Dr. Kevin M. Hannay

Chief Technology Officer
Arcascope

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Appointments

Institution	Time Period	Position
Arcascope Inc	2020-Current	Chief Technology Officer
University of Michigan	2022-Current	Visting Scholar
University of Michigan	2020-2022	Assistant Professor/ Research Fellow
Schreiner University	2017-2020	Assistant Professor of Mathematics
University of Michigan	2010 & 2013-2017	Doctoral Student

Education

University of Michigan, Ann Arbor

PhD Applied and Interdisciplinary Mathematics 2017

University of Texas at Austin

B.S. Mathematics (Honors) 2009
B.S. Biology (Honors) 2009

Publications

Peer-Reviewed Journal Articles

1. Jennette P Moreno, Kevin M Hannay, Olivia Walch, Hafza Dadabhoy, Jessica Christian, Maurice Puyau, Abeer El-Mubasher, Fida Bacha, Sarah R Grant, Rebekah Julie Park, Philip Cheng, Estimating circadian phase in elementary school children: leveraging advances in physiologically informed models of circadian entrainment and wearable devices, Sleep (2022)
2. K.M Hannay, D.B. Forger, V.Booth, Seasonality and light phase-resetting in the mammalian circadian rhythm. Sci Rep 10, 19506 (2020)
3. K.M Hannay, J.P. Moreno, Integrating wearable data into circadian models, Current Opinion in Systems Biology, 2020.
4. K.M Hannay, V.Booth, D.B. Forger, Macroscopic Models for Human Circadian Rhythms, Journal of Biological Rhythms, 0748730419878298, Oct. 2019.
5. J.P Moreno, S.J Crowley, C.A Alfano, K.M Hannay, D. Thompson, T. Baranowski, Potential Circadian and Circannual Rhythm Contributions to the Obesity Epidemic in Elementary School Age Children, International Journal of Behavioral Nutrition and Physical Activity, Vol. 16, Issue 1, 2019
6. K.M Hannay, D.B. Forger, V. Booth, Macroscopic Models for Networks of Coupled Biological Oscillators, Science Advances, Vol. 4, Num. 8, e1701047, 2018
7. K.M Hannay, V. Booth, D. Forger, Collective phase response curves for heterogeneous coupled oscillators, Physical Review E 92, 022923, 2015.
8. K.M Hannay, C. Vogel, E. Marcotte, Buffering by gene duplicates: an analysis of molecular correlates and evolutionary conservation, BMC Genomics, Vol. 8, 2008.

Other Scholarly Publications

1. K.M Hannay, "Macroscopic Models and Phase Resetting of Coupled Biological Oscillators", Doctoral Thesis, 2017
2. K.M Hannay, T. Keitt, "Invasibility, Coexistence and Spatial Structures in Networks of Competing Species", Senior Honors Thesis, University of Texas at Austin, 2009
3. K.M Hannay, O. Gonzalez, "Reaction-Diffusion Models of Ecological Interactions", Senior Honors Thesis, University of Texas at Austin, 2009

External Research Grants

1. "Nonsmooth maps, coupled oscillators and seasonal variation of sleep and circadian rhythms", V. Booth, C. Diniz Behn, K.M Hannay, National Science Foundation Grant, DMS-1853506, 2019-2022

Software

1. HannayIntroStats: An open-source R package for teaching introductory statistics and data science.
2. HCRSimPy: An an open source PYTHON package for simulating and visualizing human circadian rhythms.
3. CircadianPF: An open-source Julia package for parameter estimation of circadian rhythm models using wearable data. Under active development.
4. DiffEqFlux.jl: Open source contributor to this library for neural differential equations written in Julia.

