
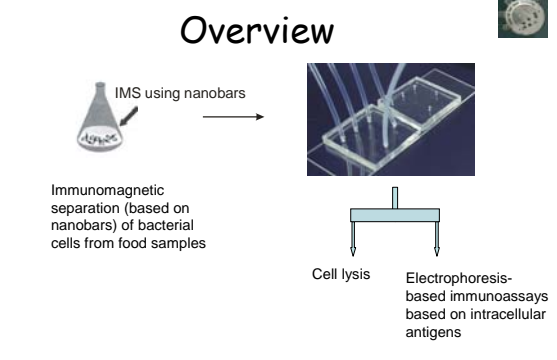


Rapid, quantitative, reusable immunosensors for bacteria detection on a microfluidic platform

Chang Lu (PI), Arun Bhunia (co-PI), Zhongyang Cheng (co-PI), Ning Bao, Hsiang-yu Wang, Bala Jagadeesan, Suiqiong Li
 Agricultural and Biological Engineering, Food Science, Purdue University, West Lafayette, Indiana 47907
 Materials Engineering, Auburn University, Auburn, Alabama 36849




Overview




IMS using nanobars → Immunomagnetic separation (based on nanobars) of bacterial cells from food samples

↓ Cell lysis ↓ Electrophoresis-based immunoassays based on intracellular antigens

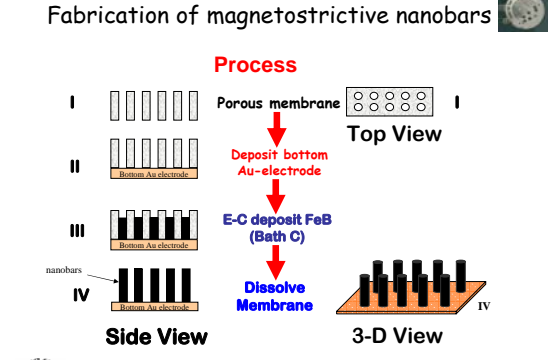


Attributes of our design

- Magnetic nanobars: larger magnetic force for separation and less clogging in microchannels compared to microspheres
- Rapid: 30 min-1 h for off-chip cell separation and <10 minutes for on-chip detection
- Quantitative: laser induced fluorescence detection allows estimation of the number of pathogenic cells
- Reusable: the same microchip for different pathogens for multiple tests (no immobilization for immunoassays)



Fabrication of magnetostrictive nanobars



Process


I Porous membrane **Top View**

II **Deposit bottom Au-electrode**

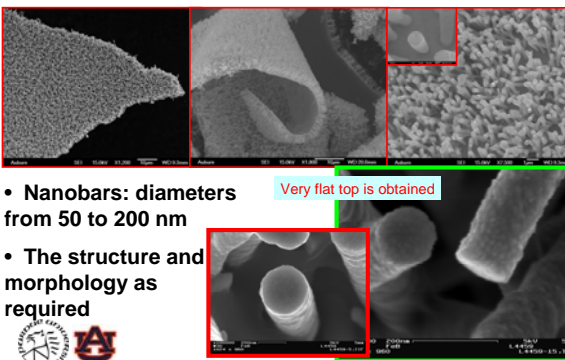
III **E-C deposit FeB (Bath C)**

IV **Dissolve Membrane** **3-D View**

Side View




The shape and morphology of nanobars

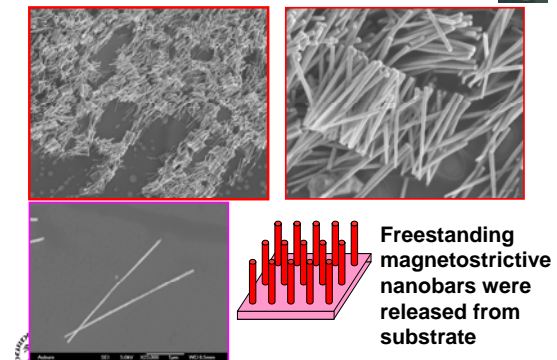


- Nanobars: diameters from 50 to 200 nm
- The structure and morphology as required


