

Zachary Danziger

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PROFESSIONAL APPOINTMENTS

Assistant Professor of Biomedical Engineering, Florida International University ≥2016
Applied Neural Interfaces Lab (<https://anil.fiu.edu>), Principal Investigator

EDUCATION

Postdoctoral Fellow, Duke University 2016
Advisor: Warren M. Grill
→ Neurourology; electrophysiology (mouse, rat, cat); pre-clinical SCI (human)

Neuroinformatics Certification, Marine Biological Laboratory, Woods Hole 2012

Ph.D. in Biomedical Engineering, Northwestern University 2011
Advisor: Ferdinando A. Mussa-Ivaldi
→ Motor learning (human); human-machine interface design

B.S. in Biomedical Engineering, *Cum Laude*, University of Michigan Ann Arbor 2005
Concentration in Philosophy (Moral and Political), University of Michigan Ann Arbor

RESEARCH FUNDING

NIH SPARC Program OT2OD030524 [\$1.02M], **PI: ZC Danziger**. *A New Paradigm for Systems Physiology Modeling: Biomechanistic Learning Augmentation with Deep Differential Equation Representations (BLADDER)*. We will develop and use the general BLADDER framework to create an organ-level model of the normal healthy LUT throughout its filling and voiding cycles. Our focus on neural reflex control and organ-level scales ensures that the BLADDER LUT model will be poised to predict effects of neuromodulation using computational studies, which so far has been impossible due to the complexity of the LUT. The BLADDER framework unites multiple individual mechanistic models (each accounting for a component function of an organ system) by using deep recurrent neural networks (RNN) to learn the appropriate coupling dynamics linking each component model. 2020-21

NIH NINDS R01NS109257 [\$1.59M], **PI: ZC Danziger**. *An Intracortical Brain-Computer Interface Model for High Efficiency Development of Closed-Loop Neural Decoding Algorithms*. In this work, we emulate part of the human brain by having human participants interact in real-time with state-of-the-art machine learning algorithms, which are trained using intracortical data from nonhuman primates. The emulator will greatly advance our ability to understand a person's intentions from their brain recordings, thereby improving neurotechnology designed to assist people with paralysis. 2019-24

Craig H Neilsen Foundation pC ID 460399 [\$320k], PI: ZC Danziger . <i>Post-SCI Bladder Reflex Conditioning with Pelvic Neuromodulation</i> . The goals of the proposed work are to 1) quantify the emergence and effectiveness of the pathological bladder voiding reflex that develops following spinal cord injury (SCI), and 2) test if targeted neuromodulation of the pelvic nerve following SCI enhances development speed and reduces hyperexcitability of the voiding reflex.	2017-21
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Wallace H Coulter SEED Grant [\$60k], Co-PI: ZC Danziger . <i>Non-Invasive Decoding of Neuromuscular Activity for Rehabilitation and Prosthetic Control</i> . The goals of this 1-year pilot proposal are to build a method for non-invasively decoding proprioceptive neural information in humans via high-density surface EMG recordings and to understand how proprioception is altered by neurological injury.	2018-19
Wallace H Coulter SEED Grant [\$2k in role as Co-I , \$20k total], PI: J Hutcheson. <i>Exploring Neural Contributions to Aortic Valve Function and Disease</i> . The project focus is on the role of neural components in aortic valve leaflet physiology and pathology, and to identify novel therapeutic targets. My role is electrophysiology measurements of tissue and bioinformatics support.	2017-18
NIH NIDDK F32DK098904 [\$107k], PI: ZC Danziger . <i>Neural Prosthetics Development for Treatment of Urinary Retention</i> . The overall goal of the project was to develop neural stimulation techniques to enhance sensation in the urethra to alleviate the symptoms of urinary retention. We developed a comprehensive, mathematical model of urethral afferent responses to physiological stimuli, and developed the theoretical groundwork for a stimulation paradigm using stochastic resonance to enhance urethral afferent activity.	2013-15
NIH NINDS T32 Grant (Fellow): Competitively awarded within Duke University for “Fundamental and Translational Neuroscience”.	2012
NSF REU Grant (Fellow): Student research grant for computational modeling of hydrocephalus.	2005

AWARDS / HONORS

Research

Top-5 rated abstract in the Society for Pelvic Research Conference	2020
Publication selected as “Editor’s Choice” in the Journal of Physiology: Danziger ZC, Grill WM, “Sensory feedback from the urethra evokes state-dependent lower urinary tract reflexes in rat.”	2017
First Place Research Award: Multidisciplinary Benign Urology Research Day, Durham NC	2016
Platform Presentation and Travel Grant: Translational and Computational Motor Control Conference group A presentation, San Diego CA	2010
Travel Grant: IEEE Engineering Medicine and Biology Conference, grant awarded for platform talk, Vancouver Canada	2008

