

Rigid Materials for Photolithography Based Rapid Microfluidic Mixing and sample Delivery

Daniel Langley

Centre of Excellence for Advanced Molecular Imaging

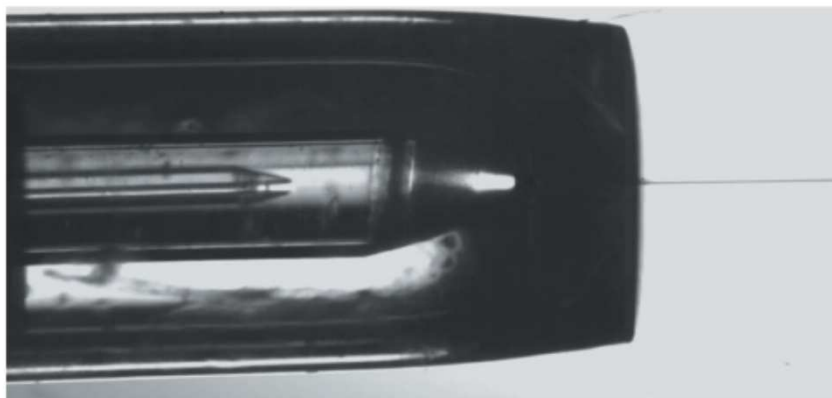
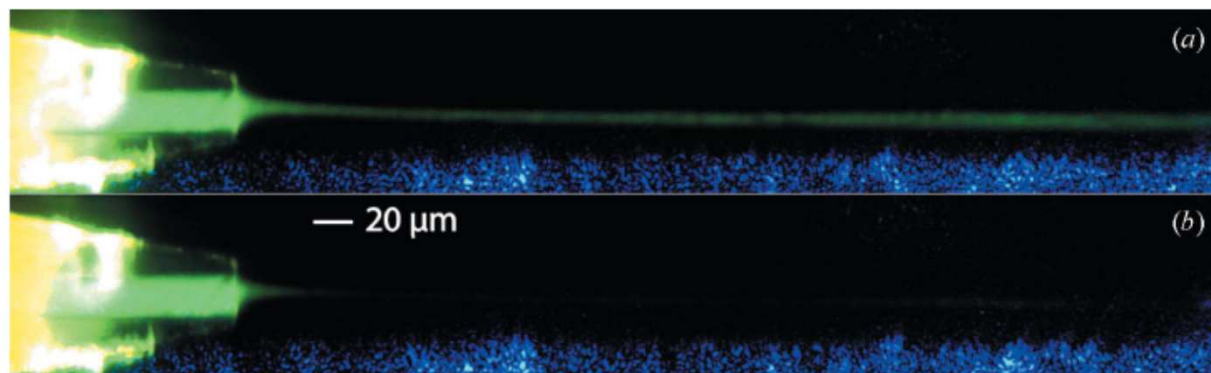
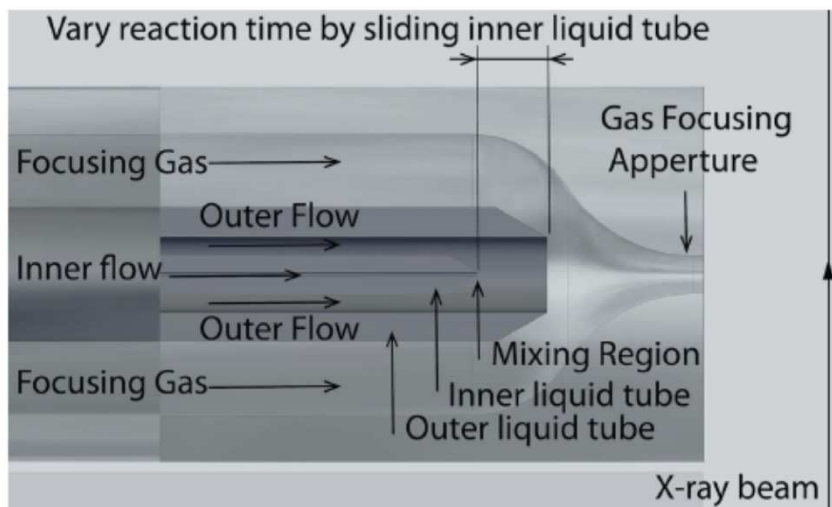
Department of Chemistry and Physics

La Trobe University, Bundoora



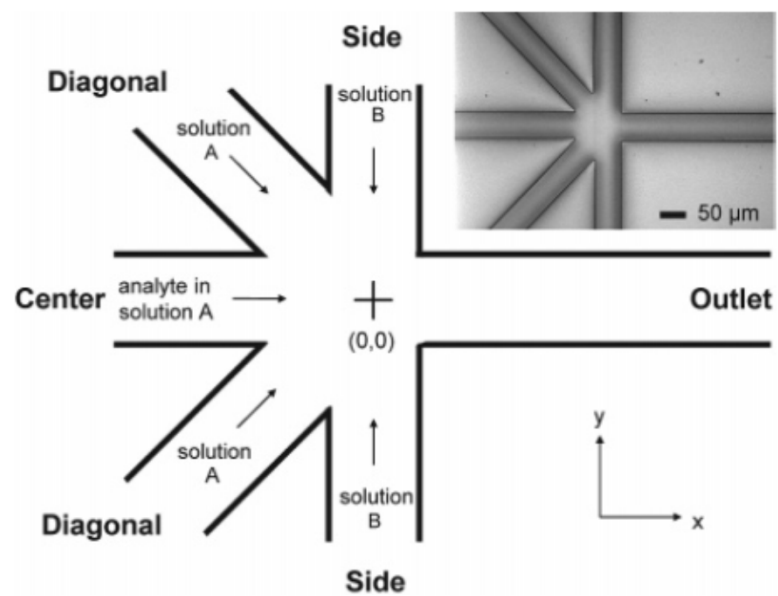
Advantages of Photolithography Based Microfluidics

