

species and mechanisms of interactions, which may contribute to the robust nature of disease inhibition in suppressive soils.

Beyond their insights into the potentially broad, community basis for disease suppression, microbiome-focused studies may also shift our understanding of the location where pathogen suppressive interactions occur. For example, the finding that fungal endophytic taxa are selectively increased in suppressive soils suggests the potential for antagonistic or disease-suppressive microbial interactions to occur in multiple compartments of the microbiome (e.g., endophytic vs. soil), broadening targets for research. While much work has focused on pathogen-microbe interactions in bulk or rhizosphere soil, it may be that bulk soil populations are important predominantly as a source of immigrants to the rhizosphere or the plant endosphere. In this case, rather than the primary habitat within which disease or pathogen suppression occurs, bulk or rhizosphere soils may supply an endophytic microbiome for disease suppression. Further characterization of variation in microbiome composition and functional characteristics across bulk, rhizosphere, or endophytic compartments of the plant microbiome may fundamentally shift the ways we think about microbial disease suppression.

Microbiome-targeted approaches have revealed novel taxa or microbial consortia associated with disease-suppressive potential (e.g., Rosenzweig et al., 2012). Recent work has also shown how the structure and co-association networks of microbial taxa shift in parallel with microbial community functional characteristics (Bakker et al., 2014). Characterizing networks of species co-association and interaction within microbiomes will provide critical insight into the ways in which the aggregate function or activity of the microbiome is distinct from the sum of its individual population components. Signaling, antagonistic, resource competitive, and mutualistic associations have all been well documented among microbial populations and may play significant roles in disease suppression or in generating disease suppressive microbiomes. Recognizing characteristic network or interaction structures associated with disease-suppression will shed light on specific microbial interactions that influence gene expression or community function in ways that support disease-suppression. Advances in transcriptomics and proteomics will be especially useful in such functional

analyses of intact and synthetic microbiomes. Specifically, in addition to helping to identify novel mechanisms of pathogen suppression, these approaches can be used to characterize relationships between microbiome composition and specific suppressive functions within the microbiome (e.g., aggregate antibiotic or enzyme production). Moreover, considering the phytobiome as a whole through systems biology and synthetic community analyses (e.g., Harcombe et al., 2014) offers a means to integrate cropping system physical and nutrient characteristics that influence disease suppression. Such approaches will provide a strong foundation for a comprehensive mechanistic understanding of phytobiome capacities to suppress plant diseases. In particular, the capacity to use whole genome sequence data to advance metabolic network models of species interactions in complex environments will be helpful in developing enhanced conceptual and predictive models for managing the phytobiome for disease suppression.

The past few years have seen tremendous advances in our ability to characterize the composition, structure, and functions of plant microbiomes. While plant pathologists continue to advance our understanding of the features of healthy plant microbiomes, we have enormous potential for advancing sustainable strategies for disease suppression by identifying the compositional, structural, and functional characteristics of disease-suppressive microbiomes. Further integration and application of approaches that explore the entire phytobiome

and span molecular, ecological, and evolutionary biology will propel plant pathologists toward accomplishing our long-sought goal of disease suppression via microbiome management.

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New Book Reviews Molecular Research on Soil- and Plant-Associated Fungi

Genome sequencing has helped us understand how fungi recycle organic material in the soil, engage in positive and negative interactions with plant roots, and attack plants as pathogens.

Genomics of Soil- and Plant-Associated Fungi highlights the relevance of fungal genetic research and biotechnological applications in plant pathogenesis, biomass degradation, litter decomposition, nitrogen assimilation, antibiotic production, mycoparasitism, energy, ecology, and soil fungi turning to human pathogens.

This comprehensive book addresses the similarities and differences in the genomes of soil saprophytes, symbionts, and plant pathogens by using examples of model fungal species, *Neurospora* and *Aspergillus*, to provide an important view of pathogens and mutualists, such as *Trichoderma* spp., *Fusarium oxysporum*, *Cochliobolus heterostrophus*, *Penicillium chrysogenum*, *Rhizopus oryzae*, *Podospora anserina*, and other species belonging to Agaricomycetes, Archaeorhizomycetes, and Magnaporthaceae.

