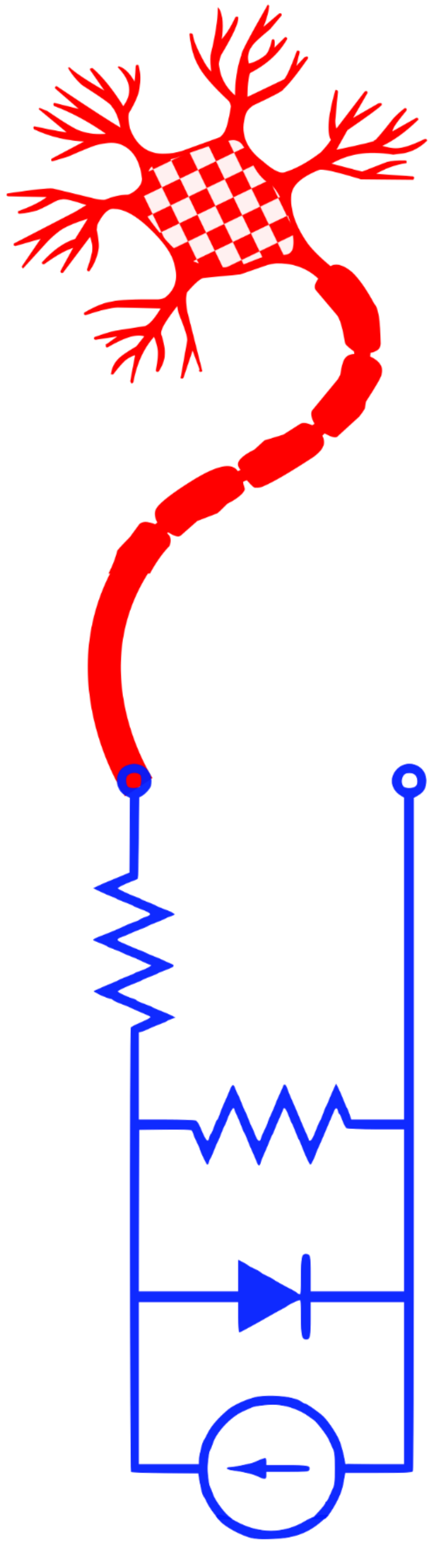
Zagreb Bioelectronics Workshop 2025



Book of Abstracts

Editors:
Vedran Đerek
Karla Filipović

Zagreb,
March 28-29, 2025

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Program committee
Vedran Đerek, University of Zagreb, Croatia
Eric Daniel Głowacki, Brno University of Technology, Czech Republic
Rainer Schindl, Medical University of Graz, Austria

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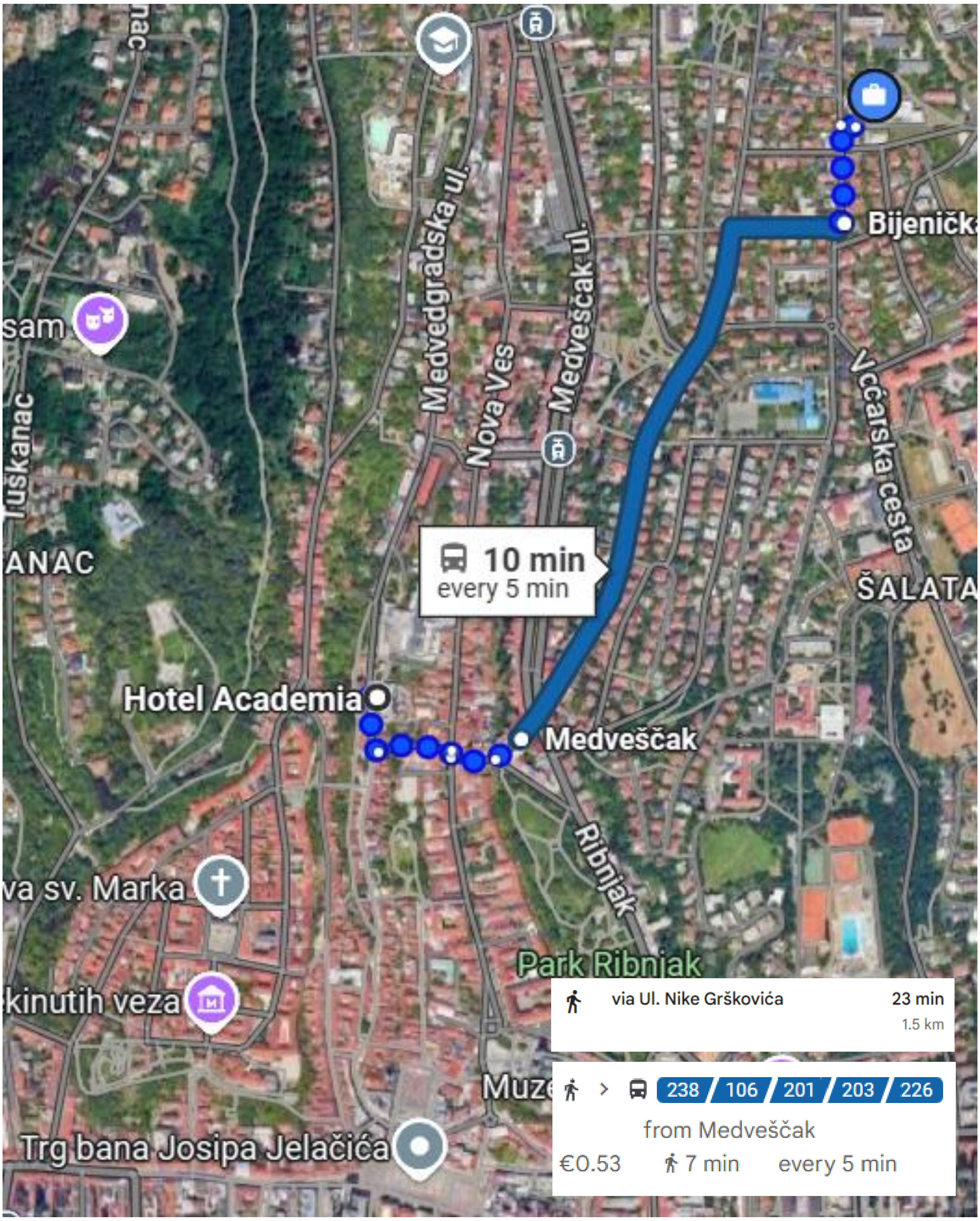
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Foreword

Dear participants, colleagues, and friends!

