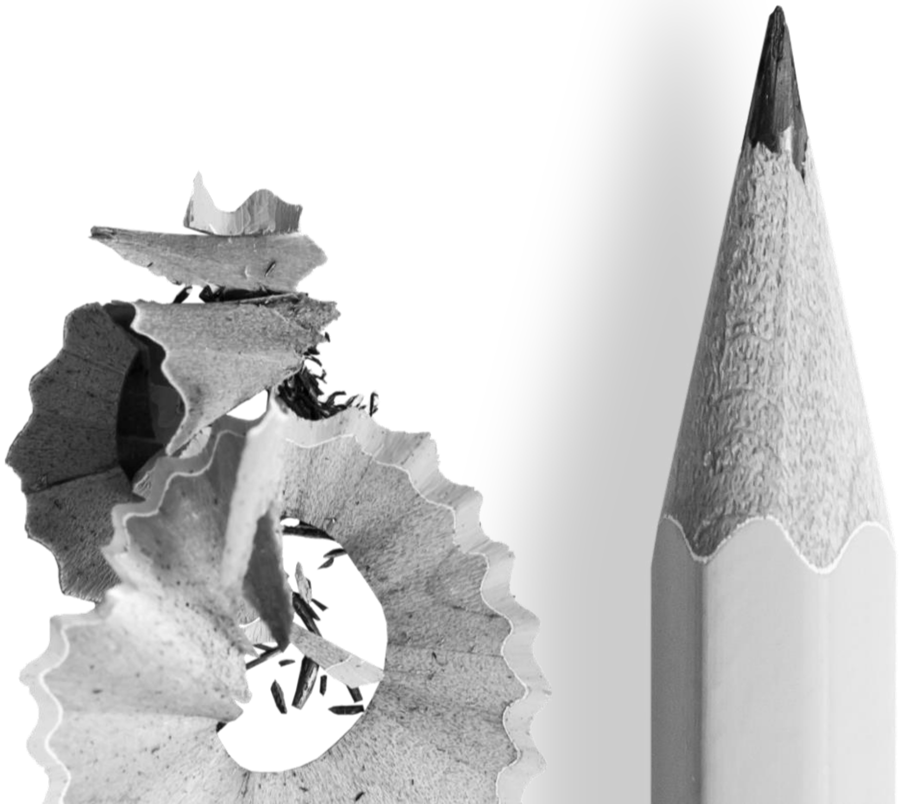
upnano

upscaling nanofabrication

EPIC

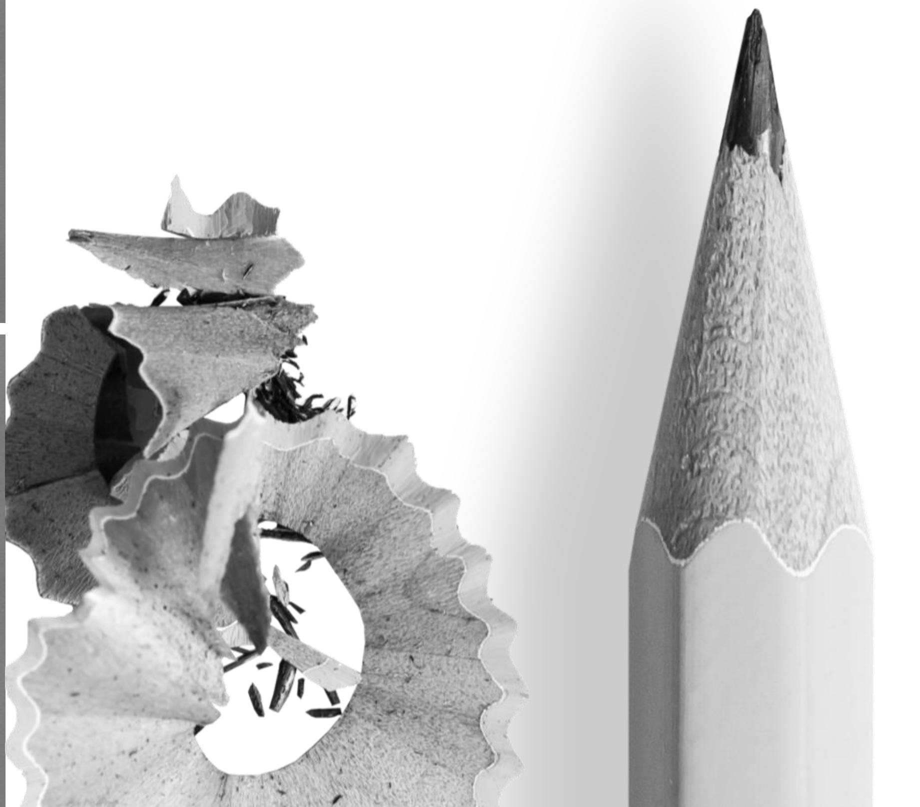
September 26th, 2023

Take a **pencil**.
Sharpen it.



Take a **pencil**.
Sharpen it.
And **3D print a castle** on the tip of it.

The miniaturized-castle has dimensions of 230 x 250 x 360 μm and was printed in less than 6 min.



