

**The Faculty of Medicine of Harvard University  
Curriculum Vitae**

**Date Prepared:** September 2024

**Name:** Michael C. Datko

**Office Address:** Cambridge Health Alliance Center for Mindfulness and Compassion, 350 Main Street, 5th Floor, Suite 5134, Malden, MA 02148

Napadow Lab, Spaulding Rehabilitation Hospital Boston, 300 1<sup>st</sup> Ave., Charlestown, MA 02129

**Work Phone:** (617) 952-6481

**Work Email:** [mdatko@cha.harvard.edu](mailto:mdatko@cha.harvard.edu), [mdatko@mgh.harvard.edu](mailto:mdatko@mgh.harvard.edu)

**Education:**

2008	B.S.	Biopsychology	University of California, Santa Barbara
2015	Ph.D.	Cognitive Science (Advisor: Jaime A. Pineda)	University of California, San Diego
2020		Program in Clinical Effectiveness	Harvard T.H. Chan School of Public Health
2020-2023		Postdoctoral Fellowship in Integrative Medicine	Harvard Medical School

**Postdoctoral Training:**

10/15-3/17	Postdoctoral Researcher	Department of Neuroscience (PI: Eric Courchesne)	University of California, San Diego, La Jolla, CA
4/17-8/18	Postdoctoral Associate	Center for Mindfulness, Department of Medicine (PI: Judson Brewer)	University of Massachusetts Chan Medical School
9/18-2024	Postdoctoral Research Fellow	Department of Radiology (PI: Vitaly Napadow)	Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital
9/18-2024	Postdoctoral Research Fellow	Center for Mindfulness and Compassion, Department of Psychiatry (PI: Zev Schuman-Olivier)	Cambridge Health Alliance, Harvard Medical School

**Faculty Academic Appointments:**

7/14-9/16 Associate Lecturer	Associate Lecturer	Cognitive Science	University of California, San Diego
4/15-6/15	Associate Lecturer	Psychology	University of California, San Diego
7/19-6/24	Research Associate	Psychiatry	Harvard Medical School
7/24-	Instructor, Research Scientist	Psychiatry	Harvard Medical School

**Other Professional Positions:**

2007-2009	Research Assistant	Neural and Behavioral Genetics Lab, Department of Psychological & Brain Sciences (PI: Karen Szumlinski)	University of California, Santa Barbara
2009	Research Assistant	Brain Imaging Center, Department of Psychological & Brain Sciences (PI: Scott Grafton)	University of California, Santa Barbara

**Professional Societies:**

2008 –	Society for Neuroscience	Member
2013 –	Cognitive Neuroscience Society	Member
2019 –	Organization for Human Brain Mapping	Member
2020 –	Academic Consortium for Integrative Medicine and Health	Member
2023 –	International Society for Contemplative Research	Member

**Grant Review Activities:**

2022	Osher Center Pilot Research Grants	Osher Center for Integrative Medicine, Harvard Medical School
		Reviewer

**Editorial Activities:****• Ad hoc Reviewer**

Biological Psychiatry

Autism Research

Biological Psychology

Brain Connectivity

Brain Research

Cognitive Neurodynamics

European Journal of Neuroscience

Journal of Autism and Developmental Disorders

Translational Psychiatry

ASN Neuro

Neuromodulation: Technology at the Neural Interface

Mindfulness

Consciousness Research

PLOS ONE

Nature Scientific Reports

The Journal of Pain

Pain

### **Honors and Prizes:**

- |      |  |
|------|--|
| 2021 | Finalist, Association of Migraine Disorders Poster Abstract Competition, during annual meeting of Society for Neuroscience.                                |
| 2020 | Winner, Best Poster Award, Osher Center Integrative Medicine Network Forum. Boston, MA.  |
| 2019 | Winner, Brain Art Competition, Real-Time Performance category. “Funktionale MRI”. Annual meeting of the Organization for Human Brain Mapping. Rome, Italy. |

### **Report of Funded and Unfunded Projects**

#### **Past**

- |           |   |
|-----------|---|
| 9/18-9/21 | Mindfulness Influences on Self-Regulation: Mental and Physical Health Implications<br>NCCIH UH3AT009145 Mindful-PC<br>Loucks (PI)<br>Role: Co-Investigator, Postdoctoral Researcher |
|-----------|---|

7/20-6/23 NCCIH T32 Postdoctoral Research Fellowship in Integrative Medicine, Osher Center for Integrative Medicine, Harvard Medical School  
NIH NCCIH T32AT000051. Role: Postdoctoral Fellow (Trainee).

### **Current**

8/18-7/25 Project Title: Boosting mind-body mechanisms and outcomes for chronic pain  
NIH NCCIH P01AT009965  
Napadow/Rosen (PI)  
Role: Co-Investigator, Postdoctoral Researcher

09/23-08/24 Osher Center for Integrative Medicine Pilot Grant Program. Project Title: “Exploring the Feasibility and Acceptability of Brief Mindfulness Training with Respiratory-Gated Vagus Nerve Stimulation for Reducing Alcohol Consumption Among Young Adults”  
(Role: Consultant) (PI: Schuman-Olivier)

06/24-05/26 Project Title: Investigating neural mechanisms of interoceptive awareness in migraine”  
NIH NCCIH 1R03NS135420, R03 Small Research Grant  
PI: Datko.  
Role: Principal Investigator.

