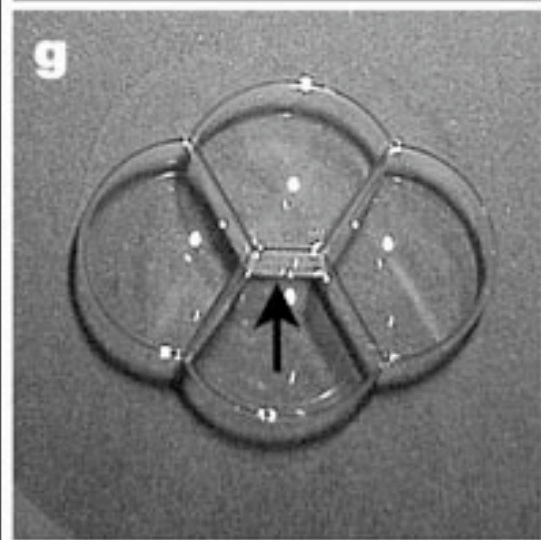
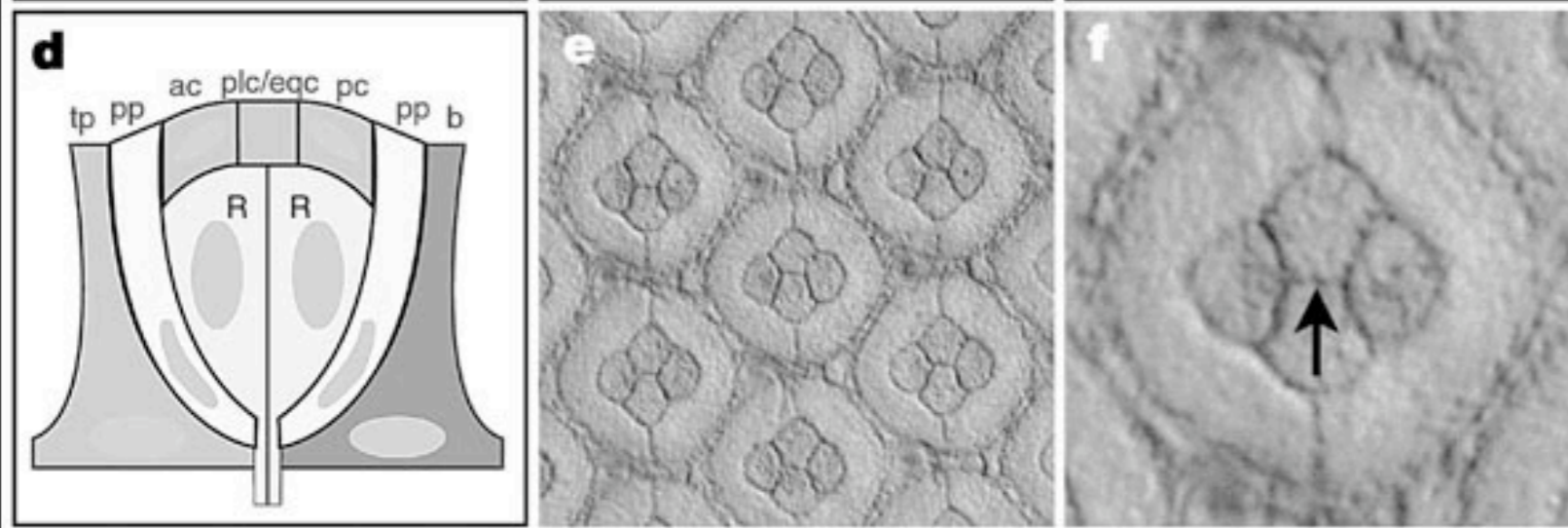
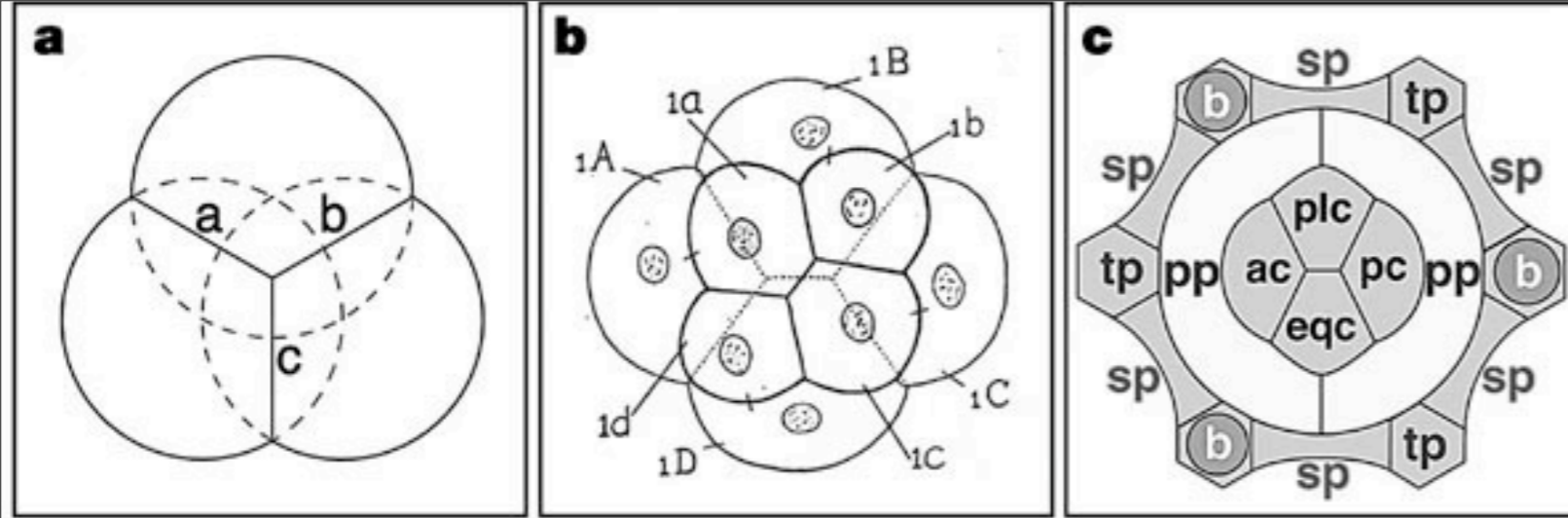


