

## **APS AWARDS AND HONORS**

*Congratulations to the following outstanding members selected to receive APS awards in honor of their significant contributions to the science of plant pathology. The awards will be presented to the recipients at this year's annual meeting in Anaheim, California, on Sunday, August 1, 2004 at the Anaheim Hilton Hotel in California A/B Pavilion. A listing of all past awardees is available online at <http://www.apsnet.org/members/awards/list.asp>*

**APS FELLOWS:** *The Society grants this honor to a current APS member in recognition of distinguished contributions to plant pathology or to The American Phytopathological Society.*

### **Michael A. Ellis**

Michael Ellis received his B.S. and M.S. degrees from Eastern Illinois University. He then attended the University of Illinois, receiving his Ph.D. degree in plant pathology in 1976. He joined the faculty at the University of Puerto Rico, Mayaguez, as assistant professor to conduct research on seedborne fungi of tropical grain legumes and to teach tropical plant pathology. In 1979, Ellis joined the faculty of The Ohio State University at Wooster as assistant professor, with responsibility for fruit crop diseases. He was promoted to associate professor in 1983 and professor in 1988. His current responsibilities are 55% research and 45% extension.

Ellis is recognized for his research and extension programs that emphasize the use of integrated disease management strategies as critical portions of an overall IPM and crop management program. Ellis, colleague L. V. Madden, graduate students, and postdocs have made major advances in understanding the epidemiology of several important diseases of strawberry, grape, and brambles, with an emphasis on determining the effects of the environment on disease development and spread. Predictive systems (forecasters) have been developed for Botrytis flower and fruit rot, anthracnose fruit rot, and leather rot of strawberry, as well as black rot, downy mildew, and Phomopsis cane and leaf spot of grape.

Especially noteworthy is his research on leather rot of strawberry fruit, caused by *Phytophthora cactorum*. This disease was a major problem worldwide but poorly understood. Ellis's research has resulted in a broad and in-depth understanding of the epidemiology of the disease, especially the relationship between weather conditions and infection, sporulation, dispersal, and disease spread. This information has been used to integrate cultural and chemical control methods to successfully manage the disease. On the basis of the results from controlled environment and field studies, a disease predictor for leather rot was developed and validated in the field. In addition to basic research in epidemiology, Ellis is also extensively involved in problem-solving research for fruit growers. His research approach incorporates knowledge of disease epidemiology and pathogen biology to integrate resistance, cultural practices, biological control, and minimal and targeted fungicide usage for the efficient and cost-effective control of fruit crop diseases. He is an excellent example of how a plant pathologist with a research-extension appointment should function: that is, his research is problem solving and has resulted in practical information that is directly useful to the fruit industry. He has authored or co-authored more than 100 refereed journal articles and in recognition of his excellence in research, was honored with the Ciba-Geigy Award by APS in 1987.

In addition to his contributions in research, Ellis is also recognized as an outstanding extension educator. His extension programs have significantly increased the awareness and use of integrated disease management strategies by commercial fruit growers in Ohio and throughout the Midwest. He is known as a great communicator within the fruit crop community and uses a wide variety of traditional and innovative processes to disseminate information. He maintains a strong commitment to multidisciplinary and regional cooperation in extension programs. In 1990, he worked closely with extension specialists in plant pathology, entomology, and horticulture in the Midwest Fruit Specialists Working Group to develop regional spray guides for commercial tree fruit and small fruit growers. These spray guides are revised annually, and Ellis continues to coordinate revision of the pathology sections. He also organized the development of the *Midwest Small Fruit Pest Management Handbook*, published in 1996, and co-edited the *Midwest Tree Fruit Handbook*, published in 1993. These handbooks serve as sister publications to the spray guides and are revised every 3 to 4 years. Together, the spray guides and pest management handbooks serve as the main sources of information on disease, insect, and weed management for fruit growers in 10 states across the Midwest. These publications are excellent examples of the multidisciplinary/regional cooperation at which Ellis excels.

Ellis is well known in Ohio and around the Midwest for his clear, organized, and uncluttered explanations on all aspects of fruit disease biology and control. He has made more than 500 presentations at fruit schools, IPM workshops, county agent “InServices,” and Master Gardener training sessions within Ohio and has also made about 100 invited presentations in more than 80 out-of-state extension and fruit production programs across the north central region, other areas of the United States, and in other countries. He has authored over 500 papers in trade journals, fruit disease fact sheets, several numbered and lengthy extension bulletins, and published many proceedings and technical reports. For his long-term contributions in extension that have dramatically improved disease control in fruit crops in the region and country, Ellis was awarded the APS Excellence in Extension Award in 2000.

During the last few years, he has expanded his geographic interests by serving as one of the leaders in the US-AID-funded Integrated Pest Management Project in Ecuador. Here he contributes his considerable experience—and fluent Spanish—to developing improved methods for managing fruit crop diseases in this developing country.

Ellis has an outstanding record of service locally, regionally, and nationally. Within APS, he recently completed his second term in the Office of Public Affairs and Education (OPAE) and is halfway through a term as Councilor-at-Large. He has also served on several APS committees and chaired some of them. He previously served as the small fruit and stone fruit section editor of *Fungicide and Nematicide Tests*, senior editor of *Plant Disease*, and was the organizing editor and one of the major writers for the *Compendium of Raspberry and Blackberry Diseases and Insects* published by APS PRESS.

Ellis has made 28 years of exceptional contributions in extension and research in the state, region, and country and is very deserving of being recognized as Fellow of APS.