### **Projects Submitted for Funding**

03/2024 Brain and Behavior Research foundation NARSAD Young Investigator Grant.  
“Investigating Effects of Mindful Self-Compassion on Neural Mechanisms of Interoception and Physical Anxiety Sensitivity Among Individuals with Generalized Anxiety Disorder”  
PI: Datko. Direct Costs Requested - \$70,000

### **Unfunded Current Projects**

09/19- “Using the Biostamp mobile ECG system to assess heart-rate variability among patients with frequent migraine throughout a mindfulness-based intervention”

### **Report of Local Teaching and Training**

#### **Teaching of Students in Courses:**

2010-2014	Teaching Assistant, Department of Cognitive Science, UC San Diego	Total of 6 full courses across 11 academic quarters.
2014-2016	Drugs: Brain, Mind, and Culture Upper division undergraduate course, Department of Cognitive Science, UC San Diego	3 lecture hours/week, 10 weeks/ academic quarter, 4 full instances of the course taught over 3 years
2015	Drugs, Addiction, and Mental Disorders Upper division undergraduate course, Department of Psychology, UC San Diego	3 lecture hours/week, one academic quarter

#### **Research Supervisory and Training Responsibilities:**

2010-2015	Mentoring and training undergraduate research assistants in clinical electrophysiology research (PI: Jaime A. Pineda, PhD)	3-4 hours per week
2014-2015	Head Teaching Assistant, Department of Cognitive Science, UC San Diego	Lead orientations each academic quarter, mentored other teaching assistants
2014	Supervisor/mentor for Karen Carrasco (Research Assistant)	Led to peer-reviewed publication in <i>Phil.Trans. Royal Soc. London B.</i> (Pineda et al., 2014).
2018-2019	Supervisor/mentor for Tenzen Desel (Clinical Research Coordinator)	Tenzin was accepted into the Cognitive Neuroscience PhD program at UC Berkeley
2019-2022	Supervisor/mentor for Kassandra Round (Clinical Research Coordinator)	Kassandra was accepted into the MSW program at Simmons University, Boston
2019-2021	Supervisor/mentor for Danielle Giachos (Clinical Research Coordinator)	Mentorship led to publication in <i>Mindfulness</i> , Giachos et al., 2022
2019-2021	Supervisor/mentor for Mackenzie Hyman (Research Technician)	Mackenzie was accepted into the Biomedical Engineering PhD program at Boston University
2020-present	Supervisor/mentor for Frannie V. Marin (Clinical Research Coordinator)	Conference abstracts about heart rate variability analysis in episodic migraine patients presented at International Symposium for Contemplative Research 2023 (San Diego), and the Osher Integrative Medicine Network Forum 2022 (Boston).
2021-present	Mentor for Sarasa Tohyama, PhD (Postdoctoral Research Fellow)	Trained and mentored in functional MRI data collection and analysis pipelines for ultra high-field 7-tesla MRI data, resulting in several conference presentations and abstracts (see Posters section below).
2021-present	Supervisor/mentor for Alison M. Goldstein (Research Assistant)	Conference abstract about cerebrovascular reactivity among migraine patients presented at annual meeting of Organization for Human Brain Mapping (OHBM), July 2023, Montreal
2023-present	Supervisor/mentor for Jack Schneiders (Research Assistant)	Conference abstract about 1-H magnetic resonance spectroscopy among episodic migraine patients submitted for MGH Clinical Research Day 2023, Boston

**Formally Mentored Harvard Students (Medical, Dental, Graduate, and Undergraduate):**

09/20-05/22 Jenny Y. Gan, Senior Honors Thesis, Neuroscience, “*Investigating Alterations in Neural Responses During Evoked Pain Following Mindfulness Intervention in Patients with Anxiety and Depression*”.

### Local Invited Presentations:

- No presentations below were sponsored by 3<sup>rd</sup> parties/outside entities  
 Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.

- 2013 “Meditation and the Brain”. Invited lecture for course titled “Altered States of Consciousness”, Department of Cognitive Science, UC San Diego.
- 2013 “Meditation and the Brain.”  
Invited talk for Center for Science and Education of Empathy and Compassion at UC San Diego. April 2013. La Jolla, California.
- 2015 Introduction to Cognitive Science  
“Social Cognition and Autism”. Invited lecture for course titled “Introduction to Cognitive Science”, Department of Cognitive Science, UC San Diego.
- 2015 “Mirror, mirror: social cognition, action perception, and the brain”. Invited lecture for course titled “Cognitive Neuroscience Seminar Series”, Department of Cognitive Science, UC San Diego.
- 2016 “Drugs and the Brain”. Invited lecture for course titled “Introduction to Cognitive Science”, Department of Cognitive Science, UC San Diego.
- 2023 Grand Rounds, “**Neural mechanisms of mindfulness-induced behavior change for anxiety and depression**”. Osher Center for Integrative Medicine at Harvard Medical School and Brigham and Women’s Hospital. March 2023.

### Report of Regional, National and International Invited Teaching and Presentations

- No presentations below were sponsored by 3<sup>rd</sup> parties/outside entities  
 Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.

