ATTILA LOSONCZY, M.D., Ph.D.

Born: November 17, 1974, Nagykanizsa, Hungary
Professor (tenured)
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FIELD OF SPECIALIZATION

The focus of my research is to provide a biophysically based, mechanistic understanding of neuronal processes supporting cognitive functions of the mammalian brain, such as episodic learning, memory and fear-related decision making. My lab is using the mouse as a model organism, where synaptic, cellular and microcircuit processes can be causally liked to evolutionally conserved adaptive behaviors under both normal and diseased conditions, such as epilepsy, schizophrenia, as well as aging. My prior experimental work established dendrites as independent computational units of principal excitatory neurons (Losonczy and Magee, 2006; Losonczy et al., 2008; Losonczy et al., 2010). Research in my own lab aims to dissect the role that excitatory, inhibitory and neuromodulatory circuit motifs play in learning and memory formation. For this, we use large-scale, subcellular-resolution *in vivo* functional imaging in combination with electrophysiology, cell-type specific manipulations, in vitro experiments, and computational modeling. Our work has provided the first evidence for the functional dissociation of inhibitory circuits in regulating neuronal input-output transformations *in vitro* (Lovett-Barron et al., 2012). Subsequent series of *in vivo* imaging studies aimed at dissecting hippocampal circuit operations *in vivo*. For example, we characterized the type of information carried by septal GABAergic (Kaifosh et al., 2013) and locus coeruleus catecholaminergic (Kaufman et al., 2020) inputs to the hippocampus at a single synapse-level *in vivo*, dissected the roles of identified hippocampal inhibitory circuits during navigation, reward and fear learning (Lovett-Barron et al., 2014, Lee et al. 2014; Basu et al., 2016, Turi et al., 2019, Geiller et al., 2020). In another other series of studies, we characterized ensemble dynamics of several types of developmentally- and genetically-defined principal cells (Denny et al., 2014; Danielson et al., 2016a, 2016b, 2017, Zaremba et al., 2017) during navigation and learning. In a recent series of studies, we uncovered novel circuit mechanisms of episodic memory formation (Geiller et al., 2022) and consolidation (Grosmark et al., 2021, Terada et al., 2022). I also investigated how the fundamental processes of learning and memory are disrupted under pathological conditions, including schizophrenia (Zaremba et al., 2017) and temporal lobe epilepsy (Sparks et al., 2020). To aid these investigations, my lab has developed several novel methods for anatomical and functional circuit mapping (Reardon et al., 2016, Geiller et al., 2022) and introduced novel frameworks for computational modeling of dendritic operations and circuit dynamics (Ahmed et al, 2020, Turi et al., 2019, Kaifosh et al., 2016). I have also established strong collaborations with circuit and systems neuroscientist (I. Soltesz, and G. Buzsaki), computational and theoretical neuroscientist (S. Fusi, Y. Poirazi, and L. Paninski), molecular neuroscientists (B. Zemelman, F. Polleux), and optical physicists (A. Vaziri, M. Schnitzer), among others, to develop novel experimental approaches and theoretical frameworks for investigations into cognitive memory functions under normal and pathological conditions.

The following publications from my laboratory exemplify our scientific approach:

1. Lovett-Barron M, Kaifosh P, Kheirbek MA, Danielson N, Zaremba JD, Reardon TR, Turi GF, Hen R, Zemelman BV, Losonczy A. Dendritic inhibition in the hippocampus supports fear learning. **Science**. 2014.
2. Geiller T, Sadeh S, Rolotti SV, Blockus H, Vancura B, Negrean A, Murray AJ, Rozsa B, Polleux F, Clopath C, Losonczy A. Local circuit amplification of spatial selectivity in the hippocampus. **Nature**. 2022.
3. Terada S, Geiller T, Liao Z, O'Hare J, Vancura B, Losonczy A. Adaptive Stimulus Selection for Consolidation in the Hippocampus. **Nature**. 2022.
4. O'Hare JK, Gonzalez KC, Herrlinger SA, Hirabayashi Y, Hewitt, VL, Blockus H, Szoboszlay M, Rolotti SV, Geiller, TC, Negrean A, Chelur V, Polleux F, and Losonczy A. Compartment-specific tuning of dendritic feature selectivity by intracellular Ca(2+) release. **Science**. 2022.

Papers in top-tier journals: Science: 6, Nature: 3, Nature Neuroscience: 9, Neuron: 19, Cell: 1
Citations: 7959, h-index: 36

A. EDUCATION

University Medical School, Pecs, Hungary M.D., 1993 – 1999

Semmelweis University, Budapest, Hungary Ph.D., in Neurobiology, 2000 – 2004
Dissertation title: *Underlying mechanisms of short-term synaptic plasticity at identified central synapses.*
Dissertation advisor: Prof. Zoltan Nusser

B. POSITIONS HELD SINCE MEDICAL DOCTORATE CONFERRED

09/1993 – 09/1999	University Medical School, Pecs, Hungary *Research Assistant* (Prof. G. Lazar, Dept. of Anatomy)
10/1999 – 03/2000	University Medical School, Pecs, Hungary *Graduate student* (Prof. L. Seress, Central Electron Microscope Laboratory; Prof. G. Czeh, Dept. of Pharmacology)
04/2000-07/2000	MRC Anatomical Neuropharmacology Unit, Oxford, UK, *Visiting student* (Prof. P. Somogyi)
08/2000 – 07/2003	Semmelweis University, Budapest, Hungary *Graduate student* (Prof. Z. Nusser, Institute of Experimental Medicine of the Hungarian Academy of Sciences)
08/2003 – 07/2006	Louisiana State University, Neuroscience Center, La, USA *Postdoctoral Fellow* (Prof. J. C. Magee)
08/2006 – 04/2007	Yale University, Department of Cell Biology, CT, US *Postdoctoral Fellow* (Prof. G. Miesenbock)
05/2007 – 10/2009	Howard Hughes Medical Institute, Janelia, Va, USA *Research Specialist* (Prof. J. C. Magee)
11/2009 – 4/2016	Columbia University, Department of Neuroscience, NY, USA *Assistant Professor*
10/2010 – present	Kavli Institute for Brain Science, Columbia University, NY, USA *Faculty Member*
07/2015 – present	Mortimer B. Zuckerman Mind Brain Behavior Institute, Columbia University, NY, USA *Faculty Member*
04/2016 – 12/2018	Columbia University, Department of Neuroscience, NY, USA *Associate Professor (with tenure)*
01/2019 – present	Columbia University, Department of Neuroscience, NY, USA *Full Professor (with tenure)*

