OMICS Group Conferences
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International Conference on
Tissue Science & Engineering

October 1-3, 2012 DoubleTree by Hilton Chicago-North Shore, USA

Understanding the role of polyphosphates in physiological mineralization: Implications for bone regeneration

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Polyphosphates are inorganic chains of phosphates that naturally occur in many cells types and that are present at higher concentrations in bone cells. They are a source of phosphate and can also act as a reservoir for calcium due to their ability to chelate large amounts of calcium (resulting in concentrations of total Ca^{2+} and $PO4^{2-}$ above physiological saturation). This chelation could provide a mechanism for the initial nucleation event in mineralization. Therefore, further characterization of polyphosphate function may be pertinent to the regulation of pathological mineralization as well as the promotion of bone regeneration. To expand the current body of knowledge of polyphosphate-related mineralization we are using NMR and FTIR to analyze intracellular polyphosphates concentrations in Saos and MC-3T3 bone cell lines. We are also evaluating the capacity of these cells to induce mineralization (as measured by Von Kossa and Alizarin Red staining) in the presence of exogenous polyphosphates. Our initial results demonstrate that Saos cells are unable to metabolize exogenous polyphosphates while MC3T3s metabolize polyphosphates to a small degree. Ongoing work utilizing gene transfer of alkaline phosphatase into cells will elucidate the cellular role of alkaline phosphatase in polyphosphate metabolism. Understanding the role(s) of polyphosphates in the physiological nucleation of mineral will provide important knowledge for therapies focusing on the initiation of bone mineral and may identify novel targets for inhibiting pathological calcification. Supported by CIHR, FRSQ and NSERC.

Biography

Marianne Ariganello was trained in Chemical Engineering (B.Eng, Lakehead University, Thunder Bay, ON, Canada) before pursuing her PhD in Biomedical Engineering from Dalhousie University, (Halifax, NS Canada). She has completed postdoctoral studies at Ecole Polytechnique (Montreal, QC, Canada) and is currently completing her post-doctoral training at Université de Montréal in the area of cell-biomaterial interactions. Her primary research area of interest is understanding the interface between biomaterials and their host environment, specifically focusing on the role macrophages have in determining successful implant integration. She has completed a certificate in University Teaching and enjoys teaching at the university level and mentoring students in research.

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