#### National

- 2012 **Datko, M.**; Pineda, J.A. Changing the Dynamics of the Mirror Neuron System Through Neurofeedback: Effects on ASD Behavior, Electrophysiology, and Functional Neuroanatomy. Society for Advancement of Brain Analysis (SABA). June 2012. San Diego, California. (selected oral abstract)

#### International

- 2012 **Datko, M.**; Pineda, J.A.; Müller, R.A. Functional Neuroanatomical Changes Produced by Mu-Based Neurofeedback Training in Children on the Autism Spectrum. Talk given at International Meeting for Autism Research (IMFAR), May 2012. Toronto, Canada.
- 2014 **Datko, M.**; Fishman, I; Cabrera, Y; Carper, R; Müller, RA. White matter compromise accompanies functional overconnectivity within the imitation network in children with autism. Nanosymposium talk at Society for Neuroscience, November 2014, Washington, D.C.

- 2015 **Datko, M;** Gougelet, R; Metke, M.; Donoghue, T.; Kirchgessner, M.; Castro, N.; Huang, M.X.; Pineda, J.A. MEG source modeling during imitation, observation, and resting state in children on the autism spectrum. Nanosymposium talk at Society for Neuroscience, October 2015, Chicago, Illinois.
- 2021 **Datko M.** Insula response to interoception is inversely correlated with migraine frequency in patients with episodic migraine. November 2021. Oral Presentation at Migraine Science Collaborative Satellite Event for Society for Neuroscience. Online via Zoom.
- 2022 **Datko, M.,** Lutz, J., Gawande, R., Comeau, A., To, M., Desel, T., Gan, J., Desbordes, G., Napadow, V., Schuman-Olivier, Z. “Increased body trusting associated with increased insula response to interoception after mindfulness training in patients with depression and anxiety.” Oral presentation for the International Congress on Integrative Medicine and Health, May 23-26, 2022. Phoenix, AZ.
- 2023 **Datko, M.,** Schuman-Olivier, Z., Gan, J., Lutz, J., Gawande, J., Comeau, A., To, M, Desel, T., Desbordes, G., Napadow, V. Mindfulness training alters brain response to evoked pain in patients with anxiety and/or depression. Oral presentation at International Symposium for Contemplative Research, February 2023, University of California, San Diego.
- 2023 **Datko, M,** Lutz, J, Gawande, R, Comeau, A, To, MN, Gan, J, Desbordes, G, Napadow, V, Schuman-Olivier, Z. “Depression severity moderates the association between changes in body trusting and brain mechanisms of interoception following mindfulness training”. Speaker for symposium titled “Mindfulness-Based Interventions for Anxiety and Depression: Clinical Trial Outcomes and Mechanisms” at the International Symposium for Contemplative Research, February 2023, University of California, San Diego.

### **Report of Technological and Other Scientific Innovations**

- |  |  |
|--|--|
| R software pipeline for data analysis; 2020- | Created a pipeline using the R programming language that imports and analyzes data from an electronic data capture database for an ongoing randomized clinical trial among episodic migraine patients. This is used by the study team and PIs of an ongoing NCCIH P01 Program Project Grant investigating the effects of mindfulness and vagus nerve stimulation in migraine patients  |
| fMRI analysis pipelines                      | Wrote fMRI analysis pipeline in Bash scripting and Matlab, used by various members of NCCIH P01 Program Project Grant to preprocess and analyze fMRI data. External libraries and toolboxes utilized in the pipeline include fmriprep, FSL, Statistical Parametric Mapping, and Freesurfer. Has led to the publication of several abstracts with multiple manuscripts in preparation.  |
| Biostamp data collection and analysis        | Set up and coded data collection and analysis protocols and pipelines using the Biostamp nPoint system (MC10/Medidata) to collect ECG and high-frequency heart rate variability data from episodic migraine patients enrolled in NCCIH P01 Program Project Grant. So far this has led to abstract presentations at international conferences and the preparation of a manuscript to be submitted to a peer-reviewed journal. |

### **Report of Education of Patients and Service to the Community**

- No presentations below were sponsored by 3<sup>rd</sup> parties/outside entities*
- Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

### **Activities**

- 2014 Reuben H. Fleet Science Center  
 “Sex in the Lab: the Neurophysiology of Attraction, Love, and Sex.” Invited talk for the Ruben H. Fleet Science Center's "Science on the Rocks" event series. Organizer: Andrea Decker (adecker@rhfleet.org). May 2014. San Diego, California.
- 2015 Pint of Science Festival  
 Sex in the Lab: The Neurobiology of Attraction and Love. Invited talk for Pint of Science event at Turquoise Cellars. May 2015. San Diego, California.
- 2015 La Jolla Playhouse  
 Speaker for Discovery Sunday event at the La Jolla Playhouse. Discussion on the neurobiology of attraction and love. Organizer: Steve McCormick. August 31, 2015. La Jolla, California.
- 2016 San Diego Repertory Theater  
 Speaker for panel discussion “Love and Neuroscience”, prior to a production called "Outside Mullingar." Organizer, host, and artistic director: Sam Woodhouse. January 28th, 2016. San Diego, California.
- 2016 Reuben H. Fleet Science Center  
 Speaker for *Suds and Science*, a series of scientific talks open to the public. Organizer: Andrea Decker (adecker@rhfleet.org). June 6, 2016. The Rose Wine Bar, San Diego, California.