C. TEACHING EXPERIENCE

C.1 Courses Taught
Synaptic Transmission & Plasticity (doctoral course; instructor, 2012–2018, co-director 2018–2023)
Issues in Neural Circuitry (doctoral course; co-director, instructor, 2011, 2014)
Survey of Neuroscience (doctoral course; lecturer, 2010–present)
NRSA grant writing course (doctoral course, 2018–present)

Neuroscience Section of "The Body in Health & in Disease (medical student lecture, fall 2015, 2016, 2017)
MD-PhD research seminar series (lecturer, 2011–present)

C.2 Mentoring Experience

† denotes student/postdoc in applying for successfully funded fellowships from the National Institute of Health, National Science Foundation, Howard Hughes Medical Institute, or other private foundations.

Postdoctoral Researchers

Dr. Tristan Geiller† (2017–present)	NIH K99/R00
Dr. Satoshi Terada† (2018–present)	JSPS, Uehara Memorial Foundation
Dr. Justin O'Hare† (2017–present, with F. Polleux)	NIH F32, NIH K99/R00
Dr. Miklos Szoboszlay (2018–present)	
Dr. Stephanie Herrlinger† (2019–present, with J. Gogos)	NIH F32, Burroughs-Wellcome PDEP Award
Dr. Eunji Kong (2022–present)	
Dr. Hyun Choong Yong (2023–present)	
Dr. Yu Xin (2023–present)	
Dr. Ivan Voitov (2023–present)	
Dr. Asako Noguchi† (2023–present)	JSPS Fellow

Former:
Dr. Andres Grosmark† (2015–2022) *Assistant Professor*, UConn
Dr. Gergely F. Turi (2010–2016): *Assistant Professor*, New York State Psychiatric Institute
Dr. Mohsin Ahmed† (2013–2022), *Associate Medical Director*, Regeneron
Dr. Rita Nyilas (2016–2019): Senior Research Fellow, IEM HAS, Budapest, Hungary
Dr. Fraser Sparks† (2016–2021), Senior Scientists, Regeneron
Dr. Adrian Negrean (2016–2022), Scientist II, Allen Brain Institute
Dr. Wenke Li (2016–2019): Senior Data Scientist, Bank of America

Sponsor of Ph.D. dissertations at Columbia University
Former:
Matthew Lovett-Barron† (2010-2014) "Functional consequences of dendritic inhibition in the hippocampus"
NSERC Fellowship
2014 Dean's Award for Excellence in Research at Columbia
Current position: *Assistant Professor*, UCSD
Patrick W. Kaifosh† (2011–2015) "The neural circuit basis of learning"
Howard Hughes Medical Institute Predoctoral Fellowship
NSERC Fellowship
2016 Dean's Award for Excellence in Research at Columbia
Current position: Co-Founder and Chief Science Officer at CTRL-Labs (Meta)
Thomas Reardon (2011–2016) "Improved mono-synaptic tracing tools for mapping, monitoring, and manipulation of neural circuits" (co-mentor with Dr. Thomas Jessell)
Current position: Co-Founder Chief Executive Officer at CTRL-Labs (Meta)
Nathan Danielson† (MD/PhD; 2012–2016) "Functional subdivisions among principal cells of the hippocampus"
NIH Predoctoral Fellowship
Current position: research scientist at CTRL-Labs (Meta)
Jeffery Zaremba† (2011–2017) "Spatial memory in health and disease: hippocampal stability deficits in the Df(16)A mouse model of schizophrenia"

NIH Predoctoral Fellowship
Current position: senior research scientist at Perceptive Automata

Joseph Tsai (MD/PhD; 2013–2018)
"The role of SRGAP2 in modulating synaptic dynamics in adult sensory cortex"
Current position: UW residency

Alexandra Kaufman† (2015–2020) "Non-canonical members of circuits: A role for the locus coeruleus in reward related place field plasticity, and investigating differences in astrocyte calcium signaling between hippocampal layers"
NSF Predoctoral Fellowship (2015–2018)
NIMH F31
Current position: postdoctoral researcher at Regeneron

Elizabeth Balough (MD/PhD; 2015–2020) "Keeping Time: Parvalbumin Interneurons' Orchestration of Episodic Memory in Health and Disease"
Current position: Residency, Harvard

Sebastien Rolotti † (2015–2021) "Neural circuit control of feature tuning in CA1 during spatial learning"
NSF Predoctoral Fellowship (2015–2018)
NIMH F31
Current position: research scientist at CTRL-Labs (Meta)

Bert Vancura † (MD/PhD, 2018–2022) "Hippocampal Interneuron Dynamics Supporting Memory Encoding and Consolidation"
NIMH F30
Current position: Columbia Medical School

James Priestley † (2017–2022) "Dynamic and compressed memory coding in the hippocampus"
NIMH F31
Current position: *Assistant Professor* at EPFL, Lausanne, Switzerland (start: January, 2023)

Zhenrui Liao †(MD/PhD, 2019–2022) "Towards a neuroscience of stories: metric space learning in the hippocampus"
NINDS F30
Current position: back to Columbia Medical School

Jack Bowler †(2016–2023) "Direct Cortical Inputs to Hippocampal Area CA1 Transmit Complementary Signals for Goal-directed Navigation"
NINDS F31
Current position: postdoctoral fellow at University of Utah in Jim Heys's lab

Current:
Kevin Gonzalez (2019–present)
Bovey Rao (2020–present)
Mihaila Tiberiu (2022–present)
Abhishek Shah (2022–present)
Carl Shi (2023–present)

Non-sponsor member of Ph.D. thesis committees at Columbia University

Former:
Dr. Andrew Fink (2013, Thomas Jessell) "Exploring a behavioral role for presynaptic inhibition at spinal sensory-motor synapses"
Dr. Zev Rosen (2013, Steven Siegelbaum) "Dopaminergic modulation of hippocampal neural circuitry"
Dr. Timothy Spellman (2014, Joshua Gordon) "Modulation of hippocampal-prefrontal circuitry during spatial working memory"
Dr. Wanying Zhang (2014, Randy Bruno) "In vivo dissection of long range inputs to the rat barrel cortex"

