An adaptive biomimetic graphene-oxide-collagen scaffold for tissue engineering applications

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During the last few years, graphene has being playing a central role in a wide range of biomedical engineering strategies, including biosensors, brain-computer-interactions and regenerative medicine. In fact, and regarding this last topic, graphene based materials are being increasingly used in tissue engineering (TE) applications due to their capability of combining their excellent electrical and mechanical features with the properties of biomaterials such as polymers with the final purpose of recreating *in vitro* complex 3D extracellular matrix architectures able to support an enhanced cellular response [1].

Thus, in this work, we successfully explored the potential of the graphene oxide (GO) sheets to act as functional building blocks by using collagen as physical crosslinker. Indeed, the electrostatic interactions between the two materials have allowed the fabrication of a self-assembled hydrogel capable of providing a suitable porous network for both static and dynamic cell culture protocols [2]. Additionally, and complementary to its enhanced chemical, mechanical and morphological properties, the GO-collagen scaffold also revealed an impressive versatility since its bulk characteristics can be easily modified to match specific TE aims. Indeed, by either adapting its conductivity via a reduction process or modulating its topographic cues via the incorporation of a 3D anisotropic Polycaprolactone (PCL) electrospun network, the GO-collagen scaffold proved to be able to mimic different cellular microenvironments such as neural and cartilage, respectively.

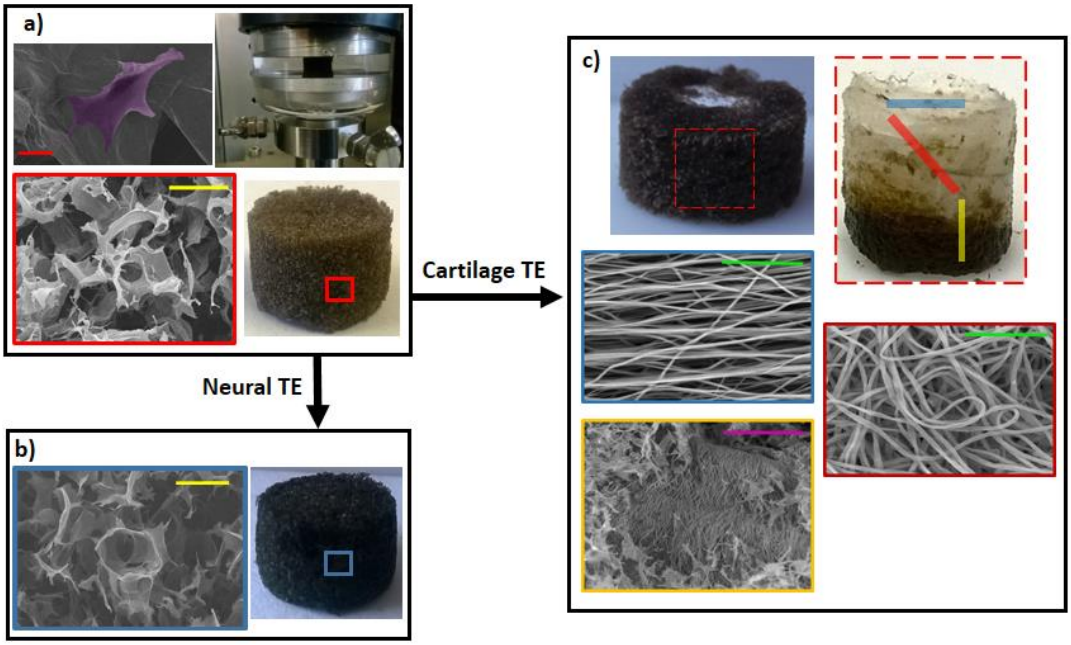

Fig. 1. GO-collagen scaffold as a versatile biomimetic microenvironment. a) GO-collagen scaffold porous network biocompatibility and dynamic stimulation assays; b) GO-collagen scaffold after a reduction process for neural TE applications; c) PCL-GO-collagen porous-fibrous scaffold for cartilage TE applications. Scale bars: red = 20 µm; yellow = 150 µm; green = 50 µm; purple = 500 µm.

References
[1] Goenka, S. et al., J Control Release, 10, 2014
[2] Girão et al., RSC Adv., 6, 2016

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