Orsolya Karácsony
Curriculum vitae



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1 Employment

1.1) Senior researcher, Institute of Cognitive Neuroscience and Psychology, HUN-REN Research Centre for Natural Sciences, Hungary, 2026 July – present.
Data Repository Ambassador, Research Documentation Centre, Centre for Social Sciences, Eötvös Loránd University, Budapest, 2026 July – present.

1.2) Research fellow, HUN-REN Institute of Experimental Medicine, Hungary, 2023-2026 June.
Projects:
1. Studying pyramidal cell activity in awake mice in a murine model of temporal lobe epilepsy. Manuscript under preparation; summarized in 8.2.
2. Development of a mouse model for chronic fatigue syndrome, to shed light on the pathophysiology and to make therapeutic implications. Manuscript under preparation; summarized in 8.1.
3. Analyzing stroke patients' dual task test performance and other neurological data, in collaboration with Judit Málly. A paper published, another one under preparation.
4. Artificial intelligence ambassador (during the 2nd round of the program, 2024 September-2025 September).
5. Data repository ambassador (during the 2nd round of the program, 2024 April-November).
6. Supervision of MS student Szandra Szedlacsek and Erasmus student Pál-Zalán Ferencz.
7. Lecture preparation and delivery as part of the PhD course Neuropharmacology.

1.3) Senior researcher, research group leader, Femtonics Ltd. Hungary, 2021-2023.
Projects:
1. Stimulated Raman scattering microscopy for cancer determination in the operating room.
2. Studying the effects of visual stimuli with an information content on a murine model of epilepsy *in vivo* by simultaneous two-photon microscopy and electrophysiology.

1.4) Researcher, Research Centre for Toxicology, Masaryk University, Czech Republic, 2020.
Developing software tools to evaluate toxicants' effects on neural development *in vitro*.

1.5) Researcher at Karolinska Institutet, Sweden, 2017- 2019.
Principal investigator of the DNABAR project, 2017-2019.
Supervisor: Dr. Björn Högberg.
Areas:
DNA nanotechnology, super-resolution microscopy, molecular biology, cell culture.
Projects:
1. Connecting morphological and sequencing data using DNA origami,
2. A novel quantitative method for the characterization of DNA origami - protein conjugates for immunotherapy.

1.6) Postdoctoral Research Associate, Oak Ridge National Laboratory, 2015-2017.
Mentor: Dr. Ian Anderson.
Area:
Connecting Atomic Force Microscopy to Mass Spectrometry.
Projects:
1. Multimodal imaging with micron-scale resolution,
2. Spatially Resolved Nanomechanically Assisted Sampling with Thermal Desorption Secondary Ionization Mass Spectrometry.
Elected president of the Oak Ridge Postdoctoral Association from 2016-2017.

1.7) Summer Visitor in the Robotics Institute, Choset Group, Carnegie Mellon, 2015.
Projects:
1. Hydrosurgery project,
2. Determination of camera position using April tags in medical snake robot.

1.8) TA in Statistical Mechanics and Thermodynamics, Bioorganic Chemistry, AFM Laboratory, Quantum Chemistry, General Chemistry, Carnegie Mellon, 2012-2015. Responsible for recitation/laboratory, holding office hours and grading, occasionally for lecture preparation and delivery.

1.9) RA in physical chemistry, Florida Institute of Technology, 2010-2011. Responsible for designing and running force spectroscopy measurements, including chemical modification of tip and substrate, data processing, manuscript preparation.

1.10) TA in general chemistry, Florida Institute of Technology, 2009-2010. Responsible for lab preparation and teaching.

1.11) TA in Software Technology, Eötvös Loránd University, 2008 Feb-June. Responsible for recitation and grading. Received grade A in the student evaluation following the course.

1.12) Support Engineer, Geomant Inc., 2008 Jan -2009 July. Provided multi-level international support to resellers and customers for a newly introduced software product. Wrote and edited documentation. Developed test plan and executed testing to ensure quality of the software product.

