A Multidisciplinary Approach to Intervertebral Disc Regeneration: from Benchtop to Preclinical Translation

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When: 3.00pm 11 July 2016
Where: Trinity Biomedical Sciences Institute, B2.72

Abstract: Degeneration of the lumbar spine intervertebral discs is widespread and strongly implicated as a cause of low back pain. Current treatment options are limited, and focused on alleviating pain without preserving the biomechanical function of the intervertebral joint. Our lab applies a multidisciplinary approach to disc regeneration comprising injectable hydrogels to restore function, anti-inflammatory drugs to arrest the degenerative cascade, and stem cells to potentiate long term native tissue reconstitution. To optimize stem cell-based disc regeneration we are studying how disc progenitor cells regulate tissue formation during embryonic development. To progress these therapies towards human application, we have developed a preclinical large animal model that recapitulates the spectrum of human disc degeneration.

Dr Lachlan Smith is a bioengineer whose primary research interest is the pathophysiology and treatment of disorders affecting the spine, particularly the intervertebral discs and vertebral bones. Dr Smith received his Bachelor of Mechanical Engineering and Ph.D in Pathology from the University of Adelaide, Australia. He then undertook postdoctoral training with Drs Dawn Elliott and Robert Mauck at the University of Pennsylvania in Philadelphia, before joining the faculty at Penn in 2013. Dr Smith’s lab uses cutting edge techniques in molecular biology, biochemistry and bioengineering, coupled with novel in vitro model systems to study disease mechanisms. His research in the translational space bridges the fields of tissue engineering, biomaterials, drug delivery and stem cells, and is focused on arresting disease progression, restoring spine function and potentiating long term tissue regeneration. Naturally occurring and inducible large and small animal models are used to study disease etiology and evaluate therapeutics. Dr Smith’s research program is funded by the National Institutes of Health, the Department of Veterans Affairs, and various private foundations.