Resolution Range

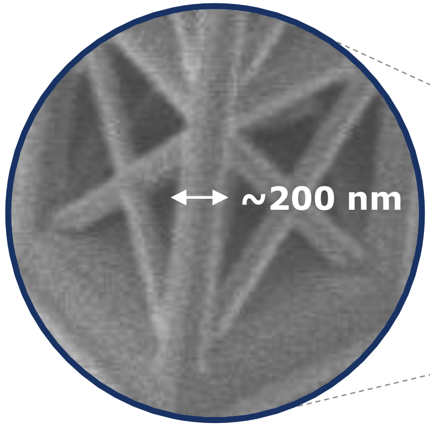
Printing from Nanometer Scale to Centimeter Scale

Resolution Range Across 15 Orders of Magnitude in one Machine

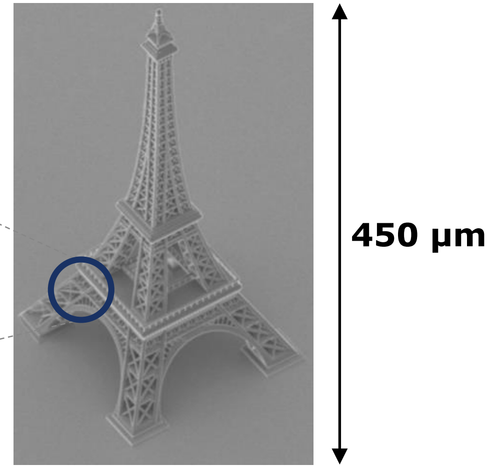
UpNano's optic engine allows for

- Printing of ≥170 nm small ultrafine structural details and
- Microparts with a hight of 40mm

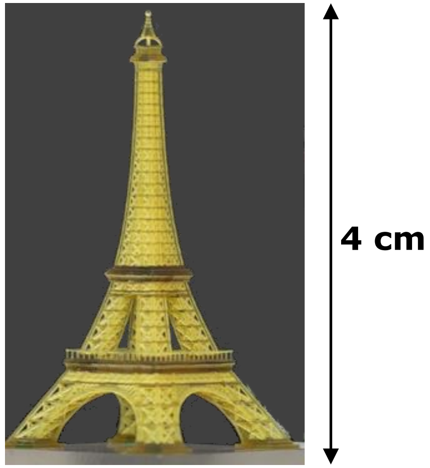
all in one machine



Electron microscope image



Electron microscope image



Actual size

100 nm **10 µm** **100 µm** **1 mm** **10 mm** **40 mm**

Smallest to biggest structure: >1,000,000,000,000,000 x higher volume


upnano

NanoOne

a platform technology

The innovation of the NanoOne platform lies in the perfect interplay of the NanoOne, the Think3D user software and the proprietary printing resins.

HARDWARE

SOFTWARE

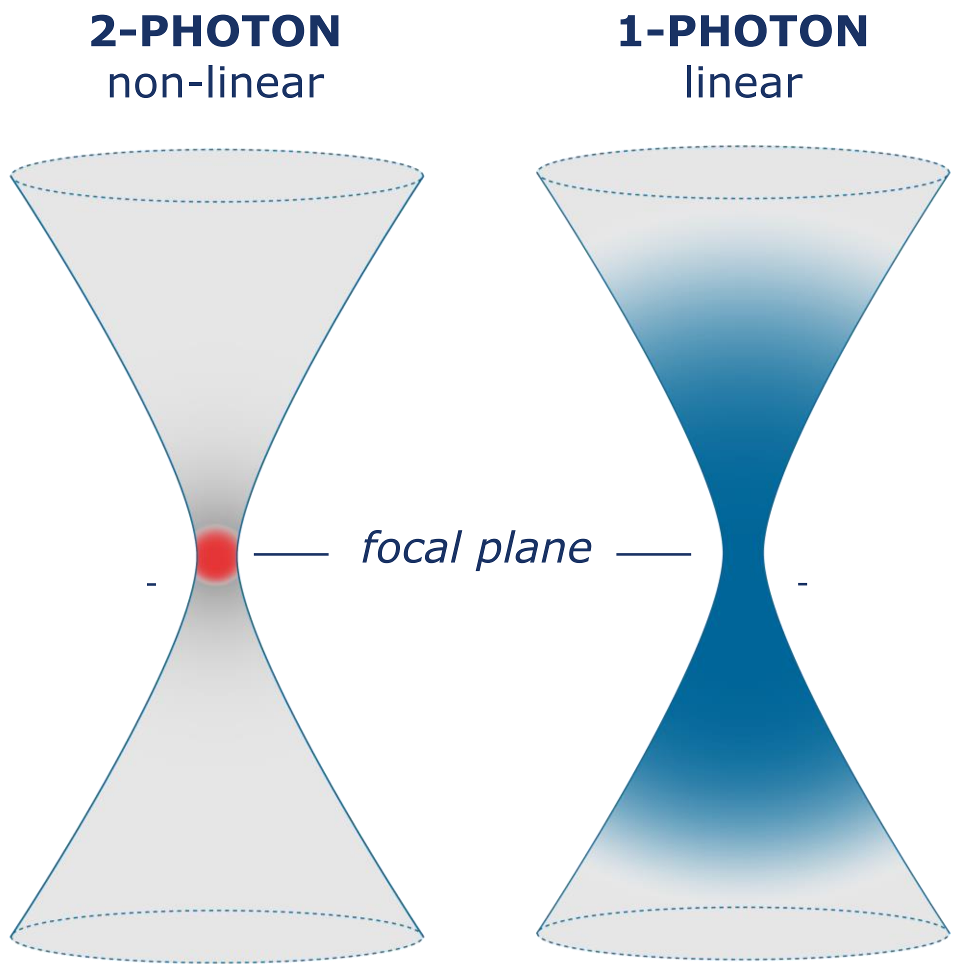
PRINT RESINS

2-Photon Polymerization

based 3D printing systems

The non-linearity of the process leads to printing only at the focal point of the optics, allowing structural details in the 100-nanometer range to be realized.

Unlike classical SLA processes, which are based on a linear process and therefore the resolution is determined by the layer thickness of the applied resin.