Mentorship

Received FIU’s university-level “Award for Excellence in Postdoctoral Scholar Mentoring”, given to one faculty per year	2019
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Service

Chair of BMES Ethics Subcommittee: Appointed to a 3-year term to chair the governing ethics body for the US national society of biomedical engineers 2018-21

TEACHING EXPERIENCE

Florida International University

- Biomedical Modeling and Simulation (BME 2740): Gateway course in numerical methods, introduction to programming, and models of biological processes
 - Fall 2017, Fall 2018, Fall 2019, Fall 2020
- Computational Analysis and Simulation of Physiological Processes (BME 6717): Course I created in modern methods of biomedical data analysis and modeling where students select course topics related to their theses and apply class concepts to their research
 - Spring 2018, Spring 2019, Spring 2020
- Engineering Analysis of Biological Systems (BME 3403): Introduction to physiology for biomedical engineers, including protein structure, basic neurobiology, cardiology, etc.
 - Emergency stand-in instructor to cover for sick faculty in Fall 2017

SERVICE AND PROFESSIONAL ACTIVITIES

Professional Ethics and Integrity

Member: Committee for Student Conduct and Academic Integrity, Florida International University. Managing policies and presiding over cases related to violations of academic integrity codes at FIU. ≥2021

Conference Co-Chair: 9th International Conference on Ethics in Biology, Engineering and Medicine, Miami FL April 14th-15th 2018. Involved 2 internationally renowned keynotes, 40 accepted abstracts, 70 registrants from 4 countries, 6 sponsors, and broad representation by organizations such as the CDC and CITI program. 2018

Chair: Ethics Subcommittee for the Biomedical Engineering Society. Generated major revisions to the code of conduct for the main professional society for biomedical engineers, developed online research ethics education materials for instructors, and other similar initiatives. 2018-21

Public Engagement

Co-founder and co-chair: *Thirst for Science*, a local public outreach group holding monthly events during the academic year in popular South Miami locations where FIU scientists explain their STEM-related research in an accessible way to a general audience at bars, coffee shops, galleries, startup incubators, etc. Each event features a different scientist taking the audience through their work using a drawing easel (no slides), fielding questions, and relaxing with the attendees. <https://anil.fiu.edu/thirstforscience> ≥2018

Represented Florida International University to local business CIOs and gave lecture on artificial intelligence to highlight bridges between industry and academic activities at FIU in South Florida community. 2016

Manager: Science outreach program – high school tours of Northwestern University and Rehabilitation Institute of Chicago with educational focus on bioengineering and rehabilitative medicine research. 2009-10

Peer Review

Grant Panel Reviewer: NSF DARE program in CBET ≥2018
Reviewing Editor: Frontiers in Integrative Neuroscience 2016-19
Journal Reviewer: Nature Scientific Reports; IEEE Transactions on Biomedical Engineering; IEEE Engineering Medicine and Biology; Frontiers in Computational Neuroscience; Computer Methods and Programs in Biomedicine; Neurourology and Urodynamics; Journal of Neurophysiology; Journal of Physiology- Renal Physiology; IEEE Control Systems Society Conference ≥2011

Scientific Resources

AMEASURE method and software for long-term urodynamic analysis in rodent models 2019
https://anil.fiu.edu/wp-content/uploads/AMEASURE_Public.zip
Development of new experiment protocols: 3 FIU IACUC (animal) studies (201278, 200694, 200727) and 1 FIU IRB (human) study (105859) ≥2016
Open Source Software Packages: Code packages downloaded collectively over 26,000 times since 2009 from MATLAB file exchange open source research software for geometric analysis, network design of spiking neuron models, novel analysis techniques for urodynamics, etc. ≥2009
<https://www.mathworks.com/matlabcentral/profile/authors/1044524>

Society Memberships

Biomedical Engineering Society ≥2018
American Urological Society ≥2017
American Physiological Society 2016-19
Society for Neuroscience ≥2012

