MONASH University
Engineering

PhD Research Project

Comparative Analysis of Mesenchymal Stem Cells Derived from Bone Marrow and other Tissues and MSCs derived from Pluripotent Stem Cells

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Description

Mesenchymal stem cells are multipotent stem cells that can differentiate into a number of cells of the mesodermal lineage such as bone, cartilage and fat cells. They have enormous clinical potential, particularly because they also have immunosuppressive and immunomodulatory properties which can aid tissue regeneration. For example a range of clinical trials are currently underway in autoimmune disease such as graft versus host disease, Crohns disease and osteoarthritis. These cells also have application in the treatment of cardiovascular disease (congestive heart failure and myocardial infarction) as they readily migrate to sites of inflammation and release agents which have potent effects on the innate and adaptive immune systems. Finally these cells can be used to treat musculoskeletal injuries such as fractures and cartilage defects.

Due to the limited supply of these cells from donors and the difficulties of generating large numbers of cells in a manufacturing process, there is significant interest in generating MSCs from a more primitive cell types that can be generated essentially indefinitely, such as embryonic stem cells or induced pluripotent stem cells. As a result a number of groups have been working towards the aim of creating well-defined mesenchymal cells using a range of published differentiation protocols. A question that arises is whether the cells generated from pluripotent cell sources are equivalent to native mesenchymal stem cells in terms of phenotype and therapeutic effects. Part of the difficulty here is that the MSC phenotype is not well defined and the term mesenchymal stem cell probably refers to a heterogeneous cell population.

In this project, we will directly compare the characteristics of human tissue-derived MSCs to those of hMSC-like cells derived from pluripotent stem cell sources. In particularly we will focus on genetic and epigenetic characterisation of the cells from both sources. In addition we will seek to understand whether important epigenetic profiles can be influenced by the properties of cell culture materials.