3D Bio printing

2 principle concepts

Printing with biocompatible materials.
Seeding with cells after print process

Printing in the presence of living cells

Biocompatible

printing resins

non-cytotoxic biocompatible resins
EN ISO 10993-5:2009. c

upphoto upopto upflow upblack upthermo

3D printing
with living cells

The Bio Unit provides a native, stress-free environment for live cells during the printing process. This allows the cells to be embedded into the printed structure.

HEATING SYSTEM
Ambient temperature to 45°C ± 0.05°C

HUMIDITY CONTROLL
Actively humidified 20-90% ± 0.1%

GAS INCUBATION SYSTEM
CO_2 concentration 0-15%


nano One bio
High-resolution 3D-bioprinting

Bioprinting

with resins from Bio Inx

Gelatine-based and synthetic, technical hydrogels as well as biodegradable polyester-based materials*

The Hydrobio material is crystal clear for microscope use.

INX

HYDROBIO INX© U200

HYDROTECH INX© U200

DEGRAD INX© U100

* All materials certified according to EN ISO 10993-5:2009.

Compatible
bio-substrates

µ-DISHES
in different format

MICROFLUIDIC CHIPS
commercial or custom-made

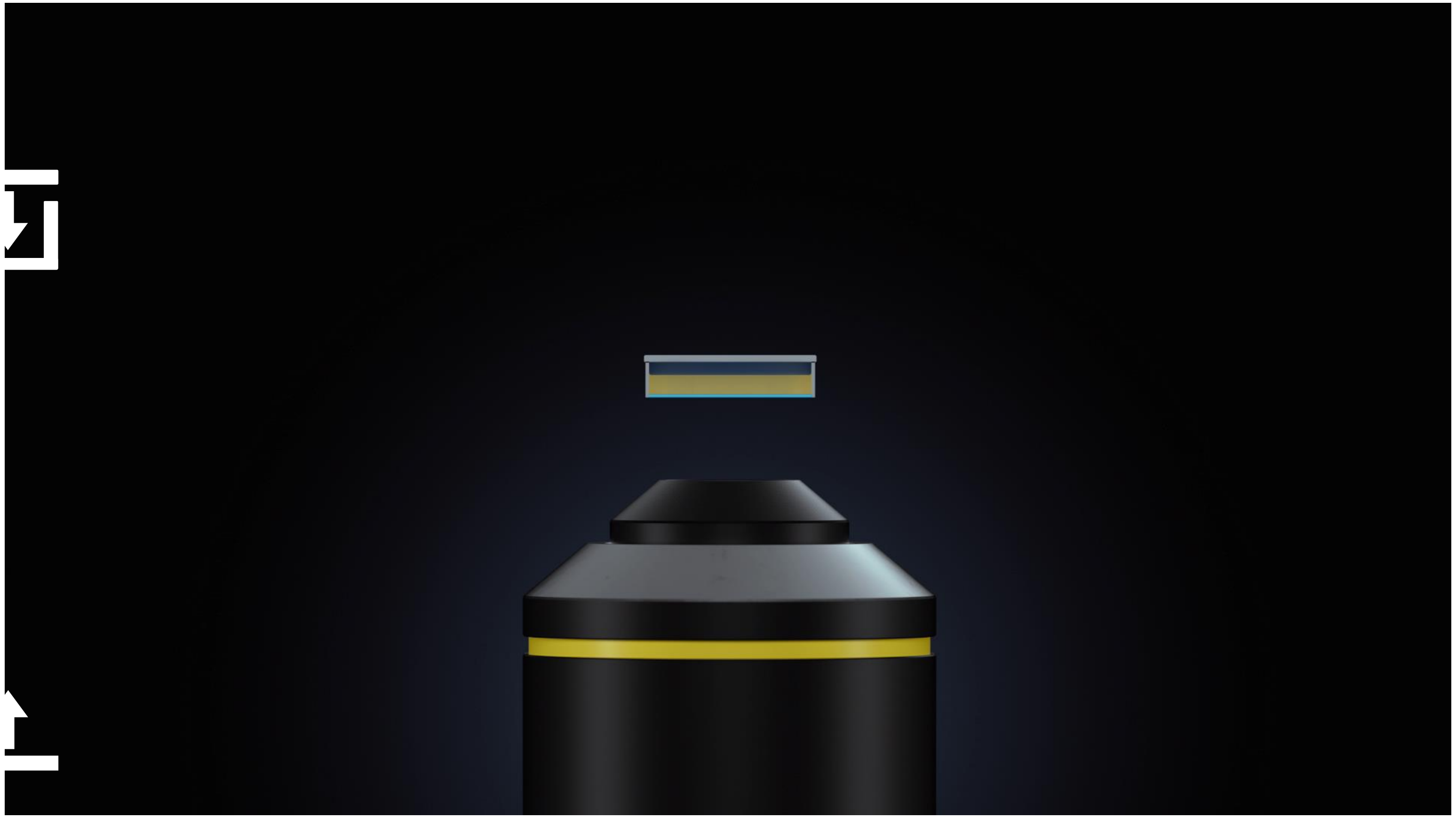
PETRI DISHES
Ø20 – 74mm

WELL-PLATES
with 384, 96, 48 etc. wells

Dip-in-free
printing process

Bottom-up Mode

With the bottom-up mode it is possible to produce high-resolution structures directly within a substrate.



