The departmental seminar will be given jointly by Professor John Haycock from the Department of Materials Science and Engineering at the University of Sheffield (UK) and PhD student Rebecca Lomax

Bioengineering strategies for repairing peripheral nerve injury

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Peripheral nerve injuries are common and although regeneration is possible axonal damage is often too significant. Surgical intervention is therefore required in order for any functional sensation to be regained. Although the gold standard for peripheral nerve repair is autografting there are major disadvantages here, including a lack of donor nerve or donor site morbidity. The high level of cell death and lack of coherent orientation of regenerating axons without surgical intervention has led to therapies using nerve guidance conduits (NGCs), especially for short gap injuries. In the simplest form NGCs are hollow tubes that act as a physical guide between the proximal and distal stumps, bridging the gap of the injury. NGCs can be made from a variety of synthetic and natural materials and experimentally can incorporate cells and/or growth factors to improve guidance. Work is presently focused on methods for improving NGC design. Approaches include:

1) The use of 3D lithography printing methods for making NGCs from degradable polymers, which contain internal structures for physical guidance
2) The synthesis and characterization of parallel degradable microfibres as a scaffold for controlling direction of neuronal and Schwann cells
3) The use of surface chemical modification with plasma deposition for improving the ability of neuronal and Schwann cells to grow
4) To surface activate biomaterials for controlled delivery of growth factors and therapeutic molecules – including antioxidants
5) New 3D in vitro and in vivo imaging methods (multiphoton and lightsheet) for pre-clinical evaluation

Biography - **John Haycock** holds a Chair in Bioengineering and is Head of Department of Materials Science and Engineering at The University of Sheffield. He joined Sheffield University in 2001 as a lecturer and since this time has been awarded grants from the EPSRC, BBSRC, RCUK, TSB/Innovate UK, MRC, from industry and the EC, including a recent £6.7M EPSRC Centre for Doctoral Training in Advanced Biomedical Materials as Co-director with Manchester University. His work concerns the development of medical device and cell therapy approaches for repairing nerve injury, and development of 3D *in vitro* models. He has a particular interest in biological imaging and has establish multi-photon and light sheet imaging facilities at Sheffield and pioneered Time Resolved Microscopy to commercial application with Becker and Hickl, Oxford and Durham Universities. He has supervised 29 PhD students who have taken up senior positions in academia, industry and the civil service, has an h-index of 40 Scopus / 44 Google Scholar and over 100 papers in journals including *PNAS, Nature Protocols, Advanced Materials, Angewandte Chemie,* and *Chemical Science*; and has edited two books on 3D cell culture technology.

Biography - Rebecca Lomax is a PhD student in the Department of Materials Science and Engineering investigating the design, manufacture and evaluation of bioactive biomaterials for producing advanced nerve guide implants for peripheral nerve repair. She has a first degree (MBiolSci Hons) in Molecular Biology from Sheffield University and is in the second year of her PhD. Her studentship is sponsored by a Dr Jeff Wadsworth – Battelle award.

The Battelle studentship awards were created by Dr Jeff Wadsworth (President & CEO Battelle, Columbus, OH, USA) Dr Wadsworth is an alumnus of The University of Sheffield. The scheme funds joint research programmes between the UK and USA including a 3-month studentship placement in the USA. The USA supervisor for Rebecca's research project is **Professor J. Andres Melendez**. Rebecca is planning her placement in the College of Nanoscale Science & Engineering (SUNY), and her work will study the role of physiological oxidants and antioxidants on neuronal cell differential, as a basis for therapeutic interventions in medical device nerve implants.