

MATERIALS SCIENCE AND TECHNOLOGY

PNRR/PNC Salute - 3D bioprinting: organ-on-a-chip models for drug screening

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584]
Supervisor	PIRRI CANDIDO - fabrizio.pirri@polito.it
Contact	NAPIONE LUCIA - lucia.napione@polito.it FRASCELLA FRANCESCA - francesca.frascella@polito.it
Context of the research activity	<p>This subject focus on the design and fabrication of 3D printable materials, with the choice of monomers that can assure the desired biocompatibility. Moreover, the characterization of the physical, mechanical properties of the printable formulation, and the test of the bioprinted construct in a contest of personalized medicine and biological twin development. This research will be made in the frame of the PNRR project “Digital Driven Diagnostics, prognostics and therapeutics for sustainable Health care”, acronym: D3 4 Health; Spoke 4: “Biological and bioengineered in vitro models for care through Digital Twin approaches”.</p> <p>Progetto finanziato nell'ambito del PNC Salute - Avviso n. 931 del 6/6/2022 - PNC0000001 Digital Driven Diagnostics, prognostics and therapeutics for sustainable Health care (D3 4 Health) - CUP B53C22005980001</p>
Objectives	<p>The research program of the Ph.D. candidate is in line with the research topics covered by the Spoke 4 on the development of biological and bioengineered in vitro models, and more specifically it is expected to contribute directly or indirectly to TK4.3 - Organ-On-Chip, TK4.4 - Microfluidic barrier models, and/or TK4.5 - 3D Bioprinting.</p> <p>Bioprinting is a multidisciplinary research field that brings together engineering, medicine, biology, physics, chemistry. Functional materials and micro-nanotechnologies for biotech and biomedical applications have produced several success stories at Politecnico di Torino, because of the establishment and growth of several research groups in the field. The subjects covered have a strong international importance. Traditional in vitro culture models are unable to fully reflect the organ microenvironment owing to the difference in terms of cell morphology, protein expression, cell–cell and cell–matrix interactions, and drug response. By contrast, the flexibility of bioprinting modes allows deposition of biomaterial–cell spheroid–tissue in any free-form-inspired complicated 3D structures on the chip, creating cell</p>

culture models tailored for studying cell–cell and cell–matrix interactions. In this framework, bioprinting is a revolutionary technology to assemble scaffolds for growing tissues. Organs-on-a-chip is a useful platform with widespread applications mainly in drug screening and pathological studies. Organ-on-a-chip models are created to recapitulate the structural, micro environmental and physiological functions of human organs. Recently, bioprinting has been applied to fabricate organ-on-a-chip models owing to its ability to print multiple materials and cell types simultaneously with good spatial resolution and reproducibility. This enables the creation of a biomimetic microenvironment with heterogeneous 3D structures. Functional structure and materials can be printed directly enabling fluid flow for transport of nutrition, gaseous exchange and removal of waste.

**Skills and
competencies
for the
development of
the activity**

Working on new approaches for biological twin development and testing requires a multidisciplinary skill set encompassing, biomaterials, cell and molecular biology, microfluidics, data analysis, collaboration, problem-solving, ethical considerations, and a commitment to continuous learning. By combining these competencies, candidates can contribute to the advancement of this exciting and promising field. The optimal candidate should have previous direct experience of 3D printing, on in vitro cell cultures and in vitro cell experiments with biomaterials.