Maxym V. Myroshnychenko

CONTACT INFORMATION

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EDUCATION

Indiana University
PhD, Program in Neuroscience — August 2011 - December 2017

University of Nevada, Las Vegas
B.S., Biology, Biomathematics — August 2011

LABORATORY AFFILIATIONS

Integrative Neuroscience section,
National Institute of Neurological Disorders and Stroke

PI: Joshua Gordon, David Kupferschmidt — February 2018 - present

- Tetrode and shank recordings from awake mice
- Closed-loop optogenetic stimulation
- T-maze

Indiana University Purdue University Indianapolis

PI: Christopher Lapish — August 2014 - December 2017

- Tetrode and shank recordings from anesthetized and awake rats
- Data analysis: state space, spectral decomposition, machine learning
- Development of automatic behavior collection and analysis tools
- Contribution to VTA/mPFC computational modeling (collaboration with A. Kuznetsov, IUPUI Math)
- TH-Cre optogenetics with anesthetized electrophysiology

Indiana University

PI: John Beggs — August 2011 to August 2014

- Statistical analyses of in vitro 512-electrode array data from mouse/rat hippocampus (collaboration with Litke lab, UC Santa Cruz), in vivo Utah array primate data (collaboration with Hatsopulous lab, U. of Chicago)
- Transfer entropy, mutual information, community detection

RESEARCH PROJECTS

Closed-loop excitation of hippocampal terminals from prefrontal cortex
Using hippocampal theta to guide excitation of ventral hippocampal inputs to mPFC. Working memory performance will be tested while using this closed-loop excitation paradigm.

Cortico-hippocampal interactions in the radial arm maze
Characterizing the process of planning in delayed spatial win-shift task using optogenetic inhibition of HC; shank and wire mPFC recordings

Effects of ethanol on interactions beetween VTA GABA and DA neurons and mPFC
Dissecting local and distal dynamic connectivity of ventral tegmental area using dual-site single-unit recordings, optogenetic stimulation, and pharmacological manipulations as a part of France-USA computational modeling collaboration

PUBLICATIONS

Padilla-Coreano N, Canetta S, Mikofsky R, Alway E, Passecker J, **Myroshnychenko MV**, Garcia-Garcia AL, Warren R, Teboul E, Blackman DR, Morton MP, Hupalo S, Tye KM, Kellendonk C, Kupferschmidt DA, Gordon JA. Hippocampal-prefrontal theta transmission regulates avoidance behavior. Neuron, 104(3), 601-610.e4.

Myroshnychenko M, Seamans JK, Philips AG, Lapish CC (2017). Temporal dynamics of hippocampal and medial prefrontal cortex interactions during the delay period of a spatial working memory task. Cerebral cortex, 27(11), 5331-5342

Morozova E O, **Myroshnychenko M**, Zakharov D, di Volo M, Gutkin B, Lapish C, Kuznetsov A (2016). Contribution of synchronized GABAergic neurons to dopaminergic neuron firing and bursting. Journal of Neurophysiology, 116(4), 1900-1923

Timme NM, Ito S, **Myroshnychenko M**, Nigam S, Shimono M, Yeh FC, Hottowy P, Litke AM, Beggs JM. (2016) High-Degree Neurons Feed Cortical Computations. PLoS Comput Biol. May 9;12(5):e1004858

Nigam S, Shimono M, Ito S, Yeh F, Timme N, **Myroshnychenko M**, Lapish C, Tosi Z, Hottowy P, Smith W, Masmanidis S, Litke A, Sporns O, Beggs JM. (2016) Rich-club organization in the functional micro-connectome. *Journal of Neuroscience* Jan 20;36(3):670-84

Timme N, Ito S, **Myroshnychenko M**, Yeh F, Hiolski E, Hottowy P, Beggs JM. (2014) Multiplex networks of cortical and hippocampal neurons revealed at different timescales. *PLoS ONE* 9(12): e115764

