A MULTI-MODALITY MOLECULAR IMAGING SYSTEM (MRSPECT) FOR IN VIVO STEM CELL TRACKING

Grant Award Details

A MULTI-MODALITY MOLECULAR IMAGING SYSTEM (MRSPECT) FOR IN VIVO STEM CELL TRACKING

Grant Type: Tools and Technologies I

Grant Number: RT1-01120

Investigator:

Name:	Orhan NALCIOGLU
Institution:	University of California, Irvine
Type:	PI

Award Value: $719,798

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Grant Application Details

Application Title: A Multimodality Molecular Imaging Systen (MRSPECT) for in Vivo Stem Cell Tracking

Public Abstract:

The stem cell research has started making many promising discoveries already. Future clinical trials will require that the location and number of such cells be tracked in live subjects, over long periods of time. Tracking of stem cells after administration is essential for a better understanding of their migrational dynamics that could be used to understand treatment effectiveness. Biomedical imaging offers the potential for tracking the cells in vivo after labeling of the cells is achieved by using imaging agents that enables one to visualize the cells inside a living organism without performing any invasive procedures such as surgery. In fact the problem of imaging small numbers of cells in the living subject is not limited to stem cell–based treatments but also has broad applicability in oncology, immunology, and transplantation.

To overcome the shortcomings of existing technologies we propose to build the world's first combined high field MRI and SPECT molecular imaging system. This system can be used for stem cell tracking in living small animals. This device will combine the advantages of MRI with SPECT since images from both techniques will be acquired with full 3D co-registration. Although both of these techniques have been used separately and have well-known advantages and disadvantages nobody has been able to collect such images simultaneously until now since such a molecular imaging device has never been built. If one performs these studies separately then the co-registration of images from both techniques cannot be achieved with a high degree of accuracy. The combined imaging device could be used for tracking stem cells labeled with either MR contrast agents or a gamma ray emitters or a combination of both. MRI offers high spatial reso-lution images in the order of 0.1-0.3mm but has low sensitivity for the detection of labeled cells. SPECT on the other hand provides lower spatial resolution images in the order of millimeters but with 10,000 times higher de-tection sensitivity compared to MRI. Thus the combination of both would offer unsurpassed advantages over the existing stem cell detection/tracking techniques.

Additionally since both techniques are already used on humans making the combined system also applicable to larger animal or human studies with appropriate modi-fications. The construction of such a molecular imaging device is very challenging since it requires that the nu-clear detectors used in SPECT should work inside a high magnetic field. Conversely, it also requires that the SPECT detectors housed inside the magnet for nuclear imaging do not cause any artifacts in the MR images. After successful conclusion of the ex vivo testing, ad-ditional testing will be undertaken to determine the system's performance in live animals. Once the proof of the concept is achieved in the current proposal such a system could be upscaled for large animal or human stud-ies under separate funding by other agencies.

Statement of Benefit to California:

The overall aim of our project is for improving human health especially in stem cell treatment for many diseases. Availability of technologies to assess the effectiveness of stem cell treatments will help translate such findings rapidly to the citizens of California. The proposed dual-modality imaging system will help strengthen California's biotechnology industry by providing them with a unique imaging device that could be used to track stem cells in small animals to humans. This would create collateral economic benefits such as high-paying jobs and increased tax revenues. Additionally, the developed imaging device will be patented by the submitting organization to collect licensing royalties for the state. Thus the completion of this project will have both short and long term positive impact on the healthcare of California citizens as well as its biotechnology.
