

4th Glycobiology World Congress

September 17-19, 2018 | Rome, Italy

Glycoengineering ECM proteins: A new tool for driving cell fate in regenerative medicine

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Biomimetic scaffolds based on the natural components of the extracellular matrix (ECM), possessing ECM-mimicking features have recently emerged as a promising class of biomaterials. ECM-based biomaterials currently used in the field of tissue regeneration include collagen. Collagen-based scaffolds can be designed to work as artificial biomimetic ECM milieu guided tissue regeneration for different tissue engineering applications. It is clear that carbohydrates play fundamental roles in a plethora of biological processes; thus, they appear as invaluable tools for the design of biomaterials for regenerative medicine applications. In fact, when exposed at the interface between material surfaces and cells, they might be able to direct and control cell fate. Different conjugation techniques for material surface covalent functionalization with specific glycan structures will be presented. The results of the interaction between neoglycosylated materials and different cell lines will be outlined, highlighting how glycans may drive cell behaviour, towards different tissue regeneration applications. For example, neoglycosylated collagen matrices drive F11 neuroblastoma cells to differentiate into active neurons, while different sialylated collagen matrices are able to modulate gene expression of mMSC towards chondrogenesis or osteogenesis.

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