

CURRENT STATUS AND FUTURE PROSPECTS OF GENOME-SCALE METABOLIC MODELING TO OPTIMIZE THE USE OF MESENCHYMAL STEM CELLS IN REGENERATIVE MEDICINE AND BIOMATERIALS

OLAFUR E. SIGURJONSSON*

REYKJAVIK UNIVERSITY
SCHOOL OF ENGINEERING
*E-MAIL: OES@RU.IS

[*ENGINEERING OF BIOMATERIALS 158 (2020) 7*]

Abstract

Mesenchymal stem cells are a promising source for externally grown tissue replacements and patient-specific immunomodulatory treatments. This promise has not yet been fulfilled in part due to production scaling issues and the need to maintain the correct phenotype after re-implantation. One aspect of extracorporeal growth that may be manipulated to optimize cell growth and differentiation is metabolism. The metabolism of MSCs changes during and in response to differentiation and immunomodulatory changes. MSC metabolism may be linked to functional differences but how this occurs and influences MSC function remains unclear. Understanding how MSC metabolism relates to cell function is however important as metabolite availability and environmental circumstances in the body may affect the success of implantation. Genome-scale constraint based metabolic modelling can be used as a tool to fill gaps in knowledge of MSC metabolism, acting as a framework to integrate and understand various data types (e.g., genomic, transcriptomic and metabolomic). These approaches have long been used to optimize the growth and productivity of bacterial production systems and are being increasingly used to provide insights into human health research. Production of tissue for implantation using MSCs requires both optimized production of cell mass and the understanding of the patient and phenotype specific metabolic situation. This review considers the current knowledge of MSC metabolism and how it may be optimized along with the current and future uses of genome scale constraint based metabolic modelling to further this aim.