BIOENGINEERING AND MEDICAL-SURGICAL SCIENCES

Ammin/DISAT - 3D bioprinting: lifelike 3D in vitro models for drug screening

Funded By	Dipartimento DISAT Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	This subjetc focus on the design and the fabrication of 3D printable materials with the choice of monomers that can assure the desired biocompatibility. The characterization of the spectroscopic, and mechanical properties of the printable formulation and the study of this bioprinted construct for drugs testing in a contest of personalized medicine and biological twin development.
Objectives	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 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	In summary, 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.