

Tyler Bradshaw, PhD

MOLECULAR, CELLULAR, AND COMPUTATIONAL BIOLOGIST

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Summary

I am a diligent and driven computational and molecular biologist. In my PhD work, I combined cutting-edge spatial and proximity proteomics tools to solve problems in molecular neuroscience. My interdisciplinary expertise spans molecular biology approaches and computational analysis! I am a self-taught programmer and data scientist, and have pioneered novel computational pipelines and molecular techniques in numerous projects aimed at understanding the organization of the neuronal proteome and its dysregulation in disease. I am interested in a career where I can continue to draw together ideas and approaches spread across the fields of cell biology and computer science.

Work Experience

Graduate Research Assistant

Fall 2016 - May 2021

SODERLING LABORATORY, DUKE UNIVERSITY

Department of Neurobiology

- Developed a novel spatial proteomics analysis pipeline for clustering and statistical inference in spatial proteomics, published in *eLife*.
- Applied and developed CRISPR-based methods for genetic depletion and tagging of endogenous proteins—work which lead to founding of CasTag BioSciences.
- Performed synaptosome subcellular fractionation to assess synaptic protein changes in multiple mouse models of human brain disorders.
- Designed peptide libraries for multiple-reaction monitoring targeted proteomics.
- Experience working with numerous model organisms including immortalized cell lines, bacteria, yeast, and mice.
- Applied and analyzed BiоЛD-based proximity proteomics for identification of subcellular specific compartments.
- Normalization and analysis of RNA transcriptomics and protein proteomics datasets.
- Design and troubleshooting of molecular biology and computational approaches.
- Awarded the Ruth L. Kirschstein National Research Service Award Fellowship to study a protein of unknown function and the mechanisms by which its loss causes a rare epilepsy disorder.

Research Technician

May 2014 - May 2016

SODERLING LABORATORY, DUKE UNIVERSITY

Department of Cell Biology

- Performed protein co-immunoprecipitation and proximity proteomics for identification of protein-protein interactions and revealing protein interactomes *in vivo*—my work was a part of the first application of BiоЛD *in vivo*, published in the journal *Science*.
- Performed immunoblotting, immunostaining, and cell and tissue culture for assessing protein expression and localization *in vitro* and *in vivo*.
- Molecular cloning and generation of adeno-associated virus for transgene expression *in vivo*.
- Maintained mouse colony with >30 strains of mice; performed mouse surgery, husbandry, genotyping, and analysis of mouse behavior.

Skills

Computational Biology

- Linear models and linear mixed-models in R
- Clustering and visualization of protein networks in R and Python
- Analysis of biological network organization and function
- DevOps toolchain: Windows, Linux, Tmux, Vim, LaTeX, R, Python, Julia, Cytoscape, Adobe Illustrator, PowerPoint
- Molecular cloning and plasmid design
- Molecular biology using immortalized human cell lines, *E. coli*, and yeast
- Protein purification, co-immunoprecipitation and immunoblotting
- Production of adeno associated virus and stereotaxic injection into mouse brain tissue
- Subcellular fractionation and tandem mass tag multiplex proteomics
- Histology, immunohistochemistry, and quantitative fluorescent microscopy
- Adherent cell culture and transfection

Molecular Biology

Education

Duke University, Department of Neurobiology

Durham, NC

DOCTOR OF PHILOSOPHY - NEUROBIOLOGY

Fall 2016 - May 2021

- Dissertation: *Statistical Inference and Community Detection in Proximity and Spatial Proteomics*; my thesis work establishes a framework for the analysis of proximity and spatial proteomics, extending protein-level inference in spatial proteomics to the level of protein-groups or modules and generates hypotheses that identify foci of biological function and dysfunction which may underlie the neuropathology of disease.

University of Washington

Seattle, Washington

BACHELOR OF SCIENCE - MOLECULAR, CELLULAR AND DEVELOPMENTAL BIOLOGY

Fall 2010 - Spring 2014

- My undergraduate research focused on the pathobiological mechanisms of type I and type II diabetes. In the the Surgical Outcomes Research Center, I worked with Ossabaw pigs to study mechanisms of weight-loss following bariatric surgery. In the Bornfeldt lab, I performed some of my first molecular biology experiments aimed at studying mechanisms of type I diabetes accelerated atherosclerosis.

