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Caviglia, Claudia; Heiskanen, Arto; Emnéus, Jenny

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IMPEDANCE SPECTROSCOPIC MONITORING OF IN-VITRO CELL GROWTH AND DIFFERENTIATION

Claudia Caviglia, Arto Heiskanen, Jenny Emnéus

Department of Micro- and Nanotechnology, Technical University of Denmark
Produktionstorvet, Building 423, 2800 Kgs. Lyngby
Claudia.Caviglia@nanotech.dtu.dk

Transplantation of stem cells has been proposed as a promising therapy to treat neurodegenerative disorders, such as Parkinson's disease [1, 2]. Understanding the self-renewal and the differentiation mechanisms represents an important challenge to derive strategies to influence the differentiation process into certain neuronal phenotypes.

Electrochemical Impedance Spectroscopy (EIS) is used as a non-invasive biophysical approach for the investigation of the electrical properties of biological materials according to their physiological and morphological changes [3]. In this work, EIS has been used to evaluate impedance changes during cell growth and differentiation phenomena. Rat pheochromocytoma cells (PC12) have been used as a model cell line to study differentiation. The experiments have been performed on laminin-coated electrode arrays (8W2x1E by Applied Biophysics) initially containing $2{,}5x10^5$ cells and incubated in a humidified atmosphere. Multiplexed EIS data from each sensor element were acquired for 7 days using a multichannel bipotentiostat [4] (30 points between 100 Hz and 100k-Hz).

Fig. 1A shows examples of the normalized spectra acquired during the cell proliferation. A peak frequency can be detected at 89 kHz and allows identifying which region of impedance magnitude is more sensitive. The differentiation experiment showed a peak frequency at 41 kHz. Data recorded at different are shown in Fig. 1B. After an initial transient (24 hours), impedance values show a global increase at high frequencies until the 6th day of measurement. This approach allows distinguishing between growth and differentiation process and will be applied to study neuronal stem cell differentiation into dopaminergic neurons.

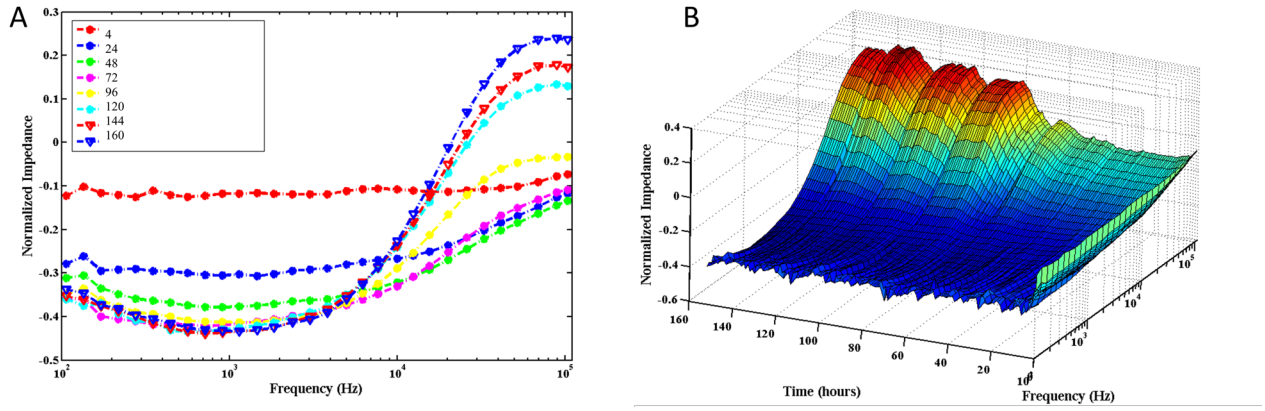

Figure 1: (a) Normalized impedance spectra recorded 4, 24, 48, 72, 96, 120, 144,160 hours after cells seeding; (b) 3D plot of the normalized impedance spectra over frequency and time (spectra acquired every 13 minutes during the first 3 hours and every hour after that).

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