William L. Kath

Curriculum Vitae kath@northwestern.edu December 2022

Education:

Ph.D. in Applied Mathematics, California Institute of Technology, 1981
Advisor: Professor Donald S. Cohen
S. B. in Mathematics (Applied Option), Massachusetts Institute of Technology, 1978

Professional Experience:

2020– Margaret B. Fuller Boos Professor
2018– Co-Director, NSF-Simons Center for Quantitative Biology
2012–2015 Visiting Scientist, HHMI Janelia Farm Research Campus
2011 Washington Square Health Foundation Lurie Cancer Center Fellow
2010–2015 Northwestern Physical Sciences-Oncology Center
2005–2010 Co-Director, Northwestern Institute on Complex Systems
1996– Professor, Engineering Sciences and Applied Mathematics, Northwestern
2004– Department of Neurobiology
2002– Northwestern University Interdisciplinary Neuroscience Program
2000–2001 Visiting Professor, Department of Neurobiology, Northwestern University
2000– Northwestern Center for Photonic Communication and Computing
1996 Visiting Professor, Computer Science and Electrical Engineering, UMBC
1990– Northwestern University Council on Theoretical & Applied Mechanics
1987–1996 Associate Professor, ESAM, Northwestern University
1984–1987 Assistant Professor, ESAM, Northwestern University
1982–1984 Von Kármán Instructor of Applied Mathematics, Caltech
1981–1982 Research Fellow in Applied Mathematics, Caltech

Honors and Awards:

Fellow of the Society for Industrial and Applied Mathematics, 2010
Fellow of the Optical Society of America, 2007
ASEE Mathematics Division Distinguished Educator and Service Award, 2002
National Science Foundation Presidential Young Investigator Award, 1985-1990
The Technological Institute Award for Teaching Excellence, 1987
National Science Foundation Postdoctoral Research Fellowship, 1981-1982
W. P. Carey Applied Mathematics Outstanding Doctoral Dissertation Prize, 1981
National Science Foundation Graduate Fellowship, 1978-1981
Phi Beta Kappa, 1978

Research Interests:

Quantitative biological modeling, circadian rhythms, growth and development; computational neuroscience, action potential propagation and dendritic integration in neurons; optical fibers and waveguides, polarization mode dispersion; importance sampling and rare event simulation; stochastic and nonlinear dynamics.

Society Memberships:

The Optical Society of America
Society for Neuroscience
Society for Industrial and Applied Mathematics (SIAM)

Graduate Student Supervision:

1985–1989	Ann Kahlow Hobbs, ESAM
1988–1991	Tetsuji Ueda, ESAM
1991–1994	J. Nathan Kutz, ESAM
1994–1999	Michael Mills, ESAM
1997–2001	Richard Moore, ESAM
2001–2005	Elaine Spiller, ESAM
2004–2008	Yael Katz, IBIS
2004–2009	Vilas Menon, ESAM
2009–2011	Mark Cembrowski, ESAM
2010–2015	Danny Wells, ESAM
2014–2020	Nathan Sanford, ESAM
2016–	Eric Johnson, ESAM
2020–	Ziyu Zhao, ESAM
2022–	Nan Ding, ESAM
1986–1990	David J. Muraki, ESAM
1990–1993	Cheryl V. Hile, ESAM
1992–1996	Anne Niculae, ESAM
1996–2000	Brian Marks, ESAM
1999–2002	Sandeep Bhatt, ESAM
2004–2008	Graham Donovan, ESAM
2002–2009	Matt McCallum, ESAM
2004–2012	Rachel Trana, ESAM
2010–2020	Nir Yungster, ESAM
2011–2014	Hannah Choi, ESAM
2014–2021	Brita Schneiders, ESAM
2016–	Joshua Levy, ESAM
2021–	Richard Suhendra, ESAM

Postdoctoral/Research Faculty Supervision:

1993–1995	Dr. Christopher Goedde
1999–2001	Dr. Gino Biondini
2007–2010	Dr. Jinglai Li
2017–2020	Dr. Daniel Poll
1996–1999	Dr. Tian-Shiang Yang
2004–2006	Dr. Theodoros Horikis
2012–2020	Dr. Aushra Abouzeid

Selected Prior and Current Sponsored Projects:

1985–1990	National Science Foundation Presidential Young Investigator Award (Applied Mathematics): “Mathematical modelling of problems in optical communication”.
2015-2019	National Institutes of Health, National Institute on Deafness and other Communication Disorders, “Mapping And Function Of Odorant Receptors In The Human Olfactory System” (T. Bozza and J. Gottfried, PIs).
2015-2019	Defense Advance Research Projects Agency, “Biochronicity Grand Challenge: Human Time Stamp Development, Validation and Prediction” (R. Allada, PI).
2015-2019	National Science Foundation, “CRCNS: Functional Imaging and Computational Models of Place Field Integration in Pyramidal Cell Dendrites ” (with D. Dombeck).
2016-2021	National Science Foundation, “RTG: Interdisciplinary Training in Quantitative Biological Modeling” (with Mary Silber, Madhav Mani, Hermann Riecke, Daniel Abrams).
2018-2023	National Science Foundation, “NSF-Simons Center for Quantitative Biology” (with Richard Carthew and 11 other Co-Investigators).

Special Publications:

1. Phase sensitive amplifiers for ultra-long distance soliton propagation, in *Optics in 1993*, (a collection of articles selected each year to highlight principal advances in optics), Optics and Photonics News, **4**, December 1993 (with Prem Kumar, J. Nathan Kutz, and Ruo-Ding Li).
2. “Making Waves: Solitons and Their Optical Applications”, SIAM News, March 1998 (with Bonnie Kath). First Place, Society for Industrial and Applied Mathematics Writing Contest.
3. A method for calculating outage probabilities due to polarization-mode dispersion using importance sampling, in *Optics in 2001*, Optics and Photonics News, **12** #12, December 2001 (with Gino Biondini and Curtis R. Menyuk).

4. A method to compute statistics of large, noise-induced perturbations of nonlinear Schrödinger solitons, SIAM Review **50** 2008, 523-549. "SIGEST highlights an exceptional paper, chosen for its readability and wide appeal to the SIAM community."

Recent Publications:

101. Hippocampal pyramidal neurons comprise two distinct cell types that are counter modulated by metabatropic receptors, Neuron **76** (2012) pp. 776-789 (with A. R. Graves, S. J. Moore, E. B. Bloss, B. D. Mensh, and N. Spruston).
102. Synaptic amplification by dendritic spines enhances input cooperatively, Nature **491** (2012) pp. 599-602 (with M. T. Harnett, J. K. Makara, N. Spruston, and J. C. Magee).
103. Realistic control of network dynamics, Nature Communications **4** (2013) 1492 (with S. P. Cornelius and A. E. Motter).
104. Balanced Synaptic Impact via Distance-Dependent Synapse Distribution and Complementary Expression of AMPARs and NMDARs in Hippocampal Dendrites, Neuron **80** (2013) 1451–63 (with V. Menon, T. F. Musial, A. Liu, Y. Katz, N. Spruston, and D. A. Nicholson).
105. Adaptation to Background Light Enables Contrast Coding at Rod Bipolar Cell Synapses, Neuron **81** (2014) 388-401 (with J. B. Ke, Y. V. Wang, B. G. Borghuis, M. S. Cembrowski, H. Riecke, J. B. Demb and J. H. Singer).
106. Hybrid Hinge Model for Polarization-Mode Dispersion in Installed Fiber Transmission Systems, J. Lightwave Tech. **32** (2014) 1412-1419 (with J. Schuster, Z. Marzec, G. Biondini).
107. Intrinsic bursting of AII amacrine cells underlies oscillations in the rd1 mouse retina, J. Neurophysiology **112** (2014) 1491-1504 (with H. Choi, L. Zhang, M. S. Cembrowski, C. F. Sabottke, A. L. Markowitz, D. A. Butts, J. H. Singer and H. Riecke).
108. Histone methyltransferase MMSET/NSD2 alters EZH2 binding and reprograms the myeloma epigenome through global and focal changes in H3K36 and H3K27 methylation, PLoS Genetics **10** (2014) pp. e1004566 (with R. Popovic, E. Martine-Garcia, E. G. Giannopoulou, Q. W. Zhang, Q. Y. Zhang, T. Ezponda, M. Y. Shah, Y. P. Zheng, C. M. Will, E. C. Small, J. Y. Hua, M. Bulic, Y. W. Jiang, M. Carrara, R. A. Calogero, N. L. Kelleher, J. P. Wang, O. Elemento and J. D. Licht).
109. Spatial and Functional Heterogeneities Shape Collective Behavior of Tumor-Immune Networks, PLoS Computational Biology **11** (2015) p. e1004181 (with D. K. Wells, Y. S. Chuang, L. M. Knapp, D. Brockmann, and J. N. Leonard).
110. Control of Stochastic and Induced Switching in Biophysical Networks, Physical Review X **5** (2015) p. 031036 (with D. K. Wells and A. E. Motter).
111. A Path-Based Method for Simulating Large Deviations and Rare Events in Nonlinear Lightwave Systems, Studies in Applied Math **137** (2016) pp. 159-173 (with J. Li).
112. Universal method for robust detection of circadian state from gene expression (with R. Braun, M. Iwanaszko, E. Kula-Eversole, S. M. Abbott, K. J. Reid, P. C. Zee and R. Allada), PNAS **115** (2018), pp. E9247-E9256.
113. Reply to Laing et al.: Accurate prediction of circadian time across platform (with R. Braun, M. Iwanaszko, E. Kula-Eversole, S. M. Abbott, K. J. Reid, P. C. Zee and R. Allada), PNAS **116** (2019), pp. 5206-5208.
114. Slip rates and slip modes in an actively mode-locked laser (with N. L. Sanford and G. M. Donovan), SIAM J. Applied Dynamical Systems **19** (2020), pp. 1472–1495.
115. TimeTrial: an interactive application for optimizing the design and analysis of transcriptomic times-series data in circadian biology research (with E. Ness-Cohn, M. Iwanaszko, R. Allada and R. Braun), J. Biological Rhythms **35** (2020), pp. 439-451.