Programmable Soft-matter

*Manu Prakash
Junior Fellow, Harvard Society of Fellows*

*Nothing amuses more harmlessly than
computation
- anonymous*

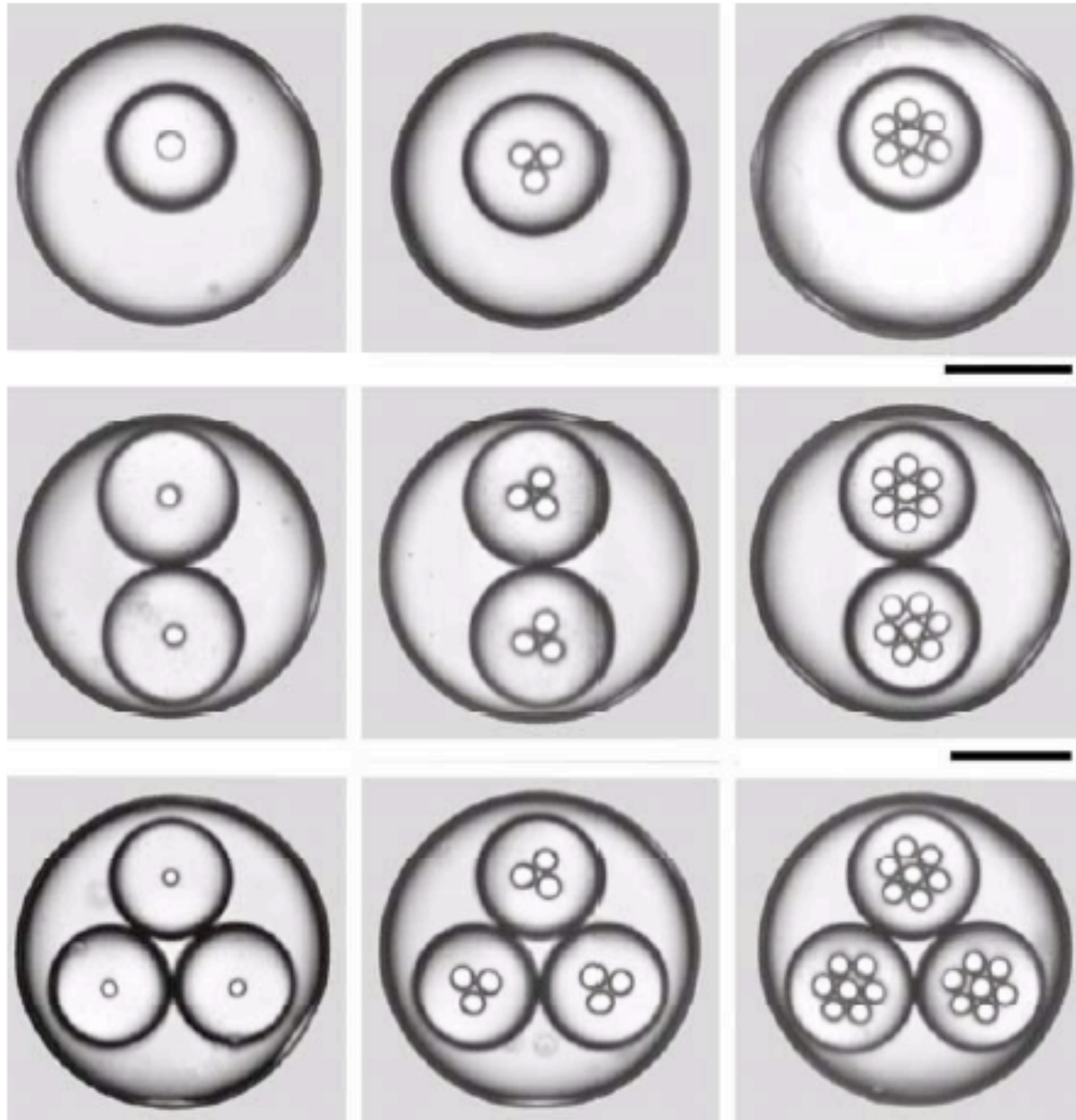


soft-matter

Living systems inhabit a **squishy** fluid world

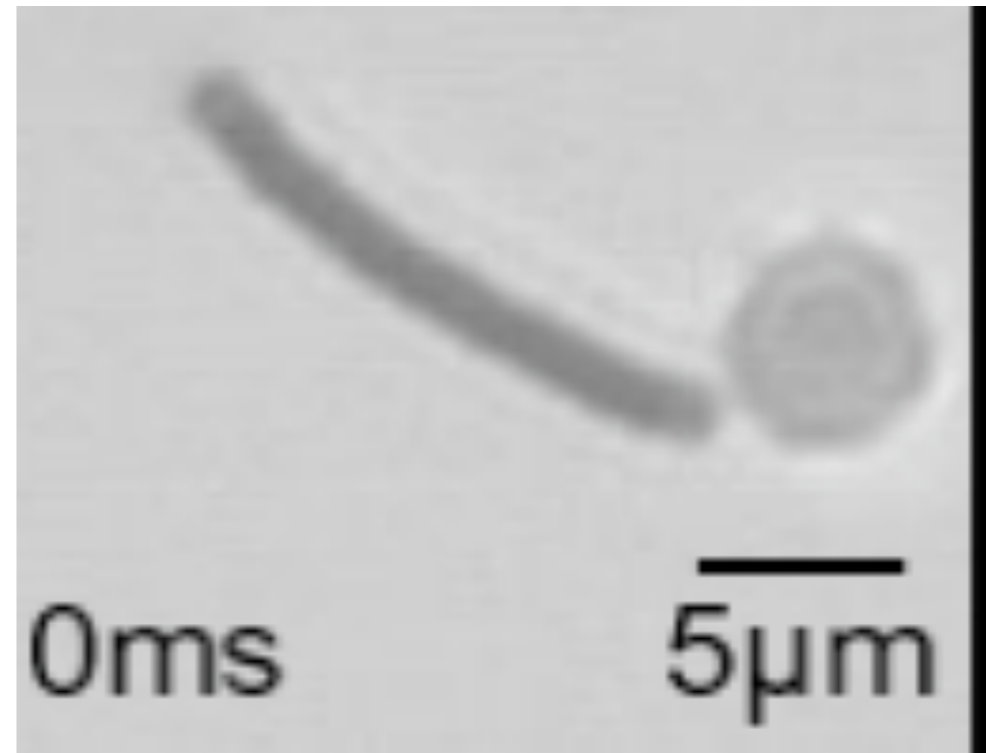
Programming this soft-squishy world..