### **Bryce W. Falk**

Bryce W. Falk was born in Culver City, California, and educated through high school in southern California. He was awarded a B.S. degree in biology from the California Polytechnic State University at San Luis Obispo in 1974. He began his graduate work at the University of California-Berkeley, receiving his M.S. degree in 1976 and his Ph.D. degree under T. Jack Morris in 1978. The subjects of his initial research efforts were “difficult” (low titer, transmitted by vector only, resisting purification) viruses, virus-associated replicating RNAs, and virus vectors, and these have remained the characteristic research interests of his career, accounting for about 50 of his more than 100 publications. Falk pursued postdoctoral research at the University of California-Riverside, with L. G. Weathers and in 1980 was appointed as assistant professor at the University of Florida Everglades Research and Education Center, Belle Glade. He moved to the University of California-Davis as assistant professor in 1985, advancing to associate professor in 1987 and professor in 1991. Falk’s work includes extensive contributions to both practical and fundamental research. On the practical side, and with technically advanced methods, he initiated and improved virus detection to document virus distribution and plant resistance to viruses. His research advanced epidemiology and a range of control practices for plant virus diseases, both cultural and pesticide-based, as well as our understanding of some of their ecological consequences. Falk’s contributions to the discovery and characterization of various viruses have resulted in clarification of virus taxonomic relationships.

Falk’s research program has made significant contributions in several areas of plant virology and plant pathology. The most noteworthy of these accomplishments dealt with the biology, molecular genetic analysis, taxonomy, and virus-vector relationships of tenuiviruses and criniviruses. While he was at Belle Glade, Falk began a research collaboration with J. H. Tsai on the tenuivirus *Maize stripe virus* (MStV) that continued after his appointment at Davis and has resulted in an extensive series of publications and an in-depth analysis of this important virus, including the definition of its genome and the discovery that subgenomic messenger RNA synthesis from MStV templates relies on host messenger RNA as the source of the 5′-end sequences (“cap snatching”). Falk’s research group also demonstrated that a non-capsid protein accumulates in MStV-infected plants, thus providing an important example of a virus diagnostic approach based on a non-coat protein rather than virus particles or nucleic acid.

In 1994, Falk began investigating *Lettuce infectious yellow virus* (LIYV), discovering that it has a divided genome, a finding that resulted in its assignment as the type member of the new genus *Crinivirus* in the

family *Closteroviridae*. Subsequent LIYV research of the Falk laboratory developed infectious transcripts and vector transmission assays of purified virions, revealed that the virions have four proteins, only one of which is a likely candidate as a vector transmission determinant, and uncovered a mechanism by which synthesis of the two genomic RNAs of LIYV is temporally controlled. Falk's laboratory is the world leader in the investigation of both MStV and LIYV.

Falk's group research efforts on another virus in the family *Closteroviridae* illustrate his commitment to both fundamental and applied aspects of plant virology. To understand pathogenicity determinants of the closterovirus *Citrus tristeza virus* (CTV) strains in California, Falk and colleagues used single-strand conformation polymorphism (SSCP) and nucleotide sequence analyses. They found that most CTV infections are typical narrow-distribution quasispecies, but some are mixed infections including potential products of RNA-RNA recombination. Even in diverse CTV populations, highly conserved, short, specific nucleotide sequence segments were found among isolates from California, Florida, Spain, Portugal, and Japan. These common sequences may have applications in diagnosis and possibly in development of novel control measures. Furthermore, collaborative studies demonstrated that aphid transmission of CTV selects specific genotypes from mixtures, possibly providing a genetic "bottleneck" and explaining the uniformity of CTV populations in infected plants.

Another important area of Falk's research activity deals with the virus-interaction phenomena of transcapsidation and RNA-RNA recombination and their implications for the generation of new viruses in mixed infections and virus-infected transgenic plants and their contribution to virus genetic diversity. His work here led to the discovery of the subviral RNA replicons that are associated with some luteovirus infections and demonstrated that many virus:virus interactions are common.

Falk has taught general plant pathology and graduate plant virology courses, both lecture and laboratory components, and has been a significant contributor to undergraduate and graduate general virology courses. His teaching is widely respected by his peers, and he receives very favorable evaluations from students. He has been particularly innovative in the structuring of the laboratory section of the graduate plant virology course. Falk also is highly regarded as an advisor and mentor of graduate students. He has contributed very valuable service to his department through management of the greenhouse facility committee.

Falk has served in various editorial capacities on the boards of the journals *Molecular Plant Pathology*, *Phytopathology*, *Plant Disease*, and *Virology*. He frequently makes presentations to commodity and research groups and has been a reviewer of numerous grant proposals submitted to federal agencies, commodity boards, and international agencies. He has been a panel member and a panel manager for the USDA competitive grants program. Falk is a member of The American Phytopathological Society, The American Society for Virology, The American Society for Microbiology, and the American Association for the Advancement of Science (AAAS) and was recently named a Fellow of AAAS.

### **Thomas C. Harrington**

Thomas C. Harrington was born and raised in Omaha, Nebraska. He earned a B.S. degree in plant pathology from Colorado State University in 1977, an M.S. degree in plant pathology from Washington State University in 1980, and the Ph.D. degree in plant pathology from the University of California-Berkeley in 1983. His first appointment was assistant professor in the Department of Botany and Plant Pathology at the University of New Hampshire, where following his promotion to associate professor in 1988, he served as chair of the department and oversaw the merger of two departments and became co-chair of the new Department of Plant Biology. In 1991, Harrington moved to Iowa State University and was chair of the Department of Plant Pathology until 1996. During this period, Harrington oversaw the expansion of the size of the faculty, research support staff, and graduate program; integration of the extension facilities and faculty into the department; and facilitated the sharply increased extramural funding and research productivity of the department. He is currently professor of plant pathology and forestry at Iowa State University and teaches forest insect and disease ecology and co-teaches wood deterioration and preservation.

Harrington is recognized as an international leader in forest pathology. He has produced major review articles on fungal-insect interactions, the ecology of pine diseases, and species concepts in fungi. The main

subjects of his research include variation and speciation of fungal pathogens and fungal symbionts of bark beetles and other forest insects. In his first independent research project as a graduate student, results of his careful studies on *Cryptosporus volvatus* showed that, contrary to previous theories, bark beetles that are vectors of wood decay fungi acquired the basidiospores while on the wing rather than from beetle galleries in recently killed trees. For his Ph.D. work, he associated root-feeding bark beetles and precommercial thinning of Douglas-fir stands with black stain root disease and described three-host specialized forms of the pathogen as varieties of *Leptographium wagneri*. At New Hampshire, a series of elegant studies by Harrington and his colleagues on root and butt rot fungi led to a persuasive alternative to the acid rain hypothesis to explain mortality in red spruce forests in the northeastern United States. Results of their studies demonstrated the role of root disease and bark beetles in the dynamics of red spruce forests and pointed to the role of wind in damage to these forests, leading to the re-evaluation of the role of natural, abiotic factors in forest decline phenomena.

