



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

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Overview




IMS using nanobars

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Cell lysis
Immunoassay based on intracellular antigen Aad


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



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


nanobars



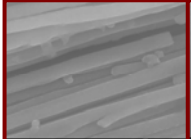
Side View



3-D View



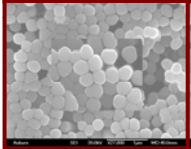
Fabrication of Magnetostrictive Nanobars




Diameter:
50 ~ 300 nm

Length:
A few to 60 μm

Nanobars can be array-like or freestanding



Amorphous magnetostrictive (Co-Fe-B) nanobars fabricated using template method. The structure was determined using XRD



Antibody Immobilization and Bacterial Cell Collection (I)

Co-Fe-B thin film

↓ Immobilizing antibody

YYYYYYYYY

Co-Fe-B thin film

↓ Immersed in bacterium solution

Y Y Y Y Y Y Y Y Y Y

Co-Fe-B thin film

↓ Wash and OsO Treatment, then SEM observation

Co-Fe-B thin film coated with Au

↓ Immobilizing antibody

YYYYYYYYYYYYYYYY


Co-Fe-B thin film coated with Au

↓ Immersed in bacterium solution

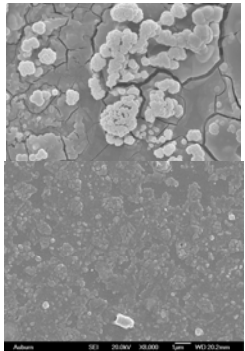
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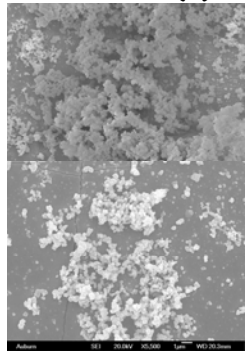
Co-Fe-B thin film coated with Au


