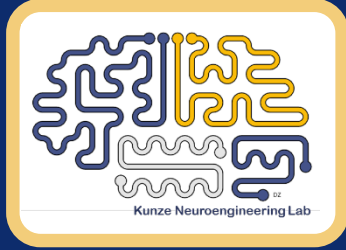# Optimizing Photolithography for Neurofluidic Devices

Kendra Hergett

Montana State University
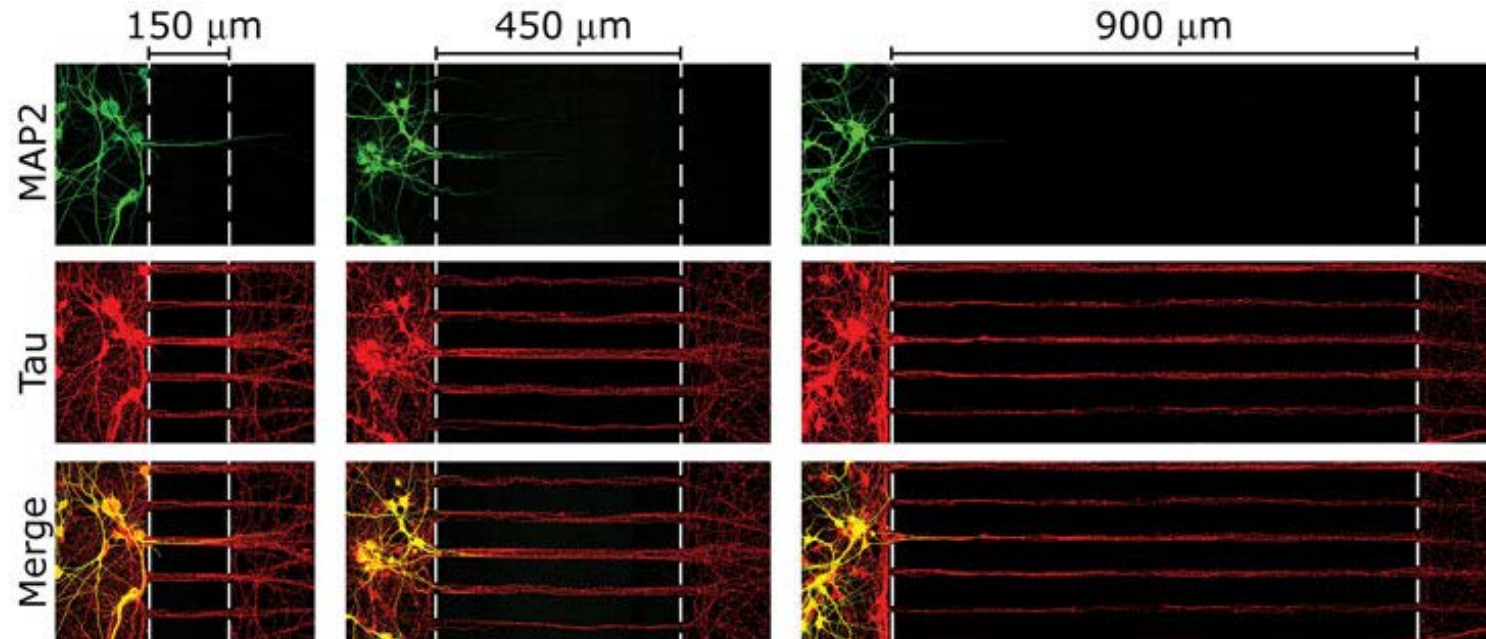Kunze Neuroengineering Laboratory

Contact: kendra.hergett@msu.montana.edu
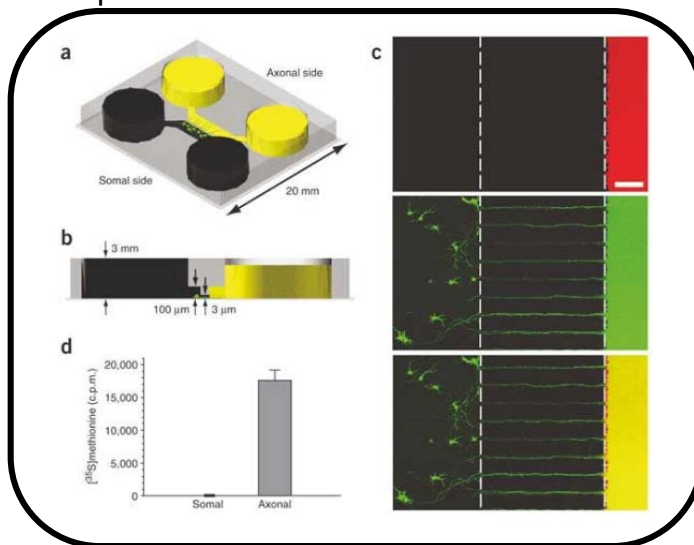Research: www.anyakunze.com
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Background/Motivation

