2012 PLPM faculty Impact Statements

Dr. David Appel, Professor

Issue 1. The trees in Texas forests and landscapes are under threat by numerous destructive pathogens. Some already exist, e.g. the oak wilt pathogen, while others are on the increase due to a changing climate or spread from elsewhere into vulnerable Texas ecosystems. In order to address these threats, my program has:

- Developed a quantitative real time polymerase chain reaction (QRT-PCR) protocol for early and rapid diagnosis of oak wilt which is in the field verification phase of being adopted by the Texas Plant Disease Diagnostic Laboratory for routine use in managing this highly destructive disease,
  - this technique will save countless trees and significant resources by providing the information needed to properly manage confusing tree disease issues.
- Initiated surveys for detection of citrus greening and sudden oak death, both of which are caused by invasive pathogens with histories of massive mortalities of their respective hosts, citrus and oak trees respectively, in their landscapes of origin,
  - these surveys will allow for a rapid response to minimize the impact of these dangerous pathogens,
  - the surveys also help growers and nursery operators remain in regulatory compliance with USDA and TDA regarding inspections and detection of the regulated agents.

Issue 2. Pierce's disease of grape (PD) is a costly problem for the Texas wine and grape industry. The disease can decimate vineyards comprised of susceptible grape varieties and is currently managed through the regular applications of expensive insecticides. In order to address this disease, my program is:

- testing the use of a biocontrol strain of the PD pathogen in greenhouses and vineyards to control disease development caused by the native strain of the pathogen,
  - biocontrol may be the only direct control method for reducing losses to this destructive pathogen, saving the growers money and reducing the environmental impact and costs of the constant use of insecticides.
- analyzing the epidemiology of PD with the purpose of comparing disease progress rates in vineyards with different varieties, soil types, climates, and management methods in order to better predict the impact of the disease and assist growers with their disease control options,
- expanding to assist grape growers to reduce losses from other emerging plant disease problems such as Texas root rot.

Dr. Paul de Figueiredo, Associate Professor

My teaching efforts directly impacted approximately 110 undergraduate or graduate students through classroom and laboratory instruction. Mentoring of graduate students as a thesis committee member resulted in the expected graduation of one M.S student (Mr. Vineet,

Bhambhani, Professional Program in Biotechnology) and one Ph.D. student (Ms. Kelly Solstysiak, Department of Microbial and Molecular Pathogenesis). My research has generated grant support and intellectual property to support productive programs in infectious disease biology, bioenergy technology development, and cancer research. Several peer-reviewed journal articles were produced. I am currently serving the Department of Plant Pathology and Microbiology as chair of the Graduate Program Committee and as the Graduate Advisor. I Also represent the Department and College of Agriculture and Life Sciences as a member of the Institutional Biosafety Committee.

Dr. Martin Dickman, Professor, IPGB Director

My research program centers on fundamental aspects of fungal plant interactions and the identification of genes that regulate pathogenic development, signal communication and programmed cell death (PCD). The overall goals of these studies are to understand the underlying mechanisms that regulate plant cell death and implement novel strategies for disease resistance and/or plant stress tolerance. Plant pathogenic fungi are the most economically important plant disease causing agents. Sclerotinia sclerotiorum the pathogen studied, is the most economically important fungus of fruit and vegetables in the United States. Annual losses of crops from diseases caused by S.sclerotiorum in the US are in the multi-million dollar range. The fact that Sclerotinia is aggressive, broad in its host range, poorly controlled and causes significant economical damage, coupled with the lack of resistant cultivars necessitates the development of alternative control strategies. Our research takes a molecular based mechanistic approach to understand why the fungus is so successful; in particular we examine the roles that reactive oxygen species and oxalic acid play as key modulators of fungal disease and cell death decisions. Results from these studies have provided information for alternative disease control strategies based on interference with these key fungal pathogenicity determinants.

From a more practical point of view, we have implemented this strategy (Control of cell death) to deploy novel genes that modulate PCD under real world field conditions for enhancing disease resistance and abiotic stress in banana (Banana is the world's most important fruit). Currently field testing and evaluation of disease resistant banana is being conducted in Australia and Uganda.

More recently, we have initiated similar studies in sugarcane; a profitable crop in Texas that is increasing in importance due to its potential as a significant, effective biomass source for fuel. These studies (disease resistance, cold tolerance) are being conducted in College Station and Weslaco. Biofuels hold great promise for reducing greenhouse gas emissions and enhancing domestic energy independence. Here, we developed and are initiating a novel biotechnology platform with the oleaginous halotolerant and patented yeast Debaryomyces hansenii, for the direct bioconversion of cellulose derived products into biodiesel and other high-energy fuel oils. This work is being done in collaboration with Dr. Paul de Figueiredo.

