George K Toworfe, J Tissue Sci Eng 2014, 5:3
http://dx.doi.org/10.4172/2157-7552.S1.016

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference on
Tissue Science & Regenerative Medicine
September 24-26, 2014 Valencia Convention Centre, Spain

Mechanotransduction of deformable nano-structured elastic membrane surfaces on proliferation of osteoblast cells

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Bioactive substrates are capable of enhancing proliferation of osteoblast cells, since these cells transduce changes in the mechanical environment. This study investigates the effect of mechano-transduction through substrate characterization on proliferation of osteoblasts-like (MC3T3-E1) cells. It is a fundamental study on the effect of mechano-transduction in bone cells through functionalised silastic bioactive nano-substrates. Strains occur in bone cells as a result of mechano-stimulus under physiological conditions and the strain rate correlate with bone formation, since the mechanical forces are transmitted to cells through the ECM which results in immediate early gene expression and proliferation of MC3T3-E1 osteoblasts cells. Osteoblast cells were anchored to a chemically functionalized substrate to ascertain whether application of equibiaxial mechano-stimulus could change the cytoskeletal architecture of the cells. The membrane was functionalized, characterized using CA goniometry, RBS and AFM. MC3T3-E1 cells were seeded onto the nano-scale biomimetic surface and subjected to mechanical deformation, after which cellular functions were evaluated, by CM, to determine changes in the cytoskeletal organization of the adherent cells. Application of biophysical forces to biological systems, according to Frost mechano-static theory, translates into cellular responses, under physiological conditions; since cellular organisms tend to adapt to their mechanical environment. There were noticeable changes in the cytoskeletal architecture of MC3T3-E1 cells after subjecting them to the dynamic equibiaxial strains, with minimum cell damage, indicating that functionalised nano-surfaces transduced mechanical stimuli onto osteoblast-like cells. We engineered a system which mechanically transduces strains in nano-structured surfaces to enhance cytoskeletal architecture of osteoblast-like bone cells.

Biography

George K. Toworfe, is an Associate Professor in Biomaterials Science, Bioengineering and Tissue Engineering. He is currently the President of the Flowers School of Technology and Management, Kusterdingen, Germany. He holds a PhD in Biomaterials Science from the University of Manchester and Postdoctoral Fellowship research training from the University of Pennsylvania, in Philadelphia, USA. He previously served as the head of two departments (in the University of Ghana College of Health Sciences); and the Dean of a Faculty at the Regent University College of Science and Technology. George has undertaken extensive research in Biomaterials Science, Bioengineering and Tissue Engineering and has published papers in peer-reviewed Biomaterials and Biomedical journals. In addition, he has published 2 books and presented more than 30 abstracts/posters/talks at conferences world-wide. Some of his recent works have been cited by over 400 research teams and scientists world-wide.

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