Bacterial Mechanics on a Chip

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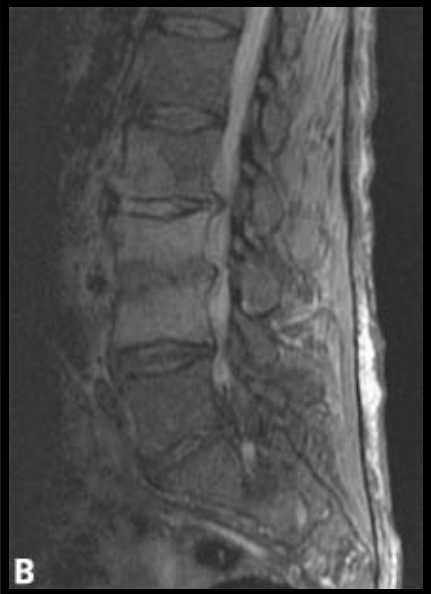
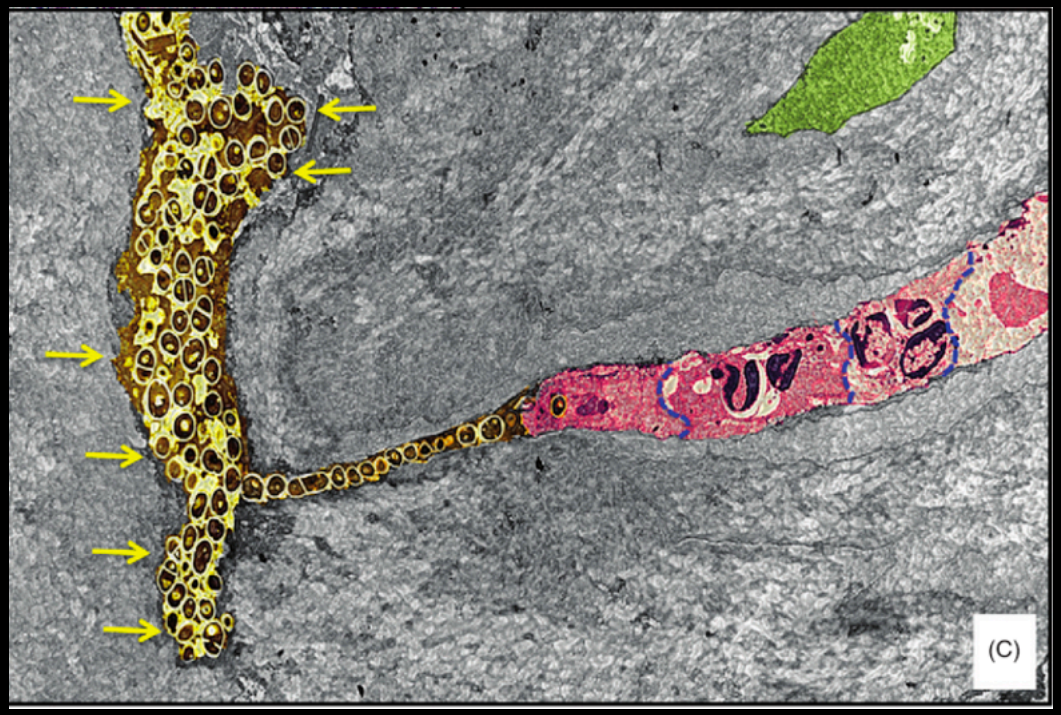
Osteomyelitis



Left: MedicalXpress.com
Right: Kim, SpineUniverse Case Study, Discitis Osteomyelitis 63 Year Old Male