Serial Crystallography for Chemical Dynamics

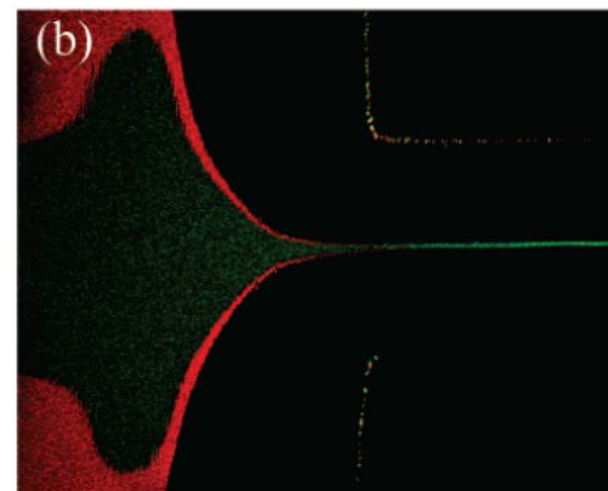
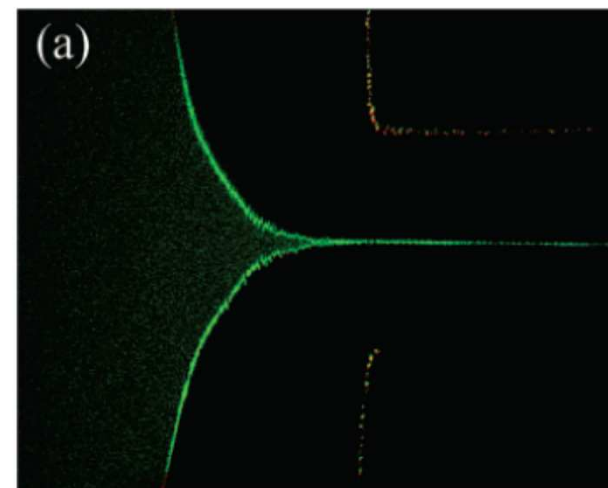


