

ZACHARY COLBURN

Cell/Molecular Biology | Biostatistics | Machine Learning

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Productive Ph.D. Scientist, eager to tackle challenges that push technical and computational limits. At ease in wet and dry lab environments. Biological expertise in epithelial and cancer cell biology. Analytic expertise in image quantification, biostatistics, mathematical modeling, and machine learning. Proven teacher and mentor. Experience in assay development, software development, and scientific writing. Broad skill set, focused on far-reaching, impactful results.

UNIVERSITY EDUCATION - Ph.D., M.S., B.S., B.S., B.S.

Ph.D., Molecular Biology | 2018 | Washington State University, Pullman, Washington

M.S., Data Analytics | 2018 | Western Governors University, Salt Lake City, Utah (online program)

B.S., Biochemistry / B.S., Neuroscience / B.S., Biology | 2013 | Washington State University, Pullman, Washington

ADDITIONAL CERTIFIED EDUCATION

- **Deep Learning Specialization** (5 courses) | DeepLearning.AI/Coursera
- **Machine Learning Specialization** (4 courses) | University of Washington/Coursera
- **General Machine Learning** (1 course) | Stanford/Coursera
- **Data Analyst Nanodegree** (7 courses) | Udacity
- **Genomic Data Science** (8 courses) | Johns Hopkins/Coursera
- **Data Science Specialization** (10 courses) | Johns Hopkins/Coursera
- **Mastering Software Development in R** (4 courses) | Johns Hopkins/Coursera
- **Android App Development** (4 courses) | Vanderbilt University/Coursera
- **Front End Web Development Certification** | Free Code Camp

PROFESSIONAL CERTIFICATIONS

- **Oracle SQL** (1Z0-071), Oracle | 2018
- **Base SAS** (A00-211), SAS | 2018
- **Statistical Business Analyst** (A00-240), SAS | 2018

EXPERIENCE

Bioinformatics Ambassador, Summer Training Program | Pine Biotech & Louisiana State University | 2018 – Present

- Provided feedback on courses and suggested improvements

Graduate Research Assistant, Laboratory of Dr. Jonathan Jones | Washington State University | 2014 – Present

- Cut analysis times for still and time-lapse microscopy analyses (> 100x).
- Created software and performed simulations to analyze structured and unstructured data sets.
- Trained graduate students and faculty on instruments and software.
- Created and provided guidance on the development of analytic pipelines.
- Super Resolution Microscopy (SIM, iPALM) training at the Howard Hughes Medical Institute (Ashburn, Virginia) (4 weeks total)

Graduate Teaching Assistant, Microbiology/Molecular Biology Lab, | Washington State University | 2016 – 2018

- Created a web app to automatically deliver students real-time feedback on their lab reports.
- Prepared labs, lectured, graded lab reports and notebooks.

Mathematical Biology Researcher, Laboratory of Dr. Mark Dybdahl | Washington State University | 2010-13

- Identified the evolutionary endpoints of a host-parasite relationship by mathematically modeling co-evolution and ecology.

Co-founder and VP of the Washington State University Biotechnology Club | 2010-13

- Arranged meetings and recruited speakers.

PUBLICATIONS

- **Complexes of $\alpha684$ Integrin and Vimentin Signal to Regulate Cell Migration.** *J Cell Sci.* Colburn, Z.T. and Jones, J.C.R. (2018).
- **(Submitted) Integrin activation by the lipid molecule 25-hydroxycholesterol induces a proinflammatory response.** Pokharel, S., Shil, N., Jeevan, G.C., Colburn, Z.T., Tsai, S., Segovia, J., Chang, T., Natesan, S., Jones, J.C.R., and Bose, S.
- **$\alpha684$ Integrin Regulates the Collective Migration of Epithelial Cells.** *Am J Respir Cell Mol Biol* 56(4), 443-452. Colburn, Z.T. and Jones, J.C.R. (2017).
- **A Hemidesmosomal Protein Regulates Actin Dynamics and Traction Forces in Motile Keratinocytes.** *FASEB J.* 30(6), 2298-2310. Hiroyasu, S., Colburn, Z.T., and Jones, J.C.R. (2016).
- **Focusing Super Resolution on the Cytoskeleton.** *F1000. 5, 998.* Shelden, E.A., Colburn, Z.T., and Jones, J.C.R. (2016).
- **Biomolecules and Implant Materials.** Reference Module in Materials Science and Materials Engineering. *Elsevier.* Jones, J.C.R. and Colburn, Z.T. (2016).
- **Alpha Actinin-1 Regulates Cell-Matrix Adhesion Organization in Keratinocytes: Consequences for Skin Cell Motility.** *J. Invest. Dermatol.* 135, 1043–1052. Hamill, K.J., Hiroyasu, S., Colburn, Z.T., Ventrella, R.V., Hopkinson, S.B., Skalli, O., Jones, J.C.R. (2015).

