Detailed structural imaging and comprehensive characterization of the arrhythmogenic myocardial substrate using motion-resolved free-running multidimensional cardiac imaging

Background: Cardiac arrhythmias are a major cause of death and cardiac morbidity. The vast majority of arrhythmias occur on subtle structural alterations in the cardiac tissue. Over the past decade, multiple MR methods have been introduced to target various tissue components of the diseased myocardium. Unfortunately, the spatial and temporal resolution of such methods is insufficient to depict structural alterations involved in arrhythmogenicity. However, major strides have recently been made in MR methods. The aim of this translational project is therefore the development, implementation, and optimization of a multidimensional cardiac magnetic resonance (CMR) approach to characterize the myocardial arrhythmogenic substrate at high spatial and temporal resolution. This will be accomplished by developing innovative free-running 3D acquisitions augmented with multiple contrast preparations for mapping and advanced augmented multi-dimensional image reconstruction incorporating AI and advanced mathematical tools. This project will leverage on a pre-existing and unique collaboration between the CHUV in Lausanne, Switzerland, a world leading group in translational CMR methods development, and the IHU LIRYC in Bordeaux, a world leading group in cardiac arrhythmia research.

Project Description: After familiarizing yourself with both the technical (i.e. MR acquisition and reconstruction) and clinical (i.e. cardiac electrophysiology) aspects of the project, you will start by exploiting novel CMR acquisition and reconstruction methods to push the boundaries of spatial and temporal resolution, and to introduce multiple contrasts for the detailed assessment of myocardial structure and tissue composition. Initial development and simulation will be in Matlab, followed by optimization in phantoms and healthy volunteers. In a second step, the CMR methods will be applied in patients and compared to state-of-the-art techniques in collaboration with the IHU LIRYC.

Time: The PhD position is available immediately and will normally take 4 years to complete.

Location: This PhD project will take place in the Department of Radiology at the Lausanne University Hospital (CHUV) and the University of Lausanne (UNIL) in Switzerland under the supervision of Prof. Matthias Stuber and Dr. Jérôme Yerly. You will be part of a group of ~15 engineers and physicists that is embedded in the hospital. The group has access to 4 state-of-the-art clinical MRI scanners and you will actively collaborate with Siemens Healthcare (on programming the scanners), the IHU LIRYC (on cardiac electrophysiology), as well as the cardiology service of the CHUV.

Your Profile: We are looking for highly motivated candidates with a master's degree in engineering, physics, life science or a similar degree, preferably at ease with applied mathematics, computer programming, and MRI physics.

To Apply: Should you be interested, please submit a CV and a brief motivation statement to Dr. Jérôme Yerly, PhD (Jerome.Yerly@chuv.ch), or visit www.unil.ch/cvmr before December 31, 2020.