Designing bioink, bioresin and spheroid bioassembly platforms

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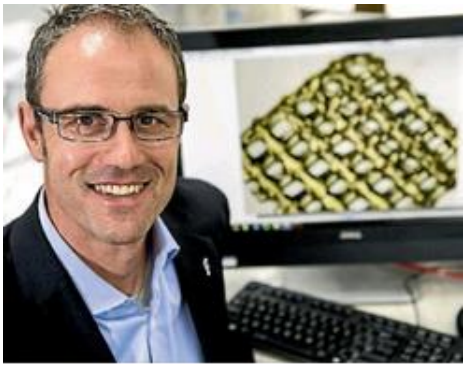
Abstract

Biofabrication technologies, including 3D bioprinting and bioassembly, enable the generation of engineered constructs that replicate the complex 3D organization of native tissues via automated hierarchical placement of cell-laden bioinks, tissue modules, and/or bioactive factors. Photo-initiated radical polymerization combining light and photo-initiators to generate radicals for crosslinking photo-polymerizable macromers, has been widely employed in 3D bioprinting of cell-laden hydrogels. Despite rapid advances in biofabrication technologies, no universal bioink exists. The major challenge for translational regenerative medicine is that the processing requirements (biofabrication window) of current bioinks is narrow, requiring optimization of each bioink for each individual biofabrication technique *and* specific tissue niche e.g. high viscosity "shear thinning" bioinks necessary for extrusion bioprinting versus low viscosity bioinks for lithography-based bioprinting. This presentation discusses alternative strategies to provide highly tunable bioinks that 1) promote a specific cell-instructive niche and 2) are printable across multiple biofabrication technologies, including extrusion-, lithography- and microfluidic-based bioprinting. This talk will describe the design of versatile, photo-clickable bioinks and bioresins for biofabrication of *in vitro* models targeting cartilage, bone and vascular network regeneration, and how their convergence with 3D spheroid bioassembly and dual perfusion bioreactor (MPS) platforms offer new paradigms for high-throughput screening, "on-chip" and osteochondral tissue repair applications.

Biography



Tim Woodfield is Professor of Regenerative Medicine at the University of Otago Christchurch, New Zealand. He holds a prestigious Rutherford Discovery Fellowship from the Royal Society of New Zealand, and is Principal Investigator within the Medical Technologies Centre of Research Excellence (CoRE). His research technology platform involves complex 3D Biofabrication and Additive Manufacturing of biomaterial scaffolds and medical devices applied to regenerative medicine of cartilage and bone, including advanced 3D tissue culture models and high throughput screening. He has published over 105 peer reviewed journal articles, book chapters and published conference proceedings (h-index: 30). He is the current President Elect and Executive Board Member of the *International Society for Biofabrication* (ISBF). He is the former President of the *Australasian Society for Biomaterials & Tissue Engineering* (ASBTE), and was recently awarded the ASBTE Award for Research Excellence. He also sits on the *Tissue Engineering and Regenerative Medicine International Society Asia Pacific* (TERMIS-AP) Council, and is an Editorial Board Member for *Biofabrication*, *APL Bioengineering*, and *Frontiers in Bioengineering & Biotechnology*.