SESSION 2.8 - BIOMECHANICAL MODELS IN TISSUE ENGINEERING

Invited speech - SENSING SCAFFOLDS FOR CELL MONITORING IN TISSUE ENGINEERING

Advanced progresses in technologies and methodologies have been happening now more than ever in the biotechnological field. Researchers are constantly looking for more efficient and effective methods able to quantitatively monitor processes related to cell cultures - such as adhesion, growth and differentiation-, addressing specific applications in pharmacology, regenerative medicine, and tissue engineering. The possibility to interact with cell cultures growing in a 3D environment and with their products, using cost-effective and non-invasive procedures and obtaining real-time feedbacks, represents in fact one of the most actual challenges. Information about cells adhesion, growth, differentiation, can be indeed achieved integrating sensing elements in scaffold or cell culture support, aiming to correlate phases of cell cycle with measurable changes in several electrical characteristics. This approach led to the definition of a specific technique known as Electrochemical Cell-Based Impedance Spectroscopy (ECIS), which represent one of the most interesting solution to the problem of real-time monitoring cell behavior. Interestingly, information about the environment - in which cells are growing - and/or about the condition-related metabolic products present in the biological samples, can be obtained by specifically integrating electrically sensing elements into cell cultures, modifying scaffold materials and/or printing dedicated electrodes into bioreactor structure. Considering all these fields of interest, in the last decades a high number of researches started to investigate various strategies to achieve highly precise and sensitive sensing elements, addressing mainly non-invasive and biocompatible solutions, thus to obtain reliable feedbacks on the biological processes, but without interfering with them. The present lecture specifically addresses the problem of monitoring cell culture in their 3D environment, trying to give a comprehensive view of all the strategies developed in the last decade to achieve an effective and non-invasive feedback, both in term of techniques realized to obtain conductive scaffold fabrication and how electrical parameters can be specifically correlated with events of the cell cycle.

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