Vasc-on-Demand: A platform technology for integrable and functional vascularization for tissue engineering

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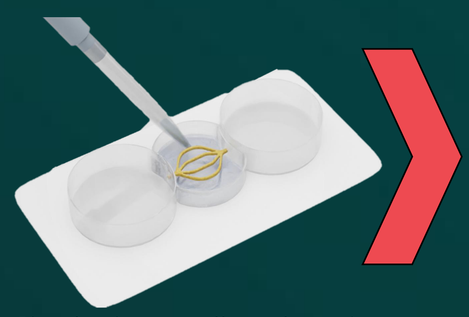
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Introduction

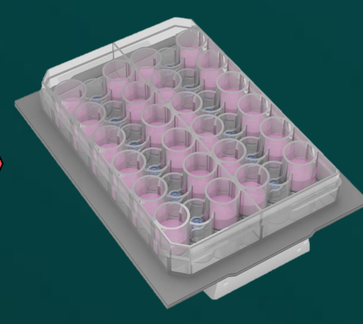
Effective tissue models must recapitulate essential aspects of native tissue, including extracellular matrix (ECM) composition, cellular organization, and perfusable vascularization. Current organ-on-chip (OoC) systems provide advanced microphysiological conditions but remain limited by their small scale and lack of complexity. Similarly, biofabrication approaches often suffer from poor reproducibility and limited scalability. To address these issues, we developed a reproducible, ready-to-use platform utilizing sacrificial scaffolds based on poly(2-oxazoline) for the generation of perfusable and functional vascular networks within tissue constructs.

Methodology





Simply pipette cells and matrix to generate channels

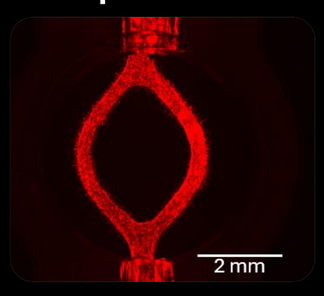


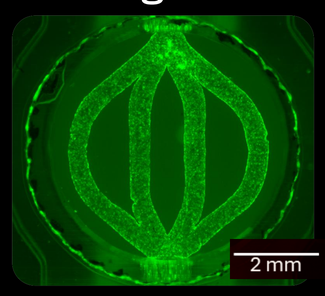
Cultivate/perfuse on a classic laboratory rocker

Scan for prototype movie!

Results: Towards an off-the-shelf solution for perfusable vascularized tissue models

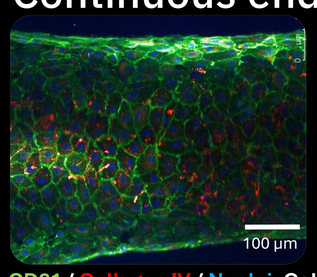
Adaptable natural design

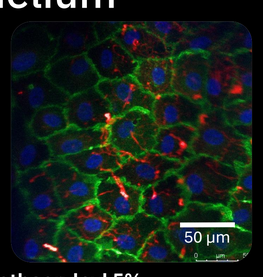




Volume ratio and angle according to Murray‘s law
Red TTFLUOR HUVEC / TTFLUOR HUVEC; Gelatin methacryloyl 5%