My teaching efforts include PLPA690-Theory of Research; a required course for Plant pathology students. I now teach every semester with a range from 6-10 students. My goals are to make students better, more critical readers of the literature and teach them to think on their feet; both are important and necessary skills for professional scientists.

My research program provides a unique and interdisciplinary training opportunity for a graduate students and postdoctoral fellows in the critical area of oxidative stress signaling and programmed cell death and conceptually addresses new ideas in how this necrotrophic plant pathogens achieves pathogenic success. Undergraduates and rotation graduate students will also have an opportunity to participate in this research.

As Director of the Borlaug Center, I co-sponsor (annually) the Texas Competition for the World Food Prize Youth Institute Symposium, a three-day forum for high school students from across the Nation. Along with Drs. Jan Leach and Thomas Wolpert, the first ever Internet 2 course was developed and delivered by myself and Drs. Leach and Wolpert. This course, Molecular Plant Pathology, has been the focus of a lead article in the Chronicle of Higher Education.

Dr. Dan Ebbole, Professor

Research in the Ebbole lab focuses on the molecular genetics of development and pathogenesis of model and plant pathogenic fungi. The rice blast fungus, *Magnaporthe oryzae* serves as both a model system for plant pathogenesis and is an economically important disease agent. The fungus spreads through asexual spores called conidia and produces a specialized infection structure to directly penetrate through the plant cell wall. During the interaction with the plant, the fungus produces factors that interact with the plant to inactivate the host defense mechanisms and to promote colonization of the host. These fungal factors may also be recognized by the host to trigger defense responses. This interaction between the pathogen offensive factors and plant defense mechanisms leads to an evolutionary. The lab seeks to identify and characterize potential virulence factors from the pathogen, understand their role in disease, and utilize these factors as tools to identify the host plant targets. A second project involves the model fungus, *Neurospora crassa*, to understand the mechanisms controlling conidiation as a starting point for comparative analysis among fungal species to examine the evolution of developmental processes.

As part of my teaching program, I've initiated efforts to create study abroad opportunities for our BESC students in China. Several of our students have traveled to Taiwan to take part in the Biodiversity, Agriculture and Culture of Taiwan (BACT) course offered through the National Taiwan University. From my collaborative research efforts with Fujian Agriculture and Forestry University (FAFU) I've also begun developing study abroad and exchange opportunities. Dr. Won-Bo Shim and I are leading an effort to promote research exchange programs and to host FAFU undergraduate students at Texas A&M. These students will take coursework and practical

training within the Department and the College of Agriculture and Life Sciences. We've also developed a faculty-led study abroad program to teach a new BESC course in International Environmental Issues along with additional course options. This study abroad program is scheduled to take place in summer, 2013.

Dr. Carlos Gonzalez, Professor

The Gonzalez laboratory has developed a phage based biocontrol system for the prevention and treatment of Pierce's disease caused by *Xyella fastidiosa*. This system will also be useful to orange and coffee growers. We have also identified and characterized an unusually broad host range high molecular weight bacteriocin (tailocin) from *Burkholderia cenocepacia* that exhibits biocidal activity against 70% of Bcc isolates tested and two additional genera.

Dr. Dennis C. Gross, Professor

We completed the sequencing of the complete genomes of two strains (i.e., B301D and HS191) of *P. syringae* pv. *syringae* that are closely related but exhibit distinct plant host specificity. This past year we completed closing gaps in sequence followed by GenePRIMP analysis for correcting gene sequences before annotation. The annotation will be completed in December 2012 and resubmitted to IMG at JGI for completion. Comparative genome analysis with B728a has now begun and should reveal distinguishing characteristics critical to the plant-pathogen interaction. Our genome work represents the 4th and 5th complete genome sequences of *P. syringae* strains. A paper will be prepared for publication in 2013.

Dr. Charles Kenerley, Professor

Summary of Research and Teaching Impacts

• First to demonstrate the gene responsible for volatile compound production in a fungal biocontrol agent.
• Demonstrated more than 24 novel volatile compounds from *Trichoderma virens*.
• Provided evidence that module skipping is the mechanism responsible for the production of 11-mer peptaibols from a gene consisting of 14 modules.
• Determined that the production of gliotoxin by *T. virens* enhances the degradation of sclerotia and biocontrol of seedling diseases incited by *Pythium*.
• Genomic mining of the *T. virens* genome has illustrated the presence of numerous secondary metabolite clusters with potential for novel compounds.
• Differential expression of genes involved in root colonization of tomato and maize by *T. virens* was demonstrated by microarray technology.
• Showed that a PKS/NRPS hybrid enzyme from *T. virens* is involved in the induction of host plant resistance.