1.13) Intern in Computer Science, Geomant, Inc, 2007 July-Dec. Responsible for programming, testing, writing and maintenance of documentation.

2 Education

2.1 **Ph.D. in Chemistry**, Carnegie Mellon University, Pittsburgh, PA, USA, 2012-2015 (defense: 17 May 2015)

Advisor: Dr. Newell Washburn, thesis title: Design, synthesis, characterization, and testing of materials for biomedical applications

2.2 **M.D.**, Semmelweis University, Hungary, 2000-2006 (graduation: 28th August)

Advisor: Dr. László Tretter, thesis title: Free radical producing mechanisms in the mitochondria of the central nervous system

2.3 M.S. in Chemistry, Florida Institute of Technology, Melbourne, FL, USA, 2009-2011

Advisor: Dr. Boris B. Akhremitchev, thesis title: Discrimination of Multiple Interactions in Single Molecule Force Spectroscopy

2.4 M.S. in Digital Image- and Signal Processing, Cranfield University, UK, 2008-2009

Advisor: Dr. Najla Megherbi, thesis title: Human Contour Tracking using Level Set in Cluttered Environment

2.5 **M.S. in Mathematics and Computer Science**, Eötvös Loránd University, Hungary, 2008-2009

Advisor: Dr. Zoltán Horváth, thesis title: Human Contour Tracking using Level Set in Cluttered Environment

2.6 **B.S. in Mathematics and Computer Science**, Eötvös Loránd University, Hungary, 2004-2008

Advisor: Dr. Tibor Ásványi, thesis title: Graphical Simulation of the Operation of a Hospital Board

2.7 **Bioinformatics** I-III. Certification from Coursera:
1. Finding Hidden Messages in DNA (Bioinformatics I) (with Honors), Credential ID: WBA645RMMWV8, issued 21 April 2017.
2. Genome Sequencing (Bioinformatics II) (with Honors), Credential ID: 3QW5E7C7U6DR, issued 2 Feb. 2017.

3. Comparing Genes, Proteins, and Genomes (Bioinformatics III) (with Honors), Credential ID: JCVRWQG95UE3, issued 29 Dec. 2016.

3 Publications

3.1) Karácsony, O.: Three disorders of the central nervous system: Chronic Fatigue Syndrome, Temporal Lobe Epilepsy, and Post-Stroke State, Animal and human studies, with conservative therapeutic implications. Book under review.

3.2) Baranyi, M..; Karácsony, O.; Sperlágh, B.: Analytical Method for Gradient Separation of Monoamine, Adenine Nucleotide, and β-Endorphin Neurotransmitters Using Amperometric and Spectrometric Detection. Sep. Sci. Plus, 10 Oct. 2025, DOI: 10.1002/sscp.70137.

3.3) The Contribution of Paresis, Age, and the Effect of Short Training on Cognitive–Motor Dual-Task Interference After Stroke: A Pilot Study. Life 2025, 15, 1881. https://doi.org/10.3390/ Life15121881.

3.4) Karácsony, O.; Sperlágh, B.; Szedlacsek, Sz.: The Impact of Visual Stimulation on Somatosensory Activity in Epilepsy in a Murine Model, manuscript in preparation.

3.5) Karácsony, O.; Szedlacsek, Sz., Pálszabó, P.; Baranyi, M, , Demeter, K. and Sperlágh, B.: A mouse model for chronic fatigue syndrome validated by behavioral, metabolic and hormonal changes, manuscript in preparation.

3.6) Tai, T.; Karácsony, O.; Bocharova, V.; Van Berkel, G. J. and Kertesz, V. Topographical and Chemical Imaging of a Phase Separated Polymer Using a Combined Atomic Force Microscopy/Infrared Spectroscopy/Mass Spectrometry Platform. *Anal. Chem.* **2016**, 88 (31), 2864-2870.