Wang 2014 Journal synchrotron radiation

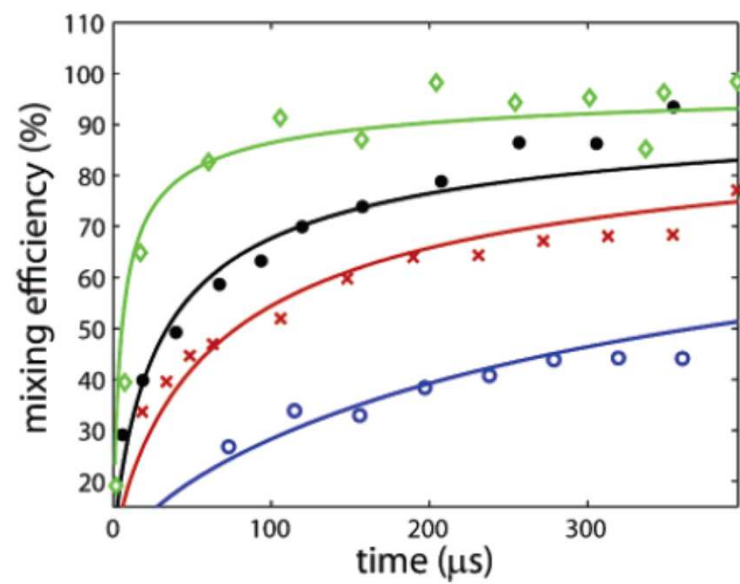
Rapid Mixing



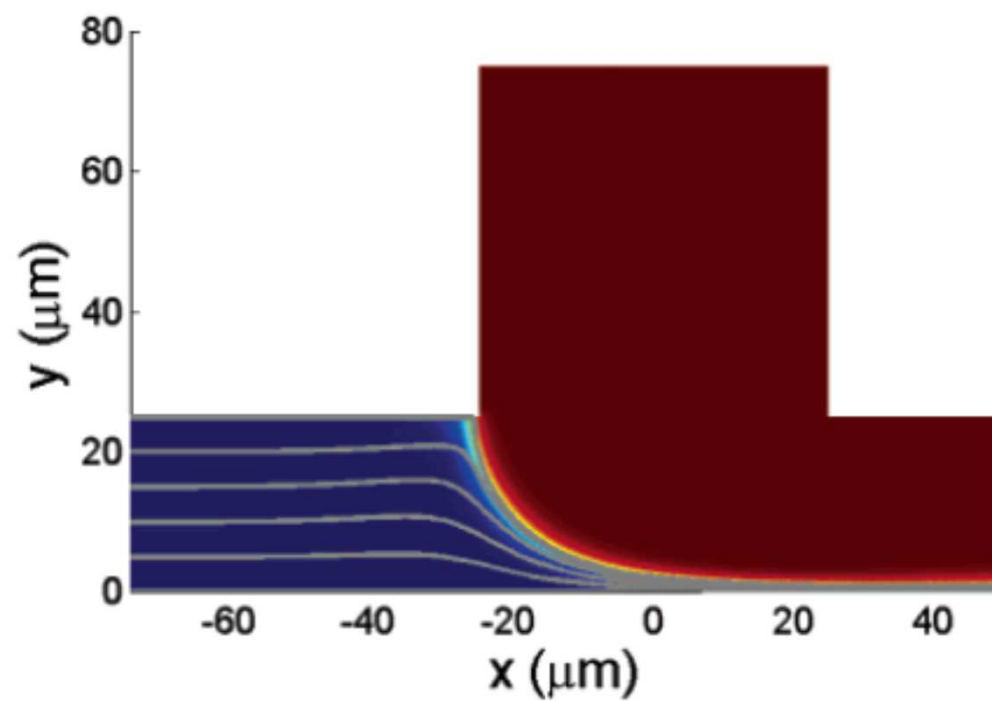
Pollack 2006 Analytical Chemistry



Rapid Mixing



Pollack 2006 Analytical Chemistry



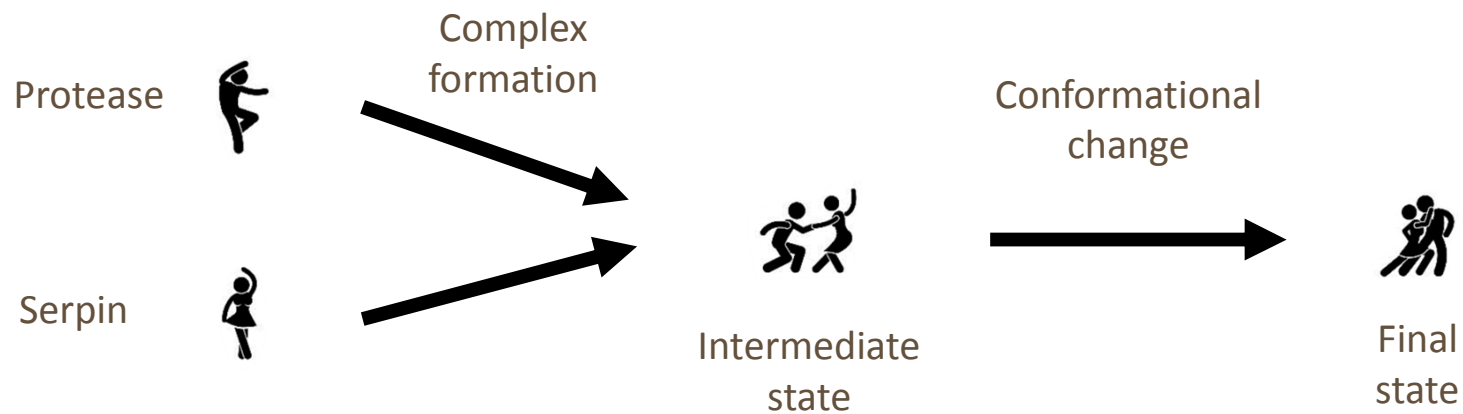
Pollack 2006 Analytical Chemistry

	Glass	Silicon	Photoresists	PDMS
Mechanical Properties	*****	*****	****	*
Chemical stability	*****	*****	***	**
X-ray resistance	*****	*****	***	**
Ease of fabrication	*	***	*****	*****
Vacuum compatilby	*****	*****	***	*
Prototype time frame	Weeks	1-3 Days	3 hours – 2 Days	3 hours – 2 Days

Kinetics of Macromolecular interactions

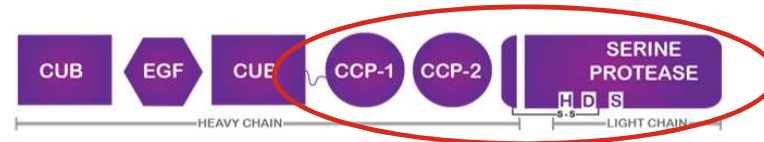
Aim: To explore the reaction kinetics of biological molecules

Experimental realization: Time-resolved mixing small angle x-ray scattering (SAXS)

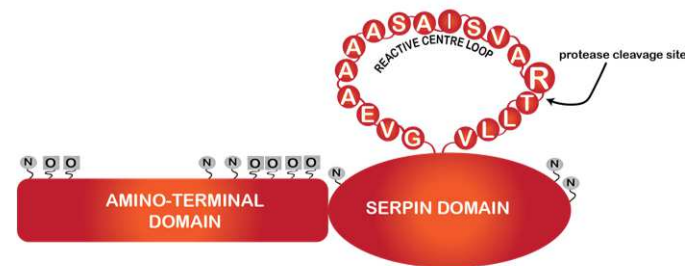


Sample

C1s (CCP1, CCP2 and SP domains only)



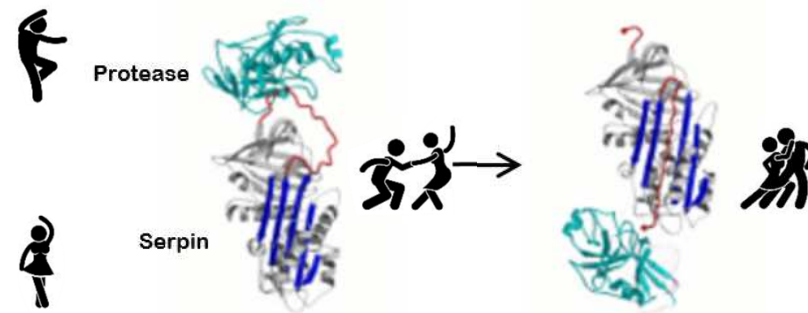
Recombinant C1-Inhibitor (un-glycosylated)
Human C1-Inhibitor (glycosylated)



C1s mutant (S195A)

C1s / recom. C1-Inh

C1s / human C1-Inh



S195A/rC1-Inh (bound complex without conformational change)

