Production and optimisation of artificial skin for toxicity testing by alteration of permeation properties.

Proposers
Abel Oliva and Federico Herrera (ITQB), INESC MN (Virginia Chu and João Pedro Conde)

There is a need to develop experimental alternatives to animal testing, particularly in the skincare and cosmetics sector. Several reconstructed skin models for the *in vitro* evaluation of toxicity are commercially available. Companies with products on the market include Episkin (a subsidiary of L'Oréal) and MatTek (Epiderm™). The skin barrier of the *in vitro* reconstructed epidermis models is considerably more permeable than native skin. A less permeable barrier would allow a more representative evaluation of the toxicity as in the real skin conditions. Thus it is desirable to adjust and optimize the permeation characteristics of cultivated skin. In this project, the student will vary the standard nutritional and cultivating conditions, and evaluate the impact on the barrier function of the skin both in macroscale and in a microfluidic system. Microfluidics has the potential to allow high-throughput screening of the skin tissue permeability, detailed microenvironment control, and sensor integration.

Tasks to be developed at ITQB:

- Optimize skin growth conditions.
- Characterization of skin and permeation properties
- Optimization of lipid delivery in culture media
- Production of NPs (liposomes) for optimized nutrient delivery
- Transfection of genes for metabolic alterations
- Tests of other cells lines (neurons and glial scar)

Tasks to be developed at INESC MN:

Development of microfluidics module to allow for high-throughput screening of:

(i) growth conditions of reconstructed epidermis in the chip (seeding, confluence, stratification)

(ii) delivery of test compounds to model skin structured in membranes via microchannels, with time resolution and possible gradient generator integration

(iii) testing of permeability of model skin structure in membranes, with sensor integration for real-time control.