



Distributed Sensor Network

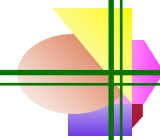
Graham Wiley

Leonid Sukharnikov

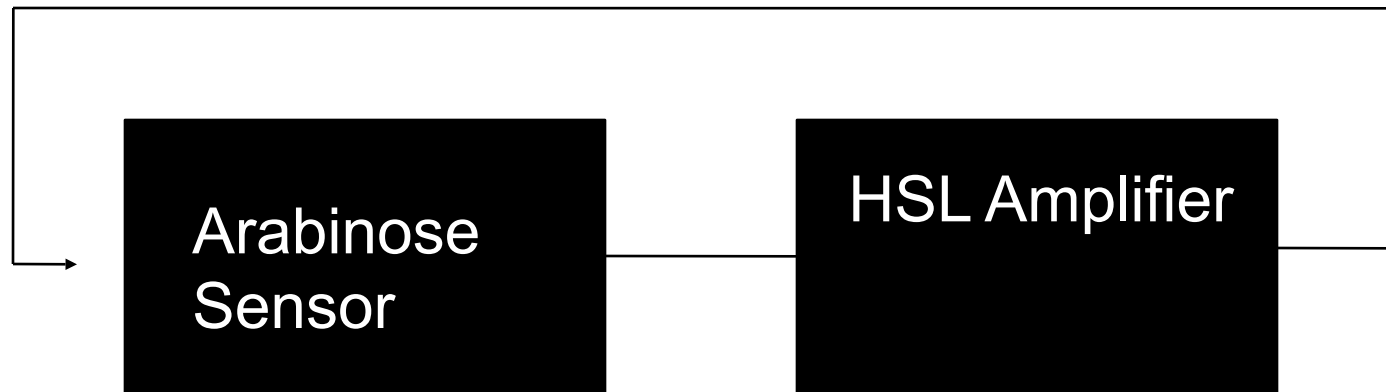


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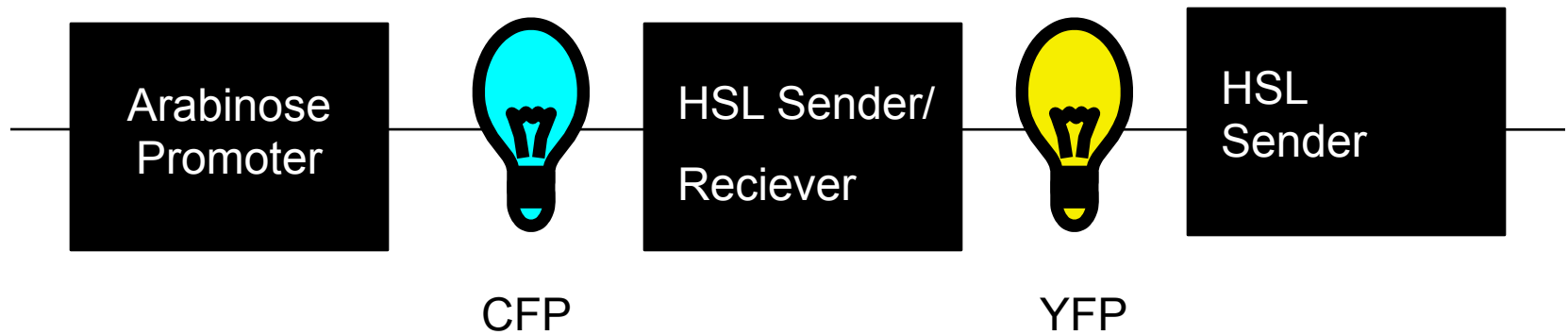
"Where nature gives up her secrets to the prepared mind"