ORAL PRESENTATIONS

Myroshnychenko MV, Kupferschmidt D, Gordon JA. Closed-loop sinusoidal stimulation of ventral hippocampal terminals in prefrontal cortex preferentially entrains circuit activity at distinct frequencies and delays. Society for Computational Neuroscience meeting, Barcelona, Spain, 2019

POSTER PRESENTATIONS

Kupferschmidt D, Clarity T, Mikofsky R, **Myroshnychenko M**, Hsiang M, Gilchrist K, Gordon J. In vivo plasticity between ventral hippocampal inputs and medial prefrontal cortex microcircuits in a mouse model of 22q11.2 deletion syndrome. American College of Neuropsychopharmacology annual meeting, San Juan, Puerto Rico, December 2021

Kupferschmidt D, Clarity T, Mikofsky R, Gilchrist K, **Myroshnychenko M**, Gordon J. In vivo effective connectivity between mouse ventral hippocampal projections and medial prefrontal cortex microcircuits. Society of Biological Psychiatry, online, April 2021

Srikanth S, Ye J, Cho F, Ranjan T, **Myroshnychenko MV**. Discrete and continuous dynamics of neural state space during decision making. Bernstein Conference, online, September 2020

Myroshnychenko MV, Kupferschmidt D, Gordon JA. Closed-loop sinusoidal stimulation of ventral hippocampal terminals in prefrontal cortex preferentially entrains circuit activity at distinct frequencies and delays. Society for Neuroscience meeting, Chicago, IL, November 2019

Myroshnychenko MV, Kupferschmidt D, Gordon JA. Closed-loop sinusoidal stimulation of ventral hippocampal terminals in prefrontal cortex preferentially entrains circuit activity at distinct frequencies and delays. Society for Computational Neuroscience meeting, Barcelona, Spain, July 2019

Alway E, Mikofsky RM, Padilla-Coreano N, Canetta S, **Myroshnychenko MV**, Passecker JP, Hupalo S, Kupferschmidt DA, Gordon JA. Frequency-specific sinusoidal optogenetic stimulation of hippocampal-prefrontal circuit alters locomotion and

avoidance behavior. NIH Postbac Poster Day 2019, Bethesda, MD (received Poster Award); Society for Neuroscience DC Metro Area Chapter Meeting, University of Maryland, College Park, MD.

Myroshnychenko M, Lapish CC. Prefrontal-hippocampal theta coherence, sharp wave ripples, and bursts of cortical unit activity underlie choices and encoding in the radial arm maze. Society for Neuroscience meeting, Chicago, IL, 2015

Myroshnychenko M, Lapish CC. Prefrontal-hippocampal theta coherence, sharp wave ripples, and bursts of cortical unit activity underlie choices and encoding in the radial arm maze. Society for Computational Neuroscience meeting, Prague, Czech Republic, 2015

Myroshnychenko M, Morozova E, Kuznetsov A, Lapish CC. Dissecting reward circuitry with simultaneous single-unit recording in PFC and VTA. Research society for alcohol, San Antonio, TX, 2015

Myroshnychenko M, Morozova EO, Kuznetsov A, Lapish CC. Dissecting reward circuitry with simultaneous single-unit recording in PFC and VTA. Indianapolis chapter of Society for Neuroscience meeting, 2014

Myroshnychenko M, Nicholson B, Yeh F, Brickman B, Dahmen K, Litke A, Beggs J. Critical features of massively parallel cortical single-unit recordings. Gill symposium, Indiana University, 2013

Janetsian SS, **Myroshnychenko M**, Lapish CL. Changes in neuronal firing and oscillatory activity in the PFC following Methamphetamine sensitization. Society for Neuroscience meeting, 2013

Myroshnychenko MV, Heaney CF, Bolton MM, Sabbagh JJ, Kinney JW "Acute Administration of Ketamine Impairs Learning in Trace Cued Fear Conditioning: Validation of an Animal Model of Schizophrenia." 21th Annual McNair Research Conference. Oklahoma State University. February 24, 2011

Myroshnychenko MV, Heaney CF, Bolton MM, Sabbagh JJ, Kinney JW. "Acute Administration of Ketamine Impairs Learning in Trace Cued Fear Conditioning: Validation of an Animal Model of Schizophrenia."The 2010 McNair Scholars Institute poster presentation. University of Nevada, Las Vegas, NV. October 21, 2010.