Static Programming

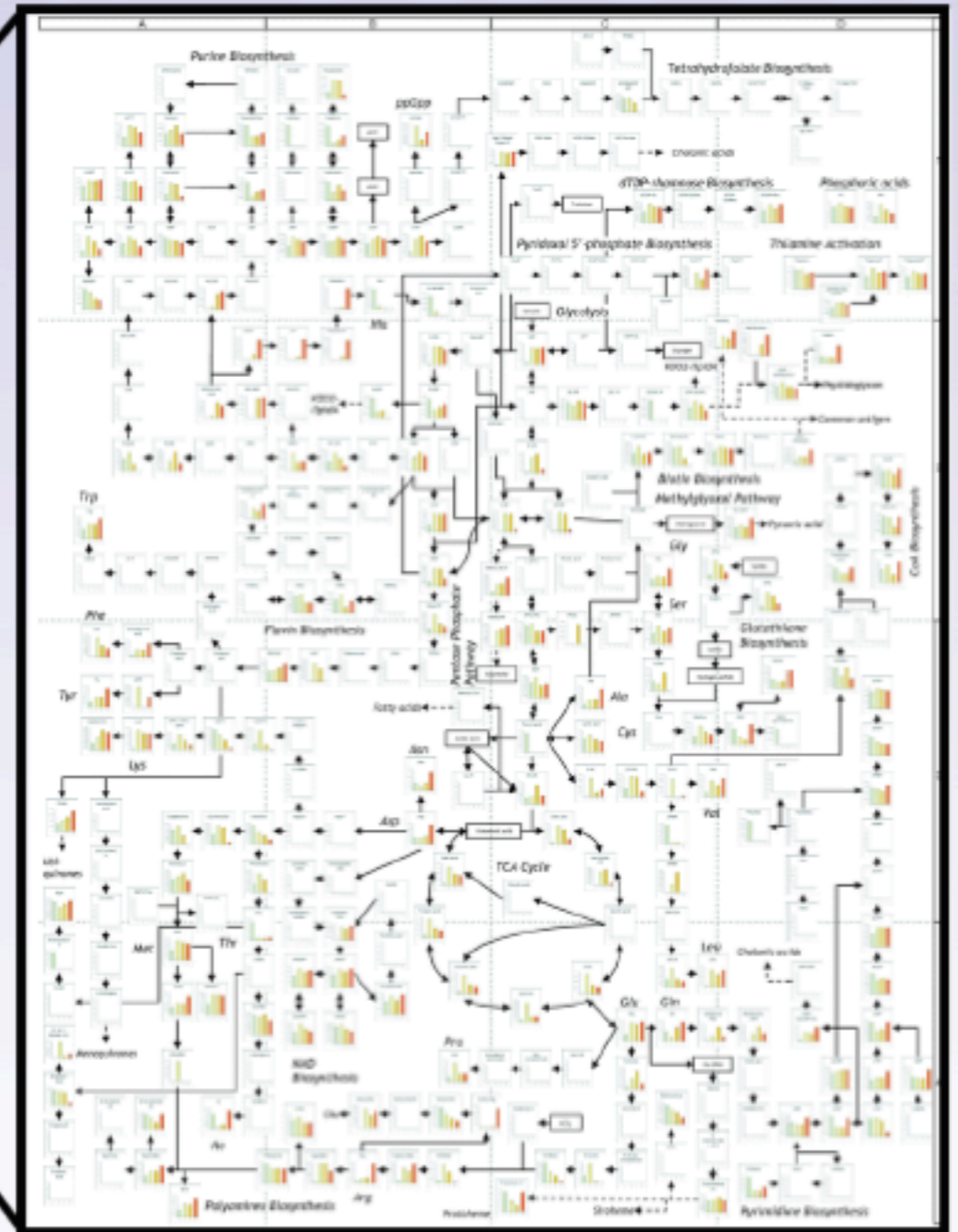
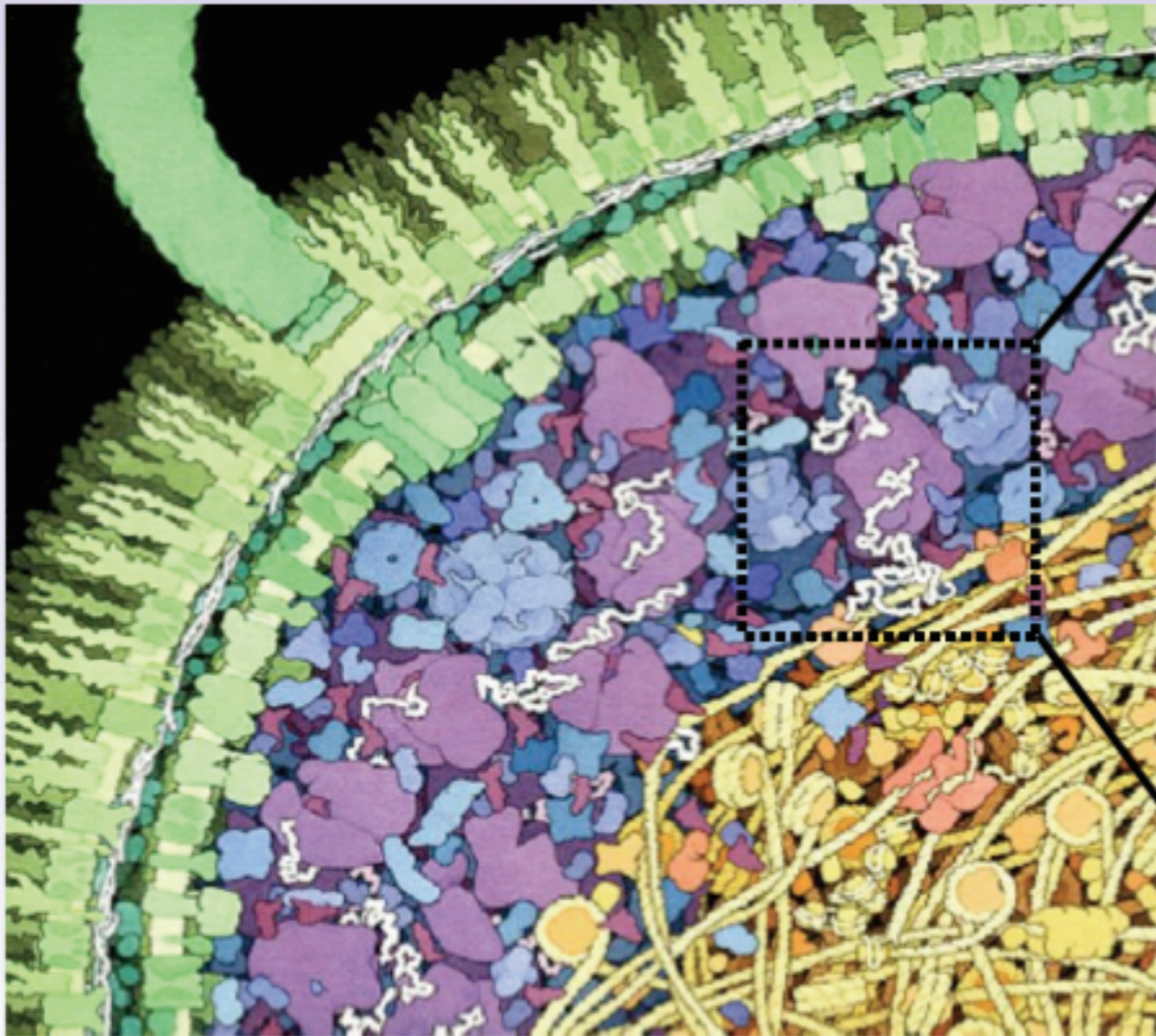