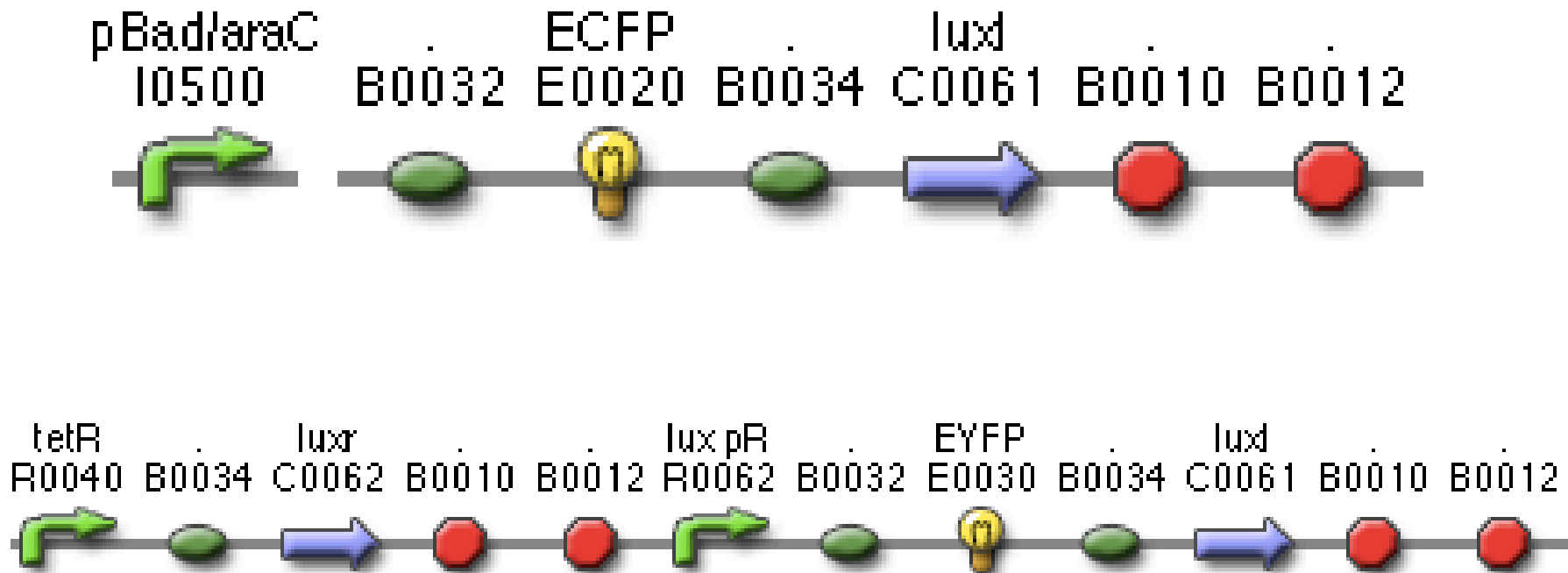
Levels of Abstraction - System



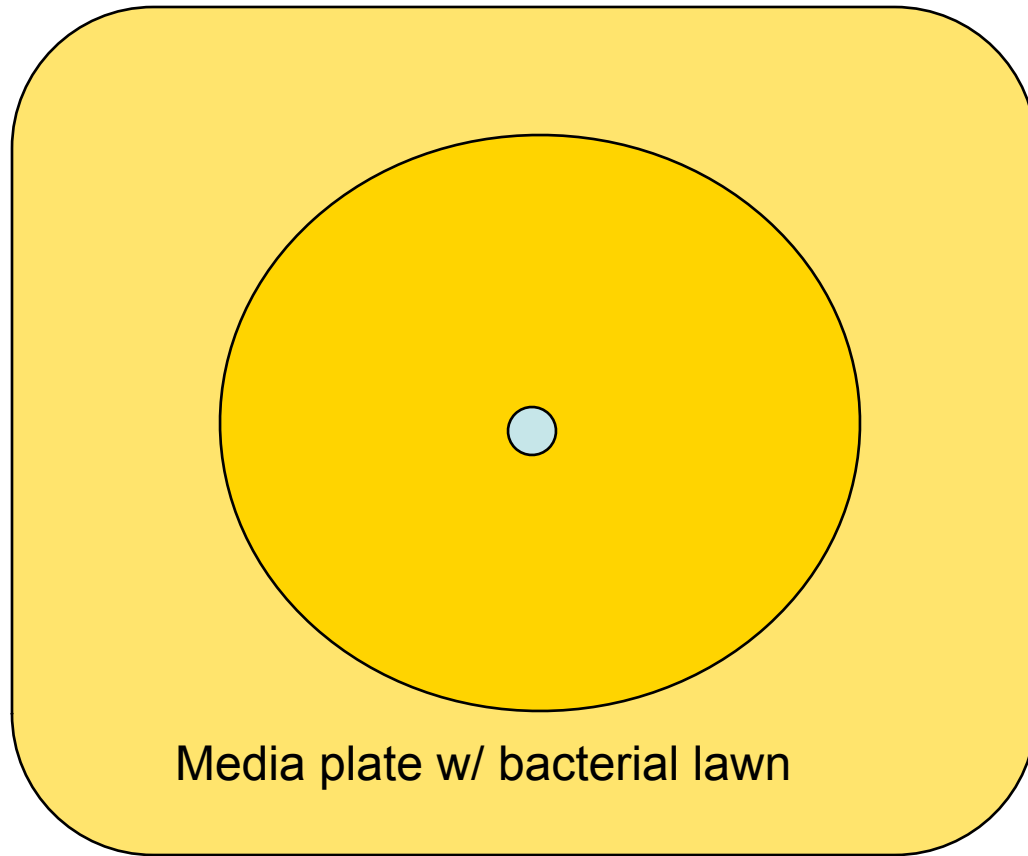
Levels of Abstraction - Devices



Levels of Abstraction - Parts



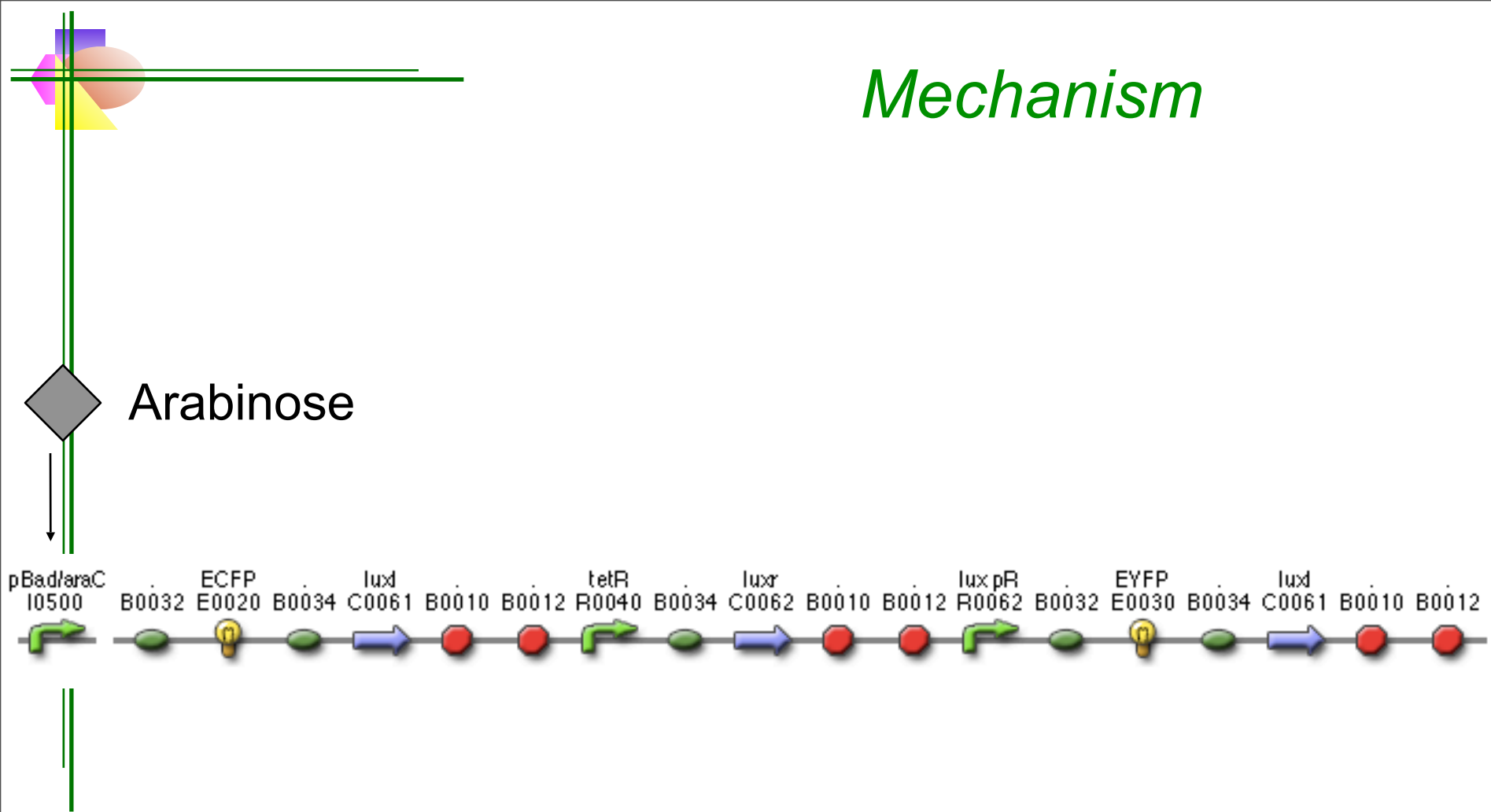
Expected Output



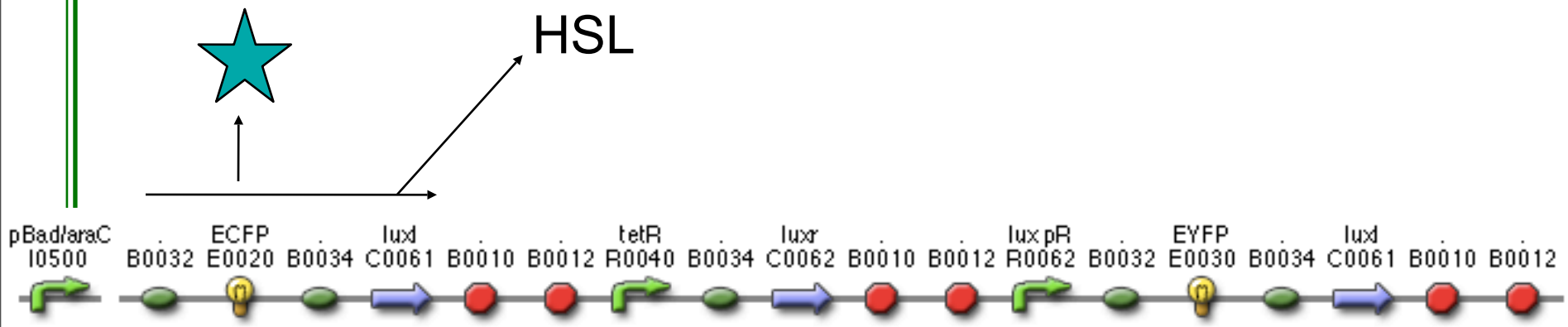
Media plate w/ bacterial lawn