Harrington has earned the reputation as one of the world's foremost authorities on the taxonomy and ecology of fungi associated with bark beetles and root rot fungi, particularly *Armillaria*, *Heterobasidion*, *Ceratocystis*, *Ophiostoma*, and *Leptographium*. Bark beetles are among the most devastating forest pests, and their fungal associates have been of increasing importance as agents of bluestain of timber. Harrington used a sabbatical leave at the University of California-Berkeley to gain expertise in molecular analyses of fungi and has integrated those tools with classical taxonomy and genetic methods to clarify genetic diversity, mating strategies, and phylogenetic relationships among fungal taxa. The combination of these approaches has advanced our understanding of the evolution and speciation of fungal plant pathogens and, in turn, enhanced our understanding of plant disease systems. Through studies on the population genetics of *C. fimbriata*, Harrington's group identified human introductions of host-specialized forms of the fungus on wood-packaging materials and in propagative tissues of sycamore, cacao, eucalyptus, sweet potato, and taro. His research on *Ceratocystis*, which has been funded by grants from the National Science Foundation, includes collaborators in six Latin American countries, with much of the work done with collaborators in Brazil, and is leading to disease management recommendations for cacao, mango, eucalyptus, and other crops.

Harrington has been involved in research projects on each of the seven continents, and the international scope of his contributions is clear from the breadth of his collaborative research. In 1997, he was a W. D. Wilson Fellow and visiting professor in the Department of Microbiology and Biochemistry at the University of Orange Free State in South Africa. Work with his South African colleagues led to the now widely used technique for the molecular identification of *Armillaria* species and resulted in genetic documentation of the earliest introduction of a plant pathogen by humans – the introduction of *A. mellea* to Capetown, South Africa, in 1650.

Harrington has an extensive record of service to APS and other professional societies. He has chaired both the Forest Pathology and Mycology Committees of APS, served two terms as associate editor of *Plant Disease* and one term as senior editor, co-organized mycology symposia at three APS annual meetings, and served as evaluator for student papers for the Northeastern Division of APS. He also has been active in the Mycological Society of America. He served as a member of the editorial board of *Mycologia* and as councilor for ecology/pathology, and he is currently chair of the MSA Endowment Committee. He was elected a fellow of MSA in 2002.

For his innovative and creative research contributions ranging from the molecular level to the ecosystem level, his scientific leadership in forest pathology, and his service to APS, Thomas Harrington is recognized as a highly deserving recipient of the APS Fellow Award.

### **Barry J. Jacobsen**

Barry Jacobsen was born and raised in Racine, Wisconsin, where he first became associated with plant agriculture by working with Wes Hansche, a vegetable grower and cabbage, onion, and carrot breeder. Through Wes he had the good fortune to meet J. C. Walker and other professors from the University of Wisconsin, who were conducting field research near Racine. He attended the University of Wisconsin, where he worked part time for J. C. Walker and thus had his first taste of work in plant pathology under one of the giants in our profession. He received his B.S. degree in plant pathology with a minor in chemistry in

1969. He continued at the University of Wisconsin to carry out graduate work and received his M.S. degree in 1971 working under Paul Williams. Arthur Kelman recommended that Barry move on to another university for his Ph.D. degree and gain more experience in extension plant pathology. He enrolled at the University of Minnesota and worked with Howard Bissonnette and Dave MacDonald, receiving his Ph.D degree in 1973.

Barry's first faculty position was at the University of Illinois-Urbana, where he moved quickly through the ranks of assistant, associate, and full professor. He was also appointed as project leader in extension plant pathology in 1978. In 1984, he spent a sabbatical leave at the Institut für Pflanzenkrankheiten in Bonn, Germany. Barry left Illinois in 1987 to become the head of the Department of Plant Pathology at Auburn University in Alabama. Through his efforts and those of the faculty, the graduate student enrollment increased dramatically, three new faculty positions were added, and the Biological Control Institute was founded. His experience in administration next took him to Montana, where he became the dean of the College of Agriculture and director of the Montana Agricultural Experiment Station at Montana State University in Bozeman. This move to Bozeman also allowed Barry to live his boyhood dreams of hunting, fishing, skiing, and horseback riding in the mountains. Barry returned to full-time faculty status in 1994 as full professor and extension plant pathologist with responsibility for potatoes and sugar beets. From 1995 to 1998, he assisted the USDA, serving as the first national IPM coordinator and member of the USDA extended faculty. His current program involves work on developing and extending integrated biologically based control measures for a variety of sugar beet and potato diseases.

Barry's professional life has involved him in a myriad of experiences, including becoming an experienced pilot. He used his skills in flying to develop a nationally recognized program for aerial applicators, helping them to adjust their equipment to maximize their application of pesticides in an environmentally safe manner. During his time at Illinois, Barry spent much of his time working with grain producers to reduce their problems with grain storage. With Don White, he developed techniques for applying fungicides to corn as it enters the grain storage facility to allow for low-temperature drying, minimizing moldy grain problems. As a result of his expertise in grain storage, he has served as a consultant to growers, grain elevator operators, transporters, and insurance companies to help solve their problems and to serve as an expert witness on the conditions that lead to storage mold problems. He also developed a relationship with members of the veterinary community to study various aspects of moldy grain and mycotoxins on farm animals. He is currently recognized by the grain trade industry as an international expert on determining the cause and responsibility for deterioration of grain by storage and field molds. Barry's expertise in midwestern agriculture also has served to allow him to be a consultant to a number of companies concerned with environmental quality. He was awarded the APS Campbell Award for his work on pea root rot in 1980 and the Merck Foundation Award in 1983 for his work on use of fungicides for managing storage molds during low-temperature drying and shipment where aeration is difficult.

