DAVID J. HERZFELD

Curriculum Vitae
March 3, 2025

CONTACT INFORMATION

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EDUCATION

2016	Ph.D.	Johns Hopkins University, Department of Biomedical Engineering
2011	M.S.	Marquette University, Department of Biomedical Engineering
2010	B.S.	Marquette University, Department of Biomedical Engineering

ACADEMIC APPOINTMENTS

July 2025	Assistant Professor (tenure track) University of Wisconsin-Madison, Department of Neuroscience
2018 - July 2025	Post-doctoral Fellow, Laboratory of Stephen G. Lisberger Duke University, Department of Neurobiology
2016 - 2018	Post-doctoral Fellow, Laboratory of Reza Shadmehr Johns Hopkins University, Department of Biomedical Engineering

RESEARCH GRANTS

2020 - 2023	National Institutes of Health (K99EY030528, Role: PI) National Eye Institute K99/R00: Pathway to Independence Award Title: Principles of operation of a neural learning circuit
2016 - 2018	Johns Hopkins Distinguished Science of Learning Fellowship (Role: PI) Johns Hopkins Science of Learning Institute Title: How does the cerebellum update our movements following an error?
2014 - 2016	National Institutes of Heath (F31NS090860, Role: PI) National Institute of Neurological Disorders and Stroke Ruth L. Kirschstein National Research Service Award Title: A memory of errors in motor adaptation

PUBLICATIONS

Herzfeld, D.J. and S.G. Lisberger. Neural circuit mechanisms to transform cerebellar population dynamics for motor control in monkeys. *BioRxiv*, 2025. doi: 10.1101/2025.02.21.639459

Herzfeld, D.J., Hall, N.J., and S.G. Lisberger. Strategies to decipher neuron identity from extracellular recordings in the cerebellum of behaving non-human primates. *BioRxiv*, 2025. doi: 10.1101/2025.01.29.634860

Beau*, M., Herzfeld*, D.J., Naveros*, F., Hemelt*, M.E., D'Agostino*, F., Oostland*, M., Sánchez-López*, A., Chung, Y.Y., Maibach, M., Stabb, H.N., Martínez Lopera, M.G., Lajko, A., Zedler, M., Ohmae, S., Hall, N.J., Clark†, B.A., Cohen†, D., Lisberger†, S.G., Kostadinov†, D., Hull†, C., Häusser†, M., and J.F. Medina†. A deep-learning strategy to identify cell types across species from high-density extracellular recordings. *Cell*, 2025. doi: 10.1016/j.cell.2025.01.041

Herzfeld, D.J., Joshua, M., and S.G. Lisberger. Rate versus synchrony codes for cerebellar control of motor behavior. *Neuron*, 111(15):2448-2460, 2023. doi: 10.1016/j.neuron.2023.07.002

Hall, N.J., Herzfeld, D.J., and S.G. Lisberger. Evaluation and resolution of many challenges of neural spike sorting: a new sorter. *Journal of Neurophysiology*, 126(6):2065-2090, 2021. doi: 10.1152/jn.00047.2021

Albert, S.T., Jang, J., Sheahan, H.R., Teunissen, L., Vandevoorde, K., Herzfeld, D.J., and R. Shadmehr. An implicit memory of errors limits human sensorimotor adaptation. *Nature Human Behavior*, 5(7):920-934, 2021. doi: 10.1038/s41562-020-01036-x

Herzfeld, D.J., Hall, N.J., Tringides, M., and S.G. Lisberger. Principles of operation of a cerebellar learning circuit. *eLife*, 9:e55217, 2020. doi: 10.7554/eLife.55217

Sedaghat-Nejad E., Herzfeld, D.J., Hage, P., Karbasi, K., Palin, T., Wang, X., and R. Shadmehr. Behavioral training of marmosets and electrophysiological recording from the cerebellum. *Journal of Neurophysiology*, 122(4):1502-1517, 2019. doi: 10.1152/jn.00389.2019