Expanding YFP ring surrounding CFP circle shows signal propagation

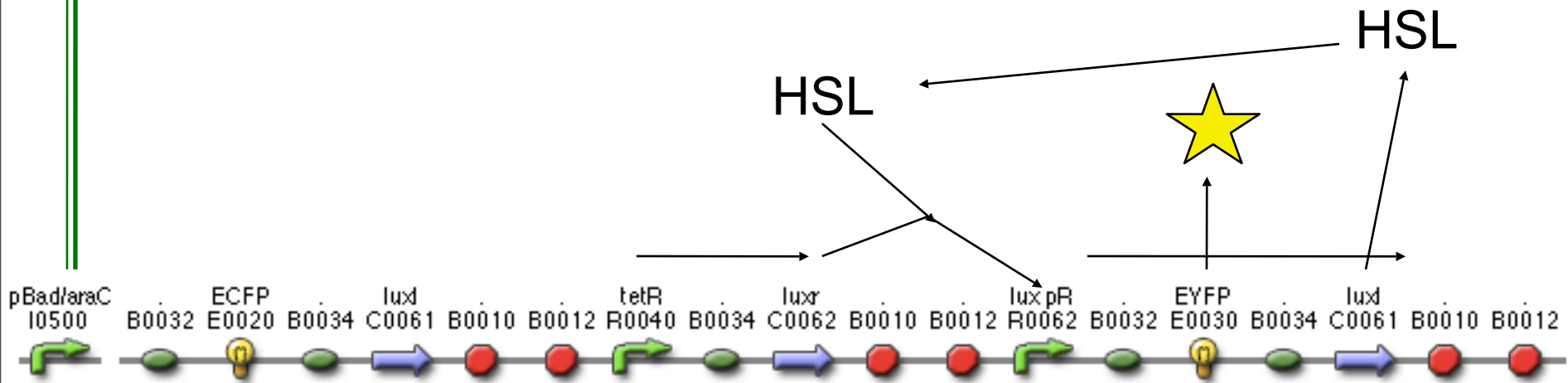
Mechanism



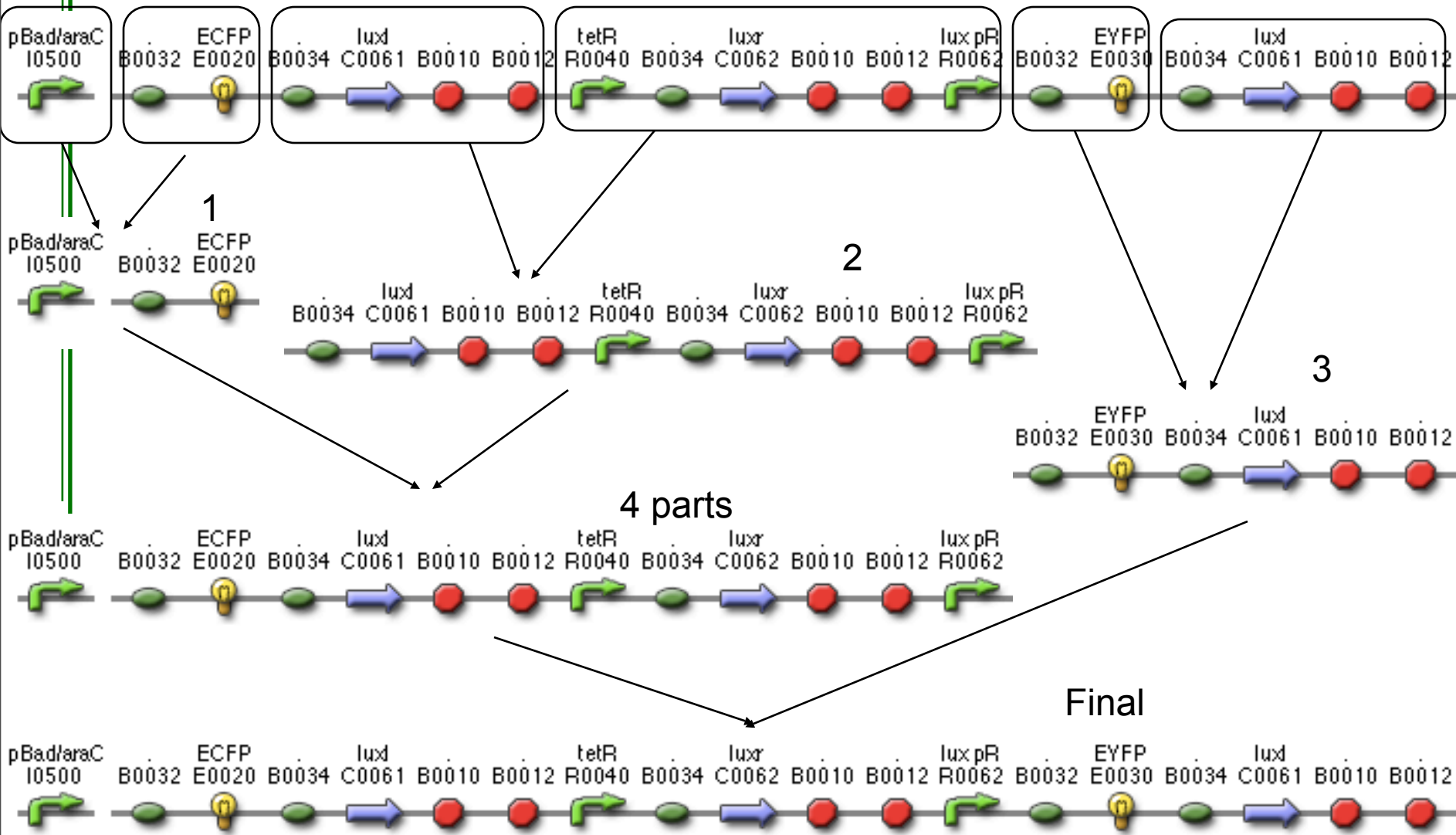
Mechanism



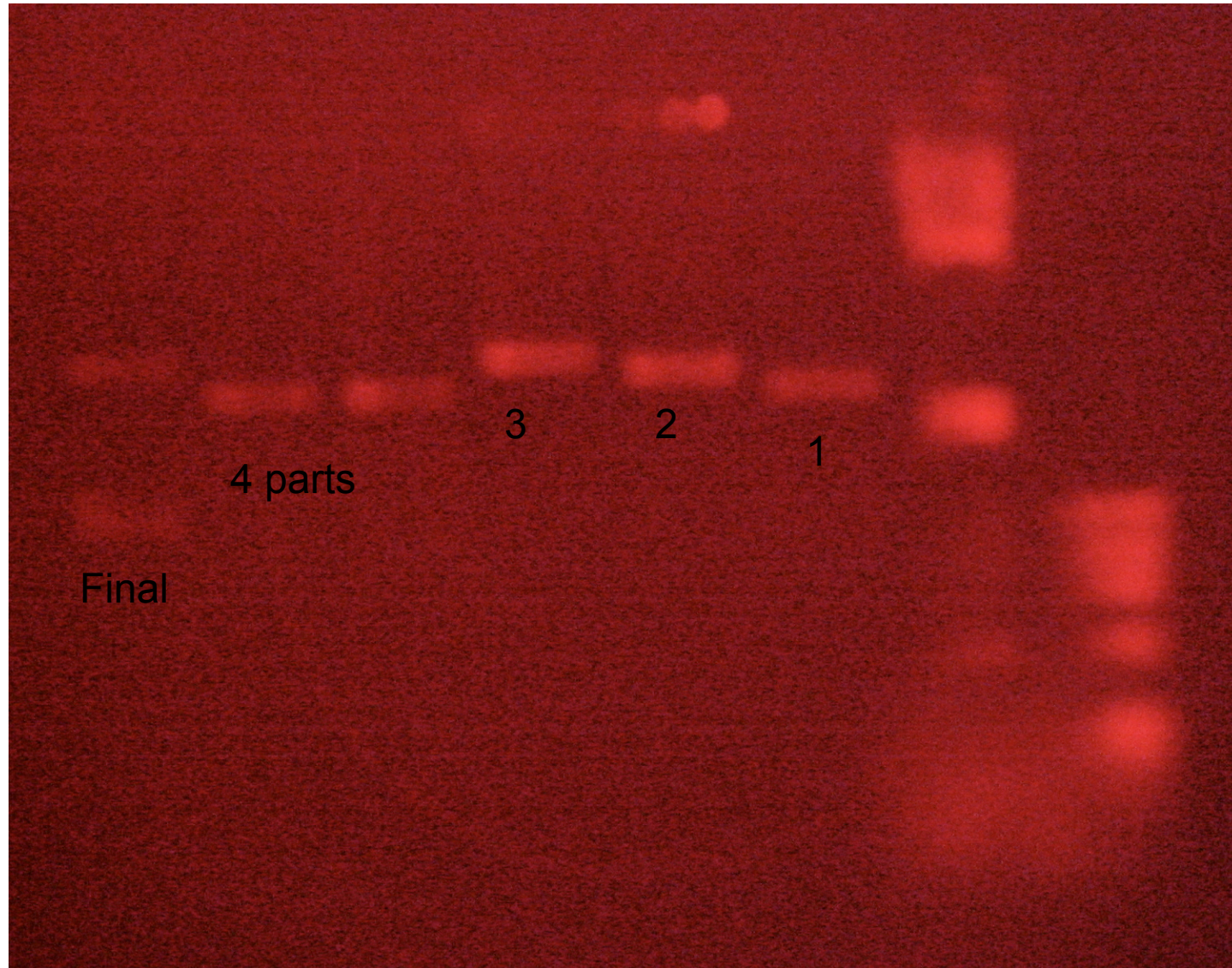
Mechanism



Construction



Construction Results



FUTURE WORK

- Check construct via sequencing
- Reconstruct if necessary





Detecting small molecule signaling using phosphorylation dependent mechanism in E.coli

Simone Macmil
Durga P Sarvepalli

4 November 2006



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SMALL MOLECULES

- Smallest part of pure chemical substance that retains its structure and properties.
- Play an important role in multiple signaling mechanisms





APPLICATIONS OF SMALL MOLECULES IN BIOLOGY

- Small molecule drugs
- Biopolymers
- Synthetic peptides
- Primers





NEED FOR SMALL MOLECULE DETECTION

- Understand molecule – protein interactions
- Effect of molecules on the viability of cells
- Genetic changes caused by molecules used in molecular therapy
- Drug discovery



