Karlsruher Institut für Technologie

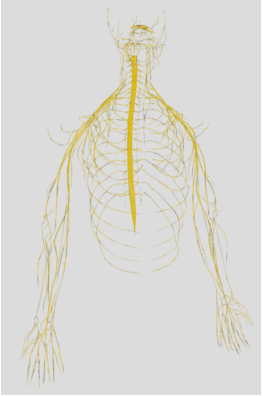
Institut für Biomedizinische Technik

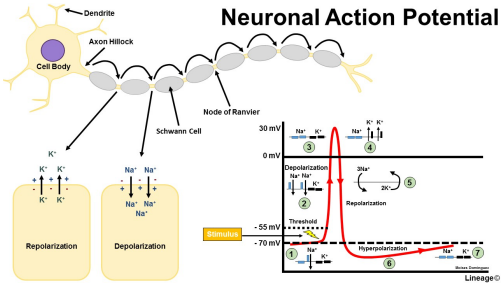
Master/Bachelor Thesis

Reducing Animal Testing: A Computer Model to Assess Muscle Contraction in PFA

Motivation

Electroporation has recently emerged as a highly versatile technique with applications across various fields, including oncology for targeting tumor cells, and the food industry for enhancing nutritional properties. Specifically in cardiac ablation, electroporation is used in the pulsed field ablation (PFA) technique, an alternative approach that shows significant promise by substantially reducing the risk of thermal damage to surrounding structures, such as the phrenic nerve, which could be fatal. However, certain PFA protocols are associated with involuntary muscle contractions that require the use paralytic drugs. To study this side effect, animal studies remain the primary method to evaluate the safety of PFA protocols. The aim of this study is to develop a computational model that incorporates the nerves surrounding cardiac tissue and assess the risk of muscle contraction. This model could improve the safety of PFA for patients and reduce the number of animal experiments required to test PFA protocols.





https://sketchfab.com/3d-models/nerves-bc355fc470414d448964a5ce44465324
https://upload.medbullets.com/topic/107054/images/neuronal action potential.jpg

Student Project

The student will use the publicly available **openCARP** software to build an in silico setup incorporating an existing nervous system model. They will tune the model's parameters to the specific use case of pulsed field ablation (PFA). The student will also use meshes from publicly available nerve system data to study how electric fields generated within the heart affect surrounding nerves. Basic programming skills in **MATLAB** or **Python** (preferred) are required, with a basic understanding of electrical signals in the human body being an advantage but not essential.

Skills needed

- Written and spoken English
- Experience in Python is desirable

Research area
Computational modelling in Biomedical Engineering

Project
Cardiac modelling

Orientation
Computational modelling, software programming, cardiac simulation

Course of studies
Electrical engineering, computer science, physics, similar

Starting date
As soon as possible

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