Sedaghat-Nejad E., Herzfeld, D.J., and R. Shadmehr. Reward prediction error modulates saccade vigor. *Journal of Neuroscience*, 39(25):5010-5017, 2019. doi: 10.1523/JNEUROSCI.0432-19.2019

Reppert, T.R., Rigas, I., Herzfeld, D.J., Sedaghat-Nejad, E., Komogortsev O., and R. Shadmehr. Movement vigor as a trait-like attribute of individuality. *Journal of Neurophysiology*, 120(2):741-757, 2018. doi: 10.1152/jn.00033.2018

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Encoding of error and learning to correct that error by the Purkinje cells of the cerebellum. *Nature Neuroscience*, 21(5):736-743, 2018. doi: 10.1038/s41593-018-0136-y

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Encoding of action in the Purkinje cells of the cerebellum. *Nature*, 526:439-442, 2015. doi: 10.1038/nature15693

Herzfeld, D.J., Vaswani, P.A., Marko, M.K., and R. Shadmehr. A memory of errors in sensorimotor learning. *Science*, 345:1349-1353, 2014. doi: 10.1126/science.1253138

Herzfeld, D.J.*, Pastor, D.*, Haith, A.M., Rossetti, Y., Shadmehr, R., and J. O'Shea. Contributions of the cerebellum and the motor cortex to acquisition and retention of motor memories. *NeuroImage*, 98:147-158, 2014. doi: 10.1016/j.neuroimage.2014.04.076

Herzfeld, D.J. and S.A. Beardsley. Improved multi-unit decoding at the brain-machine interface using population temporal linear filtering. *Journal Neural Engineering*, 7(4):046012, 2010. doi: 10.1088/1741-2560/7/4/046012

IN PREPARATION

Herzfeld, D.J., Hall, N.J., and S.G. Lisberger. The multiple sites of motor learning in the cerebellar cortex. *In Preparation.*

CONFERENCE PROCEEDINGS

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. A cerebellar network architecture underlying error-based learning. *MLMC: Advances in Motor Learning and Motor Control*, 2017.

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Error-dependent changes in cerebellar Purkinje cells during saccadic adaptation. *MLMC: Advances in Motor Learning and Motor Control*, 2016.

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Encoding of action in the Purkinje cells of the cerebellum. *TCMC: Translational and Computational Motor Control*, 2014.

Herzfeld, D.J., Vaswani, P.A., Marko, M.K. and R. Shadmehr. Sensitivity of motor adaptation depends on the history of experienced errors. *TCMC: Translational and Computational Motor Control*, 2013.

Herzfeld, D.J. and S.A. Beardsley. Synaptic Weighting for Physiological Responses in Recurrent Spiking Neural Networks. *IEEE Engineering in Medicine and Biology.* 2011:4187-90, 2011.

Herzfeld, D.J., Olson, L.E. and C.A. Struble. Pools of virtual boxes: building campus grids with virtual machines. *HPDC: Proceedings of the ACM.* 667–675, 2010.

REVIEWS

D.J. Herzfeld. Linking abnormal neural activity patterns to motor deficits. *eLife*, 2024. doi: 10.7554/eLife.100833

Herzfeld, D.J. and R. Shadmehr. Cerebellar output encodes a corrective saccadic command. *European Journal of Neuroscience*, doi: 10.1111/ejn.13345, 2016. doi: 10.1111/ejn.13345

Herzfeld, D.J. and R. Shadmehr. Motor variability is not noise, but grist for the learning mill. *Nature Neuroscience*, 17(2):149-50, 2014. doi: 10.1038/nn.3633

Herzfeld, D.J. and R. Shadmehr. Cerebellum estimates the sensory state of the body. *Trends in Cognitive Sciences*, 18(2)66-7, 2013. doi: 10.1016/j.tics.2013.10.015

HONORS & AWARDS

2023 Early Career Investigator Award
International Society of Motor Control (ISMC)

2021 Best Post-doctoral Fellow Research Award
Duke University Department of Neurobiology Retreat

2018 McKnight Allison J. Doupe Fellowship
McKnight Foundation Annual Meeting

2018 Paul Ehrlich Research Award
Johns Hopkins Young Investigators' Day

2017 Donald B. Lindsley Prize in Behavioral Neuroscience
Society for Neuroscience

2016 David T. Yue Award for Research Excellence in Biomedical Engineering
Johns Hopkins University, Department of Biomedical Engineering

