

Chemotaxis Assay Instrument

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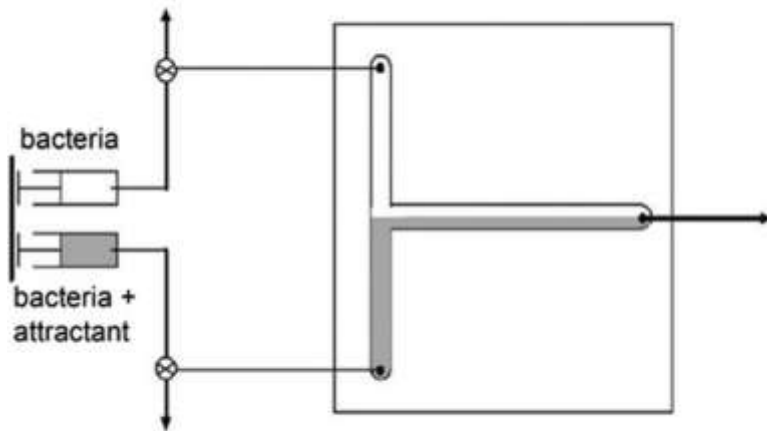
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Project Proposal

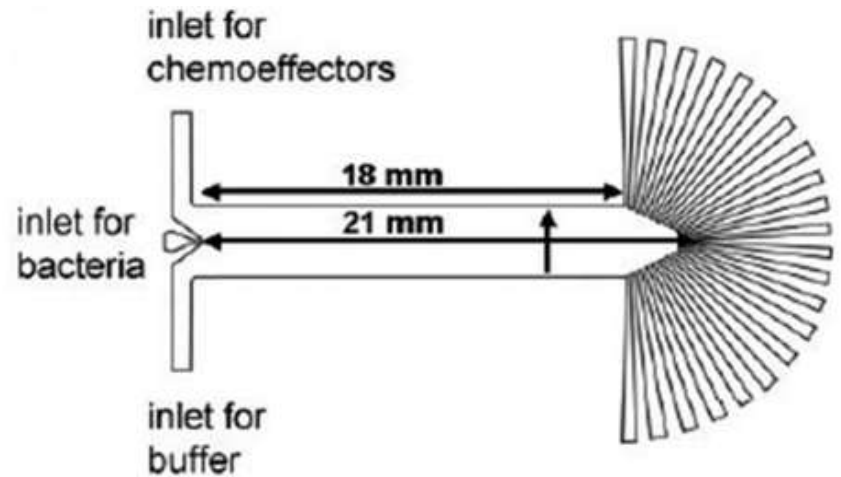
Problem With Chemotaxis Assay Devices

- More scientific questions emerge, therefore more microfluidic devices designed to address specific question
- ‘Toolbox’ of chemotaxis devices but need to develop efficient systematic microfluidic INSTRUMENT
- **Solution:** Integrate technology to these devices to become enabling instrumentation of new scientific discovery

