, elastomeric conducting and insulating polymers that have the mechanical properties similar to those of brain tissue were synthesized for developing the new generation of soft neural electrode arrays. Soft arrays are hypothesized to cause less inflammatory tissue response. Our initial in vitro culture assays showed that soft wires made of the new materials recruited and activated less microglia in culture than the stiff tungsten wires, one of the primary elements of chronic microwire arrays. Furthermore, surface modification can be done to the soft materials to further improve their biocompatibility.