PUBLICATIONS

Peer Reviewed Journal Articles

- Geramipour A, **Danziger ZC**, Sensitivity of urethral flow-evoked voiding reflexes decline with age in the rat: insights into age-related underactive bladder. Am. J. Physiol. Renal Physiol. 318 (6):F1430-F1440, 2020
- Angoli D, Geramipour A, **Danziger ZC**, Validation of an efficient and continuous urodynamic monitoring system for awake, unrestrained, chronic rodent studies." Amer. J. Phys. Renal Phys., 318: F86-F95, 2020
- McGee MJ, Swan BC, **Danziger ZC**, Amundsen CL, Grill WM, "Multiple reflex pathways contribute to bladder activation by intraurethral stimulation in persons with spinal cord injury." Urology, 109: 210-215, 2017
- **Danziger ZC**, Grill WM, "Sensory feedback from the urethra evokes state-dependent lower urinary tract reflexes in rat." J. Physiology, 595(16): 5687-5698, 2017 – *selected as "editor's choice"*
- Cho K, Yoon D, Qiu S, **Danziger Z**, Grill WM, Wetsel WC, Ferreira PA, "Loss of Ranbp2 in motor neurons causes the disruption of nucleocytoplasmic and chemokine signaling and proteostasis of

hnRNPH3 and Mmp28, and the development of amyotrophic lateral sclerosis (ALS)-like syndromes." *Dis. Model. Mech.* 10: 559-579, 2017

- **Danziger ZC**, Grill WM, "Estimating post-void residual volume without measuring residual bladder volume during serial cystometrograms." *Amer. J. Phys. Renal Phys.*, 311(2): F459-F468, 2016
- **Danziger ZC**, Grill WM, "Sensory and circuit mechanisms mediating lower urinary tract reflexes." *Auto. Neurosci.: Basic and Clinical*, 200: 21-28, 2016
- **Danziger ZC**, Grill WM, "Dynamics of the sensory response to urethral flow over multiple time scales in rat." *J. Physiology*, 593(15): 3351-3371, 2015
- **Danziger Z**, Grill WM, "A neuron model of stochastic resonance using rectangular pulse trains." *J. Comp. Neurosci.*, 38(1): 53-66, 2015
- McGee MJ, **Danziger ZC**, Bamford JA, Grill WM, "A spinal GABAergic mechanism is necessary for bladder inhibition by pudendal afferent stimulation." *Amer. J. Phys. Renal Phys.*, 307(8): 921-930, 2014
- **Danziger Z**, "A reductionist approach to the analysis of learning in brain-computer interfaces." *Biological Cybernetics*, 108(2) 183-201, 2014
- **Danziger Z**, Mussa-Ivaldi F, "The influence of visual motion on motor learning." *J. Neuroscience*, 32(29) 9859-9869, 2012
- Mussa-Ivaldi F, Casadio M, **Danziger Z**, Mosier KM, Scheidt RA, "Sensory motor remapping of space in human-machine interfaces." *Prog. Brain Res.*, 191: 45-64, 2011
- Casadio M, Pressman A, Fishbach A, **Danziger Z**, Acosta S, Chen D, Tseng HY, Mussa-Ivaldi FA, "Functional reorganization of upper body movement after spinal cord injury." *Exp. Brain Res.*, 207(3-4): 233-247, 2010
- **Danziger Z**, Fishbach A, Mussa-Ivaldi F, "Learning algorithms for human-machine interfaces." *IEEE Trans. Biomed. Eng.*, 56(5) 1502-1511, 2009
- Mussa-Ivaldi F, **Danziger Z**, "The remapping of space in motor learning and human-machine interfaces." *J. Phys. – Paris*, 103(3-5) 263-275, 2009
- Linninger AA, Tsakiris C, Tzu DC, Xenos M, Roycewicz P, **Danziger Z**, Penn R. "Pulsatile cerebrospinal fluid dynamics in the human brain." *IEEE Trans. Biomed. Eng.* 52(4):557-65, 2005

Peer Reviewed Conference Papers

- Casadio M, Pressman A, Acosta S, **Danziger Z**, Fishbach A, Mussa-Ivaldi FA, "Body machine interface: remapping motor skills after spinal cord injury." ICORR, Zurich Switzerland, 2011
- **Danziger Z**, Mussa-Ivaldi FA, "Visuo-motor learning is guided by the Riemannian structure of the observed kinematics." *Translational and Computational Motor Control*, San Diego CA, 2010
- Casadio M, Pressman A, **Danziger Z**, Tseng HY, Fishbach A, Mussa-Ivaldi F, "Functional reorganization of upper-body movements for wheelchair control." *IEEE EMBC*, Minneapolis MN, 2009
- **Danziger Z**, Fishbach A, Mussa-Ivaldi F, "Adapting Human-Machine Interfaces to User Performance," *IEEE EMBC*, Vancouver British Columbia, Canada, 2008

Theses

- **Danziger Z**, "Human Learning and its Facilitation in Human-Machine Interfaces." For the completion of Doctor of Philosophy in Biomedical Engineering at Northwestern University, 2011
- **Danziger Z**, "Learning Algorithm for Human-Machine Interfaces." For the completion of Master of Science at Northwestern University, 2009

