



Graduate Student Spotlight Zachary Dashner

I grew up an hour away in the east bay in a town called Lafayette. I am a master's student in the Horticulture and Agronomy program with an emphasis of Crop Improvement in vegetable crops (lima bean). I intend to graduate in Spring 2017, unless I make a big mistake. I chose to pursue this field because I have always been interested in agriculture and agricultural development, and enjoyed growing vegetables and fruits in my backyard. It was not until my senior year as an undergraduate in the Sustainable Agriculture and Food Systems Major, when I heard a talk from Allen Van Deynze about plant breeding, that I began to consider it as a career option. I soon realized that plant breeding would be a way for me to improve understudied and underutilized crops that have beneficial attributes and, in doing so, hopefully increase the resilience and biodiversity of our food system.

During my first visit to UC Davis I was impressed by the diversity of crops and the various facilities, departments, and resources. As an undergraduate, it was clear that agricultural research was a very large part of UC Davis' mission. Out of all the schools I applied to for a master's program, UC Davis easily had the most in terms of diversity in crops, research areas, and faculty. I believe that this diversity is one of the most important elements of UC Davis because it offers graduate students an opportunity to be exposed to different perspectives and fields of research. I am a member of the Gepts lab and I work on pest resistance in lima bean. In addition to having the benefits of working in a phenomenal lab and under a great professor, I have also been mentored by Professor John Labavitch, a world-renowned expert on plant cell walls. This collaboration between areas of research is exactly what I expected to find at Davis and I

am incredibly grateful for the patience and assistance I have received from those two professors, as well as many other faculty and employees.

The focus of my research is to identify the reason for observed resistance to lygus, an insect pest, in lima bean. By being able to more clearly understand this reason we can hopefully selectively breed this trait into other cultivars, and possibly even further improve upon it. Additionally, the integration of this resistance trait would amount to reduced pesticide usage, making lima bean production more financially feasible and environmentally friendlier. Ultimately, increased production of this nutritious and nitrogen fixing pulse at lower costs would mean an inexpensive source of protein with a small carbon footprint.

Polygalacturanase (PGs), are produced by a wide range of organisms like plants, insects, bacteria, and fungus. PGs are enzymes that break the bonds of simple pectin polymers, which are important to the structure of plant cell walls. Previous research by Professor Shackel, Professor Labavitch and other UCD researchers, identified insect watery saliva to be the reason for most of the tissue damage and flower abscissions observed in crops like alfalfa. Furthermore, PGs were identified as being one of the main components expressed in the watery saliva, which helps the insects feed extraorally. Polygalacturanase Inhibiting Proteins (PGIPs), are a form of plant defense against PGs and help to reduce enzymatic activity, thus reducing damage to the cell wall and preventing cell wall weakening and cell death. Various PGIP screenings in alfalfa and other plants have isolated a handful of PGIPs capable of partially inhibiting the lygus PGs, and one PGIP found in pear which can significantly reduce enzymatic activity. Common bean, a close relative to lima bean, has 4 PGIP genes, which can vary in protein structure. Those slight variations change the inhibitory properties of the PGIPs and allows each to be specific to various organism's PGs. It is my central hypothesis that if selection pressure exists for PGIPs that can reduce PG activity from pests and pathogens, then you would expect to see variations to PGIPs that correlate with the ability to inhibit those specific pests and pathogens which share a geographic overlap with those native lima bean accessions. To investigate this hypothesis, I will screen approximately 120 accessions from South America, Mesoamerica, and cultivars commonly grown in California with varying degrees of lygus resistance using a simple enzymatic assay known as a radial diffusion plate. Sequencing the four PGIP genes of each accession and cultivar will allow me to correlate inhibition or the PGs by the PGIPs with the specific gene sequences and hopefully lead to the identification of a resistance gene.