Multiple Scientific Questions Therefore Multiple Microfluidic Devices

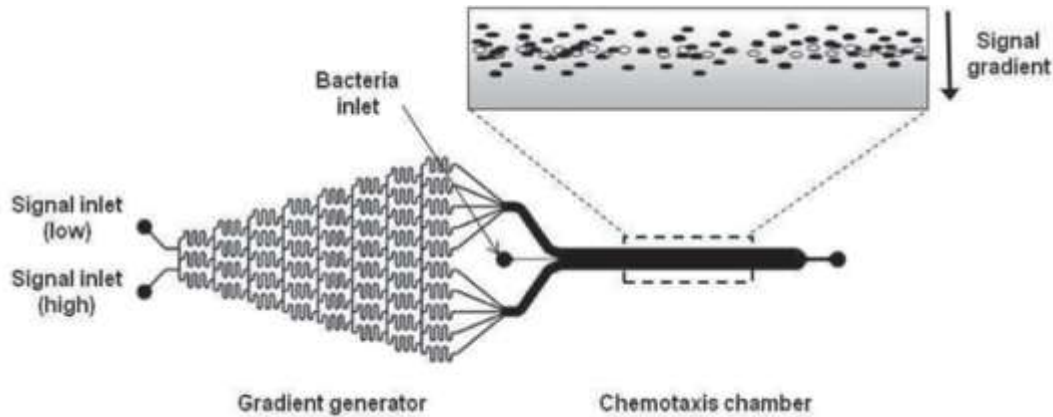


Two-inlet parallel-flow device
Lanning et al

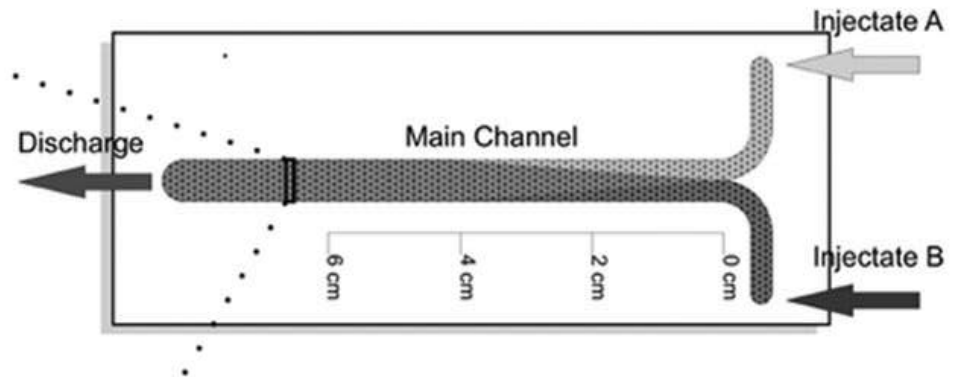


Three-inlet parallel-flow device
Mao et al

Multiple Scientific Questions Therefore Multiple Microfluidic Devices

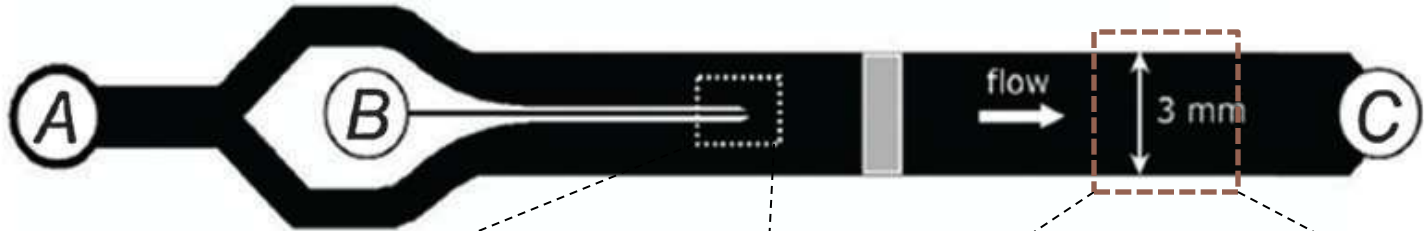


μ Flow device
Englert *et al*



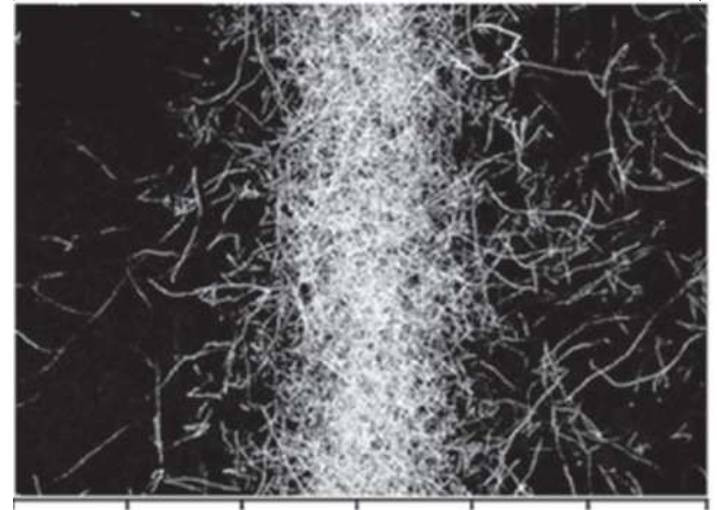
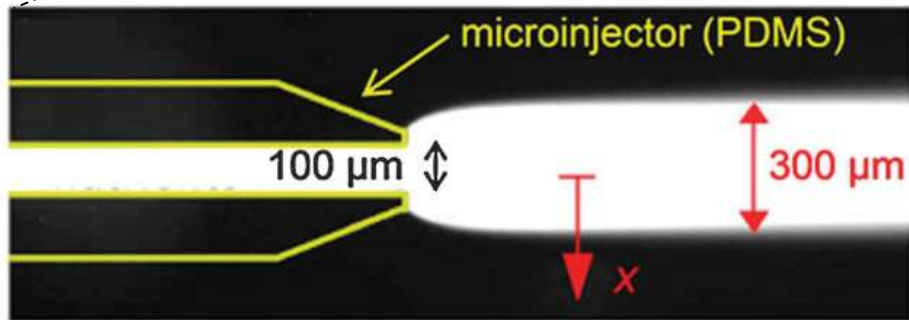
Porous parallel-flow device
Long *et al*