## Report of Scholarship

### Peer-Reviewed Scholarship in print or other media:

### Research Investigations

1. Duan K, Eyler L, Pierce K, Lombardo M, **Datko M**, Hagler Jr D, Taluja V, Zahiri J, Campbell K, Barnes C, Arias S, Nalabolu S, Troxel J, Ji P, Courchesne E. 2024. Differences in regional brain structure in toddlers with autism are related to future language outcomes. *Nature Communications*, 15(1), p.5075.
2. **Datko M**, Lutz J, Gawande R, Comeau A, To MN, Desel T, Gan J, Desbordes G, Napadow V, Schuman-Olivier Z. Increased insula response to interoceptive attention following mindfulness training is associated with increased body trusting among patients with depression. *Psychiatry Res Neuroimaging*. 2022 Dec;327:111559. doi: 10.1016/j.psychresns.2022.111559. Epub 2022 Oct 22. PubMed PMID: 36308976.
3. Meints SM, Garcia RG, Schuman-Olivier Z, **Datko M**, Desbordes G, Cornelius M, Edwards RR, Napadow V. The Effects of Combined Respiratory-Gated Auricular Vagal Afferent Nerve Stimulation and Mindfulness Meditation for Chronic Low Back Pain: A Pilot Study. *Pain Med*. 2022 Aug 31;23(9):1570-1581. doi: 10.1093/pm/pnac025. PubMed PMID: 35148407; PubMed Central PMCID: PMC9434172.
4. Giachos D, Paschali M, **Datko MC**, Fatkin T, Lazaridou A, Kaptchuk TJ, Napadow V, Edwards RR, Schuman-Olivier Z. Characterizing Nature Videos for an Attention Placebo Control for MBSR: The Development of Nature-Based Stress Reduction (NBSR). *Mindfulness*. 2022 June. doi: 10.1007/s12671-022-01903-w.
5. Lombardo MV, Eyler L, Moore A, **Datko M**, Carter Barnes C, Cha D, Courchesne E, Pierce K. Default mode-visual network hypoconnectivity in an autism subtype with pronounced social visual engagement difficulties. *Elife*. 2019 Dec 17;8. doi: 10.7554/eLife.47427. PubMed PMID: 31843053; PubMed Central PMCID: PMC6917498.
6. Janes AC, **Datko M**, Roy A, Barton B, Druker S, Neal C, Ohashi K, Benoit H, van Lutterveld R, Brewer JA. Quitting starts in the brain: a randomized controlled trial of app-based mindfulness



- shows decreases in neural responses to smoking cues that predict reductions in smoking. *Neuropsychopharmacology*. 2019 Aug;44(9):1631-1638. doi: 10.1038/s41386-019-0403-y. Epub 2019 Apr 30. PubMed PMID: 31039580; PubMed Central PMCID: PMC6785102.
7. Pal P, Theisen DL, **Datko M**, van Lutterveld R, Roy A, Ruf A, Brewer JA. From research to clinic: A sensor reduction method for high-density EEG neurofeedback systems. *Clin Neurophysiol*. 2019 Mar;130(3):352-358. doi: 10.1016/j.clinph.2018.11.023. Epub 2018 Dec 16. PubMed PMID: 30669011.
  8. **Datko M**, Pineda JA, Müller RA. Positive effects of neurofeedback on autism symptoms correlate with brain activation during imitation and observation. *Eur J Neurosci*. 2018 Mar;47(6):579-591. doi: 10.1111/ejn.13551. Epub 2017 Mar 27. PubMed PMID: 28245068.
  9. **Datko MC**, Hu JH, Williams M, Reyes CM, Lominac KD, von Jonquieres G, Klugmann M, Worley PF, Szumlinski KK. Behavioral and Neurochemical Phenotyping of Mice Incapable of Homer1a Induction. *Front Behav Neurosci*. 2017;11:208. doi: 10.3389/fnbeh.2017.00208. eCollection 2017. PubMed PMID: 29163080; PubMed Central PMCID: PMC5672496.
  10. Keown CL, **Datko MC**, Chen CP, Maximo JO, Jahedi A, Müller RA. Network organization is globally atypical in autism: A graph theory study of intrinsic functional connectivity. *Biol Psychiatry Cogn Neurosci Neuroimaging*. 2017 Jan;2(1):66-75. doi: 10.1016/j.bpsc.2016.07.008. PubMed PMID: 28944305; PubMed Central PMCID: PMC5607014.
  11. Abbott AE, Nair A, Keown CL, **Datko M**, Jahedi A, Fishman I, Müller RA. Patterns of Atypical Functional Connectivity and Behavioral Links in Autism Differ Between Default, Salience, and Executive Networks. *Cereb Cortex*. 2016 Oct;26(10):4034-45. doi: 10.1093/cercor/bhv191. Epub 2015 Sep 7. PubMed PMID: 26351318; PubMed Central PMCID: PMC5027998.
  12. **Datko M**, Gougelet R, Huang MX, Pineda JA. Resting State Functional Connectivity MRI among Spectral MEG Current Sources in Children on the Autism Spectrum. *Front Neurosci*. 2016;10:258. doi: 10.3389/fnins.2016.00258. eCollection 2016. PubMed PMID: 27375419; PubMed Central PMCID: PMC4899470.
  13. Falahpour M, Thompson WK, Abbott AE, Jahedi A, Mulvey ME, **Datko M**, Liu TT, Müller RA. Underconnected, But Not Broken? Dynamic Functional Connectivity MRI Shows Underconnectivity in Autism Is Linked to Increased Intra-Individual Variability Across Time. *Brain Connect*. 2016 Jun;6(5):403-14. doi: 10.1089/brain.2015.0389. Epub 2016 Apr 22. PubMed PMID: 26973154; PubMed Central PMCID: PMC4913487.
  14. Fishman I, **Datko M**, Cabrera Y, Carper RA, Müller RA. Reduced integration and differentiation of the imitation network in autism: A combined functional connectivity magnetic resonance imaging and diffusion-weighted imaging study. *Ann Neurol*. 2015 Dec;78(6):958-69. doi: 10.1002/ana.24533. Epub 2015 Oct 31. PubMed PMID: 26418284; PubMed Central PMCID: PMC4729560.
  15. Nair A, Carper RA, Abbott AE, Chen CP, Solders S, Nakutin S, **Datko MC**, Fishman I, Müller RA. Regional specificity of aberrant thalamocortical connectivity in autism. *Hum Brain Mapp*. 2015 Nov;36(11):4497-511. doi: 10.1002/hbm.22938. Epub 2015 Aug 19. PubMed PMID: 26493162; PubMed Central PMCID: PMC4768761.
  16. Khan AJ, Nair A, Keown CL, **Datko MC**, Lincoln AJ, Müller RA. Cerebro-cerebellar Resting-State Functional Connectivity in Children and Adolescents with Autism Spectrum Disorder. *Biol Psychiatry*. 2015 Nov 1;78(9):625-34. doi: 10.1016/j.biopsych.2015.03.024. Epub 2015 Apr 1. PubMed PMID: 25959247; PubMed Central PMCID: PMC5708535.
  17. Nair A, Keown CL, **Datko M**, Shih P, Keehn B, Müller RA. Impact of methodological variables on functional connectivity findings in autism spectrum disorders. *Hum Brain Mapp*. 2014 Aug;35(8):4035-48. doi: 10.1002/hbm.22456. Epub 2014 Jan 22. PubMed PMID: 24452854; PubMed Central PMCID: PMC5708536.