Very flat top is obtained

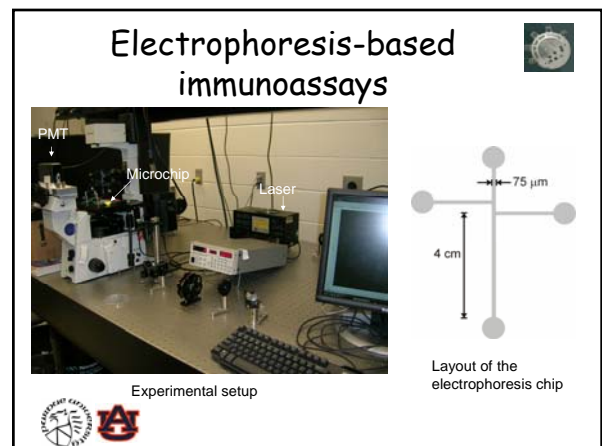
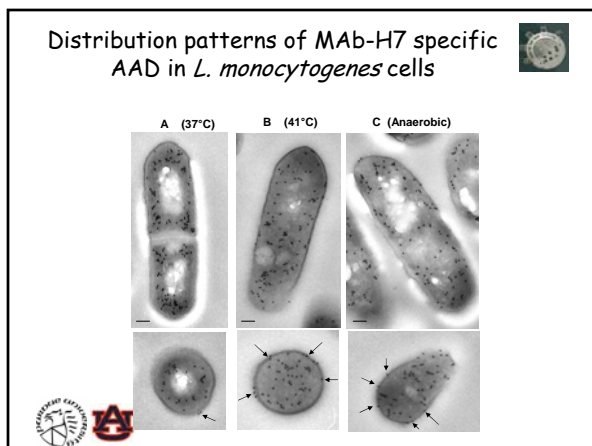
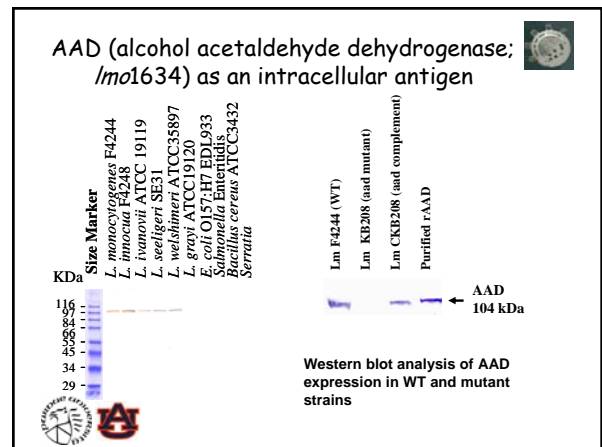
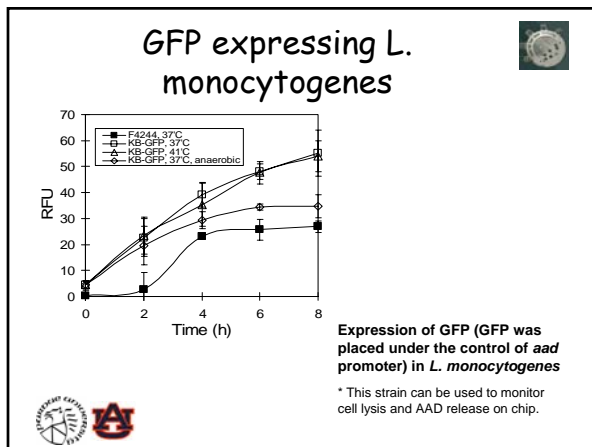
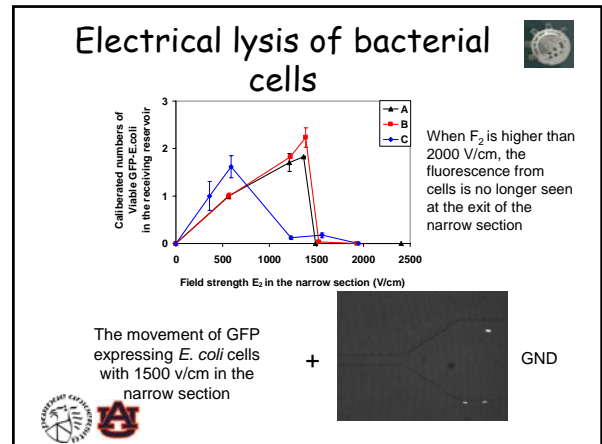
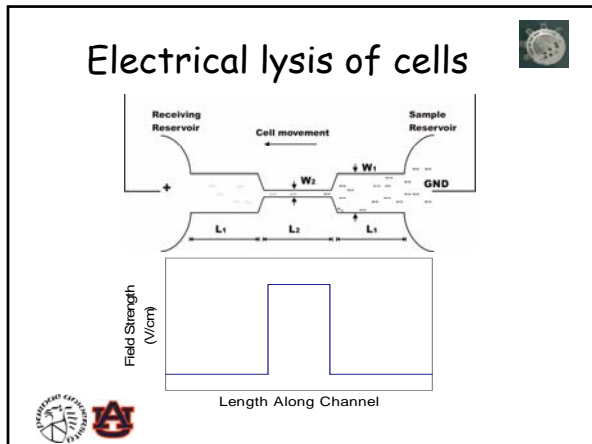


