Barcelona Institute of Science and Technology

BIST Ignite Project Progress

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1. Title of the project

Dynamic monitoring of multi-organ cross talk by combining biosensing and organ on-a-chip technology

2. Acronym

MULTI-ORGANSENS

3. Names and centres of the PIs

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4. Abstract

Insulin secretion and insulin action are critical for normal glucose homeostasis. Defects in both processes result in Type 2 Diabetes (T2D). Unravelling the mechanisms that lead to T2D is fundamental in the search of new therapeutic targets to prevent and control this disease. Developing biologically relevant models of tissues and organs in vitro and integrate them with biosensors is an important enabling step for T2D disease modelling and drug discovery. These devices, named organ-on-a-chip (OoC), have the potential to revolutionize the pharmaceutical industry by enabling reliable and high predictive in vitro testing of drug candidates. A prerequisite for the industrial use of such tissue models is scalability. OoC devices provide the requisite capacity for highthroughput applications. The capability to miniaturize biosensor systems and advanced tissue fabrication procedures have enabled researchers to create multiple tissues on a chip with a high degree of control over experimental variables for high-content screening applications. Besides, in the field of biomimetic tissues, the need to incorporate biosensing for in-situ and real time monitoring of the status or the secretion regimes of in vitro microtissues is gaining increasing attention. While recent OoCs can model native-organ microstructures for understanding disease mechanisms, current OoCs still lack the precise temporal control needed to study processes such as delayed cell response to treatment and chronic effects caused by long-term drug stimulation or fast metabolic responses to external stimuli. Specifically, the difficulty

arises when integrating the capability of stimulating the cells of interest with the capability of monitoring individual analytes released in-situ. In this project, MULTI-ORGANSENS, the goal is the fabrication of a biomimetic multi-OoC integrated device composed of skeletal muscle and pancreatic islets for studying metabolism glucose diseases and for drug screening applications in real time. Engineered muscle tissues and islets will be integrated with the technology to detect contraction induced glucose metabolism and protein biomarker secretion of cells. We aim to design a novel therapeutic tool to test drugs with a multi tissue-chip device. These findings would improve drug test approaches and would provide new therapies to prevent the loss of beta cell mass associated with T2D and defects in the glucose uptake in skeletal muscle.