Online Proceedings

Poster Session 3

Balcony, Easel 117

2:30 PM to 4:00 PM

Detection and Quantification of Nicotinamide Adenine Dinucleotide (NAD) by Method of NMR Analysis

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Initiative for Maximizing Student Development Scholar, McNair Scholar
Mentor: Kevin Conley, Radiology
Mentor: Eric Shankland, Radiology

Nicotinamide adenine dinucleotide (NAD) is used in many biological processes such as metabolism and cellular signaling. Recently NAD is found to have an important role in many signaling pathways. As NADs role in cellular pathways is being discovered, it is important to be able to detect and quantify the amount of NAD in vivo and in vitro by nuclear magnetic resonance (NMR) analysis. NAD is found in cells at low concentrations and its peak intensity in a phosphorus spectrum is much smaller than that of other phosphorus containing molecules like ATP. By decoupling and Insensitive Nuclei Enhanced by Polarization Transfer (INEPT) experiments we hope to isolate and increase the signal of the characteristic phosphorus nuclei found in NAD molecules. Isolating and increasing the signal to noise of the NAD peak will prove that we have the right peak and allow us to quantify the amount of NAD in vivo. This will provide information about health risks of a subject.

Poster Session 4

MGH 241, Easel 167

4:15 PM to 5:45 PM

Metabolic Changes in Induced Pluripotent Stem Cells during Cardiomyocyte Differentiation

Merry Toh, Senior, Bioengineering
Mary Gates Scholar
Mentor: Anna Naumova, Radiology

Induced Pluripotent Stem cells (iPSCs) have the capability to differentiate into beating cardiomyocytes, therefore have the potential to regenerate injured heart. Structural and metabolic maturation is important to support the increase in energetic demand during the differentiation process. These metabolic and energetic requirements of iPSCs during their differentiation into iPSCs-derived cardiomyocytes (iPSC-CM) are largely unexplored. The aim of this project is to study the changes in metabolic pathways in iPSCs during differentiation processes, using state-of-the-art, extracellular flux (XF) analyzer manufactured by Seahorse Bioscience (Massachusetts, USA). IPSCs were differentiated into cardiomyocytes in 96-well plates using directed differentiation protocol. Oxidative phosphorylation and glycolysis rates were measured in plate using XF machines on different time points of differentiation. The XF machine monitors the changes in energy producing pathways by measuring the amount of oxygen consumption and the acidification rate. Our findings showed significant difference in the energetic requirements of undifferentiated and differentiated stem cells. We found that undifferentiated iPSCs have active mitochondrial metabolism reflected by high respiratory rate. During differentiation of iPSCs, their metabolism shifts to a more glycolytic pathway. Fully matured cardiomyocytes demonstrate greater metabolic flexibility characterized by quick shift of energy production from oxidative phosphorylation to glycolysis in conditions where mitochondrial respiration is impaired. To our knowledge, this is the first study to measure the changes in energy metabolism in iPSCs during differentiation into cardiomyocytes by XF analyzer. The protocol developed in this study will provide novel platform for analyzing the energetics of other cells types during differentiation processes. The results of the study will provide an insight into metabolic processes underlying cardiomyocyte differentiation of iPSCs and might be useful for establishing metabolic targets to regulate cardiogenesis and cell maturation.

Poster Session 4

MGH 241, Easel 170

4:15 PM to 5:45 PM

Development of a Diffusion Tensor Imaging (DTI) Based Approach for Three-Dimensional Fiber Tracking of the Breast Ductal Network

Peixian Liu, Senior, Bioengineering
Mary Gates Scholar
Mentor: Savannah Partridge, Radiology

Diffusion tensor imaging (DTI) has been successfully used to map 3D brain structure due to its ability to characterize water diffusion rate, anisotropy, and direction. However, DTI-based

3D fiber tracking has not yet been done in human breast. The objective of this study is to develop an approach for 3D fiber tracking of the breast ductal network. In the study, an optimized DTI pulse sequence has been determined by testing on different parameter combinations. Intra-subject reproducibility has also been characterized to assess the reliability of the DTI data and post-processing methods. Lastly, 3D fiber tracking of the breast ductal network is under development using DTI measures obtained from scanning the breast of healthy volunteers. The resulting information on 3D trajectory of breast ducts can benefit the study of the anatomy and development of the breast. It may also help detect early malignancy within the ducts because of the disruption of the ductal system.