Barry's move to Alabama in 1987 to become head of the Department of Plant Pathology at Auburn University served to bring into focus his interest in biological control of plant disease. During his tenure there, he hired Joe Kloepper to complement the biological control expertise of Rod Kabana, Paul Backman, and Roy Curl, establishing the Auburn Department as a leader in biological control research. After his move to Montana, he continued this work on biological control, searching for bacteria, particularly the spore-forming bacilli that would be efficacious in controlling *Cercospora* leaf spot and *Rhizoctonia* crown rot in sugar beets. Montana State University has recently licensed two of his biocontrol strains, one to Gustafson, Inc., for use as a seed treatment in controlling *Pythium*, *Rhizoctonia*, and *Aphanomyces*-caused seedling and root rot diseases of sugar beet and the other to Montana Microbials for control of *Cercospora* leaf spot and other diseases.

In addition to Barry's career with several universities, he has also performed yeoman service for APS. At the council level, he served as councilor-at-large from 1983 to 1986. In 1991, he was one of the early members of the board of directors of the APS Foundation. In this role, he was instrumental in developing the policies and procedures for the Foundation. That this was successful can be seen today in the fact that the Foundation has over \$900,000 in its endowment fund and awards numerous graduate student travel grants each year and also funds a number of other projects. Barry's wise advice on how the funds should be invested and the income used to fund the Foundation's projects has been critical to the Foundation's

development since its inception. In addition to Barry's work with Council and the Foundation, he has served on numerous APS committees, which underscores his breadth of interest and expertise. These include the Biological Control, Chemical Control, Extension, Public Relations, Membership, Program, Postharvest Diseases, Phyllosphere Microbiology, Industry and Integrated Pest Management Committees. He has served as both member and chair on a majority of these committees.

### **Harold Corby Kistler**

Harold Corby Kistler was born and raised in northeastern Ohio. He graduated cum laude with a B.S. degree in biology from Kent State University in 1975 and then served two years as a research assistant in the Department of Biochemistry in the School of Medicine at Case Western Reserve University. He enrolled at Cornell University, majoring in plant pathology under the direction of Hans VanEtten and received his Ph.D. degree in the summer of 1983. As a graduate student, he conducted groundbreaking genetic research demonstrating that pisatin demethylase, an enzyme that degrades the pea phytoalexin, is a pathogenicity factor in the fungus *Nectria haematococca* (*Fusarium solani* f. sp. *lisi*). Following a postdoctoral position with Sally Leong, USDA-ARS at the University of Wisconsin in Madison, Kistler joined the faculty as an assistant professor in the Department of Plant Pathology at the University of Florida in Gainesville in 1985. He rose through the ranks to associate professor in 1991 and full professor in 1997. In 1999, Kistler accepted a position as research geneticist with the USDA-ARS in the Cereal Disease Laboratory in St. Paul and adjunct professor at the University of Minnesota.

Kistler is an internationally recognized authority on *Fusarium* species. His research has been consistently funded by NSF, BARD, USDA-NRI, and other agencies. At every stage of his career, he has made outstanding contributions that have advanced our knowledge of the basic biology and molecular genetics of pathogenicity of *Fusarium* species. He has developed many of the tools and techniques that are now used routinely for molecular genetic studies of *Fusarium* and has applied them to several species. He was the first to transform *Fusarium* and to determine an electrophoretic karyotype of any species in the genus, the first to demonstrate targeted, telomere-mediated chromosome breakage in filamentous fungi, the first to demonstrate widespread genetic duplication in *Fusarium*, and the first to conduct a detailed molecular systematics analysis of the genus. He has made numerous contributions to our understanding of the population genetics, evolution, and biology of *F. oxysporum*. He was the first to demonstrate the polyphyletic origin of host specificity in *F. oxysporum* and has developed methods for identifying strains with different host specificity by PCR-based assays that are currently used by diagnostic labs in the United States, Europe, and Australia.

His current research program is focused on the population genetics and genomics of *F. graminearum*, the *Fusarium* head blight pathogen of small grains. He was a member of a team that discovered that the *F. graminearum* species complex consists of at least nine cryptic species that have distinct global distributions and that polymorphisms within the trichothecene biosynthetic gene cluster are maintained by balancing selection. Kistler has been at the forefront of efforts to develop publicly available genomic resources for *F. graminearum*, including obtaining funds to sequence the genome and coordinating efforts for manual annotation, functional analysis, and the integration of the genetic and physical maps. The recent public release of the whole genome sequence of *F. graminearum* represents a major milestone in molecular biology of plant pathogenic fungi.

Kistler has served APS as associate editor of *Phytopathology* and *Molecular Plant-Microbe Interactions* and as a member and chair of the Physiology, Biochemistry, and Molecular Biology Committee, the Genetics Committee, and the Mycology Committee. He has been instrumental in developing an international forum of researchers interested in the genetics of *Fusarium* and currently serves as chair of the International Society for Plant Pathology, Committee on *Fusarium*. Kistler also has served several times on review panels in plant pathology and plant-microbe associations for the USDA-NRI competitive grants program. He was the recipient of the Award of Excellence for Graduate Research at the University of Florida in 1998 and the Civil Servant of the Year Award, given by the Federal Executive Board of Minnesota in 2003.

For his innovative research contributions, his leadership in the molecular biology of plant pathogenic fungi, and his service to APS, Corby Kistler is recognized as a worthy recipient of the APS Fellow Award.

### **Ing-Ming Lee**

Ing-Ming Lee was born February 26, 1943, in Taiwan. He obtained his B.S. degree in plant pathology from National Taiwan University in 1965. In 1966, Lee joined the Taiwan Citrus Protection Research Center, where he investigated major fungal diseases of citrus. In 1971, he came to the United States and began graduate studies at the University of California-Riverside. He was awarded an M.S. degree in 1973 and a Ph.D. degree in 1977. After his postdoctoral positions with the USDA Agricultural Research Service (ARS), Rutgers University, and University of Maryland, Lee joined the Molecular Plant Pathology Laboratory, ARS, USDA, Beltsville, Maryland, as a research plant pathologist in 1987.

