Project Name: Bioactive Beads for Local Modulation and Sensing of Cell Mechanical Environment in 3D Engineered Tissues

Project Overview:
We will develop cell-sized hydrogel microbeads with defined and systematically varied mechanical properties and with cell-interactive surface properties, with the aim of incorporating the beads into 3D tissue models so that the beads both provide local modulation of cell behavior (via controlling local mechanics for neighboring cells) as well as recording key aspects of cell behavior via special reactive moieties buried within the surface coating.

Faculty Involved:
Professor Paula T. Hammond MIT, Chemical Engineering, 66-550, Hammond@mit.edu
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Ph.D. student involved:
Eunice Costa

Expected Deliverables:
• Preparation of microsized hydrogel beads using supercritical fluid technology with defined elastic modulus and functional coatings.
• Proteases activity reports as a function of the degree of cells protease secretion.
• Excellent doctoral thesis at MIT and Portugal
• Publications in high quality international journals
• Presentation at international and national conferences

Timeline:
- Optimize the synthesis in supercritical carbon dioxide media that provide the hydrogel beads with the appropriate physical and chemical properties. This will be developed at UNL (1^{st} - 9^{th} month).
- Design and preparation of functional bead coating using layer-by-layer deposition (9^{th} - 18^{th} month).
- Examination of bioactive beads in 3D cultures of mammary epithelial cells, mesenchymal stem cells, and liver cells under culture conditions that are expected to result in highly diverse protease profiles (18^{th} - 30^{th} month).
- Thesis writing (30^{th}-36^{th} month).