Assessing the mechanism by which the Bone Morphogenetic Proteins direct stem cell fate

Grant Award Details

Assessing the mechanism by which the Bone Morphogenetic Proteins direct stem cell fate

Grant Type: Basic Biology V

Grant Number: RB5-07320

Project Objective: The overall goal is to elucidate molecular mechanisms by which BMP proteins establish sensory interneuron (IN) identity, and then translate this knowledge to produce sensory interneurons from hESCs.

Investigator:

Name:	Samantha Butler
Institution:	University of California, Los Angeles
Type:	PI

Disease Focus: Neurological Disorders, Spinal Cord Injury

Human Stem Cell Use: Embryonic Stem Cell

Award Value: $515,730

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Grant Application Details

Application Title: Assessing the mechanism by which the Bone Morphogenetic Proteins direct stem cell fate

Public Abstract:

Our goal is to use the mechanisms that generate neuronal networks to create neurons from stem cells, to either replace diseased and damaged tissue or as a source of material to study disease mechanisms. A key focus of such regenerative studies is to restore function to the spinal cord, which is particularly vulnerable to damage. However, although considerable progress has been made in understanding how to direct stem cells towards motor neurons that control coordinated movement, little progress has been made so far directing stem cells to form the sensory neurons that allow us to experience the environment around us.

Our proposed research will use insights from the mechanisms known to generate the sensory neurons during the development of the spinal cord, to derive these neurons from stem cells. We will initially use mouse embryonic stem cells in these studies, to accelerate the experimental progress. We will then apply our findings to human embryonic stem cells, and assess whether these cells are competent to repopulate the spinal cord. These studies will significantly advance our understanding of how to generate the full repertoire of neural subtypes necessary to repair the spinal cord after injury, specifically permitting patients to recover sensations such as pain and temperature. Moreover, they also represent a source of therapeutically beneficial cells for modeling debilitating diseases, such as the chronic insensitivity to pain.

Statement of Benefit to California:

Millions of Californians live with compromised nervous systems, damaged by either traumatic injury or disease. These conditions can be devastating, stripping patients of their ability to move, feel and think, and currently have no cure. As well as being debilitating for patients, living with these diseases is also extremely expensive, costing both Californians and the state of California many billions of dollars. For example, the estimated lifetime cost for a single individual managing spinal paralysis is estimated to be up to $3 million.

Stem cell technology offers tremendous hope for reversing or ameliorating both disease and injury states. Stem cells can be used to replenish any tissue damaged by injury or disease, including the spinal cord, which is particularly vulnerable to physical damage. Our proposed studies will develop the means to produce the spinal sensory neurons that permit us to perceive the environment. We will also determine whether these in vitro derived sensory neurons are suitable for transplantation back into the spinal cord. The generation of these neurons will constitute an important step towards reversing or ameliorating spinal injuries, and thereby improve the productivity and quality of life of many Californians. Moreover, progress in this field will solidify the leadership role of California in stem cell research and stimulate the future growth of the biotechnology and pharmaceutical industries within the state.