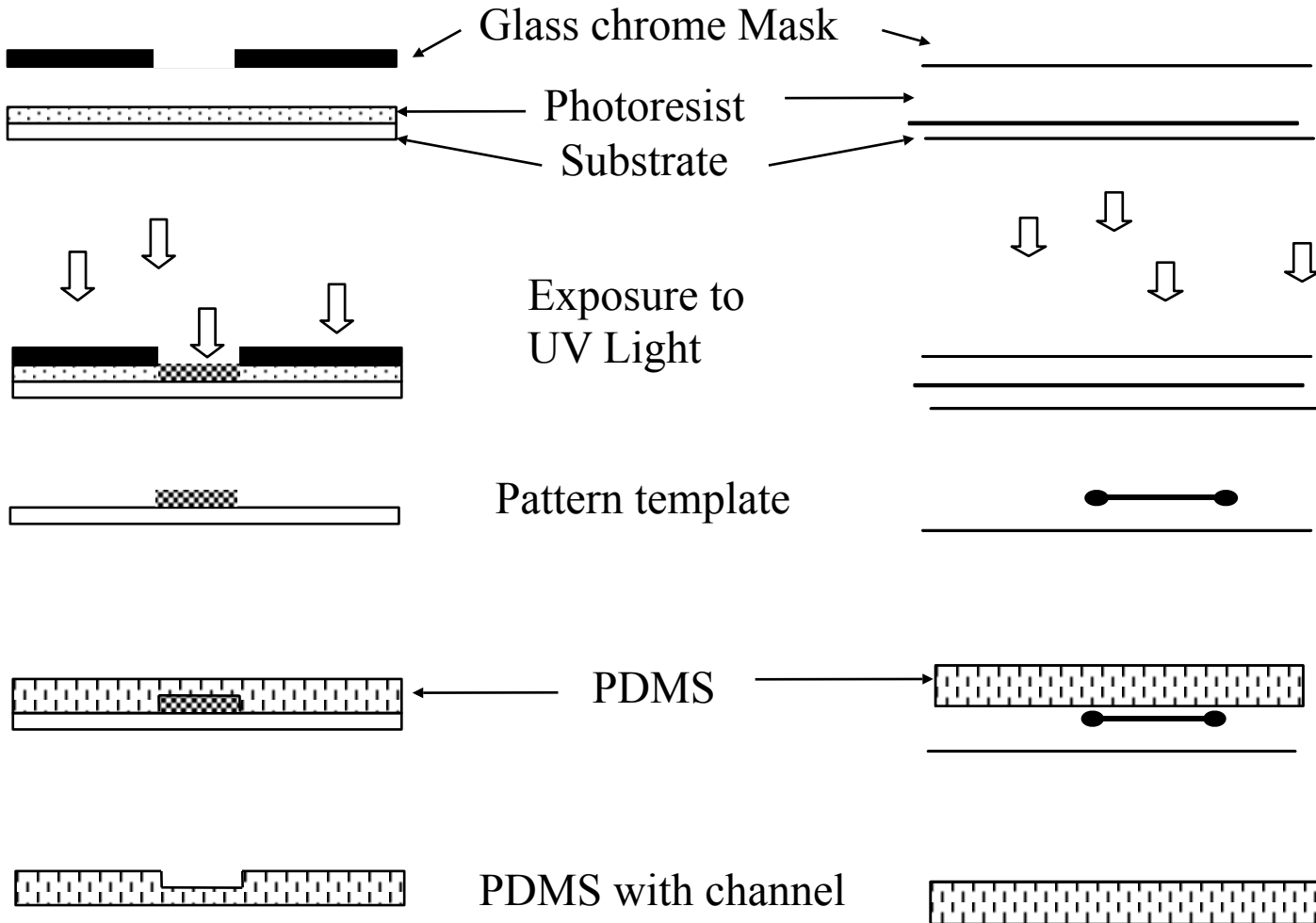


CURRENTLY AVAILABLE TECHNIQUES

- Analytical: NMR, Western blot, Spectrophotometry, Chromatography, ELISA
- Small molecule – protein interactions : Nanowire sensors (Wang et al , *PNAS* 2005;102;3208-3212)
- Disadvantages: whole cells cannot be used
- Using micro channels whole cells can be used and less amount of reagents required
- Micro channels can also be customized according to the design of the experiment and allows studies to be conducted under flow