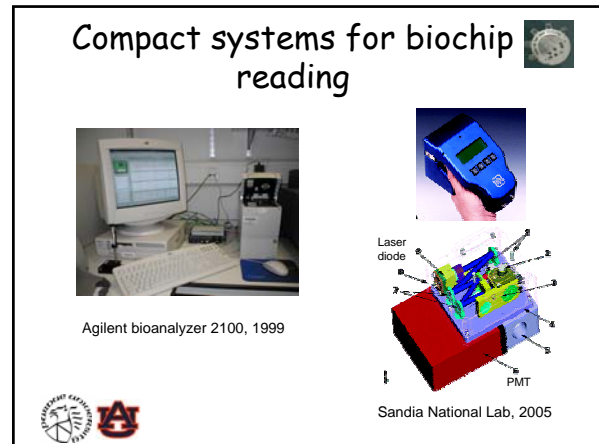
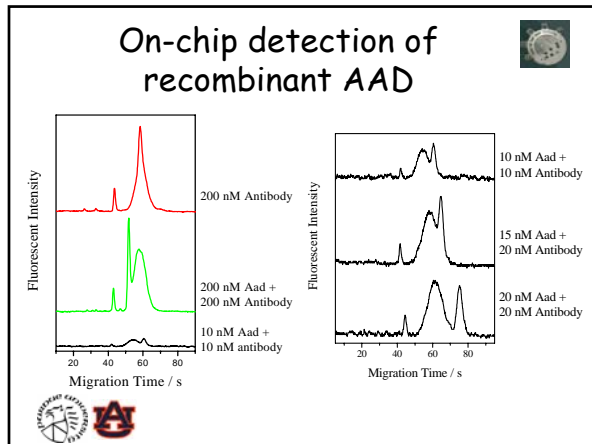
Freestanding nanobars



Freestanding magnetostrictive nanobars were released from substrate







- ### Future work
- Immobilization of antibody on magnetic nanobars for IMS
 - Testing of different cellular antigens (InlA, InlB, ActA) in *L. monocytogenes* which will improve the specificity (current assay detects *Listeria* species only)
 - Testing of electrophoresis-based immunoassays based on *L. monocytogenes* lysate
 - Integration of cell lysis and electrophoresis-based immunoassays