Talks and Presentations

Presentations

1. "Learning Dynamics of Oscillators with Applications to Circadian Rhythms", Modeling, Computation, Nonlinearity, Randomness and Waves Seminar, University of Arizona, October 2020
2. "Personalized Models of Circadian Rhythms", University of Michigan Postdoctoral Conference, (August, 2020)
3. "Learning Dynamics from Phase Response Data", Dynamic Days Digital Conference, (August 2020)
4. "Circadian State Estimation Using Wearable Data", Society for Mathematical Biology (SMB) Conference (August 2020)
5. "Towards Personalized Models of Human Circadian Rhythms", SIAM Life Sciences Conference, (July 2020) (early career prize lecture)
6. "Macroscopic Models for the Mammalian Circadian System", Society for Industrial and Applied Mathematics (SIAM) Dynamical Systems Conference, (May 2019) (contributed talk)
7. "Personalized Models for Human Circadian Rhythms", Naval Postgraduate School (March 2019) (invited talk)
8. "Biological Clocks: Synchrony and Circadian Rhythms", Trinity University, Undergraduate Mathematics Seminar (Oct 2018) (invited talk)
9. "Macroscopic Models for Human Circadian Rhythms", Society for Industrial and Applied Mathematics (SIAM), Annual Meeting (July 2018) (contributed talk)
10. "Low Dimensional Models for Human Circadian Rhythms", Society for Research on Biological Rhythms (SRBR), (May 2018) (contributed poster)
11. "Macroscopic Models for Coupled Biological Oscillators", Applied and Interdisciplinary Mathematics seminar, University of Michigan, (April 2018) (invited talk)

12. "Macroscopic Models of Networks of Coupled Biological Oscillators", Society for Industrial and Applied Mathematics (SIAM), Workshop on Network Science (July 2017) (contributed talk)
13. "Back to the Basics: A Simplified Model of Mammalian Circadian Rhythms", Society for Research on Biological Rhythms, (May 2016) (contributed poster)
14. "Uncovering the Nature of Circadian Coupling in Mammals", Society for Industrial and Applied Mathematics-Great Lakes, (May 2016) (contributed talk).
15. "Collective phase response curves for heterogeneous coupled oscillators", Dynamics of Coupled Oscillators: 40 years of the Kuramoto Model (August 2015) (contributed poster)
16. NSA Multimedia Processing Research Organization, (July 2015) (invited talk)
17. "Phase Resetting in Biological Oscillators", Student Applied and Interdisciplinary Mathematics Seminar (March 2015) (contributed talk)
18. "Phase Resetting in Biological Oscillators: Application of the Ott-Antonsen Technique", Coupled Oscillator Graduate Seminar, (March 2015) (contributed talk)
19. "The Importance of Having a Paralog", Molecular Biology Poster Session (July 2006) (contributed poster)
20. "The Importance of Having a Paralog", Penn State Functional Genomics Conference (July, 2005) (contributed poster)

Workshops/Summer Schools

1. Sleep and Circadian Summer School, University of Colorado, 2020
2. Recent Advances in Applied and Computational Mathematics: A Workshop in Memory of Professor Peter Smereka, University of Michigan, 2018
3. Inquiry-Based Learning Workshop, University of Michigan, 2016
4. Rhythms and Oscillations Summer School, Mathematical Biology Institute, Ohio State University, 2014
5. Multiscale Modeling and Analysis, University of Texas, 2008
6. System Biology Dynamics: From Genes to Organisms, McGill University, 2006

Professional Experience

Arcascope, Chief Technology Officer, 2020-Current

1. Conduct research on circadian and sleep dynamics
2. Develop algorithms for the prediction and control of circadian phase from wearable data sets
3. Conduct code reviews and supervise the software development process
4. Contribute to the development of iOS applications to include front-end and back-end development
5. Assist in product development and the growth of the company.

University of Michigan, Assistant Professor of Mathematics/Research Fellow, 2020-2022

1. Conduct research on mathematical neuroscience, coupled oscillators and circadian rhythms.
2. Assist in the development of new research areas and grant writing
3. Assist in mentoring graduate and undergraduate students within the research group.

United States Marine Corps 2020-Current

1. Selected to serve as the executive officer for the first Defensive Cyber Operations, Internal Defensive Measures companies in the United States Marine Corps Reserve.
2. Requires expertise in penetration testing, incident response, malware analysis and basic forensic analysis on DOD networks.

Schreiner University, Assistant Professor of Mathematics, 2017-2020

1. Taught mathematics and introductory statistics/data science courses to undergraduate students.
2. Conducted research on mathematical models for human circadian rhythms using molecular, physiological and wearable data. Resulting in several publications in high profile academic journals.
3. Mentored undergraduate research students in mathematical biology topics.
4. Authored open source textbook on data science and introductory statistics.

University of Michigan, Graduate Research Assistant, 2013-2017

1. Research in coupled oscillator networks, phase response curves and circadian rhythms.
2. Completed coursework in applied mathematics, mathematical biology, numerical analysis and high performance computing.