• Directed an undergraduate BURS and a senior honors student performing research involving small secreted proteins from *T. virens*.
• Serve as an advisor for the "Invisible Jungle" media production.
• Appointed to COALS committee that evaluates No Grade requests.

Dr. Mikhailo (Mike) Kolomiets, Associate Professor

Research Impact

Publications:

2012 was a very productive year in terms of published papers (4 peer-reviewed papers and 2 invited book chapters). The opr7/8 (Plant Cell) and lox10/lox8 (Plant Journal) studies took us 10 years and 2 generations of graduate students and postdocs. In 2012, a lot of additional work had to be done to address reviewers requests for additional experimentation. In addition, 12 posters and 7 talks were presented at diverse professional meetings.

Funding:

In 2012, only one additional grant was awarded (Postdoctoral Fellowship to Dr. Christincen), and the BARD resubmitted grant was not funded. Otherwise, the lab had sufficient funding to support two postdocs and two graduate students from three federal grants, totaling ~$210,000 in 2012 year alone.

Program Description

Our research program is truly multidisciplinary and addresses wide range of physiological processes of maize. This is because the focus of our program is on functional analyses of a very large group of largely understudied plant secondary metabolites called oxylipins. Oxylipins are products of fatty acid oxidation, most of which are produced by the seven enzyme branches of the lipoxygenase pathway. The best understood oxylipin is jasmonic acid, one of the major plant hormones responsible for the regulation of a range of physiological processes including reproductive development, defense against biotic and abiotic stresses and development. The functions of the rest of oxylipins are largely unknown. Animal and human oxylipins much better understood and called eicosanoids, major immune regulators and targets for a wide range of drugs, among which the most widely used in the world drug called aspirin.

The long-term goal on our program is to understand the biochemical functions of diverse oxylipins in maize by disrupting all the major enzymes of the LOX pathways. Unlike Arabidopsis, for maize, mutants are not readily available thus necessitating their creation which takes many years of field based breeding. The remarkable achievement of our lab is the creation of Mutator-insertional mutants for 11 of 13 LOXs and for 6 of 8 OPR genes. This unique collection of the mutants allowed to study the biological and agricultural significance of these genes in a wide range of agronomic traits of maize.

Major Reported Research Achievements in 2012

Functions of JA in maize. By using opr7/opr8 double mutants we have conclusively established the diverse and novel functions of jasmonic acid in plant reproductive development, immunity to soilborne oomycetes and insects. Among notable novel functions of JA discovered is suppression of ear buds initiation and growth; opr7/opr8 double mutants produce ears at each internode of the plant instead of regular to ears per plant found in wild type (Yan et al. 2012, Plant Cell).

In our preliminary analyses, opr8 single mutants displayed increased resistance to colonization of seed by Aspergillus flavus, aflatoxin producing ascomycete fungus. This suggests a role of JA in facilitating corn susceptibility to this economically important fungus and contamination to mycotoxin aflatoxin.

Green leaf volatile function in insect defense was established by comprehensive molecular and biochemical analyses of the lox10 mutants (Christensen et al, Plant Journal, in press). GLVs were shown to have a major role in induction of JA biosynthesis and herbivore-induced organic volatile terpenes. Unlike dicot species studied, in maize GLV biosynthesis is likely to occur not in chloroplasts but in another cell organelle to be identified in the future.

LOX2 is one of the major genes required for tolerance to drought (not published). Oxylipins and lipid peroxidation products appear to regulate drought tolerance in plants. This is exemplified by our previous finding that lox4 mutants are more drought tolerant and readily recover growth after prolonged period of drought stress. This gene has been sequenced in the 400 line maize diversity panel (funded by USDA) to identify novel superior alleles for breeding purposes. In 2012, we tested lox2 mutant and found that plants lacking this gene are substantially more susceptible to drought stress. Southern blotting allowed the identification of several maize lines that contain two copies of the LOX2 genes. This finding may be directly applicable for breeding purposes by introducing additional LOX2 alleles in the elite germplasm.