18. Pineda JA, Carrasco K, **Datko M**, Pillen S, Schalles M. Neurofeedback training produces normalization in behavioural and electrophysiological measures of high-functioning autism. *Philos Trans R Soc Lond B Biol Sci.* 2014;369(1644):20130183. doi: 10.1098/rstb.2013.0183. Print 2014. PubMed PMID: 24778378; PubMed Central PMCID: PMC4006184.
19. Park JM, Hu JH, Milshcheyn A, Zhang PW, Moore CG, Park S, **Datko MC**, Domingo RD, Reyes CM, Wang XJ, Etzkorn FA, Xiao B, Szumlinski KK, Kern D, Linden DJ, Worley PF. A prolyl-isomerase mediates dopamine-dependent plasticity and cocaine motor sensitization. *Cell.* 2013 Aug 1;154(3):637-50. doi: 10.1016/j.cell.2013.07.001. PubMed PMID: 23911326; PubMed Central PMCID: PMC3785238.

### **Non-peer reviewed scholarship in print or other media:**

#### **Reviews, chapters, and editorials**

1. Pineda JA, Juavinett A, **Datko M**. 2014. Rationale for Neurofeedback Training in Children with Autism, in: Patel, V.B. (Ed.), *Comprehensive Guide to Autism*. Springer US, New York City, pp. 439-460.
2. Pineda JA, Juavinett A, **Datko M**, 2012. Self-regulation of brain oscillations as a treatment for aberrant brain connections in children with autism. *Med. Hypotheses* 79, 790-798.

#### **Thesis:**

**Datko, M.** (2015). *Functional and Structural Connectivity, and the Effects of Neurofeedback Training, in Imitation-Related Brain Networks in Autism* (Doctoral dissertation, UC San Diego).

#### **Abstracts, Poster Presentations, and Exhibits Presented at Professional Meetings:**

1. **Datko M**, Tohyama S, Schnieders JH, Brusafferri L, Kinder LD, Round K, Goldstein A, Gilbert M, Hyman M, Marin F, Goodman H, Giachos D, Garcia RG, Gollub RL, Cheng HT, Hadjikhani N, Loggia ML, Schuman-Olivier Z, Rosen BR, Edwards RR, Ratai E, Napadow V. *Elevated Insula Glutamate in Migraine is Linked with Longer Headache Duration: A 7T H-MRS Study*. International Association for the Study of Pain 2024 World Congress on Pain (poster presentation), Amsterdam.
2. Brusafferri, L, Schnieders, JH, **Datko, M**, Tohyama, S, Kinder, LD, Kim, M, Round, K, Heffernan, M, Chane, CA, Murphy, JP, Grmek, G, Garcia, RG, Gollub, RL, Edwards, RR, Cheng, HT, Schuman-Olivier, Z, Rosen, BR, Napadow, V, Hadjikhani, N, Loggia, ML, 2024. Exploring heterogeneity in episodic migraine pathophysiology with [11C]PBR28 imaging. IASP 2024 Conference Abstract
3. **Datko M**, S Tohyama, JH Schnieders, L Brusafferri, LD Kinder, K Round, A Goldstein, M Gilbert, M Hyman, F Marin, H Goodman, D Giachos, RG Garcia, RL Gollub, HT Cheng, N Hadjikhani, ML Loggia, Z Schuman-Olivier, BR Rosen, RR Edwards, E Ratai, V Napadow. *Elevated Insula Glutamate in Migraine is Linked with Longer Headache Duration: A 7T H-MRS Study*. 2024 Physical Medicine and Rehabilitation Day, Spaulding Rehabilitation Hospital, Boston.
4. Schnieders, JH, **Datko, M**, Brusafferri, L, Tohyama, S, Round, K, Kinder, LD, Heffernan, MR, Garcia, RG, Gollub, RL, Ratai, EM, Edwards, RR, Rosen, BR, Cheng, HT, Schuman-Olivier, Z, Napadow, V, Hadjikhani, N, Loggia, M, 2024. *Elevated Fractional Amplitude of Low Frequency Fluctuations (fALFF) is Associated with Migraine Attack Duration in Individuals with Episodic Migraine*. Mass General Brigham Clinical Research Day 2024.