Genomics of Soil- and Plant-Associated Fungi also offers an analysis of how specific interactions with hosts and the influence of the environment may have shaped genome evolution. This APS PRESS-recommended title is now available in the APS PRESS Bookstore for \$199. APS members, save \$20 using your 10% member discount! ■



Student Degree



Anna Leon recently completed requirements for her Ph.D. degree in plant pathology at Washington State University. Her dissertation was entitled “Quantification and determination of

inoculum threshold levels of *Fusarium commune* in Douglas-fir nurseries.” Her committee included **Gary Chastagner** (chair), **Tim Paulitz**, **Ned Klopfenstein**, and **Lynne Carpenter Boggs**. Damping-off of Douglas-fir seedlings is a major problem in conifer nurseries in the Pacific Northwest. Recent work has implicated *Fusarium commune* as a cause of damping-off, but it is morphologically indistinguishable from *Fusarium oxysporum*, which has been shown to be less virulent. Leon developed a quantitative real-time PCR (qPCR) assay to quantify *F. commune* and distinguish it from *F. oxysporum*. She conducted greenhouse inoculum trials to determine the mortality threshold for Douglas-fir germinants and found that *F. commune* was virulent and caused mortality on Douglas-fir. Based on her results, she recommend that if a grower wishes to keep the Douglas-fir damping-off below 5%, soil should be managed below a level of approximately 500 CFU/g *F.*

commune or 2.3×10^{-6} ng/ μ l *F. commune* DNA. She also determined the disease threshold level in field nursery beds and validated the qPCR assay using infested field nursery soil. Leon will work as a nursery pathologist with Weyerhaeuser.

New Positions



John Bowman, senior agricultural advisor at USAID, was recently named leader for the Safe and Nutritious Foods Program Area in the Agriculture Research and Policy Office in the Bureau for Food Security. Bowman supervises collaboration between 12 global projects worth over \$100 million focused on research in horticulture, livestock, aquaculture, biofortification, nutrition, mycotoxins, and post-harvest loss. He also supervises IPM programming for USAID. In the past two years, he has given plenary speeches in Beijing, Manado, and Brisbane on USAID research

activities in horticulture and IPM and helped to organize a session on international funding opportunities at the recent APS-CPS Joint Meeting in Minneapolis.



Jeffrey Coleman joined the Department of Entomology and Plant Pathology at Auburn University as an assistant professor. His research program focuses on host-specific virulence factors that reside on supernumerary chromosomes in fungi. He will be responsible for instructing the departmental mycology class.

Ray Hammerschmidt has been named interim director of Michigan State University (MSU) extension. Hammerschmidt had been interim associate director of MSU extension since July 2014. Previously, he was the associate chair of the MSU Department of Plant, Soils, and Microbial Sciences, where his research and teaching focused on the physiology and biochemistry of plant disease and disease resistance. Hammerschmidt received a bachelor’s degree in biochemistry from the School of Agriculture at Purdue University in 1974 and a master’s degree in plant pathology in 1976. In 1980, he received a Ph.D. degree in plant disease resistance from the University of Kentucky. Hammerschmidt joined MSU in 1980 with a research and teaching appointment and conducted fundamental and applied research on potato diseases.

Award

The Iowa Soybean Association (ISA) presented a plaque to Iowa State University (ISU) acknowledging ISA’s 50-year investment of \$50 million in soybean check-off funding and their continued commitment to soybean research conducted by ISU scientists. The award was presented during the ISU versus University of Kansas men’s basketball game on January 17, 2015. The plaque was presented by the ISA president and ISA executives. Among those representing ISA was **Ed Anderson**, APS member and senior director of supply and production systems. Representing ISU were APS member and ISU President **Steven Leath**, College of Agriculture & Life Sciences Dean **Wendy Wintersteen**, and APS member **Greg Tylka**, professor and director of the newly founded Iowa Soybean Research Center at ISU.



Ed Anderson, Steven Leath, Wendy Wintersteen, and Greg Tylka

Sang-Wook Park recently joined the Department of Entomology and Plant Pathology at Auburn University (AU). Park’s research focuses on the role of cellular hormone signaling and redox homeostasis in innate immune responses during infectious diseases. Prior to joining AU, Park earned his bachelor’s and master’s degrees from Chung-Ang University, Korea, in 1998 and 2000, respectively, and a Ph.D. degree in plant biochemistry from Colorado State University in 2004. From 2004 to 2008, he served as a post-doctoral fellow at the Boyce Thompson Institute for Plant Research and, in 2008, was named a senior research associate at Virginia Bioinformatics Institute at Virginia Polytechnic Institute and State University.

