Trends in Nanosensor Arrays for Nanobiology & Nanomedicine

R. C. Farrow
Department of Physics, New Jersey Institute of Technology, Newark, NJ 07102
reginald.farrow@njit.edu

One of the key challenges in cell biology is still to sense the coordinated activity of intracellular and extracellular signals with sufficient spatial and temporal resolution to fully characterize the complexity of the massively parallel cell function. The most dramatic advances have been in florescent nanoparticles and advanced optical techniques that can provide chemical information with subwavelength spatial resolution in a 3D image. However, combining temporal resolution that matches the important reaction rates within the cell with optical florescence remains difficult. At the same time there have been advances in electrical nanoprobe array architecture that can potentially solve the temporal resolution issue (at least in two dimensions). This is because the logic speed of integrated circuits has for many years been faster than the important reaction rates. Current ICs are fast enough to measure multiple points within and around a cell while its function is essentially frozen in time. Specifically, there is the potential to use GHz IC logic to map millisecond cell operations. Electrical nanoprobes can also provide chemical information without labels or with the incorporation of functional molecules (including enzymes). The most serious challenge may be integrating the available modalities into a form that is accessible to biomedical R&D and later into modules that can be used by patients and caregivers. In this talk I will outline some of the goals, trends, and obstacles to the development of functional nanoprobe arrays for these purposes.

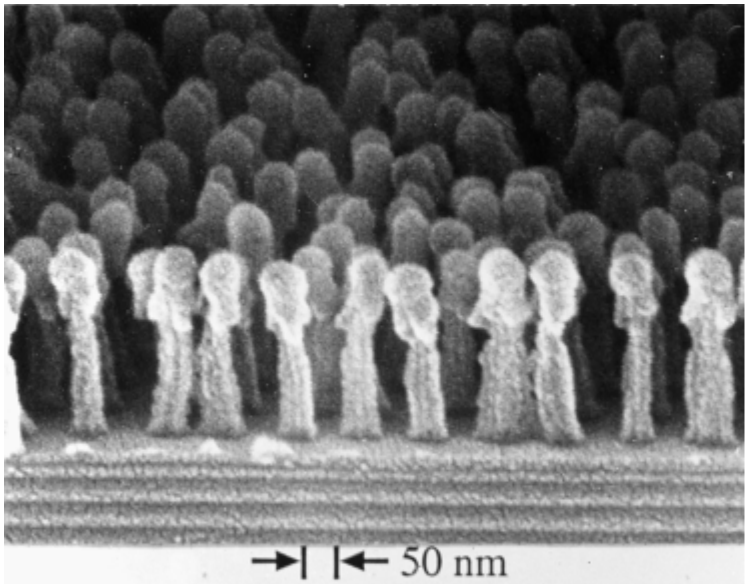

Figure 1: The Debutantes' Ball: At the debutantes' ball, young nano-women gather in their finery at the edge of the stage to weep because none of the nano-boys will dance with them. The micrograph shows an array of 50 nm wide posts with a periodicity of 100 nm. The posts consist of PMMA on top of an antireflection coating. The substrate consists of a 250 nm thick layer of silicon nitride on silicon. Winner of the 1995 “Most Bizarre Micrograph” prize. Submitted by Tim Savas, Massachusetts Institute of Technology.