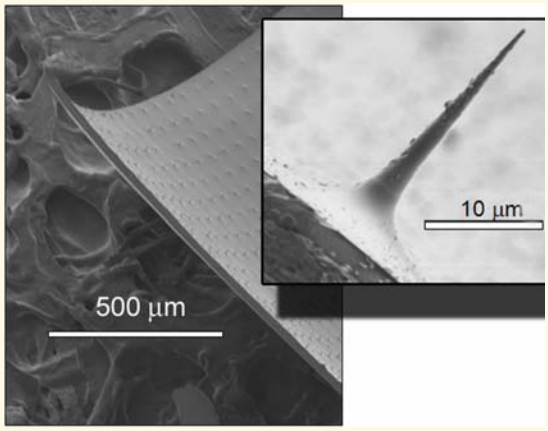
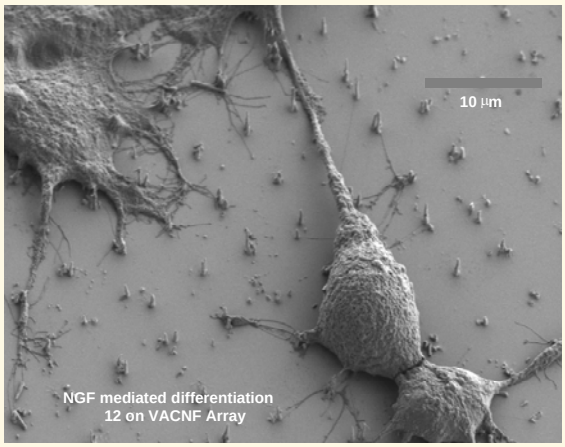
Carbon NanoFiber Systems for Tissue Interfacing

Platform Technology for Electrophysiological Interfacing and for Drug and Gene Delivery

Array of VACNFs on a Flexible Support



Growth and Differentiation of Neuronal Cell Types upon VACNFs



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PARTNERSHIPS

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Summary
Scientists at ORNL have created vertically aligned carbon nano-fibers (VACNF) that are well suited for cell and tissue interfacing applications, such as electrophysiological stimulus and recording, and drug and gene delivery. VACNFs are produced in an uniform manner that allows for structural controls over the location, length, diameter, conicity, and surface composition.

Preliminary data with nanoelectrode arrays show effective tissue stimulation due to improved contact with tissue and higher current density. VACNFs also provide cell delivery with the advantage of a scalable nano-array that can address a multitude of cells. This technology can also be incorporate in microinjection-based therapies in which the VACNF is tethered with DNA providing a mechanism to control gene fate and new approaches for gene and cell therapy

Advantages

- A variety of materials such as micro- and nano-electrode arrays, flexible sheets of the carbon nanofiber arrays, and drug and DNA delivery microarrays.
- Multiuse stimulus and electrophysiological monitoring in organotypic tissue culture, with high spatial resolutions.
- Measurements of both membrane depolarization and cell signaling species in cultures, such as dissociated neuronal cells
- Modified VACNFs provide analyte sensitivity for electroanalytical applications.
- Material for intracellular drug and gene delivery

Patents

- Individually electrically addressable vertically aligned carbon nanofibers on insulating substrates (UTB – ID 978) , US Patent 6,982,519
- Individually electrically addressable carbon nanofibers on insulating substrates (UTB – ID 978), US Patent 7,144,287
- Parallel Macromolecular Delivery and Biochemical/Electrochemical Interface to Cells Employing Nanostructures (UTB – ID 1199), US Patent Application 10/408,294
- Method and Apparatus for Sustaining Viability of Biological Cells on a Substrate (UTB – ID 1482 and UTB – ID 1483), US Patent Application US08/051190

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