Welcome to the fifth edition of the Zagreb Bioelectronics Workshop!

This is the final edition of this workshop as a part of the instalment project „3DOptoBio“, funded by the Croatian Science Foundation. Within the project, a research group in bioelectronics was established at the Faculty of Science, University of Zagreb, and this Workshop has served as a venue to nurture collaborations and start new ones, as well as to show our activities to the scientific and general public.

After a thorny start, with the first two workshops being organised during the COVID pandemic, the third workshop marked the return to somewhat normal conditions. The online meeting experience during the pandemic has helped remind us how important face-to-face meetings are. Some of us have collaborated already for many years, so meetings are important to keep our collaborations alive and healthy.

I would like to thank the funding agency, Croatian Science Foundation, for supporting this meeting, as well as the Physics Department of the Faculty of Science for their continuous support. The workshop sponsor, KOBIS d.o.o., our long-time partners, have helped provide the conference materials for all speakers, a contribution much appreciated!

The most special thanks go to all of you who are and have been participating in this event! Hope to see you again soon in Zagreb!

Zagreb, March 2025

Vedran Đerek

Workshop program

Bijenička 32, Faculty of Science, Physics department

(blue)	Meeting room floor 1
(light orange)	Seminar F-201 floor 2
(orange)	Lab IF & IRB

Friday, March 28 2025

09:30	**Registration**
10:00	**Vedran Đerek** Light-gated 3D organic electrolytic transistors for biosensing
10:30	**Florian Hartmann** Insect-scale biomimetic machines
11:00	**Martina Lihter** Atomically thin 2D materials for advanced biosensing platforms
11:30	**COFFEE BREAK**
12:00	**Marie Jakešová** A multichannel electrochemical platform for controlled H_2O_2 modulation *in vitro*
12:30	**Anna Tvrdoňová** Organic photovoltaic microburritos for photocatalytic hydrogen peroxide generation
13:00	**Eric Daniel Głowacki** The biophysics of noninvasive electrical stimulation using kHz frequency carriers – limitations and opportunities of temporal interference stimulation
13:30	**LUNCH BREAK**
15:00	**Aleksandar Opančar** Interaction of electrically excitable cells and photocapacitor devices
16:00	**Lab workshop, Institute for physics** Introduction to femtosecond laser micromachining

Meeting room floor 1	Seminar F-201 floor 2	Lab IF & IRB

Saturday, March 29 2025

10:00	**Tony Schmidt** Light-Active MicroParticles (LAMPs) for vision restoration in degenerative eye diseases
10:30	**Marta Nowakowska-Desplantes** Modulation of calcium oscillations in glioblastoma: pharmacological and electrophysiological approaches
11:00	**Karla Filipović** Fabrication of glass microstructures for controlled axonal growth using femtosecond laser micromachining
11:30	**COFFEE BREAK**
12:00	**Lovro Gudlin:** From nanoscale to live-cell imaging: microscopy in the Tolić group
12:30	**Lab workshop, Ruđer Bošković Institute** Introduction to live cell imaging
14:00	**LUNCH BREAK**
15:00	**Round table meeting:** Future of bioelectronics collaboration
16:00	**Workshop closing**

Contributions and invited talks

Light-gated 3D organic electrolytic transistors for biosensing

Vedran Đerek, Karla Filipović
vdjerek@phy.hr

Department of Physics, Faculty of Science, University of Zagreb, Bijenička c. 32, 10000, Zagreb, Croatia

Organic electrochemical transistors (OECTs) working in depletion mode and based on poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) are widely used in biosensors with high sensitivity. When appropriate gate or channel functionalization strategies are employed, they can be used for bio-sensing and bioelectronic readout applications. For use in point-of-care rapid diagnostics, these devices would ideally operate wirelessly, being wirelessly powered, gated and having the ability for a wireless readout. Organic photovoltaic (OPV) powered OECTs fabricated on flexible and stretchable substrates were previously reported [1]. Wireless readout strategies based on conventional technologies were also reported [2], however more reliable and practical readout technologies remain a worthy goal for the near future.

We will demonstrate our approach to wirelessly gating OECTs by device stacking, generating a 3D device comprising of a bottom part containing an array of OECTS, and a top part containing an organic photovoltaic layer, acting as a gate electrode, based on a bilayer of metal-free phthalocyanine (H2PC) and N,N′-dimethyl perylenetetracarboxylic diimide (PTCDI), with two parts connected by an electrolyte well, fabricated by femtosecond laser micromachining. In addition, we will propose readout strategies with external components to enable affordable single-use strategies.

Acknowledgements:
This work has been supported by the Croatian Science Foundation under project UIP-2019–04–1753. We acknowledge the support of project CeNIKS, co-financed by the Croatian Government and the European Union through the European Regional Development Fund— Competitiveness and Cohesion Operational Programme (grant no. KK.01.1.1.02.0013), and the QuantiXLie Center of Excellence, a project co-financed by the Croatian Government and European Union through the European Regional Development Fund—the Competitiveness and Cohesion Operational Programme (grant no. KK.01.1.1.01.0004).