Myroshnychenko MV, Estevez J, Harbour D. "*Krameria erecta* and *Oenotheria biennis* extracts increase density of *Staphylococcus epidermidis* biofilm." The 2010 McNair Scholars Institute poster presentation. University of Nevada, Las Vegas, NV. October 21, 2010.

Zarrabi K, Nitrosesatien N, Koh J, Naserddin S, Abanyan E, **Myroshnychenko M**, Esteves J, Harbour D, Porter H. Antibacterial Potential and GC-MS Studies of Select Medicinal Plants of Mojave Desert. Presented at the 2009 Northwest Regional Meeting of the American Chemical Society, Pacific Lutheran University, Tacoma, WA.

Open-source software

Denovellis, Eric, **Max Myroshnychenko**, and Danylo Ulianych. `Eden-Kramer-Lab/Spectral_connectivity: V0.2.5.Dev0. Zenodo, 2020. doi:10.5281/zenodo.4088934` .

Awards

Fellowships

- National Science Foundation Biomathematics Scholar May 2010 - May 2011
- University of Nevada, Las Vegas McNair Summer Institute Fellowship May 2010

Teaching, mentoring

Neuromatch Academy, International, online

Lead Teaching Assistant Summer 2020

Hands-on teaching computational neuroscience
for a group of five students while also supervising four other TAs.

Lecturer, Dynamical Neuroscience summer school, Kyiv, Ukraine

Lecturer Summer 2019

Three-lecture series of hands-on demos on the analysis of big neuroscience data

McNair mentor, McNair Institute, Indiana University, Bloomington, Indiana

Career mentor Fall - summer 2015

McNair institute mentor for underaduates from underrepresented backgrounds

Undergraduate teaching assistant, Indiana University, Bloomington, Indiana

Teaching assistant Fall 2014

Addiction neuroscience lecture and lab. Responsible for grading, lab preparation

Behavioral therapist, The Lovaas Center, Las Vegas, Nevada

Tutor June 2009 - August 2009

Applied Behavioral Analysis for children with autism.

Undergraduate tutor, Community College of Southern Nevada, Las Vegas, Nevada

Tutor September 2009 - May 2009

Responsible for coaching students on various subjects including biology, writing, and mathematics.

Summer school attendance

The Neuropixels course (UCL) March 2019

- Spike sorting massively parallel recordings
- Hands-on experience with Neuropixels probes

CoSMo (Northwestern University) June 2013

- Computational Sensory-Motor Neuroscience, organizer K. Kording
- Machine learning, Bayesian and neural net approaches to decoding

CRCNS July 2014

- Berkeley summer course in mining and modeling of neuroscience data, organizers Jeff Teeters and Fritz Sommer
- STC, model fitting, ICA, GLM

Skills

Experimental techniques

- Stereotaxic surgery
- Awake behaving/anesthetized extracellular electrophysiology
- Spikesorting shank data (spyking circus, phy packages)
- Optogenetics

Programming

- Python, Matlab, mex/C, git, Linux
- Databases: Datajoint, MySQL, xarray
- Graphics: matplotlib, seaborn, holoviews, altair

Real-time processing

- Linux OS, Open Ephys, Arduino, PulsePal

Scholarships and grants

- University of Nevada, Las Vegas Scholarship — November 2009
- Community College of Southern Nevada Scholarship — November 2008
- Federal SMART grant — 2009 - 2011

References

- Dr. Joshua Gordon joshua.gordon@nih.gov, National Institutes of Health
- Dr. David Kupferschmidt david.kupferschmidt@nih.gov, National Institutes of Health
- Dr. Christopher Lapish lapishc@gmail.com, Indiana University Purdue University Indianapolis