Biosensor integrated cell culture systems for monitoring biological responses

Proposers

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Introduction

Tumours are highly heterogeneous and show different sensitivity to available treatment options. Their microenvironment, including intercellular crosstalk, has been shown to be crucial for cancer progression and dissemination. Thus, a better understanding of the interactions established between tumour, host cells and secondary organs is required to identify new potential anti-cancer targets. Current co-culture assays do not mimic very closely the physiological environment as they are done under static conditions and do not allow for the identification of soluble factors produced by a specific cell population as co-cultured cells share the culture media. The use of dynamic systems with integrated biosensors would greatly contribute to unravel cellular interactions *in situ* and throughout time, while recapitulating more closely in vivo dynamic microenvironments.

Partner 1

INL is devoted to the development of nanotechnologies in the medical area, among others. The diagnostic tools and methods group has been developing biomimetic systems and has extensive experience in analyzing cellular crosstalk. Moreover, the extensive research in magnetoresistive biosensing of INL's nanodevices group has been successfully optimized and tested for distinct biomedical applications.

Partner 2

The group at INESC-MN has expertise in micro and nanofabrication and the application of these technologies to electronic, biological and biomedical devices. This partner has a wide experience and knowledge (over 10 years) on the development of platforms based on sensors including chips microfabrication and optoelectronic systems.

Project outline/goal

This project focuses on the use of innovative dynamic co-culture systems to study cellular crosstalk either through soluble factors and/or direct cell-cell interactions, overall important for the development of new innovative therapeutic approaches. The devices consist of two interconnected chambers where different cell types are cultured under flow and the influence of "donor" cells (well 1) over recipient cells (well 2) is evaluated.

Two approaches for integration of biosensors will be taken: (i) in the first, a label-free sensor will be developed and used to quantify the amount of specific soluble factors released by recipient cells to the cell culture media; (ii) in the second, an optical/fluorescent or magnetic sensor will be integrated in a microfluidic channel located in the interface of the two wells, to measure the levels of relevant mediators being produced by donor cells. In this case, the mediators will be previously labeled.

The biosensors will be optimized for their sensitivity in cell culture medium and after detailed characterization, the presence of relevant soluble biomarkers will be studied.

Student profile

Profile sought: preference, but not limited, to students with a background in Engineering Physics, Biomedical Engineering or Biological Engineering with an interest in exploring complex advanced microsystems for practical applications.