TALKS AND PRESENTATIONS

Invited Seminars

- University of Miami Institute of Neural Engineering – Learning and error in human-machine interfaces, October 2020
- University of Michigan Ann Arbor Department of Biomedical Engineering – Human interactions with adaptive controllers in body-machine interfaces, March 2020 (COVID-19 rescheduled)
- University of Tennessee Health Science Center Department of Pharmacy – Optimizing cystometric analysis in animal models of the urinary tract, July 2019
- Mount Sinai Medical Center Miami Beach Department of Urology – New models for invasive brain-computer interfaces, April 2019
- Mount Sinai Medical Center Miami Beach Department of Urology – The future of animal models in neurourology, July 2017

Abstract Presentations

- **Danziger ZC**, “Pairing ethical analysis with present and future stages of brain-computer interface technology”. 10th International Conference on Ethics in Biology, Engineering, and Medicine, Seattle WS, 2021
- Geramipour A, **Danziger ZC**, “Loss of urethral sensitivity leads to functional deficits in rat model: implications for age-related underactive bladder”. Society for Pelvic Research Conference, Virtual Meeting, 2020 – *selected as top 5 among all abstracts by reviewer ratings*
- Bae J, Perich MG, Miller LE, **Danziger ZC**, “Neural signal emulation for closed-loop intracortical brain computer interface decoder design”. Society for Neuroscience, Chicago IL, 2019
- Geramipour A, **Danziger ZC**, “Age-related reduction of urethra afferent sensitivity”. Society for Neuroscience, Chicago IL, 2019
- Geramipour A, **Danziger ZC**, “Age-related deficits in sensory-mediated reflex bladder control in rat”. Society for Pelvic Research Conference, New Orleans LA, 2018
- Angoli D, Geramipour A, **Danziger ZC**, “Weeks-long continuous monitoring of rodent urodynamic parameters including post void residual volumes using a novel hybrid physical-computational metabolic cage system”. Society for Pelvic Research Conference, New Orleans LA, 2018
- Geramipour A, **Danziger ZC**, “Age-related degradation of urinary tract reflexes in rat”. Society for Neuroscience Proceedings, San Diego CA, 2018
- Angoli D, Geramipour A, **Danziger ZC**, “Novel high resolution system for continuous urodynamic monitoring of bladder function in chronic rodent studies”. Society for Neuroscience Proceedings, San Diego CA, 2018
- Geramipour A, Siu R, **Danziger ZC**, “The necessity of training and collaboration in animal studies”. 9th International Conference on Ethics in Biology, Engineering, and Medicine, Miami FL, 2018
- **Danziger ZC**, Grill WM, “State dependent lower urinary tract reflexes”. Society for Neuroscience Proceedings, Washington DC, 2017
- **Danziger ZC**, Grill WM, “Novel method for non-invasive measurement of post-void residual volume in continuous animal cystometry”. Duke Multidisciplinary Benign Research Day, Durham NC, 2016
- **Danziger Z**, Grill WM, “Novel method for non-Invasive measurement of post-void residual volume in continuous animal cystometry”. Pelvic Medicine Research Consortium Multidisciplinary Benign Urology Research Day, Durham NC, 2016
- **Danziger Z**, Grill WM, “Urethral sensory neuron activation by flow: electrophysiological quantification and modeling”. Society for Neuroscience Proceedings, Chicago IL, 2015

- **Danziger Z**, Grill WM, "Characterizing and modeling sensory activity of the pudendal nerve in response to flow and pressure". Society for Neuroscience Proceedings, Washington DC, 2014
- **Danziger Z**, Grill WM, "Modulation of urethral afferent activity through minimally invasive electrical stimulation." Society for Neuroscience Proceedings, San Diego CA, 2013
- **Danziger Z**, Grill WM, "Enhancement of sensory processing in the urinary bladder." Society for Neuroscience Proceedings, New Orleans LA, 2012
- **Danziger Z**, Mussa-Ivaldi F, "Visuomotor learning is guided by the Riemannian structure of the observed kinematics." Translational and Computational Motor Control San Diego CA, 2010
- **Danziger Z**, Mussa-Ivaldi F, "The integration of multiple goals in machine learning algorithms for human-machine interfaces." Society for Neuroscience Proceedings, Chicago IL, 2009
- **Danziger Z**, Mussa-Ivaldi F, "Explicit joint angle information does not facilitate the control of a two-joint arm in a human-machine interface." Society for Neuroscience, Washington DC, 2008
- **Danziger Z**, Fishbach A, Mussa-Ivaldi F, "Learning algorithms for human-machine interfaces." Society for Neuroscience Proceedings, San Diego CA, 2007
- **Danziger Z**, Fishbach A, Mussa-Ivaldi F, "Dual learning algorithm for human-machine interfaces." Neural Control of Movement Proceedings, Barcelona Spain, 2007