100e Design of a Biomimetic, 3d Scaffold Suitable for Different Tissue Engineering Applications

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Scaffolds for tissue engineering have been created using a wide variety of techniques and materials. Poly (alpha-hydroxy esters) are widely used due to their degradation characteristics and mechanical properties. Nevertheless, these polymers posses a hydrophobic and inert nature that affects cell-matrix interactions. Thus, the creation of a construct that can mimic the in vivo molecular environment is crucial for the formation of efficient constructs for tissue engineering. In this study, we prepared a flexible, biomimetic 3D scaffold by entrapping poly (L-lysine) (PLL) in the surface of poly(L-lactic acid) (PLLA) foams in a controllable fashion. PLLA scaffolds were made by particulate leaching, using sodium chloride as the porogen. Poly (L-lysine) was physically entrapped in the surface by soaking the scaffold in acetone, and then in a solution of PLL under vacuum. N-Succinimidyl-3-(2-pyridyldithio) propionate (SPDP) was attached to the PLL and activated with dithiothreitol (DTT) for further incorporation of fluorescein-5-maleimide. Fluorescence microscopy showed a homogeneous distribution of the PLL throughout the surface of the scaffold porous network. We were also able to control the amount of entrapped PLL.

By using different linkers, such as degradable polypeptides, this stable modification can be used to attach different molecules specific for a wide array of tissue engineering applications. We have been able to incorporate an arginine-glysine-aspartic acid-cysteine (RGDC) sequence by modifying the PLL with an NHS ester. X-ray photo spectroscopy corroborated the presence of the RGDC on the surface pf the scaffolds. Mesemchymal stem cells (MSC) were seeded on the RGD-modified surface (unmodified scaffolds were used as controls). Enhanced cell attachment was observed on RGD-modified surfaces, with cells showing improved cell-matrix interactions translated into better cell spreading and higher number of cells attached.