3.7) Averick, S.; Karácsony, O.; Mohin, J.; Yong X.; Moellers, N. M.; Woodman, B. F.; Zhu, W.; Mehl R. A.; Balazs A. C.; Kowalewski, T.; Matyjaszewski, K. Cooperative, Reversible Self-assembly of Covalently Pre-linked Proteins into Giant Fibrous Structures. *Angew. Chem.*, Int. Ed. **2014**, 53 (31), 8050-8055.

3.8) Ramadan, M. H.; Prata, J.E.; Karácsony, O.; Dunér, G., Washburn, N. R. Reducing Protein Adsorption with Polymer-Grafted Hyaluronic Acid Coatings. Langmuir. **2014**, 30 (25), 7485-95.

3.9) Karácsony, O., Deschamps, J. R., Trammell,· S. A., Nita, R.; Knight, D. A. Synthesis of a 2, 2'-Bipyridyl Functionalized Oligovinylenephenylene Using Heck and Horner-Wadsworth-Emmons Reactions and X-Ray Crystal Structure of E-(4-(4-bromostyryl)phenyl)(methyl)sulfane. *Molecules* **2012**, (17), 5724-5732.

3.10) Karácsony, O.; Akhremitchev, B. B. On the Detection of Single Bond Ruptures in Dynamic Force Spectroscopy by AFM. *Langmuir* 2011, 27, (18), 11287–11291.

4 Selected Presentations

4.1) Invited talk: The Impact of Visual Stimulation on Somatosensory Activity in Epilepsy in a Murine Model. Biomedical Data Science Conference 2025 Semmelweis University, Faculty of Dentistry, 6th Aug. 2025, Budapest, Hungary.

4.2) 28th International Symposium on Separation Sciences, Messina, Italy, 22-25 September 2024 (“Analytical Method for Gradient Separation of Monoamine, Adenine Nucleotide, and β-Endorphin Neurotransmitters Using Amperometric and Spectrometric Detection”, presented by Mária Baranyi)

4.3) 39th Congress of the Hungarian Neurology Society, Szeged, 20-22 June 2024 ("Measuring the congnitive function with dual task tests", presented by Judit Málly)

4.4) International Neuroscience Conference, Pécs, Hungary, 25-26 January 2024 (“A mouse model of chronic fatigue syndrome validated by behavioural and hormonal changes”)

4.5) SciComp23, Budapest, Hungary, 11-12 November 2023 (“The effect of organized visual stimuli on the function of pyramidal cells during and after stimulation in temporal lobe epilepsy”).

4.6) Symposium of the Oak Ridge Postdoctoral Association, Oak Ridge, TN, August 8, 2016, ("Spatially Resolved Nanomechanically Assisted Sampling with Thermal Desorption Secondary Ionization Mass Spectrometry ("Scratch and Sniff")").

4.7) 249th ACS National Meeting, Denver, CO, March 22-26, 2015, ("Reducing Protein Adsorption with Polymer-Grafted Hyaluronic Acid Coatings: Optimization of Material Properties and a Study on Coating Mechanism").

4.8) CRP Consortium Meeting, Pittsburgh, PA, October 2013 ("Synthesis, Characterization and Testing of a Novel Self-healing Material and Self-assembly of Covalently Bonded Fibers by Zipper-like Driven Aggregation

4.9) APS March Meeting, Baltimore, MD, March 18-22. 2013, Baltimore, MD ("Quantification of tip-sample forces on and below resonance in tapping mode atomic force microscopy")

4.10) Joint 62nd SE/ 66th SW Regional ACS Meeting, New Orleans, LA December 1-4, 2010 ("Synthesis of Novel Conjugated 2,2'-Bipyridyl Ligands for Homogeneous Catalytic Hydrolysis on a Gold Nanoparticle Platform")

4.11) DTRA CBD S&T Conference; Orlando, FL, November 15-19, 2010 ("Electronic effects for the hydrolysis of phosphate esters at gold nanoparticle surfaces")