References:

[1] Park, S., Heo, S.W., Lee, W. et al. Self-powered ultra-flexible electronics via nano-grating-patterned organic photovoltaics. Nature 561, 516–521 (2018). https://doi.org/10.1038/s41586-018-0536-x

[2] Anal. Chem. 2022, 94, 16, 6156–6162. https://doi.org/10.1021/acs.analchem.1c05210

Insect-scale biomimetic machines

Florian Hartmann
hartmann@is.mpg.de
INVITED TALK

Biomimetic Materials and Machines Group, Max-Planck-Institute for Intelligent Systems, Heisenbergstraße 3, 70569 Stuttgart, Germany

Nature has evolved remarkably intricate designs at small scales, enabling insects and other organisms to perform complex movements with efficiency and agility. Replicating such functionality in miniature robots remains a significant challenge, particularly in actuation, where conventional motors face severe limitations when miniaturized. To address this, we explore materials and fabrication processes for multilayer electronic thin films that function as artificial muscles at the millimeter scale. By combining flexible electrodes with dielectric liquids, we create soft electrohydraulic actuators that offer high bandwidth (0–150 Hz) and low power consumption (35 mW). We demonstrate the monolithic integration of these actuators into centimeter-scale swimming robots (25–45 mm body length), which propel themselves across the water surface using undulating fin propulsion. Independent control of each actuator enables versatile maneuvering, including forward, backward, sideways, and turning motions. Integrated miniature power electronics and control systems allow untethered, autonomous operation in cluttered environments, such as grassy aquatic landscapes. These robots can navigate obstacles, seek out light sources, and execute rapid maneuvers, opening up applications in environmental monitoring, agriculture, and search-and-rescue operations.

Atomically Thin 2D Materials for Advanced Biosensing Platforms

Martina Lihter
mlihter@ifs.hr
INVITED TALK

Centre for Advanced Laser Techniques, Institute of Physics, Zagreb, Croatia

Two-dimensional (2D) materials, such as transition metal dichalcogenides, exhibit exceptional electronic, optical, and mechanical properties, making them highly versatile for a broad range of applications including (opto)electronics, sensing, catalysis, energy harvesting, etc. Their atomic-scale thickness, high surface-to-volume ratio, and tunable electronic properties make them particularly promising for biosensing applications. Integrating these materials into biosensing devices, such as single-molecule sensors[1,2] and field-effect transistors[3], can offer high sensitivity, real-time, label-free detection of ultra-low analyte concentrations. Designing such devices requires advanced microfabrication techniques to precisely pattern and structure the material[1], as well as chemical functionalization strategies to tailor material surface properties[4,5]. Attaching different molecules and functional groups onto the surface of 2D materials can be used for tuning their optoelectronic properties, surface charge, and surface chemistry, but also for creating hybrid nano-bio interfaces.

This presentation will focus on the microfabrication and functionalization of devices based on a monolayer of molybdenum disulfide 2D material, while highlighting the key challenges and future prospects in this rapidly evolving field.

References:

[1] Graf M., Lihter M., Thakur M., Georgiou V., Topolancik J., Ilic R. B., Liu K., Feng J., Astier Y., Radenovic A. Nat. Protoc. 14, 1130 (2019)

[2] Liu K., Lihter M., Sarathy A., Caneva S., Qiu H., Deiana D., Tileli V., Alexander D. T. L., Hofmann S., Dumcenco D., Kis A., Leburton J. P., Radenovic A. Nano Lett. 17, 4223 (2017)

[3] Graf M., Lihter M., Altus D., Marion S., Radenovic A. Nano Lett. 19, 9075 (2019)

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A multichannel electrochemical platform for controlled hydrogen peroxide modulation *in vitro*

Marie Jakešová[1], J. Ehlich[1], S. Erschen[2,3], L. Nemeskeri[2], V. Handl[2,3], R. Schindl[2,3], L. Waldherr[2,3], E. D. Głowacki[1]
Marie.Jakesova@ceitec.vutbr.cz
INVITED TALK

[1] *Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic*
[2] *Division of Medical Physics and Biophysics, Medical University of Graz, Graz, Austria*
[3] *BioTechMed-Graz, Graz, Austria*

Reactive oxygen species (ROS) play a fundamental role in redox biology, impacting cellular signaling, oxidative stress responses, and disease progression.[1] However, studying their effects *in vitro* remains challenging due to the difficulty of precisely controlling ROS levels over time. Traditional approaches rely on manual additions of H_2O_2, which lead to rapid concentration fluctuations and poor reproducibility.

Here, we introduce a 96-well plate-compatible electrochemical platform that enables continuous, real-time modulation of H_2O_2 levels in cell culture by leveraging the oxygen reduction reaction. By precisely adjusting the applied electrical input, we generate defined amounts of H_2O_2 via a two-electron oxygen reduction pathway[2] directly in solution, allowing dynamic and sustained ROS exposure without the need for frequent media changes or external chemical additions.

To demonstrate its biological relevance, we tested the system on two cancer cell lines with differing resistance to oxidative stress. Controlled H_2O_2 generation induced dose-dependent cell death in both melanoma (A375) and glioblastoma (U87) cells, with U87 cells displaying greater resilience, consistent with previously reported findings.[3] The addition of catalase fully prevented cytotoxicity, confirming that the observed effects were H_2O_2-specific. This variability in sensitivity highlights the potential of our platform for studying cell-type-dependent oxidative stress responses in a controlled manner.

Beyond cancer models, this electrochemical approach provides a versatile tool for studying redox regulation *in vitro* with precise temporal and dosage control. It allows researchers to mimic physiological or pathological ROS exposure with improved reproducibility over traditional methods. Potential applications extend to oxidative stress research in neurodegeneration, inflammation, and redox-based therapeutics, where tightly regulated ROS levels are essential for understanding cellular responses.

References:

[1] Sies, H. Hydrogen peroxide as a central redox signaling molecule in physiological oxidative stress: Oxidative eustress. *Redox Biol* 11, 613–619 (2017).

[2] Ehlich, J. *et al.* Direct measurement of oxygen reduction reactions at neurostimulation electrodes. *J Neural Eng* 19, 036045 (2022).

[3] Doskey, C. M. *et al.* Tumor cells have decreased ability to metabolize H2O2: Implications for pharmacological ascorbate in cancer therapy. *Redox Biol* 10, 274–284 (2016).