Role of plant volatiles in within plant, plant-to-plant, plant-pathogen, plant-insects signal communication. This aspect of our research is truly exciting, which is why undergraduate students are easily drawn to these projects in our lab. Our interest in this area stems from the discoveries that several LOX mutants have altered volatile organic molecules metabolism. An example is lox10 mutants which are deficient in biosynthesis of green leaf volatiles and 70% lower emission of other VOCs, such as volatile terpenoids. Testing volatile-mediated interactions with pathogens and insects revealed significant alteration in how pathogens undergo sporulation and growth or how insect and their predators behave in the environment of the mutants vs wild types, or how the neighboring plants respond by activation of defense responses. This is a largely untapped area of research. I expect a bright future in exploring the volatile world

involvement in shaping the environment in which we (and our subject organisms) live and function.

Teaching Impact

I am teaching both graduate and undergraduate level classes which according to student evaluations are well received by the students. In the years I was teaching Plant Pathology 301 class, I learned to enjoy this class which was originally quite a challenge for me. This is because my M.S., B.S. and Ph.D. education was primarily in genetics, biochemistry and molecular biology fields. Thus, I had to learn Introductory Plant Pathology materials from scratch. I am pretty sure, that this is the reason why I think I have a perfect understanding of how to teach this class since I understand the knowledge base that an average undergraduate student has before they take this class. The class is rather large averaging 100 students making it difficult to involve every student on an individual basis. This class is also designated as PLPA601 and usually attracts 7-8 graduate students. This adds to complexity as I am trying to accommodate my lectures to a more advanced knowledge levels that the graduate students usually have.
My graduate teaching principally includes PLPA 601 (taught at the same time as PLPA301) and PLPA 617. I really enjoy teaching PLPA617 class as it allows me to take advantage of my advanced training in the fields listed above.
In my role as a Major Professor for graduate students and supervisor for postdoctoral fellows, my philosophy is that I have to help them grow professionally with my EVERY DAY involvement with their projects. Thus far I have trained 4 postdocs, 2 visiting professors, 2 M.S., 7 Ph.D. and more than 50 undergraduate students in my lab. I served as a member of 19 Graduate Student Committees advising students from 4 different Departments.

Dr. Clint Magill, Professor

The targeted impact of my research is sustainable production of crops important to Texas. Whether it is the identification of new sources of genetic resistance to sorghum pathogens and tagging the gene or genes involved, measuring genetic diversity in pathogen populations or exploring a new method of making cotton resistant to nematodes, our research provides tools and insights for preventing losses caused by diseases. Our contribution to crop production is indirect in that it provides tools useful to breeders and information useful to researchers involved in understanding the molecular basis of host/pathogen interactions. Consequently, any monetary impact is difficult to assess, especially since findings may have implications beyond the crops involved.

Classroom teaching impact at the graduate level comes from Genetics 603, a course taught to approximately 24 students each fall. Lectures, assignments and tests are designed to make sure Genetics majors are ready for advanced courses in Molecular, Population, Quantitative, Developmental, Cyto- and Immuno- genetics, but 603 is also structured to serve as the sole

course in Genetics for new graduate students in various other programs such as MEPS and veterinary Pathobiology. At the undergraduate level, approximately 180 students per year from many majors learn the basic principles of genetics in GENE 310, with interest enhanced through an emphasis on the many aspects of our lives that are impacted by genetics. Approximately 30 undergraduate students per year majoring in Genetics gain experience in researching relevant topics and making oral presentations through GENE 482. A similar course, BESC 481C offers communications credits to 14 BESC students in alternate years.

Service impact reflects active participation in committees and activities of my department, the Faculty of Genetics, the Molecular and Environmental Plant Sciences Faculty and the Masters of Biotechnology program, as well as serving as representative for the TAMU Faculty Senate on several university level committees.

Dr. Herman Scholthof, Professor

Plant viruses cause huge yield and food quality losses in crops grown throughout the world, with damages by some estimated to exceed $60 billion annually. Towards designing better control strategies, we are currently conducting experiments to investigate which plant proteins are involved in *mobilizing the antiviral RNA silencing defenses*. We also continuously explore various strategies to develop or enhance the utility of viruses and virus products as *tools in biotechnology* to express high levels of value-added pharmaceutical or bioenergy-optimizing foreign proteins in plants. Separate research projects past and present involve a molecular characterization of *newly emerging diseases* of unknown etiology.

For this reporting year, we can highlight the following:

- We published six peer-reviewed papers and gave several presentations at professional national and international meetings.
- I was a Keynote speaker at a plant molecular biology convention.
- The seminal conclusions of these collective reports are that we:

1. Showed the effect of host on performance of virus vectors-mediated foreign gene expression
2. Discovered a dynamic interaction between psyllids and the bacterium they transmit that causes Zebra Chip disease on potatoes
3. Have a patent awarded on a new technique that utilizes a virus protein to improve foreign gene expression in plants pending.
4. Provided concise reviews on the latest findings on antiviral RNAi in plants and its suppression by certain virus proteins.

