

21 Apr 2020 11:00 AM

Breakthrough Theatre Level 4, Matrix 30 Biopolis St Singapore 138671

Biomimicry of glycosaminoglycans in the bone marrow microenvironment

Speaker: *Prof Simon Cool*



Abstract

Mesenchymal stem cell (MSC) therapy offers significant potential for musculoskeletal regeneration. However, the low abundance of MSCs in bone marrow aspirates necessitates expansion in culture before their clinical application. Such ex vivo expansion leads to a loss of stem cell characteristics and thus, unpredictable therapeutic outcomes. Studies of the MSC secretome have highlighted the importance of endogenous FGF2 for their survival and maintenance of stemness. This seminar will describe studies related to MSC potency and therapeutic efficacy, and how these attributes can be enhanced by sustaining endogenous FGF2 signalling through supplementation with an affinity-selected heparan sulfate (HS) co-factor. Microfluidic assays show that HS improves the bioavailability of FGF2, so providing more distant MSCs with a source of active FGF2. This results in the sustained growth of multipotent MSC over extended passaging. When used to treat osteochondral injuries in small and large animal models, MSCs preconditioned in an HS-rich microenvironment show improved ICRS II and O'Driscoll healing scores compared with control. Moreover, MRI shows reduced osteochondral lesioning following treatment with MSCs supplemented with HS, with Instron biomechanical testing highlighting an associated improvement in biomechanical properties. Collectively, these data indicate that modulation of endogenous FGF2 signals by select HS glycosaminoglycans represents an effective strategy for the bioprocessing of MSCs with sustained therapeutic potency.

Biography

Prof Cool received his BSc (Hons) and PhD degrees from the University of Queensland, Australia where he subsequently held a faculty position in the School of Biomedical Sciences

until 2003. He then joined IMCB, A*STAR and in 2008 moved to IMB. Prof Cool is focused on developing novel glycosaminoglycan biomolecules that enhance tissue repair and control mesenchymal stem cell activity. He has 43 granted patents across 18 families in the field of glycosaminoglycan biochemistry and tissue regeneration and more than 130 publications. Prof Cool is an Adjunct Professor (Research) in the Department of Orthopaedic Surgery at NUS and is currently Treasurer of TERMIS-AP and Vice-Treasurer of the Singapore Stem Cell Society. He is also Section Editor for the Journal of Molecular Histology and serves on the Editorial Boards of Biomaterials, the Journal of Tissue Engineering and Regenerative Medicine, and Stem Cells and Development. Prof Cool was also co-founder of SMC Biotechnology, an A*STAR spin-off company developing glycosaminoglycan-based medical devices for orthopaedic use.

Host: Prof Hong Wanjin