William Chase

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Executive Summary

- Microbiologist and bioinformatician with 5 years of independent research experience with strong computational skills, extensive wet lab experience, excellent communication skills, and a collaborative mindset
- Fluent in R; expert in many bioinformatics and computational methods including: phylogenetics of complex gene families, computational modeling of proteins, data wrangling, database management, and more
- Extensive wet lab experience; proficient in standard molecular biology and biochemistry techniques with a focus on cloning, recombinant protein expression, and advanced imaging techniques
- Conceived of 3 independent projects as an undergraduate researcher and taught myself the computational techniques required to answer our questions; these projects resulted in three first author manuscripts in preparation
- Collaborated with experts in a wide variety of fields to formulate research questions and develop novel methods as part in a trans-disciplinary research center

Education

BSc in Microbiology   May 2017
The Pennsylvania State University

Relevant Coursework
- Multivariate calculus
- Differential equations
- Probability theory
- Linear algebra
- Bioinformatics
- Advanced microbiology lab
- Microbial pathogenesis
- Evolution of infectious disease

Research

Research Technician   July 2017 - Present
Department of Biology, Center for Lignocellulose Structure and Formation
The Pennsylvania State University
Advisor: Daniel J. Cosgrove

- As a research technician with the trans-disciplinary Center for Lignocellulose Structure and Formation (CLSF), my time was split

between independent projects and collaborative research with CLSF members. I collaborated with experts in fields ranging from polymer physics to chemical enginerring on hypothesis generation and methods development. I also trained and supervised two undergraduate students on cloning, protein expression, and bioinformatics pipelines. My independent research projects focused on better understanding the relationship between plant primary cell wall structure and plant growth. I designed molecular probes to examine the distribution of different polysaccharides in the cell wall and developed novel methods in Atomic Force Microscopy to obtain nanoscale images and nanomechanical maps of the cell wall. I also designed and implemented a new statistical workflow in R—including custom algorithms—for the processing and analysis of force spectroscopy data. We are currently analyzing the results of this project and expect two publications to result.

Independent Research June 2016 - Present

Collaborators: Lori Shapiro, Olga Zhaxybayeva, Rob Dunn, Daniel Cosgrove

- In early 2016, I began researching the distribution of expansin genes in non-plant species as an independent curiosity. The initial results were promising, and I reached out to Lori Shapiro and others to collaborate on the evolution of expansin genes. Through this project I taught myself new phylogenetic methods including the use of IQ-TREE to test and implement advanced evolutionary models, and application of duplication-transfer-loss (DTL) models to infer the evolutionary history of a gene. I also developed a novel method of inferring the relative age of horizontal transfer events and used R to analyze and visualize our phylogenies with associated data. This project is currently in preparation for submission. I have also begun a project with Lori Shapiro and Kerry Mauck where we perform a meta-analysis of plant pathogen occurence, evolution, and life history of pathogens. This project involves significant web scraping, database construction, geospatial analysis, and statistical modeling. Using these data, we hope to create a useful database for plant pathogen researchers, involve citizen scientists in documenting plant pathogens, and ultimately identify life history traits that promote plant pathogen emergence and spread.

Resarch Assistant June 2013 - June 2017

Department of Biology

The Pennsylvania State University

Advisor: Daniel J. Cosgrove

- As an undergraduate, I worked in the Cosgrove lab designing and carrying out original research on the structure, function, and evolution of expansin proteins. I was tasked with heterologously expressing plant expansins—a goal which has eluded the cell wall community for 30 years. Like my predecessors, I was unsuccessful, but along the way I gained valuable experience in cloning, mutagenesis, protein purification, experimental design, and heterologous expression methods for bacteria, yeast, and algae. After numerous failed attempts, I proposed a computational solution to study expansin structure-function. This proposal was funded

as a research grant by the Department of Biochemistry, and I carried out this research in collaboration with molecular modelers from our department, teaching myself sequence analysis and protein structural prediction along the way. This work resulted in a first author publication which is now submitted at New Phytologist.

Publications

1. **Chase, W. R.**, & Cosgrove, D. J. (2018). Carbohydrate Binding Module Family 63. *CAZypedia.* cazypedia.org/index.php/Carbohydrate_Binding_Module_Family_63
2. **Chase, W. R.**, Yang, H., & Cosgrove, D. J. (2018). An in-silico structure of the expansin AtEXPA4 reveals the structure-function of α-expansin. *Manuscript submitted for publication.*
3. **Chase, W. R.**, Mauck, K., Zhaxybayeva, O., Dunn, R. R., Cosgrove, D. J., Rocha, J., Kolter, R., & Shapiro S. R. (2018). From morphogenesis to pathogenesis: A cellulose loosening protein is one of the most widely distributed tools in nature. *Manuscript in preparation.*

Presentations

- What I Wish I Knew When I Started R: R Projects, Version Control, and the Tidyverse *(talk, PSU Department of Anthropology, 2018)*
- Using R to Build Websites: Blogdown and the Rmarkdown Universe *(talk, We R: PSU UserR Group, 2018)*
- A Cellulose Loosening Protein is One of Nature's Most Widely Shared Tools *(poster, PSU Bioinformatics and Genomics Retreat, 2018)*
- A Computational Solution to Expansin Structure-Function *(poster, PSU Undergraduate Research Exhibition, 2014)*

Awards

Summer Discovery Grant   May 2014
The Pennsylvania State University Department of Biochemistry and Molecular Biology
$4000 awarded for independent research proposal

1st place in BMB category   September 2014
Undergraduate Research Exhibition
For poster: *"A Computational Solution to Expansin Structure-Function"*

Skills

Lab Skills
- DNA purification and PCR
- Cloning and heterologous protein expression
- Protein purification (affinity, ion exchange, FPLC)
- Immunobiochemistry (Western Blot, ELISA)
- Microbial culturing (bacteria, yeast, algae, diatoms, fungi)
- Microbial characterization (metabolism, identification, susceptibility tests)
- Light and fluorescence microscopy
- Atomic Force Microscopy

Computational Skills

- R
- Web scraping
- Data wrangling
- Geospatial analysis
- App development with Shiny
- HTML/CSS
- SQL
- Protein structure modeling and analysis
- Sequence analysis (BLAST, sequence alignment, etc)
- Phylogenetics (IQ-TREE, MrBayes, PAML, SplitsTree, etc)

Other

- Reproducible Research with Git and Rmarkdown
- Fluent in Spanish and Portuguese
- Development of new protocols and experimental design in a trans-disciplinary research group
- Documentation, backup, and sharing of research notes using Microsoft OneNote and OneDrive

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References

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