During the year I mentored a senior postdoc (Assistant Research Scientist) who now is Director of Plant Health in Industry. I also provided research training for two undergraduate students, and two visiting students. I was major professor for two graduate students and one of these has finished his M.S. and quickly found employment as a senior research technician in Bio/Bio.

International exchanges were highlighted by presenting a one-week condensed lecture series in Plant Virology at the Eurasian University in Astana, Kazakhstan.

During the reporting period I served as: i) *Associate Editor* for the two leading journals in my discipline (*Virology* and *Journal of Virology*), ii) *Chair* of our departmental Graduate Programs Committee and now serve as *Chair* of Graduate Student Recruitment, and iii) I was recruited by an *Italian government* agency as an evaluator for the quality of research in Italian universities and institutes.

Dr. Libo Shan, Assistant Professor

My research focuses on the molecular and biochemical mechanisms that govern plant resistance and growth regulation. Plants and animals live in an environment rich in potentially harmful microbes and have evolved the immune systems to defend against infections. Innate immune responses are triggered by the activation of immune sensory complexes recognizing evolutionarily conserved microbial components. Regulating the activation and attenuation of immune signaling is crucial to effectively combat infections without deleterious effects. Our long-term goal is to elucidate the regulation of immune sensor activation and decipher the convergent early signaling events in plant and animal innate immunity. Given the remarkable conservation in the mechanisms of microbial perception and host immune signaling in multicellular eukaryotes from plants to humans, results from our studies will not only provide mechanistic understanding of regulation and activation of mammalian innate immune system, but also aid efforts to develop therapeutic manipulations of immune processes. The project will provide comprehensive training in molecular biology, cell biology, genetics and biochemistry for postdoctoral fellows, graduate students and undergraduate students.

My teaching efforts include Introduction to Bioenvironmental Science. BESC201-500 with 143 students in Spring 2012. The learning objectives of this course are to foster curiosity and critical thinking; to enhance an understanding of environmental sciences and to recognize a variety of world views associated with the environment. I also taught Principles and Methodology in Plant-Microbe Interactions, PLPA616 with 11 graduate students enrolled in Fall 2011. The goals for this class are to provide graduate students with an introduction to the molecular basis of plant-microbe interactions and to master the principles and methodologies implied in studies of plant-microbe interactions. In addition, I am actively involved in training graduate students and a mentor for six PhD student candidates and one postdoc research and one visiting scientist. My lab also routinely recruits and hosts undergraduate students for research internships.

Dr. Brian D. Shaw, Associate Professor

My formal classroom teaching includes BESC 204: Molds and Mushrooms (96 students in Spring 2012) and PLPA 631 and 632 Fungi: Cell Biology and Taxonomy and Laboratory (11 Students Fall 2012). I have offered an honors section of BESC 204 since 2010. Combined I have taught more than 500 students in the these classes in the last 8 years. I have advised 5 graduate students, including one current PhD student ; three who have completed their PhD and one who has completed an MS. One of the PhDs is now a faculty member at the National Chung Hsing University in Taiwan. One is a Post Doc at Duke Medical School and the other is a Post Doc at Dartmouth Medical School. I have mentored 18 undergraduate researchers in my laboratory, including one who has written a senior honors thesis and two who have submitted papers to the TAMU Explorations undergraduate research journal. I received three consecutive SLATE awards for my teaching.

My research has generated a total of over $1,100,000 of funding through a combination of federal competitive grants.. I have published 27 research papers, including 19 since joining TAMU in 2003 and two that were published in 2012. One major accomplishment is the establishment of the Apical Recycling Model, that has altered the discourse on the mechanism of cellular growth in fungi. Two popular press articles appeared highlighting this research (http://www.eurekalert.org/pub_releases/2009-12/taac-fff121809.php; http://agnews.tamu.edu/showstory.php?id=1611). The Apical Recycling Model was the topic of two invited symposium talks at the 2013 Fungal Genetics meeting, by researchers from Britain and Mexico working independently of me. My research has been the focus of journal cover illustrations on three occasions. I have given 21 invited talks, including one at the Mycological Society of America in 2012. I was honored with the Alexopolous Prize in 2009 form the Mycological Society of America, the highest award for research offered to early career investigators by the society.