Sealing microfluidic devices

PDMS/PDMS

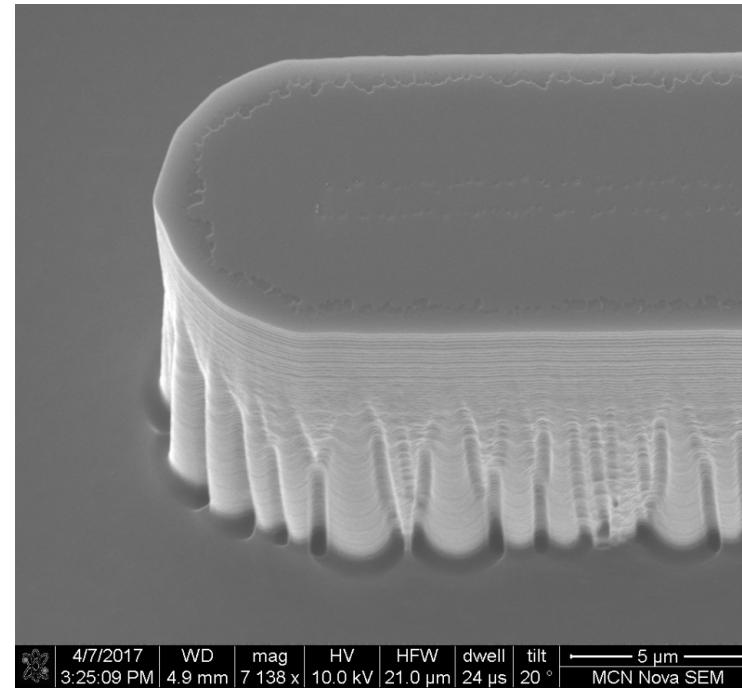
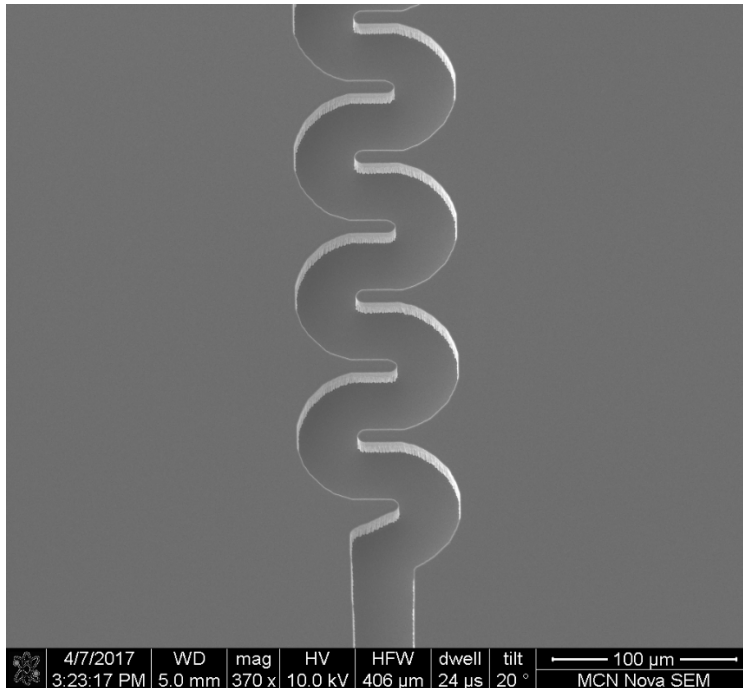
PDMS/SiO₂

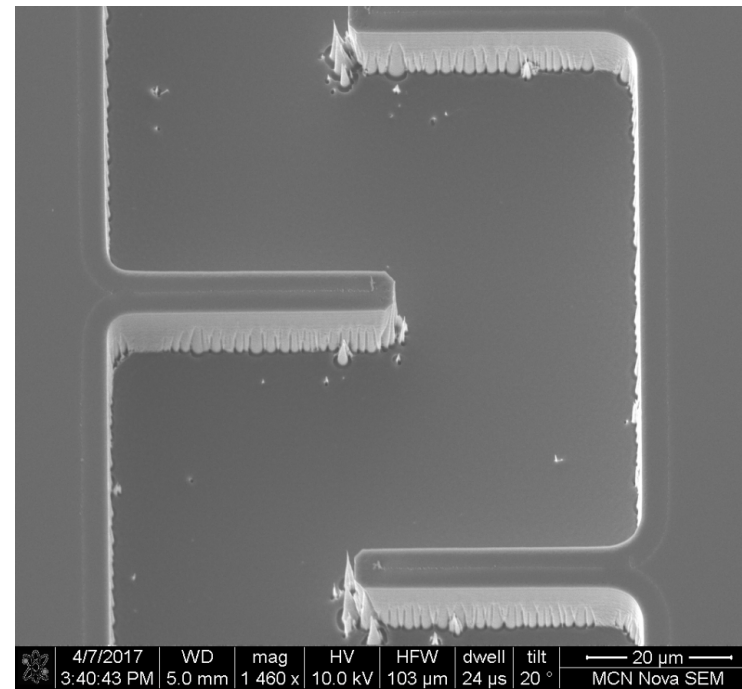
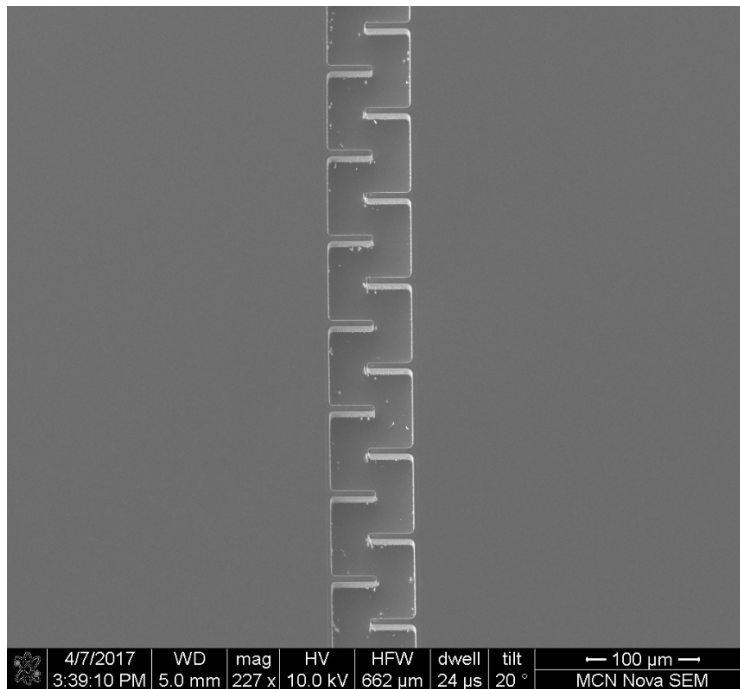
Si/SiO₂