Weitz et al 2008

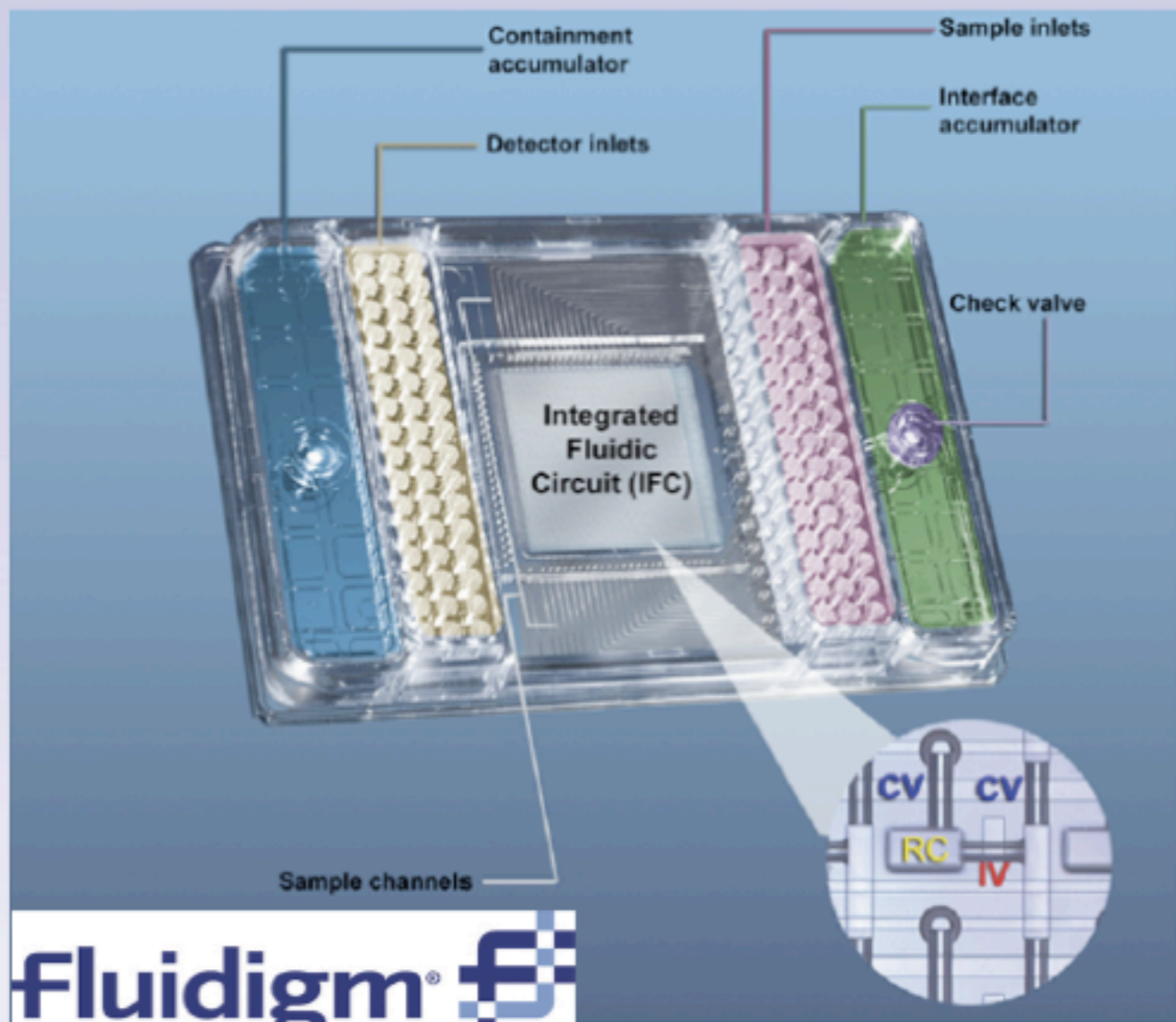
Dynamic Programming



Why? Biological “dark-matter”

