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CASE STUDY: 3D Bioprinting with PeptiGels® Offer Enhanced Printability and Cell Viability

Manchester BIOGEL

The Challenge

3D bioprinting is an emerging field in regenerative medicine where the aim is to produce cell-laden, three-dimensional structures to mimic bodily tissues. This has an important role not only in tissue engineering, but also in drug delivery, drug discovery and cancer studies.

The key limitation, however, is the development of an optimal bioink; i.e. one that enables the geometrical accuracy of the printed constructs, post printing mechanical stability, as well as long term cell viability.

The Solution

Synthetic, chemically defined peptide hydrogels, PeptiGels®, have shear thinning properties, hence they can be injected, and printed, and recover their structural integrity immediately after removal of shear. PeptiGels® also have tuneable mechanical properties, do not need physical or chemical post processing post printing and they are particularly adept at promoting cell attachment, proliferation, and differentiation.

The Science

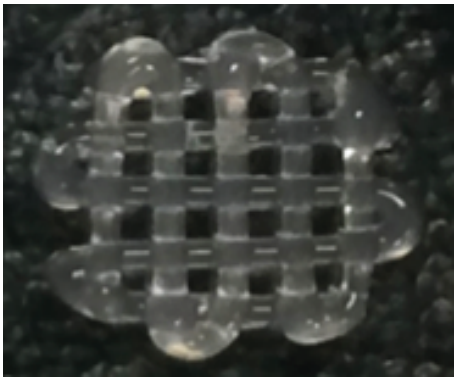
Dr. Marco Domingos and co-workers from The University of Manchester have used PeptiGels® of variable stiffness to print cell laden constructs. They have explored and optimised the printing process parameters, namely extrusion pressure, nozzle diameter and valve opening time, before exploring the ability of the system to print cell laden constructs of mammary epithelial cells using PeptiGels® with variable stiffness. Any impact of the shear stresses induced by the extrusion-based pressure on the viability of the cells was explored via live/dead assays over a period of seven days in cell culture.

READ MORE
Raphael, B., et al. Materials Letters. 2017;190:103

PeptiGels® offer excellent compromise between the physicochemical (rheological) and biological properties of the printed structure to ensure it retains its structural integrity in addition to a high cell viability.

Dr Marco Domingos
Senior Lecturer at The University of Manchester

The Results



Complex structures laden with mammalian epithelial cells were successfully printed using PeptiGels® and a commercially available extrusion bioprinter (Figure). Results revealed structures could be printed with a high structural integrity and geometrical/dimensional accuracy of the printed cell laden constructs. The printed samples were subsequently cultured for seven days after which the number of viable cells remained high and had started to proliferate for all stiffnesses of PeptiGel®. This confirmed that the conditions the epithelial cells were subjected to were not detrimental to their health and thus PeptiGels® demonstrating the feasibility of the system to print 3D matrices and tissues.

The Future

PeptiGels® have successfully demonstrated their ability to offer enhanced printability and cell viability highlighting their suitability for use as a bioink for 3D bioprinting.