I am currently serving as the local coordinator of the Mycological Society of America annual meeting for 2013. This office involves all aspects of coordinating facilities for the meeting. I am an Associate Editor of the journal Mycologia. I was a guest editor for a special issue of the journal Fungal Biology in 2011 that focused on fungal growth. I served on the Karling lecture committee from 2009-2013 (chair 2012). This is the most prestigious lecture given at the Mycological Society of America meeting, and involvement in the lecture is one of the most high profile events at the meeting. I served on the governing council of the Mycological Society of America from 2004-2006, and I am currently standing for election for a second term. I have served on the TAMU faculty senate from 2010-2013. I am currently the co-Chair of the Department of Plant Pathology and Microbiology graduate recruiting committee. I developed and implemented the departmental assessment plan as chair of the undergraduate curriculum committee in 2007-2008, and administered the assessment plan as chair of the assessment committee from 2009-2012. I have been the faculty coordinator of the Bioenvironmental Sciences Undergraduate Research Scholars (BURS) program since 2011.

Dr. Won-Bo Shim, Associate Professor

My research program at Texas A&M University is focused on fungal pathogens of corn and sorghum. Numerous foliar, stalk, and kernel diseases as well as mycotoxin contamination are prevalent in Texas as well as throughout the US. According to the USDA-Economic Research Service, crop losses as well as the regulatory, testing, and management costs associated with mycotoxins in the US tops $1 billion annually. My research goal is to characterize and understand key genetic mechanisms associated with corn stalk rot and mycotoxin (aflatoxin and fumonisin) contamination. The outcome of these efforts will lead to innovative control strategies or resistant hybrid development for our growers and safer food and feed for the public. These activities are primarily funded through USDA NIFA AFRI competitive research grants. Significantly, I will be serving as a co-PI and a member of the executive committee on a multi-state USDA AFRI funded 5-year project (2013~2017) entitled "Integrated management strategies for Aspergillus and Fusarium ear rots of corn".

My classroom teaching effort for 2012 includes BESC403 Sampling and Environmental Monitoring and PLPA301 Plant Pathology. The aim of BESC403 is for students to learn the principles and techniques of environmental sampling and monitoring for air, water, soil and hazardous wastes based on EPA standard methods To further enhance the learning experience, I have recently instituted a simulated interview session as well as business design models to stimulate students' participation and interest. The course is in extreme high demand, and the enrollment is constantly at its maximum capacity (24 students/semester). A recent student evaluation comment "This class prepared me the most for the real world than any other class I have taken at Texas A&M. I think it is essential to the BESC program" highlights the significance of BESC403 for our undergraduate students. I also taught PLPA301 Summer course in 2012 with 29 students enrolled. The course focused on discussing the nature of disease causing agents, the outcomes of the interaction between plants and pathogens, and the general principles we used to control the diseases.

In addition to classroom teaching, I am actively involved in training graduate students and undergraduate students in my laboratory. In 2012, I mentored two Ph.D. graduate students and four BESC undergraduate students, and I am extremely proud of my students' research productivity. They have been recognized with numerous awards, including Texas A&M Academic Excellence Award, SLOAN fellowship, USDA fellowship, Texas A&M Undergraduate Research Scholar, Texas A&M Louis Stokes Alliance for Minority Participation (LSAMP) Undergraduate Researcher, and actively volunteer in Texas A&M Student Research Week, and Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS) conference. Two BESC students have presented their research at American Phytopathological Society Caribbean Division Meeting in April 2012.

Dr. Jim L. Starr, Professor

<u>Research</u>

My research continues to focus on the identification, characterization and development of resistance to nematodes in cotton and peanut. I have contributed to the release on one new source of resistance to root-knot and reniform nematodes in the cotton germplasm line "BARBREN" one new nematode resistant peanut cultivar "Webb". During the past year I initiated thee new projects, one is a collaboration with CW Smith to develop improved seedling disease resistance in cotton (funded by Texas State Support Committee) and is being expanded to include resistance to bacterial blight. Another new project is a collaboration with G Sword (Entomology) to assess the potential of selected cotton endophytes to provide protection to cotton from nematodes (I have no funding for this effort), but we will be submitting proposals to USDA. The final new project is collaborative with F Davies is more technology transfer, working with colleagues in Ghana and Nigeria to increase use of nematode resistance by graphing susceptible scions to resistant root-stocks. This is funded by the USDA Foreign Ag Service program.

Publications

Simpson, C. E., Starr, J. L., Baring, M. R., Burow, M.D., Cason, J. M., and Wilson, J. N. 2012. Registration of 'Webb' Peanut. Journal of Plant Registrations IN PRESS.