United States Marine Corps (2010-2013: Active Duty, 2013-2017: Drilling Reserves)

1. Logistic Planner, 15th Marine Expeditionary Unit, 2012-2013, *Deployment*
2. Platoon Commander, Marine Wing Support Squadron 471 (Reserves) , 2013-2015
3. Executive Officer (XO), Engineer Company, Marine Wing Support Squadron 471 (Reserves), 2016
4. Company Commander (CO), Engineer Company, Marine Wing Support Squadron 471 (Reserves), 2017
5. Executive Officer (XO) Defensive Cyber Operations, Company A, 2020-Current

Teaching Experience

Schreiner University

Differential Calculus	3 Courses
Vector Calculus	3 Courses
Applied Statistics	10 Courses
Linear Algebra	3 Courses
Differential Equations	1 Course
Scientific Computing	1 Course
Complex Variables	1 Course
Nonlinear Dynamics and Chaos	1 Course

University of Michigan

Differential Calculus (Instructor)	4 Courses
Integral Calculus (Instructor)	1 Course
Partial Differential Equations	Guest Lecture

Awards and Honors

1. Society for Industrial and Applied Mathematics (SIAM) Life Science Activity Group Early Career Award, 2020.

2. Mathematical Association of America (MAA) Project NExT Fellow (2020)
3. Award for Excellence in Research, Scholarship and Creative Activity, Schreiner University, 2019
4. Faculty Development Grants, Schreiner University, 2019 (1 Grant: $2000 Total)
5. Co-winner Smereka Prize for the best doctoral thesis in applied and interdisciplinary mathematics, University of Michigan, 2017
6. HSI-STEM Course re-design award for MATH 2330 Applied Statistics
7. Faculty Development Grants, Schreiner University, 2018 (2 Grants: $4000 Total)
8. Merit Award for Research: Society for Research on Biological Rhythms, 2016
9. Mathematics Alumni/Alumnae Scholarship (2014)
10. University Honors 2004-2006, Fall 2007-Spring 2009
11. Computational and Applied Mathematics REU with Tim Keitt and Oscar Gonzalez (2008)
12. Research Training Group Grant in Computational and Applied Mathematics (2008-2009)
13. Unrestricted Presidential Scholarship (2008)
14. Undergraduate Research Fellowship (2005,2007)
15. Cailloux Foundation Scholarship (2003-2005)
16. Department of Homeland Security Scholar (2005-2007)
17. Dean's Scholars Honors Program, University of Texas at Austin (2004-2009)

Community Involvement

Schreiner University Service

Faculty Search Committee	7 Times
Online Learning Taskforce	2017-2018
Faculty Research Taskforce	2017-2020
Honor's Program Committee	2018-2019
Quality Enhancement Plan (QEP) Committee	2019-2020
Core Improvement Taskforce	2019-2020

Scholarly Service

1. Reviewer, SIAM Journal on Applied Dynamical Systems, Journal of Biological Rhythms
2. Vice-Chair, Mathematics and Computer Science Section, Texas Academy of Science, 2018-2019
3. Chair, Mathematics and Computer Science Section, Texas Academy of Science, 2019-2020

Professional Affiliations

1. Society for Industrial and Applied Mathematics (SIAM)
2. Society for Research on Biological Rhythms (SRBR)
3. Mathematical Association of America (MAA)
4. Texas Academy of Science (TAS)

Undergraduate Research Mentoring

1. Marcella Padron, Jacob Woytek 2017-2018
2. Carrie Fulton, Samuel Brice, Tiara Hendricks-Secord, Courtney Mendez 2018-2019
3. Carrie Fulton and Courtney Mendez 2019-2020
4. Carrie Fulton, National Science Foundation REU, 2020 (Co-mentor with Victoria Booth)

Technical Skills

Conceptual:

Mathematical: Dynamical Systems, Probability and Stochastic Processes, Algorithms, Numerical Analysis, Asymptotic Methods, Fourier Analysis, Functional Analysis

Statistical: Inference, Generalized Linear Models, Linear Mixed Models, Markov Chain Monte Carlo, Bayesian Approaches, Particle Filters and State Estimation, Parameter fitting for large dynamical models

Machine Learning: Random Forests, Artificial Neural Networks, Clustering, Deep Learning, Model Discovery

Computing:

Languages: Python, R, C/C++, Julia, Matlab, Mathematica

Libraries: Numpy, Scipy, Pandas, Tidyverse, Statsmodels, Scikit-learn

High Performance Computing: OpenMP, MPI, GPU Programming (CUDA)

Tools: Git, Jupyter Notebooks, Latex, RMarkdown