5. Tohyama, S, **Datko, M**, Brusaferrri, L, Hyman, M, Goldstein, AM, Round, K, Kinder, LD, Garcia, RG, Gollub, RL, Edwards, RR, Rosen, BR, Hadjikhani, N, Cheng, HT, Schuman-Olivier, Z, Loggia, ML, Napadow, V 2024. Structure-function associations of the trigeminal system in episodic migraine – a combined DTI, fMRI and PET study. Spaulding Rehabilitation Hospital PM&R Research Day. Boston, MA.
6. Tohyama, S, **Datko, M**, Brusaferrri, L, Hyman, M, Goldstein, AM, Round, K, Kinder, LD, Garcia, RG, Gollub, RL, Edwards, RR, Rosen, BR, Hadjikhani, N, Cheng, HT, Schuman-Olivier, Z, Loggia, ML, Napadow, V. 2024. Structure-function associations of the trigeminal system in episodic migraine – a combined DTI, fMRI and PET study. Mass General Brigham Celebration of Science. Boston, MA.
7. **Datko M**, Lutz J, Gawande R, Comeau A, Gan J, To MN, Desbordes G, Griswold T, King J, Loucks E, Napadow V, Schuman-Olivier Z. Mindfulness training-induced behavior change linked with post-training increase in mPFC activity during pain anticipation. Poster presented at the Organization for Human Brain Mapping Conference, July 2023, Montreal.
8. Goldstein A, **Datko M**, Tohyama S, Hyman M, Round K, Kinder L, Brusaferrri L, Housman H, Le V, Gollub R, Edwards, Rosen B, Hadjikhani N, Cheng H, Schuman-Olivier Z, Loggia M, Chan ST, Garcia R, Napadow V. Breath-Hold Induced Cerebrovascular Reactivity in Episodic Migraine: a 7T MRI Study. Poster presented at the Organization for Human Brain Mapping Conference, July 2023, Montreal.
9. Tohyama S, **Datko M**, Hyman M, Goldstein AM, Round K, Kinder LD, Brusaferrri L, Housman H, Le V, Garcia RG, Gollub RL, Edwards RR, Rosen BR, Hadjikhani N, Cheng HT, Schuman-Olivier Z, Loggia ML, Napadow V. Function-structure associations of the trigeminal system in episodic migraine – an ultra-high field 7 Tesla MRI study. Poster presented at the Organization for Human Brain Mapping Conference, July 2023, Montreal.
10. Brusaferrri L, Alshelh Z, Morrissey EJ, Kim M, Knight P, Zhang Y, Carvajal AT, Johnson-Akeju S, **Datko M**, Toyama S, Housman H, Kinder L, Round K, Wu O, Garcia Gomez R, Gollub RL, Edwards RR, Rosen BR, Cheng HT, Schuman-Olivier Z, Napadow V, Hadjikhani N, Loggia ML. The Impact Of COVID-19 Pandemic on Brain Inflammation and Age in Non-Infected Chronic Pain Patients. Poster presented at the annual meeting of the US Association for the Study of Pain (USASP), 2023, Durham, NC.
11. Tohyama S, **Datko M**, Hyman M, Goldstein AM, Round K, Kinder LD, Brusaferrri L, Housman H, Le V, Garcia RG, Gollub RL, Edwards RR, Rosen BR, Hadjikhani N, Cheng HT, Schuman-Olivier Z, Loggia ML, Napadow V. Functional and Structural Neuroimaging of the Trigeminal System In Episodic Migraine: A 7T Magnetic Resonance Imaging Study. Poster presented at the annual meeting of the US Association for the Study of Pain (USASP), 2023, Durham, NC.
12. Marin F, **Datko M**, Schuman-Olivier Z, Garcia R, Barbieri R, Edwards RR, Giachos D, Fatkin T, Goldstein A, Grimaldi I, Matos Q, Kaptchuk T, Napadow V. Heart rate variability response to mindfulness meditation and a novel nature-based video control activity in migraineurs. Poster presented at International Symposium for Contemplative Research, February 2023, University of California, San Diego.
13. **Datko M**, Lutz J, Gawande R, Comeau, A, Gan J, To MN, Desbordes G, Griswold T, King J, Loucks E, Napadow V, Schuman-Olivier Z. Mindfulness Training-Induced Behavior Change Linked with Post-Training Increase in Medial Prefrontal Cortex Activity. Poster presented at 2023 Cambridge Health Alliance Research Symposium, Boston.
14. **Datko M**, Lutz J, Gawande R, Comeau A, Gan J, To MN, Desel T, Desbordes G, Napadow V, Schuman-Olivier Z. “Neural biomarkers of mindfulness-induced behavior change in primary care patients with anxiety and depression”. 2023 Harvard Medical School Psychiatry Day, Boston.
15. Schnieders, JH, **Datko, M**, Brusaferrri, L, Tohyama, S, Round, K, Garcia, RG, Gollub, RL, Ratai, EM, Edwards, RR, Rosen, BR, Cheng, HT, Schuman-Olivier, Z, Napadow, V, Hadjikhani, N, Loggia, M, 2023. 1H-Magnetic resonance spectroscopy neurometabolite concentrations and their associations with migraine symptomatology. Mass General Brigham Clinical Research Day 2023

