3D Bioprinting using decellularized extracellular matrix bioinks

Background
3D bioprinting is an efficient tool to fabricate constructs with hierarchical architecture similar to native tissues, opening new opportunities for tissue engineering and development of 3D in vitro advanced tissue models. In this context, the composition and formulation of the bioink are crucial, as they greatly influence the biological and mechanical properties of the 3D printed construct, and thus the cellular response. Bioinks are composed by biomaterials, bioactive molecules and cells. The material part usually consists in hydrogels, obtained either from synthetic or natural polymers, with adequate mechanical and biological properties to be extruded, to achieve fast gelation at physiological pH and temperature, and to be suitable for cell encapsulation, adhesion and growth. In the field of natural polymers, decellularized extracellular matrix (dECM), obtained from the decellularization of tissue extracellular matrix, is a promising candidate. Indeed, decellularization preserves ECM structure and composition, while removing the cellular components, which permits to give cells a physiological 3D environment. However, 3D bioprinting of dECM remains challenging, and only a few studies report the use of dECM hydrogels as bioinks.

Project description
In our group, we are developing dECM bioinks with controlled mechanical properties, for applications in tissue engineering or in vitro cancer modeling. The goal of this multidisciplinary project will be to adjust different formulations of the bioink, and study cells encapsulation and survival after printing, depending on the rheological properties of the bioink and mechanical properties of the printed construct. Rheology, mechanical testing, optical and electronic microscopies will be used for the study of the bioink and printed constructs, as well as cell culture techniques for the study of cell viability. Students with expertise in biomedical engineering, material science, or with background in biology are welcomed to apply.

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