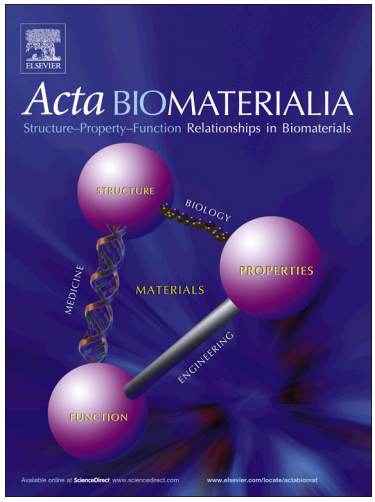

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Peptide Modification of Polyimide-Insulated Microwires: Towards Improved Biocompatibility through Reduced Glial Scarring

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Abstract:

The goal of this study is to improve the integration of implanted microdevices with tissue in the central nervous system (CNS). The long-term utility of neuroprosthetic devices implanted in the CNS is affected by the formation of a scar by resident glial cells (astrocytes and microglia), limiting the viability and functional stability of the devices. Reduction in the proliferation of glial cells is expected to enhance the biocompatibility of devices. We demonstrate the modification of polyimide-insulated microelectrodes with a bioactive peptide KHIFSDDSSE. Microelectrode wires were functionalized with (3-aminopropyl) triethoxy silane (APTES); the peptide was then covalently bonded to the APTES. The soluble peptide was tested in 2D mixed cultures of astrocytes and microglia, and reduced the proliferation of both cell types. The interactions of glial cells with the peptide-modified wires was then examined in 3D cell-laden hydrogels by immunofluorescence microscopy. As expected for uncoated wires, the microglia were first attracted to the wire (7 days) followed by astrocyte recruitment and hypertrophy (14 days). For the peptide-treated wires, astrocytes coated the wires directly (24 hours), and formed a thin, stable coating without evidence of hypertrophy, and the attraction of microglia to the wire was