- What is a neurofluidic device?

- Why do we use neurofluidics?
  - Precision medicine for the brain
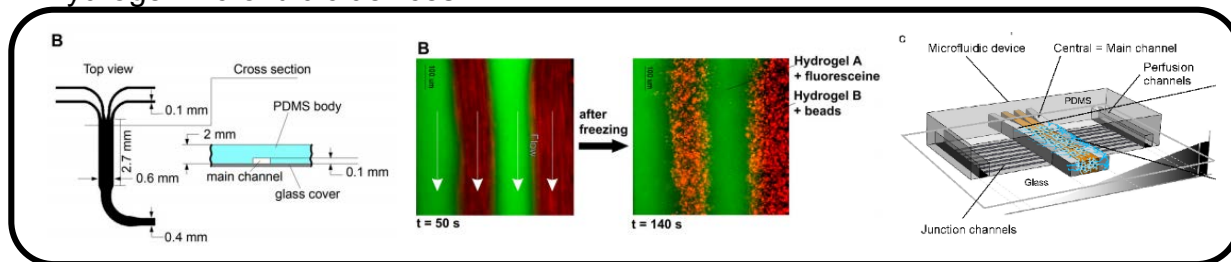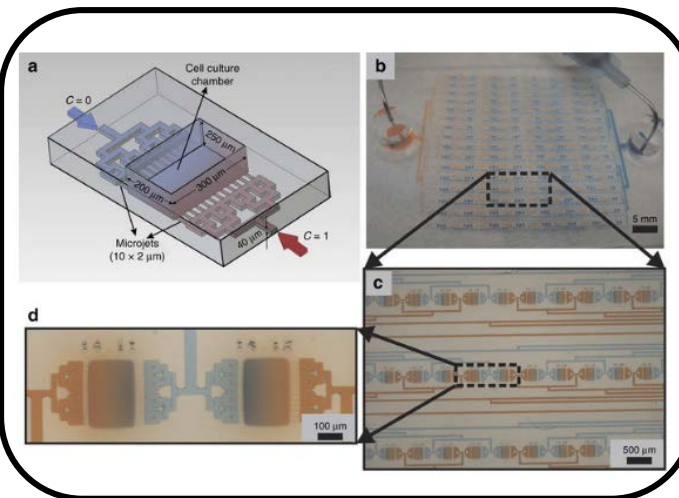 - Organizing brain cell growth in a petri dish