Organic photovoltaic microburritos for photocatalytic hydrogen peroxide generation

Anna Tvrdoňová, M. Jakešová, E. D. Głowacki
tvrdonova@vutbr.cz
INVITED TALK

Bioelectronics Materials and Devices Laboratory, Central European Institute of Technology CEITEC, Brno University of Technology, Purkyňova 123, 61200 Brno, Czech Republic

Hydrogen peroxide (H_2O_2) has traditionally been regarded as a cytotoxic compound due to its role in inducing oxidative stress and cellular damage [1]. These processes are commonly caused by elevated concentrations of H_2O_2 within the biological system. However, under normal physiological conditions, H_2O_2 functions as a key signaling molecule, regulating cell proliferation and growth processes [2]. The ability to precisely regulate H_2O_2 levels is crucial for understanding its dual nature in cellular function, as well as for developing approaches for controlled oxidative signaling.

In this study, we introduce an injectable platform for the *in situ* generation of H_2O_2 using red light-activated microstructures, termed microburritos, composed of organic semiconductor materials with thickness levels of less than 100nm. The photosensitive PN-gold microburritos generate H_2O_2 through an oxygen reduction reaction at the photoactive PN layer, while simultaneously oxidizing an electron donor on the gold layer upon illumination. We examined H_2O_2 production considering the surrounding medium, from well-defined electrolytes with donors to complex cell culture media. We also investigated the effect of changing light source intensities, and duty cycles. This system provides a controllable and non-invasive method for inducing localized H_2O_2 delivery, with potential applications in cellular redox modulation.

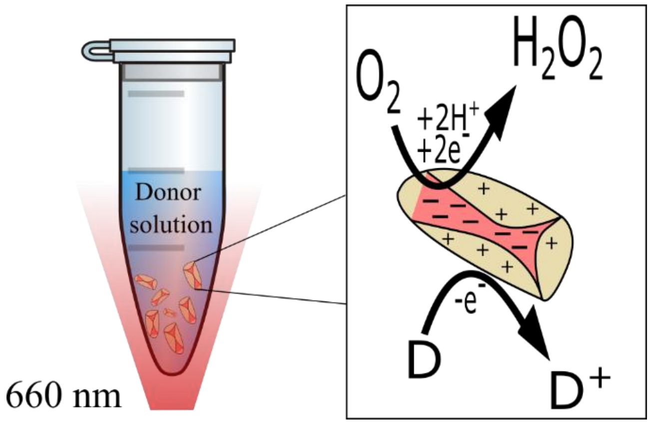


Figure: Light-induced redox reactions result in the production of H_2O_2 on the organic PN junctions with the simultaneous oxidation of a sacrificial donor

References:

[1] H. Sies, “Hydrogen peroxide as a central redox signaling molecule in physiological oxidative stress: Oxidative eustress,” Apr. 01, 2017, *Elsevier B.V.* doi: 10.1016/j.redox.2016.12.035.

[2] H. Sies and D. P. Jones, “Reactive oxygen species (ROS) as pleiotropic physiological signalling agents,” Jul. 01, 2020, *Nature Research*. doi: 10.1038/s41580-020-0230-3.

The biophysics of noninvasive electrical stimulation using kHz frequency carriers – limitations and opportunities of temporal interference stimulation

A. Opančar,[1,2] D. S. Rose,[1] V. Đerek,[2] Eric Daniel Głowacki[1]
glowacki@vutbr.cz
INVITED TALK

[1] *Bioelectronics Materials and Devices Lab, Central European Institute of Technology, Brno University of Technology, Purkyňova 123, 61200 Brno, Czech Republic*
[2] *Department of Physics, Faculty of Science, University of Zagreb, Bijenička c. 32, 10000, Zagreb, Croatia*

Temporal interference stimulation (TIS) has attracted increasing attention as a promising noninvasive electrical stimulation method. The idea behind TIS is exploiting high frequency carriers (> kHz) which are amplitude-modulated at a low frequency (AMF). The method rests on the assumption that the kHz carrier does not stimulate, but neurons are able to demodulate the AMF, essentially resulting in low-frequency stimulation at the AMF. We have found experimental evidence that this is incorrect, and apparent stimulation using TIS is driven by the kHz carrier. We will present our current understanding of the mechanism behind kHz stimulation, and will report new possibilities and directions. In particular, we will focus on experiments on neuromuscular stimulation. We have found important differences in qualitative recruitment of sensory versus motor fibers as a function of modulation waveform, producing reliable muscle contraction in human subjects with minimal evoked sensory response.

Interaction of electrically excitable cells and photocapacitor devices

Aleksandar Opančar [1,2]
opancar@vutbr.cz

[1] Bioelectronics Materials and Devices Lab, Central European Institute of Technology, Brno University of Technology, Purkyňova 123, 61200 Brno, Czech Republic
[2] Department of Physics, Faculty of Science, University of Zagreb, Bijenička c. 32, 10000 Zagreb, Croatia

Organic electrolytic photocapacitors (OEPCs) offer a promising approach to wireless and minimally invasive neurostimulation, but their effectiveness depends on optimizing both device design and biophysical interactions. In this talk, I will present recent advances in OEPC technology that significantly enhance spatial resolution and stimulation efficiency, integrating insights from materials science, biophysics, and computational modeling.

A key breakthrough in this research is the prediction that 2D structuring and an inverted OEPC geometry can amplify the local electric field by up to 20 times, enabling precise single-cell stimulation. Additionally, incorporating PEDOT:PSS as a return electrode material further improves stimulation efficiency. To better understand these effects, a numerical model was developed, coupling device physics with extracellular neurostimulation dynamics. Finite element simulations reveal that capacitive microelectrodes achieve lower stimulation thresholds than Faradaic electrodes, particularly when neurons are tightly coupled to the OEPC surface. These findings provide critical insights into the mechanisms governing photocapacitive neurostimulation and inform future device designs.

This talk will highlight the potential of optimized OEPCs as a next-generation tool for bioelectronic interfaces, offering high-resolution, wireless neurostimulation without the drawbacks of conventional electrode-based approaches. I will discuss the broader implications of these findings for fundamental neuroscience research and the future development of optoelectronic neural interfaces.