Microinjector Device



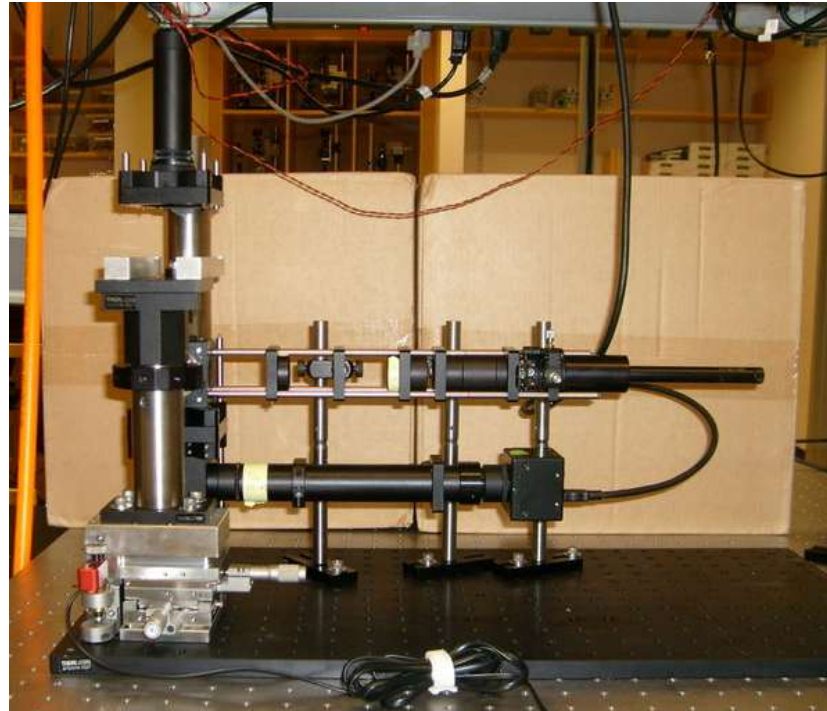
Seymour et al

Videomicroscopy



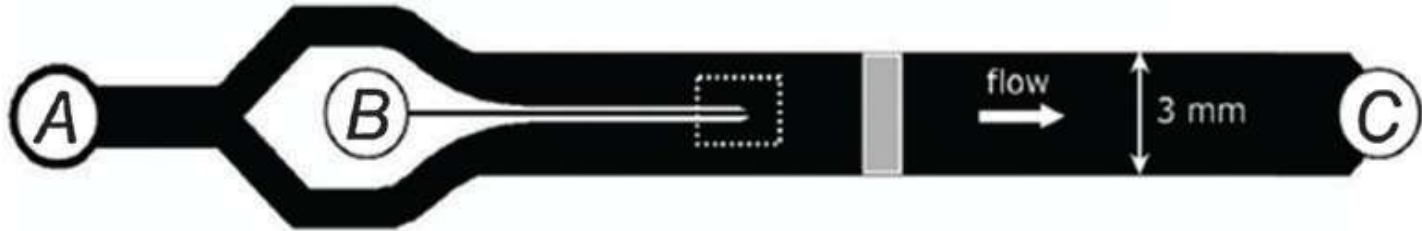
Objective

<http://scripts.mit.edu/~20.309/wiki/index.php?title=File:20.309-Microscope.jpg>



- Turn microfluidic device into a microfluidic instrument

Microinjector Device



Seymour et al

- Simple and easy to fabricate
- Applicable to both fluid-flow and flow-free studies
- Able to measure individual cell kinetics
- Potential to advance chemotaxis research and other fields of research