People continued on page 38

In Memory

James Edson DeVay, professor emeritus of plant pathology at the University of California (UC)-Davis, passed away on December 4, 2014. Jim was born on November 23, 1921, in Minneapolis. He joined the Navy during World War II and served as a pilot and flight instructor. As a returning veteran, he attended the University of Minnesota (UMN), receiving his bachelor's degree in 1949 and his Ph.D. degree in plant pathology in 1953. His doctoral research was mentored by **E. C. Stakman** and **John B. Rowell**, where he conducted biochemical studies of sex and pathogenicity in *Ustilago zaeae*.

After a brief post-doctoral appointment, Jim joined the faculty in the UMN Department of Plant Pathology as an assistant professor in 1954 and associate professor in 1957. That same year, he accepted an opportunity to join the faculty in the Department of Plant Pathology, UC-Davis, where he was promoted to professor of plant pathology in 1965. During his distinguished 35-year career at UC-Davis, Jim was chair of the plant pathology department and served as an associate dean in the Division of Biological Sciences. Jim received a number of honors during his career, including APS Fellow in 1972 and the E. C. Stakman Award in 2001.

DeVay was internationally recognized and respected for his research on plant-pathogen interactions, where early on he recognized the importance of knowledge of sequential interactions of host and pathogen and applied modern biochemical techniques to the study of host-parasite physiology. He researched a variety of pathosystems throughout the course of his career, and often at multiple



levels of inquiry that included basic studies of the plant-microbe interaction to applied aspects of epidemiology and disease management. Jim and his many students, post-doctoral associates, technical staff, and faculty collaborators also worked closely with growers in the field, providing information on etiology and control. His early research at UC-Davis focused on fungal and bacterial diseases of orchard crops, particularly bacterial canker of stone fruits, *Ceratocystis* canker of almond and prune, and hull rot of almond. The pioneering research of Jim and his group on *Pseudomonas syringae* led to a number of seminal discoveries, including isolation and characterization of the phytotoxin syringomycin, as well as uncovering aspects of the etiology of bacterial canker disease. In later years, he worked on the etiology, epidemiology, and management of diseases of cotton, particularly fungal seedling diseases and Verticillium and Fusarium wilts. Jim was among the first investigators to rigorously evaluate solarization for management of soilborne diseases in cotton and other crops in California. A perusal of his publications reveals the remarkable diversity of his research interests and significant contributions to plant pathology. Jim's research studies were an integral part of his teaching. For many years

he co-taught courses on fungal physiology and the physiology of host-parasite interactions, and later he brought his wealth of experience and knowledge to teaching introductory plant pathology. Colleagues who had the privilege of teaching with him and students in his classes were enriched by his enthusiasm and his historical knowledge of physiological plant pathology that was both crucial and critical because he was a big part of it.

Jim was active in APS, serving as chair of the Disease and Pathogen Physiology Committee (an early precursor to the Molecular and Cellular Phytopathology Committee) and associate editor of *Phytopathology*, as well as serving on other committees. He was also on the Editorial Board of *Physiological Plant Pathology*. He was a frequent speaker at international meetings, including the First International Congress of Plant Pathology and the U.S.-Japan Joint Science Seminar series and was on the organizing committee for the Second International Congress of Plant Pathology.

Jim retired from UC-Davis in 1992 and continued to remain active and drop by the department for many years. Jim was predeceased by his beloved wife of 67 years, Mary Alice DeVay, who passed away in September 2014, and a granddaughter. He is survived by his six children, 15 grandchildren, 12 great-grandchildren, and his sister and brother.

Written by Richard M. Bostock, John Andrews, David G. Gilchrist, and R. Joseph Wakeman. The full version of DeVay's obituary can be found on the APS website. ■



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Important APS Dates to Remember

March 2015

- 16 APS Annual Meeting Call for Papers closes
- 20 Applications due for Student Travel Awards

May 2015

- 15 Outstanding Volunteer Award nominations due

July 2015

- 1 Art in Phytopathology entries due

Here are just a few of the headlines you missed from the APS Twitter feed.