Light-active microparticles (LAMPs) for vision restoration in degenerative eye diseases

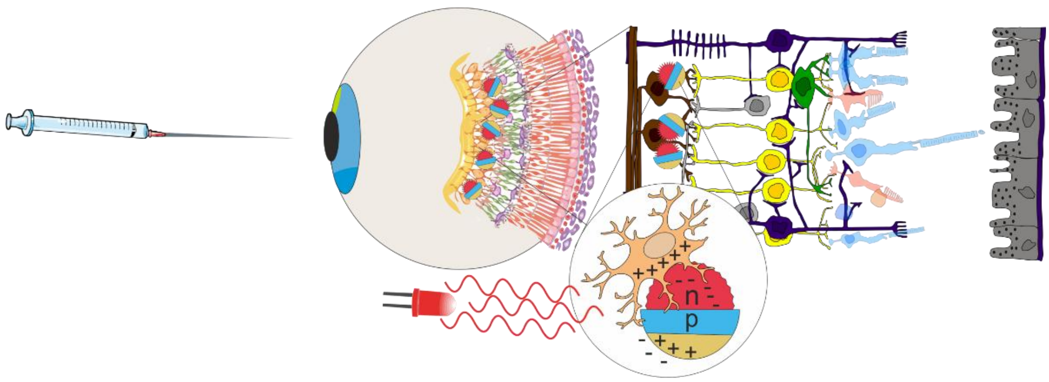
L. Schäfer[a], *A. Tvrdoňová*[c], *M. Nowakowska*[b], *M. Jakešová*[c], *E. D. Głowacki*[c], *Tony Schmidt*[a]
tony.schmidt@medunigraz.at
INVITED TALK

[a] *Gottfried Schatz Research Center, Chair of Biophysics, Medical University of Graz, Neue Stiftingtalstraße 6, 8010 Graz, Austria*
[b] *Research Unit of Experimental Neurotraumatology, Department of Neurosurgery, Medical University Graz, Auenbruggerplatz 2.2, 8036, Graz, Austria*
[c] *Bioelectronics Materials and Devices Laboratory, Central European Institute of Technology, Brno University of Technology, Purkyňova 123, 61200 Brno, Czech Republic*

The rapidly evolving field of organic semiconductors opened new innovative pathways for cellular stimulation. Our previous research has successfully demonstrated the modulation of ion channel gating and neuronal stimulation through photocapacitive stimulation, utilizing light-sensitive organic semiconductors as photovoltaic device.

A particularly intriguing yet underexplored pathway for stimulating excitable cells involves the generation of Reactive Oxygen Species (ROS). The production and regulation of ROS are crucial in various biological scenarios and pathological contexts. The manipulation and understanding of ROS production through organic semiconductors, especially under low-light conditions, present a unique research area between materials science and life science.

In this work we will present our experience and preliminary data of Light-Active MicroParticles (LAMPs) in the context of neurobiology. We could demonstrate that LAMPs have an effect on increasing neural activity in brain slices and explanted retinae from *sus scrofa* when illuminated with red light. We currently investigate the activation mechanisms in the cell and will explore the translational potential of this technology for degenerative eye diseases.



Modulation of calcium oscillations in glioblastoma: pharmacological and electrophysiological approaches

Marta Nowakowska-Desplantes, B.Bacsa, R. Schindl

marta.nowakowska@medunigraz.at

INVITED TALK

Division of Medical Physics and Biophysics, Gottfried Schatz Research Center for Cell Signaling, Metabolism and Aging, Medical University of Graz, Austria

Glioblastoma (GBM) is a highly aggressive malignant brain tumour with a median survival of only 8 to 14 months despite standard chemotherapy.[1-3] One defining feature of GBM cells is their ability to form an interconnected network through calcium-mediated communication. A subset of these cells (5-10%) exhibits spontaneous calcium oscillations, which contribute to tumour progression even after surgical resection.[4] These oscillations are regulated by a complex interplay among internal calcium stores, store-operated calcium channels (such as Orai1), and calcium-activated potassium channels (such as KCa3.1).

In our novel approach, we sought to modulate GBM calcium oscillations using both pharmacological and electrophysiological interventions. In our preliminary study conducted on U87 cells transfected with the NEMOc calcium reporter, we demonstrated that inhibiting KCa3.1 with CM4620 (1 µM for 40 minutes) suppressed calcium signalling, leading to the emergence of single calcium waves and regular oscillations following drug washout. Activation of KCa3.1 using 1-EBIO (500 µM for 15 minutes) induced either oscillatory activity or a single large influx of calcium. Additionally, external electrical field stimulation (20 ms monophasic pulses at 10 Hz, 2 V) temporarily suppressed calcium signalling, with oscillations resuming after stimulation ceased.

These findings highlight the potential to manipulate GBM calcium dynamics through targeted interventions. Further research is needed to determine whether these approaches can influence tumour progression in vitro and in vivo, thereby opening new possibilities for therapeutic strategies aimed at treating GBM.

References:

[1] Stupp, R. *et al.* Effects of radiotherapy with concomitant and adjuvant temozolomide versus radiotherapy alone on survival in glioblastoma in a randomised phase III study: 5-year analysis of the EORTC-NCIC trial. *The Lancet Oncology* **10**, 459-466 (2009). https://doi.org:https://doi.org/10.1016/S1470-2045(09)70025-7

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[3] Ostrom, Q. T. *et al.* CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2012-2016. *Neuro Oncol* **21**, v1-v100 (2019). https://doi.org:10.1093/neuonc/noz150

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Fabrication of glass microstructures for controlled axonal growth using femtosecond laser micromachining

Karla Filipović[1], H. Skenderović[2], V. Đerek[1]
kfilipov@phy.hr

[1] Department of Physics, Faculty of Science, University of Zagreb, Bijenička Cesta 32, Zagreb, Croatia
[2] Institute of Physics, Bijenička Cesta 46, Zagreb, Croatia

During brain development axons grow towards their target with a high degree of accuracy guided by different chemical, topographical and galvanotropic cues. Studying external cues for axonal guidance is vital for possible clinical applications, such as accelerating nerve regeneration after traumatic injuries. Structures needed for this type of research need to be made in transparent materials due to imaging demands. However, microstructuring transparent dielectrics such as glasses presents a significant challenge due to their brittleness and hardness. Femtosecond lasers have proved themselves to be an invaluable tool for glass microprocessing. Interaction between a femtosecond laser pulse and material is non-thermal which reduces the chance for shattering and crack formation. Laser machining offers several advantages compared to more traditional lithography techniques. This non-contact method can be used on various materials, is fast, highly adaptable, has a high degree of precision and avoids the need for photoresist and other chemicals.

