



Newsletter No. 70

Electroporation featured in Science!

Dance Your PhD 2022 WINNER: Electroporation of Yeast Cells

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It does not happen very often – does anybody remember when electroporation appeared in Science? – yes, the AAAS Science Journal. Thanks to Povilas Šimonis from Center for Physical Sciences and Technology, Department of Material Science and Electrical Engineering, Vilnius, Lithuania, PEF treatment and electroporation are featured in the News section of the Science published February 24, 2022. The main article with details about competition is available here: <https://www.science.org/content/article/watch-winners-year-s-dance-your-ph-d-contest>, while the PhD thesis is freely available via the link: <https://doi.org/10.15388/vu.thesis.136>.

Povilas in his PhD, entitled “Investigation of yeast cell responses to pulsed electric field treatment” was investigating how important it is to control the shape of the pulse. When using exponentially decaying pulses, the “descent”, i.e. the tail of the pulse, is not well defined, as discharge of the capacitors is determined by the load through which the pulse discharges. The load thus depends on the geometry, the medium in which the cells are, the cell density, and it changes with the electroporation during the pulse. It was shown that without control, conductivity of the load increases, which can increase effective pulse duration by up to 50 % and decrease yeast cells' viability by up to 10 %. Irreversible damage after exposure to PEF was detected in the plasma membrane, but not in the cell wall, while both structures' integrity stabilized within 100 seconds. For the very first-time, yeast-modified electrodes were successfully used to investigate electroporation of the same cells. Exposure to PEF resulted in lower redox activity, which could be compensated for entirely by adjusting the extracellular concentration of NADH to 1 mM. In his PhD Povilas shows the applicability of PEF technology for the modulation of amperometric signals. To the best of our knowledge, this study is the first to show that exposure of yeast cells to electric field pulses with nanosecond duration causes expression of features characteristic to caspase-dependent death. Exposure to PEF was followed by activation of yeast metacaspases, permeabilization of the plasma membrane, and externalization of phosphatidylserine. Lastly, he showed that pulses of nanosecond duration could selectively inactivate yeast cells while keeping beneficial bacteria alive. Povilas in particular focused on answering questions, the answering of which will enable successful knowledge transfer from fundamental yeast electroporation research to biotechnological applications. And he presented his results in an “unusual” way. Povilas won the biology category, in addition to the overall prize, which speaks of the strength of his video's delightful storytelling and attention to detail, says judge Matt Kent from the dance company Pilobolus.

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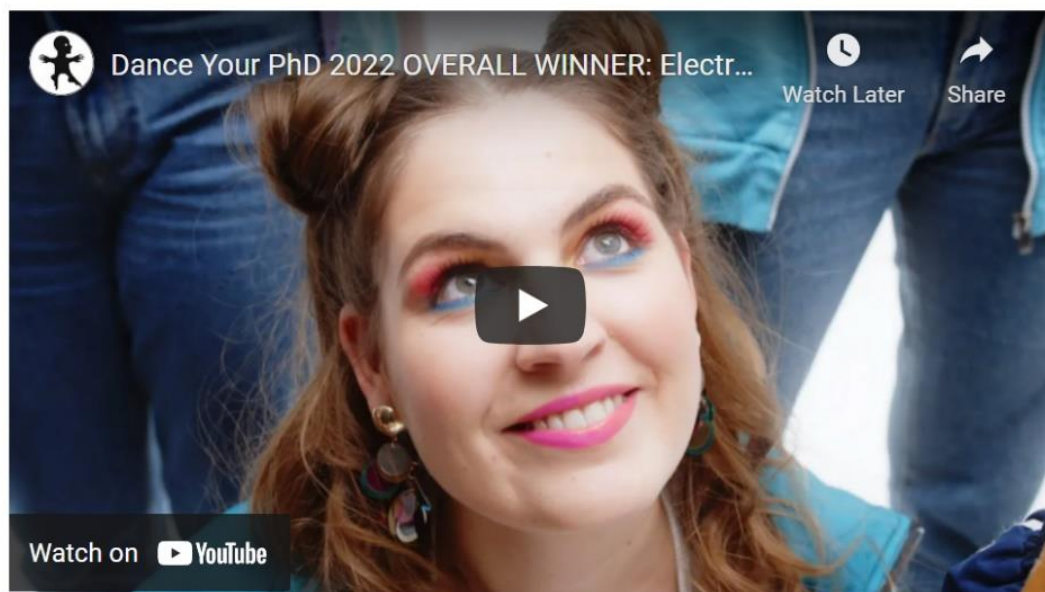
Direct link to PhD thesis presented singing and dancing with his friends/artists:

<https://www.youtube.com/watch?v=dq5uYGNeOS0>.



Overall winner and biology category winner

Povilas Šimonis, “Investigation of yeast cell responses to pulsed electric field treatment”



Announcement as presented in the original news item of the Science website at <https://tinyurl.com/povilas-phd>.

I strongly encourage you to watch the other categories’ winners too. It is just amazing how science and art fit well together. And, if that helps promoting science and bringing more clever young people into science, I welcome this. Povilas Šimonis! Please accept our congratulations and my personal admiration for finding extra time and energy to go beyond what we usually do.

Forthcoming events

8th School on Pulsed Electric Field Applications in Food and Biotechnology

Compiègne, May 30 – June 3, 2022

<https://pefschool2022.electroporation.net>

4th World Congress on Electroporation and Pulsed Electric Fields in Biology, Medicine, and Food & Environmental Technologies

Copenhagen, October 9 – 13, 2022

<https://wc2022.electroporation.net>

15th interdisciplinary postgraduate course and international workshop Electroporation Based Technologies and Treatments (EBTT)

Ljubljana, November 14 – 20, 2021 (on-site and on-line event)

<http://www.ebtt.org>

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Povilas in his element. Photo courtesy of Povilas.

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