Cover Page

Multidisciplinary research Initiation Grant (MIG) ***Office of the Vice President for Research*** *STUDY APPLICATION*	Office use only Received: Sent to reviewers: Review Board meeting: Applicant notified:

Title: **Nanoparticle labeled Neural Stem Cell Tracking In Vivo by Magnetic Resonance Microscopy**

Principal Investigator: Stanislaus Wong

Department: Chemistry

Co-Investigators and Departments: (alphabetical order)

Meigan Aronson (Physics)
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Mirjana Maletic-Savatic (Neurology)

Summary: (Not to exceed 200 words)

The proposed research has three objectives and the following expected results. The first is to define the optimal size and coating of nanoparticles for 'labeling' of neuronal stem cells (NSC) including their magnetic resonance (MR) signatures. The second objective is to define the minimal number of nanoparticle labeled NSCs that can be detected in live mice so that a realistic protocol can be developed that will allow for characterization of the NSC migration in vivo. The third objective is to track migration patterns of nanoparticles labeled from the site of implantation to inflammatory lesions in a mouse model of amyotrophic lateral sclerosis (ALS).

The ability to identify and track neural stem cells by nanoparticle imaging will have profound implications for diagnostic, prognostic and therapeutic purposes for a wide variety of neurodegenerative diseases such as amyotrophic lateral sclerosis including tissue engineering and organic biosensors.

Abstract

DESCRIPTION OF PROJECT:
The objective of this proposal is to develop and implement new technology using (a) stem cells, (b) nanoparticles coated with organic moieties and (c) high-resolution magnetic resonance (MR) microscopy to track the fate of neuronal stem cells on a bio-systems level in vivo.

HOW THIS PROJECT MEETS THE GENERAL CHARACTERISTICS OF THE MIG SEED PROGRAM:
The combination of the new capabilities of custom-based nanoparticle design and synthesis and novel imaging capabilities of the high-field 9.4T microMRI is the true basis for inter-disciplinary and 'fusion' of technologies. The proposed project will be a first spin-off of using defined nanomaterials to track living stem cells in a mouse model of human disease.

EXPECTED RESULTS:
The proposed research has three objectives and the following expected results. The first is to define the optimal size and coating of nanoparticles for 'labeling' of neuronal stem cells (NSC) including their MR signatures. The second objective is to define the minimal number of magnetite nanoparticle labeled NSCs that can be detected in live mice so that a realistic protocol can be developed that will allow for characterization of the NSC migration in vivo. The third objective is to track migration patterns of nanoparticles labeled from the site of implantation to inflammatory lesions in a mouse model of amyotrophic lateral sclerosis (ALS).

IMPACT ON SCIENCE:
The ability to identify and track neural stem cells by imaging will have profound implications for diagnostic, prognostic, and therapeutic purposes for a wide variety of neurodegenerative diseases such as amyotrophic lateral sclerosis including tissue engineering and organic biosensors. Success in this project will provide preliminary data necessary for us to obtain funding from a variety of sources including NIH and NSF as well as relevant foundations supporting medical research.