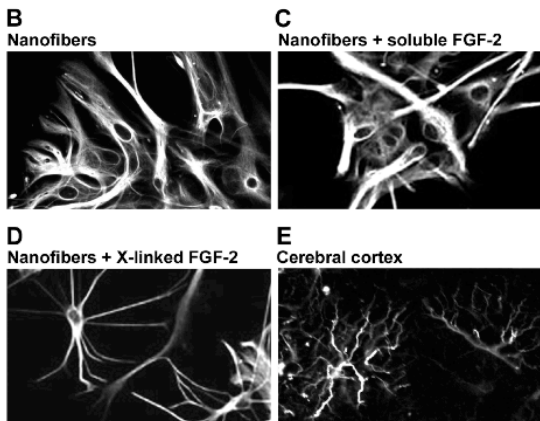
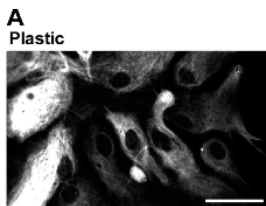


Scanning Probe Recognition Microscopy - A New Tool for Quantitative Mapping of Nanoscale Properties in Regenerative Neural Cell Systems

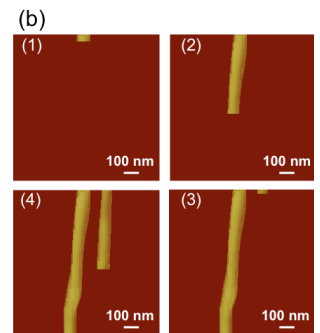
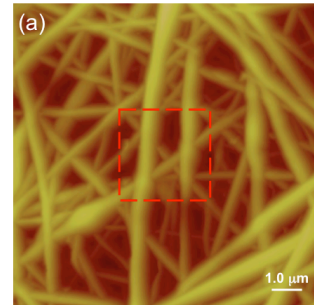
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Scanning Probe Recognition Microscopy (SPRM) is a new and dynamic mode of scanning probe microscopy [1,2]. Incorporating recognition-based tip control, SPRM can auto-track on selected regions of interest. The recognition capability is realized using algorithms and techniques from computer vision, pattern recognition, and signal processing fields. Adaptive learning and prediction make the detection and recognition procedure quicker and more reliable. SPRM improves measurements in three ways: 1) auto-tracking is performed only on regions of reliable data; 2) statistically meaningful numbers of reliable data points are extracted, providing more accurate interpretations of material characteristics; and 3) all data is extracted using an automatic procedure that maintains experimental uniformity.

We are currently employing SPRM to evaluate the nanoscale biomaterial properties of a Spinal Cord Prosthetic (SCP) that is comprised of a layered array of synthetic polyamide nanofibrillar matrices prepared by electrospinning. The nanofibrillar layers within the SCP are



Astrocytes on 2D substrates have a pathological morphology (A). Astrocytes on 3D nanofibrillar matrices (D) compare well with in-vivo astrocyte morphology (E). [3]



SPRM (bottom) versus AFM (top) [2]

architecturally mimetic for the basement membrane and have demonstrated promise for the repair of injured spinal cord in vivo [3, 4]. Properties identified from these experiments that should have general relevance for the design of nanoscale devices for regenerative medicine are: 1) presentation and coverage of nanofiber associated growth factors, 2) curvature, 3) mesh density, 4) elasticity, and 5) surface roughness of nanofibers. Compiling the data of SPRM auto-tracking along individual nanofibers provides a method to develop a statistical representation of the entire nanofibrillar matrix, thus enabling the quantification and mapping of nanoscale cues that have heretofore been challenging to achieve using current AFM, XRD, and NMR approaches. The development of accurate experimental and interpretive metrics will be presented for SPRM based mapping of nanoscale properties.

Biography

Virginia M. Ayres is an Associate Professor in the Department of Electrical & Computer Engineering, and heads the Electronic and Biological Nanostructures Laboratory (<http://www.egr.msu.edu/ebnl>) at Michigan State University. Her research interests include scanning probe microscope instrumentation development for the investigation of the nanoscale properties of regenerating cell systems. Dr. Ayres earned her Ph.D. and M.S. in Physics from Purdue University, and her B.A. in Physics and Biophysics from the Johns Hopkins University. She is the recipient of numerous NSF, NASA and international awards (Japan) that support ongoing research in electronic and biological nanostructures.

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