Neurofluidic History
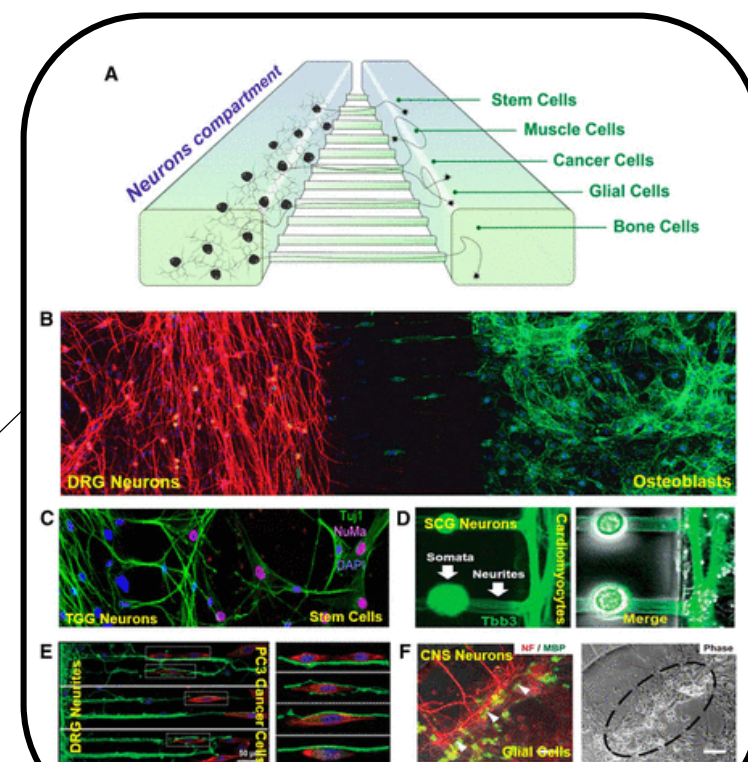

Compartmentalized microfluidic devices

Gradient microfluidic devices

Co-culture microfluidic devices

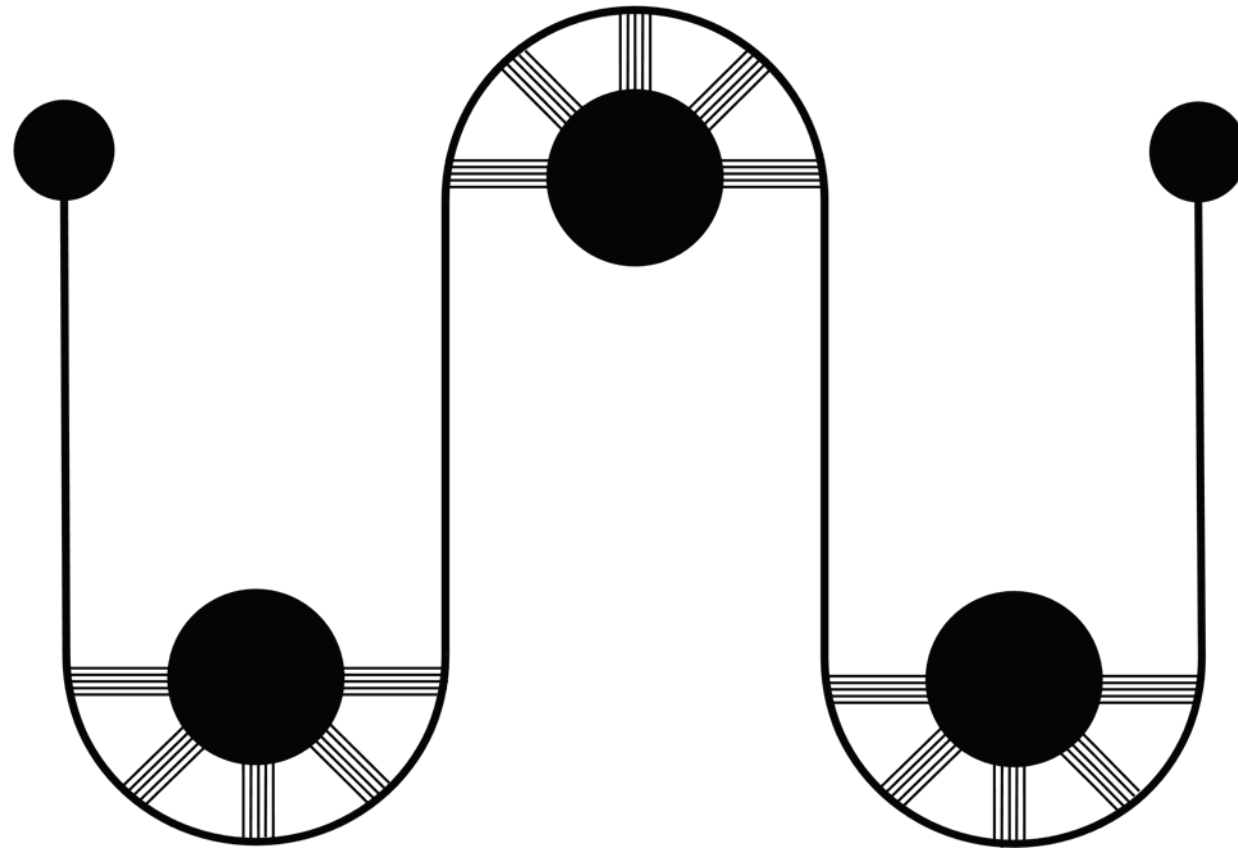Hydrogel microfluidic devices

2000's

2005

2010

2011

2016

2015

[2,3,4,5]