MRSA Penetrating Bone

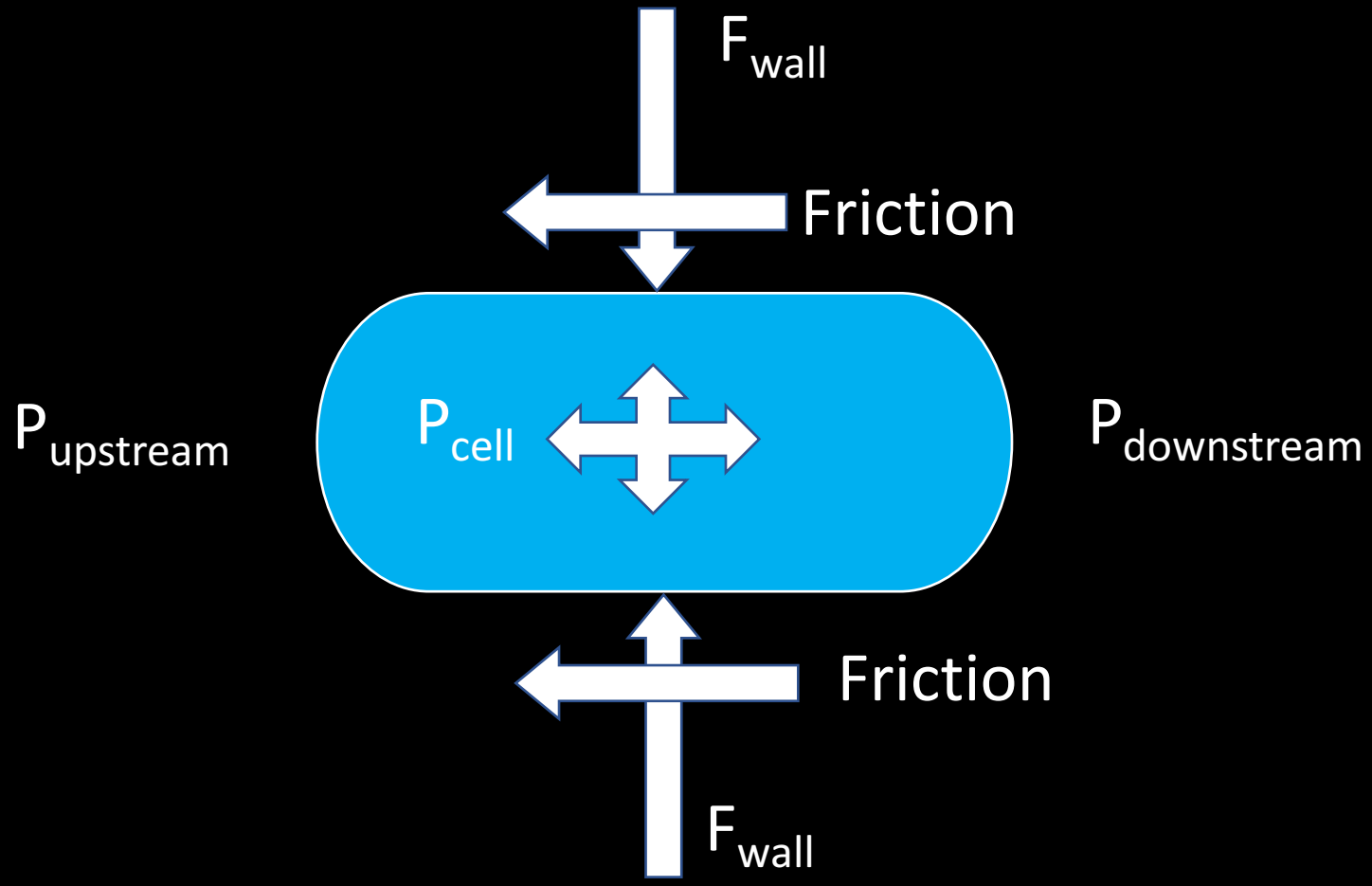


Nishitani *et al* 2016

Bacteria in a Tapered Channel: Extrusion Loading

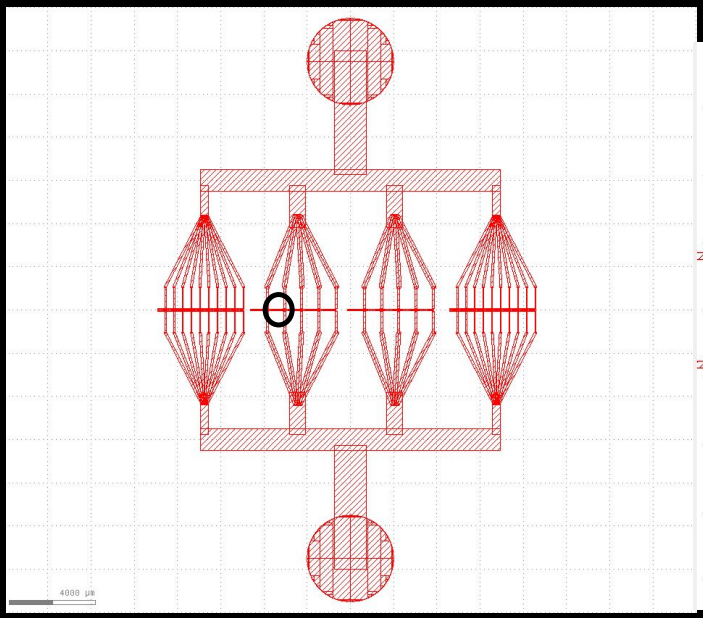
1 µm diameter

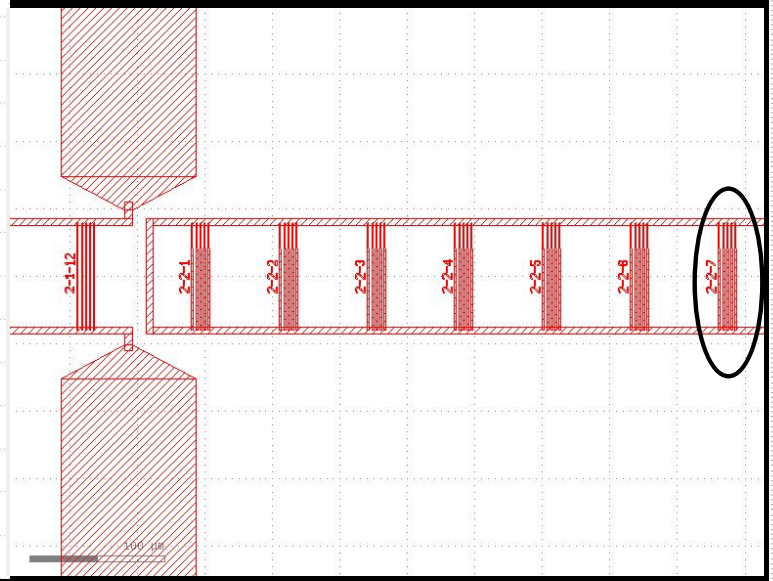