↓ Wash and OsO Treatment, then SEM observation

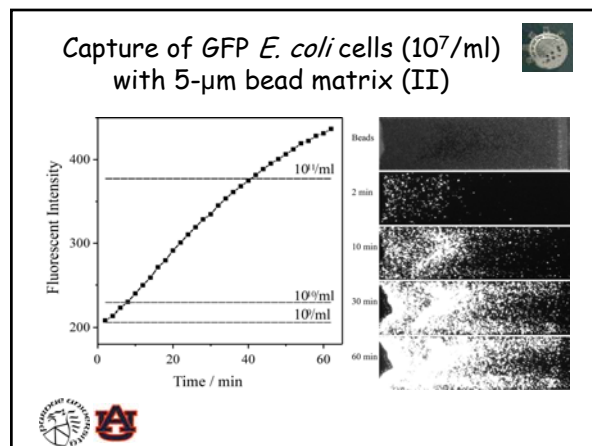
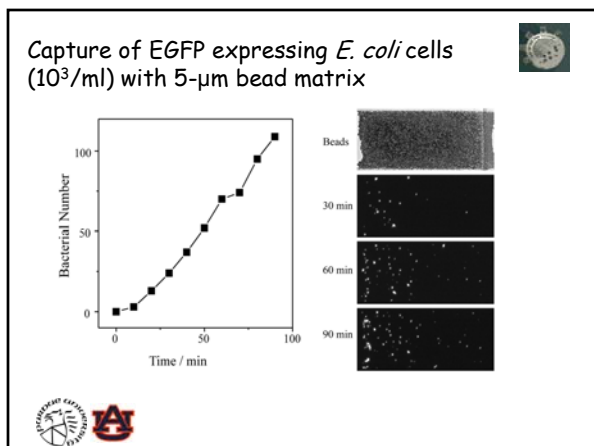
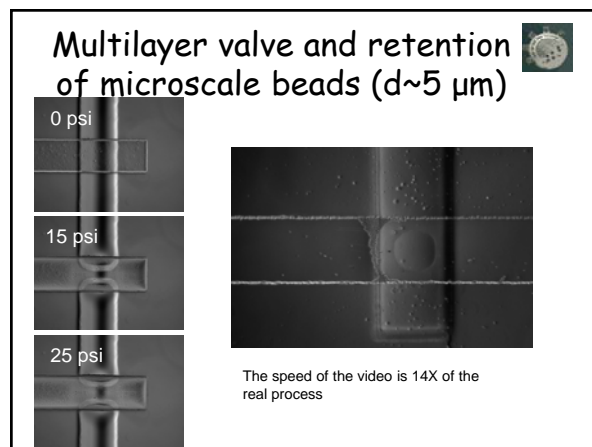
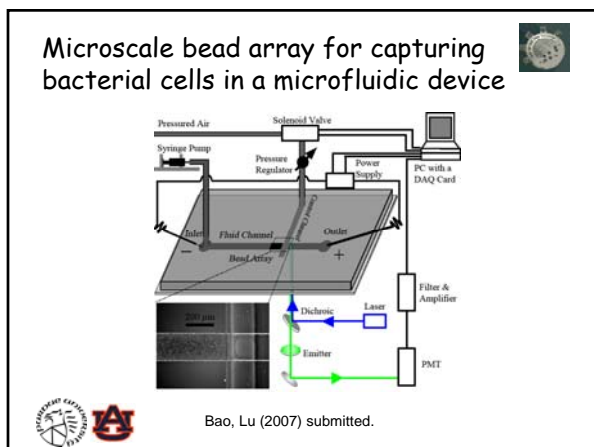
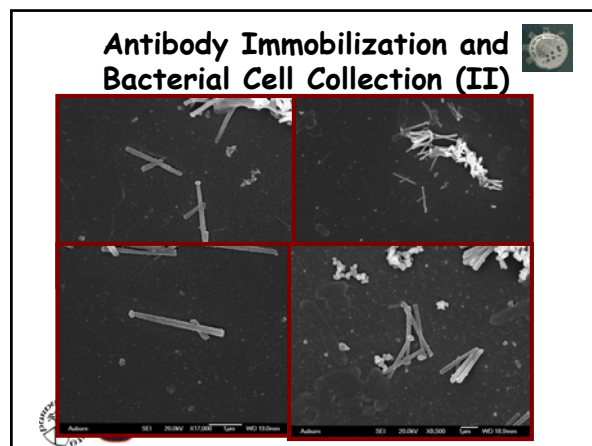
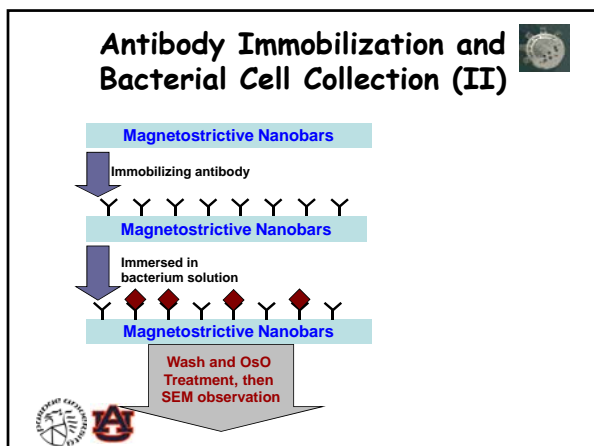