Dr. Timothy Machado (2015, Thomas Jessell) "Probing Circuits for Spinal Motor Control"
Dr. Joseph Stujenske (2015, Joshua Gordon) "Microcircuits underlying fear and safety processing"
Dr. Jessica Jimenez (2017, Rene Hen) "The Role of the Ventral Hippocampus in Anxiety-Related Behavior"
Dr. Samuel Clark (2017, David Sulzer) "*In vivo* optical studies on the direct and indirect paths of the striatum and *in vivo* observation of the release of norepinephrine"
Dr. Benjamin Hoffman (2019, Ellen Lumpkin) "The peripheral nervous system: From molecular mechanisms to non-invasive therapeutics"
Dr. Ian Diascone (2019, Franck Polleux) "Global Synaptic Input Mapping of Cortical and Hippocampal Pyramidal Neurons"
Dr. Martin Vignovich (2019, Charles Zucker) "Integration of Taste and Odor in Agranular Insular Cortex"
Dr. Alexander Sisti (2020, Charles Zucker) "The Neural Basis of Sugar Preference"
Dr. Georgia M. Pierce (2021, Randy Bruno) "Movement related activity surpasses touch responses in secondary somatosensory thalamus"
Dr. Alexander Whitebirch (2021, Stephen Siegelbaum) "Inhibitory-excitatory inbalance in hippocampal subfield CA2 circuitry in a mouse model of temporal lobe epilepsy"
Francisco X. Pena (2021, Daniel Salzman) "The role of amygdala in non-homeostatic eating"
Dr. Dan Kato (2022, R. Bruno) "Effects of learning and experience on multisensory integration in primary sensory cortical areas"

Ongoing:
Olivia Lofaro (Steve Siegelbaum)
Daniel Virga (Franck Polleux)
Sergio Manuel Garcia (Franck Polleux)

External member of Ph.D. thesis committees at other institutions
Former:
Dr. Jon Maffie (2011, Bernardo Rudy's lab, NYU)
Dr. Georg Kosche (2016, Michael Long's lab, NYU)
Dr. Laura McGarry (2017, Adam Carter's lab, NYU)
Dr. Yuta Senzai (2018, Gyorgy Buzsaki's lab, NYU)
Dr. Matthew Davis (2020, Boris Zemelman's lab, UT Austin)

Member of Ph.D. qualifying exam committees at Columbia University
Christine Constantinople (2010, Randy Bruno's lab), Jessica Jimenez (2014, Rene Hen), Martin Vignovich (2013, Charles Zucker), Jozsef Meszaros (2013, David Sulzer), Nancy Padilla (2013, Joshua Gordon), Alexander Sisti (2015, Charles Zucker), Daniel Iascone (2015, Franck Polleux), Georgia Pierce (2016, Randy Bruno), Jack Berry (2017, Rene Hen), Dan Kato (2017, Randy Bruno), Andres Villegas (2019, Polleux)

Co-mentor, collaborator or consultant on federal research grants for postdoctoral fellows (selected)

NIH-NIMH T32 MH018870 (Jonathan Javitch, PI); 2014-to date (primary mentor)
NIH-NINDS T32 for Advanced Graduate Students in Neurobiology and Behavior (Lloyd A. Greene, PI); 2013-to date (primary mentor)
Dr. Tommy Lewis (Franck Polleux's lab): NIH K99 (co-mentor)
Dr. Talia Atkin (Joseph Gogos): NIH K01 (co-mentor)
Dr. Mazen Kheirbek (Rene Hen): NIH K01 (consultant)
Dr. Eiman Azim (Thomas Jessell): NIH K99/R00 (consultant)
Dr. Avishek Adhikari (Karl Deisseroth, Stanford): NIH K99/R00 (consultant)
Dr. Christoph Anacker (Rene Hen): NIH K99 (co-mentor)
Dr. Kimberly Kempadoo (Eric Kandel): NIH K22 (collaborator)

Dr. Justine Kupferman (Franck Polleux): NIH NRSA (co-mentor)
Dr. Victor Luna (Rene Hen): NIH K01 Career Development Award (co-mentor, awarded)
Dr. Bradley Miller (Rene Hen): NIH K01 (consultant)
Dr. Justin O'Hare (Franck Polleux): F32 (co-mentor)
Dr. Ewoud Schmidt (Franck Polleux): NIH K99 (consultant)
Dr. Heike Blockus (Franck Polleux): NIH R21 (consultant)
Dr. Xinyi Deng (Liam Paninski): NIH, K99 (consultant)
Dr. Heike Blockus (Franck Polleux): NIH K99 (co-mentor)
Dr. Sebnem Tundecmir (Rene Hen): NIH K99 (co-mentor)
Dr. Barna Dudok (Ivan Soltesz): NIH K99 (consultant)
Dr. Jordan Farrell (Ivan Soltesz): NIH K99 (consultant)
Dr. Erdem Varol (Liam Paninski): NIH K99 (co-mentor)

D. PUBLICATIONS

PUBLISHED PEER-REVIEWED RESEARCH ARTICLES

Peer-Reviewed Publications:

1. Vancura B, Geiller T, Grosmark A, Zhao V, Losonczy A. Inhibitory control of sharp-wave ripple duration during learning in hippocampal recurrent networks. **Nature neuroscience**. 2023. Epub 2023/04/21. doi: 10.1038/s41593-023-01306-7.

2. E. Troullinou, G. Tsagkatakis, A. Losonczy, P. Poirazi and P. Tsakalides, A Generative Neighborhood-based Deep Autoencoder for Robust Imbalanced Classification. **IEEE Transactions on Artificial Intelligence**. 2023 doi: 10.1109/TAI.2023.3249685.

3. Liu LB, Losonczy A, Liao Z. tension: A Python package for FORCE learning. **PLoS Comput Biol.** 2022;18(12):e1010722. doi: 10.1371/journal.pcbi.1010722.

