William Chase

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Education

BSc in Microbiology May 2017
The Pennsylvania State University

Research Experience

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

- As a full time research technician with the Center for Lignocellulose Structure and Formation, my time was split between independent research, and technical assistance for lab members. I assisted lab members with protein purification, fluorescent tagging, plant histology, plant biomechanical assays, and microscopy. I also trained and supervised two undergraduate students on cloning and heterologous expression of expansin proteins. My own research projects focused on better understanding the relationship between plant primary cell wall structure and plant growth. To accomplish this, I designed fluorescently tagged Carbohydrate Binding Modules as molecular probes to examine the distribution and localization of different polysaccharides in the cell wall. In conjunction, I developed novel methods in Atomic Force Microscopy to obtain nanoscale images and corresponding quantitative 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.

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, heterologous expression methods for bacteria, yeast, and algae, and protein purification. I also learned persistence and experimental design, as I designed new methods of heterologous expression when a previous attempt failed. 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 proceeded to teach myself sequence analysis, phylogenetics, and protein structural prediction. This work resulted in a first author publication which is now submitted at New Phytologist.

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 joined with Lori Shapiro and others to study the interesting evolution of expansin genes. Through phylogenetic analyses, we discovered that this gene is extremely widespread across a diverse array of microbes. We found that the gene has spread through multiple horizontal transfer events, both in recent and ancient time, and that multiple horizontal transfers have occurred between eukaryotes and prokaryotes. These results are currently in preparation for submission. As a follow up, we have begun investigating the origin of expansins, their presence in algae, and how they helped facilitate the transition from algae to land plants.

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 unique biochemical features 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.*

Awards

Summer Discovery Grant May 2014

The Pennsylvania State University Department of Biochemistry and Molecular Biology

$4000 awarded for independent research proposal

1st place prize in BMB category September 2014

Undergraduate Research Exhibition

For poster: *"Predicting the 3D Structure of Alpha Expansins"*

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)
- Plant histology
- Light and fluorescence microscopy
- Atomic Force Microscopy

Computational Skills

- R
- App development with Shiny
- HTML
- CSS

- Protein structure modeling and analysis
- Sequence analysis (BLAST, sequence alignment, etc)
- Phylogenetics (IQ-TREE, RAxML, PAML, SplitsTree)

Other

- Reproducible Research with Git/GitHub and Rmarkdown/Knitr
- Fluent in Spanish and Portuguese

Back to top