In this presentation, we will present our work on different processing techniques such as microstructuring, laser cutting and welding of borosilicate and fused silica glasses. Using the above-mentioned techniques, we created a glass microstructure which consists of two wells connected by trenches that are 5 µm wide with varying depths. The substrate was characterized using an optical profilometer and a scanning electron microscope (SEM) which examined surface topography. This microstructure was specifically designed for research of topographical axonal guidance with trenches wide enough to allow axons to enter and grow but also narrow enough to prevent the larger soma from entering.

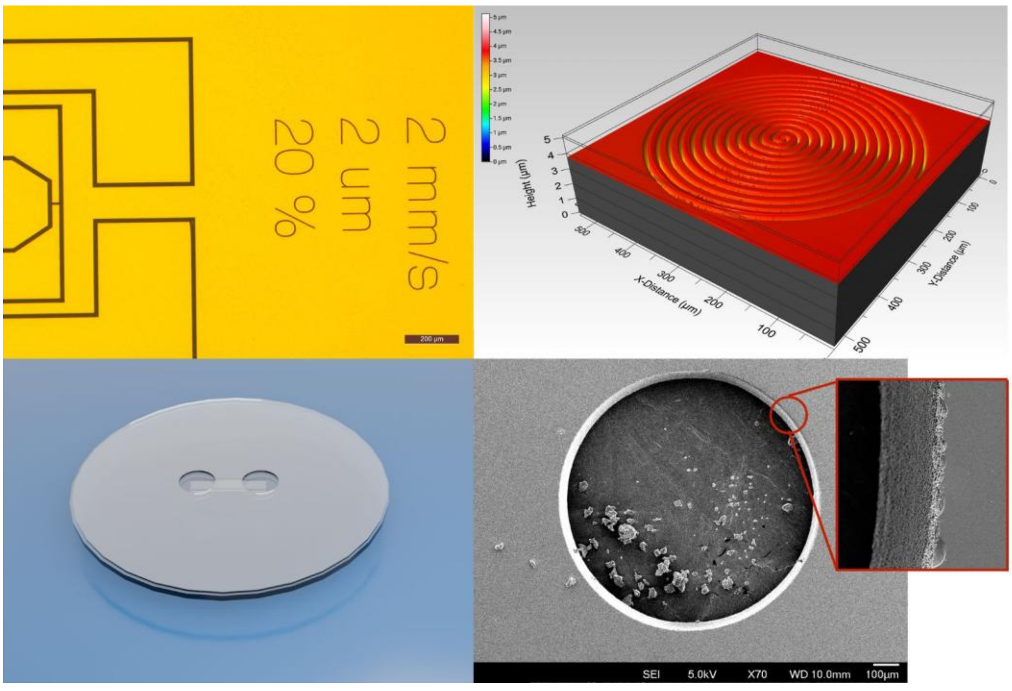


Figure: Examples of structures created by femtosecond micromachining and a sketch of the planned substrate for axonal guidance.

From nanoscale to live-cell imaging: Microscopy in the Tolić group

Lovro Gudlin
lgudlin@irb.hr
INVITED TALK

Ruđer Bošković Institute, Bijenička Cesta 54, Zagreb, Croatia

Advancements in microscopy have revolutionized the study of cellular architecture and dynamic processes, enabling researchers to visualize structures and interactions at unprecedented resolution. The Tolić group employs a diverse set of high-performance imaging modalities to address key questions in cell biology, ranging from cytoskeletal organization to intracellular transport. Each of these techniques is optimized for specific experimental challenges, balancing resolution, speed, and phototoxicity.

To achieve super-resolution imaging beyond the diffraction limit, the STED system provides nanoscale precision, enabling detailed visualization of cellular structures. The Lattice Light-Sheet microscope offers high-speed, volumetric imaging with minimal phototoxicity, making it particularly suited for long-term live-cell studies. The Dragonfly 505 spinning disk confocal system, equipped with ablation and photomanipulation modules, integrates rapid imaging with targeted laser perturbations, allowing controlled manipulation of cellular components. Complementing these approaches, the LSM 880 confocal microscope provides spectral flexibility and high-resolution imaging for a broad range of applications.

By integrating these technologies, the Tolić group applies advanced microscopy to study cellular dynamics with high spatial and temporal precision. Future developments will focus on enhancing image analysis workflows, including the integration of automated processing methods to improve feature detection and quantitative analysis. These efforts aim to further optimize data extraction and interpretation, supporting ongoing research into the complex organization and behavior of cellular systems.

A Chronicle of Progress: The Last Five Years

Workshop program 2023

Bijenička 32, Faculty of Science, Physics department

Meeting room floor 1 (green)	
Seminar F-201 floor 2 (orange)	
Lab F-013 floor -1 (purple)	

Sunday, October 22 2023

15:30	**Welcome and opening**
16:30	**Vedran Đerek:** Micro- and nano-structures for 3D opto-bioelectronics – progress update
16:45	**Collaboration meeting session I – LOGOS-TBI / MedUni Graz / TU Graz**

Monday, October 23 2023

09:30	**Registration**
10:00	**Theresa Rienmuller:** Modeling the cellular response of cardiac cells to optoelectronic stimulation
10:30	**Muammer Üçal:** Induction of regenerative responses in neural tissue using organic electrolytic photocapacitors (OEPCs) – Preliminary Progress in LOGOS-TBI
11:00	**Rainer Schindl:** Continuous local chemotherapy with iontronic devices for effective treatment of ex ovo brain tumors
11:30	**COFFEE BREAK**
12:00	**Ivana Vinković Vrček:** Hormone-related effects of complex chemical mixtures
12:30	**Eric Daniel Głowacki:** Prototyping neuroelectronic device concepts in low-cost invertebrate model organisms
13:00	**Katarina Vulić:** Exploring neuron function and learning in engineered neural networks
13:30	LUNCH
14:30	**Lab workshop:** Substrate 3D patterning by pulsed laser ablation
15:30	**Lab workshop:** Electric fields in electrolytes
16:30	**Collaboration meeting session II – CEITEC Brno / ETH Zürich / IMI Zagreb**

