**The differentiation of osteocytes within a well-defined**

**biomimetic synthetic polymer**

*Jung Un (Ally) ChoiA, Amanda W KijasA, Jan LaukoA, Alan E RowanA*

AAustralian Institute for Bioengineering and Nanotechnology, The University of Queensland,

Brisbane, Australia

**Introduction**

Extracellular matrix (ECM) plays an important role in regulating cellular behaviour such as motility, differentiation, survival for the most abundant bone cells called osteocytes1. Osteocytes control overall activities of bone formation and resorption which is influenced by the extracellular matrix (ECM) via integrins2. Integrins are cell surface receptors which they are able to sense and integrate into biochemical signals leading to the changes of overall bone remodelling process.

**Aims**

To investigate the changes of osteocyte behaviour by integrin-mediated interaction for differentiation process over time in a 3D cell culture system.

**Methods**

A novel polyisocyanopeptide-based hydrogel was used as an ECM mimic, to investigate the interaction of two specific integrin pairs on osteocytes3. For this, the polyisocyanopeptide-based hydrogel was functionalized with α5β1 integrin-specific GRGDS ligand and αVβ3 integrin-specific cyclic RGDyK ligand. The specific interaction of the integrin–ligand pairs was demonstrated by using osteocyte cells (Ocy454) cultured in a 3D microenvironment and by monitoring their differentiation over time.

10 µm

**Results**

Our preliminary data showed that osteocytes are able to widen matrix pores (< 3µm) and produce cell processes extensively, both of which are important morphological changes during differentiation process (Figure 1). Interestingly, the shape and number of cell processes were dynamic within a synthetic polymer. This process involves integrin clustering demonstrating the interaction of integrin-ligand binding process.

Figure 1. Osteocyte cell differentiation within a MB488-labelled synthetic polymer

 **Discussion**

The force-driven development of cell processes is essential for cell-cell communication during differentiation. Osteocytes are able to widen matrix pores which is mediated through matrix plasticity. Furthermore, the integrin clustering demonstrated the presence of integrin–ligand binding, through which osteocytes are able to bind and adapt to the microenvironment of a synthetic polyisocyanopeptide-based hydrogel.

**Conclusion**

Osteocytes are able to sense and differentiate within a 3D culture system using a novel synthetic polymer. The integrin-mediated interaction between cell and ECM is important for the differentiation process which will promote the overall bone remodeling process.

**References**

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