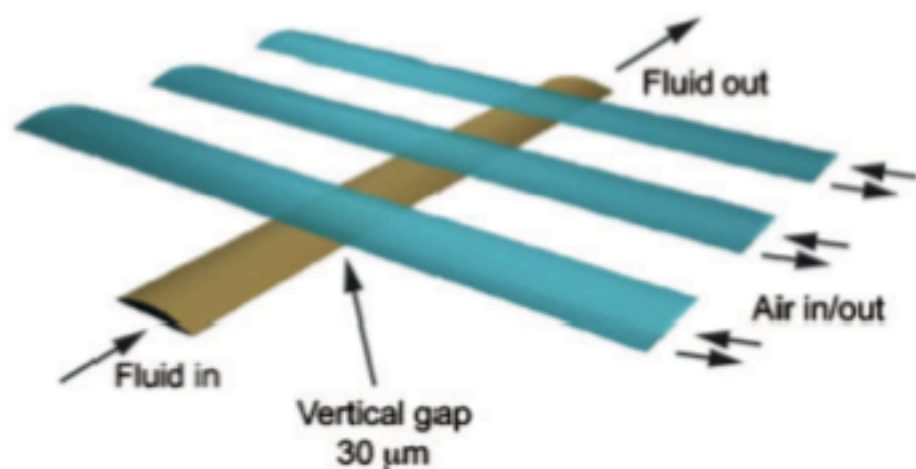


Current state of the art



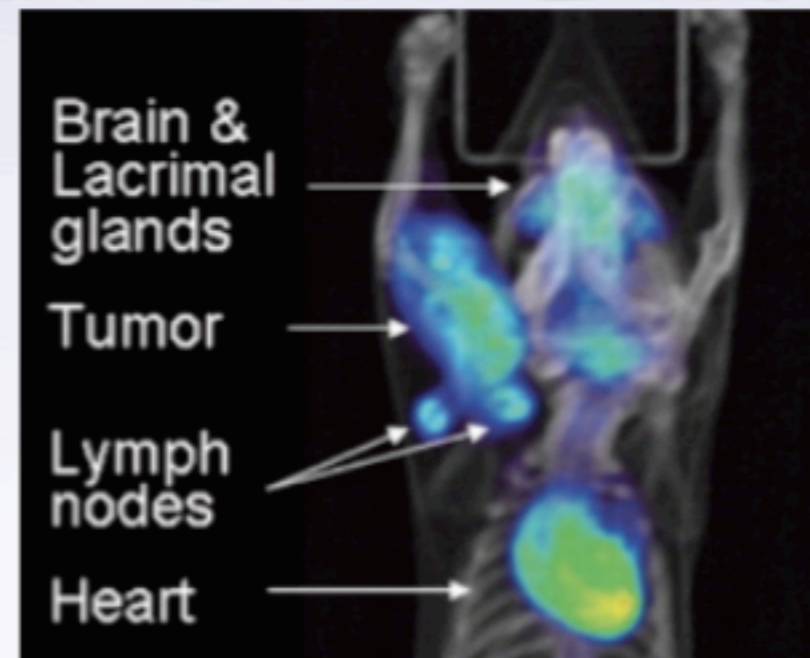
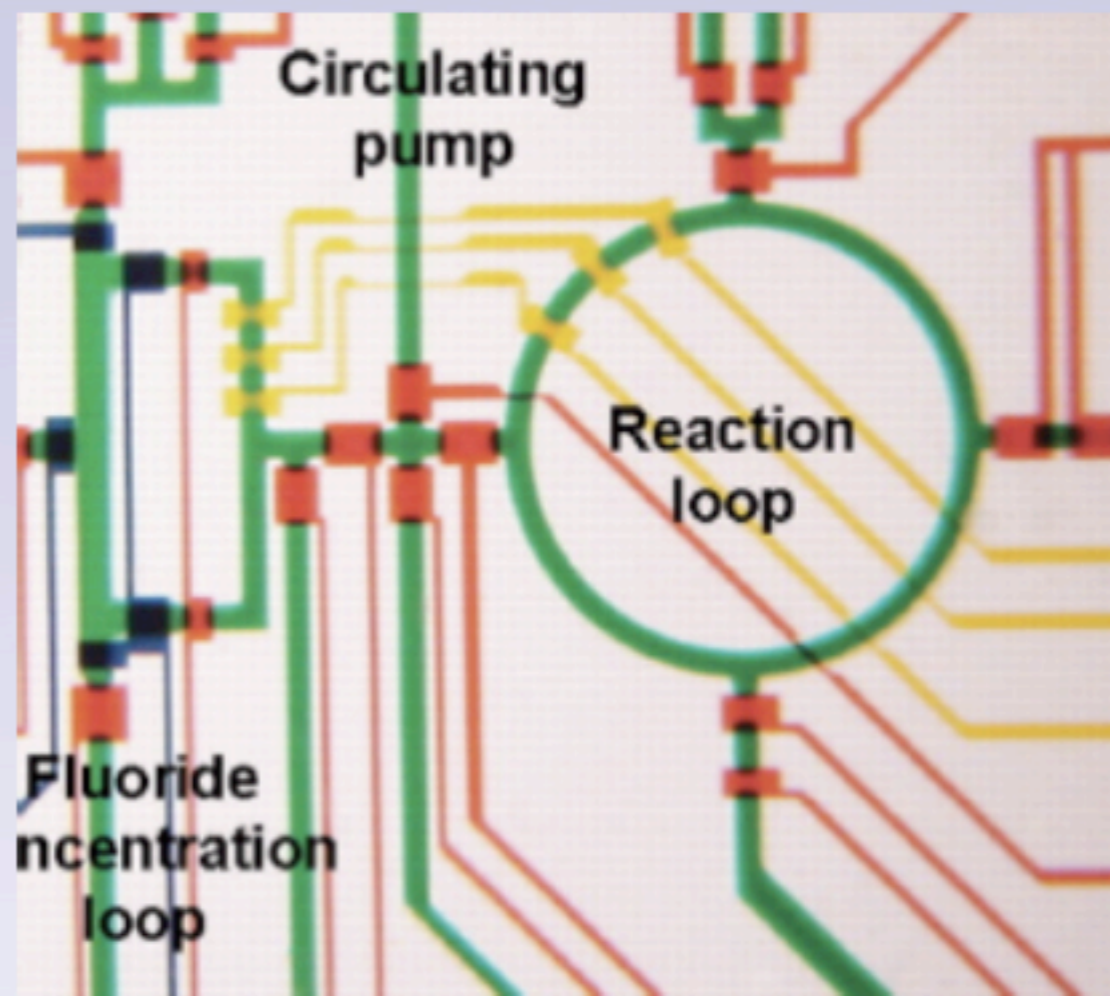
Fluidigm 

48 x 48 Dynamic array chip, 2304 RT gene expression measurements,
Reaction Chamber (RC), Containment Valve (CV), Interface Valve (IV)



