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Development of a generic tissue engineering research platform for the mechanistic understanding of tissue regeneration

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A generic research platform with 2-dimensional (2D) cell culture technology, a 3-dimensional (3D) tissue model and a scaled-down cell culture and imaging system was developed and utilized to obtain the mechanistic understanding of tissue formation. When cultivated onto Tissue Culture Plates (TCPs), Human Dermal Fibroblasts (HDFs) behaved individually and had no strict requirement on seeding density for proliferation; while immortalized keratinocytes (HaCat cells) relied heavily on initial densities for proliferation and colony formation which was facilitated when co-cultured with HDFs. HDFs and HaCat cells mono- or co-cultured in serum or serum-free medium were then compared and analyzed via the platform. It was demonstrated that serum depletion had significant influence on the attachment of HaCat cells onto TCPs, porous substrates and scaffolds, which was further enhanced by the pre-seeded HDFs. When mono-cultured on TCPs, both HDFs and HaCat cells were less proliferative in medium without serum than with serum. However, both cell types were successfully co-cultured in serum free medium. Based on the results from 2D cultures, co-culture of both cell types on modular substrates and cellulosic scaffolds in serum free medium were conducted successfully. The generic research platform thus demonstrated great potential for in-depth understanding of tissue regeneration, which could inform the mechanism-based manufacturing processes for engineered tissues and organs.

Biography

Tao Sun is a Senior Lecturer in Industrial Biotechnology at Loughborough University, UK. His research efforts in tissue engineering and regenerative medicine and mainly focuses on the mechanistic understanding of cell-cell, cell-scaffold interactions during tissue formation, investigation of scale-down and up issues in TERM using scale-down and scale-up tissue culture models, bioreactor development for cell and tissue cultures, reconstruction of engineered human tissues for diagnostic and clinical purposes and clinical trial of engineered human skins.

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