

Matej Hotka – Curriculum Vitae

Name: Matej HOTKA

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Place/date of birth: Bratislava, Slovakia, 11.07.1985

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Academic titles: Masters degree in electrical engineering (Ing.)
Philosophiae doctor in biophysics (PhD.)

Education: (2005 - 2010) Ing, electrical engineering, Faculty of electrical engineering and information technology, Slovak University of Technology, Bratislava, Slovakia

(2010 - 2015) PhD, biophysics, Department of Biophysics, Faculty of Natural Sciences, Pavol Jozef Šafárik University, Košice, Slovakia

Academic history: (2010 - 2016) – Research assistant, Institute of Molecular Physiology and Genetics, Slovak Academy of sciences, Bratislava, Slovakia.

(2016 - 2020) Postdoctoral research fellow at the Department of Neurophysiology and Neuropharmacology, Center for Physiology and Pharmacology, Medical University of Vienna, Austria

(2020 – present) Senior postdoctoral research fellow at the Department of Neurophysiology and Neuropharmacology, Center for Physiology and Pharmacology, Medical University of Vienna, Austria. I am a principal investigator of a scientific project (nr. FWF P-33797: Regulation of mitochondrial ATP synthesis by neuronal Cav1).

Main research areas:

My long-term research interests can be divided in two parts. I'm interested in the role of neuronal L-type calcium channels in epilepsy/epileptogenesis. Especially in their role in regulation of neuronal metabolism during the increased neuronal activity.

The other field of my research is related to my degree in electrical engineering: By combination of electrophysiology and electrical circuit analysis, I'm developing methods by which we study cellular processes in real-time with high resolution. For example, ligand binding and transport of substrates by plasma membrane proteins or exo/endocytosis.

Methods and skills, I use in my research include: laser-scanning confocal microscopy, patch-clamp electrophysiology and mathematical modeling.

Memberships:

European Calcium Society (ECS)

Austrian Neuroscience Association (ANA)

The main research achievements:

Identification of a bimodal regulation of mitochondrial bioenergetics by L-type calcium channels. (publication # 1-2).

A definition of bona fide Paroxysmal depolarizations shift (PDS) and of the main research questions that need to be solved to understand the role of PDS in epileptology (publications # 3 and 4).

Demonstration of a crucial implication of L-type calcium channels and in particular of the Ca_v1.3 subtype of L-type calcium channels in the formation of paroxysmal depolarization shifts (publication # 5-6).

Development of an electrophysiological approach for label-free monitoring of ligand binding to proteins (publications #7-9).

Identification of alterations in L-type calcium channel currents as a part of excitation contraction machinery of cardiac ventricular myocytes during development and disease (publications #10).

10 most important publications:

1: Dhoundiyal A, Goeschl V, Boehm S, Kubista H, **Hotka M**. 2022. Glycerol-3-phosphate shuttle is a backup system securing metabolic flexibility in neurons. *J Neurosci*. Aug 19;42(39):7339–54. doi: 10.1523/JNEUROSCI.0193-22.2022.

2: **Hotka M**, Cagalinec M, Hilber K, Hool L, Boehm S, Kubista H. L-type Ca²⁺ channel-mediated Ca²⁺ influx adjusts neuronal mitochondrial function to physiological and pathophysiological conditions, *Science signaling*, 2020, doi: 10.1126/scisignal.aaw6923.

3: **Hotka M**, Kubista H. The paroxysmal depolarization shift in epilepsy research. *Int J Biochem Cell Biol*. 2019 Feb;107:77-81. doi: 10.1016/j.biocel.2018.12.006.

4: Kubista H, Boehm S, **Hotka M**. The Paroxysmal Depolarization Shift: Reconsidering Its Role in Epilepsy, Epileptogenesis and Beyond. *Int J Mol Sci*. 2019 Jan 29;20(3). doi: 10.3390/ijms20030577.

5: Stiglbauer V, **Hotka M**, Rieß M, Hilber K, Boehm S, Kubista H. Ca_v1.3 channels play a crucial role in the formation of paroxysmal depolarization shifts in cultured hippocampal neurons. *Epilepsia*. 2017 May;58(5):858-871. doi: 10.1111/epi.13719.

6: Meyer C, Kettner A, Hochenegg U, Rubi L, Hilber K, Koenig X, Boehm S, **Hotka M**, Kubista H. On the Origin of Paroxysmal Depolarization Shifts: The Contribution of Cav1.x Channels as the Common Denominator of a Polymorphous Neuronal Discharge Pattern. *Neuroscience*. 2021 Aug 1;468:265-281. doi: 10.1016/j.neuroscience.2021.05.011. Epub 2021 May 18. PMID: 34015369.

7: **Hotka M***, Burtscher V*, Li Y, Freissmuth M, Sandtner W. A label-free approach to detect ligand binding to cell surface proteins in real time. *Elife*. 2018 Apr 26;7. pii: e34944. doi: 10.7554/eLife.34944.

***equal contribution**

8: **Hotka M***, Burtscher V*, Freissmuth M, Sandtner W. An Electrophysiological Approach to Measure Changes in the Membrane Surface Potential in Real Time. *Biophys J*. 2019 Jul 5. pii: S0006-3495(19)30542-9. doi:10.1016/j.bpj.2019.06.033.

***equal contribution**

9: **Hotka M**, Zahradník I. Reconstruction of membrane current by deconvolution and its application to membrane capacitance measurements in cardiac myocytes. PLoS One. 2017 Nov 22;12(11):e0188452. <https://doi.org/10.1371/journal.pone.0188452>.

10: Cagalinec M, Zahradníková A, Zahradníková A Jr, Kováčová D, Paulis L, Kureková S, **Hotka M**, Pavelková J, Plaas M, Novotová M, Zahradník I. Calcium Signaling and Contractility in Cardiac Myocyte of Wolframin Deficient Rats. Front Physiol. 2019 Mar 13;10:172. doi:10.3389/fphys.2019.00172.

Scientific talks and awards:

2018 – “*L-type , Ca^{2+} channels regulate mitochondrial ATP production in hippocampal neurons*”, 15th International Meeting of the European Calcium Society, Hamburg, Germany.

2018 – “*The interplay of mitochondrial dysfunction and epileptiform discharge activities*”, 13th European Congress on Epileptology, Vienna, Austria.

2017 – “*The link between mitochondria and epileptiform activity*”, 15th meeting of the Austrian Neuroscience Association, IST Klosterneuburg, Austria.

2017 – “*The link between mitochondria and epileptiform activity*”, MitoPorto, Porto, Portugal

2016 –” *Investigating the link between mitochondria, Ca^{2+} and epileptiform activity*”, 14th European Calcium society meeting, Valladolid, Spain.

2016 - ECS Junior Travel Fellowship, 14th European Calcium Society meeting, Valladolid, Spain.

2014 - Best Oral Presentation, Young Biomedical Engineers and Researchers Conference Bratislava, Slovakia.

2012 - Education Committee award, 56th Annual Meeting at the San Diego Convention Center in San Diego, California, February 25-29, 2012

Grants received:

2020 – grant nr.: FWF P-33797, Regulation of mitochondrial ATP synthesis by neuronal Cav1.

2023 – grant doi: 10.55776/PAT8605623, Paroxysmal depolarization protects neurons via mitochondria