Research Project Proposal
Academic year 2021-2022
Máster en Investigación Biomédica

Project Nº 11 ASIGNADO

Title: Bioorthogonal modification of natural polymers for the development of new biomaterials for tissue engineering

Department/ Laboratory
CIMA, 1.01 lab

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Summary: Short summary of the project with a maximum extension of 250 words, including the goals and the methodology that will be used.

Advancement towards the *in vitro* fabrication of bioartificial tissues relies heavily on developing new materials capable of supplying a 3D structure to cells. Being one of the most promising types of materials, physical properties-tuneable hydrogels rely on external stimuli, be it light irradiation of chemical initiators, to form a crosslinked network. However, the presence of side reactions with chemical groups present in cells limit their applicability. Biorthogonal chemistry arises to provide strategies capable of working under mild (biological) conditions, with no reactivity to groups present on cells. Therefore, biocompatibility is enhanced. This project aims at synthesising and characterizing a library of new formulations derived from the natural polymers cellulose and keratin, able to crosslink under biorthogonal conditions. Next, capacity to form gels will be assessed, as well as biocompatibility with different human primary cells (osteoblasts, chondrocytes and fibroblasts). On a step forward towards the generation of advanced human engineered tissues, human induced pluripotent stem cells (hiPSCs) will be differentiated to cardiomyocytes and cardiac fibroblasts (CMs and cFibs) through small molecule-based modulation of the Wnt pathway. hiPSC-CMs will be isolated, and biocompatibility tested with the new hydrogels. Next, capacity to form self-standing beating constructs will be determined. Finally, to better comply with the natural properties of cardiac tissue, scaffolds will be 3D printed using melt electrowriting (MEW), a 3D printing technology with the capacity to print the smallest fibres. hiPSC-CMs will be embedded in the biorthogonal hydrogels and crosslinked on the MEW scaffolds, with different architectures. Throughout the project, the candidate will acquire training on chemical synthesis, cell biology, hiPSC culture and differentiation, MEW, as well as a range of analytical techniques, including RT-qPCR, IF, FACS and confocal microscopy amongst others. A highly interdisciplinar thinking capacity and self-motivation is required for this enterprising project.

yes	
no	x

Does the project include the possibility of supervised animal manipulation to complete the training for animal manipulator?