

Sensors integrated in blood brain barrier on a chip

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Abstract

Nanotechnology is a cutting-edge field that extends different possibilities for the study and treatment of different diseases. In this work the most widespread neurodegenerative disease, Alzheimer disease (AD), has been studied under Blood Brain Barrier (BBB) in vitro model. An alternative animal-free in vitro model has been developed for a low cost, easy to work system that simulate the main drug access to the brain, the BBB, by means an Organ-on-a-chip devices [1]. The permeability of the BBB is the main issue to deal when a drug needs to cross this barrier. Moreover, in many neurodegenerative diseases (NDDs) the BBB permeability is strongly affected by vascular and inflammatory problems derived from the NDD. These changes on permeability has to be included in the BBB on a chip to correctly mimic an affected BBB by a specific NDD.

In this work a novel technology combining sensor and actuator was integrated in a BBB on a chip to. The sensor permits to characterize in real time the barrier permeability by Transepithelial/transendothelial electrical resistance (TEER) [2]. Moreover, the actuators were parallelly patterned on each sides of the barrier to electrically tuning the barrier permeability. The BBB on a chip was fabricated and the cells seeded combining a 3D co-culture of human astrocytes and pericytes inside the hydrogel in one channel, to simulate the brain interstitial fluid (ISF) and then endothelial cells in the parallel channel to growth up the vascular barrier generated by this cells. Confocal fluorescence microscope was used in combination with immunostaining to characterize the formed cells barrier and to show the correct development of tight junctions between the adjacent brain endothelial cells.

Biography:

Dr. Mònica Mir received the Degree in Chemistry from University Rovira i Virgili, Spain in 1998. In 2006 she received her PhD in biotechnology in the same University. She realized different predoctoral stages at the Institute of Microelectronic in Demokritos, University of Bath and National Hellenic Research Foundation. From 2007, she held a postdoctoral position in Max Planck Institute for Polymer Research, Germany. Since 2008, she joins the Institute for Bioengineering of Catalonia (IBEC), Spain as Senior CIBER researcher, combined with her teaching as associate professor in the University of Barcelona. Along her carrier she was managing European, National and industrial research projects, supervising PhD and Master students and collaborating in congresses organization as coordinator and scientific committee. Her main scientific interests are focused on electrochemical biosensor, integrated in lab-on-a-chip and point of care technologies, implantable sensors, organ-on-a-chip for biomedical applications..

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