Lee began his innovative research career as a graduate student at the University of California-Riverside, where he pioneered research on citrus stubborn disease. In 1973, after more than 20 years of unsuccessful searches by entomologists looking for the vector of the citrus stubborn disease pathogen (*Spiroplasma citri*), his novel approach, involving direct cultivation of the pathogen from insects, led to his discovery of the first known natural vector (*Circulifer tenellus*). This discovery was recognized worldwide as a major breakthrough for citrus stubborn disease research, and it opened the way for subsequent work that proved conclusively that a wall-less bacterium caused a plant disease.

Lee is recognized internationally for important contributions to understanding cell wall-less plant-pathogenic bacteria of class *Mollicutes* (spiroplasmas and phytoplasmas or MLOs) and the diseases they cause. In early work as a postdoctoral researcher, he led development of new media, including the first serum-free and chemically defined media, for cultivation of *S. citri*, *S. kunkelii* and other spiroplasmas. Based on DNA homology studies and serological relationships, Lee with his colleagues proposed the first taxonomic classification of spiroplasmas. The new taxonomic criteria were adopted internationally and new *Spiroplasma* species named accordingly.

Lee is best known for his pioneering studies on molecular detection, identification, and classification of phytoplasmas. During the past decade, he and his colleagues devised new methods and reliable molecular tools (cloned DNA probes and monoclonal antibodies) for phytoplasma detection. This made it possible to study the genetic interrelatedness among diverse phytoplasmas. Lee and colleagues in 1992 proposed several distinct phytoplasma groups (genomic clusters) and constructed the first genotype-based differentiation of phytoplasma strains. These new molecular-based tools greatly advanced phytoplasma diagnostics and largely replaced traditional approaches based on biological properties, such as symptomatology, host range, and vector relationships.

In 1993, Lee and colleagues constructed the first comprehensive phytoplasma classification system, based on RFLP analysis of 16S rDNA. This novel system provided for the first time a rapid and accurate means for differentiation and identification of a broad array of phytoplasmas. Lee led a team that further expanded the classification system in 1998 and again in 2000 to include 15 major phytoplasma groups and over 40 subgroups, providing the most comprehensive phytoplasma classification system available. This approach changed the direction of phytoplasma research. As a result, the phytoplasma research field has dramatically expanded during the last 10 years. It has been recognized by international peers as a major breakthrough for classification of phytoplasmas and has been adopted by scientists worldwide. The scheme is currently used by the National Center for Biotechnology Information (NCBI)/Genbank for classification of phytoplasmas.

Lee and colleagues also developed ultrasensitive nested-PCR assays, enabling detection of low titers of phytoplasmas associated with woody plants and detection of multiple phytoplasmas (mixed infections) in the same plant. As a result, Lee and his collaborators solved etiologies of many emerging phytoplasma diseases. Using this framework, Lee and colleagues gained new insights into phytoplasma ecology and genomic diversity and devised a model of phytoplasma evolution driven by ecological constraints, a model supported by his recent study of an aster yellows disease epidemic in Texas.

Lee's accomplishments also include the discovery in 1997 that a phytoplasma causes desirable free-branching in commercial poinsettia cultivars. This was the first example of using molecular means to fulfill (modified) Koch's postulates to prove pathogenicity of any phytoplasma and the first definitive demonstration of a commercially beneficial phytoplasma.

In 1994, Lee led the first global phylogenetic analysis (the graduate study of Ph.D. student Dawn E. Gundersen, advised by Lee); this accomplishment placed phytoplasmas definitively among members of the class *Mollicutes* and revealed that phytoplasmas form a large discrete monophyletic clade. Significantly, all subclades corresponded to 16S rDNA RFLP groups previously delineated by Lee's team. Lee and his team proposed that each phylogenetic subclade represented at least one *Phytoplasma* species. This study formed the basis for delineating new genus- and species-level taxa and led to the establishment of formal phytoplasma taxonomy in which over 20 "*Candidatus Phytoplasma* species" have been proposed.

While researching phytoplasmas, Lee extended his research to include walled, bacterial pathogens. He and colleagues developed sensitive and specific PCR-based assays, enabling detection of potato ring rot bacterium *Clavibacter michiganensis* subsp. *sepedonicus* and brown rot bacterium *Ralstonia solanacearum* biovar 2/race 3 in symptomless seed potatoes, an essential step to meet zero tolerance for import/export of seed potatoes. His assay for *R. solanacearum* biovar 2/race 3 (currently under U.S. quarantine) was adopted by APHIS to verify the identity of a new strain that appeared to be responsible for an outbreak of geranium wilt disease in the United States.

Lee has demonstrated a career-long dedication to research on plant-pathogenic *Mollicutes*. His achievements have established him as an authority and leader in the field of plant pathology and phytoplasma research. During the past decade, he has initiated successful collaborative studies on phytoplasmas nationally and internationally and has trained many U.S. and foreign visiting scientists, including two Ph.D. students. Lee has been invited as a U.S. and international expert and consultant and has delivered numerous invitational seminars at national and international meetings. Lee has been a review panel member of USAID; has participated in APS as a member of APS Bacteriology Committee; chaired sessions at APS annual meetings; and served as associate editor for *Plant Disease*.

#### **Robert C. Seem**

Robert C. Seem is nominated for his contributions to his institution, his society, and his science. During his tenure as associate director, and now interim director of Cornell's Experiment Station at Geneva, at a time when many institutions are in a state of contraction and retrenchment, expansion of plantings and facilities have proceeded unabated. Seem has been one of the guiding forces for the development of the first agricultural technology park associated with an experiment station. He has served his profession both as associate and senior editor of *Phytopathology*. He has fostered international collaboration among those investigating grape diseases and hosted the first International Workshop on Grapevine Downy and Powdery Mildew at Geneva, New York. Its impact can be gauged by the rapid growth of this international collaborative group at three subsequent workshops, where Seem and his colleagues have been leading contributors. He is widely respected for his creative and inclusive approaches to research and for his applications of new technologies to solving problems. He is a leading authority in the application of geographic information systems and high-resolution weather forecasting to the management of plant diseases. Seem and his colleagues have made major contributions in forecasting grapevine downy mildew, the early development of ontogenic (or age-related) resistance in grape berries, interactions between diffuse powdery mildew and bunch rots of grape, and the impacts of light and temperature upon ascospore release and infection in the apple scab pathogen. The productivity of his research and the high regard for his efforts can be estimated from the success of his program in competitive grants and publication. Consider also that this is the record of an individual who has held a 50% appointment in Cornell administration during the aforementioned period of time. Robert C. Seem is thoroughly deserving of recognition of his accomplishments and service by appointment as a fellow of The American Phytopathological Society.