2016 Martin & Carol Macht Research Award
Johns Hopkins Young Investigators' Day

2016 Siebel Scholar, Class of 2016
Thomas and Stacey Siebel Foundation

2015 Mette Strand Research Award
Johns Hopkins Young Investigators' Day

2015 Society for the Neural Control of Movement Young Investigators Scholarship Award
Society for the Neural Control of Movement

2010 Richard W. Jobling Fellowship
Marquette University, Department of Biomedical Engineering

2009 Anthony J. and Rose E. Bagoszzi Medical Research Fellowship
Marquette University, Department of Biomedical Engineering

2010 Top Scholar in Curriculum
Marquette University, Department of Biomedical Engineering

SELECTED INVITED TALKS

2024 Cracking the computations of the cerebellar circuit
The Foundation des Treilles, Cerebellum Meeting

2024 Understanding how circuits compute: tracing oculomotor signals through the cerebellar circuit
Johns Hopkins, David S. Zee Eye Movement Seminar Series

2023 Understanding how circuits compute: tracing signals through the cerebellar circuit
Johns Hopkins, Shadmehr Cerebellar Seminar Series

2023 Rate versus synchrony codes for cerebellar control of motor behavior
Gordon Cerebellar Conference

2021 Using multi-contact probes to functionally dissect the primate floccular circuit
Webinar: Advancing Research with Linear Probes
Plexon Inc. Webinar Series

2016 Encoding of action in the Purkinje cells of the cerebellum
Symposium: The Neural Basis of Adaptive Motor Control in the Cerebellum
Society for Neuroscience Annual Meeting

2016 Error-dependent changes in cerebellar Purkinje cells during saccadic adaptation
MLMC: Advances in Motor Learning and Motor Control

2016 Motor learning: An overview of methods and models.
Learning at the Interface of Vision and Oculomotor control
Bernstein Conference

2015 Encoding of action in the Purkinje cells of the cerebellum
Gordon Cerebellar Conference

2015 Encoding of action in the Purkinje cells of the cerebellum
Neural Control of Movement

2014 A memory of errors in sensorimotor learning
Brotz Seminar, Marquette University

2013 Learning from error in sensorimotor learning
Workshop on Neural Population Dynamics Underlying Sensorimotor Integration
Janelia Farms (HHMI)

2013 Learning from error: history of past errors dictates sensitivity to error
TCMC: Translational and Computational Motor Control Conference

PATENTS

2015 Devices, systems and methods for evaluation and feedback of neuromodulation treatment
U.S. and International Patents (45973616, 13/281,269, 9066720)

TEACHING EXPERIENCE

2022-2023 Neural Control of Movement
Duke University, Guest Lecturer for Marc A. Sommer

2014 Learning Theory
Johns Hopkins University, Teaching Assistant & Guest Lecturer

2014 Introduction to Embedded Microcontrollers
Johns Hopkins University, Instructor

2011 Biocomputer Design Lab II
Marquette University, Teaching Assistant

2011 Embedded Biomedical Instrumentation
Marquette University, Teaching Assistant

2011 Computing for Biomedical Engineers
Marquette University, Teaching Assistant & Guest Lecturer

2010 Biocomputer Design Lab I
Marquette University, Teaching Assistant & Guest Lecturer

PROFESSIONAL SERVICE

Ad-hoc Reviewer: *Cell Reports*, *eLife*, *PLOS Biology*, *Current Biology*, *Journal of Neuroscience*, *PLOS Computational Biology*, *European Journal of Neuroscience*, *Journal of Neurophysiology*, *NeuroImage*, *Experimental Brain Research*, *Neural Networks*

SELECTED ABSTRACTS

Herzfeld, D.J., and S.G. Lisberger. Spatial and temporal transformations in the cerebellar circuit during smooth pursuit eye movements. *Soc. Neurosci.*, 2024.

