Nicholas Guilbeault, Ph.D.

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Qualifications

- Pioneered and launched open-source software called BonZeb for behavioral tracking, closed-loop stimulation, and virtual reality, leading to a first-author publication and a conference presentation award
- Conceptualized novel experimental assays; integrated experimental instrumentation, *in vivo* imaging, optical stimulation, and behavioral paradigms; modelled and fabricated >30 custom 3D printed parts and laser cut parts, enabling the lab of a junior professor to rapidly prototype experiments and collect high-quality data
- Built novel data analysis pipelines and improved existing pipelines for processing diverse datasets
- Collaborated and contributed to international research spanning Canada, USA, and Germany; engineered a semi-autonomous, underwater, robotic, imaging system for studying natural scene statistics of aquatic environments; made rapid, significant improvements to field data acquisition protocol increasing data throughput and maximizing time and resource utility
- 7+ years of software development; proficient in Python, Bonsai, C#/.NET, ReactiveX, GLSL, and Git
- 8+ years of data analysis; expertise in neurobiology, microscopy, optogenetics, and behavior
- Received >$100,000 in awards, scholarships, bursaries, and prizes for research and achievements
- Exceptional analytic, mentoring, and communication skills evidenced by strong record of publications, presentations, awards, and teaching experience

Education

Ph.D., Department of Cell and Systems Biology *University of Toronto, Canada* 09/2016 – Present

- Dissertation title: Developing tools for characterizing neural circuit function and sensorimotor behavior of larval zebrafish (*Danio rerio*) and African cichlids (*Astatotilapia burtoni*)
- Natural Sciences and Engineering Research Council of Canada (NSERC) Fellowship
- Transferred from M.Sc. program in 06/2018
- GPA: 4.0 / 4.0

B.Sc. (Honours), Behavior Cognition and Neuroscience *University of Windsor, Canada* 09/2012 – 06/2016

- Thesis Title: A longitudinal study of spatial and nonspatial working memory in mice
- Dean's Honours List (2012 – 2016)
- GPA: 3.8 / 4.0

Experience

Graduate Student Researcher *Thiele Lab, University of Toronto Scarborough* 09/2016 – Present

- Conceptualized, developed, and published open-source software called BonZeb for high-resolution behavioral tracking, closed-loop stimulation, and analysis
- Constructed assays for *in vivo* calcium imaging using two-photon and confocal microscopy, optogenetic stimulation, laser ablations, classical/operant conditioning paradigms with automated feeders and electrical stimulation; designed >10 3D models in Blender and fabricated >30 custom 3D printed, and laser cut parts
- Collaborated with labs in Canada, USA, and Germany; engineered a semi-autonomous, locomotive, robotic imaging platform; rapidly enhanced data acquisition protocol increasing data throughput by 30%
- Built applications for processing large, diverse datasets of calcium imaging and behavior using image processing, supervised and unsupervised classification, dimensionality reduction, statistical analyses, modelling, and data visualization; reduced behavioral and calcium imaging data processing time in half
- Supervised and mentored 5 undergraduate students; guided students to generate independent research projects and facilitated successful completion of honor's thesis

Teaching Assistant and Project Supervisor *Neuromatch Academy* 07/2020, 07/2021

- Collaborated and generated standardized Google Colab notebook for EEG/EMG/ECoG signal processing; implemented band pass filtering, power spectral analysis, time-frequency decomposition, and visualization
- Executed hands-on Python tutorials to groups of 15 junior faculty, post-docs, and graduate students; programmed reinforcement learning, single-neuron leaky integrate-and-fire models, logistic regression, bayes inferencing, statistical modelling, principal component analysis, supervised and unsupervised classification, and processing local field potential/neurophysiological data

Research Technician *Koyama Lab, University of Toronto Scarborough* 01/2021 – 04/2021

- Prepared chemical solutions; performed transgene induction protocols
- Screened transgenic animals using epifluorescent microscopy; conducted zebrafish husbandry

Course Instructor *CAJAL Advanced Neuroscience Training Program* 01/2021

- Organized, curated, and delivered course content material on Bonsai; developed visual reactive programming exercises on image processing, data analysis, signal processing and microcontroller interfacing
- Lectured to audience of >40 junior faculty, post-docs, and graduate students on behavioral tracking, closed-loop visual stimulation, and behavioral analysis with BonZeb

Publications

Guilbeault, N. C., Guerguiev, J., Martin, M., Tate, I., & Thiele, T. R. (2021). BonZeb: Open-source, modular software tools for high-resolution zebrafish tracking and analysis. *Scientific Reports*, *11*, 1-21. doi: https://doi.org/10.1038/s41598-021-85896-x

Muthukumaran, K., Kanwar, A., Vegh, C., Marginean, A., Elliot, A., **Guilbeault, N.**, …, & Pandey, S. (2018). Ubisol-Q10 (a nanomicellar water-soluble formulation of CoQ10) treatment inhibits Alzheimer-type behavioral and pathological symptoms in a double transgenic mouse (TgAPEswe, PSEN1dE9) model of Alzheimer's disease. *Journal of Alzheimer's Disease*, *61*, 221-236. doi: https://doi.org/10.3233/JAD-170275

Awards

Alexander Graham Bell Postgraduate Scholarships Doctoral Award – $63,000 09/2018 – 08/2021
Natural Sciences and Engineering Research Council of Canada (NSERC)

Vietnamese-Canadian Community Graduate Award In Zoology – $600 01/2021
Faculty of Arts & Science, University of Toronto

Best Poster Presentation Award – $100 04/2019
Interdisciplinary Graduate Research & Discovery (IGRAD) Conference

Yoshio Masui Prize in Developmental, Molecular, or Cellular Biology – $2,300 12/2018
Faculty of Arts & Science, University of Toronto

Conference Presentations (* = presenter)

Cai, L., Alexander, E., Hladnik, T., …, **Guilbeault, N.,** … & Thiele, T.* (2021, July). Investigation of visual circuit adaptations to natural environmental motion in zebrafish and African cichlids. Poster presented at the Human Frontiers Science Program Awardees Meeting, virtual.

Guilbeault, N.*, Guerguiev, J., Martin, M., Tate, I., & Thiele, T. (2021, July). BonZeb: Open-source, modular software tools for high-resolution zebrafish tracking and analysis. Poster presented at the Human Frontiers Science Program Awardees Meeting, virtual.

Westbrook, M., Steighner, J., Sweatt, G., **Guilbeault, N.**, Krishna, V., Thiele, T., & Juntti, S.* (2021, July). Do you see what I see? Developing transgenic tools in cichlid fish to quantify neural activation and visually guided behaviors. Poster presented at the Human Frontiers Science Program Awardees Meeting, virtual.

Ansari, R.*, Faour, S., **Guilbeault, N.**, Frankland, P., & Thiele, T. (2021, June). Investigating the mechanisms of neurogenesis-based forgetting using zebrafish. Poster presented at the 16th International Zebrafish Conference, virtual.