Burow, M. D., Simpson,C. E., Holbrook, C. C., Denwar, N., Chagoya, J., Starr, J. L., Leal-Bertioli, S., and Bertioli, D. 2012. Marker-assisted selection for biotic stress resistance in peanut. in R. Tuberosa and R. Varshney (eds). Genomics Applications in Plant Breeding. Wiley-Blackwell Publishers. IN PRESS

Del Rio, S. Y., Starr, J. L. 2012. Identification of root-knot nematode resistance loci in Gossypium hirsutum using simple sequence repeat markers. Journal of Nematology 44. IN PRESS

Starr, J. L., McDonald, A. H., and Claudius-Cole, A. O. 2012. Nematode resistance in crops. in R. N. Perry and M. Moens, eds. Plant nematology, 2nd edition. Wallingford,UK: CABI Publishing (In Press)

Grants

National Peanut Board – Peanut disease management strategies. $5,000 Jan 2012 till Dec 2012.

Texas Peanut Producers Board - Improving in the management of peanut diseases. $4,500 May 2011 till April 2012.

Cotton Incorporated – Development of elite cotton germplasm with resistance to root-knot nematodes. $20,000 Jan 2012 till Dec 2012.

Texas State Support Committee – Breeding for genetic improvement of cotton: Seedling disease resistance. $30,000 Jan 2012 till Dec 2012.

USDA – FAS - Use of Grafting to Increase Availability of Disease/ Nematode Resistant Vegetable Crops. $45,000 Oct 2011 till Sept 30 2013. (Co- Pi F Davies)

Teaching

Spring 2012 –
PLPA 301/601(3 cr) – Plant Pathology , 104 students (101 undergrads and 3 grads)
PLPA/ENTO/AGRO 610 (3 cr) – Host plant resistance, 8 students
Summer 2012 –
PLPA 603 (3 cr)– Plant Disease Management , 8 students
Fall 2012 –
PLPA 681 (1 cr)– Seminar, 7 students

Graduate Students
Chair – 1 Ph D candidate (Sonia Del Rio, Mapping nematode resistance loci in exotic cotton germplasm)
Committee member – 5 students

Service
Member - AgriLife Plant Release committee
Dean's Awards for Excellence committee, COALS
Chair - PLPM Facilities and Equipment committee
Executive Officer, American Peanut Research & Education Society
Editorial Board Member, Nematology
Ad Hoc reviewer for several journals (approximately 1-2 manuscripts per month)

Dr. Heather H. Wilkinson, Associate Professor
IMPACT STATEMENT:
The central focus of my microbial genetics research program is working with graduate students in identifying the genotypes, genes, and gene networks associated with adaptation to particular environments or developmental states. In fungi, we study gene expression to identify the genes responsible for manifestation of traits (e.g. asexual spore production, mutualism with plants, nutrient acquisition). These studies contribute to our basic understanding of the evolution of adaptation in fungi across different phylogenetic scales. We also study microbial communities (especially bacteria and archaea) associated with extreme environments (e.g. saline and/or thermal) in order to identify consortia that are pre-adapted for industrial conditions associated with biofuel fermentations. Ultimately we are interested in understanding what traits are associated with optimal performance under process conditions.

My teaching responsibilities include: BESC 367 US. Environmental Regulations, BESC 403 Bioenvironmental Sampling and Monitoring, and BESC 484 Bioenvironmental Field experience. My main goal in teaching is to cultivate student curiosity, which I feel ultimately contributes a student's tendency toward life-long learning. If students leave the university as scholars, capable of synthesizing information and solving problems, we have succeeded. Cultivating student curiosity for a specific discipline requires recognizing pre-existing assumptions, establishing the fundamental foundation via assimilation or accommodation of new information, and finally encouraging investigation of the more current/dynamic aspects of the field. Therefore,

throughout the learning process I favor tactics that require students to recognize their own worldview, construct their own understanding given new information and reassess their worldview. By practicing the behaviors involved in constructing a conclusion frequently throughout the learning process, students build the habits necessary for scholarship. As the instructor, I prefer to act as facilitator, while the students play an active role in their learning.

Beyond classroom teaching and research mentoring I also strive to keep abreast of the topics and skill sets involved in a variety of environmental professions. Maintaining a current understanding of the field helps me to keep my courses current. Furthermore, I think my efforts to track the profession provide for better departmental, college and university service. I serve as the faculty advisor for the student chapter of the National Association of Environmental Professionals student chapter (NAEP) (2008 to present), as faculty liaison to our BESC Professional Board, the Chair of the eCampus Implementation Advisory Committee, a member of the QEP Advisory Committee, a member of the Institutional Biosafety Committee (2008 to present), and as a member of the Council of Principal Investigators (CPI) as a representative of the College of Agriculture (2011 to present). I serve as a member of the executive committee on the CPI (2011 to present).