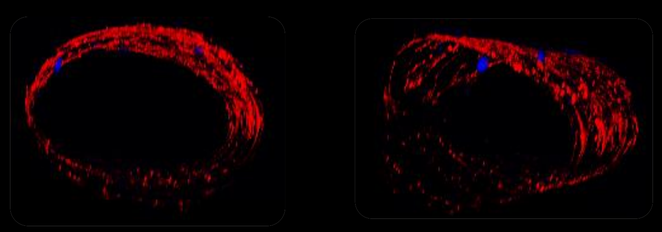
Continuous endothelium



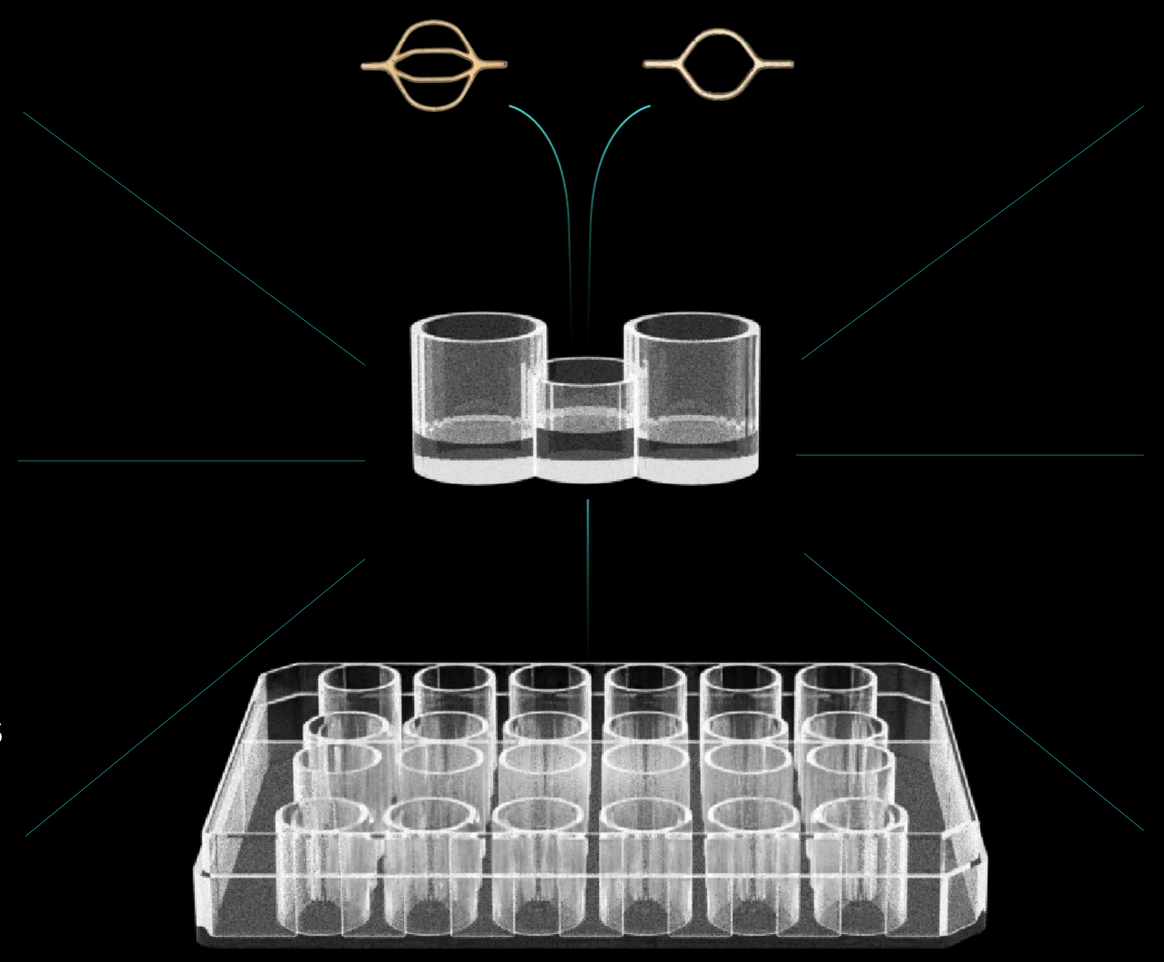


CD31 / Collagen IV / Nuclei; Gelatin methacryloyl 5%

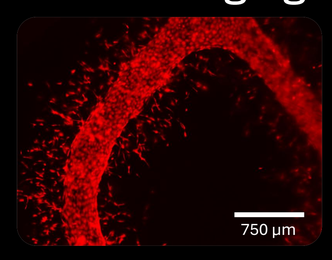
Suspended barrier-free channels

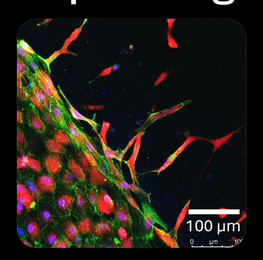


F-actin/Nuclei Fibrin 10 mg/ml



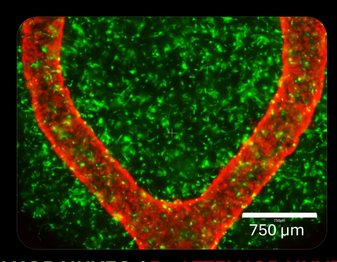
Angiogenic sprouting

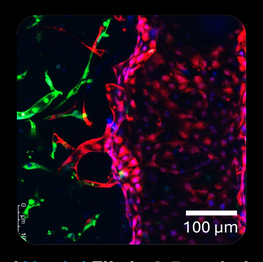




F-actin / Red TTFLUOR HUVEC / Nuclei Fibrin 2.5 mg/ml, d7

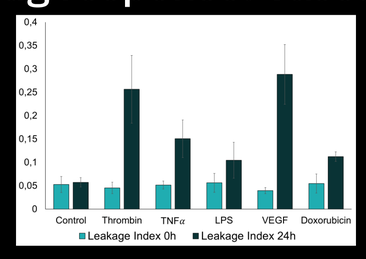
Cell-laden matrix & anastomosis





TTFLUOR HUVEC / Red TTFLUOR HUVEC / Nuclei Fibrin 2.5 mg/ml

Drug response: vascular leakage





FITC-Dextrane (70 kDA)

Current developments

Inserts/ frames



TEER-measurement



Unidirectional perfusion-chip



Outlook: Freestanding interconnected channels

Suspended, stable channels based on a biological matrix (GelMA)

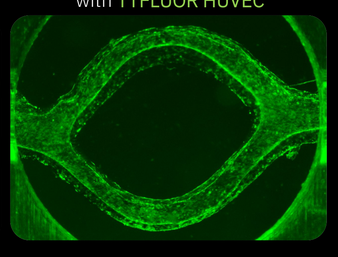
Tight channel in PBS



Porous channel in PBS



Porous interconenncted channel with TTFLUOR HUVEC



- ✓Compatibility to soft matrices like Matrigel, pure collagen and even media
- ✓Interconnection between organoid and bloodvessel in development
- ✓Even simpler protocol – Removal of the sacrificial scaffold is not needed anymore

Interested?

We are a translational project looking for collaborators, testers and feedback.



Feel free to contact us!

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European Innovation Council

Funded by the European Union

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