Si/Si

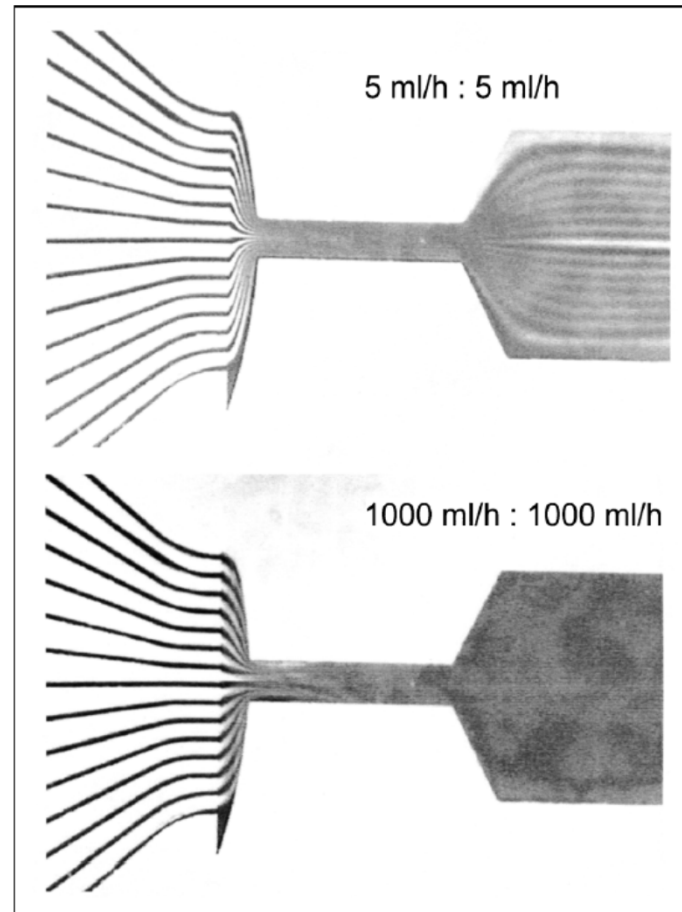
SU-8

Silicon Microfluidic devices



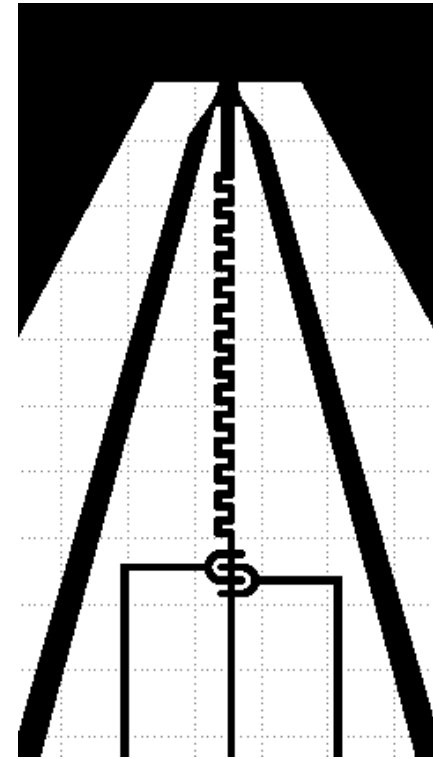
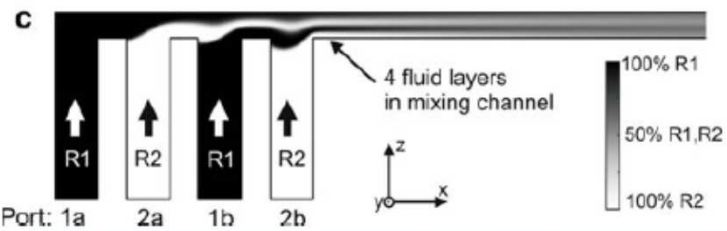
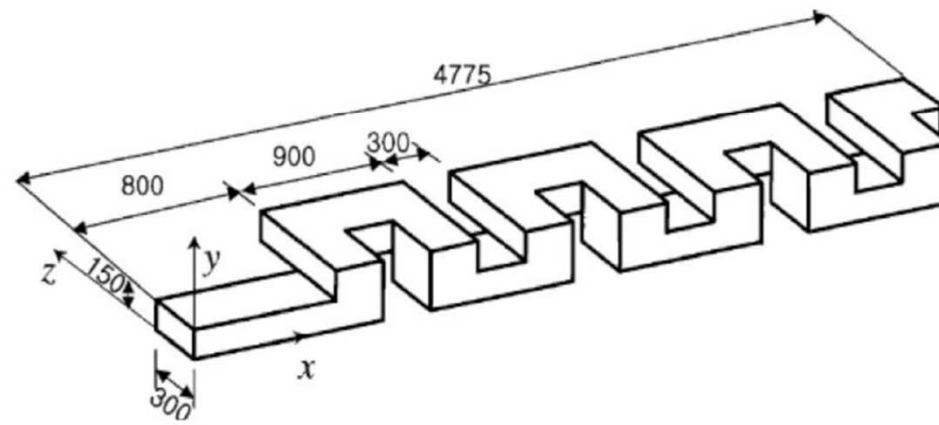
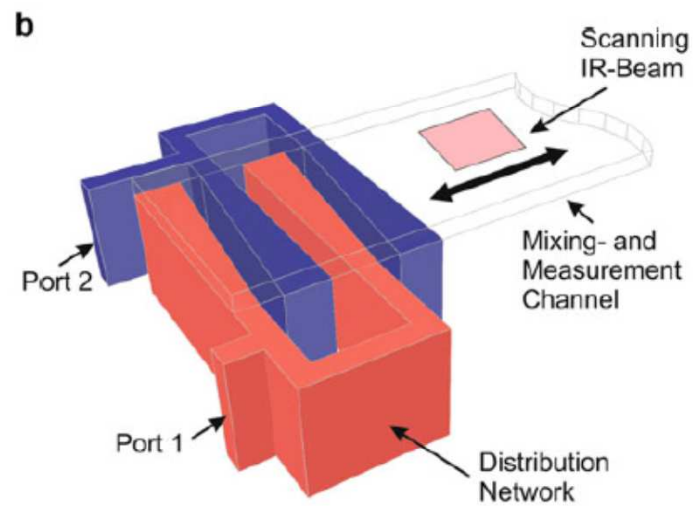
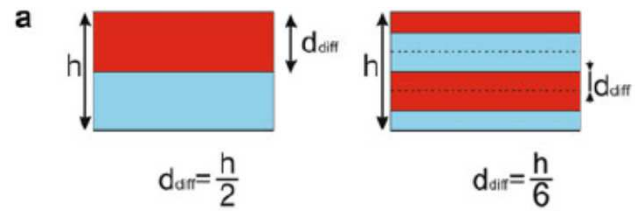


