

Surface Modification: Challenges and Opportunities

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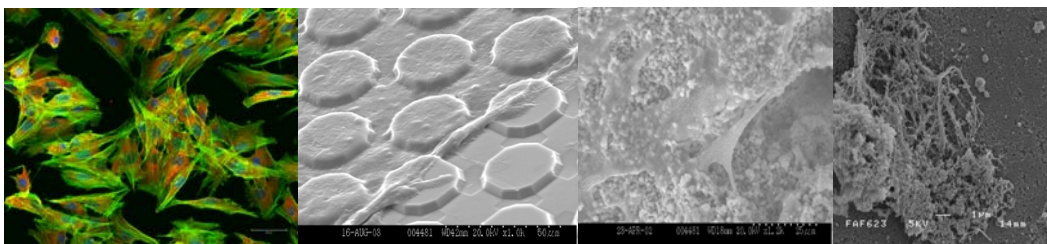
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Abstract

A central focus of the next healthcare revolution will be delivering the opportunities offered by the emerging interdisciplinary field of regenerative medicine, which has the potential to significantly improve the quality of life for many individuals. Regenerative medicine (RM) uses human cells to replace or regenerate tissues or organs, to restore or establish normal function. The importance of regenerative medicine (which in this context encompasses tissue engineering) to society is specifically identified in the UK Foresight Document Healthcare 2020 [1]. Beyond the obvious healthcare benefits that it may bring, there is also a requirement to provide more affordable clinical solutions in the future.

In order to achieve a successful clinical outcome it is envisaged that any regenerative medicine product needs a source of healthy and expandable cells that are qualified for clinical application. In the case of Tissue Engineered products, suitable scaffolds and automated cell culture systems/bioreactors optimised for the task are also required. Within this environment cells are seen as the functional elements of repair and regeneration and the scaffold as the initial 3D mechanical construct. As a result it is important that the appropriate cells can be sourced, cultivated and expanded *in vitro* to attain the appropriate phenotype or function, and the this process can be accurately qualified prior to transplantation. Indeed, any clinical product will rely heavily on the development of qualified manufacturing systems for the translation of laboratory based technologies into clinically effective, reproducible, and economically acceptable products. They will also have to fulfill the appropriate regulatory requirements laid out by the Federal Drug Administration (FDA) in the US and the Medicines and Healthcare Products Regulatory Agency (MHRA) in the UK. Whereas, there is much guidance on how this should be approached, the area remains largely unexplored to date.



This presentation hopes to explore some of the challenges that must be addressed in relation to providing suitable surfaces for expanding and supporting healthy cell populations for RM applications. Particular emphasis will be placed on reporting key findings from studies underway at NIBEC in this area, such as those investigating Radio Frequency (RF) magnetron sputtered calcium phosphate coatings and atmospheric plasma treatment of polymers. The presentation will finish by reviewing some of the work currently being conducted in NIBEC using Raman spectroscopy to monitor cell behaviour *in vitro*, work that may provide opportunities to qualify the cells within the emerging regulatory landscape.

Biography



Adrian Boyd was awarded his PhD in 2000 from the University of Ulster for his work on RF magnetron sputtered calcium phosphate coatings. He was appointed to a Lecturership in the School of Engineering, University of Ulster in December 2005 and is based at the Nanotechnology and Integrated Bioengineering Centre (NIBEC), on the Jordanstown campus. He is a core member of the Biomaterials and Tissue Engineering Research Group within NIBEC and was a member of the Unit of Assessment 29 submission in the 2008 Research assessment exercise (RAE). Previous to his academic appointment, Adrian worked as a Research Scientist at Avalon Instruments (now part of PerkinElmer Life and Analytical Sciences) for two years (2001 – 2003) specialising in the development and application of Raman spectrometers into the life sciences sector. His general research activities are directed towards the development of functional biomaterials, with particular interest on the role of biological interfaces in mediating and controlling the resultant cellular response. Core projects in this regard include investigations of bioactive calcium phosphate surfaces for bone tissue engineering and the development of new methods for the non-invasive evaluation of in vitro cellular processes for tissue engineering and regenerative medicine applications. He has over 60 publications in peer reviewed journals and conference proceedings, is a past President for the Northern Ireland Biomedical Engineering Society (NIBES) as well as being a current council member for the UK Society for Biomaterials (UKSB). Adrian is currently the course director for the BSc (Hons) Biomedical Engineering degree programme at the University of Ulster and is a Fellow of the Higher Education Academy.