



BioSystems Science and Engineering

Annual Work presentation

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Osteogenesis-on-chip: A novel perspective in regenerative medicine towards evaluating biomaterial response

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Abstract

interdisciplinary concept of biomicrofluidics is continuously maturing which demands to develop novel strategies to exemplify accurate outcomes regarding cell based studies. Hence in this study, a novel strategy to integrate microfluidics and biomaterials has been attempted. The study has been conducted on cellular differentiation by influencing the cells with physical cues given by the biomaterial composites along with mechanical stimulation due to shear flow. This generates changes in the cellular functionality which can facilitate the applications of regenerative medicine. This technique will have enormous potential towards making decision to choose implant materials. Osteogenic differentiation was induced to the selected human mesenchymal stem cell (hMSc) line, on entrapping them inside microfluidic lab-on-chip (LOC). The without-flow culture represents the conventional system while the with-flow culture is the prototypical arrangement to create body physiology. But variation in cellular response in terms of degree of differentiation has been perceived on application of shear. The differential response had been found to commensurate well with the cytoskeletal changes evoked by the influence of the materials and the shear. Noticeable amount differentiation of the cells growing onto the nanoparticle added composites was exhibited which aggravated more by adding the impact of shear. Comparing MWCNT and nHA, the later has supported cellular functionality in cellular differentiation towards osteogenesis better than the former one. Taken together, the experimental results suggest that implementing shear can effectively enhance desirable osteogenesis which can evaluate the performance of the implant materials accurately, when placed inside the body, in a noninvasive way

Keywords: Lab-on-chip, regenerative medicine, osteogenesis, electrophysiology,

Brief Bio of Student (max 100 words)

Sharmistha Naskar is a PhD student of BioSystems Science and Engineering (IISc). Her research work emphasizes Lab-on-Chip and Biomicrofluidics. She did her M.Sc. in Human Physiology at the University of Burdwan, followed by M.Tech in Biotechnology at West Bengal University of Technology.

Publications

List journal or conference publications of the student with DOI and full citation

1. **Naskar S, Kumaran V, Basu B**, "On The Origin of Shear Stress Induced Myogenesis Using PMMA Based Lab-on-Chip", ACS Biomater. Sci. Eng. 2017 DOI: [10.1021/acsbomaterials.7b00206](https://doi.org/10.1021/acsbomaterials.7b00206)
2. **R. Upadhyaya, S. Naskar, N. Bhaskar, S. Bose and B. Basu**, "Modulation of Protein adsorption and Cell Proliferation on Polyethylene Immobilized Graphene Oxide Reinforced HDPE Bionanocomposites", ACS Applied Materials & Interfaces, 2016 DOI: [10.1021/acsami.6b00946](https://doi.org/10.1021/acsami.6b00946)