

P015 3D Cell Culture of Chondrocytes on Modified Di-Phenylalanine Scaffolds

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The design of self assembled peptide-based structures for 3D cell culture and tissue repair has been a key objective in biomaterials science for decades. In search of the simplest possible peptide system that can self-assemble, we discovered that combinations of dipeptides that are modified with aromatic stacking ligands can form nanometer sized fibres when exposed to physiological conditions. For example, we demonstrated that a number of fluorenyl-methyloxycarbonyl (Fmoc) modified di- and tri-peptides form highly ordered hydrogels via hydrogen bonding and π - π interactions from the fluorenyl rings. These highly hydrated gels allowed for cell proliferation of chondrocytes in 3D [Jayawarna et al, Adv. Mater., 2006]. We demonstrated that fibrous architecture and physical properties of the resulting materials was dictated by the nature of the amino acid building blocks.

Here we report the self-assembly process of three diphenylalanine analogues, Fmoc-Phe-Phe-OH, Nap-Phe-Phe-OH, Z-Phe-Phe-OH, to compare and contrast the self-assembly properties and cell culture conditions attributable to their protecting group difference. Fibre morphology analysis of the three structures using Cryo-SEM and TEM suggested fibrous structures with dramatically varying fibril dimensions, depending on the aromatic ligand used. CD and FTIR data confirmed β sheet arrangements in all three samples in the gel state. The ability of these three new hydrogels to support cell proliferation of chondrocytes was confirmed for all three materials.