

Can cells be cultured on chip?



Stangegaard, M. Petronis, S., Jørgensen, A.M., Christensen, C.B.V and **Dufva, M**., A Biocompatible Micro Cell Culture Chamber (μ CCC) for the Culturing and On-line Monitoring of Eukaryote Cells, Lab. Chip., 2006, **6**, 1045 - 1051



Cell programming – time dependent



More culture chambers



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Cell culture chips





32-channel pump system





Peristaltic micropump

- 8 channels
- Channel-channel variation
 < 9%
- Durability
 - > 33 mL or 45 days
- Typical flow rate regime
 30 nL/min 5 µL/min
- Typical pulse volumes
 - 80 nL



Skafte-Pedersen¹, Sabourin¹ et al., *Lab Chip*, 9, 2009 Sabourin et al., *Microfluid. Nanofluid.*, 9, 2010







Pump Chip



In the LAF bench



Using MainSTREAM – inserting into microscope



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In the microscope



Flow optimised differentiation



Adipose derived stem cells, ASC

Differentiation Medium, 3W





Adipocytes

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Time

Time

Mass transport on chip





Hemmingsen M, Vedel S, Skafte-Pedersen P, Sabourin D, et al. (2013) The Role of Paracrine and Autocrine Signaling in the Early Phase of Adipogenic Differentiation of Adipose-derived Stem Cells. PLoS ONE 8(5): e63638. doi:10.1371/journal.pone.0063638 http://www.bl.blossnee.ch.grantlegrand.com/articlegrand.com/ar



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2 x 10*5

4x 10*5

Hemmingsen M, Vedel S, Skafte-Pedersen P, Sabourin D, et al. (2013) The Role of Paracrine and Autocrine Signaling in the Early Phase of Adipogenic Differentiation of Adipose Agrice Agr



Figure 4. Quantitative measurements of gene expression of adipogenic markers.

Hemmingsen M, Vedel S, Skafte-Pedersen P, Sabourin D, et al. (2013) The Role of Paracrine and Autocrine Signaling in the Early Phase of Adipogenic Diff@TeldthelionfoothAlleposealehtiveerseleonf@eeltsaRLoS ONE 8(5): e63638. doi:10.1371/journal.pone.0083608/ture chips Martin Dufva 17/10/2013 http://www.plosone.org/article/info:doi/10.1371/journal.pone.0063638



Hemmingsen M, Vedel S, Skafte-Pedersen P, Sabourin D, et al. (2013) The Role of Paracrine and Autocrine Signaling in the Early Phase of Adipogenic Differentiation of the State of Cells: Phase of Adipogenic State of Cells: Phase of of Cell

Figure 7. Graphical model of signaling in ASC adipogenic differentiation.

Perfusion with AM Perfusion with CM Factor X LPL Adiponectin Added adipogenic factors C/EBP6 C/EBP6 PARY

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Similarities between hepatocyte and fat cell differentiations





MainSTREAM core components and systems design

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Stem cell biology

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Theory and simulation

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Scaffolds Soumyaranjan Mohanty