Tuesday, October 24 2023

10:00	**Mathias Polz:** Towards biomimetic organic photovoltaic devices
10:20	**Manuel P. Kainz:** Biomimetic hydrogels: Synthesis, characterization,and potential applications in neural tissue engineering
10:40	**Daniel Ziesel:** Exploring the modulation of cardiac activity through multielectrode arrays and organic photovoltaic devices
11:00	**COFFEE BREAK**
11:30	**Tony Schmidt:** Shedding light on ROS – a life scientist's perspective on low light stimulation of organic semiconductors
11:50	**Aleksandar Opančar:** Simulation of electrodes for bioelectronic numerical modeling
12:20	**Vedran Đerek:** Managing the chemical reactions at stimulation electrodes
13:00	**LUNCH**
15:00	**Workshop closing**

Workshop program 2022

Bijenička 32, Physics department

Meeting room floor 1	Seminar F-201 floor 2	Lab F-013 floor -1

Friday, December 2nd 2022

11:00	**REGISTRATION**
12:00	**LUNCH**
13:30	**Welcome and opening**
13:45	**Eric Głowacki:** The Faraday Scalpel - on-demand manipulation of oxygen and reactive oxygen species in biological environment
14:10	**Anna Tvrdoňová:** Photofaradaic microstructures for controlled production of hydrogen peroxide (Nanodust)
14:25	**Ivana Vinković Vrček:** Combined in vitro/in vivo methodologies for evaluating mode of actions of novel therapeutic approaches
14:50	**SPONSOR PRESENTATION** – KOBIS d.o.o., Zagreb
15:10	**COFFEE BREAK**
15:40	**Theresa Rienmuller** and **Mathias Polz:** OSCAR - Optoelectronic Semiconductor Conduit for Axonal Regrowth
16:05	**Daniel Ziesel**: Modification of neuronal activity through subthreshold electrical stimulation and in vitro applications
16:20	**Andrej Novak:** Why do we choose the mechanistic approach over machine learning for some image-processing tasks?
16:45	**Aleksandar Opančar:** Interaction of electrically excitable cells and photocapacitor devices
17:00	**COFFEE BREAK**
17:30	**Collaboration meeting session**

Saturday, December 3rd 2022

10:00	**Welcome session**
10:30	**Reiner Schindl:** Bioelectronic Chemo Drug Delivery for Brain Tumor Treatment
10:55	**Tony Schmidt:** Single light pulse stimulation of organic photocapacitors induces ion channel gating and action potentials in neurons
11:10	**Marta Nowakowska:** Neuronal activation following photocapacitive stimulation of organotypic brain tissue culture
11:25	**COFFEE BREAK**
12:00	**Nenad Pavin:** Mechanobiology of the Mitotic Spindle
12:30	**Vedran Đerek:** A novel aqueous lift-off process for organic semiconductors
13:00	LUNCH
14:30	**Lab workshop:** Transient scanning photovoltage
15:30	**Lab workshop:** Photocapacitor pattterning
17:00	**Collaboration meeting session**

Sunday, December 4th 2022

10:00	**Collaboration meeting session**
12:00	**Workshop closing**

CROATIAN NEUROELECTRONICS SYMPOSIUM/ ZAGREB BIOELECTRONICS WORKSHOP 2021

Thursday, 4th November 2021
Croatian Brain Research Institute, Šalata 12

9.00-9.30	**REGISTRATION**
9.30-9.45	**WELCOME AND OPENING**
9.45-10.30	**KEYNOTE LECTURE** **Eric Daniel Głowacki:** Advances in neural interface technology – minimalistic recording and stimulation
10.30-10.45	**Jiri Ehlich:** Oxygen Reduction Reactions at Neurostimulation Electrodes
10.45-11.05	**COFFEE BREAK**
11.05-11.30	**Damir Kovačić:** The use of graphene and hBN-based substrates for auditory neuroelectronic interfaces
11.30-11.45	**Boris Delipetar:** Recording of spontaneous action potentials and electrical stimulation of in-vitro spiral ganglion neurons acquired with high-density neuroelectronic interface
11.45-12.00	**Jelena Žarković:** Graphene-based in-vitro cell-culturing surfaces alter morphological properties of neonatal spiral ganglion neurons
12.00-12.30	**Davor Horvatić:** Human-Centric explainable AI for neuroscience: Revealing neuron population activity
12.30-13.45	**LUNCH BREAK**
13.45-14.10	**Muammer Üçal:** LOGOS-TBI: Light-controlled organic semiconductor implants for improved regeneration after traumatic brain injury
14.10-14.25	**Marta Nowakowska:** Activation of regeneration-associated pathways in neurons following photocapacitive stimulation
14.25-14.50	**Theresa Rienmüller:** Analysis, modeling and simulation in biomedical applications
14.50-15.05	**Daniel Ziesel:** Electrical stimulation methods for the preclinical treatment of TBI sequelae – an overview
15.05-15.25	**COFFEE BREAK**
15.25-15.40	**Linda Waldherr:** Chemo Ion Pumps for Tumor Treatment
15.40-15.55	**Tony Schmidt:** Light stimulation of mammalian cells on organic photocapacitors
15.55-16.10	**Nikola Habek, Ivan Strinić:** Founding of Laboratory for neuroelectronics and brain computer interactions @ Croatian Institute for Brain Research

16.10-16.35	**Vedran Đerek:** Micropyramid structured photo capacitive interfaces
16.35-16.50	**Aleksandar Opančar:** Functional tuning of photocapacitors by optimization of layers thicknesses
16.50-17.00	**Anja Mioković:** Characterization of transient fields around arbitrarily shaped OEPC devices
17.00	**POSTERS AND DISCUSSIONS**

