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# Rapid Electrochemical Immunoassays for Low-Cost, Multiplex Detection of Food Pathogens using Capillary Driven Microfluidic Devices

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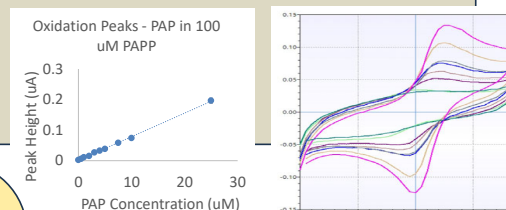
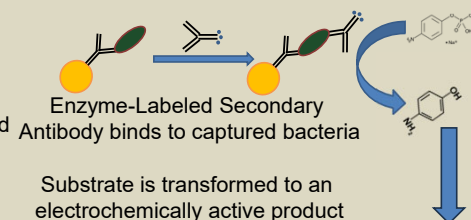
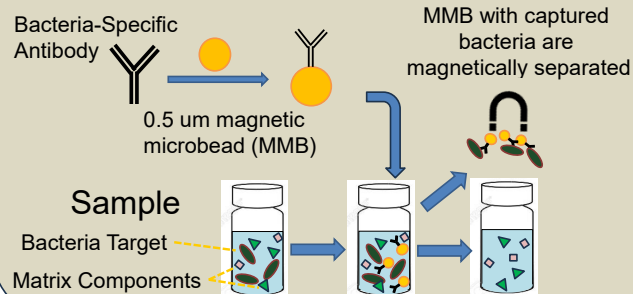
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## Foodborne Illness in Warfighters

- Foodborne Illness in Warfighters costs \$900 million of lost productivity annually
- Food samples are inherently difficult to analyze due to the complexity of the matrix (fats, solids, non-harmful bacteria) as well as the low amount of bacteria being analyzed
- When analysis is possible with traditional techniques, the complexity of the current assays limits their use to trained technicians
- Analysis can take days depending on the technique employed
- Previous work has demonstrated the limiting factors in paper-based flow devices and colorimetric detection

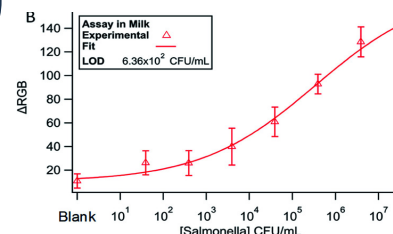
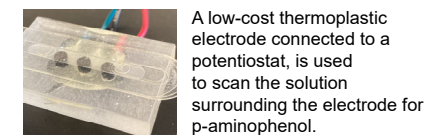
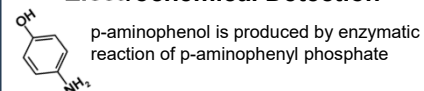
## Assay Mechanism



## Overview

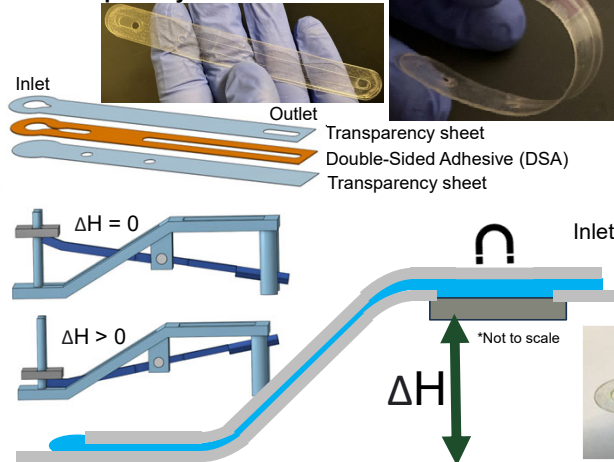
- MMB-Bacteria-Enzyme sandwich assay enables detection of low concentrations of bacteria ( $10^2$  cfu/mL)
- Flexible flow channel (0.3 x 4 mm) allows real-time control of flow rate, without clogging issues seen in paper.
- External device simplifies operation and speed of assay (< 2 Hours)
- Electrochemical detection lowers limit of detection of assay product, enhancing sensitivity

## Electrochemical Detection



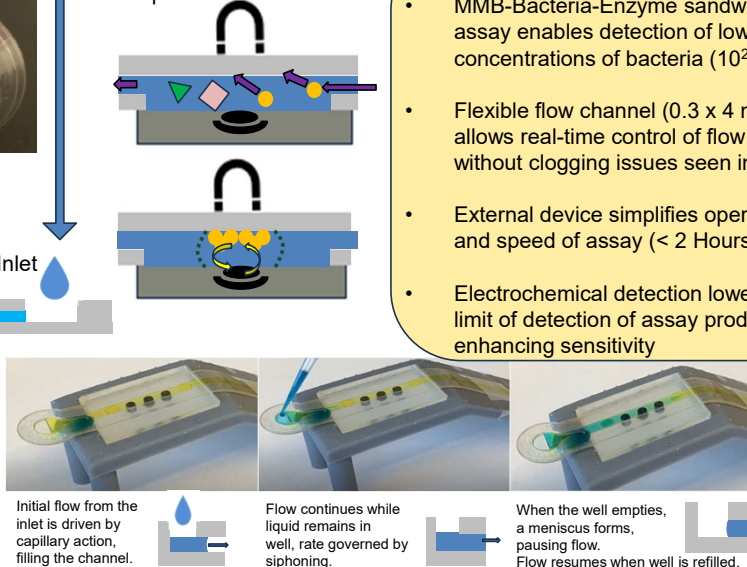
Assay utilizing MMB bacterial capture and concentration - Colorimetric Carrell CS, ET AL. RSC Adv. 2019 Sep 17;9(50):29078-29086.

## Flexible channel formed from transparency and DSA



Outlet is passive, requiring no pump.  
Flow rate is modifiable via change in  $\Delta H$  (above)

## Microbeads captured from sample matrix within device



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