Herzfeld, D.J., and S.G. Lisberger. Cell-type resolution of circuit computations in the cerebellum during smooth pursuit eye movements. *Soc. Neurosci.*, 2023.

Herzfeld, D.J., Hall, N., Hemelt, M., Beau, M., Oostland, M., Kostadinov, D., Naveros, F., Sanches-Lopez, A., Ohmae, S., Cohen, D., Medina, J.F., Hausser, M., Hull, C., and S.G. Lisberger. Behavioral responses of expert-identified cerebellar cell types during smooth pursuit eye movements in primates. *Soc. Neurosci*, 2022.

Herzfeld, D.J., Joshua, M., and S.G. Lisberger. Information transmission in the cerebellum: the role of rate and synchrony during smooth pursuit. *Soc. Neural Control of Movement*, 2022.

Herzfeld, D.J. and S.G. Lisberger. Transfer of cerebellar motor learning in smooth pursuit eye movements between sites with distinct behavioral and neural properties. *Gordon Cerebellar Conference*, 2019.

Herzfeld, D.J. and S.G. Lisberger. Transfer of cerebellar motor learning in smooth pursuit eye movements between sites with distinct behavioral and neural properties. *Soc. Neurosci*, 2019.

Hall, N.J., Herzfeld, D.J., and S.G. Lisberger. Spike sorting for multichannel recordings in floccular complex of the primate cerebellum. *Soc. Neurosci*, 2019.

Karbasi, K., Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Sensory prediction error, not motor error, drives complex spikes in the Purkinje cells of the cerebellum. *Soc. Neurosci*, 2019.

Herzfeld, D.J., Tringides, M., Subramanian, D., and S.G. Lisberger. Properties of the signals that drive directional learning in smooth pursuit eye movements. *Soc. Neurosci*, 2018.

Sedaghat-Nejad, E., Herzfeld, D.J., and R. Shadmehr. Reward-prediction-error modulates learning for sensory-prediction-error. *Soc. Neurosci*, 2018.

Orozco, S.P., Herzfeld, D.J., and R. Shadmehr. Signatures of the fast and slow learning processes in the motor commands that move the eyes during a saccade. *Soc. Neurosci*, 2018.

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Cerebellar complex spikes encode error direction and magnitude. *Soc. Neurosci*, 2017.

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Organization of the cerebellum by prediction errors reveals bidirectional changes during saccade adaptation. *Soc. Neural Control of Movement*, 2017.

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Sensory prediction errors during saccade adaptation drive cerebellar complex spikes and learning. *Soc. Neurosci*, 2016

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Encoding of action in the Purkinje cells of the cerebellum. *Soc. Neurosci*, 2015.

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Encoding of action in the Purkinje cells of the cerebellum. *Gordon Cerebellar Conference*, 2015.

Shadmehr, R. and D.J. Herzfeld. Changes in error-sensitivity account for sensorimotor savings. *Soc. Neurosci*, 2014.

Herzfeld, D.J., Kojima, Y., Soetedjo, R., and R. Shadmehr. Encoding of prediction error by complex spikes of the cerebellum. *Soc. Neurosci*, 2014.

Herzfeld, D.J., Vaswani, P.A., and R. Shadmehr. Sensitivity of motor adaptation depends on the history of experienced errors. *Soc. Neurosci*, 2013.

Herzfeld, D.J., Vaswani, P.A., Marko, M.K., Kojima, Y., Soetedjo, R., and R. Shadmehr. Sensitivity of motor adaptation depends on the history of experienced errors. *Gordon Cerebellar Conference*, 2013.

Herzfeld, D.J., and R. Shadmehr. Sensitivity to error depends on perturbation statistics. *Soc. Neurosci*, 2012.

Herzfeld, D.J., and S.A. Beardsley. Localization of synaptic changes using simulated hemodynamic responses. *Soc. Neurosci*, 2011.

Herzfeld, D.J., and S.A. Beardsley. Improved multi-unit decoding at the brain-machine interface using population temporal linear filtering. *Soc. Neurosci*, 2009.