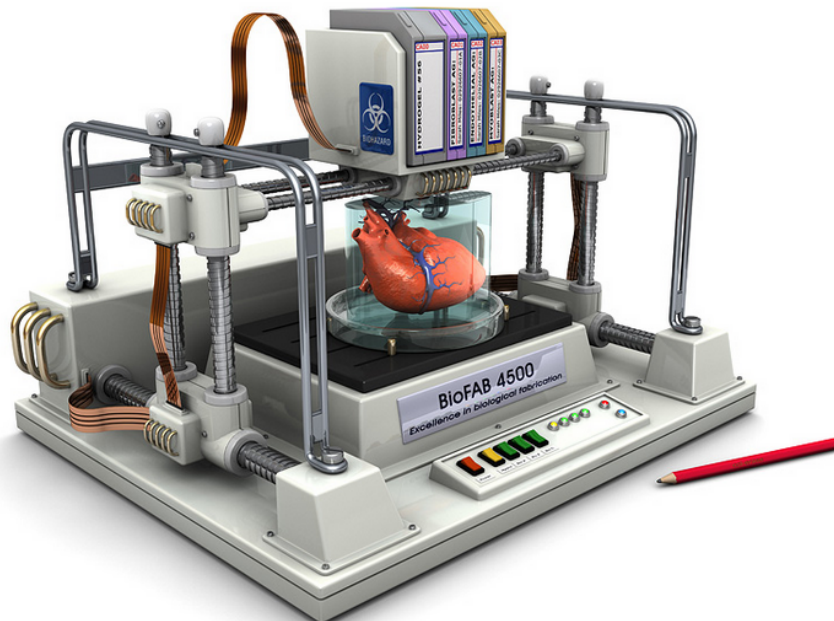


3D Bioprinting: when will we get organs on demand?

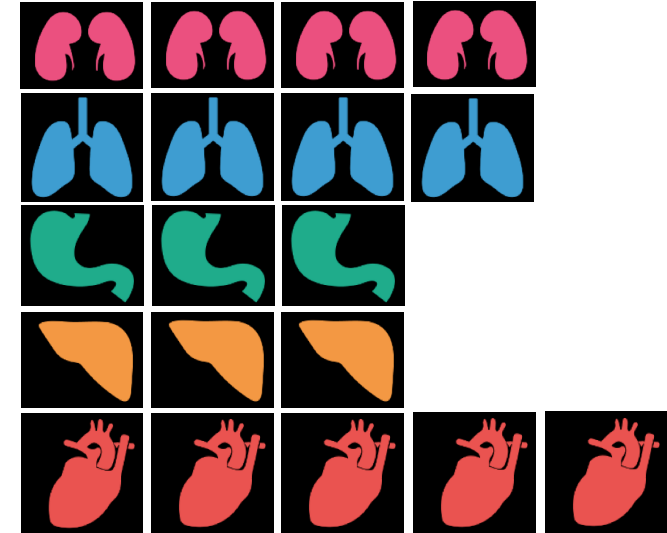
Prof. Dr. Olivier Guenat

ARTORG Center, Head Organs-on-Chip Technologies

<http://3drevolutions.com>

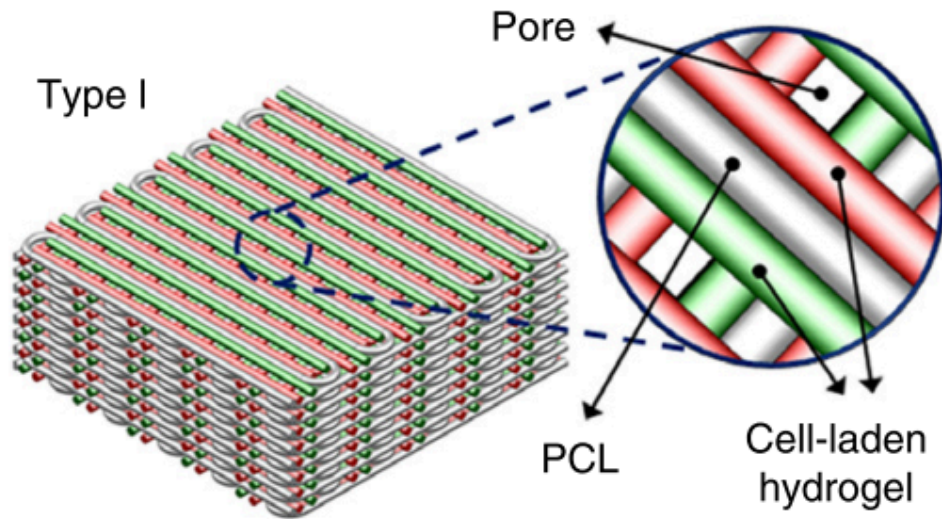


Click on the picture to order:





3D - Bioprinting



Kang et al. Nature Biotechnology, 2015

- **Layer by layer printing**
- Resolution: 20-100um (depends on the material)
- **Scaffold** materials (e.g. hydrogel, ...)
- **Sacrificial** material (e.g. sucrose, pluronics,...)
- **Biological** material (cell line, primary cells)

Video: <https://www.youtube.com/watch?v=Zz-i-tll2MA>

Regenhu 3D Bioprinter available at ARTORG with 3 printheads:

- Dispenser – Dosing directly out of cartridges (cells, hydrogels,...)
- Thermo polymer Extruder (PS, hard plastics)
- Microvalve printhead for accurate jetting or contact dispensing (hydrogels, cells)



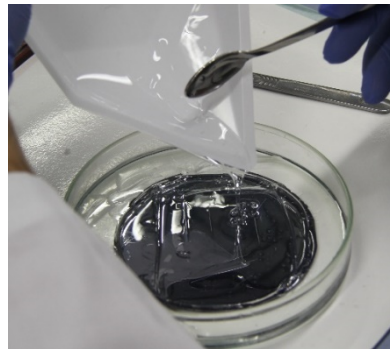
Other rapid prototyping technologies

Spin Coating



<http://findspicture.com/spin-coating-machine.html>

Soft Lithography



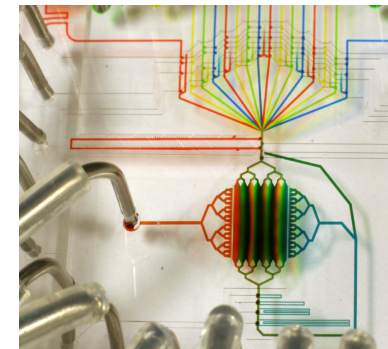
ARTORG, University Bern

Mold Designing



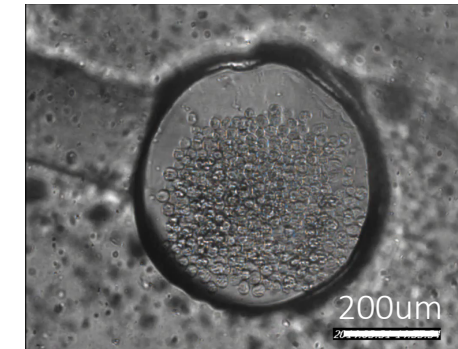
Ruppen, Lab Chip 2015

Microfluidics



<https://bluesci.files.wordpress.com>

Cell biology



Video:
<https://www.youtube.com/watch?v=adM91DcoDhg>

3D Bioprinting & Organs-on-Chip Technologies

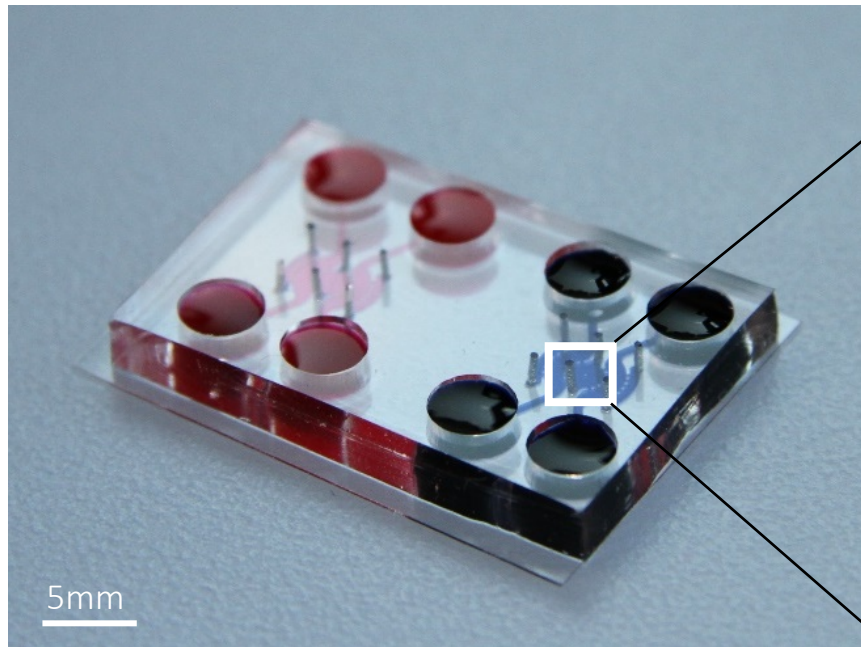
- Technologies to create **microstructures with dimensions similar to those of cells**
- Possibility **to accurately reproduce** the cellular microenvironment (small quantity of liquids, small number of cells)



In vitro vasculogenesis

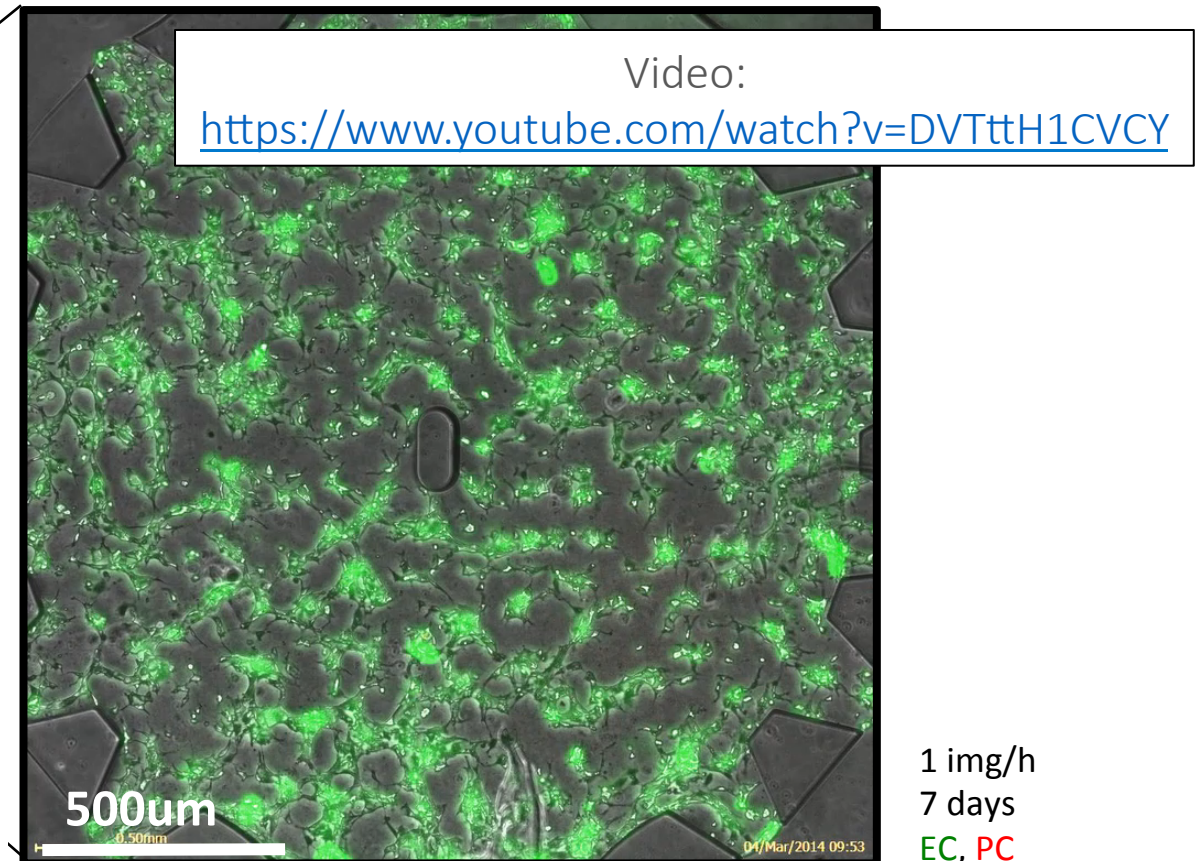
Collaboration:

- Pulmonary Medicine Department, Prof. Th. Geiser
- Thoracic Surgery Department, Prof. R. Schmid



Bichsel et al. 2015

Endothelial cells and pericytes
in a fibrin environment



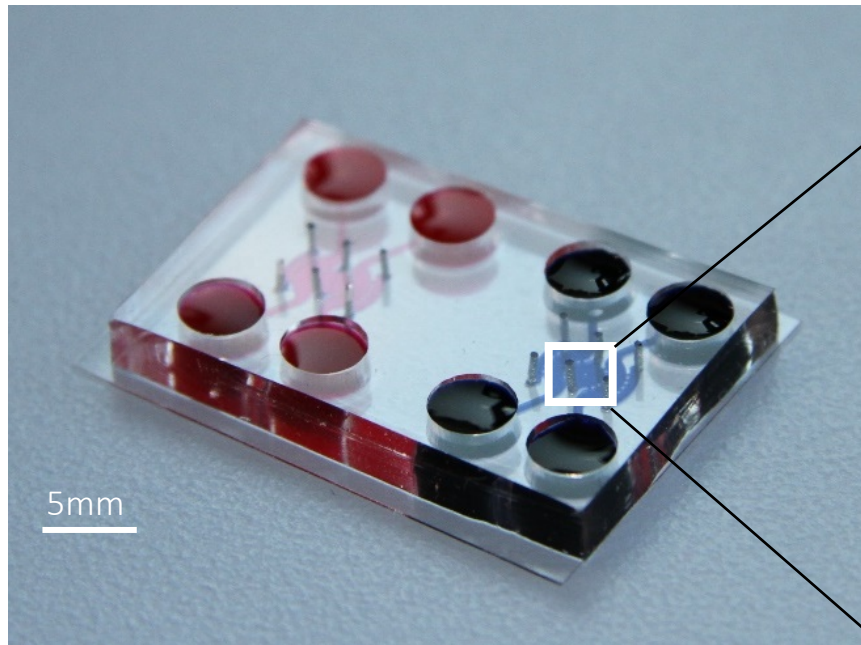
1 img/h
7 days
EC, PC



In vitro vasculogenesis

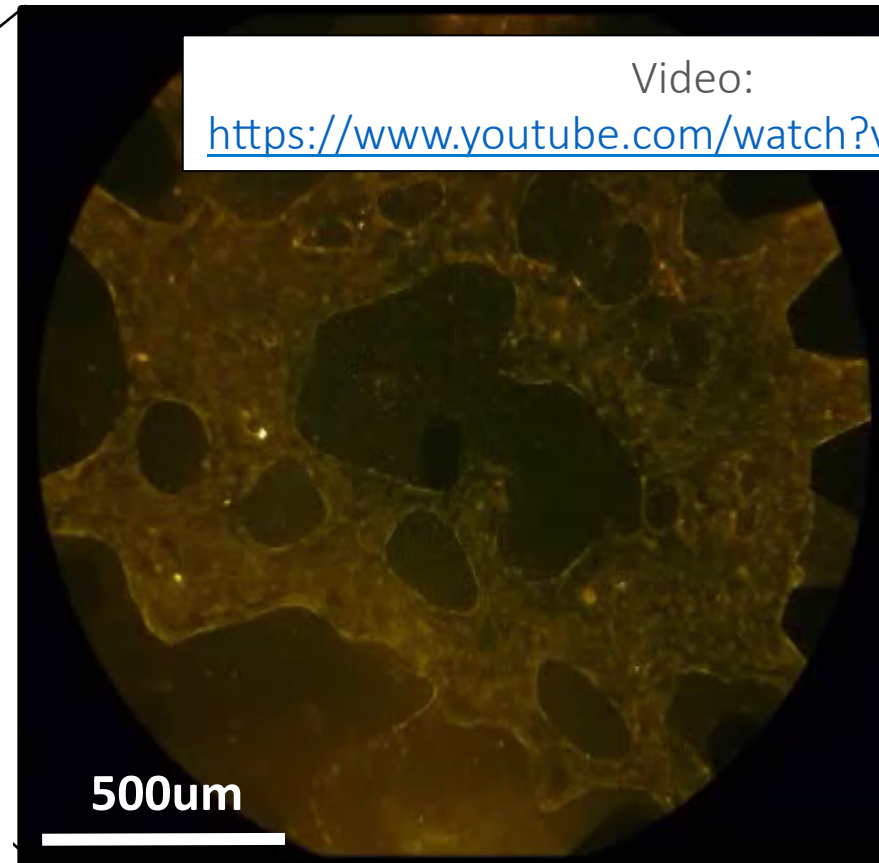
Collaboration:

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Bichsel et al. 2015

Perfusable and functional
(vasoconstrictive) lung microvasculature



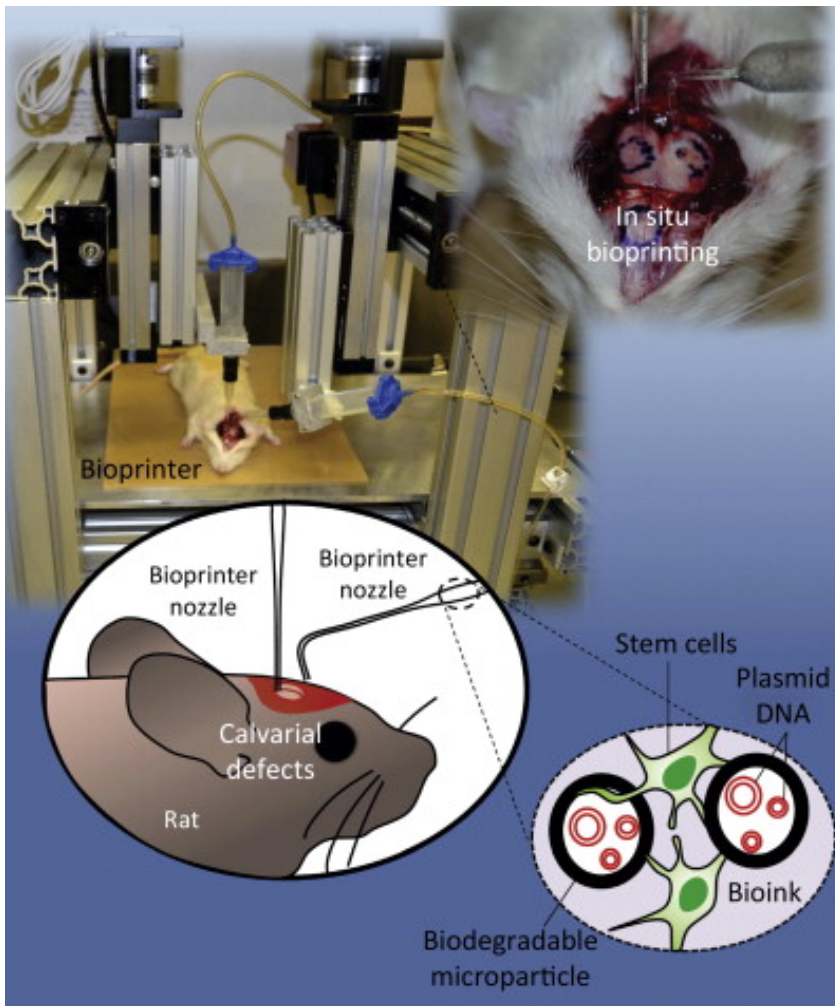
Video:

<https://www.youtube.com/watch?v=DVTtH1CVCY>

Bichsel et al. 2015



Future: in-situ bioprinting!



Ozbolat, Trends in Biotechnology (2015)

Possible applications

- Extremities injuries
- Crano-facial defects (picture left)

Challenges

- Material: which bioink?
- Cell sources: primary, iPS cells, ...
- Vascularised tissues
- Tissue innervation



Contact

Are you interested to bioprint your dream biostructure?
Contact us!

http://www.artorg.unibe.ch/research/organs_on_chip_technologies/research/lung_microvasculature/index_eng.html

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