Levi A. Gheber
Department of Biotechnology Engineering
The Ilse Katz Institute for Meso and Nanoscale Science and Technology (IKI)
http://www.bgu.ac.il/~glevi/website; glevi@bgu.ac.il

Broad fields of interest:

- ☐ Nano-bioscience (biophysics)
- ☐ Nano-medicine (nano-biolithography)

Keywords: Nanofountainpen, NSOM, nanobiochips, enzyme nano-biolithography, polymer microlenses, Molecularly Imprinted Polymers (MIPs), Membrane organization, light microscopy

Main effort is being invested into miniaturizing and integrating arrayed biosensors (so called "biochips"), in order to make them portable and deployable. Such stand-alone multi-sensors could revolutionize healthcare and transform it into preventive, rather than defensive as it is nowadays.

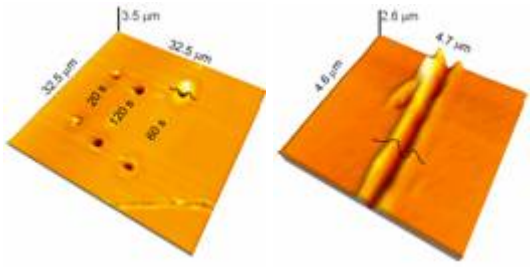
Main tools: Scanning Probe Microscopy – AFM, NSOM, Nano Fountain Pen (NFP), Total Internal Reflection Fluorescence Microscopy (TIRFM).

Abilities: Biomolecule (nano) printing, Enzyme nanolithography, Polymer Microlenses, (nano)-MIPs

Some Projects:

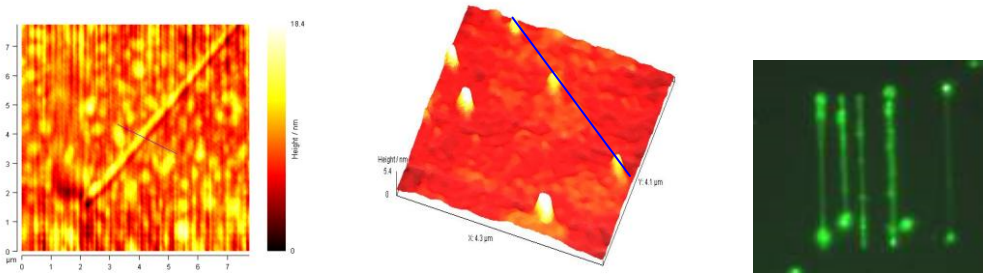
Enzyme Nanolithography

A novel approach to "direct-write" negative nano-lithography, based on biological specificity, where a proteolytic enzyme is used to etch grooves in a hardened protein layer. We are using trypsin to engrave features in a BSA layer, while flowing the trypsin solution via a nano-pipette (controlled by a SPM) to the surface. Trypsin is a proteolytic enzyme that cleaves very specifically on the carboxyl side of lysine and arginine residues.



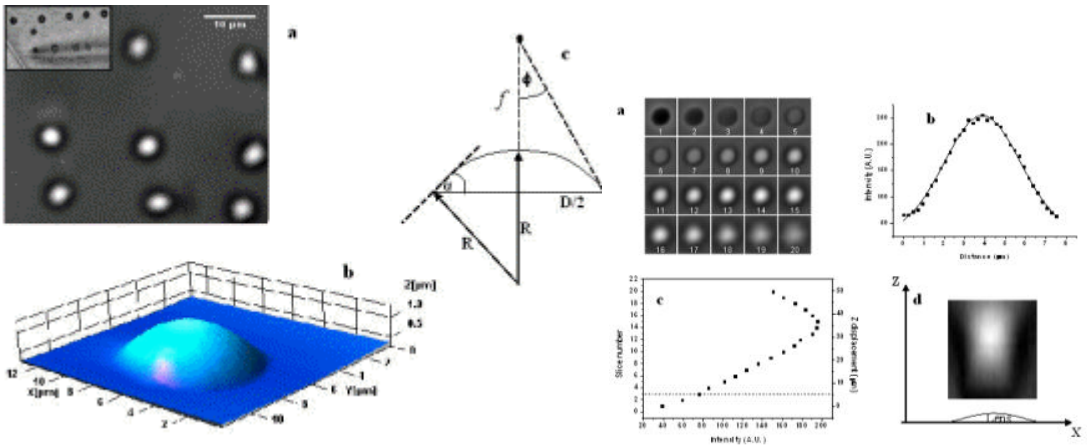
Protein Printing at nanoscales

We demonstrate the direct printing of proteins on a surface using a cantilevered nanopipette as the probe of a scanned probe microscope (Nano fountain pen - NFP). Proteins were directly delivered through the ~100 nm aperture of the nanopipette by simply contacting the probe with the surface, in ambient conditions. Protein features with dimensions as small as ~200 nm have been deposited and characterized both by Scanning Force Microscopy (SFM) and Near-field Scanning Optical Microscopy (NSOM).



Polymer Microlenses with NFP

Using the Nano Fountain Pen (NFP) we deliver small volumes of monomer solution which is subsequently UV polymerized to create microlenses. Thus, we can position individual microlenses with very high positioning precision in strategically important locations. We demonstrated the feasibility of enhancing the fluorescent signal emitted by bio-molecule dots, with the use of these microlenses.



Nano- Molecularly Imprinted Polymers (MIPs)

The technique of molecular imprinting allows for the preparation of synthetic polymers with specific binding sites for a target molecule. This can be achieved if the target is present during the polymerization process, thus acting as a molecular template. Molecularly imprinted polymers have been named "antibody mimics". We deposit the pre-polymerization mixture using NFP, and subsequently (UV) polymerize the resulting nanostructures, that function as MIPs.