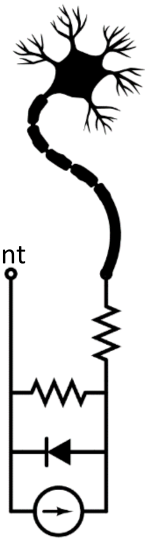
ZAGREB BIOELECTRONICS WORKSHOP 2021

Friday, 5th November 2021

9.30-12.30	Faculty of Science, Physics department, laboratory F-013 **Aleksandar Opančar:** Structured bio-optoelectronics devices by physical vacuum deposition of organic pigments
9.30-12.30	Faculty of Science, Physics department, lecture hall F-201 **Collaboration meeting sessions**
12.30-13.30	**LUNCH BREAK**
13.30-15.00	Faculty of Science, Physics department, laboratory F-013 **Vedran Đerek, Anja Mioković:** Optoelectronic characterization of photocapacitors
14.00-17.00	Croatian Institute for Brain Research, Laboratory for cellular neurophysiology R-219 **Nikola Habek, Ivan Strinić:** Acute brain slice preparation for electrophysiological recordings and Ca^{2+} Imaging
15.00-17.00	Faculty of Science, Physics department, lecture hall F-201 **Aleksandar Opančar:** 3D finite element method modeling of optoelectronic stimulation devices

Saturday, 6th November 2021

10.00-12.30	Faculty of Science, Physics department, lecture hall F-201 **Collaboration meeting sessions**
12.30-13.30	**LUNCH BREAK**
13.30-17.00	**Open discussions and closing remarks**



Zagreb Bioelectronics Workshop 2020

30.01 – 01.02. 2020

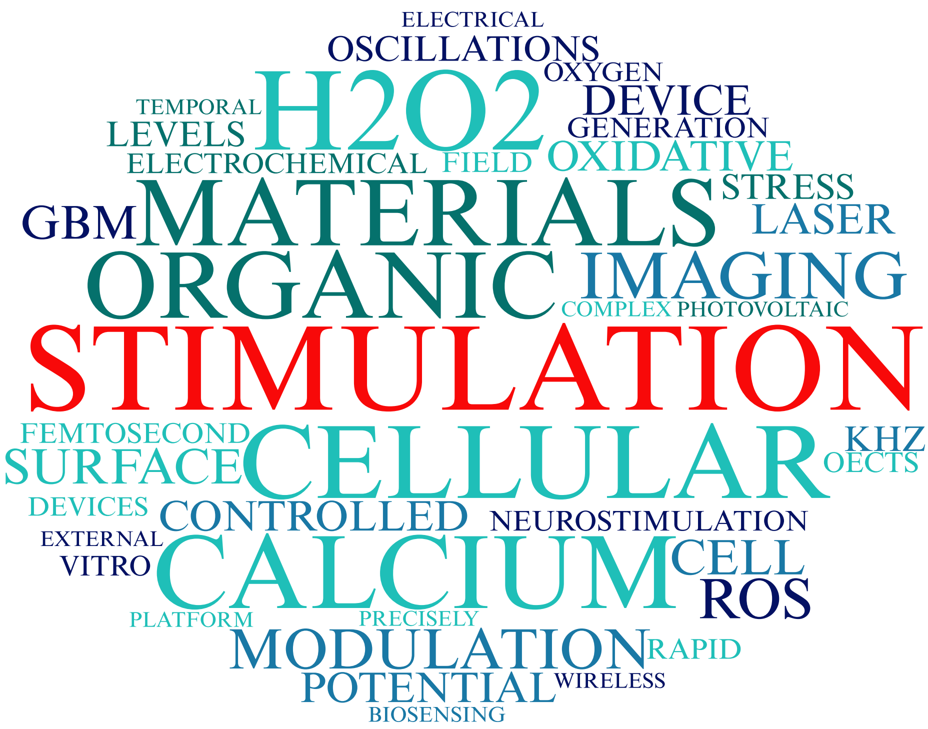
University of Zagreb, Faculty of Science, Physics department
Bijenička cesta 32, Zagreb

Workshop program

Thursday, 30.01.2020	**TP Seminar, F-201 (2nd floor)**	
09:30-10:00	**Vedran Đerek** University of Zagreb, Physics department	Micro- and nano-structures for 3D opto-bioelectronics – project overview
10:00-10:45	**Eric Głowacki** Linköping University, Sweden	Organic nanocrystalline semiconductors for bioelectronics and catalysis
10:45-11:15	**COFFEE BREAK** (Blue room, 1st floor)	
11:15-11:35	**Marie Jakesová** Linköping University, Sweden	Precise drug delivery with organic electronic ion pump
11:35-11:55	**Ludovico Migliaccio** Linköping University, Sweden	Fabrication of organic flexible neural interface devices for optical stimulation
11:55-12:10	**Marta Nikić** University of Zagreb, Physics department	Advantages of 3D structuring for neural intrfaces
12:10-12:30	**Malin Silverå Ejneby** Linköping University, Sweden	Optoelectronic control of single cells using organic photocapacitors – the Xenopus laevis oocyte model
12:30-12:45	**Katarina Vulić** University of Zagreb, Physics department	Return electrode in electrostimulation – faradaic versus capacitive modes
12:45-14:00	**LUNCH BREAK** (Blue room, 1st floor)	
14:00-16:00	3DOptoBio project kick-off meeting	

Friday, 31.01.2020	**3DOptoBio Lab (F-013)**	
09:30-12:30	Eric Głowacki, Vedran Đerek	Photocapacitor workshop I – vacuum evaporation of organic pigments for fabrication of optoelectronic devices
12:30-13:30	**LUNCH BREAK**	
13:30-17:00	Marie Jakesová, Malin Silverå Ejneby, Ludovico Migliaccio	Photocapacitor workshop II – photocapacitor characterization by electro-photo response measurements

Saturday, 01.02.2020	**Blue room, 1st floor**	
10:00-11:00	Vedran Đerek	Processing big data from Intan electrophysiology platforms
11:00-12:30	Vedran Đerek	Python/Intan workshop



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