Lauren **Corbin Goodman, PhD**

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Experienced biophysical modeler skilled in utilizing simulation, signal processing, and machine learning techniques to rapidly prototype and implement algorithms from literature across the nanoscopic to macroscopic scale.

Skills

Programming Languages

- **Python:** Proficient in machine learning (Scikit-Learn, PyTorch, TensorFlow), data analysis and visualization (Pandas, NumPy, Matplotlib, Seaborn), generative art (Stable Diffusion, DALL-E, DreamBooth), scientific computing (SciPy, Numba), and GUI development (Tkinter).
- **MATLAB:** Proficient in signal processing, deterministic and stochastic molecular modeling, unit testing, and app development.
- **R:** Proficient in organizing and analyzing data and preparing figures with Tidyverse packages.
- **C:** Proficient in deterministic and stochastic modeling. Familiar with parallel computing with OpenMP and MPI.
- **Bash, Mathematica, Latex:** Proficient.

Software

- **Imaging and Visualization:** ImageJ/FIJI, LAS X, Huygens Deconvolution, InkScape, PyMol.
- **Computational Tools:** OpenSim, version control (git), ssh, Linux, Mac, Slurm, JupyterLab.

Computational Techniques

- **Simulation Techniques:** Stochastic models (Monte Carlo, Gillespie algorithm, Brownian dynamics), deterministic models (PDEs, ODEs).
- **Signal Processing:** Fourier transforms, wavelet analysis, image processing, filtering, noise reduction, computer vision.
- **Machine Learning:** Deep learning, neural networks, decision trees, random forests, support vector machines, k-nearest neighbors, ensemble models, supervised learning.
- **Data Analysis:** Data preprocessing, wrangling, and interpretation, high-dimensional parameter optimization, feature extraction, time series analysis, experimentation.

Wet Lab

- **Biochemistry:** Protein purification, assembly and activity assay design, EM and fluorescent protein tag design, crystallography screens, DNA extraction and manipulation, buffer and media preparation.
- **Imaging:** Stimulated emission depletion (STED) microscopy, scanning confocal microscopy, epifluorescence microscopy, transmission electron microscopy, image processing.
- **Cell Biology:** Mammalian and bacterial cell culture, fixation, flow cytometry, plasmid design, experimental design.

Other

- Communication, problem-solving, collaboration, customer service, thought leader, educator, detail oriented, translate complex analytical techniques.

Experience

Data Scientist   Aug. 2022 - Mar. 2023

Edge Analytics   San Francisco, CA

- Employed edge computing to process large quantities of structured and unstructured data to enable data driven insights.
- Routinely presented to leadership and organized summary reports for both internal and external customers leveraging data visualization to articulate complex data science in a meaning and concise way.
- Examples of specific projects:
  - Improved wearable device's activity and walking speed detection from IMU data for client specific sensor configuration.
  - Developed a wavelet transform-based solution to detect muscle firing from surface EMG signals, achieving significant accuracy improvements with minimal latency.
  - Leveraged OpenSim to simulate FES stimulation on the leg, utilizing IMU data to estimate the required stimulation.
  - Developed method to fine-tune Stable Diffusion model to generate customized artwork of two subjects specified by user-provided images.

Kinetic Modeling Consultant

Feb. 2022 - Aug. 2022

Lab of Prof. Harold Erickson, Duke University School of Medicine

Durham, NC

- Developed custom Python software to simulate binding, unbinding and rebinding of engineered antibodies to spike protein with 3D stochastic Brownian Dynamics model.
- Calculated the probability density function of the distance between linked antibody fragments with worm-like chain model.

Graduate Student Researcher

Jan. 2016 - Feb. 2022

Lab of Prof. Harold Erickson, Duke University School of Medicine

Durham, NC

Computational:

- Developed stochastic model with Gillespie algorithm in MATLAB to explain FtsZ treadmilling, GTP hydrolysis and nucleation.
- Designed custom image processing algorithm in Python to measure cell length and width from STED microscopy images.
- Utilized image analytics and processing techniques in MATLAB to digitize results from historic biochemistry publications.
- Created publication-quality figures with R and scientific illustrations with Inkscape for presentations.

Cell Biology/Biochemistry:

- Developed fluorescence and absorbance assays to study enzymatic activity and protein polymer assembly
- Validated protein polymer assembly using transmission electron microscopy (TEM)
- Expressed and purified cell division proteins using BL21 E. coli and HPLC
- Collaborated with researchers to determine crystal structure of FtsZ protein
- Characterized *E. coli* septation in the sudden loss of cytoskeletal protein FtsZ with epifluorescence light microscopy, STED microscopy, confocal microscopy, and flow cytometry.