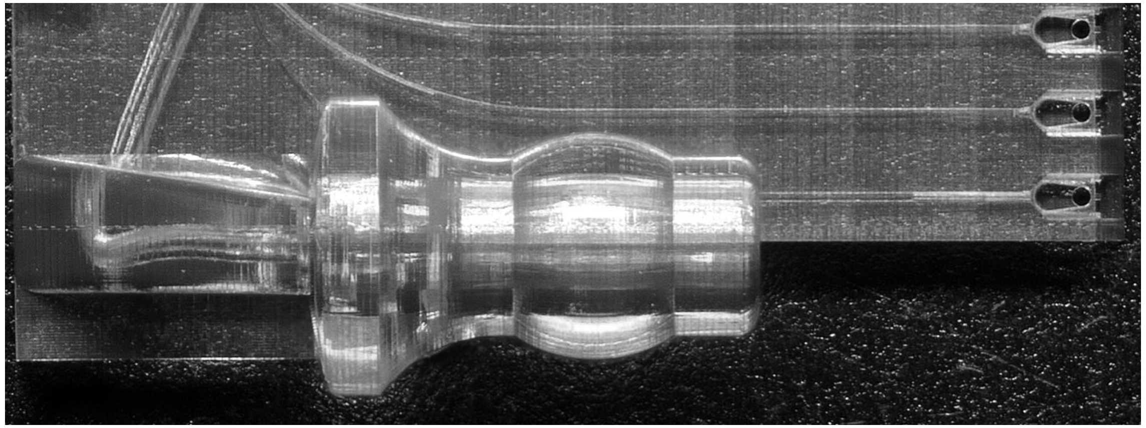
Case Study

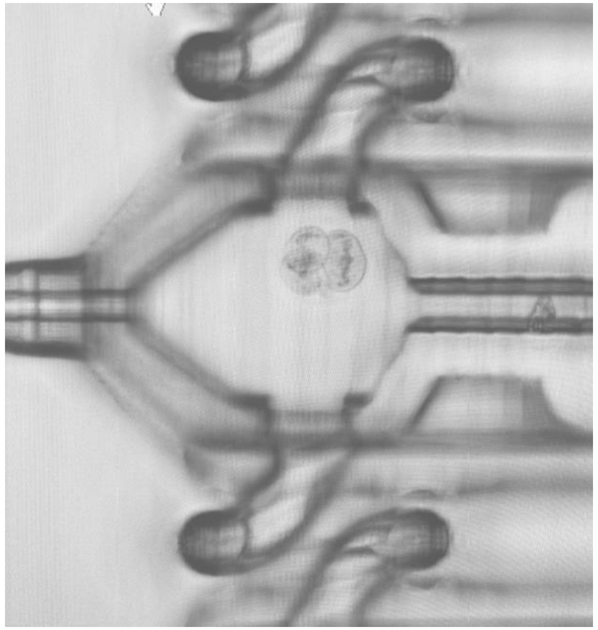
Microfluidic for IVF

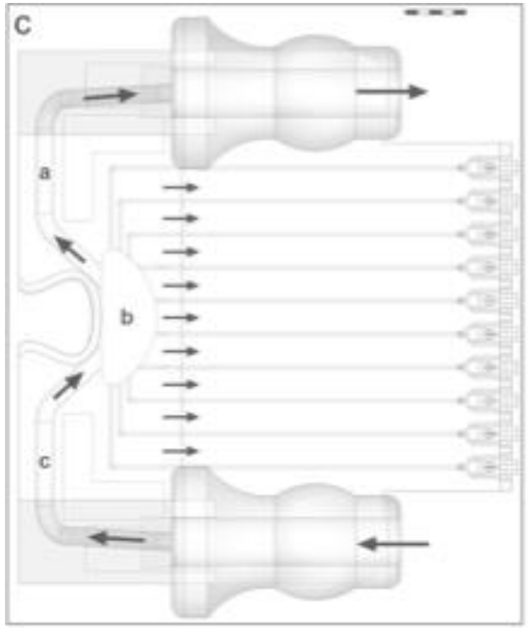
Largest microfluidic chip ever printed entirely from 2PP (8.8 mm x 8.2 mm x 3.6 mm) with <50 mm channels for low flow rates of ~ 600 nL/min per channel.

Device designed to optimize nano-flow mixing and modeling of the natural micro- environment for embryo selection in IVF.

”UpOpto” was used to create these devices, it is highly transmissive to visible light and suitably stiff to create rigid structures, while still being sufficiently flexible under elastic strain (enable nozzle insertion within the embryo nest).







Scientific Reports 2023; 13:562.