Four Components of Project and Chemotaxis Instrument

1. Brightfield/Fluorescent Microscope (videomicroscopy)
2. Pneumatic system for fluid flow regulation
3. Computer programming to fluid-flow control
4. Computer programming to track chemotaxis

Pressure Controlled Fluid-Flow Techniques

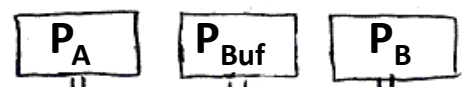
- **Pervious:** Seymour & Stocker used piston driven syringe pumps
 - Very long and tedious experimental set up
- **My Approach**
 - Pressure driven fluid-flow
 - Computer & manually regulated pressure
 - Computer regulated valves (actuators)

Technical Approach

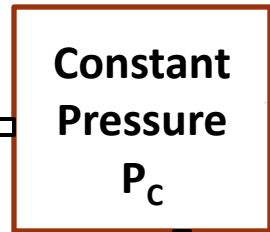
Fluid Flow	Fluid Stopped
P_A	P_C
P_B	P_C
P_C	P_C



DAC controlled
Regulator P_A



DAC controlled
actuator valves

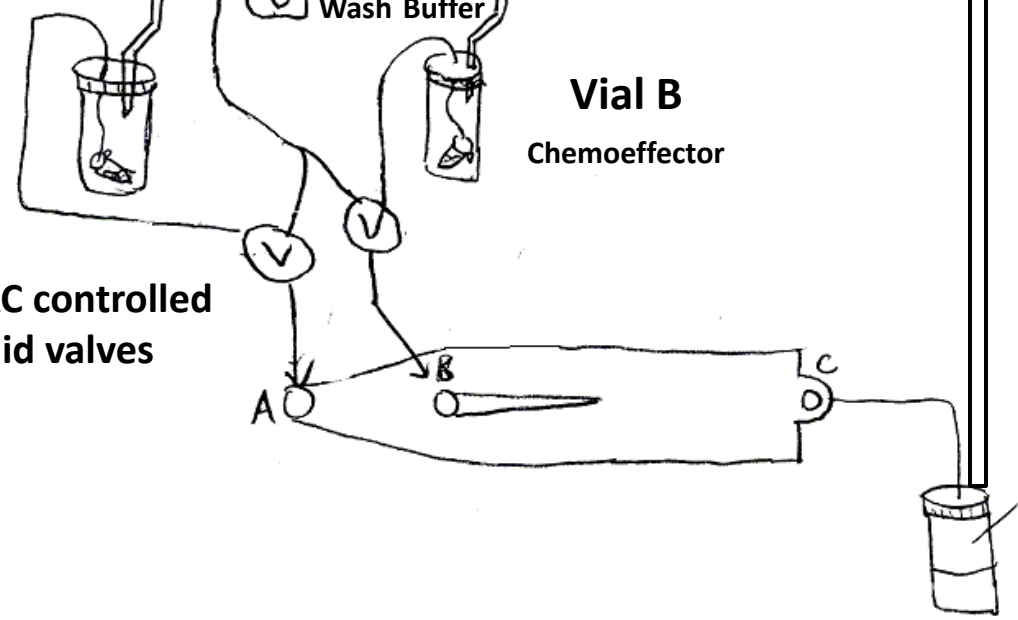


Vial A
Bacteria



Vial B
Chemoeffector

DAC controlled
Fluid valves



Vial C
Waste

Potential Issues

- Hydrostatic pressure difference lead to small fluid flow
- Pressure leakage causing unwanted flow
- Pressure driven flow not as precise as syringe driven flow

Objective Summary

- Integrate pressure driven fluid flow technology to Microinjector Device to become enabling instrumentation of new scientific discovery
- Instrument will be applicable to multiple fields

Questions