4. Liu X, Terada S, Ramezani M, Kim JH, Lu Y, Grosmark A, Losonczy A, Kuzum D. E-Cannula reveals anatomical diversity in sharp-wave ripples as a driver for the recruitment of distinct hippocampal assemblies. **Cell reports**. 2022;41(1):111453. doi: 10.1016/j.celrep.2022.111453.

5. Priestley JB, Bowler JC, Rolotti SV, Fusi S, Losonczy A. Signatures of rapid plasticity in hippocampal CA1 representations during novel experiences. **Neuron.** 2022;110(12):1978-92 e6. doi: 10.1016/j.neuron.2022.03.026.

6. O'Hare JK, Gonzalez KC, Herrlinger SA, Hirabayashi Y, Hewitt VL, Blockus H, Szoboszlay M, Rolotti SV, Geiller TC, Negrean A, Chelur V, Polleux F, Losonczy A. Compartment-specific tuning of dendritic feature selectivity by intracellular Ca(2+) release. **Science.** (New York, NY). 2022;375(6586):eabm1670. doi: 10.1126/science.abm1670.

7. Rao BY, Peterson AM, Kandror EK, Herrlinger S, Losonczy A, Paninski L, Rizvi AH, Varol E. Non-parametric Vignetting Correction for Sparse Spatial Transcriptomics Images. **Med Image Comput Comput Assist Interv.** 2021;12908:466-75. doi: 10.1007/978-3-030-87237-3_45.

8. Tuncdemir SN, Grosmark AD, Turi GF, Shank A, Bowler JC, Ordek G, Losonczy A, Hen R, Lacefield CO. Parallel processing of sensory cue and spatial information in the dentate gyrus. **Cell reports.** 2022;38(3):110257. doi: 10.1016/j.celrep.2021.110257.

9. Rolotti SV, Blockus H, Sparks FT, Priestley JB, Losonczy A. Reorganization of CA1 dendritic dynamics by hippocampal sharp-wave ripples during learning. **Neuron**. 2022;110(6):977-91 doi: 10.1016/j.neuron.2021.12.017.

10. Rolotti SV, Ahmed MS, Szoboszlay M, Geiller T, Negrean A, Blockus H, Gonzalez KC, Sparks FT, Solis Canales AS, Tuttman AL, Peterka DS, Zemelman BV, Polleux F, Losonczy A. Local feedback inhibition tightly controls rapid formation of hippocampal place fields. **Neuron**. 2022;110(5):783-94 doi: 10.1016/j.neuron.2021.12.003.

11. Kosmidis S, Negrean A, Dranovsky A, Losonczy A, Kandel ER. A fast, aqueous, reversible three-day tissue clearing method for adult and embryonic mouse brain and whole body. **Cell Rep Methods**. 2021;1(7):100090. doi: 10.1016/j.crmeth.2021.100090.

12. Farrell JS, Lovett-Barron M, Klein PM, Sparks FT, Gschwind T, Ortiz AL, Ahanonu B, Bradbury S, Terada S, Oijala M, Hwaun E, Dudok B, Szabo G, Schnitzer MJ, Deisseroth K, Losonczy A, Soltesz I. Supramammillary regulation of locomotion and hippocampal activity. **Science.** (New York, NY). 2021;374(6574):1492-6. doi: 10.1126/science.abh4272.

13. Terada S, Geiller T, Liao Z, O'Hare J, Vancura B, Losonczy A. Adaptive stimulus selection for consolidation in the hippocampus. **Nature**. 2022;601(7892):240-4. doi: 10.1038/s41586-021-04118-6.

14. Geiller T, Sadeh S, Rolotti SV, Blockus H, Vancura B, Negrean A, Murray AJ, Rozsa B, Polleux F, Clopath C, Losonczy A. Local circuit amplification of spatial selectivity in the hippocampus. **Nature**. 2022;601(7891):105-9. doi: 10.1038/s41586-021-04169-9.

15. Blockus H, Rolotti SV, Szoboszlay M, Peze-Heidsieck E, Ming T, Schroeder A, Apostolo N, Vennekens KM, Katsamba PS, Bahna F, Mannepalli S, Ahlsen G, Honig B, Shapiro L, de Wit J, Losonczy A, Polleux F. Synaptogenic activity of the axon guidance molecule Robo2 underlies hippocampal circuit function. **Cell reports.** 2021;37(3):109828. doi: 10.1016/j.celrep.2021.109828.

16. Grosmark AD, Sparks FT, Davis MJ, Losonczy A. Reactivation predicts the consolidation of unbiased long-term cognitive maps. **Nature neuroscience**. 2021;24(11):1574-85. doi: 10.1038/s41593-021-00920-7.

17. Dudok B, Szoboszlay M, Paul A, Klein PM, Liao Z, Hwaun E, Szabo GG, Geiller T, Vancura B, Wang BS, McKenzie S, Homidan J, Klaver LMF, English DF, Huang ZJ, Buzsaki G, Losonczy A, Soltesz I. Recruitment and inhibitory action of hippocampal axo-axonic cells during behavior. **Neuron**. 2021;109(23):3838-50 e8. doi: 10.1016/j.neuron.2021.09.033.

18. Hadjiabadi D, Lovett-Barron M, Raikov IG, Sparks FT, Liao Z, Baraban SC, Leskovec J, Losonczy A, Deisseroth K, Soltesz I. Maximally selective single-cell target for circuit control in epilepsy models. **Neuron**. 2021;109(16):2556-72 e6. doi: 10.1016/j.neuron.2021.06.007.

19. Dudok B, Klein PM, Hwaun E, Lee BR, Yao Z, Fong O, Bowler JC, Terada S, Sparks FT, Szabo GG, Farrell JS, Berg J, Daigle TL, Tasic B, Dimidschstein J, Fishell G, Losonczy A, Zeng H, Soltesz I. Alternating sources of perisomatic inhibition during behavior. **Neuron**. 2021;109(6):997-1012 e9. doi: 10.1016/j.neuron.2021.01.003.

20. Sparks FT, Liao Z, Li W, Grosmark A, Soltesz I, Losonczy A. Hippocampal adult-born granule cells drive network activity in a mouse model of chronic temporal lobe epilepsy. **Nature communications**. 2020;11(1):6138. doi: 10.1038/s41467-020-19969-2.