5 Funding, Awards and Scientific Activities

Member of the
5.1) 2026- Member of the Hungarian Microscopy Society
5.2) 2022-present Member of the Hungarian Neuroscience Society
5.3) 2021-present Member of the Editorial Review Board of Smart and Sustainable Built Environment
5.4) 2017-2019 Vinnova grant (1.6 million SEK) for the DNABAR project as Principal Investigator
5.5) 2016 Interviewed by ORNL Today (Why science?)
5.6) 2014 GUSH funding at Carnegie Mellon

5.7) 2005 Medical Student Researchers' Annual Conference, Physiology Section, 3rd Place (shared with Bálint Liktor) at Semmelweis University

5.8) 2004 Presidental Thesis Award, 1st place ("Free radical productive mechanisms in the mitochondria of the central nervous system") in Biochemistry at Semmelweis University

5.9) 2001 Annual Biophysics Competition of Medical Students: 2nd place, Semmelweis University, 2001

5.10) 2003-2005 Member of the Medical Student Researcher Community. Field of study: Neurobiochemistry (Institute of Biochemistry)

5.10) 2010-2015 ACS Member

5.11) 2015 Member of the Student Safety Committee in the Chemistry Department at Carnegie Mellon
5.12) 2015 Assistance with the Office of Student Activities at Carnegie Mellon
5.13) 2015 Member of the Oak Ridge Postdoctoral Association at Oak Ridge National Laboratory
5.14) 2015 Manuscript Reviewing for the following journals/conferences:
Journal of Pharmaceutical Analysis, IEEE/RSJ International Conference on Intelligent Robots and Systems

6 Supervision

6.1) 2018 Caroline Charlotte Juliano completed a project on UV-crosslinking DNA nanostructures for biological applications as a summer intern during my supervision. She is now an M.S. student at the École Polytechnique Fédérale de Lausanne
6.2) Patrick Philipp Reith completed a project on optimizing culturing conditions for rosette-forming neuroepothelial stem cells and on solving the problem of how to connect the location data of cells and DNA origami nanostructures, which differ by two orders of magnitude in size. He is now a Ph.D. student at Chalmers University of Technology.
6.3) Anastasiya Hrabennikava completed a Masters thesis at Masaryk University being partially funded with a Visegrád Scholarship that she obtained under my supervision.

6.4) Boróka Szőcs completed her Masters thesis at Eötvös Loránd University using the stimulated Raman Scattering microscopy data that she collected under my supervision.
6.5) Pál-Zalán Ferencz, summer student at the HUN-REN Institute of Experimental Medicine learned how to perform two-photon microscopy in live, awake mice under my supervision.
6.6) Szandra Szedlacsek, MS thesis student learned how to perform two-photon microscopy in live, awake mice under my supervision, how to perform and interpret the results of Fast Fourier Transformation and Principal Component Analysis and how to curate data.

7 Leadership experience

7.1) From 2016-2017, I have served as elected president of the Oak Ridge Postdoctoral Association (ORPA). The president runs the association with close collaboration with the laboratory's leadership, and manages the association's monetary assets, with the treasurer's help. ORPA acts, on one hand, as a research committee and organizes a yearly Research Symposium and a series of talks by world-leading scientists. The organization also acts as a trade union and in this quality organizes a Career Fair and professional development events, cooperating with other organizations within the laboratory, such as the Early Career Professionals. From ORPA's activity during my presidential term, I would like to highlight the establishment of the Outreach Committee and that I have brought in Professor Digby McDonald from Berkley, who was nominated for Nobel Prize.

During this time, I was also a member of the Postdoctoral Program Advisory Council comprising of division chairs and the head of HR, which regulates the laboratory's postdoctoral program.

8 Short description of most recent projects

8.1) Chronic fatigue syndrome (CFS) is a debilitating illness that occurs in up to 1% of infections by certain, mostly viral, pathogens, lasts for 3-6 months and is followed by chronic pain. In mice immune-challenged with polyinosinic:polycytidylic acid (P(I:C)) and in vehicle controls, I evaluated the function of the immune system (IS), central nervous system (CNS), and energy homeostasis (EH) as literature suggests that these are key players in the condition.