3

Designing a Compartmentalizing Neurofluidic Device

Fabricating a Compartmentalizing Neurofluidic Device

PR ——— 95 cSt

PR ——— 13000 cSt
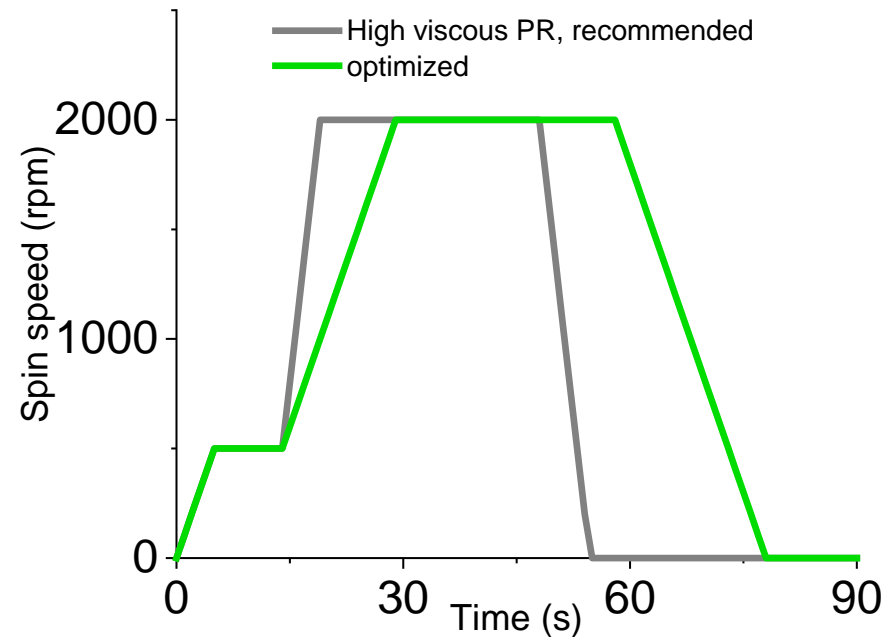
Mask

Mask

UV

UV

Develop

Develop
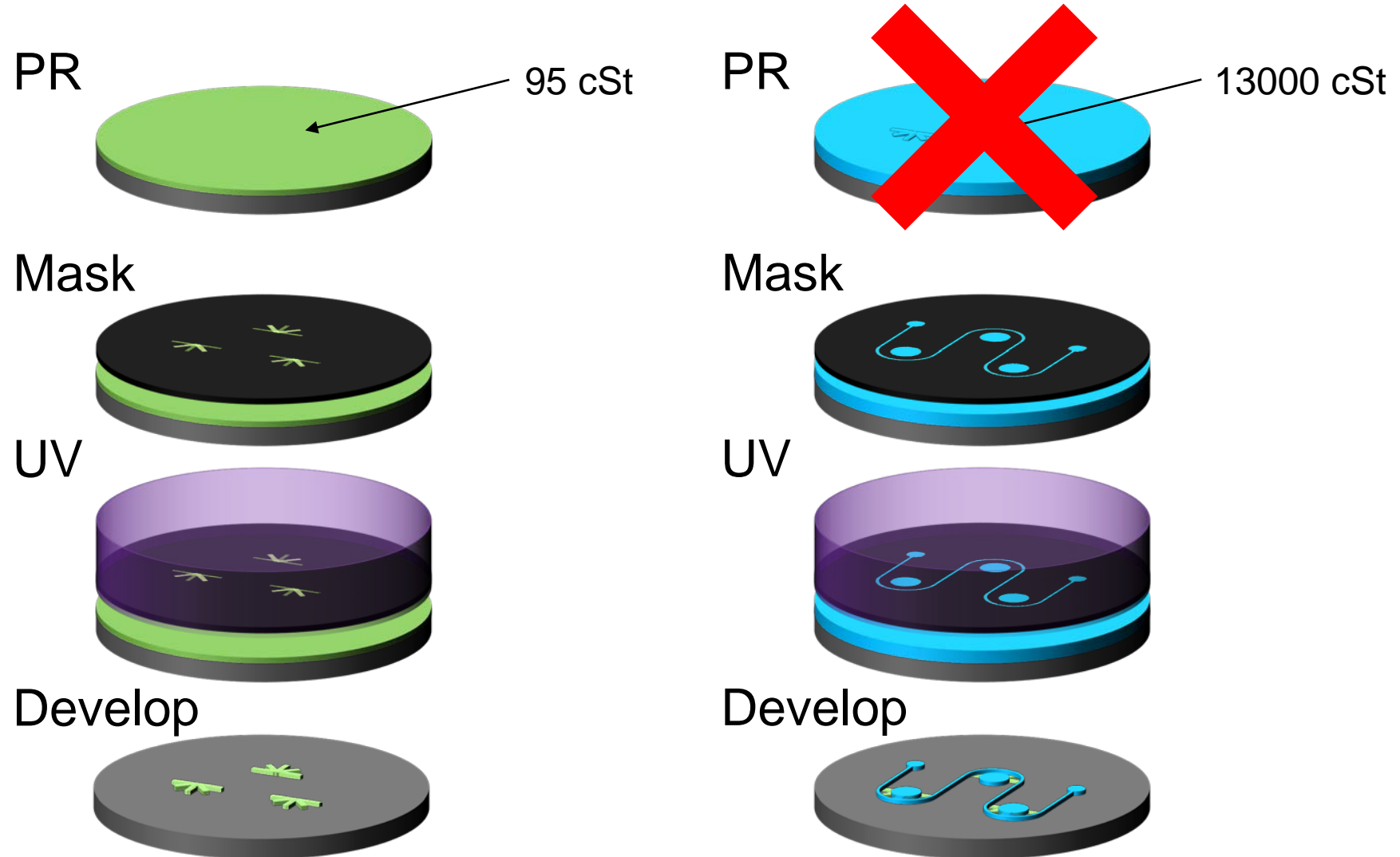
Two-step Photolithography Can Cause Air Bubble Traps between PR layers
