



Newsletter No. 119

CardioEP: A new interdisciplinary project developing electroporation-based cardiac therapies in Ljubljana

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Cardiovascular diseases remain the leading cause of mortality and morbidity worldwide. While electroporation has already transformed the treatment of atrial fibrillation through pulsed field ablation (PFA), substantial therapeutic potential remains untapped, particularly for ventricular arrhythmias, cardiac gene therapy, and cell therapy for heart failure. A new large-scale Slovenian interdisciplinary project, CardioEP, has recently been funded to address precisely these challenges.

The CardioEP project (<https://tinyurl.com/CardioEP>) — Experimental and Clinical Cardiac (Electro)physiology, and Electroporation-Based Cell and Gene Therapy — is a five-year initiative that started in November 2025 and will continue until October 2030. The project is funded by the Slovenian Research and Innovation Agency as a Large Interdisciplinary Project of the University of Ljubljana, with a total budget of €2.375 million. The project is led by Damijan Miklavčič and brings together a consortium of four University of Ljubljana faculties: the Faculty of Electrical Engineering, the Faculty of Medicine, the Faculty of Computer and Information Science, and the Veterinary Faculty, together with three external partners: the University Medical Centre Ljubljana, the Institute of Oncology Ljubljana, and the Jožef Stefan Institute. In total, the consortium comprises over 60 researchers, including 16 PhD students.

The project pursues five scientific objectives, organized into corresponding work packages. The first objective is to develop methods for detecting and predicting areas of reversible and irreversible electroporation using artificial intelligence analysis of intracardiac electrograms and medical imaging data. This work will employ deep learning approaches for time-series analysis, while simultaneously developing advanced MRI approaches to detect cardiac electroporation and monitor its progression in the affected tissue.

The second objective focuses on personalized treatment of ventricular arrhythmias. Building on the consortium's established collaboration with industry and clinical PFA experience at University Medical Centre Ljubljana, the team will develop a "digital twin" platform that integrates patient-specific medical imaging, electro-anatomical mapping, and numerical modelling to predict electroporation outcomes and guide ablation procedures in complex ventricular geometries.

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The third and fourth objectives venture into cardiac regeneration. In the gene therapy work package, the team will develop electroporation protocols for nonviral delivery of therapeutic nucleic acids — particularly microRNAs that promote cardiomyocyte proliferation — first in myocardial tissue slices and subsequently in rat models *in vivo*. This work builds directly on the ongoing ERC Starting Grant project REINCARNATION led by Lea Rems at the Faculty of Electrical Engineering. The cell therapy work package will investigate whether reversible electroporation can improve CD34+ stem cell retention in the myocardium, with the aim of conducting a prospective randomized clinical study in patients with nonischemic dilated cardiomyopathy.

The fifth objective is to establish Slovenia's first large animal electrophysiology research facility at the Veterinary Faculty, enabling preclinical validation of the treatments developed within the project and creating infrastructure for continued research beyond its duration.

The project builds on a strong foundation of prior collaborative achievements within the consortium, such as the development of the first FDA-approved PFA system (PulseSelect by Medtronic), the successful translation of electrochemotherapy and gene electrotransfer into clinical practice at the Institute of Oncology Ljubljana, and a pioneering stem cell therapy program for heart failure patients at the University Medical Centre Ljubljana. International collaborations with groups, among others, at King's College London, Karlsruhe Institute of Technology, Mayo Clinic, McGill University, and the LIRYC Institute in Bordeaux, further strengthen the project's reach.

By combining world-leading electroporation expertise with clinical cardiology, artificial intelligence, advanced imaging, and translational research capabilities, CardioEP aims to position the University of Ljubljana as a globally recognized center for electroporation-based cardiac treatments — and to deliver new therapeutic approaches for some of the most challenging heart diseases.

Forthcoming events

6th World Congress on Electroporation and Pulsed Electric Fields in Biology, Medicine, & Food and Environmental Technologies

Daytona Beach, September 27 – October 1, 2026

<https://wc2026.electroporation.net/>

20th interdisciplinary postgraduate course and international workshop Electroporation Based Technologies and Treatments (EBTT)

Ljubljana, November 9 – 14, 2026 (*on-site* and *on-line* event)

<https://2026.ebtt.org/>

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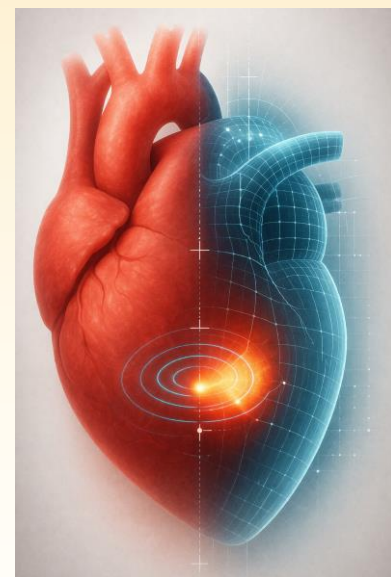
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