I judged IS functionality from following blood corticosterone and from terminal weights of immune organs; CNS functionality from the concentrations of monoamine neurotransmitters, β-endorphin and Brain-derived Neurotropic Factor in plasma and hippocampus; and EH functionality from daily body weight, physical activity, energy consumption measurements and concentrations of ATP and its metabolites in plasma and the hippocampus.

I calculated correlations between these and performed principal component analysis (PCA) on the physical activity values of our mice and Iditarod teams.

The observed large-amplitude oscillations in energy intake and usage in healthy animals, with two maxima per week, are necessary to explain the following *significant* effects. Namely, P(I:C)-injected animals *move less* and do not consume more/less sugar than controls, and yet, their *body weights decrease* for P(I:C). The frequency of oscillation in *sucrose intake* in immune-challenged animals *increases*, with no other P(I:C)-control or before-after differences.

PCA shows that the murine body's daily sampled movement as a function of time is well modelled as a linear time-invariant discrete-time control system.

Correlations and changes over time show that metabolic oscillations originate from neurogenesis in the dentate gyrus, which belongs to two control loops (energy intake and energy usage), that Protein Kinase R deregulation decouples these loops, that transition to chronic pain appears when the cycles of β-endorphin production also get affected, and that there is a natural restoring mechanism for CFS through the microbiota-gut-brain axis. Own project, reference: Beáta Sperlágh.

8.2) Temporal lobe epilepsy is notoriously difficult to treat both pharmaceutically and surgically. The hypothesis of this project was that organized stimuli (stimuli with an information content) can decrease severity, by engaging the brain more in its natural activity.

In a murine model of temporal lobe epilepsy, I used two-photon microscopy to measure changes in intracellular Ca^{2+}-concentration, performed simultaneously with electrophysiological recordings. When checked with two-photon microscopy, in epileptic animals, the number of active cells in the somatosensory cortex in darkness exceeded the normally larger visual cortical activity. Based on tethered electrophysiological recordings from intracranial electrodes, I showed that projection of a video of vertically moving horizontal gratings decreases the frequency of interictal spikes compared to the value measured in darkness, and in some cases this effect persists even after projection ends.

According to simultaneously recorded microscopy videos, the number of active cells show a similar trend and, additionally, the number of cell triads that are active at the same time increases. Moreover, on one hand, upon evaluating the planar patterns formed by these triads by hierarchical clustering, in a milder case of epilepsy, a more organized activity can be observed than in a more severe case, and, on the other hand, projection also increases the level of organization. This result is also supported by the simultaneous activity of nearby cells spanning a larger time period, by the binary activity matrix of nearby cells' Fast Fourier Transform's magnitude spectrum approaching the normal one and by the disappearance of simultaneously active cell triads' drifting in space over time, an apparently epileptic feature during projection. These results suggest that visual information decreases epileptic severity during and, to some extent, after projection. Own project; reference: Balázs Rózsa.

9 References

9.1) Dr. Beáta Sperlágh, supervisor at current position, sperlagh@koki.hu

9.2) Dr. Balázs Rózsa, supervisor at previous position, rozsabal@femtonics.eu

9.3) Dr. Björn Högberg, Karolinska Institutet: postdoctoral advisor, +46 (0)852487036, bjorn.hogberg@ki.se

9.4) Dr. Ian Anderson, Sandia National Laboratory, USA: my former mentor at Oak Ridge National Laboratory, USA whom I worked with in my role as the president of the Oak Ridge Postdoctoral Association, +1-505-284-4148, ianders@sandia.gov.

9.5) Dr. Rudolf Wehmschulte, Florida Institute of Technology, USA: former graduate committee member, examiner at cumulative exams, teacher in class, +1 (321) 674-7659, rwehmsch@fit.edu