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MAGNETIC MICROGEL ASSEMBLIES FOR INJECTABLE SOFT BIOCOMPOSITES

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We have developed the Anisogel, which is a hybrid hydrogel that can be injected in soft tissues to provide unidirectional guidance. Rod-shaped microgels and short fibers are rendered magnetic by incorporating low concentrations of iron oxide nanoparticles (SPIONs) and align in magnetic fields in the millitesla range. The anisometric elements are fabricated with variable dimensions, aspect ratio, stiffness, and SPION amount. After alignment, surrounding pre-polymer solutions can crosslink into a network to fix the position of the elements after removal of the magnetic field. To understand the physical mechanisms behind the ordering of the soft magnetic elements, experimental data is compared with a model based on the magnetic rotation of an ellipsoidal element dispersed in a Newtonian fluid. This enables us to predict the orientation state and alignment time of the microgels, depending on their design parameters, and the viscosity of the surrounding fluid. When mixed with cells and nerves, the cells align and grow in a linear manner and the fibronectin produced by fibroblasts is also oriented. RGD modification of the microgels further improves the orientation of the cells but significantly reduces fibronectin production. The mechano-sensitive protein yes-associated protein (YAP) shuttles to the nucleus due to the mechanical anisotropy of the Anisogel. Regenerated nerves are functional with spontaneous activity and electrical signals propagating along the anisotropy axis of the material

Biography

L De Laporte has graduated from the University of Ghent as a Chemical Engineer. She obtained her PhD at Northwestern University in the laboratory of Lonnie Shea, where she focused on the development of scaffolds for spinal cord repair. During her Postdoc at EPFL, Switzerland, she worked with Jeffrey Hubbell in the field of regenerative hydrogels and protein engineering. In 2015, she received an ERC Starting Grant to develop the Anisogel, which is an injectable hybrid hydrogel that orients *in situ* to direct cell and nerve growth. Recently, she was awarded with the Leibniz Professorinnen Program, for which she now has a joined position between the DWI–Leibniz Institute for Interactive Materials and the RWTH Aachen, Germany. At DWI, she coordinates the Bioactive and Bioinstructive Materials Research Program. In her research group, synthetic biomaterial constructs are designed for tissue regenerative purposes.

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