Microbiome Studies continued from page 29

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 to 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! ■

People continued from page 37

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 zeae*.

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. ■

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

twitter@plantdisease

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

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

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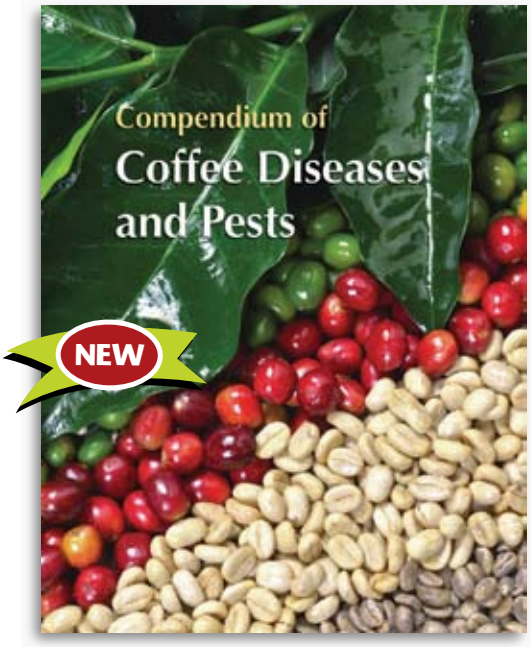

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Calendar of Events

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-Transmissable 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