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SKILLS

Cell/Molecular Biology

- **Protein Analyses:** Western blotting, Immunoprecipitation, Flow cytometry, ELISA.
- **Microscopy Techniques:** Live fluorescent imaging, Confocal, TIRF, SIM, PALM, Cell motility assays, Scratch assays.
- **Microscopy Analyses:** Particle tracking, Image segmentation, Colocalization, PALM localization clustering.
- **Genetic Analyses:** PCR, qPCR, RNA-Seq. Familiar with edgeR, DESeq2, Seurat.
- **Cell culture:** Mammalian cell culture, Transfection, Lentiviral/Adenoviral infection.

Analytical

- **Classification/Regression:** K-means, Decision trees, Logistic regression, Linear regression, Neural/Convolutional networks.
- **Literate Programming:** R markdown, Jupyter/IPython notebooks.
- **Modeling:** Agent-based models, Monte Carlo simulations.

Programming

- **Languages:** R (expert), Python, SQL, SAS, Bash, Java, HTML, CSS, JavaScript, C++ (beginner).
- **Machine Learning:** caret, Keras.
- **Data Visualization:** ggplot2, Plotly, Tableau.

HONORS, AWARDS, & ASSOCIATIONS

Graduate: *Machine Learning Excellence Award*, 2017 | *Poncin Fellowship* (\$25,000, awarded twice), 2015/16 | *Visiting Researcher*, *Howard Hughes Medical Institute*, 2016/17 | *Dr. Bruce Gibbins Travel Fellowship* (\$1,000), 2016 | *Stephan Fodor and Janelle Benoit Fellowship*, 2015/16

Undergraduate: Co-founder WSU Biotechnology Club | Graduation from WSU's Honors College | WA State Opportunity Scholarship | Honors College's Johnson Scholarship | Leo McMillan Research Scholarship | School of Biological Sciences Research Grant | College of Sciences Mini-grant | Academic Achievement Award (twice) | Glenn Terrell Presidential Scholarship (twice) | Undergraduate Biology and Mathematics Scholarship (twice) | Outstanding Freshman Scholar

Associations: *CompTIA Association for Information Technology Professionals (AITP)*, 2018 – Present | *Healthcare Information and Management Systems Society (HIMSS)*, 2018 – Present | *American Chemical Society (ACS)*, 2016 – Present | *American Association for the Advancement of Sciences (AAAS)*, 2016 – Present | *Phi Beta Kappa National Academic Honor Society (PBK)*, 2011 – Present

SELECTED PROJECTS (MOST AVAILABLE ON GITHUB)

R

Prediction of breast cancer progression, *Machine Learning (in progress)*. | 2018 | Identified proteins differentially expressed between breast cancer stages using proteomic data. Developed a machine learning model to predict breast cancer stage.

SimplifyStats, *R package, CRAN*. | 2018 | Created a set of functions that generate an exhaustive set of descriptive statistics and perform pairwise hypothesis tests for all unique combinations of any number of grouping variables.

Fibroblast differentiation mapping, *R project, manuscript in preparation*. | 2018 | Identified genes driving fibroblast differentiation by performing diffusion mapping on single cell RNA-Seq data; created high quality visualizations, including interactive 3D graphics.

Bioi (Biological Image Analysis), *R package, CRAN*. | 2017 | Cut PALM localization clustering time by +10,000x compared to naive method; implemented type checking, unit testing, and continuous integration for R and C++ functions.

evolution (evolution modeling), *R package*. | 2017 | Created a framework for simulating the evolution of specific gene sequences under different conditions using a Monte Carlo-based approach.

Lab Report Corrector, *R Shiny Web App*. | 2017 | Automatically delivered real-time feedback to students on their lab reports. Regularly utilized by at least 20% of my students.

Python

Agent-based model of wound healing, *Python*. | 2018 | Created a mathematical model to simulate wound healing and compared populations composed of cells with varying phenotypes.

Computer vision of phase microscopy, *Python*. | 2018 | Created a computer vision model, implementing convolutional networks, using Keras to identify the location of the wound boundary in phase microscopy images of scratch wounds.

Java

Programming News, *Android App*. | 2017 | Fetched articles from RSS feeds; persistently stored references to them in a SQLite database; enabled users to *favorite* articles and store them for later reading.

LANGUAGES

Native *English*; advanced *Spanish*; beginner *French*.