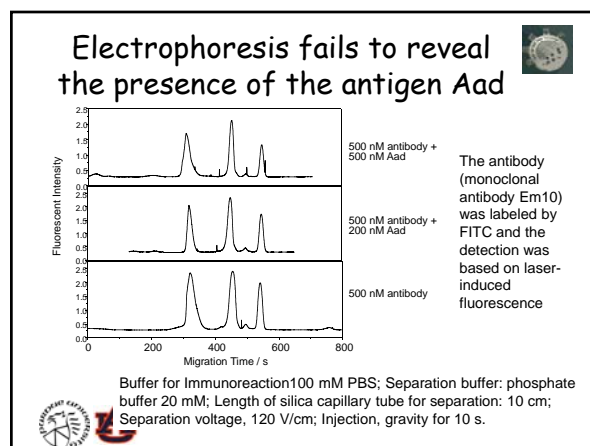
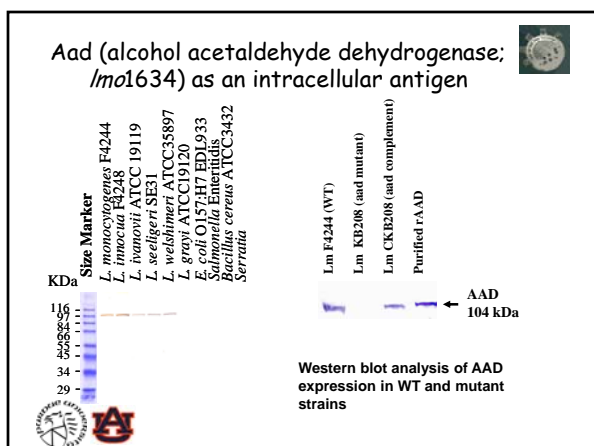
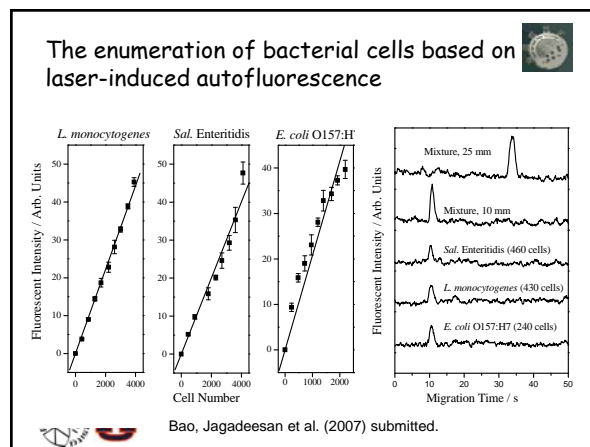
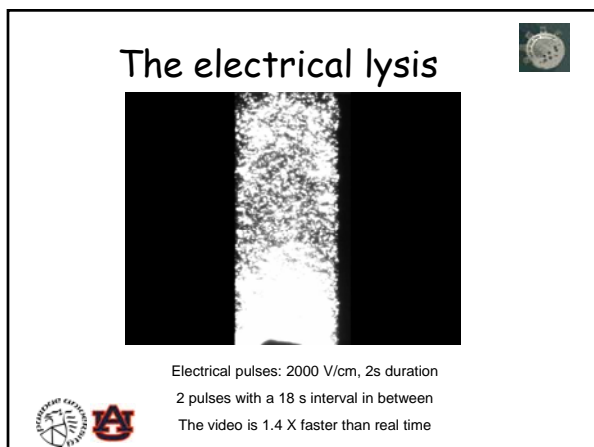
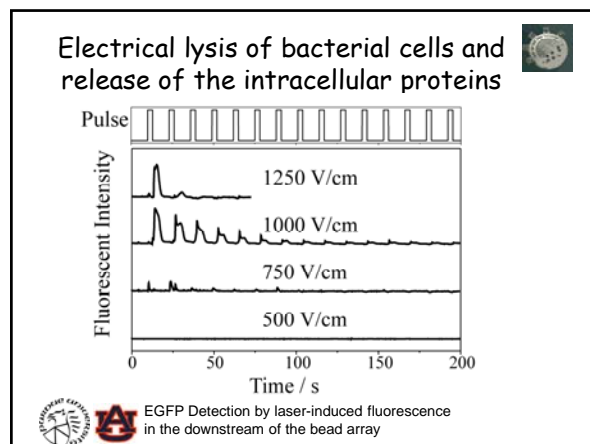
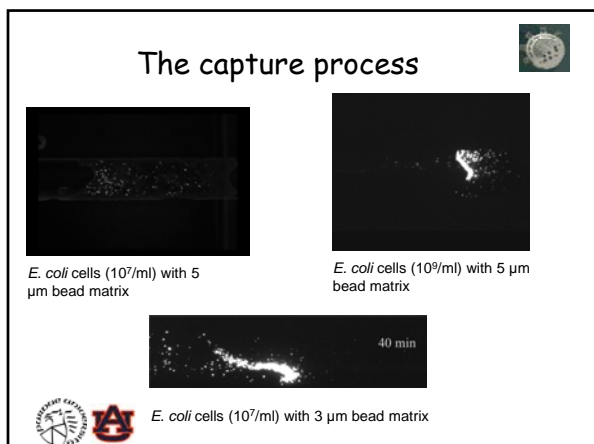
Antibody Immobilization and Bacterial Cell Collection (I)