116. Robustness and plasticity in Drosophila heat avoidance (with J. M. Simões, J. I. Levy, E. E. Zaharieva, L. T. Vinson, P. Zhao, M. H. Alpert, A. Para and M. Gallio, Nature Communications **12** (2021), p. 2044.
117. The E3 ubiquitin ligase adaptor *Tango10* links the core circadian clock to neuropeptide and behavioral rhythms (with J. Lee, C. Lim, T. H. Han, T. Andreani, M. Moye, J. Curran, E. Johnson, C. O. Diekman, B. C. Lear and R. Allada, PNAS **118** (2021), p. e2110767118.
118. EMBEDR: Distinguishing signal from noise in single-cell omics data (with E. M. Johnson and M. Mani), Cell Patterns **3** (2022), p. 100443.
119. Circadian programming of the ellipsoid body sleep homeostat in *Drosophila*, T. Andreani, C. Rosensweig, S. Sisobhan, E. Ogunlana and R. Allada, Elife **11** (2022), p. e74327.

Recent invited talks:

1. "TimeSignature: An Accurate, Fast, and Universal Method for Inferring Physiological Time from Gene Expression Data", UC Irvine NSF-Simons Center 2nd Annual Symposium on Multiscale Cell Fate Research, October 2019.
2. "Control of switching in complex reaction networks", Workshop on Reaction-Diffusion Modeling for Neurobiology, Organization for Computational Neuroscience Annual Meeting, University of Antwerp, Belgium, July 2017.
3. "Spatial Variation of Spike Initiation Threshold in Large Active Dendritic Arbors", Minisymposium on The Dynamics and Function of Neuronal Networks, SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, May 2017.
4. "Untangling Cause and Effect in Active Neuronal Dendrites", The Richard C. DiPrima Lecture, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, April 2017.
5. "Errors Growing from Noise in the Zeros of a Lightwave Communication System", Minisymposium on Stochastic Perturbations to Nearly Integrable Systems, SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, PA, August 2016.
6. "Using the Wentzell-Freidlin Least Action to Maneuver Network Dynamical Systems", Minisymposium on Making Noise Work For You: Switching, Extinction, Control and all that!, SIAM Annual Meeting, Boston, MA, July 2016.
7. "Models of Large Deviations and Rare Events for Optical Pulses", Minisymposium on Rare Events in Stochastic Systems, SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 2015.
8. "Estimating and directing the probabilities of rare transitions in regulatory networks", AFOSR/NCI/DARPA Strategic Workshop: Convergence of Physical Sciences for Biomedical Applications Meeting, Arlington, VA, August 2014.
9. "Models of Large Deviations and Rare Events for Optical Pulses," Nonlinear Guided Waves VII Conference, Kingussie, Scotland, May 2014.
10. "Models of large deviations and rare events for optical pulses," Minisymposium on Stochastic Evolution Equations and Exit Problems, Society for Industrial and Applied Mathematics Conference on Uncertainty Quantification, Savannah, GA, March 2014.