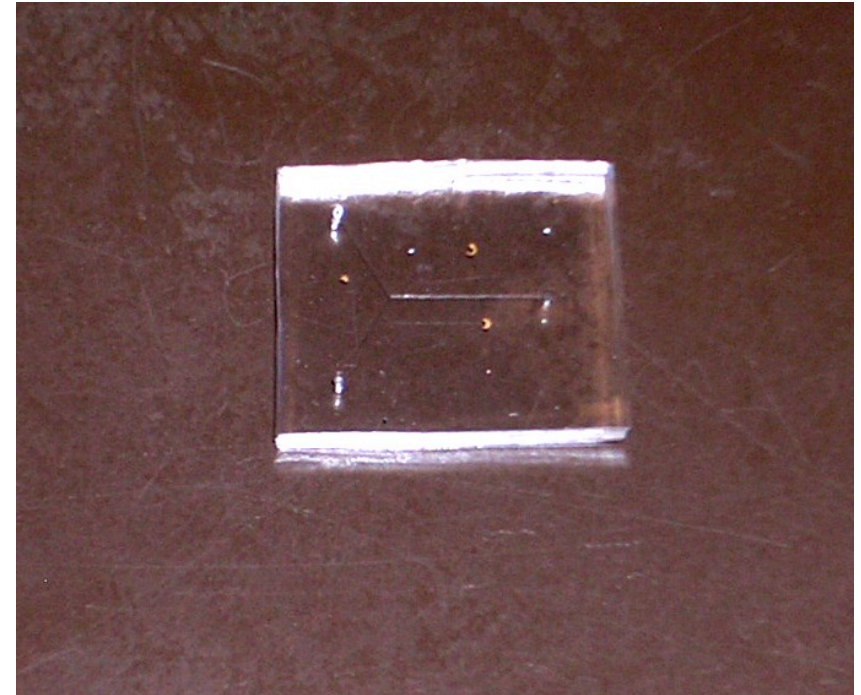
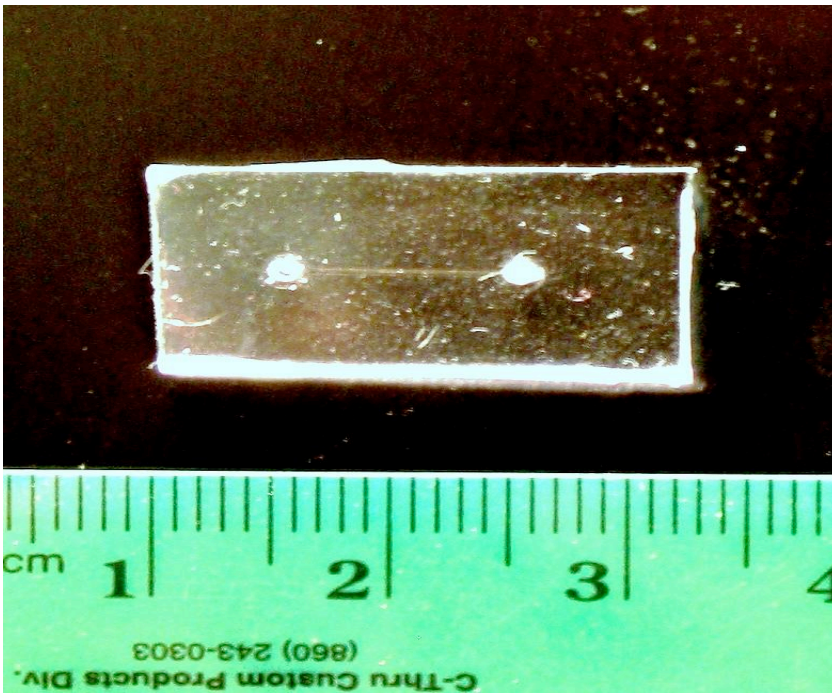
FABRICATION OF MICROFLUIDIC CHANNEL



PDMS - Poly dimethyl siloxane



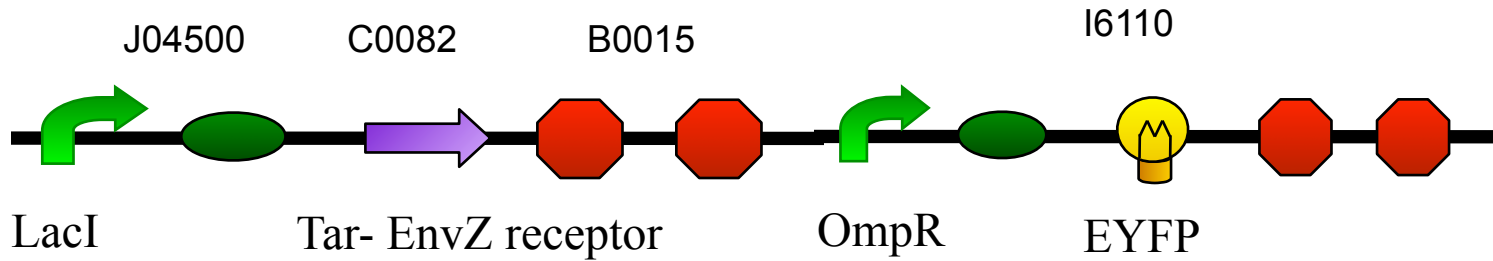
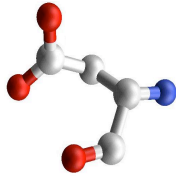
MICROFLUIDIC CHANNEL DIMENSIONS



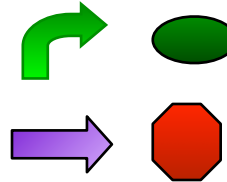
Channel width : $200\mu\text{m}$
depth : $50\mu\text{m}$