16. Marin F, **Datko M**, Schuman-Olivier Z, Garcia R, Barbieri R, Edwards R, Giachos D, Fatkin T, Goldstein A, Grimaldi I, Matos Q, Kaptchuk T, Napadow V. Heart rate variability response to mindfulness meditation and a novel nature-based video control activity in migraineurs. Poster presented virtually at the Osher Integrated Medicine Network Forum, November 2022.
17. **Datko M**, Schuman-Olivier Z, Brusafferri L, Housman H, Tohyama S, Round K, Garcia R, Gollub R, Edwards R, Rosen B, Hadjikhani N, Hsinlin Cheng, Marco Loggia, Vitaly Napadow. Insula Response to Interoception Is Inversely Correlated with Trait Mindfulness, Self-compassion, and Migraine Frequency in Patients with Episodic Migraine. Poster presented at the annual meeting of the US Association for the Study of Pain (USASP), 2022, Cincinnati, OH.
18. Housman H, Brusafferri L, **Datko M**, Tohyama S, Round K, Garcia Gomez R, Gollub RL, Edwards RR, Makary M, Rosen BR, Cheng HT, Schuman-Olivier Z, Napadow V, Hadjikhani N, Loggia M. In Vivo Molecular Imaging of Neuroinflammation in Patients with Migraine. Poster presented at the annual meeting of the US Association for the Study of Pain (USASP), 2022, Cincinnati, OH.
19. **Datko M**, Schuman-Olivier Z, Brusafferri L, Housman H, Tohyama S, Round K, Garcia R, Gollub R, Edwards R, Rosen B, Hadjikhani N, Hsinlin Cheng, Marco Loggia, Vitaly Napadow. Insula response to interoception is associated with trait mindfulness, self-compassion, and interictal period in patients with episodic migraine. Poster presented virtually at the annual meeting of the Organization for Human Brain Mapping, 2022.
20. **Datko M**, Lutz J, Gawande R, Comeau A, Gan J, To MN, Desel T, Desbordes G, Napadow V, Schuman-Olivier Z. Mindfulness training alters brain response to evoked pain in patients with anxiety and/or depression. Poster presentation at 2022 Osher Integrative Medicine Network Forum, Boston, MA.
21. **Datko M**, Gan J, Lutz J, Gawande R, Comeau A, To MN, Desel T, Desbordes G, Napadow V, Schuman-Olivier Z. Changes in brain mechanisms of emotion regulation in response to evoked pain following mindfulness training for patients with anxiety and depression. Poster presented at 2022 Cambridge Health Alliance Research Symposium.
22. Brusafferri L, Housman H, **Datko M**, Tohyama S, Round K, Garcia Gomez RG, Gollub RL, Edwards RL, Makary M, Rosen BR, Cheng HT, Schuman-Olivier Z, Napadow V, Hadjikhani N, Loggia M. Migraine and neuroinflammation: a [11C]PBR28 PET-MR study, IASP 2022 Toronto, Canada.
23. Tohyama, S, **Datko, M**, Hyman, M, Goldstein, AM, Round, K, Brusafferri, L, Housman, H, Le, V, Garcia, RG, Gollub, RL, Edwards, RR, Rosen, BR, Hadjikhani, N, Cheng, HT, Schuman-Olivier, Z, Loggia, ML, Napadow, V. 2022. Cortical and brainstem fMRI response to trigeminal sensory afference in episodic migraine: an ultra-high field (7 Tesla) study. IASP World Congress on Pain. Toronto, Canada.
24. Tohyama, S, **Datko, M**, Brusafferri, L, Hyman, M, Round, K, Housman, H, Le, V, Garcia, RG, Gollub, RL, Edwards, RR, Rosen, BR, Hadjikhani, N, Cheng, HT, Schuman-Olivier, Z, Loggia, ML, Napadow, V. 2022. Trigeminal nerve diffusivity is associated with migraine features in patients with episodic migraine. Organization of Human Brain Mapping. Glasgow, Scotland.
25. **Datko M**, Schuman-Olivier Z, Brusafferri L, Housman H, Tohyama S, Round K, Hyman M, Le V, Cheng HT, Garcia RG, Gollub RL, Edwards RR, Rosen B, Hadjikhani N, Loggia M, Napadow V. Insula response to interoception is associated with migraine frequency in patients with episodic migraine. Virtual poster presentation for the Society for Neuroscience annual meeting, November 2021. Chicago, Illinois.
26. Tohyama, S, **Datko, M**, Brusafferri, L, Hyman, M, Round, K, Housman, H, Le, V, Garcia, RG, Gollub, RL, Edwards, RR, Rosen, BR, Hadjikhani, N, Cheng, HT, Schuman-Olivier, Z, Loggia, ML, Napadow, V. 2021. Association between trigeminal nerve microstructure and clinical characteristics in migraine: an ultra-high field 7 Tesla DTI study. Society for Neuroscience. Virtual Conference.
27. **Datko M**, Lutz J, Gawande R, To MN, Desel T, Napadow V, Schuman-Olivier Z, Desbordes G. Insula response during interoception after mindfulness training in anxiety, depression, and migraine. Poster presented virtually at Organization for Human Brain Mapping, June 2021.