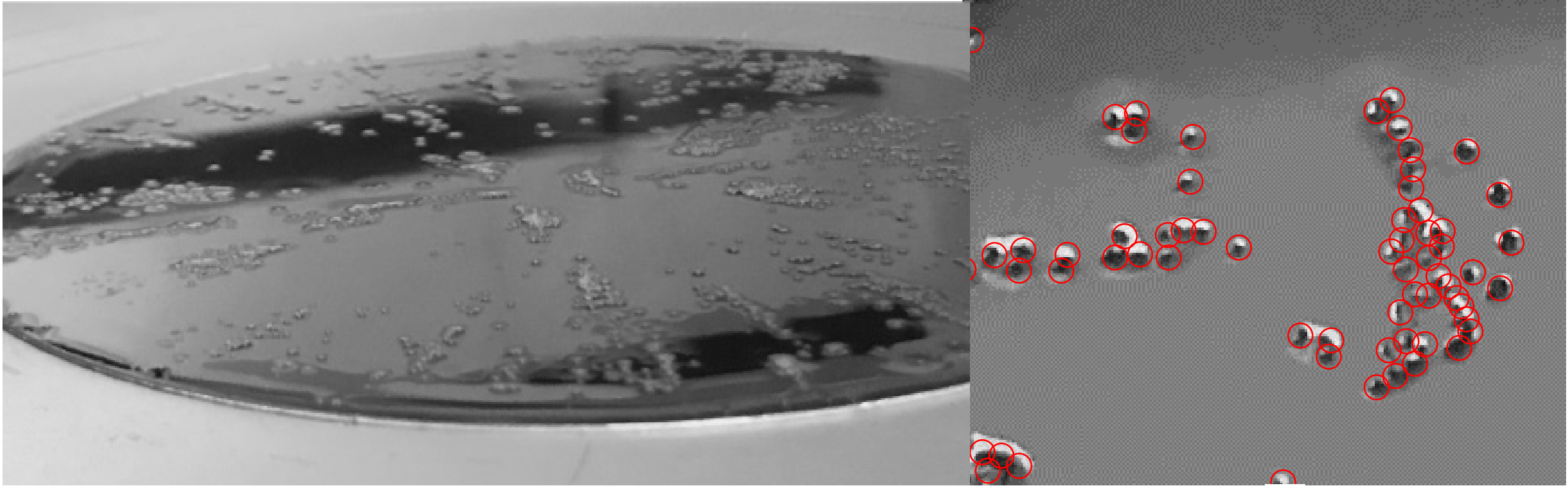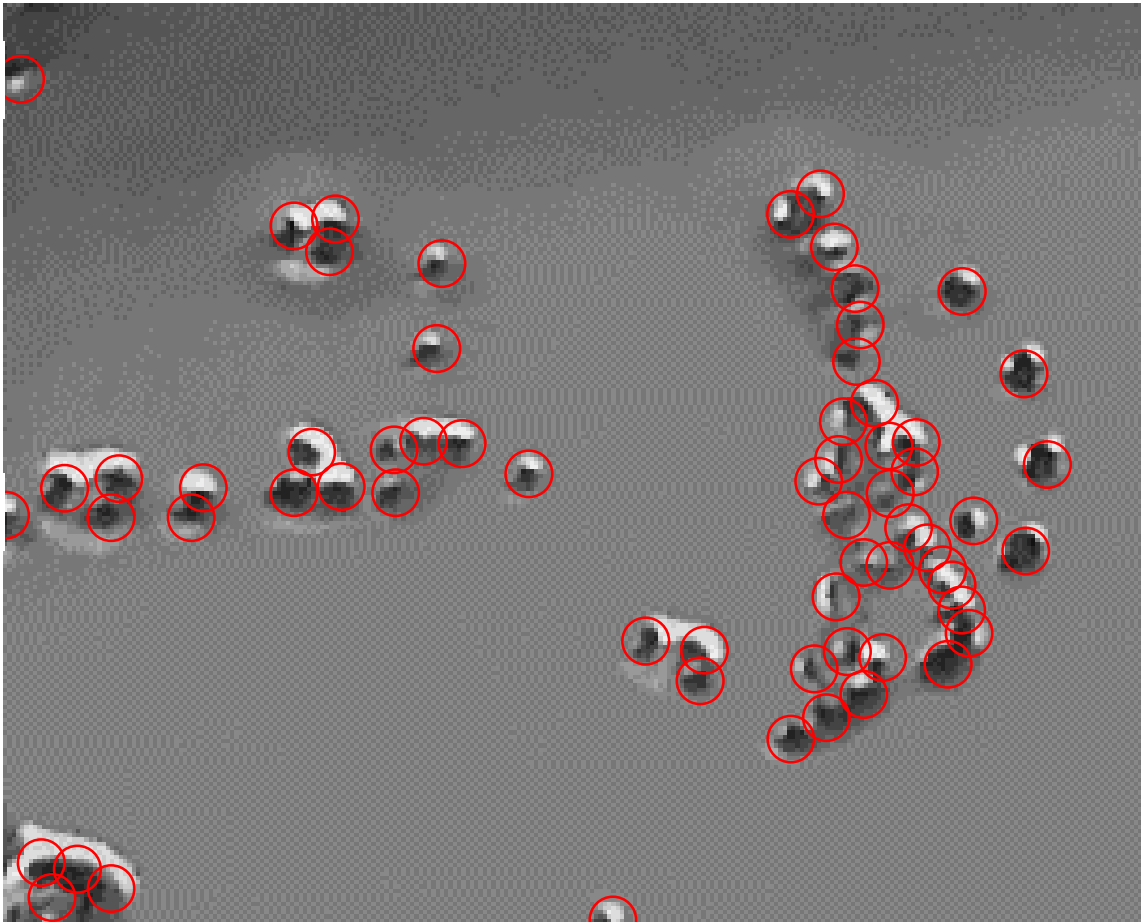
Optimizing Spin-coating Curve for High-viscous PR