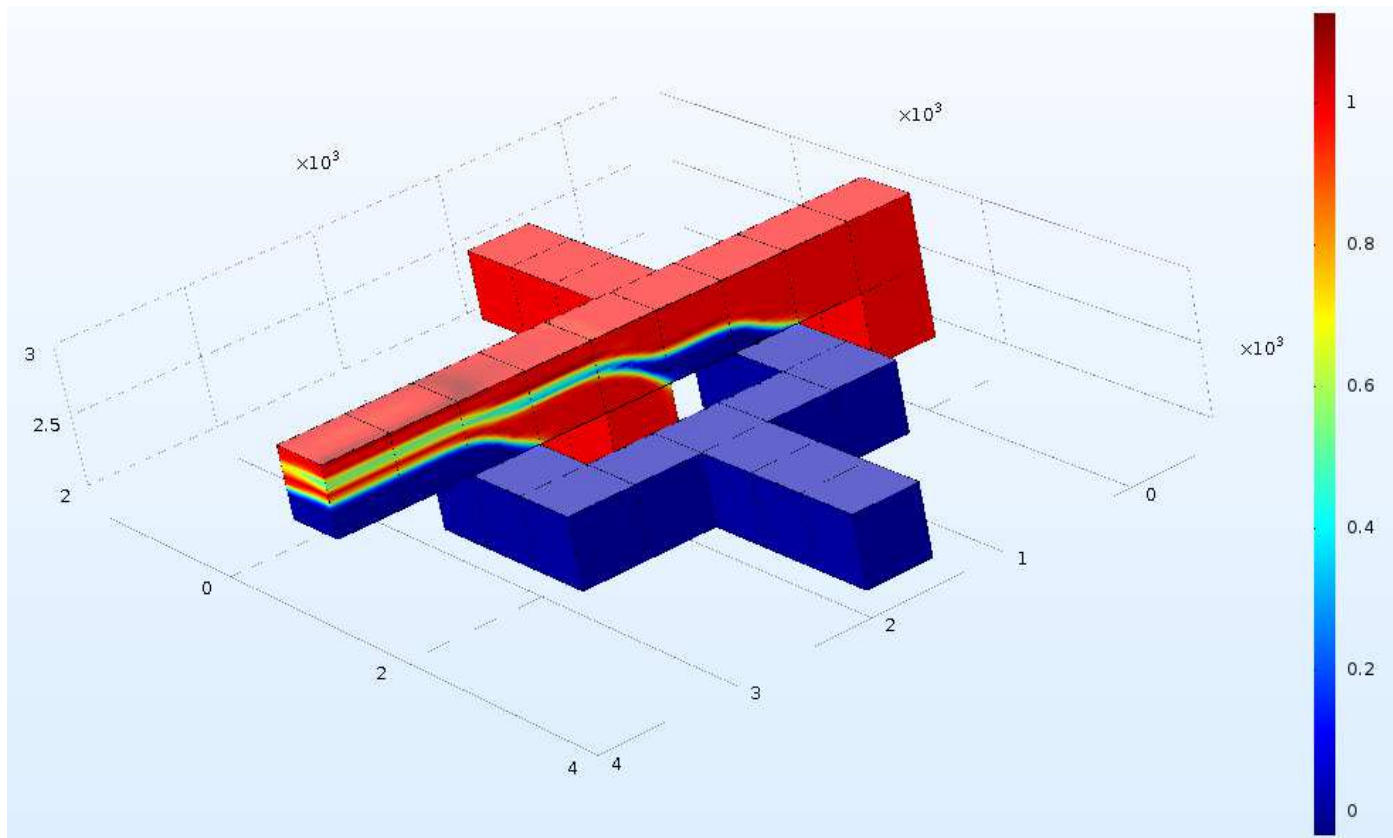
Ideas for Rapid Homogenous Mixing

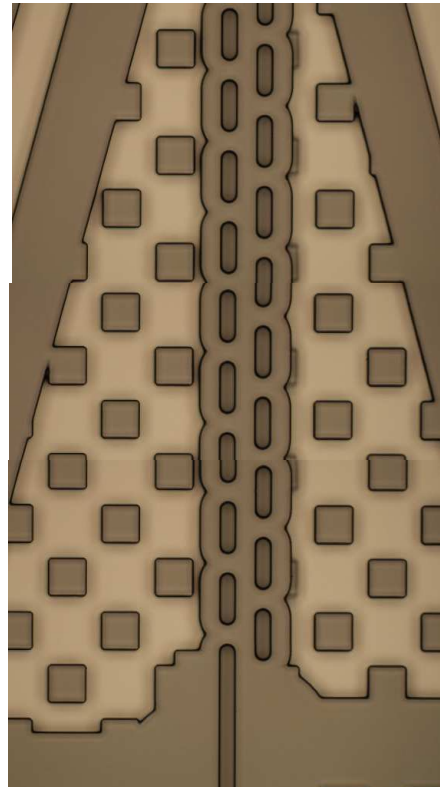
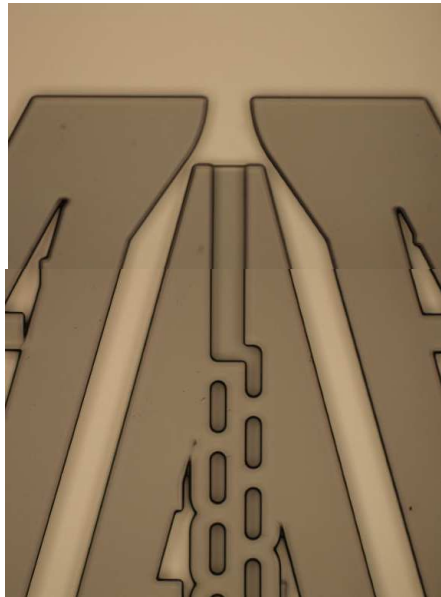


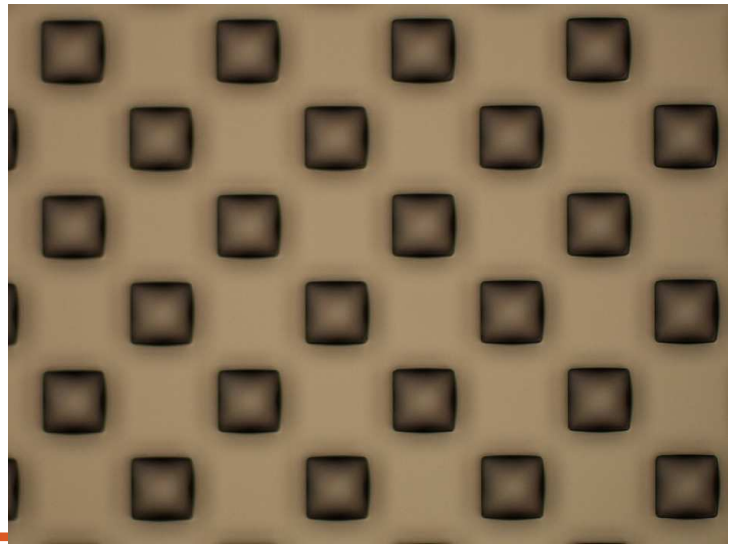