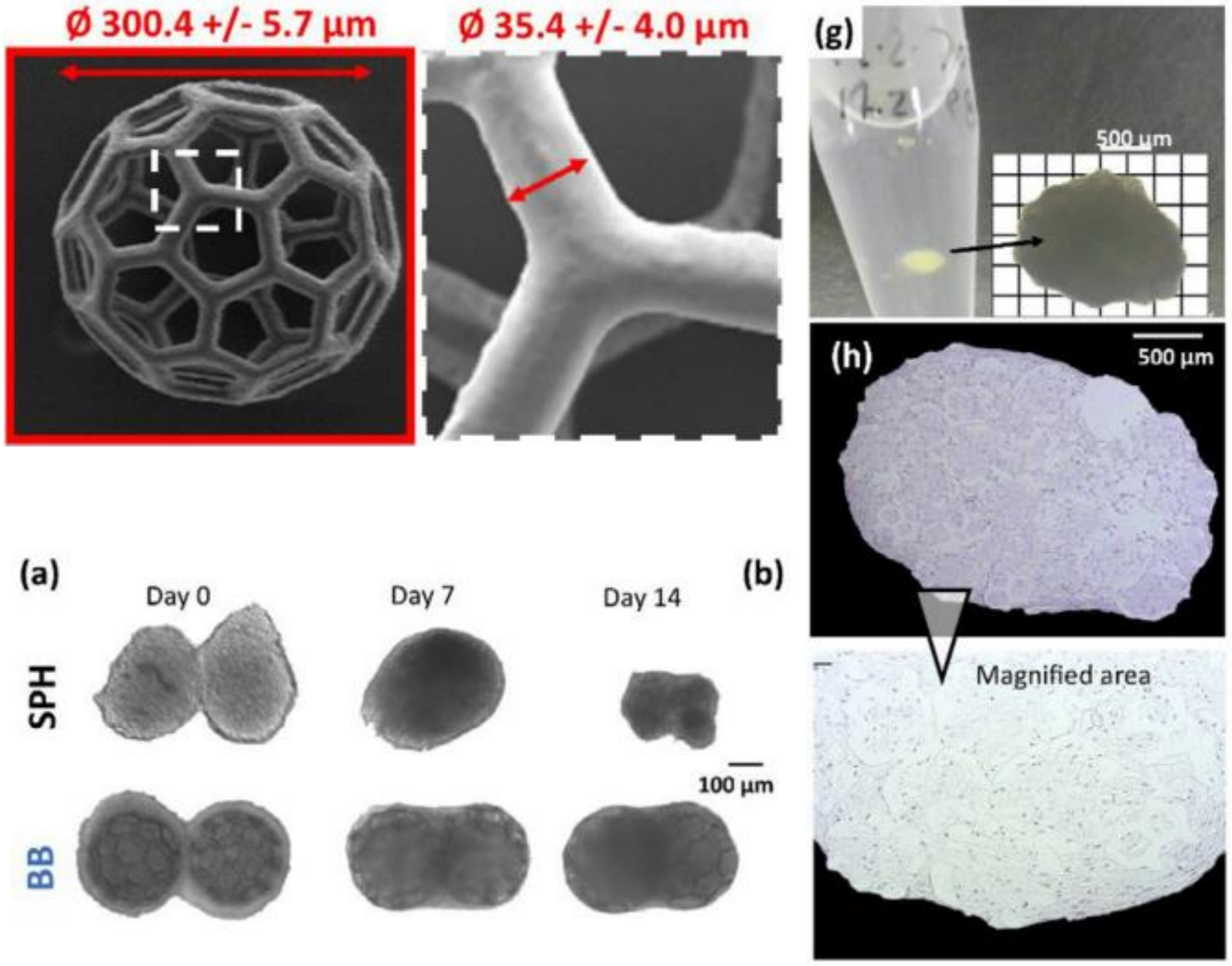
Case Study

Microscaffolds as modular tissue units

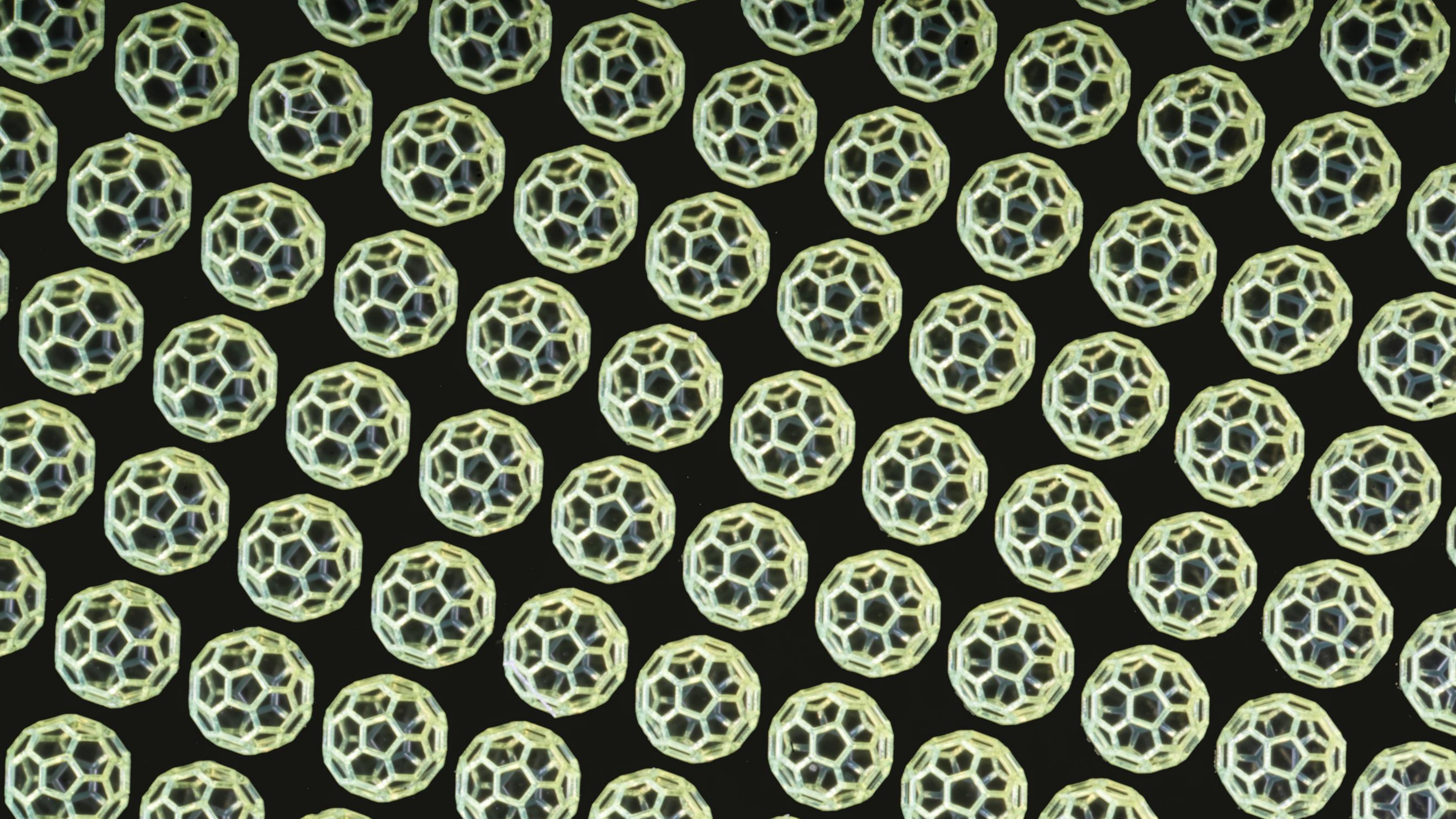
Microscaffolds with a strut size of 35 µm have been printed using a biodegradable PCL-based resin (Degrad INX U100, BIO INX).

