Daniel Hellenbrand et al., J Dev Drugs 2018, Volume 7
DOI: 10.4172/2329-6631-C3-033

Treating neurological disorders via sustained drug delivery from mineral coated microparticles

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Many of the treatments for varying neurological disorders involve a systemic delivery of a protein or drug, which can cause unwanted side effects. Here, we are testing the use of mineral coated microparticles (MCMs) to deliver a locally sustained release of therapeutic proteins. Mineral coatings grown in simulated body fluids are particularly advantageous in drug delivery, as it allows for a high level of control over coating properties and resultant protein release kinetics. Our lab is utilizing mineral coatings on both sutures and microparticles to develop treatments to enhance regeneration after neural tissue injuries. Recently, we have demonstrated that mineral coated sutures loaded with neurotrophin-3 significantly increase the number of axons regenerating into peripheral nerve grafts implanted in the spinal cord. Currently, we are developing microparticles with mineral coatings to deliver the anti-inflammatory cytokine interleukin-10 (IL-10) after a spinal cord injury. Using mineral coatings on microparticles, we are able to overcome many of IL-10's limitations including IL-10 has a short half-life, it does not cross the blood spinal cord barrier, and IL-10 is rapidly cleared from the injury site. IL-10 delivered from mineral coated microparticles reduced pro-inflammatory cytokines resulting in a higher level of functional recovery after spinal cord injury when compared to a bolus injection. Based on our previous results and in view of the importance of cytokines and growth factors to treat varying neurological disorders, the proposed mineral coatings may be a uniquely enabling technology.

Biography

Daniel Hellenbrand works as an Assistant Researcher in Dr. Amgad Hanna's Spinal Cord and Nerve Lab. He received his Bachelor of Science in Mechanical engineering Technology from Miami University in 2008 and a Master of Science in Biomedical Engineering from the University of Wisconsin in 2010. Dan's primary research interests involve treatments to improve functional recovery after spinal cord injury. They are currently investigating the capabilities of interleukin-10, an anti-inflammatory cytokine, to reduce inflammation after spinal cord injury and the use of neurotrophin-3, a growth factor, to promote axon growth after spinal cord injury.

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