>>> ANNOUNCEMENT

Benjamin Newland

National University of Ireland, Galway, Ireland

Biomaterial approaches to gene therapies for Parkinson's disease

ABSTRACT

Parkinson’s disease (PD) is a neurodegenerative disease characterised by the progressive loss of dopaminergic neurons, with an unknown etiology, ever increasing prevalence in western countries, and no disease modifying treatment currently exists. However, growth factors such as glial cell-derived neurotrophic factor (GDNF) have well documented neuroprotective effects in animal models and disease progression is often slow, allowing a good window for intervention. The Achilles’ heel of new therapies based on neuroprotection lies in the current delivery methods of therapeutic agents. Therefore I have focused my PhD studies on the development of new materials for applications in gene therapies for PD.

A unique polymerisation technology, developed by Dr. W. Wang, was applied to three out of four areas of my research focus: efficient nonviral transfection agents*, in situ* crosslinking nanogels and moving towards sustained vector delivery. The fourth area of focus was on improving cell based therapies for PD. Nonviral transfection is plagued by low transgene expression efficiencies and vector related toxicity. It was therefore desired to produce a more efficient vector with lower toxicity which has a synthesis facile in nature to allow for up-scale. During the development of the first vector it was noticed that our polymerisation data strongly contradicted current understanding of polymerisation of branching materials. It was also noticed that this hyperbranched polymer gave high transgene expression capabilities without increasing toxicity[1]. In fact a totally new structure of polymer was being formed, one by which the chains linked covalently to themselves during the polymerisation in a “knot” structure without gelling[2]. A second vector was then designed using this knot structure that superseded commercially available transfection agents[3]. This could deliver the GDNF encoding gene to neuronal cell cultures, allowing protection of neurons from toxins and causing longer neurites to extend from neuron cells (Fig-1).

Polymers were also produced for proof-of-concept studies in glutathione treatments for PD[4] (Fig-2), and for sustained delivery applications (Fig-3) (required for the long disease progression time). Final studies used the knot transfection vector to produce stem cells over expressing GDNF for transplantation into the rat brain as a means of *ex vivo* gene therapy (Fig-4).

<u>References</u>

1) B. Newland, Y. Zheng *et al., Chem Commun.* (2010) 46, 4698-4700

2) Y. Zheng, B. Newland *et al., J. Am. Chem. Soc.* (2011) 133, 13130–13137

3) B. Newland, Y. Zheng *et al., J. Am. Chem. Soc.* (2012) 134, 4782–4789

4) A. Saeed, B. Newland et al., *Chem Commun.* (2012) 48, 585-587

BIO

Since 2008	PhD Student at the Network of Excellence for Functional Biomaterials (NFB), National University of Ireland Galway – under supervision of Prof. Abhay Pandit, and co-supervisors Dr Wenxin Wang and Dr Eilís Dowd
2007 – 2008	MRes Nanomaterials - Imperial College London
2005 – 2006	PGCE Teacher Training Course at Leeds University (Science – Chemistry specialist)
2002 – 2005	BSc Natural Sciences, University of Durham

February 12, 2013 at 3 p.m.

Leibniz-Institut für Polymerforschung Dresden e. V.
Max Bergmann Center of Biomaterials Dresden
Seminar Room B1, Ground Floor, Budapester Straße 27

Contact: Prof. Carsten Werner, IPF/Max Bergmann Center of Biomaterials Dresden

Leibniz-Institut für Polymerforschung Dresden e. V.

MAX BERGMANN center of biomaterials dresden