Initially, I didn't have a clear intention on working on lima bean or specifically on pest resistance. Upon being accepted to join the Gepts lab, I was introduced to the subject of crop domestication and evolution, which I had previously been unfamiliar with. This new-found perspective has changed the way I view breeding and I believe has informed me in many ways to be a better breeder. Additionally, joining this lab introduced me to a lot of (cont.)

driven and brilliant people like Sarah Dohle and Jorge Berny, to just name a few. Their passion and knowledge about pulses is truly inspiring and has been helpful in deciding on a research project. Yet another aspect that I believe has changed my focus while at Davis has been joining an OREI funded project also known as Student Collaborative Organic Plant Breeding Education (SCOPE). SCOPE has given me an opportunity to do a hands-on student driven breeding project, giving me breeding experience I wouldn't have gotten otherwise. Through this project I have also met a lot of other graduate and undergraduate students and professors working in this area, and have learned from them along the way.

When thinking about the future, I hope to be doing a something that makes me happy and I think that continuing with a career centered on plant breeding is one way to do that. There are a lot of opportunities like teaching, doing research, and outreach that I would especially like to do, all in hopes of making a positive difference in the food system. One of the opportunities I've had at UC Davis include traveling as an undergraduate for the Young Earth Solutions competition hosted by the Barilla Food and Nutrition Center. Our project was based on a sustainable cropping system to produce feed for crickets, which would then be processed and turned into flour for protein bars. I think by participating, it encouraged me to formulate a way to reduce hunger and malnutrition and improve the economic and environmental aspects of farming. This was also a great opportunity to work on presentation skills and to meet other young students from around the world. That international network has proven to be a useful tool that I think will be a source of collaboration in the future when working on projects. Another opportunity that I participated in was the 2016 Annual Student Organic Seed Symposium (SOSS) in Waterville, Maine. The symposium brought together graduate students from across the U.S. to talk about a variety of issues ranging from plant breeding to U.S. and international policies on the organic seed industry. I'll be helping to organize the 2017 SOSS at UC Davis with labmate Travis Parker.

I think that one of the most valuable things an incoming student should know is to realize they are a human, not just a graduate student. Many people may start school and feel overwhelmed or feel like they've been accidentally admitted. The "imposter syndrome," as well as feeling like you need to read every paper that's published in your field is something that comes with the territory of being a graduate student. Realize that learning all these new things takes time and never really ends. Next, don't sweat the small things; experiments fail and we too fail occasionally, whether it's in school or in life. One of the most valuable pieces of life advice was given to me on my grandfather's 90th birthday. He said, "You know, all that worrying didn't accomplish anything, things all worked out and I don't think I could be happier." Finally, get involved in on-campus organizations like Outdoor Adventures or off-campus organizations and meet people. If you focus too much time on research or school, when those things get tough you can't exactly call those them up talk about what just went wrong. Like Ferris Bueller said, "If you don't stop and look around every once in a while, you might just miss it," so pause when you can and enjoy every minute you can in Davis!

OPPORTUNITIES AND EVENTS

PBC ANNUAL PUBLIC FILM SCREENING "THE GARDEN"

JANUARY 11, 7-9PM

UC DAVIS GENOME CENTER, AUDITORIUM 1005

In collaboration with the Student Farm, GGHA, and Campus Community Book Project, the PBC presents, "The Garden," a film by Scott Hamilton Kennedy. This screening is free and open to the public. To find the full synopsis and film trailer, click [here](#). No registration needed. Visitor parking available for \$9. Find the event link [here](#).

PBC SEMINAR: NATALIA DE LEON FEBRUARY 2, 12:10-1PM, PES 3001

"Understanding genotype-by-environment interaction and its role in the prediction of hybrid performance in maize." Register [here](#).

SCOPE PROJECT INTERNSHIPS FOR UNDERGRADUATE STUDENTS

The SCOPE Project is a student-led collaborative of student and faculty plant breeders working on improving crop varieties for organic farming systems. This project is currently offering internship credits for undergraduate students. To join the project, contact Amanda Saichaie. Find more information on the project [here](#).

2017 UC DAVIS PLANT BREEDING SYMPOSIUM APRIL 24, 2017

More info coming soon!

NATIONAL ASSOCIATION OF PLANT BREEDERS 2017 ANNUAL MEETING AUGUST 7-10, 2017

UC DAVIS CONFERENCE CENTER

More information coming soon!

STUDENT ORGANIC SEED SYMPOSIUM UC DAVIS AUGUST 11-14, 2017

More info coming soon!

PLANT BREEDING CENTER:

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UC Davis Plant Breeding Center



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