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Electrical stimulation of PC-12 cells cultured on silk fibroin scaffolds coated with reduced graphene

Salvador Aznar-Cervantes[1], Ana Pagán[1], Jose G Martínez[2], Antonia Bernabeu-Esclapez[3], Toribio F Otero[2], Luis Meseguer-Olmo[4], Juan I Paredes[5] and **Jose L Cenis[1]**

[1]Imida Murciano Institute for Agricultural and Food Research and Development, Spain
[2]Polytechnic University of Cartagena, Spain
[3]University of Murcia, Spain
[4]Catholic University San Antonio de Murcia, Spain
[5]National Institute of Coal - CSIC, Spain

New approaches to neural research require biocompatible materials capable to act as electrode structures or scaffolds in order to stimulate or restore the functionality of damaged tissues. Graphene is a conducting material introduced in the field of tissue engineering due to its good biocompatibility and potential applications in biomedicine. Silk fibroin (SF) is also a well-known biocompatible material in itself that combines with graphene producing hybrid films formats, providing an excellent support for cell proliferation. However, the use of electrospun mats seems to be a better choice due to the biomimetic configuration with an extracellular matrix. Therefore, the approach proposed in the present work explores the combination of reduced graphene oxide (rGO) adsorbed onSF mats in order to confer them electroconductive properties. PC-12 cell line was chosen for the study since these cells can be differentiated into a neuronal-like phenotype by exposing to NGF. The differentiation levels achieved with this treatment (SF/rGO/NGF) were compared to the ones obtained in cells growing on: Pure SF mats (SF), mats coated with rGO submitted to Electrical Stimulation (SF/rGO/ES) and mats coated with rGO without any other stimulus (SF/rGO). The method of production of these scaffolds barely alters the mechanical properties of pure SF mats. However, multiple benefits are obtained by means of the coating with rGO. In addition to the optimal viability detected in cells growing on all the produced materials, a clear improvement of adhesion and proliferation is exhibited in mats containing rGO. The stimulus provided by the rGO itself induces a significant differentiation level to neuronal-like phenotypes. However, the percentage of differentiation can be increased by means of the application of ES (100 mV during 2h) or the treatment with NGF, being the neurite outgrowth more pronounced when electric currents are applied to the cell cultures.

Biography

Salvador Aznar-Cervantes works as a Researcher in the Department of Biotechnology in the R&D Center in Biotechnology and Biomedicine, IMIDA (Murcia). He obtained his Degree in Biology from the University of Murcia (2006), then he completed his Doctoral thesis, working as a Grant Holder (FPI-INIA), under the guidance of Dr. José Luis Cenis Anadón, in January 2013. While he is pursuing his PhD, he researched on biotechnological and biomedical applications of the silk worm (Bombyxmori). This period was complemented with 3 successive visits (2010, 2011, and 2012) to the Department of Chemical Engineering of Massachusetts Institute of Technology (MIT), where he also collaborated with Tufts University (Professor David L Kaplan) and the Massachusetts General Hospital (Professor Robert Redmond).

sdac1@um.es

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