Phospho-proteomic profiling of cell adhesion effects to signal transduction

D. S. Tzeranis[1]*, M. Ioannou[1], I. Preza[1], I. V. Yannas[2], L. G. Alexopoulos[1]
[1]National Technical University of Athens, Department of Mechanical Engineering, 9 Heroon Polytechniou Str., Zografou 15780, Greece, tzeranis@gmail.com
[2]Massachusetts Institute of Technology, Departments of Mechanical and Biological Engineering, 77 Massachusetts Avenue, Cambridge MA 02139, USA
* Corresponding Author

Keywords: *Biomaterials, Cell Adhesion, Phospho-proteomics, Cell Contraction*

Abstract

The ability of biomaterials to induce regeneration *in vivo* has been shown to depend significantly on their chemical and mechanical properties. This effect has been partly attributed to cell interactions with the surrounding matrix. Yet, there is limited systems-level description on how biomaterial properties modulate the complex signal transduction networks that regulate key phenotypes that affect the wound healing outcome. This study utilizes phospho-proteomics to describe the effect of biomaterial surface chemistry on fibroblasts, cells involved in several cytoskeleton-related processes that affect wound healing (e.g. wound contraction, matrix remodeling). Here, fibroblasts are cultured on 2D surfaces or seeded inside porous 3D collagen scaffolds, and then stimulated by cytokines present in inflammation and wound healing. The transient response of cells to cytokines is quantified by measuring the phosphorylation of ≈ 20 signaling proteins using lumimex-based multiplex proteomics. The resulting phospho-proteomic dataset can be fitted into an a-priori signaling network using a modified implementation of algorithms developed initially for systems pharmacology (Mitsos et al. 2009). Preliminary results provide a novel description of how cell adhesion to 3D biomaterials regulates key intracellular signaling pathways related to cytoskeleton remodeling.