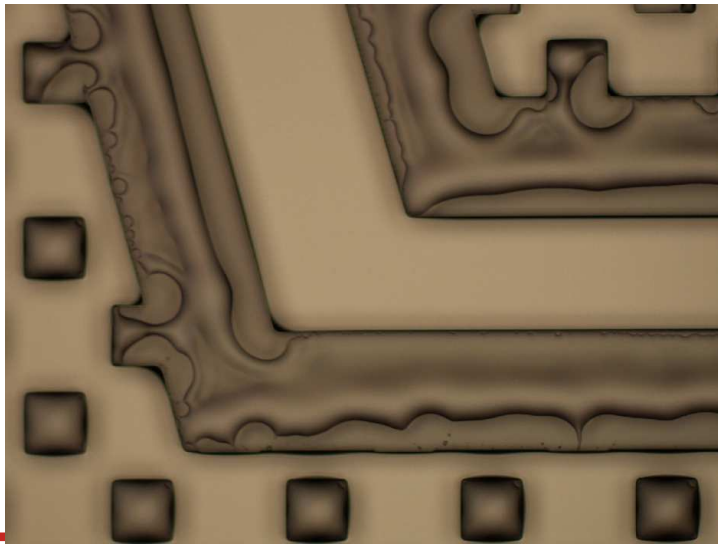
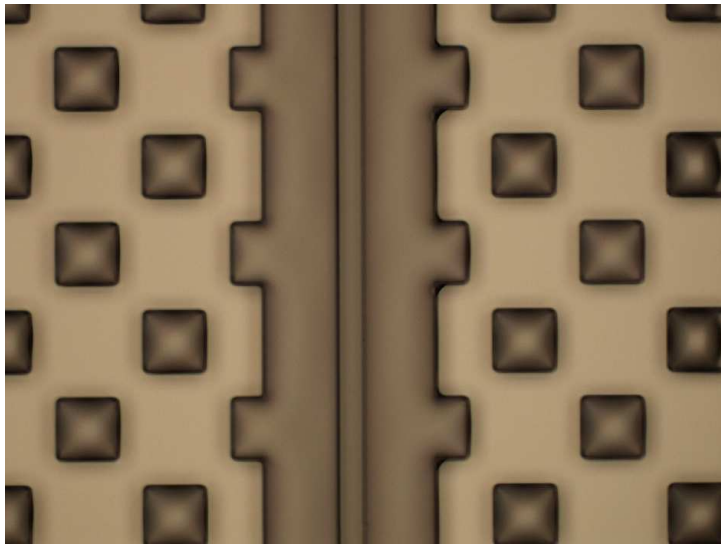
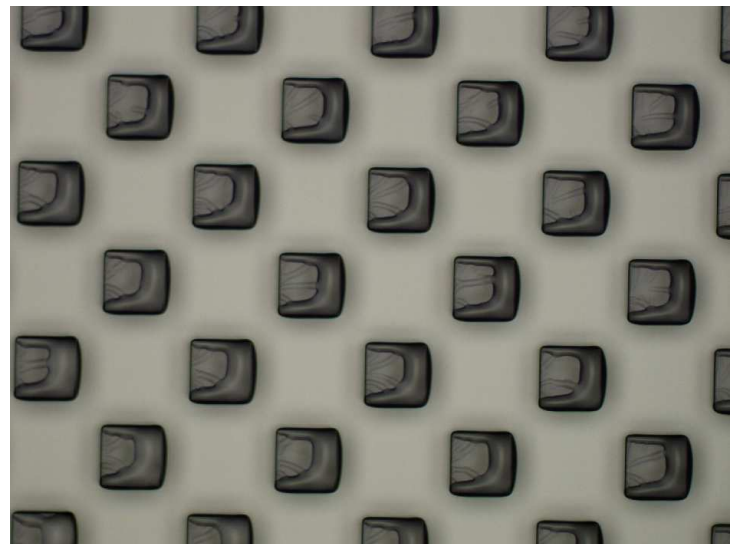
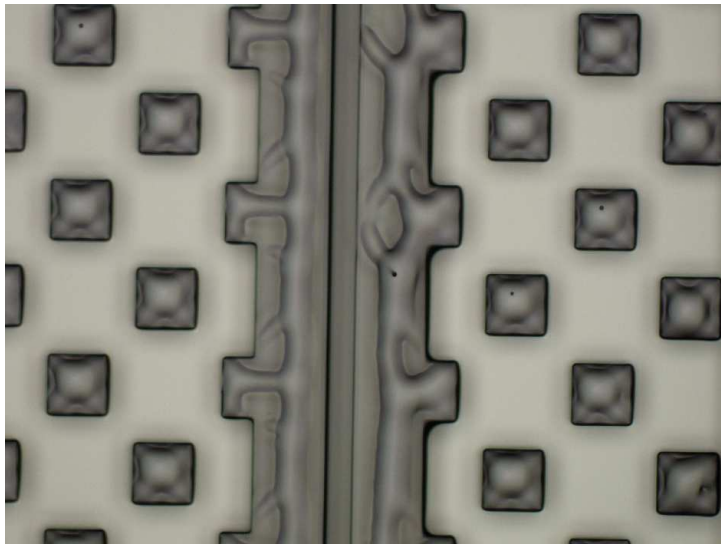
Hessel 2003 AiChE Journal