The scaffolds have been populated with human adipose-derived stem cells (hASCs) and it has been shown that they are viable, are able to form spheroids and can retain their differentiation potential.

Cells cultured in the microscaffolds can retain their shape over a couple of weeks in culture and can be used to form millimeter large tissue constructs.



Guillaume et al. (2023), Acta Biomaterialia, https://doi.org/10.1016/j.actbio.2022.03.010



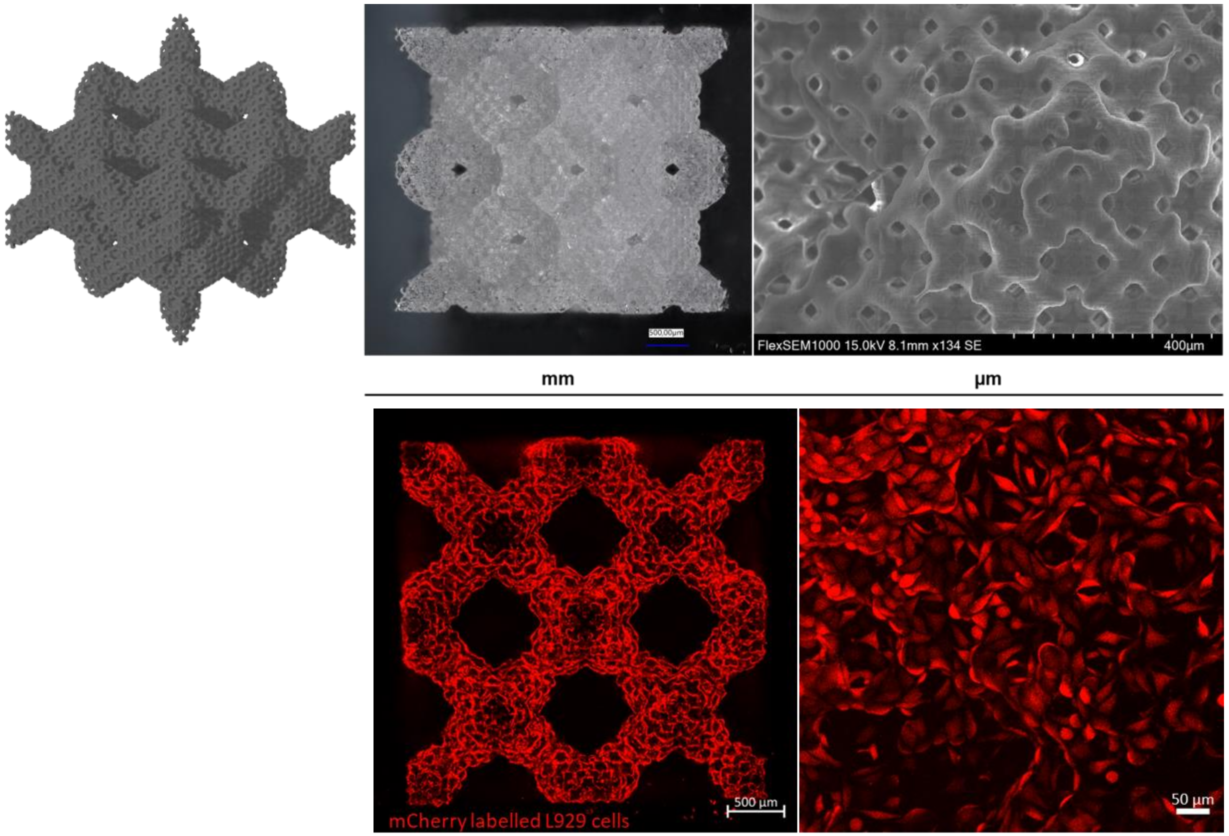
Case Study

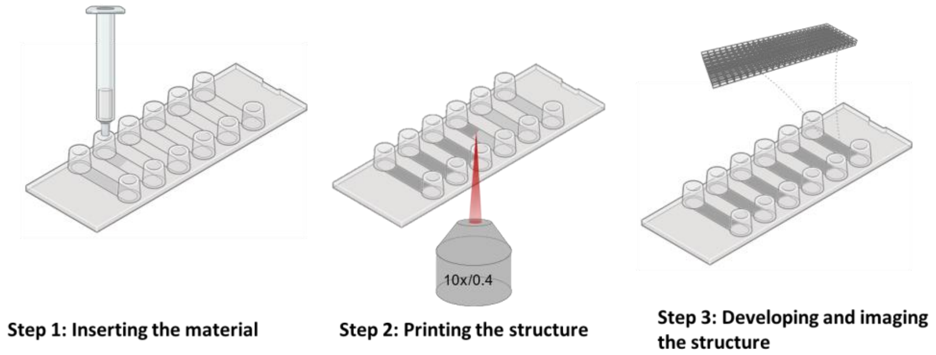
Microscaffolds for T cell cultivation

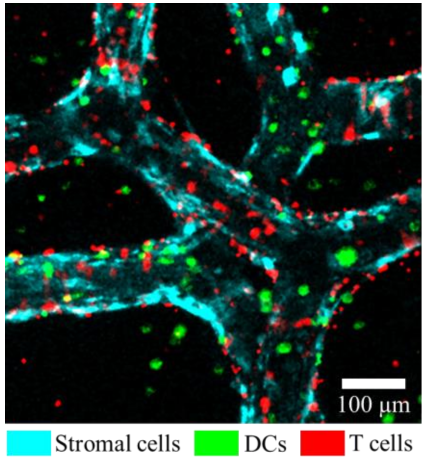
