Graphene for enhanced embryonic stem cell photo-transfection efficiency

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Abstract: Due to their pluripotency properties, embryonic stem (ES) cells possess great potential in regenerative therapy. Since reported a promising tissue engineering scaffold material, here, graphene is demonstrated to significantly improve the ES cell photo-transfection efficiency.

OCIS codes: (140.3538) Laser, pulsed; (160.4236) Nanomaterials; (170.1020) Ablation of tissue.

1. Introduction

The self renewal and pluripotency properties of ES and now, the recently discovered and Nobel Prize winning induced pluripotent stem cells, pronounce these cells of extreme requirement for the advancement of current therapies in tissue regeneration and/or engineering. However to achieve repair as well as the eventual improvement in tissue functions following tissue engineering, different biocompatible materials must be combined with living cells. Graphene, an atomic-thick sheet of carbon atoms has been reported by Nayak *et al*, 2011 [1] as one of the promising biocompatible scaffolds that promotes cellular proliferation in human mesenchymal stem cells.

In the past the two most popular techniques, namely electroporation and liposome-mediated methods were the most frequently used methodologies to transfect mouse embryonic stem cells. However, mES cell transfection efficiencies of lower than 10 % were obtained using electroporation [2]. Contrarily, femtosecond laser pulses have been reported to allow mammalian cell plasma membrane permeability thereby promoting intracellular introduction of foreign genetic species into both multipotent and pluripotent stem cells successfully [3-6]. As a result, a "chemical-free" cell transfection procedure that utilises micro-litre scale volumes of reagents was established. In this paper we report for the first time transient and non-invasive photo-transfection of the ES-E14TG2a pluripotent cells on graphene coated glass coverslips. Our results showed significant increase in the photo-transfection efficiency of ES cells plated on graphene.

2. References

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