Extrusion Loading Model

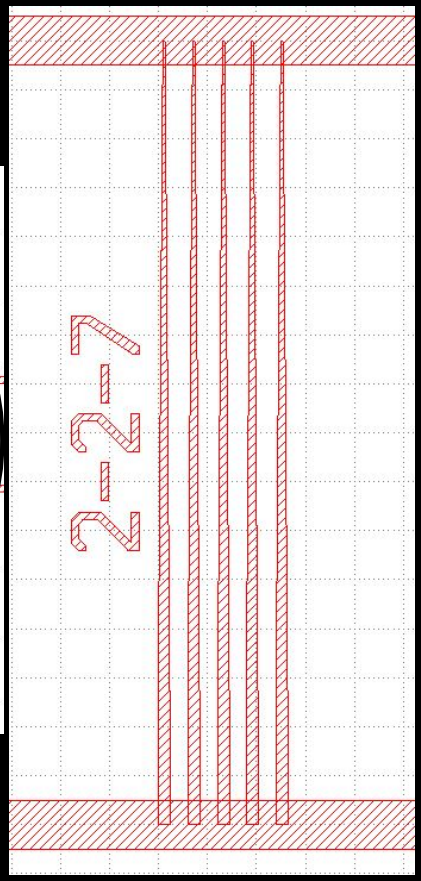


Design

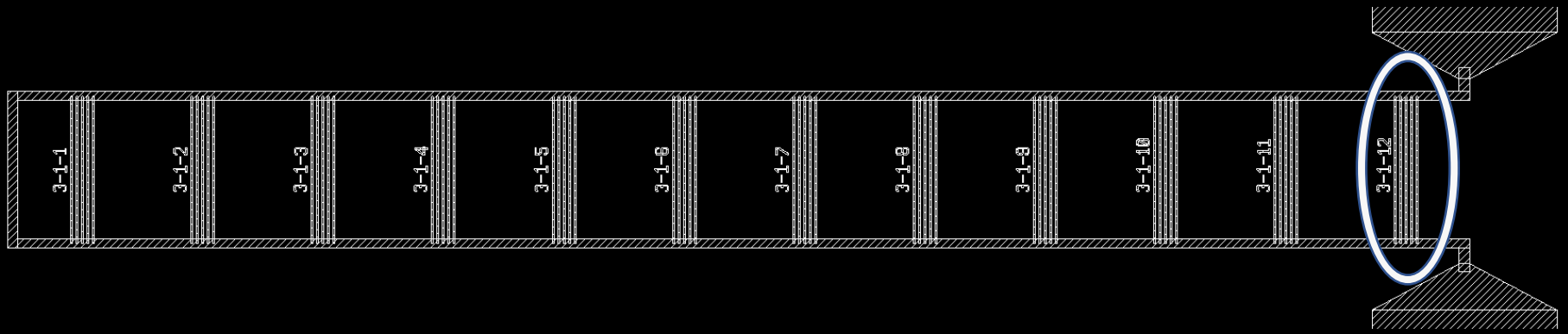
Zoom

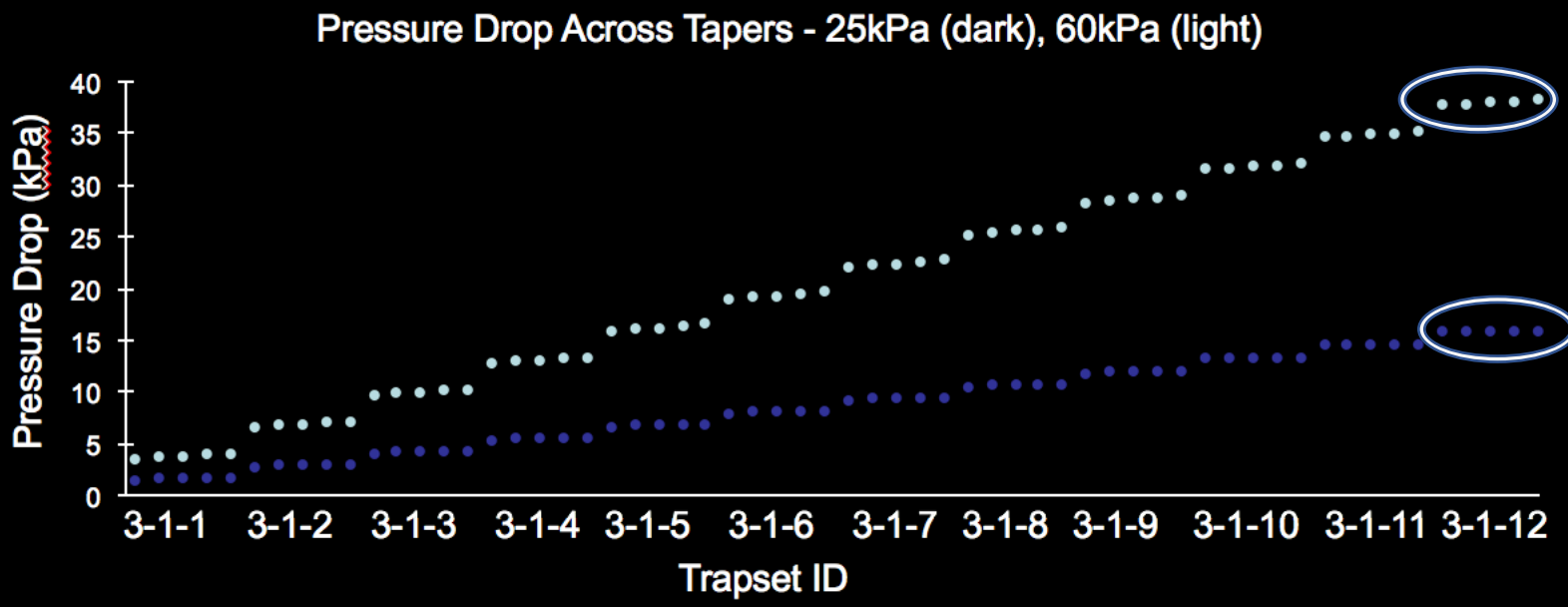




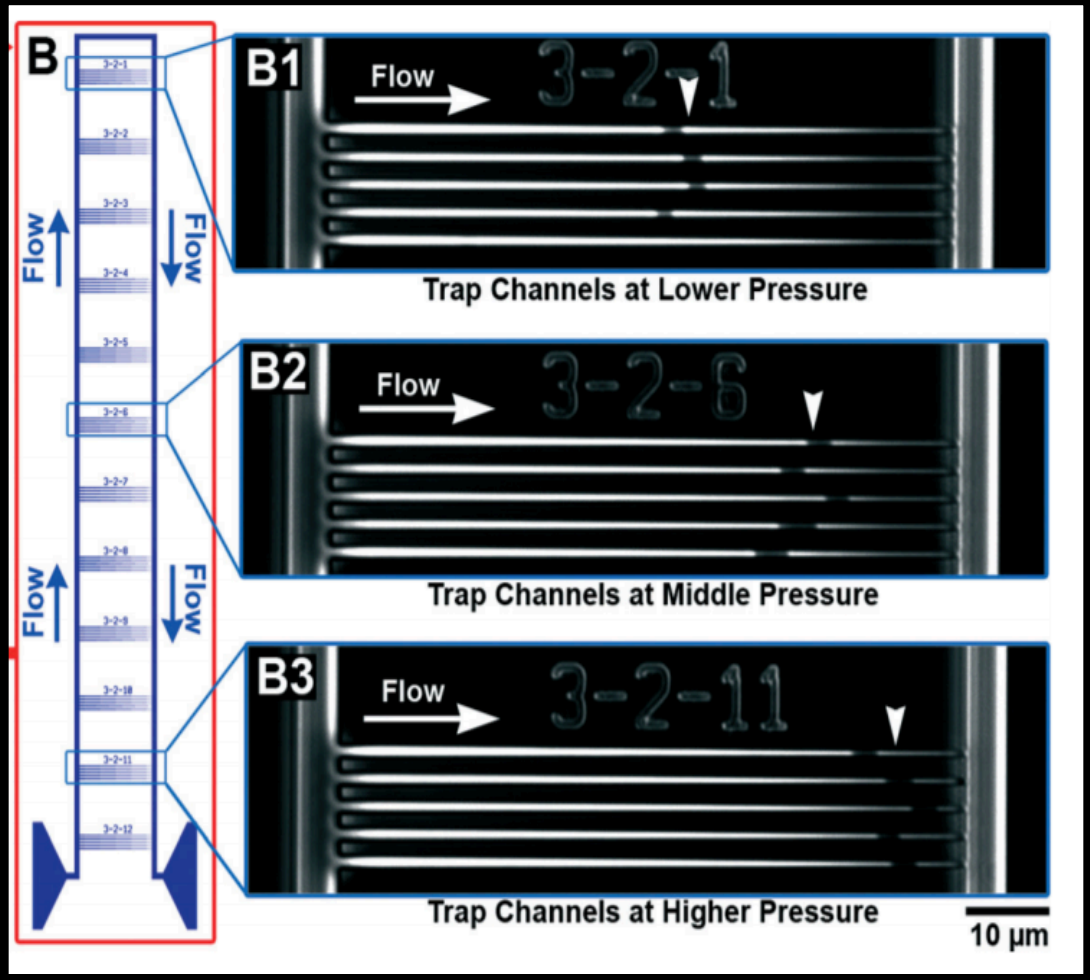


Resistance to Fluid Flow in Bypass



