Injectable Hydrogels for the Delivery, Maturation, and Engraftment of Clinically Relevant Numbers of Human Induced Pluripotent Stem Cell-Derived Neural Progenitors to the Central Nervous System

Grant Award Details

Injectable Hydrogels for the Delivery, Maturation, and Engraftment of Clinically Relevant Numbers of Human Induced Pluripotent Stem Cell-Derived Neural Progenitors to the Central Nervous System

Grant Type: Tools and Technologies III

Grant Number: RT3-07948

Project Objective: Development of injectable hydrogel to improve viability and function of hiPSC-dervived Neural Progenitors in the central nervous system.

Investigator:

Name:	Sarah Heilshorn
Institution:	Stanford University
Type:	PI

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Name:	Giles Plant
Institution:	Stanford University
Type:	Co-PI

Disease Focus: Neurological Disorders, Spinal Cord Injury

Human Stem Cell Use: iPS Cell

Award Value: $1,347,767

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 3/NCE

View Report

Grant Application Details

Application Title: Injectable Hydrogels for the Delivery, Maturation, and Engraftment of Clinically Relevant Numbers of Human Induced Pluripotent Stem Cell-Derived Neural Progenitors to the Central Nervous System

Public Abstract: One critical bottleneck in the translation of regenerative medicine into the clinic is the efficient delivery and engraftment of transplanted cells. While direct injection is the least invasive method for cell delivery, it commonly results in the survival of only 5-20% of cells. Studies suggest that delivery within a carrier gel may enhance cell viability, but most of the gels used previously were naturally derived materials that have complex and unknown compositions. In our previous CIRM-funded work, we discovered that pre-encapsulating cells in very weak hydrogels offers the best protection during injection; however, those gels may be too compliant to support long-term cell survival. To address these limitations, we propose the design of a fully defined, customizable, and injectable material that initially forms a weak gel that then stiffens post-injection. We focus our studies on the delivery of human induced pluripotent stem cell-derived neural progenitors for the treatment of spinal cord injury (SCI). There are ~12,000 new SCI patients in the US each year, primarily young adults. SCI commonly results in paralysis, and the estimated lifetime cost for a patient can rise above $4 million dollars. In preclinical models of SCI, stem cell therapies have resulted in partial regeneration; however, reproducible delivery and engraftment of sufficient cells remain difficult and unmet challenges. This award potentially develops transformational regenerative therapies for SCI.

Statement of Benefit to California: The annual incidence of spinal cord injuries (SCI) in the United States is estimated at 12,000 new cases per year, with motor vehicle crashes accounting for up to a third of these cases. SCI has devastating impacts not only on the quality of life for the victims and their families, but also on their economic security – the estimated lifetime cost of an SCI patient can rise to over $4 million dollars depending on the severity and age at which the injury was sustained, not including the loss of wages and productivity. Although the most prevalent types of SCIs are those sustained at either the cervical or thoracic vertebrae, there are currently no definitive therapies approved for the chronic management of these SCI. Stem cell-based therapies have recently been shown to be mildly successful in several clinical and pre-clinical trials in various injuries and diseases, and a number of trials are ongoing for applications in SCI. In our proposal, we seek to advance the stem cell-based approach to the treatments of SCI. The potential benefit of this proposal to the state of California and its citizens include 1) the provision of a better medical prognosis for patients with spinal cord injuries, 2) the improved quality of life for SCI patients and their families, 3) the reduction of the burden of health care costs, 4) the creation and maintenance of jobs in the stem cell technology field, and 5) preserving California's prominence in the field of stem cell research.