The Chinese University of Hong Kong

# Department of Biomedical Engineering

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**Venue: Room 215, William M.W. Mong Engineering Building, CUHK**

## Material Development for Stem Cell Applications


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## Abstract

From scalable manufacturing, consistency and regulatory perspectives, culturing human adult stem cells such as mesenchymal stem cells and human pluripotent stem cells (hPSCs) on synthetic surfaces with well-defined chemical and physical properties is of great importance for future applications. Whilst many approaches are possible, a scalable approach to surface preparation which can be readily manufactured is crucial. We have developed a number of surface coating approaches which can be readily applied to multiwell plates, tissue culture flasks and microcarrier particles as well as 3D electrospun scaffolds for tissue engineering applications which will be described in this seminar. These methods rely on surface initiated polymerization using inexpensive monomers and either peptide or small molecules immobilised in a second step, either before or after sterilization using gamma irradiation.

In certain situations, methods which give more controlled methods are preferred. Thus reversible deactivation radical polymerisation (RDRP) techniques, such as atom transfer radical polymerization (ATRP) or reversible activation-fragmentation chain transfer or RAFT polymerization methods can be used. We have applied ATRP and Cu(0) mediated radical polymerization to grow polymer brush coatings from a variety of substrate substrates including tissue culture ware and electrospun scaffolds (both degradable and non-degradable scaffolds). For lower cost, higher volume surface modification of cell culture ware, one step methods which use radiation (e.g. UV) induced grafting-from reactions may be more attractive. These methods do not provide the same level of control as RDRP methods but the properties can be optimized to suit many cell types, including hMSCs and hPSCs. More highly crosslinked coatings containing a cyclic RFDfK peptide are preferred in the case of the expansion of hPSCs while maintaining pluripotency over 10 passages, whereas softer coatings are acceptable for maintenance of hMSC multipotency.


## Biography

Laurence Meagher is the Deputy Director/Director of Research in the Monash Institute of Medical Engineering and Professor in Monash University's Department of Material Science and Engineering. Prior to joining Monash University, he worked at CSIRO Manufacturing. Over the last 18 years his research focus has been biomedical materials, most notably in the area of silicone hydrogel contact lenses, where he was part of a team that developed the CIBA Vision's second-generation Air OPTIXTM product. More recent research interests include the development of bioactive surface coatings for commercial applications such as synthetic, chemically defined materials for scaled ex vivo stem cell expansion, polymeric and liposomal vehicles for drug and protein delivery, "stealth" and bioactive coatings for biomedical implants and antibacterial materials and surface coatings for biomedical devices. Many of the approaches use controlled radical polymerisation techniques such as atom transfer radical polymerisation (ATRP) and reversible addition-fragmentation chain-transfer (RAFT) polymerisation and include both surface initiated and solution polymer strategies. Since joining Monash University, amongst other research areas, he has been applying the approaches used to develop bioactive surface coatings to prepare hydrogel systems useful in 3D cell culture and cell bioprinting, as well as the use of 3D printed, degradable polymer scaffolds in regenerative medicine

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