- Spin coater under vacuum
- Spin more viscous layer first
- Adjust the speed at which the machine accelerates

13000 cSt

Reduced Spin Speed Acceleration Minimizes Air Bubble Traps

Before Optimization

After Optimization
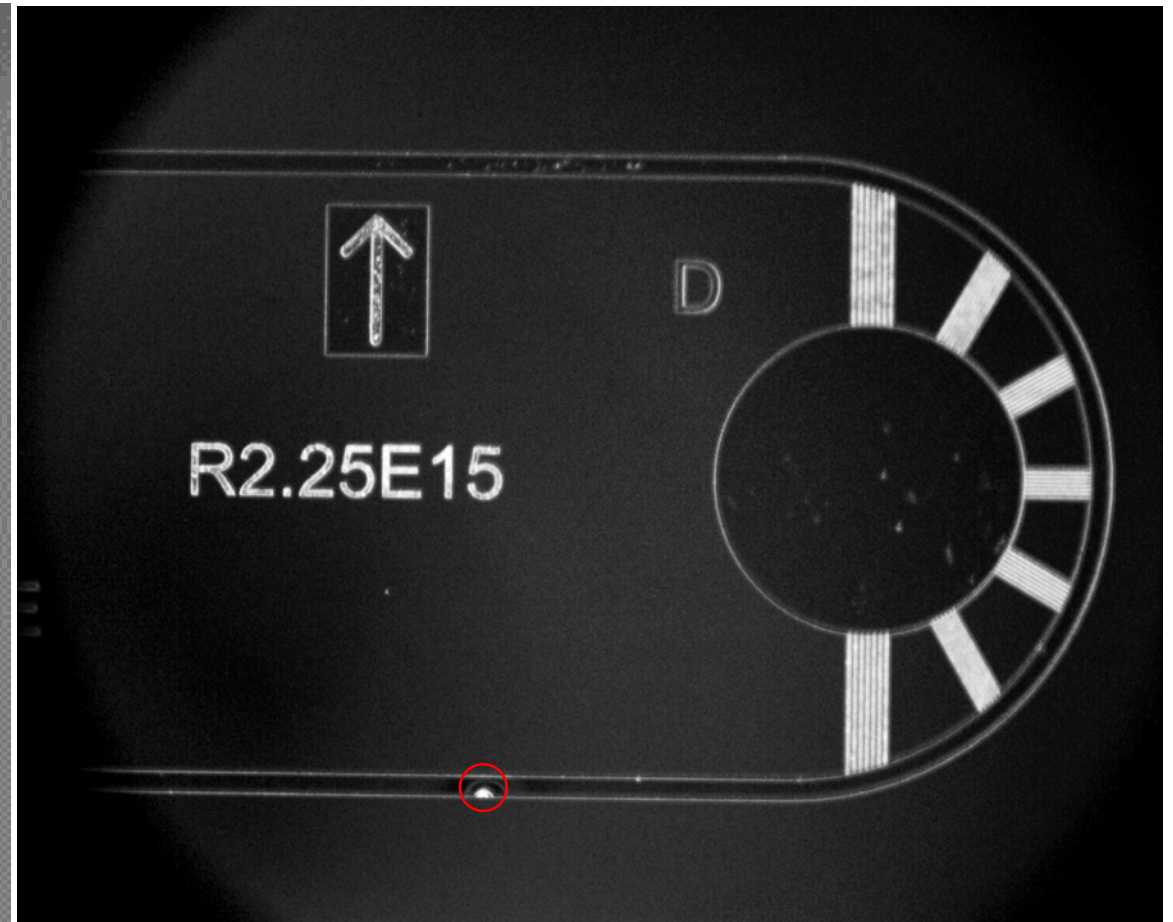
Result: Operational PDMS device
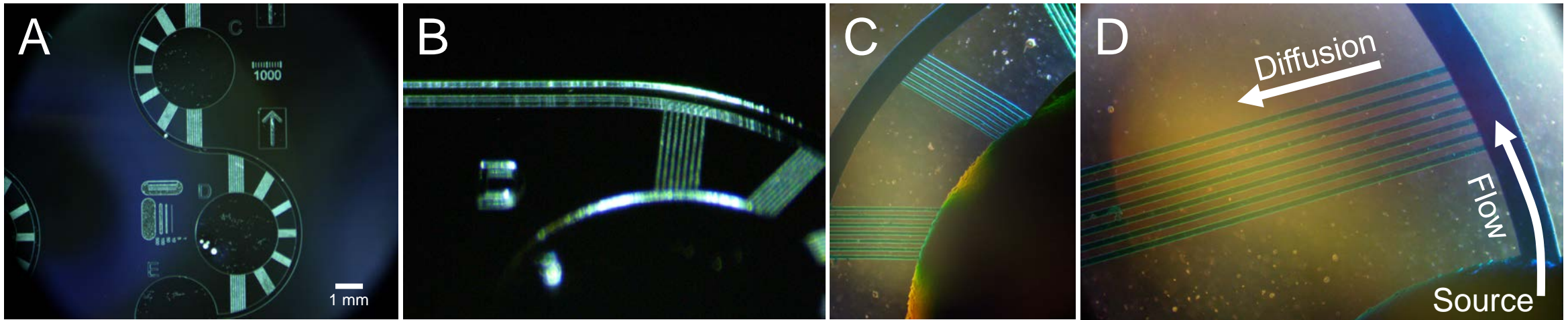
(A) Top-view of two-layer PR pattern on silicon device shows the full channel layout. (B) Tilted-view highlights the different PR thicknesses of the perfusion channel and of the compartmentalizing channels. (C & D) Bottom-view microscope image of PDMS molded channel structures filled with blue dye, after channels were sealed to glass slides through plasma bonding.

