Thermogelling biomimetic hydrogel supporting 3D neuronal networks

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Engineered natural biomaterials, able to perform the sol-gel transition in the presence of cells under specific external stimuli, have gained great attention in the field of tissue engineering and regenerative medicine [1], despite of this, for the encapsulation of neurons and the development of 3D neuronal networks, are still limited.

In order to study neuronal (dys)functions and particularly neuronal connectivity*, in vitro* human brain models need to include not only a chemically and physically relevant microenvironment, but also structural network complexity [2]. To mimic the brain ECM environment, a porous and soft structure is preferred in the design of an artificial neural network.

The goal of this study was to demonstrate the versatility of thermosensitive chitosan-based scaffold as an artificial matrix for 3D neuronal networks for in vitro studies and as an injectable-hydrogel for the in-vivo applications or innovative ink for 3D bioprinter. Chitosan is a widely used biomaterial, well known for its biocompatibility, biodegradability, muco-adhesiveness as well as its antibacterial activity [3]. It is already demonstrated that chitosan is able to sustain the development of 3D scaffold for neuronal networks [4]. In this work, chitosan thermogels were fabricated and characterized by different techniques. The scaffold was used to encapsulate primary rat neurons and human-induced neurons cultures to carry out morphological characterization by immunofluorescence techniques and a preliminary electrophysiological characterization of spontaneous activity by Micro-Electrode Arrays.

References

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