21. Geiller T, Vancura B, Terada S, Troullinou E, Chavlis S, Tsagkatakis G, Tsakalides P, Ocsai K, Poirazi P, Rozsa BJ, Losonczy A. Large-Scale 3D Two-Photon Imaging of Molecularly Identified CA1 Interneuron Dynamics in Behaving Mice. **Neuron**. 2020;108(5):968-83 e9. doi: 10.1016/j.neuron.2020.09.013.

22. Ahmed MS, Priestley JB, Castro A, Stefanini F, Solis Canales AS, Balough EM, Lavoie E, Mazzucato L, Fusi S, Losonczy A. Hippocampal Network Reorganization Underlies the Formation of a Temporal Association Memory. **Neuron**. 2020;107(2):283-91 e6. doi: 10.1016/j.neuron.2020.04.013.

23. Kaufman AM, Geiller T, Losonczy A. A Role for the Locus Coeruleus in Hippocampal CA1 Place Cell Reorganization during Spatial Reward Learning. **Neuron**. 2020;105(6):1018-26 e4. doi: 10.1016/j.neuron.2019.12.029.

24. Troullinou E, Tsagkatakis G, Chavlis S, Turi GF, Li W, Losonczy A, Tsakalides P, Poirazi P. Artificial neural networks in action for an automated cell-type classification of biological neural networks. **IEEE Transactions on Emerging Topics in Computational Intelligence**. 2020;5(5):755-67. doi: arXiv:1911.09977v3

25. Szonyi A, Sos KE, Nyilas R, Schlingloff D, Domonkos A, Takacs VT, Posfai B, Hegedus P, Priestley JB, Gundlach AL, Gulyas AI, Varga V, Losonczy A, Freund TF, Nyiri G. Brainstem nucleus incertus controls contextual memory formation. **Science.** (New York, NY). 2019;364(6442). doi: 10.1126/science.aaw0445.

26. Weisenburger S, Tejera F, Demas J, Chen B, Manley J, Sparks FT, Martinez Traub F, Daigle T, Zeng H, Losonczy A, Vaziri A. Volumetric Ca(2+) Imaging in the Mouse Brain Using Hybrid Multiplexed Sculpted Light Microscopy. **Cell**. 2019;177(4):1050-66 e14. doi: 10.1016/j.cell.2019.03.011.

27. Mehta P, Kreeger L, Wylie DC, Pattadkal JJ, Lusignan T, Davis MJ, Turi GF, Li WK, Whitmire MP, Chen Y, Kajs BL, Seidemann E, Priebe NJ, Losonczy A, Zemelman BV. Functional Access to Neuron Subclasses in Rodent and Primate Forebrain. **Cell reports.** 2019;26(10):2818-32 e8. doi: 10.1016/j.celrep.2019.02.011.

28. Turi GF, Li WK, Chavlis S, Pandi I, O'Hare J, Priestley JB, Grosmark AD, Liao Z, Ladow M, Zhang JF, Zemelman BV, Poirazi P, Losonczy A. Vasoactive Intestinal Polypeptide-Expressing Interneurons in the Hippocampus Support Goal-Oriented Spatial Learning. **Neuron**. 2019;101(6):1150-65 doi: 10.1016/j.neuron.2019.01.009.

29. Guruge C, Ouedraogo YP, Comitz RL, Ma J, Losonczy A, Nesnas N. Improved Synthesis of Caged Glutamate and Caging Each Functional Group. **ACS Chem Neurosci.** 2018;9(11):2713-21. doi: 10.1021/acschemneuro.8b00152.

30. Soltesz I, Losonczy A. CA1 pyramidal cell diversity enabling parallel information processing in the hippocampus. **Nature neuroscience.** 2018;21(4):484-93. doi: 10.1038/s41593-018-0118-0.

31. Zaremba JD, Diamantopoulou A, Danielson NB, Grosmark AD, Kaifosh PW, Bowler JC, Liao Z, Sparks FT, Gogos JA, Losonczy A. Impaired hippocampal place cell dynamics in a mouse model of the 22q11.2 deletion. **Nature neuroscience**. 2017;20(11):1612-23. doi: 10.1038/nn.4634.

32. Danielson NB, Turi GF, Ladow M, Chavlis S, Petrantonakis PC, Poirazi P, Losonczy A. In Vivo Imaging of Dentate Gyrus Mossy Cells in Behaving Mice. **Neuron**. 2017;93(3):552-9 e4. doi: 10.1016/j.neuron.2016.12.019.

33. Lewis TL, Jr., Turi GF, Kwon SK, Losonczy A, Polleux F. Progressive Decrease of Mitochondrial Motility during Maturation of Cortical Axons In Vitro and In Vivo. **Current biology**. 2016;26(19):2602-8. doi: 10.1016/j.cub.2016.07.064.

34. Danielson NB, Zaremba JD, Kaifosh P, Bowler J, Ladow M, Losonczy A. Sublayer-Specific Coding Dynamics during Spatial Navigation and Learning in Hippocampal Area CA1. **Neuron**. 2016;91(3):652-65. doi: 10.1016/j.neuron.2016.06.020.

35. Kaifosh P, Losonczy A. Mnemonic Functions for Nonlinear Dendritic Integration in Hippocampal Pyramidal Circuits. **Neuron**. 2016;90(3):622-34. doi: 10.1016/j.neuron.2016.03.019.

36. Danielson NB, Kaifosh P, Zaremba JD, Lovett-Barron M, Tsai J, Denny CA, Balough EM, Goldberg AR, Drew LJ, Hen R, Losonczy A, Kheirbek MA. Distinct Contribution of Adult-Born Hippocampal Granule Cells to Context Encoding. **Neuron**. 2016;90(1):101-12. doi: 10.1016/j.neuron.2016.02.019.

37. Reardon TR, Murray AJ, Turi GF, Wirblich C, Croce KR, Schnell MJ, Jessell TM, Losonczy A. Rabies Virus CVS-N2c(DeltaG) Strain Enhances Retrograde Synaptic Transfer and Neuronal Viability. **Neuron**. 2016;89(4):711-24. doi: 10.1016/j.neuron.2016.01.004.