A hierarchical fluorite lattice with a respective pore size of 450 µm and 35 µm in the two levels of hierarchy has been printed in a biocompatible, transparent and low fluorescent polymer.

Cells have been seeded onto the scaffold an they are homogeneously populating the surface.

The scaffold was printed inside an injection molded microfluidic chip and T memory stem cells (T_{SCM}) have been generated.







Unpublished data

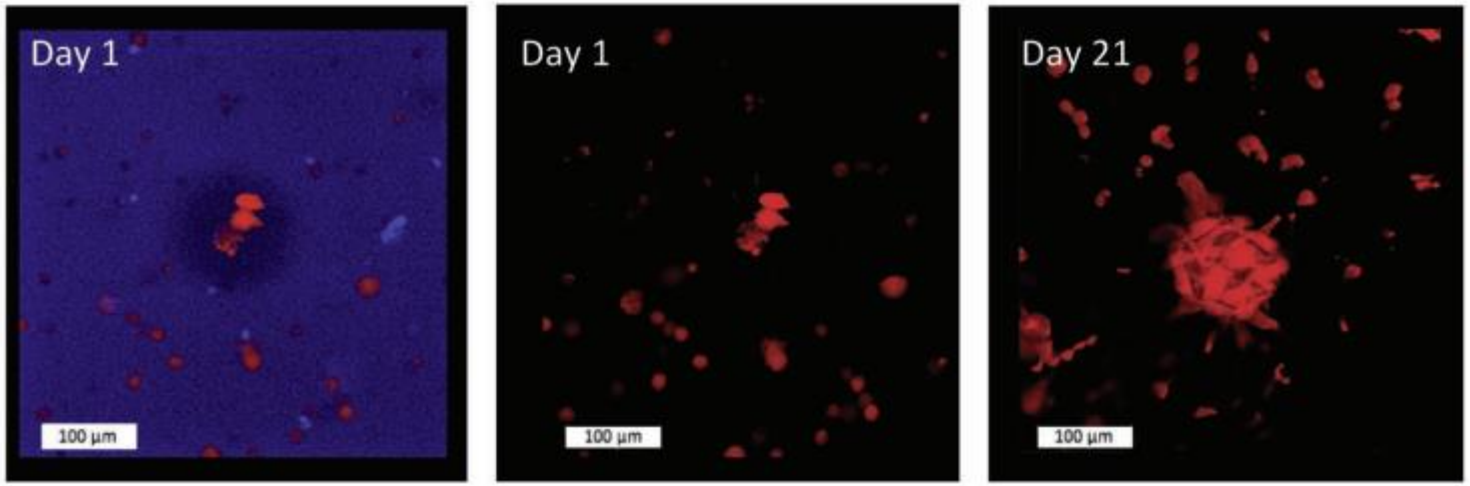
Case Study

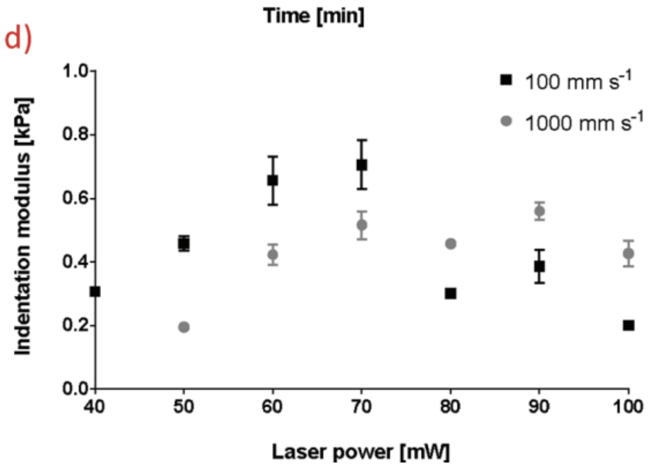
Stiffness gradients Printing in the presence of cells

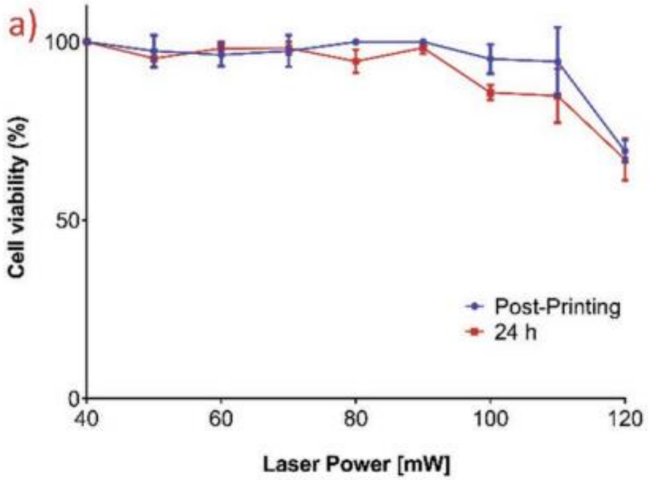
Fibroblast cells have been encapsulated in a gelatin-based hydrogel with 2PP.

