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The 3rd Slovenian Electroporation Congress

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The 3rd Slovenian Electroporation Congress, held on March 14 and 15, 2025 at the Faculty of Electrical Engineering of the University of Ljubljana, brought together a diverse community of Slovenian scientists, clinicians and engineers to share the latest research findings, clinical experiences and technological developments in the field of electroporation. The congress provided a multidisciplinary platform to demonstrate how electroporation—a technique in which electric pulses are applied to cells or tissues to increase membrane permeability—is being used for a growing number of biomedical and clinical applications.

The program included a variety of lectures that highlighted basic research as well as translational and clinical research. New and ongoing research projects were presented in several lectures, highlighting Slovenia's active role in innovative electroporation studies. Topics ranged from research into immune system interactions in cancer treatment to the development of preclinical models for vascular malformations and large interdisciplinary projects dealing with cardiac applications. This emphasis on collaborative, interdisciplinary work reflects the increasing integration of electroporation into complex therapeutic strategies.

A significant part of the congress was dedicated to biomedical applications, particularly in oncology. Researchers reported on clinical and experimental results related to gene electrotransfer, and tumor immunology. A particular focus was on electrochemotherapy—a treatment combining electroporation with chemotherapy to improve drug delivery into cancer cells—which has become one of the most mature and promising applications of the technique. Speakers explored its growing potential, from local tumor ablation to systemic immune activation, and discussed the integration of electroporation with novel immunotherapies such as immune checkpoint inhibitors and gene-based vaccines.

The congress was linked to two European projects: the Joint Action on Networks of Expertise (JANE 2) and Twinning for Excellence to Advance Research in the Activation of Anti-Tumor Immune Response after Electrochemotherapy Combined with Gene Electrotransfer of pDNA Encoding ICIs (ZAP Cancer). During the event, we presented the activities and progress of these initiatives. Their objectives align closely with Slovenian research efforts in this field, as well as international collaborations. In addition, these projects highlight our leading role in the rapidly evolving field of electroporation.

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In addition to cancer therapies, the role of electroporation in cardiology was also given great attention, with particular focus on irreversible electroporation techniques for cardiac ablation. Presentations covered clinical experience with catheter-based procedures for the treatment of atrial fibrillation, biophysical modeling of electric fields, and safety considerations such as lesion control and tissue selectivity. These presentations reflected the growing interest in electroporation as a non-thermal, tissue-selective alternative to conventional ablation technologies.

In addition to clinical studies, the congress offered sessions on technological innovations and future research directions. Speakers presented advances in the development of pulse generators, real-time monitoring systems and the application of artificial intelligence and machine learning to analyze biological responses to electric pulses. *In silico* and *ex vivo* modeling also played an important role in the discussions. The importance of accurate simulations for optimizing electroporation protocols and improving the predictability of treatment outcomes was highlighted.

The poster sessions further enriched the congress by providing an insight into ongoing laboratory and computational research. Topics included gene delivery platforms, cellular responses to high voltage pulses, combination therapies and device testing. Notably, several posters explored the biological basis of electroporation at the molecular level, as well as its effects on cell death, cytokine release and vesicle production.

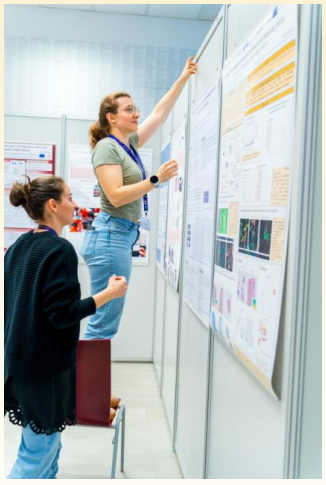
Overall, the congress was well attended (73 participants, from 7 different institutions) and demonstrated the maturity and dynamism of the field of electroporation. It highlighted not only the current successes in treatment and research, but also the outstanding challenges — such as the need for standardized clinical protocols, a better understanding of the underlying mechanisms, and strategies for broader clinical application. The event served as a vibrant center for knowledge exchange, fostering collaboration and inspiring future innovation in academic, clinical and technological domains.

Forthcoming events

10th School on Pulsed Electric Field Applications in Food and Biotechnology
Salerno, September 1 – 5, 2025
https://www.prodalricerche.it/en/pef-school-2025/

17th International Bioelectrics Symposium (Bioelectrics 2025)
Eindhoven, September 14 – 17, 2025
http://www.bioelectrics2025.nl/

19th interdisciplinary postgraduate course and international workshop Electroporation Based Technologies and Treatments (EBTT)
Ljubljana, November 10 – 15, 2025 (*on-site* and *on-line* event)
https://2025.ebtt.org/



"Just-in-time final adjustments" In all, 18 posters were presented at the Congress.

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