Programmable Soft-matter

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Nothing amuses more harmlessly than computation
- anonymous
Living systems inhabit a squishy fluid world

Programming this soft-squishy world..
Static Programming
Dynamic Programming

Bibette et al. 2005

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Why?

Biological “dark-matter”
Current state of the art

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]

[¹⁸F]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

\[ \Delta Q \text{ nl/sec} \]

\[ Q_a/Q_1 = 1 \]

\[ Q_a/Q_1 = 0.6 \]

Bubble length / Channel width

[Prakash et al, Science 2007]