Internship Proposal

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Project Title:
Microfluidic system for the evaluation of placental diffusion of drugs and toxins: improving maternal/fetal health

Level:

Master Student

Project Summary:

The thesis is embedded in the European funded initiative ‘Lifesaver’ that focuses on a microfluidic in-vitro system that emulates pre-natal conditions at the placental interface and can predict the risk of a drug or chemical substance crossing the placenta and acting as potential harmful factor towards unborn babies.

Work to be developed by the student:

The Lifesaver system is a microfluidic placenta-on-a-ship model which consists of a pressure driven maternal circulation loop and fetal circulation loop separated by a cellular membrane which emulates the placenta. Initially, the student will need to familiarize themselves with the microfluidic (hardware) setup and how the software and hardware interface with one another, which is a critical step within the installation task. Debugging will be conducted on a preliminary phase since the system will most likely require some adjustments and shaping. Cellular viability assessments within system will be performed by the student, the cellular membranes (placenta mimetic) will be assembled at i3S and evaluated under flow conditions. The student will then move onto evaluating the effect of the drugs/chemicals on, and the diffusion of them through the cellular membrane. The student will also be responsible for the quantification of cell/placental biomarkers, chemicals and drugs in the media circulating in the microfluidic system using gold-standard instrumentation such as liquid chromatography-mass spectrometry (e.g. HPLC-MS). To mitigate negative impacts on cell viability, there must be an optimization of the maternal and fetal flow rates, drug/chemical exposure and concentration, and sample collection.

References:

1.C.M. Abreu, V. Thomas, P.Knaggs, A. Bunkheila, A. Cruz, S.R. Teixeira, P. Alpuim, L.W.

Francis, A. Gebril, A. Ibrahim, L. Margarit, D. Gonzalez, P.P. Freitas, R. Steven Conlan, I. Mendes Pinto; Non-invasive molecular assessment of human embryo development and implantation potential (2020) Biosensors and Bioelectronics, 157, 112144, doi:10.1016/j.bios.2020.112144.

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