

# Novel Hydrogels and their Uses in Biomanufacturing

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## Abstract

The clinical potential of stem cells in tissue engineering and regenerative medicine, and their exploitation in *in vitro* disease models for drug toxicity and discovery, is recognised to be significant, but remains a substantial challenge to realise and effect. Many of these challenges lie in achieving high quality, high purity cellular products (whether stem cells, differentiated progeny or neo-tissues) in sufficient numbers or volumes, reproducibly. Repurposed traditional culture ware and FDA approved biomedical polymers for these applications has failed to address these challenges.

In this workshop presentation, I will overview how new insights into the biology and physiology of stem cells, their differentiated progeny and tissues, have been derived from synthetic hydrogels that display physicochemical properties reminiscent of the natural cell microenvironment and that can be engineered to display essential biological cues. I will also discuss how having learnt from these insights we and others have developed next generation hydrogels that have seen applications in cell bioprocessing and biomanufacturing. Lastly, I will highlight how high throughput methodologies are now being used to, in an unbiased manner, identify novel ‘biomaterial-driven’ effectors of stem cell behaviours to unlock the clinical potential of stem cells in cell therapy, tissue engineering and regenerative medicine.

## Biography

Professor Cooper-White’s laboratory develops biomaterials and biomicrodevices to decipher the roles of biophysical and biochemical cues provided by the extracellular (niche) microenvironment on stem cell fate. Such insights inform the design of directive biomaterials that are applied to cell therapy and musculoskeletal and cardiovascular repair/regeneration. Prof. Cooper-White has over 200 publications in high impact journals, including *Science Advances*, *Nature Communications*, *Nature Protocols*, *Biomaterials*, *Lab on a Chip*, *Stem Cells*, *Cell Stem Cell*, *Stem Cells and Development*, *Integrative Biology* and *APL Bioengineering*. He has produced 6 Worldwide patents that have reached National Phase Entry in USA, Europe and Australia in the areas of formulation design for agriproducts, microbioreactor arrays (MBAs) and tissue engineering scaffolds. He has received numerous awards, including most recently CSIRO OCE Science Leader Fellowship (2013-2018), the AON Insurance and Life Sciences Queensland Regenerative Medicine Award (2015) and the NHMRC Marshall and Warren Award for Research Excellence (2015).

