

SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

3D Printing by Drop on Demand

The concept is simple: develop a 3D printer that uses droplets of bio-compatible materials to print scaffolding structures where cells can grow. The final aim is to develop a method to manufacture organs and/or organoids.

Aims:

1. Develop and characterize an additive manufacture method for bio-gels.
2. Find the optimum/appropriate conditions for the (3D) printing of cells and scaffolding materials.
3. Develop a reactor to maintain and control the physiological-relevant conditions of the printed structures.
4. Apply the findings to various cells and organs, including brain cells and skin samples.

The Laboratory of Applied Science hosts a range of advanced fluidic devices and inkjet printing methods, including setups to print cells and gels. Conventional droplet generators can only jet liquid materials within a very narrow range of liquid properties and with very small loadings of particles (~10 %). These restrictions make inkjet not ideal for bio-applications. However, we have developed a series of novel drop on demand systems that can effectively jet high viscosity liquids and heavily loaded colloids. Our projects aims to implement these printing capabilities in to medical applications. This project offers a good combination of bio-engineering (cell development, attachment and characterization), instrumentation/engineering (computer control, design, electromechanics) and physics (fluid mechanics).

2. Project Scope

- Develop an additive manufacturing setup to print cells.
- Develop 3D printing protocols for the printing of cell structures.
- Develop a liquid droplet system to deliver liquid media to cultured.

3. Desired Skills from the Student

- Basic background in electronics & coding is desired but not compulsory.
- Experience in Laboratory work (physics or engineering) would be advantageous.
- Interest in experimental physics and engineering. A good degree in Engineering, or Bio-engineering, or Physics is required.

- Experience writing reports and/or scientific papers would be advantageous.

4. Supervisory Team

Primary: Jose Rafael Castrejon-Pita (S. Lecturer, PhD).

Secondary: Rosalind Hannen (Fellow, PhD) The Blizard Institute