Conductive polymers as Substrates for Neural growth

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Polypyrrole represents one of the most attractive biomaterials among conducting polymers due to its unusual electronic properties. Although most of the undergoing research is focussed in applications such as organic electronic devices, chemical and biological sensor devices, etc, its low electrochemical surface potential and flexible physical properties favours a good biocompatibility, and therefore is a good candidate for tissue engineering applications. [] Its electroactivity is however the crucial point that could make of it an important material in neural prosthetic devices and electrostimulation where conductivity and charge capacity storage are crucial. The possibility of modulating the starting material oxidation state by electrochemical intercalation of ions present in biological media and therefore its acting potential, may help modulate its effect on neural adhesion, viability and growth.
This works attempts to show a preliminary study on its behaviour as substrate in cortex neuron culture, as a function of preparation method, doping extent and the corresponding final physico-chemical characteristics. Counterion effects, Surface charge, doping extent, roughness and other physicochemical parameters are studied and correlated with cell culture success. Synthesis of polypyrrole thick and thin films were made via electrochemical deposition on thin film transparent gold substrates, with percholrate and DBS counterions. Films were deposited by two different techniques, potentiostatically (E = 0,6V vs Ag/AgCl) and with cyclic voltammetry at 5mV/s and 10mV/s up to 0.6V or to 0,75V. These different conditions determined the morphology features of the samples, causing differences among them depending on their synthesis conditions. Doping was perfomed in NaCl saline media and phosphate buffer solutions. Characterizations of the films and their electrochemical response and doping were performed by XPS , AFM, SEM, CV, contact angle measurements and IR spectroscopy. Nanopics profilometry and interferometric microscope served us to know film thicknesses. In general, the identity of the polymer varies as a function of its thickness, maximum potential reached and the speed at which the doping is perfomed. Reversibility of the doping process and morphological changes are also correlated with those factors. Cell viability is limited to three days in the conditions studied, and is inferior to borosilicate controls. The behaviour of new hybrids based on polypyrrole is also under study.