

Preface

This thesis is submitted for the degree of doctor of philosophy at Indian Institute of Technology (Banaras Hindu University), Varanasi. The research described herein was conducted under the supervision of Dr. Marshal in the school of biomedical engineering, Indian Institute of Technology (Banaras Hindu University), Varanasi, between July 2017 to February 2022.

This work is the best of my knowledge, original except where acknowledgment and reference are made to previous work. Neither this nor a substantially similar thesis has been or is being submitted for any other degree, diploma, or other qualification at any other university.

Stem cell therapy is booming for providing valuable cells to repair or regenerate damaged cells and tissues that conventional medicines cannot cure. Understanding stem cell biology can lay the foundation for cell-based therapies of disease. The engineered material can act as a driver to guide stem cells to differentiate into a particular lineage. Thereby, exploiting the material properties can provide an effective strategy to generate the desired cells of our choice from the undifferentiated stem cells. Also, the differentiation process is an energy-driven mechanism, so analyzing the dynamics of the cell's powerhouse, mitochondria, can help understand the mechanism of differentiation and cell-material interaction. The comprehensive study of material properties and their correlation with energy metabolites and intracellular messengers can advance our knowledge in developing precise treatment modalities. The present thesis's objective was to investigate the role of intracellular messengers and energy metabolites during cell transdifferentiation on bioengineered platforms. This thesis will be beneficial for the researcher/ academics / industrial working in the area of stem cell therapy and regenerative medicine.