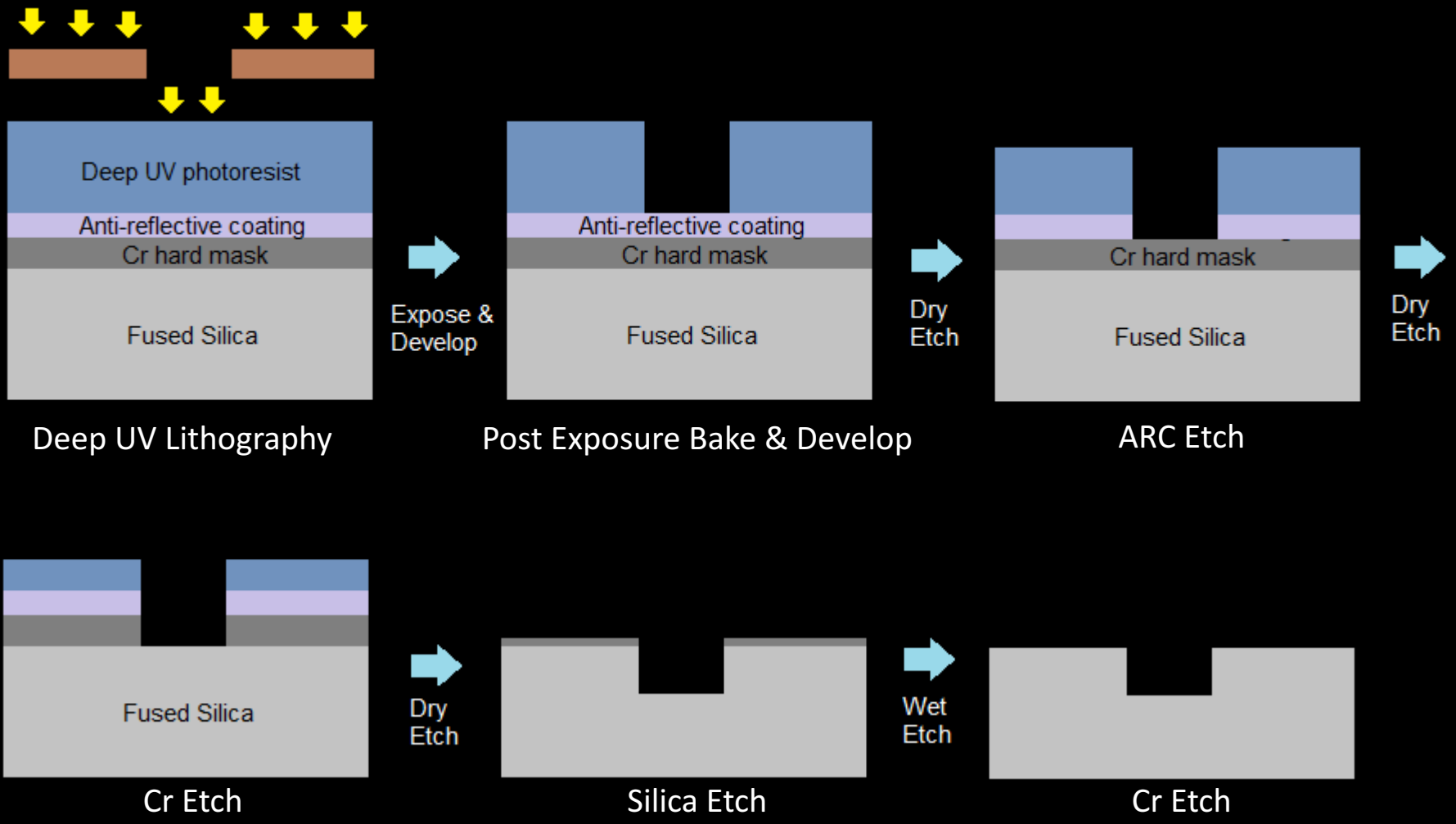


Distance Traveled Relation to Pressure

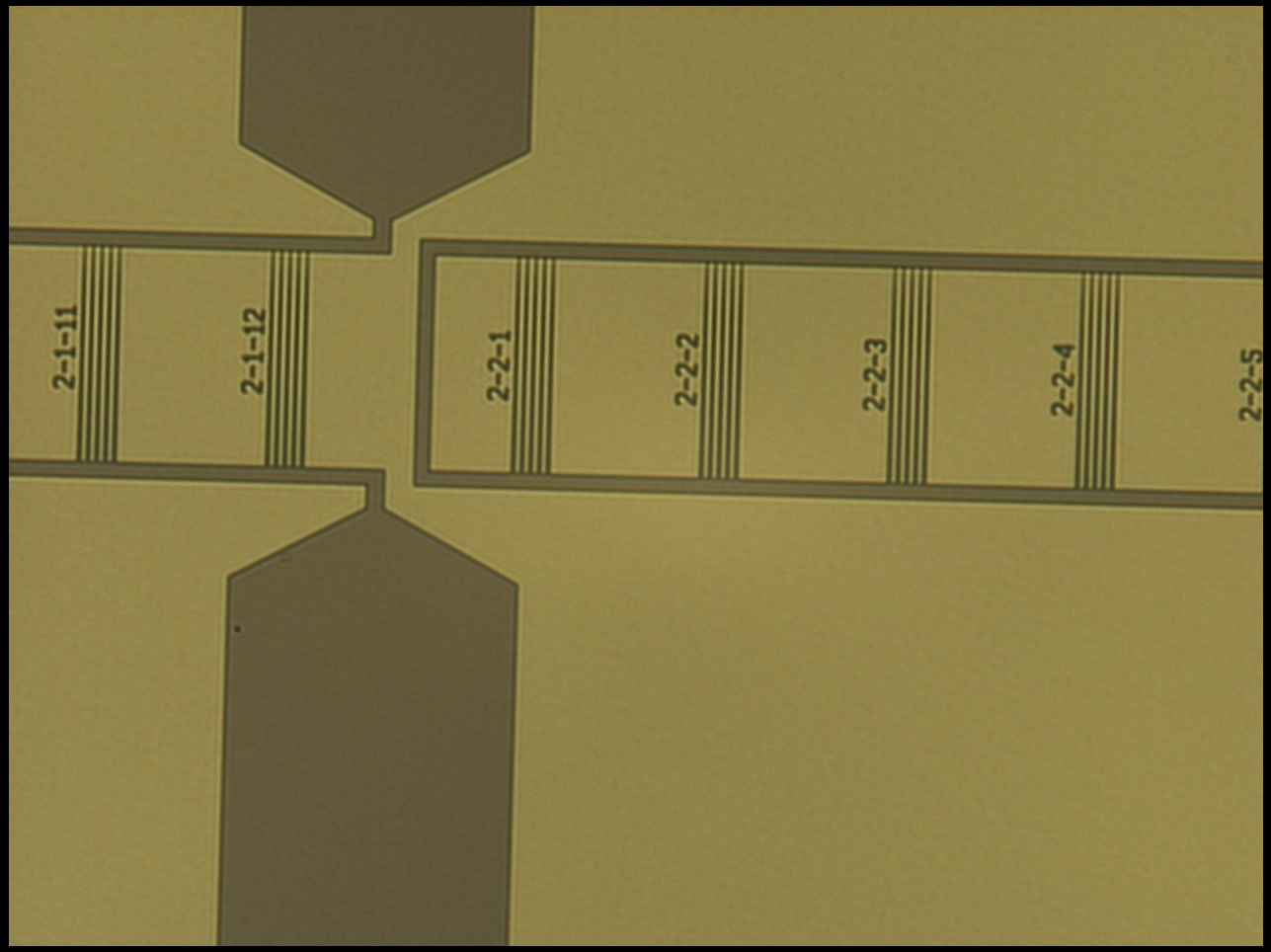


Sun *et al* Lab Chip 2014

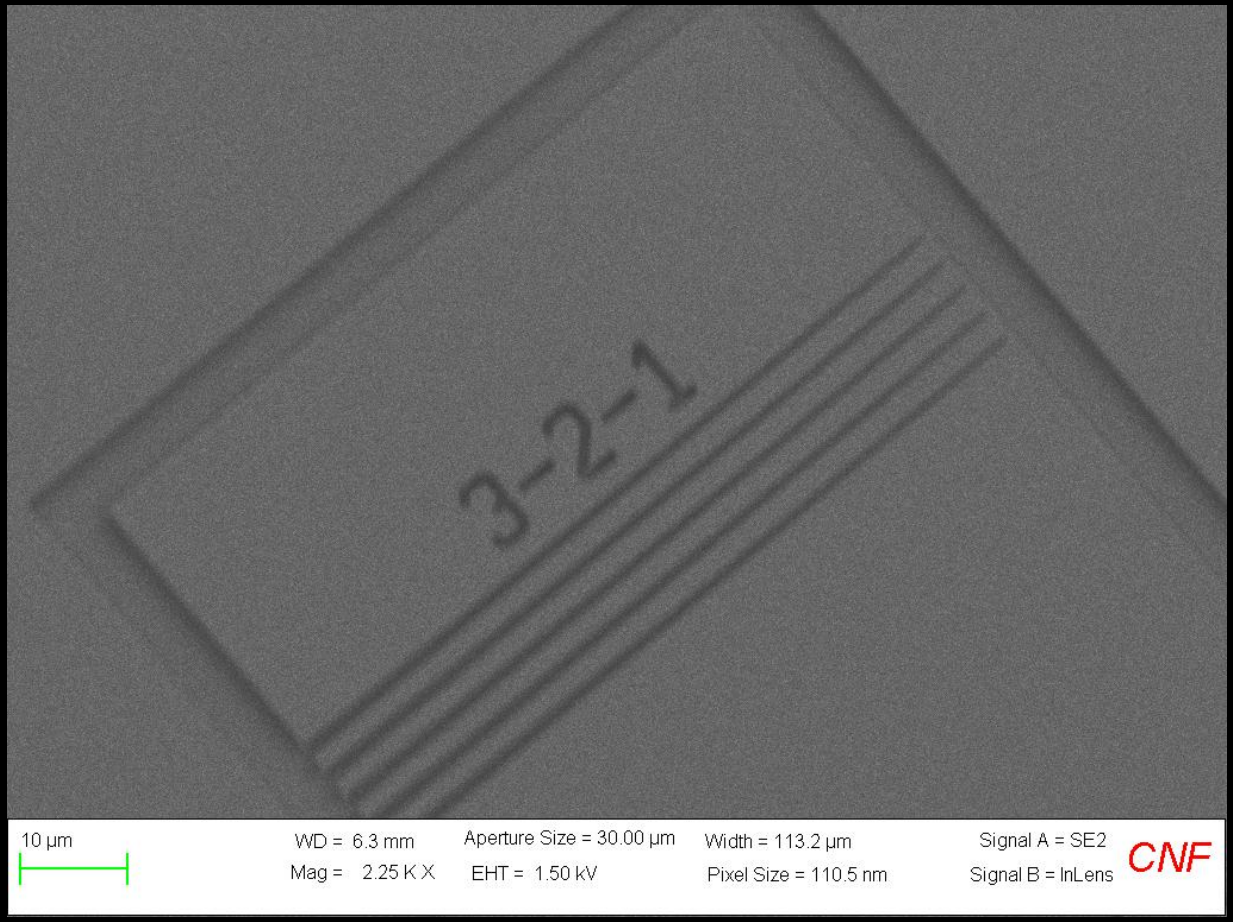
Device Fabrication



