**3rd semester projects medis/medicin (10 ECTS)**

The project is for module 3.4a) Muscle function or 3.4b) nerve function:

Project title: Nerve excitability testing protocol to identify abnormal voltage-gated ion channels

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Background: Diabetes is a global health care problem. In Denmark alone, over 250,000 people have been diagnosed with diabetes, predicted to increase to 430,000 by the year 2030. Furthermore, 30% of diabetic patients develop diabetic peripheral neuropathy (DPN) with symptoms ranging from numbness to burning chronic pain. Available diagnostic tools for DPN mainly include clinical examination, skin biopsy and quantitative sensory testing of small fiber functionality. Existing diagnostic tools for DPN are insufficient. The major reason for this is that they do not asses the excitability of pain fibers, which is altered in both DPN patients as well as in animal models of DPN. Our research group have developed the perception threshold tracking technique to indirectly measure the excitability of pain fibers (nociceptor). A pin electrode is placed on the skin surface of the subjects to preferentially activate the nociceptor fibers. When a small current is applied through the electrode, a high electrical density is generated in the superficial layers of the skin where the nociceptor fibers terminate. The electrode will therefore preferentially activate nociceptive fibers as opposed to non-nociceptive fibers, which terminate in deeper skin layers.

The focus of the current project will be on voltage-gated ion channels (VGIC), which effectively govern the sensitivity of the nociceptive fibers by moderating the excitability of the cell membrane. VGIC are small pore-formed channels protruding through the cell membrane where electrically charged ions can flow. They enable the generation and propagation of nerve signals, e.g. from the skin through the spinal cord up to the brain. For nociceptive fibers, there are around ten subtypes of VGICs, which are relevant for normal nociceptor functionality. VGICs have therefore been speculated to play a pivotal role in the development of DPN. However, while there are candidate VGICs derived from animal models of DPN the underlying subtypes of VGIC abnormalities are essentially unknown.

It would be of great importance to identify which ion channels are altered in patients both for the understanding of pain mechanisms but also for drug development. A novel nociceptor nerve fiber protocol has already been derived by computational modeling to isolate alterations of ion channels.

Aim of Project: The aim is to evaluate a new nerve testing protocol in healthy subjects.

Applied methods: Cutaneous electrical stimulation, which means that a small electrical current will be applied on the skin in order to activate nerve fibers.

Number of groups that can be assigned to this project: 1