## Project 3.16 Microfluidics-assisted precision printing of granular hydrogels for applications in tissue engineering

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## **Background:**

Granular hydrogels, that is dense suspensions of hydrogel microbeads, serve as excellent scaffolds for tissue engineering because they can be easily manipulated, injected, aspirated, molded, or printed. Due to their porous nature, cell culture media can also efficiently perfuse them to provide nutrients and oxygen to the encapsulated cells or tissues. Despite significant progress in the bioprinting of granular bio-inks, precision bioprinting--warranting control over individual grains--is still to be demonstrated. Such control would open the way to unprecedented applications, e.g., in high-throughput drug testing, wherein individually printed grains could serve as separate bioreactors and be monitored continuously for assessment of the drug efficacy over time. In particular, the biological assays based on precision-printed microscopic beads encapsulating miniature cancer tissues (mini-tumors) would significantly accelerate the development of anti-cancer therapeutics—with applications both in the pharmaceutical industry and in personalized cancer medicine.

## Aim:

The project aims to develop (i) a microfluidic printhead capable of extrusion printing cellladen hydrogel microbeads one by one and (ii) a 2D-printed microgel-based assay for highthroughput screening of anticancer therapeutics. The optimized geometry of the printhead will also be exploited for the fabrication of microgel aggregates as a new tool in the engineering of tissues consisting of several types of cells.

## **Requirements:**

- Requirements include: experience in mechanical, electrical, or chemical engineering,
- laboratory skills including the ability to build experimental setups,
- basic experience in programming and lab automation,
- previous experience in microfluidics or 3D printing will be advantageous but is not obligatory