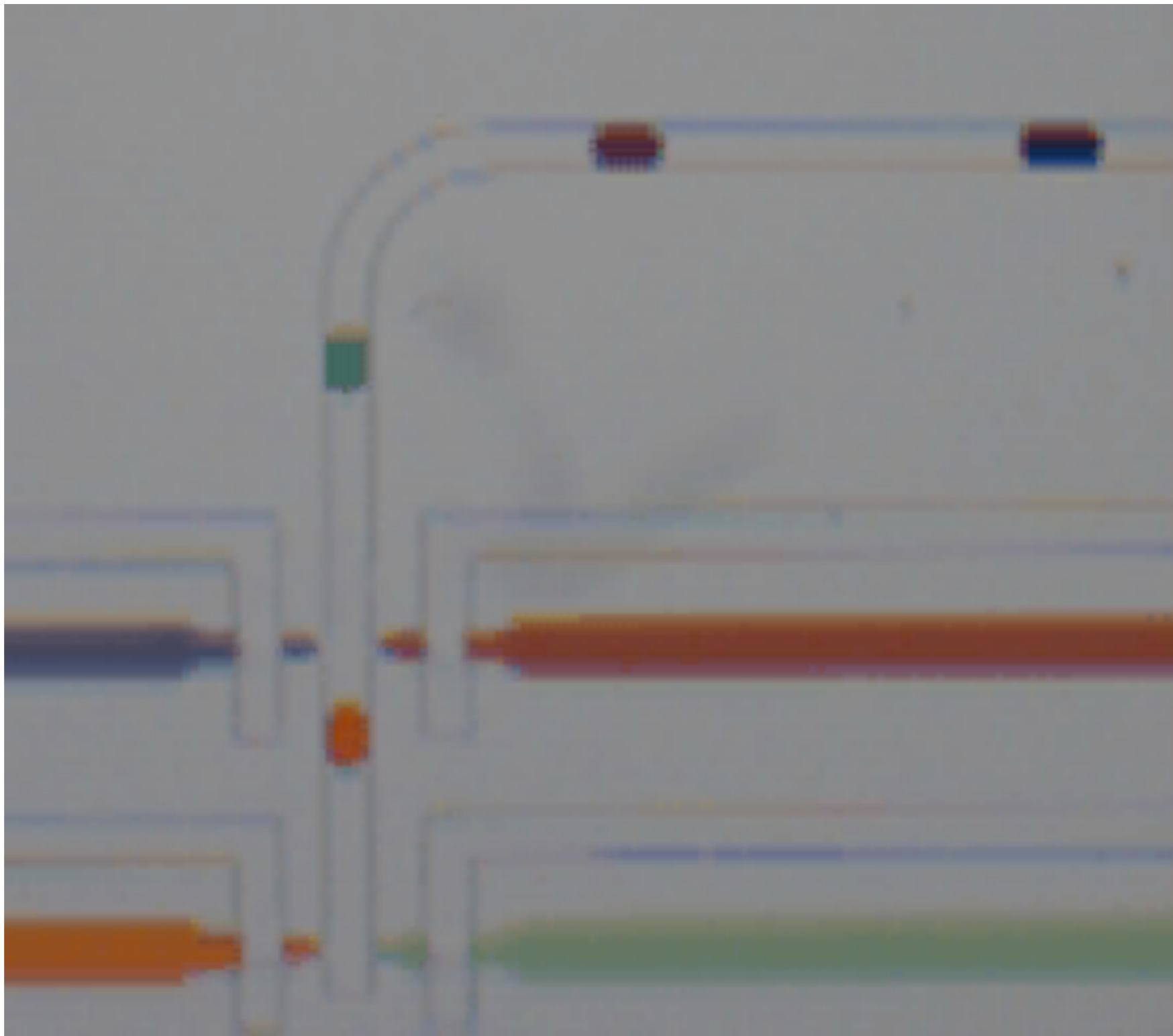
- [Unger et al., Science 2000]
- [Thorsen et al., Science 2002]
- [Lee et al., Science 2005]
- Balagadde et al., Science 2005]
- [Ottesen et al., Science 2006]
- [Markel et al., Science 2007]
- [Spurgeon et al., PLoS One 2008]

