

BioSyM Seminar Series 2017

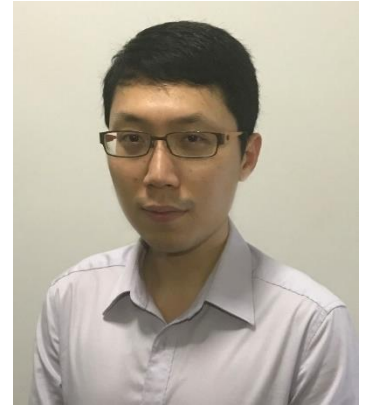
Application of spiral microchannel device in cell-based cartilage repair

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Date : 20th November 2017, Monday

Time : 12 pm to 1 pm

Venue : Level 5, Perseverance Room

Abstract

Current clinical approaches for articular cartilage repair have not been able to restore the joint surface of hyaline cartilage with zonal architecture, and its biomechanical and functional properties. Although mimicking the zonal organization of articular cartilage in neo-tissue by implanting zonal chondrocyte subpopulations in multilayer construct could enhance the functionality of the graft, engineering of stratified tissue has not yet been realized due to the lack of efficient and specific zonal chondrocyte isolation protocols and limited amount of donor tissue to yield adequate viable zonal cells. We show that by using a spiral microchannel device, the superficial, middle and deep zone chondrocytes can be separated and enriched from full thickness porcine cartilage in a high-throughput, label-free manner based on cell size. The size-sorted zonal chondrocytes when delivered in a bi-layered stratified hydrogel construct, can facilitate better cartilage repair with mechanically enhanced cartilage tissue *in vivo*, in comparison to conventional chondrocytes implantation. We also investigate cartilage repair with mesenchymal stem cell due to its ease of isolation and amenability to *ex vivo* expansion. We identified a “chondrogenic competent” subpopulation of MSCs based on cell size, and invent a selective MSC culture expansion method to enrich the subpopulation based on spiral microfluidic cell sorting. We show that the new expansion method result in selected MSCs with faster proliferation and better chondrogenic potential as compared to MSC derived from conventional expansion method.

Short Biography

Dr. Yin Lu is currently a postdoctoral associate in BioSyM-IRG of SMART center. Dr. Yin pursued undergraduate study from 2003 to 2007 in the bioengineering department of NTU, followed by PhD study from 2007 to 2012 in the computational systems biology program of SMA, NUS. Dr. Yin joint ID-IRG of SMART as postdoctoral associate in 2012. He used a combination of genetic lineage tracing and high-content imaging-based tissue informatics approach to study the lung tissue repair cellular mechanism in adult and aged mice after influenza infection. Dr. Yin joint BioSyM in 2013, and started to explore the application of spiral inertial microfluidic devices in a wide range of biomedical researches, including detection of CTC, isolation of lung progenitor cell, separation of zonal chondrocytes, enrichment of MSC subpopulation, purification of erythroid culture, development of automated perfusion culture system, etc.