Dr. Joshua S. Yuan, Assistant Professor

As a faculty member at Texas A&M University (TAMU), it is my privilege and mission to serve the people of Texas and beyond through excellence in teaching, research, and service. I consider the three roles to be integrated and synergistic, where advances in knowledge through research promote teaching of the latest scientific discoveries and help to foster sustainable economic development in Texas. All of our teaching, research and service endeavors focus on developing renewable energy solutions for the state of Texas and beyond.

Teaching Impact

I always believe that disseminating knowledge, especially the latest scientific developments, is a noble and powerful task that can motivate young Aggies to go beyond their aspirations and develop professional careers that are rewarding throughout their lives. Based on these beliefs, I have initiated two new courses focused on the rapidly developing biofuels and computational biology fields. These courses address important educational areas needed at TAMU and in the state of Texas. These two courses directly impact the life of approximately 100 undergraduate or graduate students each year. For example, one of my former students became the Chief Scientific Officer for a local Texas start-up company called AlgEternal. The knowledge he learned in my class helped to equip him with the expertise needed to establish a career in algal biofuel development. I am gratified to witness the power of teaching that can directly transform a student's life that promises to be of economic benefit to Texas. Mentoring students and postdoctoral scientists in my research program is another very important aspect of teaching, especially as I strive to inspire students to discover solutions for important research problems in bioenergy field. For this reason, I am actively involved in hosting six to ten undergraduate students as research interns in my laboratory each year. I am also serving as major advisors for four Ph.D. students and two Masters students. I have oversight seven postdocs during the past three years and served on more than 10 students' graduate committee. Through these mentoring,

the students and postdocs from our lab have published over 15 publications and have applied 4 patents that have direct impact in the biofuel industry.

Research Impact

I have developed an integrated and multidisciplinary research program centralized around developing bioenergy enablement using the state-of-the-art systems and computational biology approaches. The research is directly relevant to economic development and environmental stewardship in Texas. The emerging biofuel industry is a multi-billion dollar market with enormous economic potential for Texas. However, key scientific challenges such as efficient biomass conversion need to be addressed before the industry can become profitable, mature, and sustainable. During the past three years, my research has generated a total of over $4.7 million of federal and state funding with me as the leading PI, with approximately $1.7 million going to our research program in biofuels and plant systems biology. The research has focused on four major aspects from feedstock development to processing optimization. First, we have used systems biology approach to discover several important genes involved in plant growth regulation and defense and these genes have been exploited for feedstock and crop improvement. Second, we employed the latest HDX mass spectrometry platform in combination with computational biology to dissect the novel dynamics-function relationship and to guide the development of stable and efficient enzymes for biofuel and bioproduct applications. Third, we have used systems biology approaches to explore various natural biomass utilization systems, in which we have discovered key enzymes for developing efficient and low-cost conversion process. Fourth, we are using metabolic flux modeling-guided approaches to maximize the production of terpenoid hydrocarbon in plants and algae for biofuel applications. In addition to hydrocarbon production, we also developed some practical techniques for cultivate algae to support this initiative. Notably, two of our applied technologies have been licensed by start-up companies. I have also spoken in numerous scientific conferences, guest lectures and departmental seminars around the world. With the commercialization of our latest algae biofuel technology, our research will directly impact the economy and rural development in the state of Texas and beyond.

Service Impact

At the departmental level, I have served on several committees that have helped me better understand my role as a faculty member at TAMU. At the college and university levels, I am actively involved in expanding the international impact of TAMU. For example, I organized the first US-China bioenergy summit in 2008 as a forum for the US-China Relationship Conference in Beijing. I coordinated and edited the publication of a special issue on biofuels for the US-China Collaborative Bioenergy Research program. These efforts should help enable TAMU to be one of the leading institutions involved in US-China collaborative bioenergy research and to enhance our global impact in a sustainable world. In addition to service at TAMU, my service role includes grant reviews, editorial tasks for journals, and scientific boards. For example, I served as Associate Editor for BMC Research Notes and as an adhoc reviewer of between 10 to 20 journal articles annually for other scientific journals. I was recently elected to serve on the Board of Directors for the MidSouth Computational Biology and Bioinformatics Society (MCBIOS). As a member of the five-member Board of Directors, I will be helping the society to achieve its mission in promoting bioinformatics research and education, as well as developing

grants for collaborative research and education. These services have helped foster growth of our research community and to establish connections for my own research and teaching programs.