BSc/MSc-project

Title: Ex vivo studying the influence of Bone Morphogenetic Protein (BMP4) on cellular glucose metabolism and ATP level in pancreatic insulin producing beta cells.

Description:

Reduced metabolism of glucose and oxygen consumption can cause energy failure (ATP depletion), which can in turn trigger processes leading to cellular dysfunction.. Glucose can support glycolytic ATP production even in the absence of oxygen however oxidative phosphorylation is required for proper beta cell function and release of insulin. On the other hand high level of glucose in the blood (hyperglycemia) and subsequent high levels of glucose metabolism could damage or decrease the cell function and survival. Therefore the glucose concentration in blood is regulated to into its default value by two hormones secreted from Pancreatic islets cells (alpha and Beta). This project focuses on *ex vivo* studying how a known pro-inflammatory cytokine BMP affects ATP generation and glucose metabolism at the cellular level. BMP is known to negatively affect beta cell growth and function through changes in gene transcription and has been suggested to play a role in the development of diabetes. Some of the affected genes are involved in glucose metabolism and thus ATP generation. The effects of BMP4 on glucose metabolism and ATP generation will be studied using beta cells isolated from mice or obtained from human donors.

Magnatic Resonance Spectroscopy (MRS) allows for particular chemical compounds or metabolites in volume of interest to be observed. The technique is based on molecules (MR visible) that are resonating when they're exposing to a large externally applied magnetic field (B_0). The resonance (*Larmor*) frequency of a proton e.g. 1H (or other resonating atomic nuclei) can be disturbed by the small electrical field produced by the electrons surrounding the nucleus. The phenomenon produces what is known as the chemical shift (shift in the *Larmor* frequency) and can be utilized in MR spectroscopy to identify different chemical components. MRS can generate a spectrum including the metabolites of interest where the concentration of a given metabolite is proportional to its spectroscopic peak area. Phosphorus (P-31) and Carbon (C-13) MR spectroscopy are used for measuring cellular ATP and glucose levels respectively.

The experiment's running at NMR center using the Bruker BioSpec 9.4 T MR small animal scanner. The candidate student will work with already optimized MRS protocols and will work in a highly interdisciplinary environment and will have the opportunity to collaborate with other researchers at the University of Copenhagen.

Required qualifications: Physics

Responsible institution: Biomedical Institute, Panum NMR Center

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Allowed no of students per report: 1-2

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