#### **Norman W. Schaad**

Norman W. Schaad was born in Myrtle Point, Oregon. He received his B.S. degree in 1964, his M.S. degree in 1966, and his Ph.D. degree in 1969, all from the University of California-Davis. After postdoctoral work with C. I. Kado on the molecular biology and ecology of *Erwinia rubrifaciens*, he moved to the University of Georgia, Griffin, as an assistant professor in 1971 and was promoted to associate professor in 1977 and professor in 1982. There he completed research leading to the practical control of black rot of cabbage. His studies on bacterial wilt and root rot of sweet potato aided in reviving the Georgia sweet potato industry. From 1982 until 1988, he was on the faculty of the University of Idaho, where he

worked effectively on the ecology of plant-pathogenic bacteria and on seed pathology with emphasis on black chaff of wheat and halo blight of beans. He was the manager of biotechnology and plant pathology for Harris Moran Seed Company from 1988 to 1992 and then became research leader of the USDA/ARS Foreign Disease Weed Science Research Unit and later research phytobacteriologist in that unit.

Schaad is known internationally for his research in the ecology, epidemiology, and control of plant-pathogenic bacteria. He has developed several effective semi-selective media for detection of major bacterial pathogens. The novel starch medium he designed was used to determine that *Xanthomonas campestris* survived over a year in cruciferous plant debris. He developed a method to establish for the first time a seed infection threshold for a bacterial pathogen based upon levels of seed infection and resulting field disease data. Schaad also discovered that *X. campestris* survived in asymptomatic crucifer weeds in or near transplant and seed production fields and was spread in windblown rain to crop plants. Other bacterial culture media developed by Schaad are now used routinely in seed health testing worldwide, resulting in significant reductions in crop losses.

Schaad is highly respected for his many contributions to the identification and taxonomy of plant-pathogenic bacteria. He identified *Erwinia chrysanthemi* as the causal agent of a wilt and root rot of sweet potato, which had been thought to be caused by a fungus and which threatened the viability of the Georgia sweet potato industry. He also led a team of ARS pathologists and a university microbiologist to identify the causal agent of an unknown seedling disease of watermelon as a new *Pseudomonas* species, *P. pseudoalcaligines* subsp. *citrulli*. That organism and *P. avenae* were later named as a subspecies of a new bacterial genus, *Acidovorax*. The disease has now spread worldwide and is recognized as the most destructive disease of watermelon and melon production. He recently led a team to reclassify the emerging bacterium *Xylella fastidiosa* as three separate subspecies, subsp. *piercei*, subsp. *multiplex*, and subsp. *pauca*.

One of Schaad's major contributions has been to edit three editions of the APS PRESS *Laboratory Guide for Identification of Plant Pathogenic Bacteria*. This publication has sold over 7,500 copies and has become a standard text for teaching and research in phytobacteriology.

Schaad was the first to utilize a gene for phaseolotoxin production from *P. phaseolicola* as a specific marker unique to the target organism for a DNA-based detection technique. A previous DNA dot blot method had failed to provide adequate sensitivity for detecting the pathogen in seeds. Schaad led a team to develop the first PCR-based method to detect a plant-pathogenic bacterium utilizing sequences of a cloned gene. PCR was found to work well with pure cultures but not in seed extracts due to the presence of PCR inhibitors and low sensitivity. To avoid inhibitors and increase sensitivity and reliability, he developed and received a U.S. patent on a novel PCR technique based on enrichment on agar or in a liquid medium just prior to use of PCR. The technique, termed BIO-PCR, can detect a single viable cell with a sensitivity 100- to 1,000-fold greater than classical PCR. Schaad also was the first to design a real-time TaqMan PCR assay for detecting plant-pathogenic bacteria. His continued leadership in developing novel PCR-based detection techniques was demonstrated by his development of a PCR assay making it possible to diagnose plant diseases under field conditions in less than one hour.

Schaad also has advanced our knowledge of structural proteins and the serology of bacterial pathogens and has had a lead role in basic characterization of membrane and ribosomal proteins of *Erwinia* spp., *Xanthomonas campestris*, *X. vesicatoria*, and *X. fastidiosa*. Membrane proteins of *X. campestris* were found to have unique fingerprints. Antisera to purified ribosomes and membrane proteins were developed to study basic serology and for routine identification of several plant-pathogenic bacteria.

Recently, Schaad has become recognized as a leader in the area of crop bioterrorism. He developed a research program to characterize exotic bacteria and develop rapid PCR-based biosensors for detecting deliberately released pathogens. He served as administrator of a special ARS project to collaborate with a former Soviet Union bioweapons facility in Uzbekistan and currently has an International Science Technology Center project with the All Russian Phytopathology Research Institute in Moscow, Russia, to assist former biowarfare scientists in changing from research on biological weapons to peacetime research activities. In a related project, Schaad led a team of experts from plant pathology and interested government

communities in designing software to provide a numerical rating system for determining the highest risk plant pathogens for each major U.S. crop and developing a priority list of foreign pathogens that might be targeted for deliberate release. Schaad also organized the program for the first international symposium on crop biosecurity, held as part of a joint meeting of the American and Canadian Phytopathology Societies in Montreal in 1999.

Schaad has authored or co-authored over 100 peer-reviewed papers, four U.S. patents, four books, and numerous book chapters. He has organized or participated in numerous international workshops on the detection of bacteria and has advised students from China, India, Thailand, Korea, Turkey, Greece, Brazil, Philippines, and Morocco. He has served APS as chair of the Bacteriology and Seed Pathology Committees, as a member of the Office of International Programs (OIP) Advisory Board and chair of the OIP Research Committee, and as an associate editor of *Phytopathology*. He currently is chair of the APS/APHIS Ad Hoc Committee on Prevalent Bacteria.