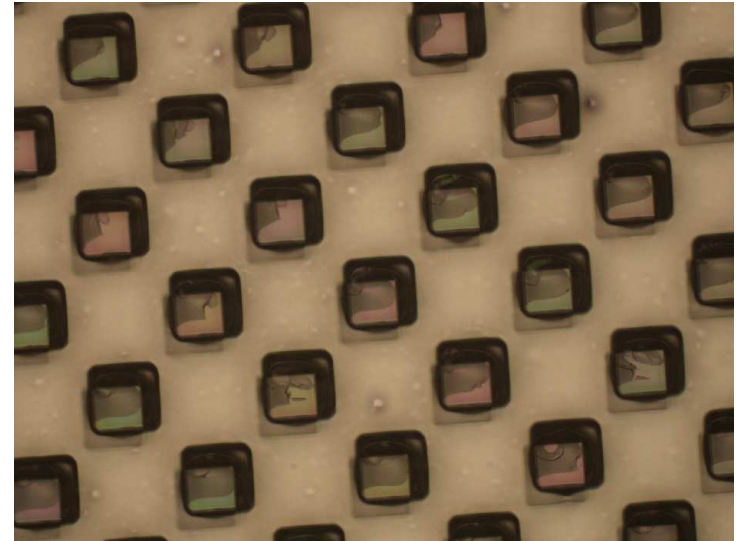
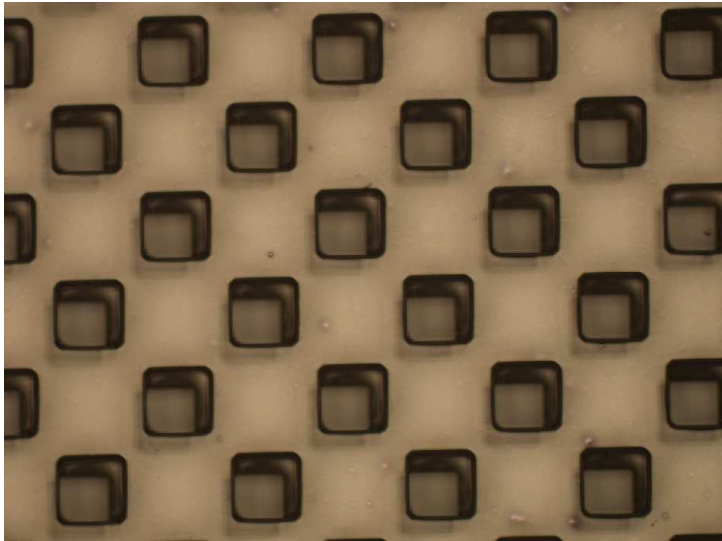
Buchegger 2010 Microfluidics and Nanofluidics











Thank you



d.angley@latrobe.edu.au



Brian Abbey
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Connie Darmanin
Peter Berntsen



Harry Quiney
Saumitra Saha
Andrew Martin



Nigel Kirby
Tim Ryan



Martin Trebbin
Diana Monteiro
Florian Kopf



Rita Graceffa



Sebastian Westenhoff
Oskar Berntsson