Timothy W. Dunn

Contact Information

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Current Appointment

Duke University. Duke Forge Postdoctoral Scholar. 2017 – Present

Education

Ph.D. in Neurobiology, **Harvard University** 2015
Brain-wide neural dynamics underlying looming-evoked escapes and spontaneous exploration with Florian Engert

B.A. in Molecular and Cell Biology, **University of California at Berkeley** 2008
With Highest Honors

Honors and Awards

NVIDIA GPU Grant 2017
Harvard University Certificate of Excellence in Teaching 2017
A2 Fellowship (international collaboration). Japan National Institute of Genetics. 2015
National Science Foundation (NSF) Graduate Opportunities Worldwide Fellowship 2013
Harvard University Certificate of Distinction in Teaching
National Science Foundation (NSF) Graduate Research Fellowship 2011
Molecular and Cell Biology Department Citation (Best in Class). UC Berkeley. 2008
I.L. Chaikoff Award for Excellence in Undergraduate Research. UC Berkeley.
Nathan and Violet David Scholarship (competitve research fellowship). UC Berkeley. 2007
Regents and Chancellor's Scholarship (full undergraduate funding). UC Berkeley. 2004

Past Research Experience

Harvard University. College Fellow of Molecular and Cellular Biology 2016 – 2017
- Developed deep learning methods for functional connectomics
- Designed and lectured course on modern computational techniques for biological data analysis (mcb112.org) *with Sean Eddy*

Harvard University. Postdoctoral Researcher *with Florian Engert* 2015 – 2016
- Built circuit models explaining zebrafish optomotor response behavior
- Simulated foraging and exploration to probe state-dependent, spontaneous search strategies

Harvard University. Graduate Researcher *with Florian Engert* 2010 – 2015
- Built new software to measure fast animal behaviors with precise environmental control
- Developed new software to assay these behaviors during two-photon imaging of brain activity
- Discovered new principles governing neural population encoding of threatening visual stimuli
- Connected hindbrain nuclei to the statistical generation of spontaneous swimming patterns

While a Visiting Scientist *with Misha Ahrens* at **HHMI Janelia Research Campus**:
- Light-sheet imaged pan-neuronal genetically encoded calcium indicators in behaving animals
- Linked neural activity to behavior using regression-based tools to refine brain-wide data

While an international NSF Graduate Fellow *with Filippo Del Bene* at **Institut Curie**:
- Measured activity in specific populations of inhibitory interneurons in the zebrafish optic tectum

Publications

Dunn TW and Fitzgerald J. "Correcting for physical distortions in visual stimuli improves reproducibility in zebrafish neuroscience." *Under Review. Nature Methods.*

Dunn TW and Koo PK (**2017**). "Inferring Functional Neural Connectivity With Deep Residual Convolutional Networks." *bioRxiv*

Naumann EA, Fitzgerald JE, **Dunn TW**, Rihel J, Sompolinsky H, Engert F (**2016**). "From whole-brain data to functional circuit models: the zebrafish optomotor response." *Cell*

Publications Cont.

Dunn TW*, Mu Y*, Narayan S, Randlett O, Naumann EA, Yang C-T, Schier AF, Freeman J, Engert F, Ahrens MA (**2016**). "Brain-wide mapping of neural activity controlling zebrafish exploratory locomotion." *eLife*

Dunn TW, Gebhardt C, Naumann EA, Riegler C, Ahrens MB, Engert F, Del Bene F (**2016**). "Neural circuits underlying visually evoked escapes in larval zebrafish." *Neuron*

Huang KH, Ahrens MB, **Dunn TW**, Engert F (**2013**). "Spinal projection neurons control turning behaviors in zebrafish." *Current Biology*

Kokel D, **Dunn TW**, Ahrens MB, Alshut R, Cheung CY, Saint-Amant L, Bruni G, Mateus R, van Ham TJ, Shiraki T, Fukada Y, Kojima D, Yeh JR, Mikut R, von Lintig J, Engert F, Peterson RT (**2013**). "Identification of nonvisual photomotor response cells in the vertebrate hindbrain." *Journal of Neuroscience*

Fortin DL, **Dunn TW**, Fedorchak A, Allen D, Montpetit R, Banghart MR, Trauner D, Adelman JP, Kramer RH (**2011**). "Optogenetic photochemical control of designer K+ channels in mammalian neurons." *Journal of Neurophysiology*

Fortin DL, **Dunn TW**, Kramer RH (**2011**). "Engineering light-regulated ion channels." *Cold Spring Harbor Protocols*

Fortin DL, Banghart MR, **Dunn TW**, Borges K, Wagenaar DA, Gaudry Q, Karakossian MH, Otis TS, Kristan WB, Trauner D and Kramer RH (**2008**). "Photochemical control of endogenous ion channels and cellular excitability." *Nature Methods*

Selected Conference Presentations

Dunn TW*, Marshall J*, Wang W, Carlson D, Olveczky O (**2019**). "Quantifying 3D body and limb kinematics as a prerequisite for understanding behavior." *LMRL Workshop, NeurIPS 2019*

Schroeder R, Neely B, **Dunn TW**, Frasure E, Huang E, Mathew J (**2019**). "Use of neural net modeling for drug diversion surveillance among anesthesiology providers." *American Society of Anesthesiologists 2019*

Dunn TW*, Mu Y*, et al. (**2015**). "Neural control of spontaneous behavior patterns in larval zebrafish." *Cosyne 2015* (Oral)

Selected Talks

"New methods for tracking and parsing animal behavior." Computational and Theoretical Neuroscience Seminar, Duke University, 2018, Durham, NC

"Functional connectivity from calcium imaging data." Neurotuscany Circuits and Behavior Conference, 2017, Montecastelli Pisano, Italy

"Methods for analyzing whole-brain data and behavior." Humboldt-Universität, 2016, Berlin, Germany

"Spontaneous brain rhythms and exploration." Cold Spring Harbor Laboratory, 2016, Cold Spring Harbor, NY

Teaching Experience

Duke University.

Lecturer. Duke Machine Learning Summer School, Winter School, Coursera — 2018, 2019

Harvard University.

Lecturer. MCB 111: Mathematics in Biology — 2017

Guest Lecturer. NEURO 109A: Precision Neuroscience — 2017

Lecturer. MCB 112: Biological Data Analysis — 2016

Guest Lecturer. OEB 105: Neurobiology of Motor Control — 2015

Teaching Fellow. MCB 105: Systems Neuroscience — 2011, 2012, 2013

Co-Director. Imaging and Behavioral Analysis Workshop — 2013

Massachusetts Institute of Technology.

Perceptron: An interactive video installation visualizing motion perception. (septmay.org) — 2013