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Quiescent pluripotent stem cells capable of expressing Sox2, Oct4, Klf4 and c-Myc reside within peripheral nerves in adult mammals and can differentiate into cells of all 3 germ layers

We have documented a large population of quiescent stem cells within peripheral nerves. In response to nerve injury, or stimulation with the cytokine BMP2, these cells proliferate and form pluripotent stem cells, expressing Sox2, Klf4, Oct4 and c-Myc (verified by double stain immunohistochemistry and by real time PCR). These are the transcription factors that confer embryonic pluripotency (Cell 126: 663, 2006). We call these cells Nerve Derived Pluripotent Stem cells, or NEDAPS cells. The cells propagate restrictive media and are readily induced to form tissues from all 3 germ layers. We hypothesize they represent the central feature in an important and previously unknown universal pathway for tissue repair. Nerves are nearly ubiquitous in the body. Thus, we believe that nerve injury accompanies virtually any injury and the consequent proliferation of these stem cells occurs locally following essentially any injury representing a previously unknown universal pathway for healing. Data will document induction and successful culture of these unique new pluripotent cells from three mammalian species and demonstrate their directed differentiation into osteoblasts, endothelial cells, primitive neural cells, definitive endoderm and fibroblasts as demonstrated by morphology, immunohistochemical staining and by Real Time-Polymerase Chain Reaction (RT-PCR) data. Stem cell biology is a field that has recently seen an explosion of new work in the last decade, stimulated by the remarkable discovery that induced pluripotent stem cells (iPCs) 4 transcription factors (listed above), most often by the use of retrovirus vectors (Yamanaka, Cell 126: 663, 2006). Such iPCs are being widely studied as possible sources of cells for the treatment of human disease. This work has been hampered by issues of malignant transformation of iPCs and by immune rejection of "non-self" cells. We are aware that previous claims to successful identification of cells with universal differentiation from non-gonadal adult tissue have sadly resulted in some notable and well publicized scandals, involving fabricated data. Confidence in our admittedly unprecedented idea is provided by information from other species. It has long been known that a salamander or starfish can re-grow an entire arm after amputation, but that ablation of the nerve stump will block the regeneration. (Kumar and Brokes Trend. Neurosci 2012 p691). We propose that this new knowledge will also explain vexing clinical problem of impaired wound healing experienced by severely diabetic patients and victims of leprosy. We suggest that in the severe depletion or absence of these newly discovered stem cells due to the neuropathies associated with these illnesses, is the cause of the healing difficulties seen clinically. The other implication of this discovery is that we may now have a straightforward opportunity to obtain individual specific "self-to-self" stem cell treatments based on cells obtained by minimally invasive biopsy of a nonessential peripheral neve of a specific patient in need.

Speaker Biography

Michael Heggeness completed his PhD at UC San Diego in membrane biology and a postdoc at Rockefeller University in Virology. He received his MD from the University of Miami. After a residency in Orthopaedic Surgery, he completing a fellowship in Spine Surgery at the University of Toronto. He then joined the faculty at Baylor College of Medicine where he became Chairman of Orthopaedic Surgery in 2004. He moved take the Orthopaedic Surgery Chair at University of Kansas in Wichita in 2013. He has 84 publications and 4 issued patents.

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