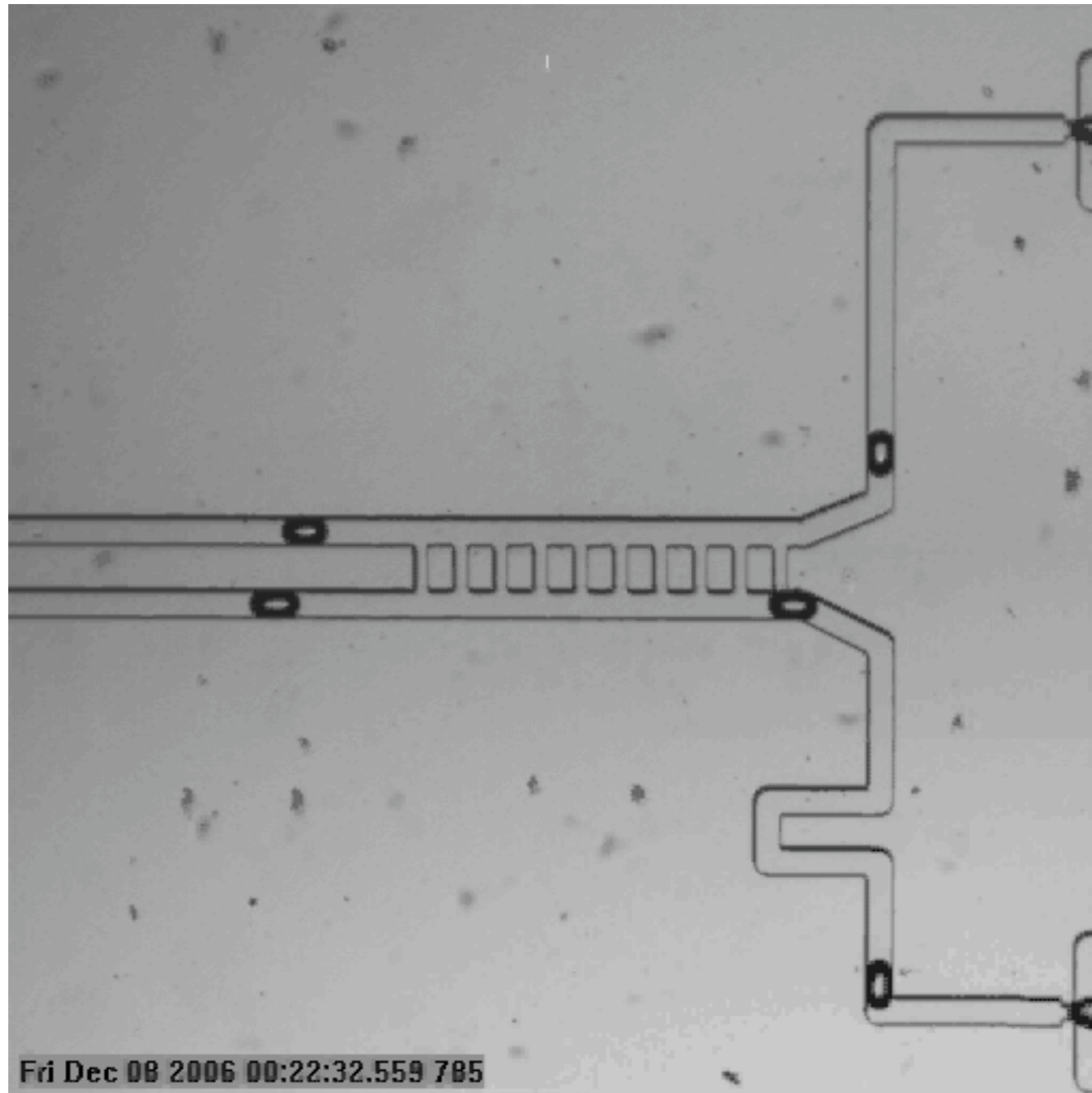
8

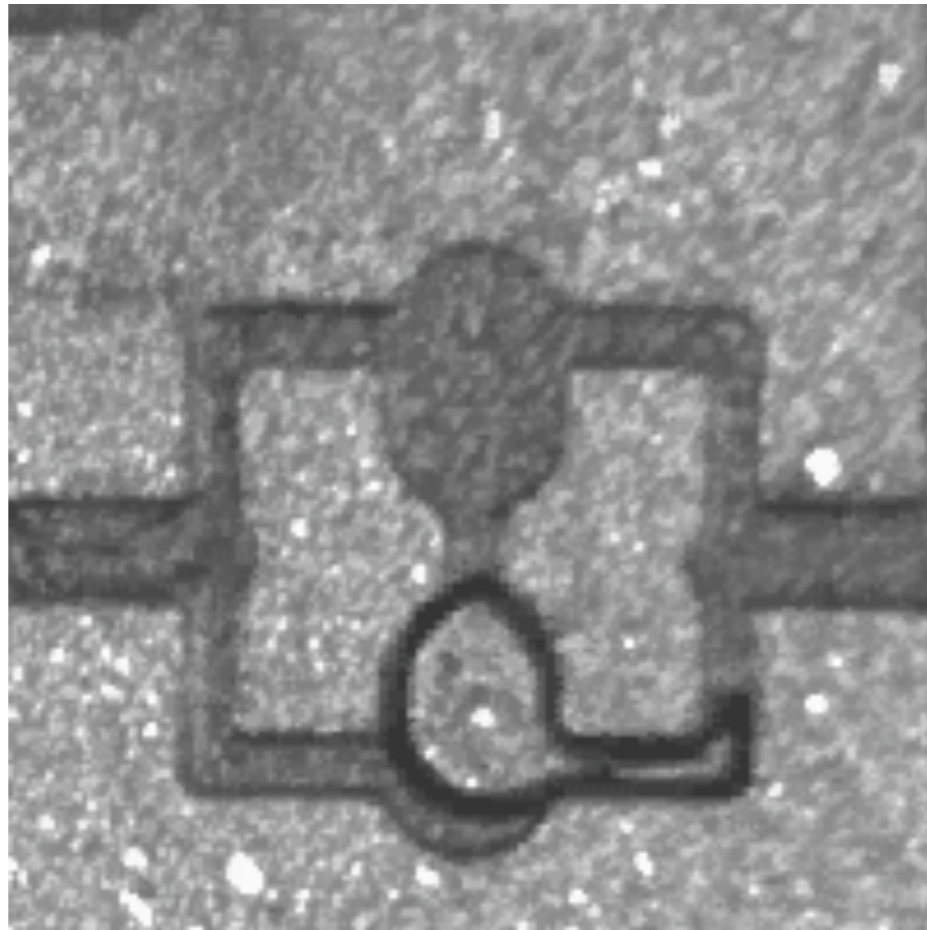


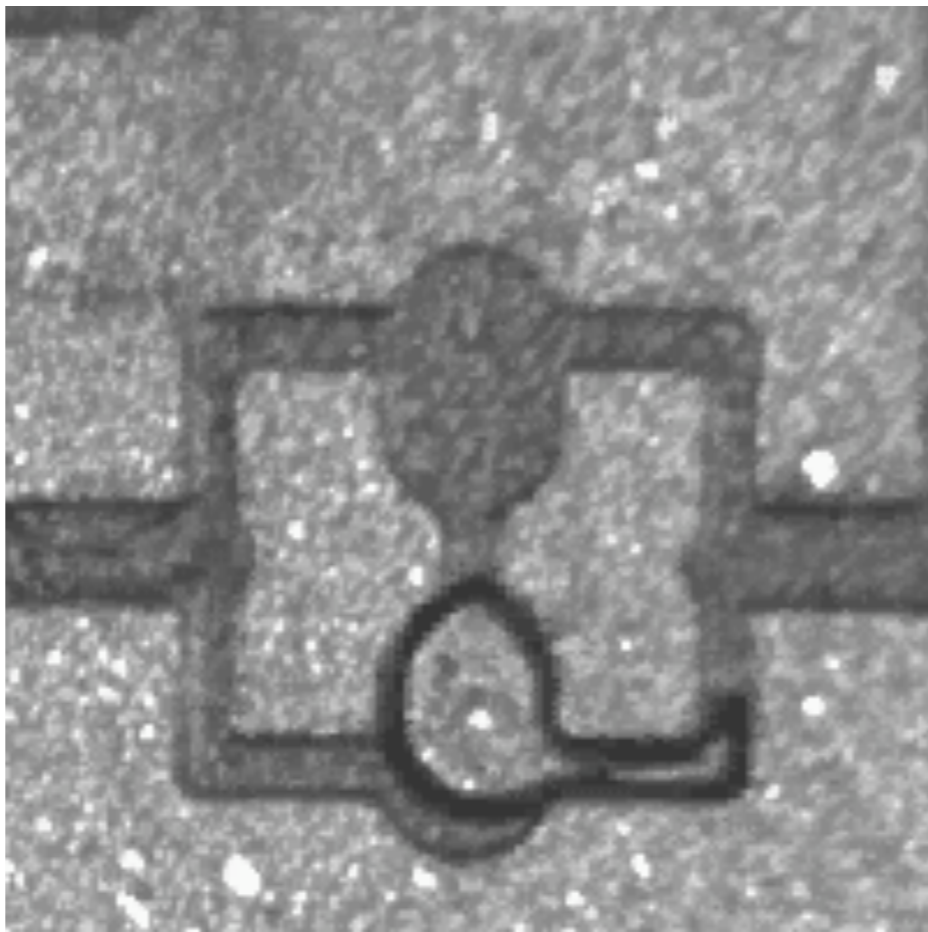
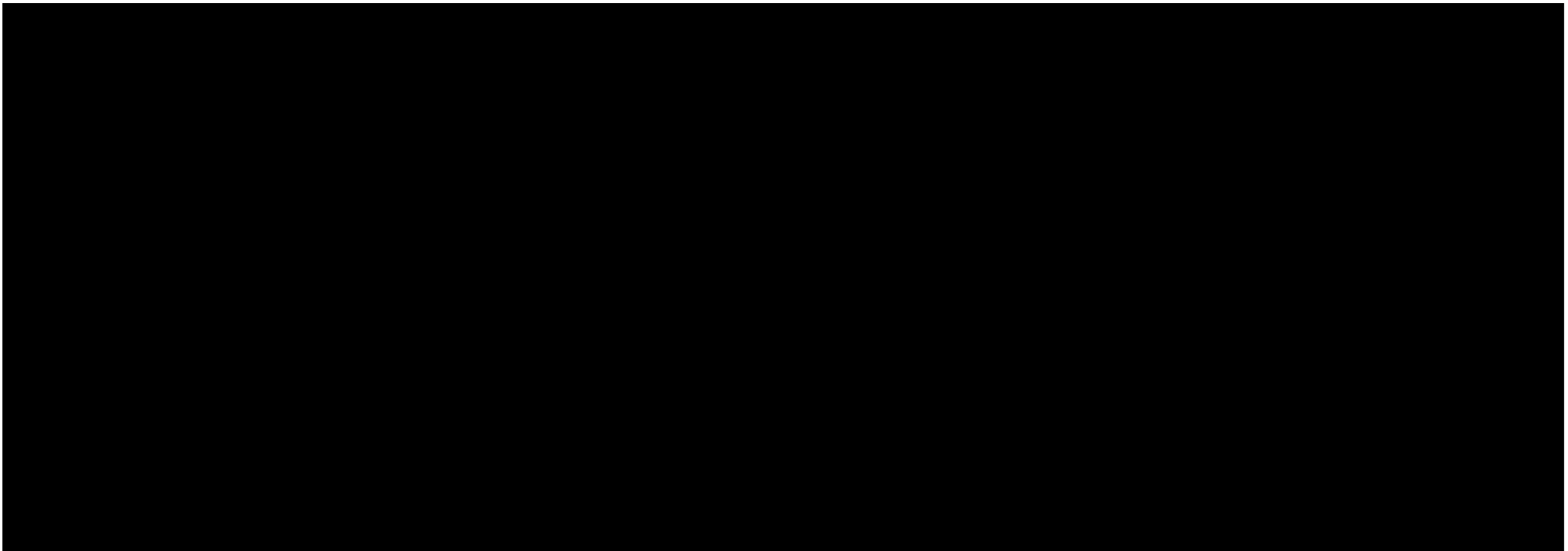
$[^{18}\text{F}]$ FDG radio-labeled imaging probe synthesis









