CLAYTON DUNFORD

Department of Cell Biology and Physiology · Neuroscience Center
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EDUCATION

Brigham Young University Expected May 2027
Bachelor of Science, Bioinformatics; Minor, Computer Science — Provo, Utah
Cumulative GPA: 3.97 / 4.00

RESEARCH EXPERIENCE

Parrish Laboratory, Brigham Young University July 2025 – Present
Undergraduate Research Assistant (July 2025 – Present); Programming Team Lead (January 2026 – Present)
Department of Cell Biology and Physiology / Neuroscience Center · Principal Investigator: R. Ryley Parrish, PhD

- Investigate spreading depolarization (SD) using optogenetic and electrophysiological models, including a halorhodopsin-based induction paradigm that triggers SD while neurons are hyperpolarized and extracellular potassium is below baseline.
- Established the laboratory's intrinsic optical signal imaging (IOSI) capability for SD, co-developing the imaging protocol and authoring the analysis software, enabling quantification of propagation speed, area recruited, and time to return to baseline reflectance.
- **Sole developer of Swell**, an open-source desktop application for the detection, segmentation, and quantification of SD from IOSI recordings. Built in Python using the Segment Anything Model 2.1 as its segmentation engine; validated against direct-current electrophysiology and expert manual annotation. Released under a BSD 3-Clause license; version 0.3.7 archived at Zenodo (doi:10.5281/zenodo.22033534).
- Developed a MATLAB graphical interface for visualizing SUIT-protocol results from Oroboros O2k high-resolution respirometry (July – September 2025).
- Prepared scientific figures for NIH R01, McKnight Foundation, and Department of Defense grant proposals.
- Lead a team of three undergraduate programmers, with responsibility for onboarding, project organization, and weekly individual progress meetings.

Ridge Laboratory, Brigham Young University April 2026 – Present
Undergraduate Research Assistant; Project Lead
Department of Biology · Principal Investigator: Perry Ridge, PhD

- Lead a project estimating autosomal SNP heritability of late-onset Alzheimer's disease using Alzheimer's Disease Sequencing Project (ADSP) R5 whole-genome sequencing data.
- Built and executed a GCTA-GREML analysis pipeline on the BYU Office of Research Computing cluster, spanning approximately 14,900 European-ancestry participants and 7 million biallelic SNPs, including relatedness estimation, reference-based ancestry confirmation, principal-component analysis, sample and variant quality control, and variance partitioning of the APOE region and other established Alzheimer's disease loci.
- Authored the project's technical and scientific handoff documentation to support reproducibility and independent audit. Manuscript in preparation (first author).

PUBLICATIONS

Under Review

Dunford C, Withers PC, Nevers DS, Shafer TL, Parrish RR. Swell application reveals and quantifies wavefront propagation of halorhodopsin-induced spreading depolarization. *The Journal of Headache and Pain*. Submitted August 2026; currently under peer review.

Preprint

Ricks R, Nevers DS, Poulos T, Shafer TL, **Dunford C**, Reynolds PR, Bikman BT, Parrish RR. β-Hydroxybutyrate maintains energetically demanding neural functions during glucose deprivation. *bioRxiv*. Posted 11 June 2026. doi:10.64898/2026.06.07.730699

In Preparation

Dunford C, et al. SNP heritability of late-onset Alzheimer's disease in ADSP R5 whole-genome sequencing data. (First author.)

Characterization of spreading depolarization across ketogenic bath conditions. (Contributing author.)

GRANTS AND AWARDS

College Undergraduate Research Award (CURA) 2025
BYU College of Life Sciences · $4,000 · Student Principal Investigator
Development of a Computational Tool to Image and Study the Propagation Dynamics of Halorhodopsin Induced Spreading Depolarization. Faculty mentor: R. Ryley Parrish, PhD.

Heritage Scholarship (full tuition), Brigham Young University 2022–2023, 2025–2027

Dean's List, Brigham Young University Fall 2025, Winter 2026

TECHNICAL SKILLS

Programming: Python, MATLAB, R, C++, Java, JavaScript, Bash, SQL

Scientific Computing: NumPy, SciPy, PyTorch, machine learning, Docker, Git, SLURM high-performance computing

Statistical Genetics: GCTA, PLINK2, KING, PC-AiR / PC-Relate, GrafAnc, SKAT

Imaging and Analysis: Intrinsic optical signal imaging; image segmentation (Segment Anything Model 2.1); desktop application development; nonparametric statistics and cluster-bootstrap methods

Scientific Communication: Adobe Illustrator, Adobe Creative Suite, BioRender; figure preparation for manuscripts and grant proposals

ADDITIONAL EXPERIENCE

The Church of Jesus Christ of Latter-day Saints June 2023 – May 2025
Full-Time Volunteer Representative — London, England
Two-year leave of absence from undergraduate study.