Outlook: Axonal growth studies

- How the channel design affects axon growth

- How channel design affects mitochondrial and calcium dynamics

100 μm
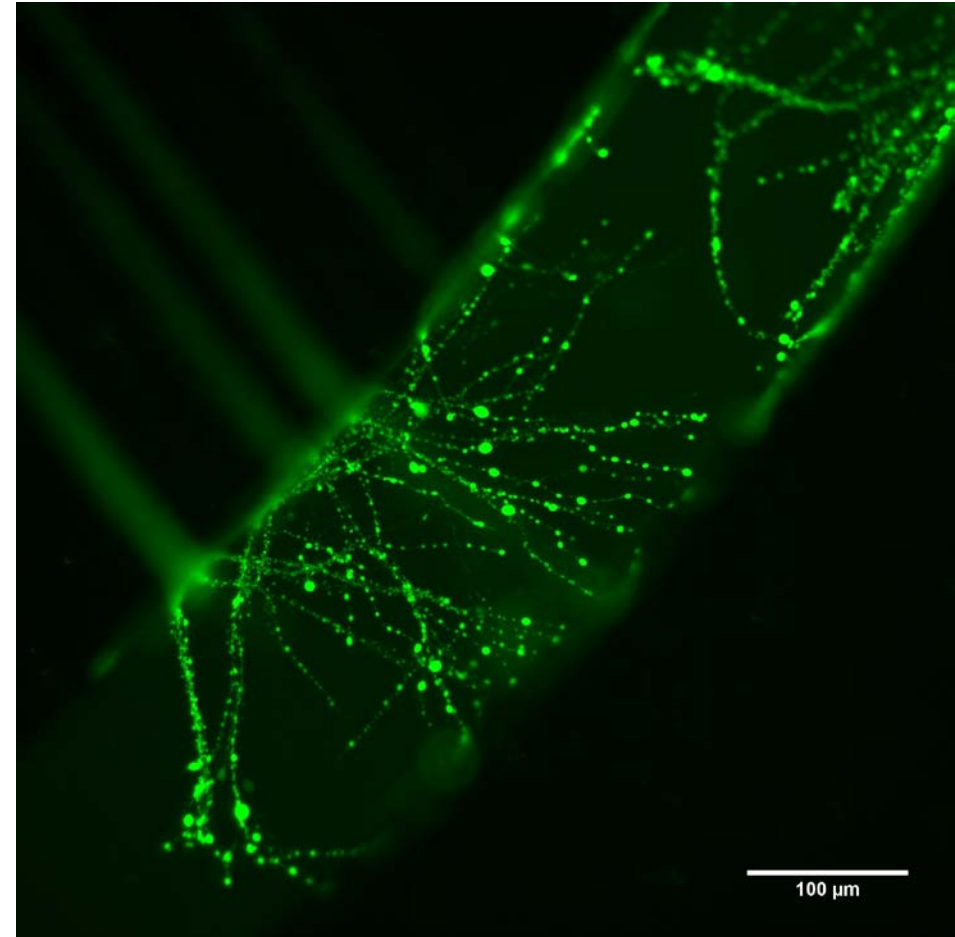
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- Derek Judge (Microfluidic fabrication)

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- Benjamin Huang
- MMF Clean Room Facilities

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