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Other:

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E. FUNDING SOURCES

ACTIVE:

1R01NS131728 (Soltesz, Losonczy) 04/01/2023 – 03/31/2028
NIH/NINDS
Activity-dependent endocannabinoid control in epilepsy
Role: PI

1R01AG080818 (Losonczy, Fusi, Hen) 12/01/2023 – 11/30/2027
NIH/NIA
Dissecting the role of the dentate gyrus microcircuit to improve cognitive discrimination in aging and Alzheimer's Disease
Role: PI
The major goal of this study is to dissect aging-related alterations in hippocampal cognitive memory functions and to test the potential interventional techniques to improve memory deficits.

1R01MH124867 (Losonczy, Poirazi) 01/01/2020 – 11/30/2025
NIH/NIMH
Experimental and modeling investigations into microcircuit, cellular and subcellular determinants of hippocampal ensemble recruitment to contextual representations

The goal of this proposal is to make the first attempt to comprehensively describe and understand how neurons in the mammalian hippocampus are selected and recruited to encode memories.

1R01MH124047 (Losonczy, Gogos) 09/1/2020 – 06/30/2025
NIH/NIMH
Microcircuit, cellular and molecular dissection of impaired hippocampal function in a mouse model of the 22q11.2 deletion

The goal of this study is to comprehensively describe and understand cellular, molecular and microcircuit pathomechanisms of schizophrenia risk mutation-related episodic memory deficits in a genetic mouse model of schizophrenia.

1R01NS121106 (Soltesz, Losonczy) 04/1/2021 – 03/31/2026
NIH/NINDS
Control of the axon initial segment in epilepsy

The project aims to address long-standing controversies concerning the interneuronal regulation of the axon initial segment in epilepsy by leveraging technical breakthroughs.

1U01NS115530 (Vaziri, Losonczy) 09/01/2020 – 08/31/2024
NIH/NINDS/BRAIN
High-speed and hybrid multiphoton volumetric imaging of multimodal network dynamics across the intact hippocampus

The major goal of this study is to develop and implement novel functional imaging techniques to study hippocampal circuit function.

<u>COMPLETED</u>

5U19NS104590-03 (Soltesz, Buzsaki, Losonczy, Schnitzer)
NIH/NINDS/BRAIN
Towards a complete description of the circuitry underlying sharp wave-mediated memory replay
The major goal of this project is to understand how the hippocampus generates sharp-wave-ripples.
Role: PI and Project Lead

Hippocampal inhibitory control of contextual fear learning
R01 MH100631
3/1/2014 – 2/28/2020
NIH/NIMH
Role: PI

High-speed volumetric imaging of neuronal network activity at depth using Multiplexed Scanned Temporal Focusing (MuST)
U01 NS094263
9/30/2015 – 7/31/2019
NIH/NINDS
Role: MPI/Subaward PI

Closed-loop intervention in epilepsy
5R01NS094668-04 (Soltesz & Losonczy)
9/30/2015 – 8/31/2020

NIH/NINDS
Role: MPI/Sub PI

Inhibitory control of hippocampal memory functions
Source: Searle Kinship Foundation
6/20/2011 – 6/20/2014
Role: PI

GABAergic inhibitory circuit deficits in schizophrenia
Brain and Behavior Research Foundation
2/1/2013 – 2/1/2015
Role: PI

In vivo imaging in hippocampal circuits
Kavli Foundation at Columbia University
12/1/2011 – 1/1/2013
Role: multi-PI (PI: Losonczy, Sawtell)

In vivo functional imaging in hippocampal circuits
Harvey L. Karp Neuroscience Discovery Award
3/1/2012 – 2/1/2013
Role: PI

Dissecting hippocampal microcircuit dysfunctions underlying cognitive memory deficits in schizophrenia
McKnight Foundation
2/1/2013 – 1/31/2016
Role: PI

In vivo functional imaging and high-resolution manipulations of hippocampal memory circuits Source: Human Frontiers Science Program
9/1/2012 – 3/01/2015
Role: PI (co-PI: Bolze, Vaziri, Zemelman)

Towards a complete description of the circuitry underlying memory replay
Brain Initiative – National Institute of Health (U01)
9/30/2014 – 7/31/2017
Role: co-PI (PI: Soltesz, co-PI: Buzsaki, Lisman, Losonczy)

High-speed volumetric imaging of neuronal network activity at depth using Multiplexed Scanned Temporal Focusing (MuST)
Brain Initiative – National Institute of Health (U01)
9/1/2015 – 8/31/2017
Role: co-PI (PI: Vaziri)

New Cells for Memory. Necessary, but why?
Zegar Family Foundation
1/1/2016 – 1/1/2018
Role: PI

F. PATENTS HELD OR PENDING

None

G. AWARDS & HONORS

1993 1st Prize at the National High School Academic Competition (Biology)
1997 Scholarship – Hungarian Republic
1999 Pro Scientia Award – Hungarian Academy of Sciences for Excellence in Academic Research
2000 Scholarship – North Oxford Overseas Centre, Oxford, United Kingdom
2001 Graduate Student Scholarship – Boehringer Ingelheim Foundation, Germany
2010 Member – Kavli Institute for Brain Science, Columbia University
2011 Searle Scholar – Searle Kinship Foundation
2012 Kavli Grant Award – Kavli Institute for Brain Science at Columbia University
2012 HFSP Program Grant – Human Frontiers Science Program
2012 Harvey L. Karp Discovery Award
2013 Young Investigator Award – NARSAD
2013 Memory and Cognitive Disorders Award – McKnight Foundation
2014 Brain Initiative U01 Award – National Institute of Health
2015 Harold and Golden Lamport Award for Excellence in Basic Science Research at Columbia University
2015 Member – Mortimer B. Zuckerman Mind Brain Behavior Institute at Columbia University
2015 Member – Executive Committee, Mortimer B. Zuckerman Mind Brain Behavior Institute at Columbia University (2015 – 2020)
2015 Brain Initiative U01 Award – National Institute of Health
2016 Kavli Grant Award – Kavli Institute for Brain Science at Columbia University
2017 Zegar Family Foundation Award
2017 Senior Group Leader, Friedrich Miescher Institute, Basel (declined)
2017 Brain Initiative U19 Award – National Institute of Health
2018 Kavli-Simons Scholar – Kavli Institute for Brain Science at Columbia University
2025 Chair, Gordon Gordon Research Conference "Inhibition in CNS"