NPR: California's Strawberry Feud Ends, But Who Will Breed New Berries?
<http://n.pr/1DjeQWb>

A New Look at Plant Health with Google Glass <http://bit.ly/1AxZr47>

The Chocolate Curse: Seeking a Solution for Witches' Broom in Ecuador via @nprnews
Episode 601: <http://n.pr/1uYlmLi>

Little Cherry Virus Checks Reveal Extent of Disease <http://ab.co/19gcI6O>

Leaf Blotch Disease in Wheat: The Science Solution <http://bit.ly/1ESxAy0>

Research to Fight Pathogens That Infect Canola Takes Root at Rutgers-Camden
<http://bit.ly/1IDHyPJ>

New Tools to Help Manage SDS <http://bit.ly/1xYwHvj>

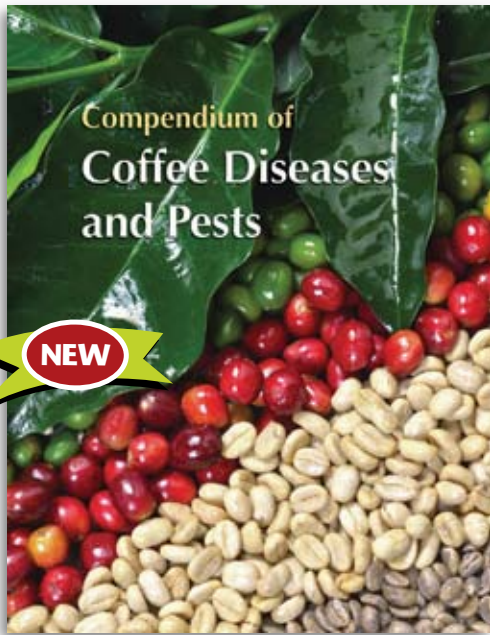
USDA: \$30 million to fight citrus greening <http://bit.ly/1vJstNG>

Race to save Britain's beloved ash trees <http://t.co/SRQaUPwwoj> bit.ly/1KAXYBA

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Calendar of Events

APS Sponsored Events

March 2015

- 11-13 APS Potomac Division Meeting.**
Rehoboth Beach, DE. www.apsnet.org/members/divisions/pot

June 2015

- 10-12 North Central Division Meeting.**
East Lansing, MI. www.apsnet.org/members/divisions/nc

July 2015

- 19-23 Caribbean Division Meeting.**
Mexico City, Mexico. www.apsnet.org/members/division/carib

August 2015

- 1-5 APS Annual Meeting.** Pasadena, CA.
www.apsnet.org/meet
- 1-5 Pacific Division Meeting** (in conjunction with APS Annual Meeting).

July 2016

- 30-Aug 3 APS Annual Meeting.**
Tampa, FL.

Other Upcoming Events

March 2015

- 8-13 2015 Gordon Research Conference and Seminar on Chemical and Biological Terrorism.** Ventura, CA. www.grc.org
- 17-22 28th Fungal Genetics Conference.** Pacific Grove, CA.
www.genetics-gsa.org/fungal/2015/index.shtml
- 19-20 Plant Genomics Congress: Asia.** Kuala Lumpur, Malaysia.
www.globalengage.co.uk/plantgenomicsasia.html
- 23-27 Eighth International IPM Symposium, IPM: Solutions for a Changing World.** Salt Lake City, UT. www.ipmcenters.org/IPMSymposium15
- 24-26 61st Annual Meeting of the Conference on Soilborne Plant Pathogens.** University of California-Riverside. <http://soilfungus.ars.usda.gov>
- 26 Climate Change and the Future of Plant Life Symposium.** Cambridge, MA.
www.newenglandwild.org/sym

May 2015

- 11-12 Third Plant Genomics Congress.** London, England.
www.globalengage.co.uk/plantgenomics.html
- 18-21 CROPS 2015.** Huntsville, AL. <http://hudsonalpha.org/crops>

June 2015

- 8-12 23rd International Conference on Virus and Other Graft-Transmissible Diseases of Fruit Crops.** Morioka, Japan. www.icvf23.jp
- 16-17 35th New Phytologist Symposium—The Genomes of Forest Trees: New Frontiers of Forest Biology.** Boston, MA. www.newphytologist.org/symposiums/view/37

August 2015

- 10-28 2015 Rice Research to Production Course.** IRRI, the Philippines.
<http://ricediversity.org/r2p>
- 24-27 XVII International Plant Protection Congress.** Berlin, Germany. www.ippc2015.de
- 30-Sep 2 CCC/EUCHIS 2015.** Münster, Germany. <http://chitin2015.eu>

September 2015

- 14-15 Third Plant Genomics Congress: USA.** St. Louis, MO.
www.globalengage.co.uk/plantgenomicsusa.html
- 14-16 Resistance 2015.** Rothamsted Research, Hertfordshire, United Kingdom.
www.rothamsted.ac.uk/resistance2015
- 14-16 Australian Plant Pathology Conference.** Fremantle, Western Australia.
www.apps2015.com.au