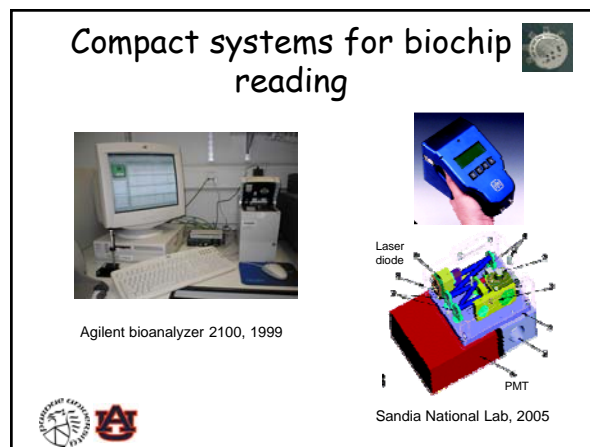
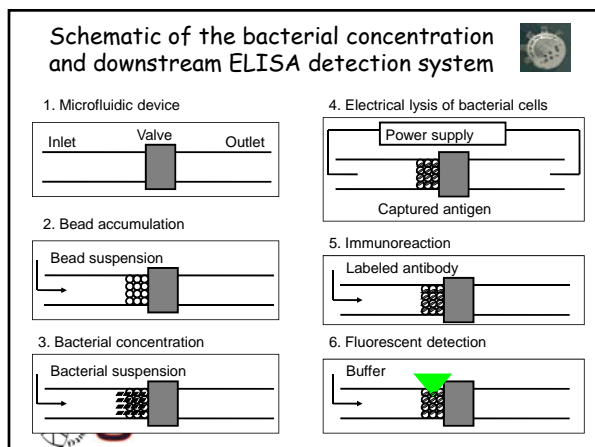
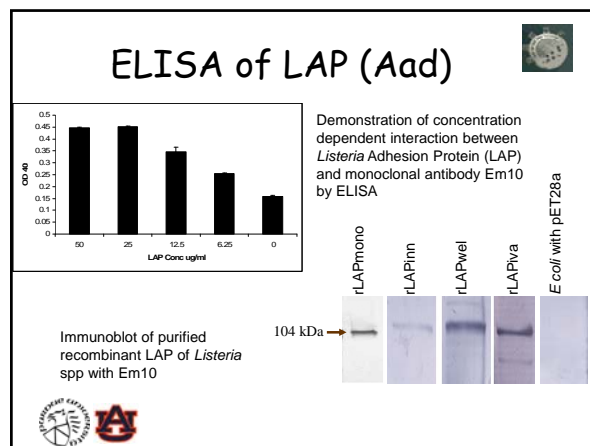
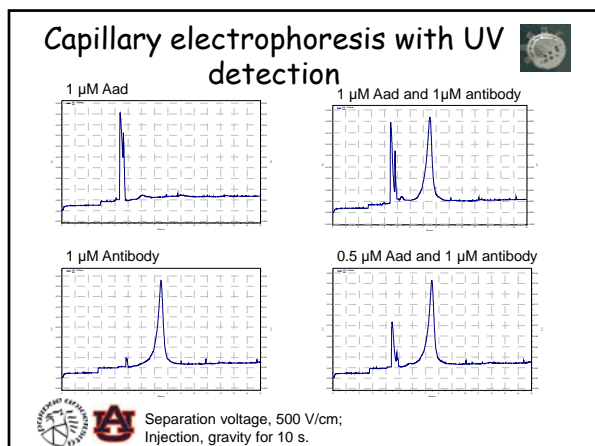












- ### Summary
- Adsorption of bacterial cells on magnetic nanobars demonstrated
 - A simple microfluidic device for capturing and lysing bacterial cells developed
 - Autofluorescence of bacterial cells can be applied for enumeration
 - Electrophoresis-based immunoassay does not work for the particular antigen and antibody

- ### Future work
- IMS of *L. monocytogenes* cells from food sample
 - Incorporation of nanobar-adsorbed bacterial cells with microscale bead based cell capture
 - Integration of cell lysis and ELISA-based immunoassays