### **John L. Sherwood**

John L. Sherwood was born at Barksdale Air Force Base in Shreveport, Louisiana, in 1952. Born into an active military family, he experienced a number of moves prior to settling in Springfield, Virginia. He received his B.S. degree in biology from the College of William and Mary in 1974. After engaging in technical positions with a private veterinarian and a commercial cell culture laboratory for a year, he pursued an M.S. degree in the Department of Botany and Plant Pathology at the University of Maryland. He worked under the direction of William L. Klarman on the protective effect of ectomycorrhizae on pine against methane gas that is typically released in landfills and received his M.S. degree in plant pathology with a minor in biochemistry in 1977. He received his Ph.D. degree in plant pathology with a minor in botany in 1981 from the University of Wisconsin under the direction of Robert W. Fulton. For his Ph.D. research, he was given the problem of elucidating the nature of cross protection between tobamovirus strains, a phenomenon that has been studied since the 1920s with little progress. He showed that inhibition of the early events of uncoating of the challenge virus is the likely mechanism underlying cross protection. This seminal finding, prior to availability of plant transformation systems, provided a foundation to explore the use of plant transformation with tobamovirus coat protein gene to protect from virus infection. In 1982, Sherwood was hired as an assistant professor in the Department of Plant Pathology at Oklahoma State University (OSU) to develop a plant virology program. He was promoted to associate professor in 1987 and to professor in 1991. Sherwood moved to the University of Georgia in June 1997 as professor and head of the Department of Plant Pathology.

Much of Sherwood's initial efforts at OSU were to improve the diagnostics for diseases of concern to producers in Oklahoma. In the fall of 1983, in cooperation with Mark Sanborn (formerly of the Department of Botany and Microbiology, OSU), a joint project on production of monoclonal antibodies (MABs) was initiated, as it was becoming evident that this technology was going to be a significant tool in virology. This effort led to the development of a campus-wide resource, the first biotechnology-related multi-user facility at OSU. Work in Sherwood's laboratory in this area resulted in the first report of monoclonal antibodies to a number of plant viruses including the potyviruses *Peanut mottle virus* and *Bean common mosaic virus*, the Furovirus *Wheat soilborne mosaic virus* (WSBMV), the tospovirus *Tomato spotted wilt virus* (TSWV), and the tritovirus *Wheat streak mosaic virus*. The antibodies generated provided valuable tools for a number of investigations on these economically important viruses.

Through a collaborative program with Robert Hunger and Ed Smith at OSU, a nationally recognized wheat performance nursery for wheat soilborne mosaic was developed, and the WSBMV-resistant cultivar 'Tonkawa' and other germ plasm lines with resistance to WSBMV were released. Another significant outcome of these studies was the finding that expression of resistance is moderated by temperature. Cool conditions, typical of the growing season for hard red winter wheat, were required for virus resistance to be expressed. Resistance was not expressed in plants inoculated and grown at temperatures typical of the warm spring days in Oklahoma. Further studies in Sherwood's laboratory demonstrated that the putative p27 movement protein of WSBMV could moderate plasmodesmatal size exclusion limit in wheat.

More recently, Sherwood has focused on the acquisition and transmission of TSWV by thrips. After developing the first MAB for detection of TSWV, Sherwood began developing MABs or polyclonal

antibodies to the other structural and nonstructural proteins of the virus in collaboration with Diane Ullman (UC-Davis) and Tom German (UWI) to determine the specific interaction of TSWV with its thrips vector that leads to acquisition and subsequent transmission of the virus. During the decade-long collaborative effort, this team determined that the virus replicates in the thrips vector and revealed the route the virus takes in the vector leading to virion production in the salivary glands. Additional work, primarily in Sherwood's laboratory, led to the identification of a potential receptor for TSWV in the thrips midgut, which is the first potential receptor identified in a vector for a plant virus. Current efforts in Sherwood's laboratory have focused on elucidation of the role of the viral glycoproteins in virus acquisition by its thrips vector. Sherwood's publications are of the highest quality; he is the author or co-author of over 60 refereed journal articles and book chapters.

Sherwood has been significantly involved in service to APS throughout his career. He was on the Virology Committee from 1983 to 1989, serving as chair in 1987. He was an associate editor for *Plant Disease* from 1990 to 1991 and then senior editor (1991 to 1994). He served as treasurer from 1997 to 2003, which entails touching on about every aspect of the Society. He chaired an *ad hoc* committee to review the structure of the APS National Plant Pathology Board in 2000, resulting in the current structure of the Public Policy Board (PPB). He has been serving on the PPB since 2000 and currently chairs this board. As such he has served as a representative of APS in a number of venues on public policy issues affecting the discipline of plant pathology.

### **Turner B. Sutton**

Turner Bond Sutton was born in Windsor, North Carolina, on October 24, 1945, where his family had been engaged in agriculture for nearly 200 years. His lifelong interest in agriculture and science began early while he followed his father through peanut fields. He earned an A.B. degree in botany and chemistry from the University of North Carolina in 1968. Sutton then studied plant pathology under Carlyle N. Clayton at North Carolina State University and earned his master's degree in 1971 and doctorate in 1973. Between 1973 and 1974, Sutton served as a postdoctoral research associate with Alan Jones at Michigan State University. In 1974, he returned to NC State University as a research associate and joined the faculty as an assistant professor in 1976. He was promoted to associate professor in 1981 and became a full professor in 1987.

Sutton is the world leader in management of summer diseases on apples, internationally recognized for his research on diseases of bananas, and a leader in the advancement and application of integrated pest management programs on apples.

His publication record, with more than 80 papers published in refereed journals and 11 book chapters, reveals a clear and consistent record of excellence in fundamental and applied research aimed toward understanding the biology and epidemiology of fruit diseases and the effective use of cultural and chemical management strategies to solve disease problems. His approach to solving apple and other fruit diseases combines the knowledge and thoroughness of a classical plant pathologist with the skills of a modern epidemiologist who is extremely well-versed in understanding the options available for integrated cultural and chemical control for a complex of diseases caused by a number of distinct pathogens. Further evidence of Sutton's philosophy of knowledge-based control programs is his utilization of molecular tools for current investigations on the *Colletotrichum/Glomerella* complex on apples and Pierce's disease on grapes.