28. Tohyama, S, **Datko, M**, Brusaferrri, L, Hyman, M, Round, K, Housman, H, Le, V, Garcia, RG, Gollub, RL, Edwards, RR, Rosen, BR, Hadjikhani, N, Cheng, HT, Schuman-Olivier, Z, Loggia, ML, Napadow, V. 2021. Association between trigeminal nerve microstructure and clinical characteristics in migraine: an ultra-high field 7 Tesla DTI study. Martinos Center Summer Symposium. Boston, MA.
29. **Datko M**, Lutz J, Gawande R, Comeau, A, To MN, Desbordes G, Napadow V, Schuman-Olivier Z. Insula response during interoception after mindfulness training in anxiety, depression, and migraine. Poster presented virtually at 2020 Osher Integrative Medicine Network Forum, Boston, MA.
30. Giachos D, **Datko M**, Paschali M, Fatkin T, Lazaridou A, Napadow V, Edwards RR, Kaptchuk T, Schuman-Olivier Z. Development of Nature-Based Stress Reduction Program as an Attention Placebo Control Group for MBSR. Poster presented virtually at 2020 Osher Integrative Medicine Network Forum, Boston, MA.
31. Hyman M, **Datko M**, Anzolin A, Desbordes G, Edwards R, Gollub RL, Le V, Napadow V, Round K, Schuman-Olivier Z, Garcia RG, Barbieri R. Novel method for characterizing autonomic response to transcutaneous vagus nerve stimulation treatment for migraine patients. Poster presented virtually at Osher Integrative Medicine Network Forum 2020. Boston, Massachusetts.

### **Narrative Report**

A core focus of my career as a neuroscientist thus far has been on using neuroimaging approaches to understand both the underlying neural basis for and mechanisms of action of integrative medicine-based interventions for various neurodevelopmental and psychiatric disorders. My background is in cognitive and clinical neuroscience, with extensive training in non-invasive neuroimaging approaches such as functional MRI (fMRI) and EEG. For my dissertation, I focused on using these approaches to investigate how functional and structural brain network connectivity develops atypically in adolescents with autism spectrum disorders (ASDs). Findings from this work helped to show that functional and structural connectivity, particularly in brain networks supporting action observation, imitation, and social cognition, is atypical among youth with ASDs, and I demonstrated that a neurofeedback intervention can normalize this network function in ASD to some extent (Datko et al., 2018). For my postdoctoral research, I have focused on studying the mechanistic effects of mindfulness-based interventions (MBIs) on brain and behavior. For example, I used fMRI to show that a 3-week mindfulness-based smoking cessation smartphone app program led to decreased brain reactivity to smoking-related cues (Janes et al., 2019). More recently as a trainee in the Harvard Medical School T32 Postdoctoral Fellowship Program in Integrative Medicine, I have worked on two trials investigating brain-based responses to MBIs, one focused on understanding such effects among patients with depression and anxiety (Datko et al., 2022) and the other patients with episodic migraine. I am currently using functional MRI to measure hypothesized changes in self-regulation and attention networks resulting from a mindfulness-based training program that has been integrated into primary care for patients with anxiety and depression. I am also using high-field MRI (7-tesla) to measure changes in brainstem, somatosensory, and central autonomic networks in patients with chronic migraine who undergo a combination of mindfulness meditation training and treatment with respiratory-gated transcutaneous vagus nerve stimulation. Collectively, these projects have contributed to a growing evidence base supporting the use of MBIs for a range of health conditions; they have also helped further develop methods for studying the effects of integrative medicine-based interventions more broadly (Giachos et al., 2022).

The research I recently proposed in my K01 Mentored Research Scientist Development Award would allow me to build upon this work by examining potential mechanisms of a multimodal integrative medicine-based intervention, which may optimize the already promising effects of MBIs for anxiety disorders through the addition of a synergistic neuromodulation technique (transcutaneous vagus nerve stimulation). In addition to having important clinical relevance, this project will also allow me to develop new skills in the design and conduct of clinical trials, the implementation of multimodal technology-assisted mindfulness-based interventions, and the use of advanced computational analysis methods

integrating neuroimaging with prediction modeling of mechanistic treatment response. Whether through the K01 or other funding mechanisms, I plan to transition into a fully independent investigator focused on integrative medicine research and contemplative and clinical neuroscience.