

## SUPPORT MATERIALS

### Single-Cell Membrane Drug Delivery using Porous Pen Nanodeposition

Yongliang Yang<sup>\*#</sup>, Jing Yu<sup>#</sup>, Amir Monemian Esfahani, Kristina Seiffert-Sinha, Ning Xi, Ilsoon Lee, Animesh A. Sinha, Liangliang Chen, Zhiyong Sun, Ruiguo Yang<sup>\*</sup>, Lixin Dong<sup>\*</sup>

Dr. Yongliang Yang, Dr. Liangliang Chen, Prof. Ning Xi, Dr. Zhiyong Sun and Prof. Lixin Dong  
Department of Electrical and Computer Engineering  
Michigan State University  
East Lansing, MI 48824, USA  
Email: ldong@egr.msu.edu  
Email: ylyang@msu.edu

Dr. Jing Yu, and Prof. Ilsoon Lee,  
Department of Chemical Engineering and Materials Science  
Michigan State University  
East Lansing, MI 48824, USA

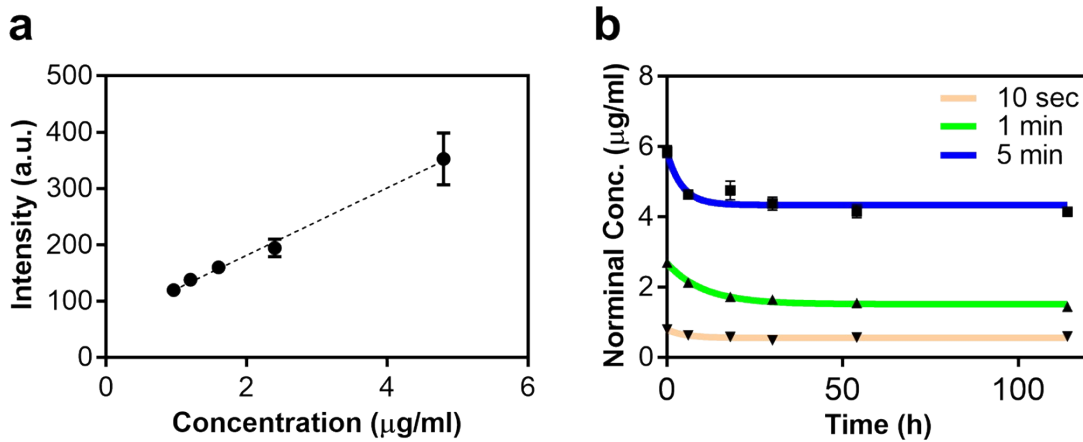
Amir Monemian Esfahani, and Prof. Ruiguo Yang  
Department of Mechanical and Materials Engineering  
University of Nebraska -Lincoln  
Lincoln, NE 68588, USA  
Email: ryang6@unl.edu

Prof. Kristina Seiffert-Sinha, and Prof. Animesh A. Sinha  
Department of Dermatology  
University at Buffalo  
Buffalo, New York 14203, USA

**Videos:**

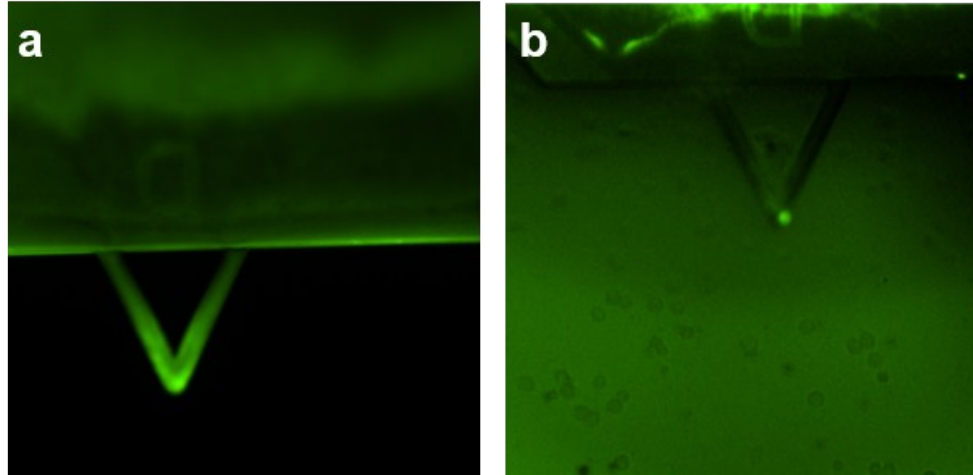
**AK23:** Time-lapse fluorescence images of cells stimulated by AK 23 loaded AFM tip. Speed: 1 second in video equals 12 seconds, scale bar: 100  $\mu\text{m}$

**Negative control:** Time-lapse fluorescence images of cells stimulated by negative control porous structured AFM tip. 1 second in video equals 12 seconds, scale bar: 100  $\mu\text{m}$



**Figure S1. Calibration of concentration of loaded protein solution in porous pen. a)**

Concentration of fluorescence antibody is linearly related with fluorescence intensity. The slop of linear fitting is 59.9 intensity/ $(\mu\text{g/ml})$ . b) The nominal concentration of loaded protein of the three experimental conditions over 114 hours.



**Figure S2. Depositing GFP-tagged antibodies onto a single cell membrane via PPN.** a) Porous pen loaded with GFP-tagged antibody. b) Antibodies with fluorescence tag are deposited onto the cell membrane via PPN. The probe can be controlled to target any cell within the field of view.