Biocompatible and highly conductive reduced graphene oxide cell culture substrates

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All cells are known to be electrically active, the separation of charge caused by ionic concentrations sets up a transmembranal voltage (TmV) and the flow of ionic species up and down this gradient are integral to a wide variety of downstream signaling cascades. Changes in TmV can be seen in a variety of cellular processes including proliferation [**1**], indeed there appears to be a tight correlation between the proliferative behaviour of cells and TmV [**2**]. Due to these phenomena, there is growing interest in the application of electrical stimulation to cells, with particular reference to the applications of neural prostheses, cancer and regenerative medicine. However, the response of many cell types to electrical stimulation is poorly understood and there is a pressing need for the systematic examination of the behavioural responses of different cell types to electrical stimuli. Here, we present a facile method for the production of **conductive and biocompatible reduced graphene oxide (rGO) cell culture substrates** that can be used as an *in vitro* test bed for stimulating cells. rGO offers many potential advantages including cost, stability in aqueous solution and low resistance (14 ohm/mm ± 5.5). We have developed a novel and facile spraying technique, which when followed by in situ chemical reduction by Hydriodic acid (HI), would potentially allow these stable conductive films to be coated onto existing devices. Efficient reduction of the Graphene Oxide was confirmed by XPS (C:O increasing from 2.45 to 7.04). Furthermore, the material has been shown to be able to support the growth of a range of cell types including neurons (N2A), epithelial cells (A549), macrophage (BV2) and fibroblasts (NIH3T3). The biocompatibility of the material was further confirmed by flow cytometry and Alamar blue fluorescent assay.

References

[1] Blackiston DJ et al, Cell Cycle, 2009.
[2] Levin M et al, Bioessays; 2012.

Figures

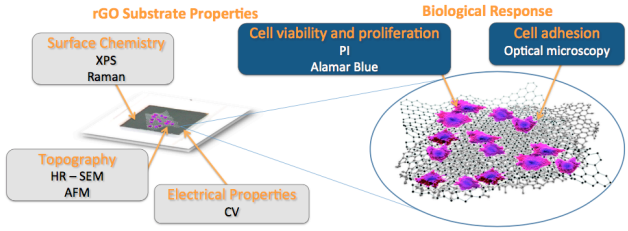

Figure 1: Summary of data presented

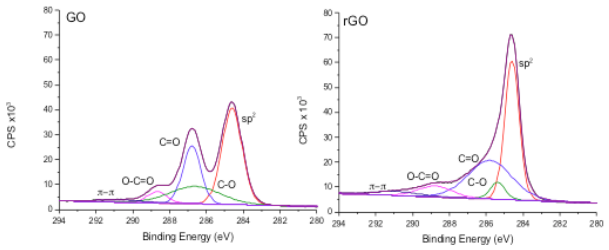

Figure 2: Confirmation of efficient reduction of rGO by C1s Scan of XPS.

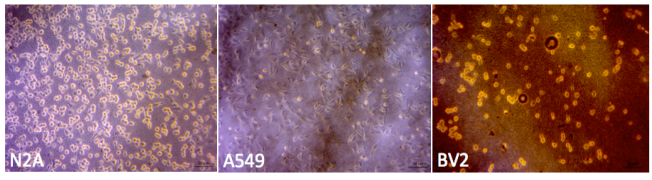

Figure 3: Successful culture of a range of cell types on rGO substrates.