Aspartate detector

Induction



Parts from the registry



Restriction enzyme digestion



Sequential ligation to create construct



Ligate into pUC



Transformation



Sequence transformants



Grow selected transformants in micro channels

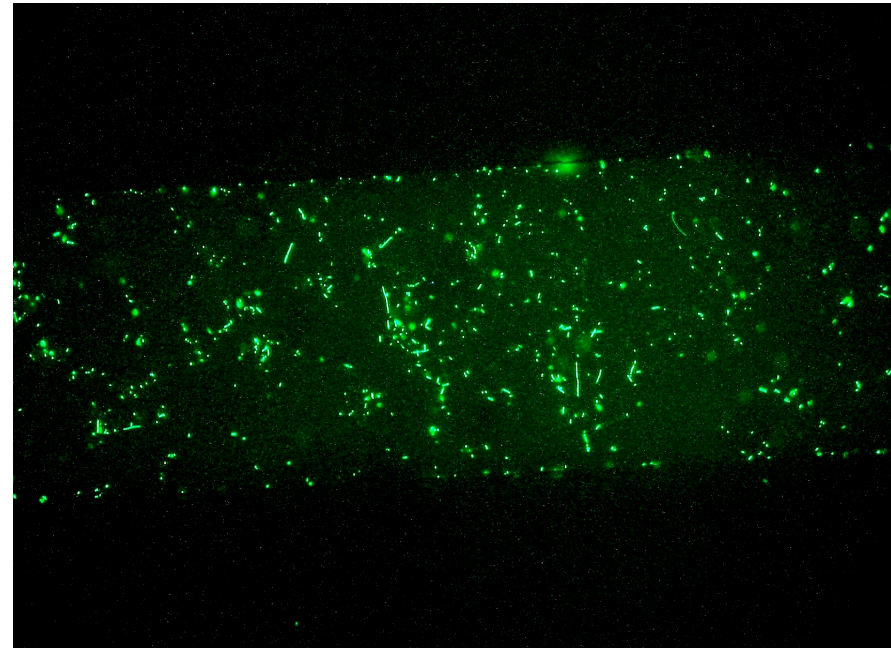
Aspartate detection

Cells grown in Minimal Media lacking aspartate and induced with IPTG

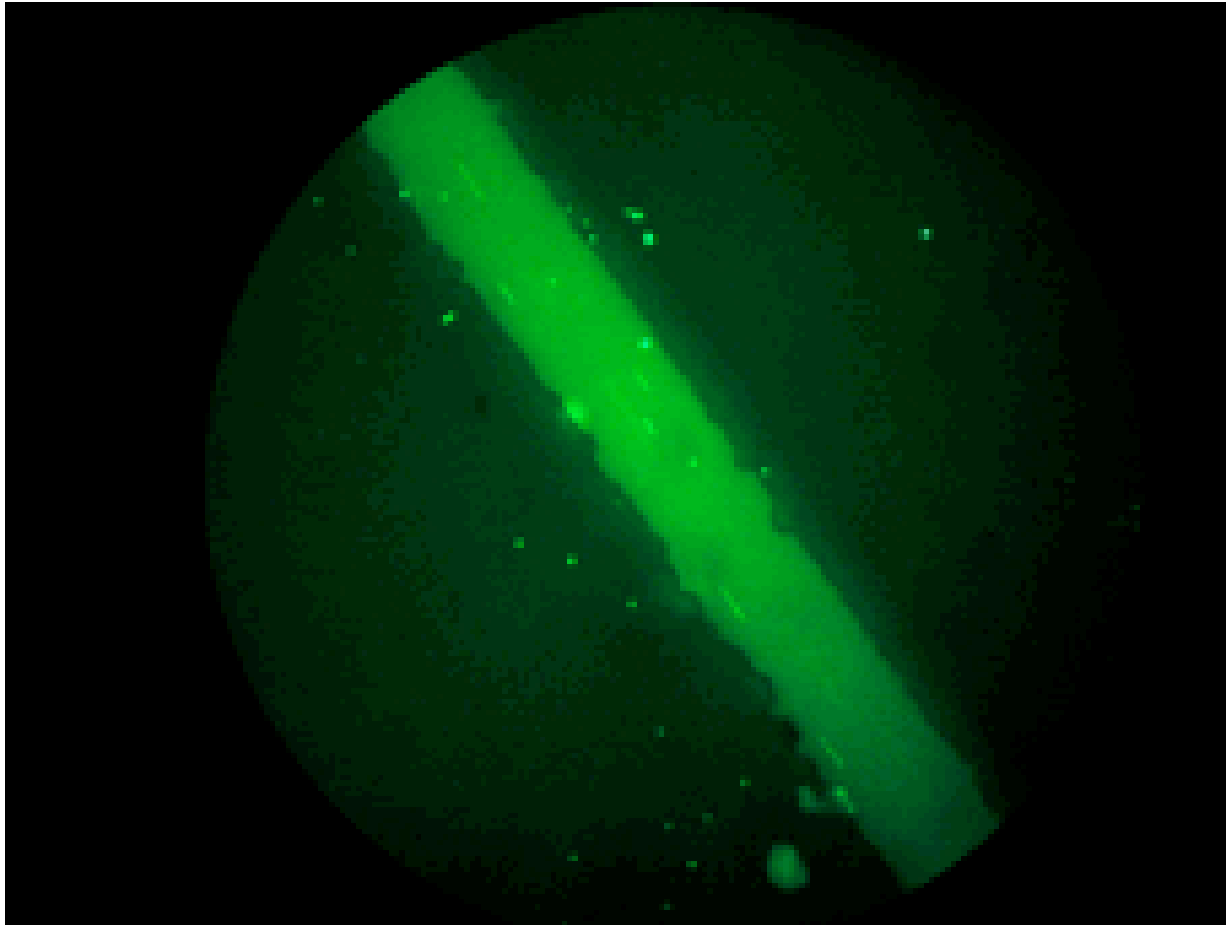


Microfluidic channel

Cells fluoresce after 30 min in the presence of LB



Movement of *E.coli* in the channel





FUTURE WORK

- Improvise microchannels
 - Study flow of bacteria under various conditions - chemotaxis, sensitivity of bacteria in the gut to pH, temperature.
- Detect low concentration of small molecules formed during bio-industrial production.
 - Design appropriate sensors for detection (small peptides and sugars)



ACKNOWLEDGEMENTS

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