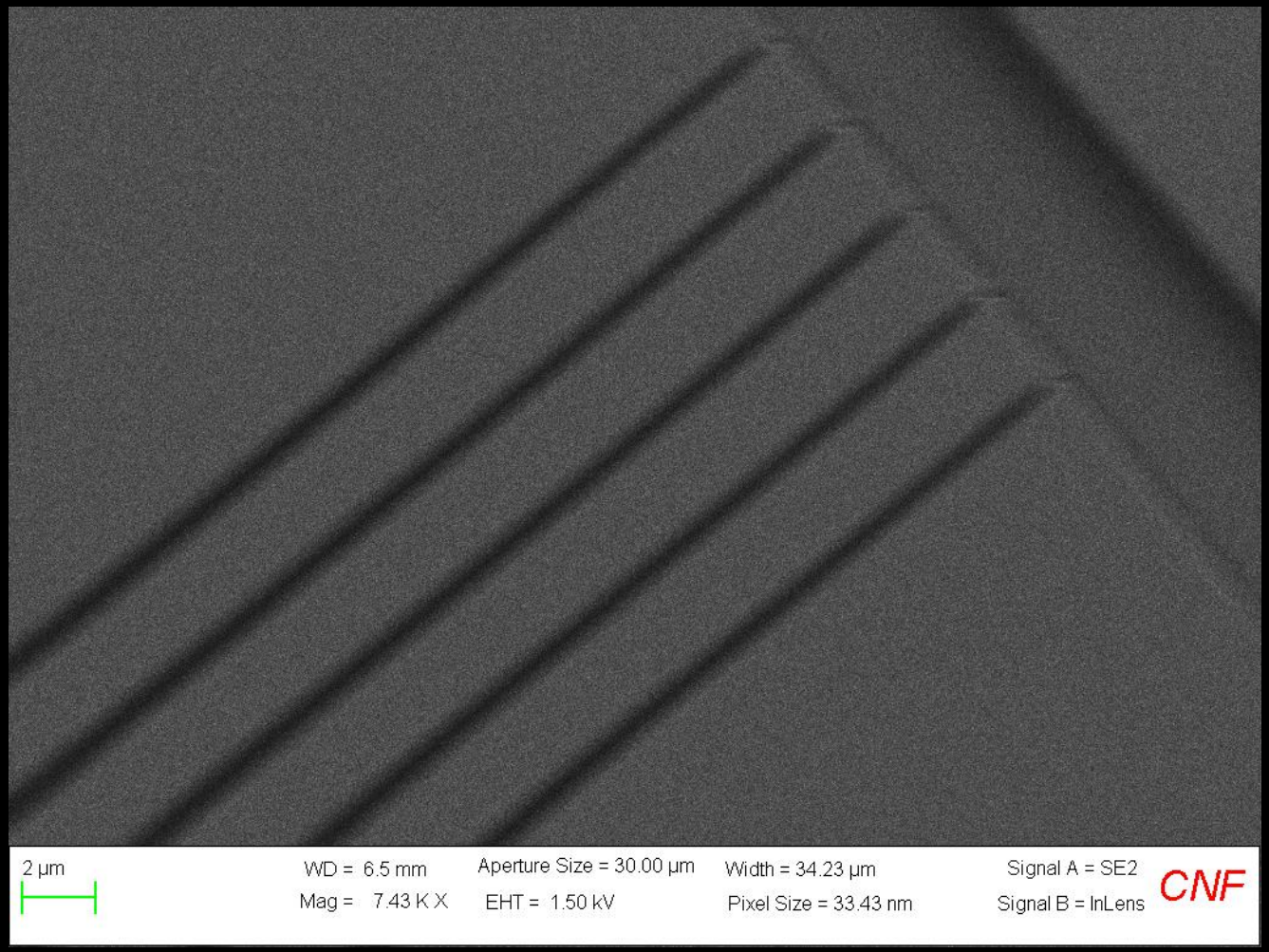
Post Exposure Tapers



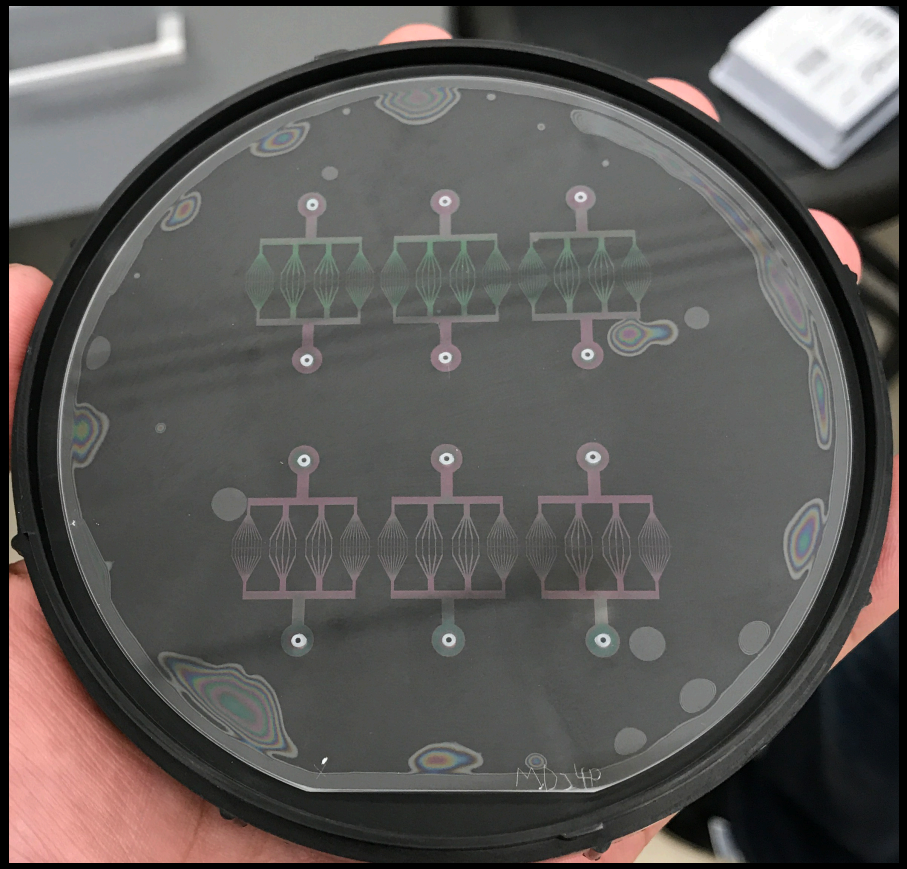
SEM Taper Characterization



SEM Taper Characterization

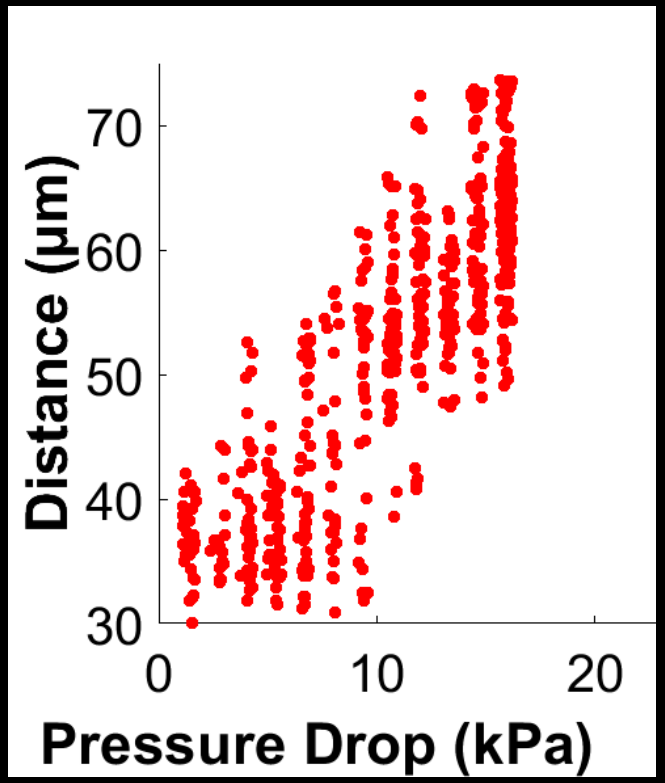


End Product

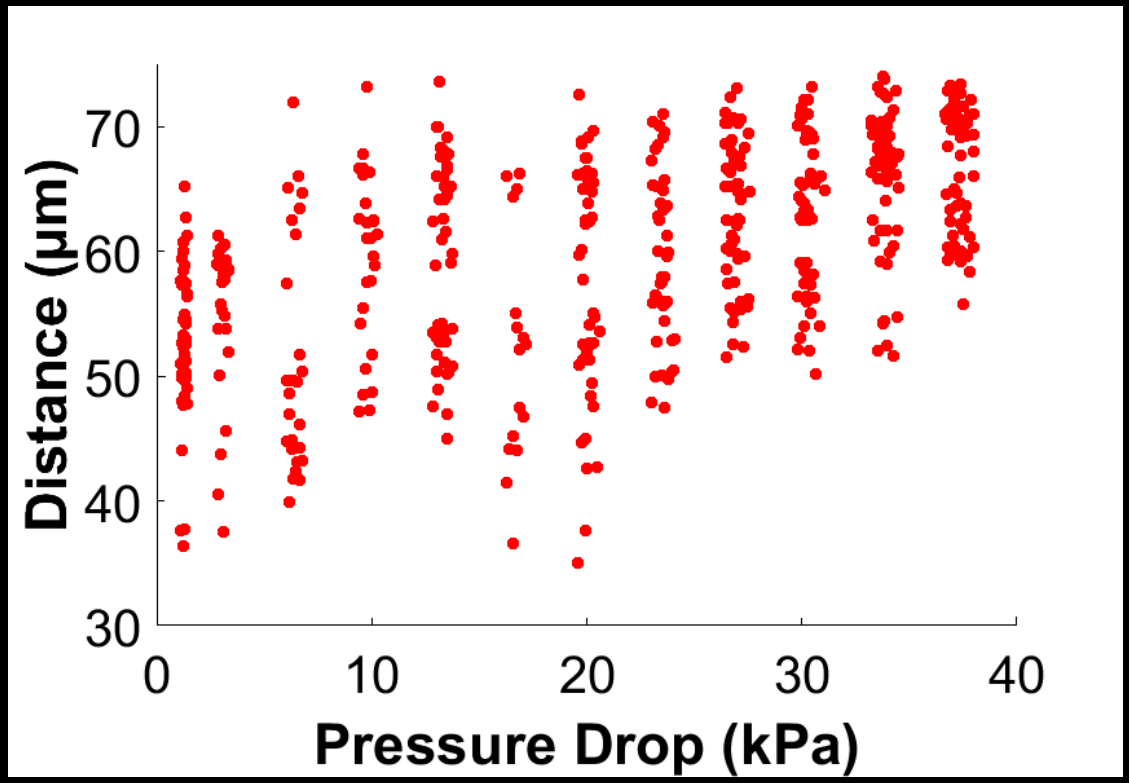


Distance Traveled By Bacteria

25 kPa Loaded Device



60 kPa Loaded Device

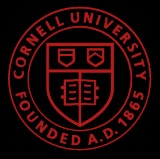


Discussion

- At 60 kPa, bacteria can reach 300 nm constriction around 6 kPa pressure drop
  - Barely need pressure drop to travel up to 85-90% of taper
- At 25 kPa, bacteria can reach 300 nm constriction with pressure drop around 12 kPa
  - Need at least 10 kPa to travel 85-90% of taper length

Future Work

- Test bacteria known to cause bone infections (*Staphylococcus aureus*)
- Long term: Determine what exactly allows bacteria to move through sub-micron channels



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- CNF Staff

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