Lab Maintenance:

- Procured lab supplies, managed chemical inventory, and coordinated equipment maintenance and repairs.
- Trained new lab members in light microscopy, TEM, and biochemistry techniques.
- Contributed to grant applications and provided peer review for publications.
- Coordinated with lab mates and safety office to determine procedures for hazardous chemicals.
- Prepared lab for annual safety audit and scheduled waste removal.

Signals and Systems Teaching Assistant

Aug. 2018 - Dec. 2018

Biomedical Engineering Department, Duke University

Durham, NC

- Mentored undergraduate students via weekly recitation and tutoring sessions.
- Facilitated online collaboration about course material.
- Coached students through labs for image processing, sound processing and basic pharmacology.
- Utilized online tools to graded student work.

Ordinary and Partial Differential Equations Teaching Assistant

July 2018 - Aug. 2018

Math Department, Duke University

San Jose, Costa Rica

- Reviewed challenging concepts with students after lectures.
- Graded daily homeworks.
- Developed an end-of-semester modeling project on swinging bridge dynamics.

Student Researcher

Aug. 2013 - May 2015

Lab of Prof. Gregory Haenel, Elon University Biology Department

Elon, NC

- Conducted independent, faculty mentored, two-year thesis research on the frequency of genetic resistance mechanisms of *Myzus persicae* as a real-time model of evolution.
- Extracted DNA from *M. persicae* lines and utilized PCR techniques to amplify GABA receptor subunit and acetylcholinesterase genes.
- Analyzed populations for insecticide resistance alleles with direct DNA sequencing and restriction fragment length polymorphism (RFLP) techniques.
- Wrote literature review on diverse biochemical mechanisms of insecticide resistance in crop populations of aphids.

Student Researcher
May 2014 - Aug. 2014

Lab of Prof. Nenad Bursac, Duke University Biomedical Engineering Department

Durham, NC

- Designed and constructed plasmids containing various isoforms of mammalian and bacterial voltage-gated sodium channels to transfect into HEK-293 cells for electrophysiological assessments.
- Performed lentiviral transduction of ion channel genes into embryonic fibroblast (MEF) cells and selected monoclonal lines to be analyzed for electrical properties.
- Characterized ion channel expression and trafficking in mammalian cells with immunostaining and fluorescence imaging techniques.
- Maintained mammalian cell lines and prepared necessary media for HEK-293 and MEF cells.

Education

PhD, Biomedical Engineering
Aug. 2015 - May 2022

Duke University

Durham, NC

- **Advisor:** Harold Erickson
- **Dissertation:** FtsZ assembly dynamics - Treadmilling, nucleation and membrane constriction

BS, Biology
Aug. 2011 - May 2015

Elon University

Elon, NC

- **Minors:** Mathematics, Environmental Studies
- **Awards & Achievements:** Presidential Scholarship, Honors Fellow, President's List, Dean's List
- **Honor's Thesis:** Molecular mechanisms of insecticide resistance in Myzus persicae.

Publications

Erickson HP, **Corbin Goodman L**. 2023. Recently designed multivalent spike binders cannot bind multivalently-How do they achieve enhanced avidity to SARS-CoV-2? Biochemistry. 62(2):163-168.

Corbin Goodman LC, Erickson HP. 2022. FtsZ at mid-cell is essential in Escherichia coli until the late stage of constriction. Microbiology. 168(6).

Corbin LC, Erickson HP. 2020. A Unified Model for Treadmilling and Nucleation of Single-Stranded FtsZ Protofilaments. Biophysical Journal. 119(4):792-805.

Schumacher MA, Ohashi T, **Corbin LC**, Erickson HP. 2020. High-resolution crystal structures of Escherichia coli FtsZ bound to GDP and GTP. Acta Cryst. F. 76:94-102.

Corbin LC. 2015. Molecular mechanisms of insecticide resistance in Myzus persicae. Honors Thesis. Elon University.

Talks

Triangle Cytoskeltal Meeting
Sep. 2018

Modeling directional treadmilling of bacterial cell division protein FtsZ

Saxapahaw, NC

Gordon Research Conference on Plant and Microbial Cytoskeleton
Nov. 2017

Monte Carlo model for FtsZ treadmilling

Andover, NH

National Conference of Undergraduate Research
April 2015

Molecular mechanisms of insecticide resistance in *Myzus persicae*

Spokane, WA

Select Course Work

Computational	Parallel Computing, Signals and Systems, Quantitative Approach to Biological Problems, Signals and Systems
Math	Calculus through Differential Equations, Mathematical Modeling, Advanced Probability Theory and Statistics, Experimental Design and Statistics
Chemistry	General Chemistry I and II, Organic Chemistry I and II, Biochemistry, Structure of Biological Macromolecules
Biology	Advanced Genetics, Human Genetics, Genetic Solutions to Biological Problems, Gene Circuits, Biotechnology, Cellular and Molecular Biology