INVITED SEMINARS

2024 The Multiscale Integration of Neural Function, Venice, Italy (upcoming)
2023 Max Planck Florida Institute (upcoming)
2023 Gordon Research Conference "2023 Inhibition in the CNS" (upcoming)
2023 Gordon Research Conference "2023 Excitatory Synapses and Brain Function"
2023 Gordon Research Conference "2023 Dendrite" (upcoming)
2023 University of Bonn, DZNE, Germany
2022 UCLA, Department of Neuroscience
2022 John Hopkins University, Department of Neuroscience
2022 UPenn, Department of Neuroscience
2022 UT Austin, Department of Neuroscience
2022 UT Southwestern, Dallas
2022 16th Multinational Congress on Microscopy, keynote, Brno, Czech Republic
2022 Symposium: "Neuronal representation – from synapses and microcircuits to behavior", Freiburg, Germany
2022 Japanese Neuroscience Society Meeting
2022 System Neuroscience Seminar, Department of Psychiatry, Columbia University
2022 AREADNE meeting on "Dendrites", Greece
2022 Pathway to Memory Spring Conference, Irvine, USA

2022 Hungarian Microscopy Society, plenary, Budapest, Hungary
2022 Stanford University, California, USA
2021 Ruhr University Bochum, Germany
2021 New York Medical College
2021 INSERM, Marseille, France
2020 Rutgers University
2020 Case Western University
2019 SFN, Symposium Lecture, Chicago, 2019
2019 Neurological Research Institute, Baylor College of Medicine, Houston, Texas
2019 NICHD, Bethesda
2019 Max Planck Institute, Frankfurt, Germany
2018 Gordon Research Conference "Optogenetic approaches to understanding neural circuits and behavior"
2018 "Hippocampal Network and Memory Across the Lifespan: Circuit, Code, Cognition" – Plenary Lecture, Budapest, Hungary
2018 Boston University, Departmental seminar
2018 "Plasticity and Stability of Neuronal Circuits" Symposium, Tel Aviv, Israel
2018 Penn State University, Departmental Seminar
2018 Rockefeller University, Leon-Levy Foundation Seminar
2018 Keystone Conference "State of the Brain"
2017 Stanford University, Department of Biomedical Engineering, Stanford, CA
2017 FENS Regional Meeting – Plenary Lecture, Pecs, Hungary
2017 Yale, Department of Neuroscience
2017 Gordon Research Conference "2017 Inhibition in the CNS"
2017 SUNY Downstate, New York
2017 IST, Vienna, Austria
2017 Gordon Research Conference "2017 Dendrites"
2017 NIEHS, Durham
2017 UT Southwestern, Dallas
2016 NIPS International Workshop, Keynote speaker, Okazaki, Japan
2016 MIT Picower Institute, Boston, MA
2016 INSERM Neuroscience Research Center, Marie Curie University, France
2016 FMI, Basel, Switzerland
2016 Keynote speaker, SUNY, Albany, Hudson-Berkshire Society for Neuroscience Chapter
2016 Annual Meeting of the Japanese Neuroscience Society, Yokohama, Japan
2016 FENS Meeting, Copenhagen, Denmark
2016 AREADNE meeting on "Dendrites", Greece
2016 McKnight Foundation Meeting, Minneapolis, MN
2016 "Synaptic Micro-networks in Health and Disease", Bonn, Germany
2016 Department of Neurosciences, University of Montreal
2016 Department of Psychiatry, Yale, New Haven
2016 King's College, London, UK
2015 Cold Spring Harbor Laboratories, Cold Spring Harbor, NY
2015 HHMI Janelia Research Campus – "Hippocampal-Entorhinal Complexities"
2015 Department of Epileptology, University of Bonn, Bonn, Germany
2015 University College London, Wolfson Institute for Biomedical Research, London, UK
2015 5th European Synapse Meeting, Bristol, UK
2015 Conference on Learning and Memory, Austin, Texas
2015 Gordon Research Conferences – "Dendrites: Molecules, Structure & Function", Ventura Beach, California
2015 Foundation des Treilles Meeting, Les Treilles, France

2015 Vollum Institute, Oregon Health Science Center, Portland, Oregon
2015 Harvard Center for Brain Science, Boston, Massachusetts
2015 Centre de Recherche Université Laval Robert-Giffard, Quebec City, Canada
2014 GABAergic Signaling in Health and Disease, Washington DC
2014 Max Planck Florida Institute, Jupiter, Florida
2014 Center for Biomedical Neuroscience – Neurology Ground Round, San Antonio, Texas
2014 Department of Neurobiology, Harvard Medical School, Boston Massachusetts
2014 ENINET – Annual Meeting of European Neuroscience Societies, Freiburg, Germany
2014 Institute of Science and Technology, Vienna, Austria
2014 Gordon Research Conferences – "Synaptic transmission", Waterville Valley, New Hampshire
2014 FENS – Annual Meeting of Federation of European Neuroscience Societies, Milan, Italy
2014 Conference Jacques Monod – "Optical imaging of brain structure and function on multiple spacial scales", Roscoff, France
2014 Department of Neuroscience, Yale University, New Haven – Swartz seminar series
2014 National Institute of Health/NIGMS, Bethesda, Maryland
2014 Epilepsy Research Center Symposium, UC Irvine, California
2014 IBRO – International Brain Research Organization Workshop, Debrecen, Hungary
2013 Institute of Experimental Medicine, Budapest, Hungary
2013 Friedrich Miescher Institute, Basel, Switzerland
2013 Gordon Research Conferences – "Inhibition in the CNS", Les Diablerets, Switzerland
2013 Gordon Research Conferences – "Dendrites", Les Diablerets, Switzerland
2013 Picower Institute, MIT, Boston, Massachusetts
2012 HHMI Janelia Conference – "Neuron types in the hippocampal formation"
2012 Department of Neurobiology, New York University, New York
2012 Albert Einstein College of Medicine, Department of Neuroscience, New York
2012 HHMI Janelia Conference – "Dendrites, substrates for information processing"
2011 IBRO/FENS Conference, Ljubljana, Slovenia
2011 Department of Physiology, Columbia University, New York
2008 Department of Neuroscience, Yale, New Haven
2008 Picower Institute, MIT, Boston, Massachusetts
2005 Department of Anatomy, UC Irvine, California
2005 Southern Photonics Conference, Atlanta, Georgia

H. SERVICE

1. University/Department Service

Neuroscience Seminar Series committee (member, 2012–13, co-chair 20014 – 2107)
Neuroscience Faculty Search committee (member, 2010, 2016–2020)
Neuroscience Doctoral Program Open House committee (member 2013–2017)
Institutional Animal Care and Use Committee (member, 2016–present)
Institutional Biosafety Committee (member, 2017–present)

Thesis/Qualifying Exam committees are listed in section "C.2. Mentoring Experience" above.

