Title: Biomimicking the Intestinal Mucosa

Contact: Elena Martínez (emartinez@ibecbarcelona.eu) or Vanesa Fernández (vfernandez@ibecbarcelona.eu). Institut de Bioenginyeria de Catalunya (IBEC).

Introduction: Hydrogels are considered very good candidate materials for engineering tissue scaffolds due to their unique compositional and structural similarities to the natural extracellular matrix, in addition to their desirable framework for cellular proliferation and survival. We have developed and experimental set-up to fabricate 3D hydrogels that mimics the crypt-villi architecture of the human small intestine epithelium by a simple photolithographic technique using poly(ethylene) glycol diacrylate (PEGDA) as the synthetic polymer that supports the growth of intestinal cells. We aim to further develop our model to a more complex cellular configuration that would better resemble the intestinal mucosa, comprising both the intestinal epithelium and the lamina propria (including intestine fibroblasts and immune cells).

Objective: The objective of this Master Thesis is to modify the composition of our scaffold to provide and appropriated matrix component that permits both intestinal epithelial growth on the surface and stromal cells (fibroblasts and immune cells) encapsulation inside the scaffold. We plan to overcome the biological limitations of PEGDA by incorporating Methacrylated gelatin (GelMA) to the pre-polymer solution. GelMA is a natural polymer enzymatically degradable and photocrosslinkable where cells can grow and spread. Thus, we plan to develop a photo-crosslinkable PEGDA-GelMA composite hydrogel that combines the desired features of each of these materials, namely to be tuneable, biocompatible, bioactive and biodegradable.

Specific Aims:
- Characterization of the hydrogel composite (PEGDA-GelMA).
- Stablish the fabrication conditions (UV-exposure time, Photoinitor concentration and hydrogel composition) for optimal survival of the encapsulated cells.
- Evaluate the survival of the encapsulated cells over time.

Experimental Work:
- Microfabrication technics
- Material characterization technics
- Tissue culture methods
- Immunostainings