The influence of the process parameters on the indentation modulus has been measured and it can be adjusted between 0.2 and 0.7 kPa.

Gradient 3D constructs are produced, and the morphology of the embedded cells is observed over the course of 3 weeks.







Dobos et al. (2019), Advanced Healthcare Materials, https://doi.org/10.1002/adhm.201900752

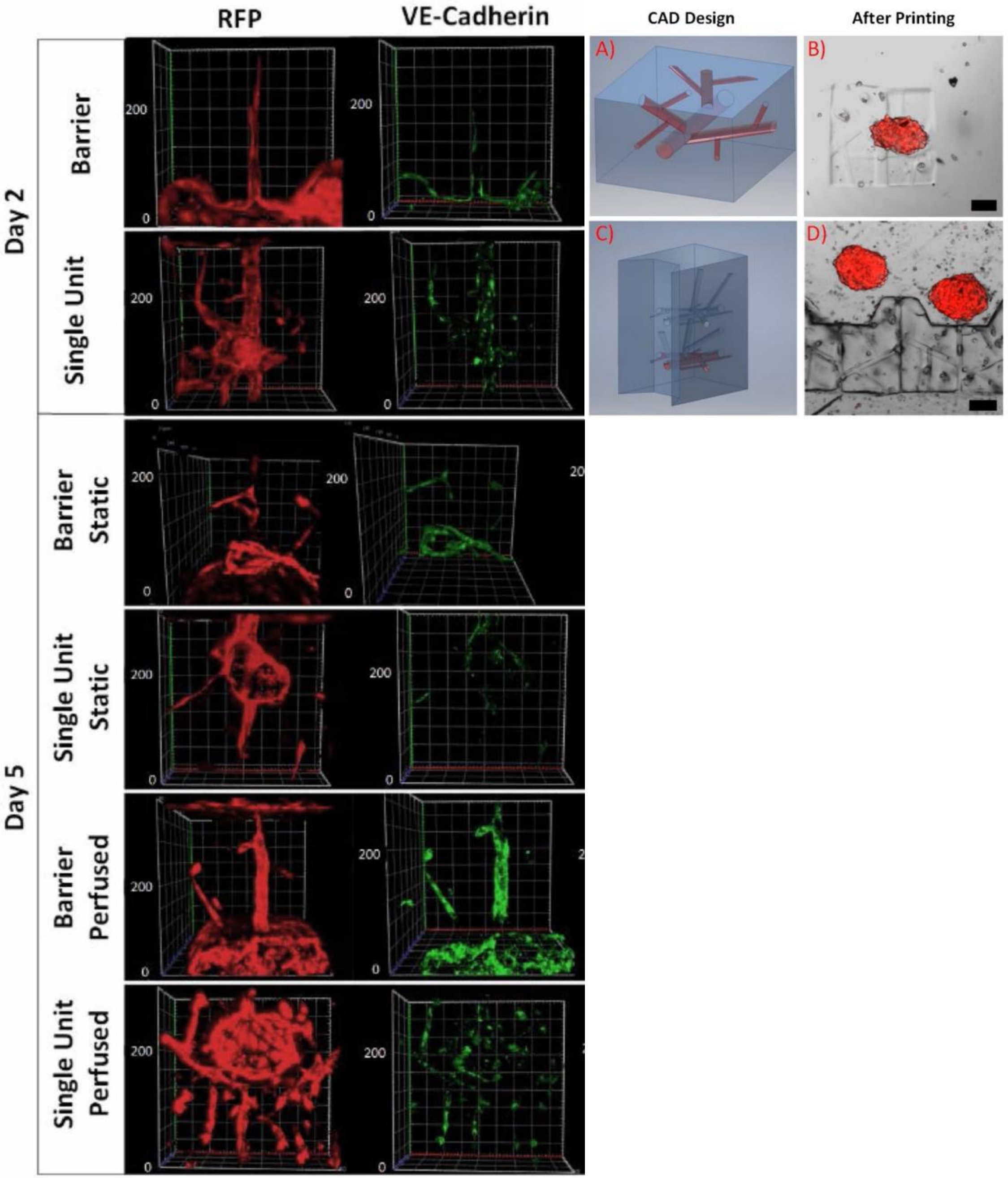
Case Study

Bioprinting of Microvascular Structures

In this work, 2PP enabled the researchers to fabricate a complex microvascular network with a smallest channel diameter of 10 µm.

2PP of microvascular structures directly on-chip was done using a thiol-ene photo-click hydrogel consisting of thiolated gelatin (Gel-SH) and gelatin-norbornene (Gel-NB.

A co-culture of human umbilical vein endothelial cell spheroids (HUVEC) with adipose derived stem cells (ASC/TERT1) as the supporting cell line was used.



Dobos et al. (2021), Biofabrication, https://doi.org/ 10.1088/1758-5090/abb063

The New York Times

What Is This? A Handbag for Ants?

The Microscopic Handbag by MSCHF takes the tiny-purse trend to the extreme. To see it, you'll need a microscope.

The New York Times

2PP is not only high-tech

but also, high-fashion!

As an innovation leader in the field of high-resolution 3D printing
we see it as our mission to upscale nanofabrication.

Modecenterstrasse 22/D36 | 1030 Vienna | Austria
www.upnano.com | office@upnano.com | +43 (0) 1 8901652