2. Scientific Community Service

- **Reviewer for Journals and Funding Agencies**

Ad hoc Reviewer: Nature, Science, Cell, Nature Neuroscience, Nature Reviews Neuroscience, Neuron, Nature Communications, Scientific Reports, Neuropsychopharmacology, Cell Calcium, Cell Reports, The Journal of Neuroscience, Journal of Physiology, European Journal of Neuroscience, Elife, PLOS One, PLOS Biology, Hippocampus, Cerebral Cortex, IEEE Transactions on Neural Networks and Learning Systems, Journal of the Royal Society Interface, Physiological Reviews

Regular member:

NIH, Learning, Memory and Decision Neuroscience Study Section (2021– present)

Ad hoc reviewer:

NIH BRAIN Initiative: Team-Research BRAIN Circuit Program R01/U01 (2018– present)
NIH BRAIN Initiative: Team-Research BRAIN Circuit Program U19 (2018– present)
NIH Molecular and Cellular Substrates of Complex Brain Disorders Special Emphasis Panel ZRG1 MDCNP(57), NIH ZRG1 IFCN-J(02)
European Research Council: Starting, Consolidator, Advanced, and Synergy Grants
The Hungarian Scientific Research Fund
Hungarian Brain Project
The Wellcome Trust (UK)
Royal Society (UK)
Human Frontiers Science Program (HFSP)
Leibnitz Prize (Germany)
McArthur Genius Award (US)
Swiss Science Foundation
W. M. Keck Foundation (US)
Institute Pasteur (France)
Israel Science Foundation
Boehringer Ingelheim Foundation (Germany)

- **Editorial Board:**

2019 – present *Hippocampus*

- **Conference Organizer**

"Dissecting fear circuits in rodents" International Brain Research Organization (IBRO) Workshop – Annual Hungarian Neuroscience Society Meeting, 2014 (organizer)
Neuromatch 3.0, 2020 (organizer)
"Inhibition in CNS" Gordon Research Conference, 2025, (chair)

- **Membership**

Society for Neuroscience (2000-present)

- **Meeting Participation**

Gordon Research Conference "Inhibition in CNS", 2019
Gordon Research Conference "Optogenetic approaches to understanding neural circuits and behavior", 2018
Keystone Meeting, 2018
"Dendrites" FENS-IBRO meeting (Crete, Greece) 2016, 2022
Annual Society for Neuroscience meeting: 2001-2008, 2010-2016
Federation of European Neuroscience Societies (FENS) Meeting (Brighton, UK), 2000
Federation of European Neuroscience Societies (FENS) Meeting (Milan, Italy), 2014
McKnight Foundation Meeting, 2014-2016
Searle Foundation Meeting, 2012-2014
Les Treilles Foundation Meeting "What does the cortex do?" (Les Treilles, France), 2014

International Brain Research Organization (IBRO) Workshop – Annual Hungarian Neuroscience Society Meeting (Hungary), 1999-2002, 2014, 2016
Annual Meeting of the Japanese Neuroscience Society, Yokohama, Japan, 2016
International Brain Research Organization (IBRO) Meeting (Ljubljana, Slovenia), 2011
"Hippocampal-Entorhinal Complexities" (HHMI Janelia, USA), 2015
"Dendrites: Substrates for Information Processing" (HHMI Janelia, USA), 2012
"Neuron Types in the Hippocampal Formation: Structure, Activity, and Molecular Genetics" (HHMI Janelia, USA), 2012
Gordon Research Conference on Gordon Conference on "Excitatory Amino Acids" (Il Ciocco, Italy), 2001
Gordon Research Conference on "Dendrites: Molecules, Structure&Function" (Les Diablerets, Switzerland), 2013
Gordon Research Conference on "Inhibition in the CNS" (Les Diablerets, Switzerland), 2013
Gordon Research Conference on "Synaptic Transmission" (Waterville Valley, USA), 2014
Gordon Research Conference on "Dendrites: Molecules, Structure&Function" (Ventura, California), 2015
European Neuroscience Institutes Network (ENINET) Meeting (Freiburg, Germany): 2014
"Optical imaging of brain structure and function on multiple spacial scales" Conference Jacques Monod (Roscoff, France), 2014
International Epilepsy Research Center (EpiCenter) Symposium (Irvine, USA), 2014
Austin Meeting on Learning and Memory (Austin, USA), 2015
5th European Synapse Meeting, Bristol, UK, 2015
"Synaptic Micro-networks in Health and Disease", Bonn, Germany, 2016

- **Major Collaborations**

Prof. Ivan Soltesz, Stanford University, Stanford, USA
Prof. Boris Zemelman, University Texas, Austin, USA
Prof. Yiota Poirazi, IMBB-FORTH, Crete, Greece
Prof. Balazs Rozsa, Femtonics, Budapest, Hungary
Prof. Joseph Gogos, Columbia University, New York, USA
Prof. Alipasha Vaziri, Rockefeller University, New York, USA
Prof. Claudia Clopath, Imperial College London, London, UK
Prof. Stefano Fusi, Columbia University, New York, USA
Prof. Franck Polleux, Columbia University, New York, USA
Prof. Gyorgy Buzsaki, New York University, New York, USA
Prof. Mark Schnitzer, Stanford University, Stanford, USA
Prof. Zoltan Nusser IEM, Budapest, Hungary
Prof. Tamas Freund IEM, Budapest, Hungary