Honors & Awards

2018-2021 **Ruth L. Kirschstein National Research Service Award**, NIH NRSA 5F31NS113738-03

Duke University

Epilepsy, the condition of spontaneous recurrent seizures, is a devastating neurological disorder. Rare genetic mutations provide unique opportunities to understand the molecular mechanisms that drive susceptibility to seizures and epilepsy. This work studied a human epilepsy candidate gene towards generating a deeper understanding of the molecular mechanisms underlying epilepsy.

Presentations

Statistical inference and community detection in proximity and spatial proteomics: resolving organization of the neuronal proteome

Department of Neurobiology

DISSERTATION PRESENTATION

March 22nd, 2021

- Dissertation seminar given to Duke faculty and students

Evaluating changes in the synaptic protein architecture in mouse autism disorders

Neurobiology Retreat

POSTER PRESENTATION

November 2018

- Research poster presentation

Seizures and Ube3a synergistically impair a sociability circuit in a mouse model of autism

Department of Neurobiology, Duke University

STUDENT SEMINAR PRESENTATION

2018

- Presentation to Duke Neurobiology faculty and students

A Targeted-Proteomics Approach to Interrogate the Synaptopathology Underlying Monogenic Autism Spectrum Disorders

Neurobiology Retreat, Wrightsville Beach, NC

POSTER PRESENTATION

2017

- Presentation to Duke Neurobiology faculty and students

Development of a Targeted-Proteomics Approach to Identify Underlying Mechanisms of Synaptic Pathologies

The Society for Neuroscience, San Diego, CA

POSTER PRESENTATION

2017

- Presentation to Duke Neurobiology faculty and students

Unraveling the Molecular Mechanisms of Inhibitory Synaptic Function in vivo

Cell Biology Retreat, Beaufort, NC

POSTER PRESENTATION

2015

- Presentation to Duke Neurobiology faculty and students

Exploring diabetes-derived intestinal changes that promote atherosclerosis

Bornfeldt Laboratory, University of Washington, Seattle WA

HONORS RESEARCH MANUSCRIPT

2014

- Presentation to SOURCE faculty and students

Obesity, Insulin Resistance, and Type 2 Diabetes in Ossabaw Swine

Surgical Outcome Research Center, Seattle WA

PRESENTATION

2013

- Presentation to SOURCE faculty and students

Publications

Courtland and Bradshaw et al., (2021)

eLife

CONTRIBUTIONS: CONCEPTUALIZATION, SOFTWARE DEVELOPMENT, ANALYSIS, VISUALIZATION, WRITING

2021

- *Genetic Disruption of WASHC4 Drives Endo-lysosomal Dysfunction and Cognitive-Movement Impairments in Mice and Human.* Jamie Courtland, Tyler Bradshaw, Greg Waitt, Erik Soderblom, Tricia Ho, Anna Rajab, Ricardo Vancini, Il Hwan Kim, Scott Soderling. *eLife* 2021 March 22; 10:e61590 doi: 10.7554/eLife.61590.

Uezu et al., (2019)

eLife

CONTRIBUTIONS: CONCEPTUALIZATION, WRITING - REVIEW AND EDITING

2019

- *Essential role for InSyn1 in dystroglycan complex integrity and cognitive behaviors in mice.* Akiyoshi Uezu, Erin Hisey, Yoshihiko Kobayashi, Yudong Gao, Tyler Bradshaw, Patrick Devlin, Ramona Rodriguez, Purushothama Rao Tata, and Scott Soderling. *eLife* 2019 Dec 12;8:e50712. doi: 10.7554/eLife.50712.

Gao et al., (2018)

Neuron

CONTRIBUTIONS: INVESTIGATION, METHOD DEVELOPMENT, WRITING - REVIEW AND EDITING

2018

- *Plug-and-Play Protein Modification Using Homology-Independent Universal Genome Engineering.* Yudong Gao, Erin Hisey, Tyler Bradshaw, Eda Erata, Walter E. Brown, Jamie L. Courtland, Akiyoshi Uezu, Yu Xiang, Yarui Diao, and Scott H. Soderling. *Neuron* 2018 July 1; S0896-6273(19)30523-9. doi: 10.1016/j.neuron.2019.05.047.

- *Identification of an Elaborate Complex Mediating Postsynaptic Inhibition.* Akiyoshi Uezu, Daniel J. Kanak, **Tyler Bradshaw**, Erik J. Soderblom, Christina M. Catavero, Alain C. Burette, Richard J. Weinberg, and Scott H. Soderling. [Science](#) 2016 Sep 9; 353(6304): 1123–1129. doi: 10.1126/science.aag0821