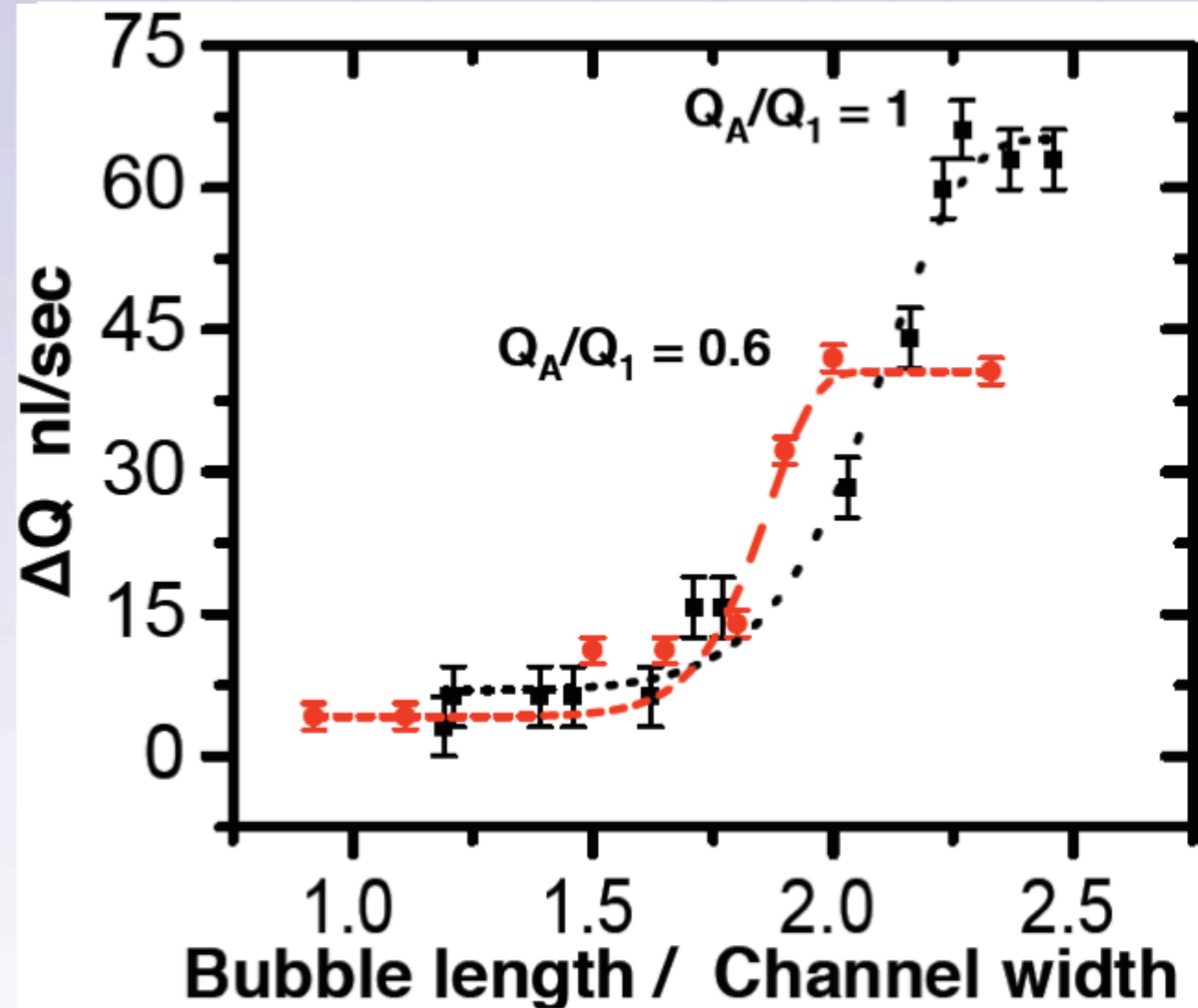
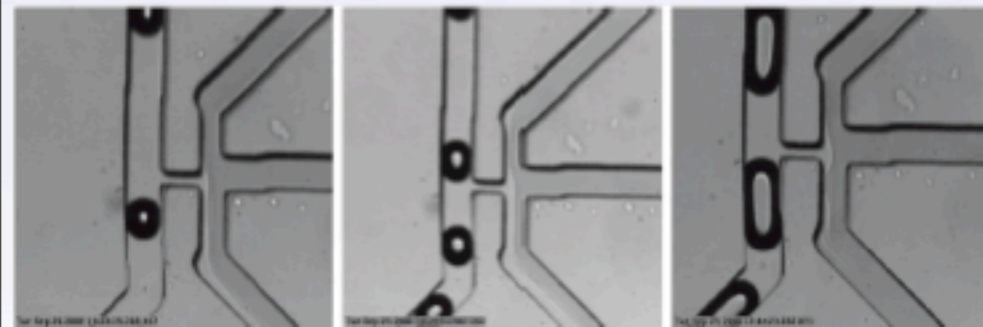


Conservative logic gates : Gain

Dependence on bubble length

- *Viscous dissipation in thin continuous fluid film*
- *Viscous dissipation in dispersed phase*

size of control bubble
→



[Prakash et al, Science 2007]