Sutton and his colleagues and students have made significant contributions to our knowledge of all nine of the summer diseases of apples in the southeastern United States. As an example, he and Elizabeth Brown were the first to elucidate the life cycle of *Mycosphaerella pomii*, causal agent of Brooks spot of apples, and define the period of time during the growing season when infection is most likely to occur. He and Eugenia Gonzalez studied the diversity of *Colletotrichum* spp. and *Glomerella cingulata* on apples and characterized a strain of *G. cingulata* associated with a new leaf spot disease of Gala in the United States. Many of his studies have focused on sooty blotch and flyspeck of apple. He and Brown developed a model for predicting the onset of symptoms of the diseases and the use of eradicant fungicides to manage it. He and Eric Johnson were the first to demonstrate that the sooty blotch was not caused by a single pathogen, but by a complex of at least five different fungi, one of which they described as a new species.

In addition to his research on apple diseases, he and colleague C. R. Unrath in the Department of Horticultural Science at NC State University were the first to document the utility of the tree-row-volume model for applying pesticides. This model, which relates the amount of pesticide needed to the size of the trees in the orchard, is now widely used throughout the world on deciduous tree fruit as a guide to pesticide applications.

Sutton is widely sought as an invited speaker on a diversity of topics but most especially on pest management, disease forecasting, epidemiology, and disease management. He has been hosted by universities in Japan, pesticide manufacturers in Germany, growers' associations throughout the Southeastern, Atlantic, and Midwest regions of the United States, and international symposia in Germany and Latin America.

Outstanding as Sutton's research and extension activities are, he balances them well and excels at teaching and mentoring. He has taught his department's core epidemiology and disease control course for 16 years, during which time it has increasingly attracted students from allied departments. He has chaired the advisory committees of 12 Ph.D. and 12 M.S. candidates, several of whom have emerged as leaders in the discipline both nationally and internationally. Sutton's successful recruitment and training of international graduate students has resulted in ongoing collaborative projects, particularly in Costa Rica. Among these efforts, he contributed significantly to our understanding of diseases of bananas and citrus in Central America and apples in Brazil. The impact of his contributions in Costa Rica was recognized with honorary membership in Asociacion Costaricense de Fitopatologos in 1997.

That honor is among many he has earned. In 1989, Sutton received the Lee M. Hutchins Award from The American Phytopathological Society in recognition of his contributions to the fruit industry. In 1993, he was awarded a fellowship by the Japan Society for the Promotion of Science. In 1997, the bulletin *Diseases of Tree Fruits in the East*, which he co-edited with APS Fellow Alan Jones, won the Gold Award in the Agricultural Communications in Education Critique and Awards Program (first place among 474 entries.) In 2001, he was recognized with the Gamma Sigma Delta society's Award of Merit for Distinguished Service to Agriculture.

Sutton has actively supported his profession and has served as a member of the APS Epidemiology Committee (1980–1983), chair of the APS Chemical Control Committee (1986–1989), member of the New Fungicide/Nematicide Data Committee (1997–2000), associate editor of *Phytopathology* (1986–1989), and editor of the Pome Fruits Section of the Fungicide & Nematicide Tests (1988–1991), as well as a member of the Northeast Regional IPM Program (1985, 1987, 1989, 1996, 1997), Southern Region Pesticide Impact Assessment Program (1987), other review panels.

Sutton is a member of Phi Kappa Phi and Gamma Sigma Delta and a tireless member of numerous committees in his department, college, and university.

**NOEL T. KEEN AWARD FOR RESEARCH IN MOLECULAR PLANT PATHOLOGY:** *This award recognizes individuals who have made outstanding contributions in host-pathogen interactions, plant pathogens or plant-associated microbes, or molecular biology of disease development or defense mechanisms*

#### **Brian Staskawicz**

Brian J. Staskawicz was born in Boston, Massachusetts, on April 30, 1952. He received a B.A. degree from Bates College in Lewiston, Maine, in 1974 and an M.F.S. degree in forestry science from Yale University in 1976. In 1980, he was awarded a Ph.D. degree in plant pathology from the University of California-Berkeley. He then joined the International Plant Research Institute in San Carlos, California, where he worked as a senior research scientist on plant biotechnology applications from 1980 until 1983. Staskawicz was appointed as an assistant professor at the University of California-Berkeley in 1983, promoted to associate professor in 1987, to professor in 1992, and he is now the Maxine J. Elliot Professor and Chair of the Department of Plant and Microbial Biology.

Staskawicz and Noel Keen were long-time friends and collaborated on several early pioneering contributions to our understanding of resistance to plant pathogens. In 1984, they cloned the first *avr* gene from *Pseudomonas* and transferred it to virulent bacteria to elicit a race-specific incompatibility resistance response in soybean. This work provided the first molecular evidence in support of the “gene-for-gene” hypothesis for plant-pathogen resistance responses and encouraged other investigators to initiate molecular studies with different host-pathogen systems. One reason for the success of this research was the development of model systems in which both the plant and the pathogen are easily manipulated at the genetic and molecular levels. This approach was evident in the first experiments where the *avr* genes were shown to elicit a resistance response in specific host lines against pathovars to which they normally were susceptible. Staskawicz and others subsequently demonstrated that *avr* genes with little sequence relatedness are present in a wide variety of bacterial pathogens that infect plant species.

Staskawicz’s research has yielded numerous conceptually important findings about the nature and properties of avirulence genes. These studies have demonstrated that *avr* genes not only elicit defense responses in different cultivars of a given species, but that the same genes can trigger resistance in other potential host species to provide a mechanism for “non-host” resistance. Thus, one *avr* gene from *Xanthomonas campestris* conferred a resistance response in specific bean cultivars when introduced into a pathovar that normally is virulent on bean. Transfer of this gene to other *X. campestris* pathovars elicited similar hypersensitive recognition by several other dicot species and even by corn, providing the first molecular evidence that *avr* genes may operate to control host-pathogen specificity at multiple levels. Other studies conducted by Staskawicz and colleagues during the 1980s were the first to demonstrate a molecular mechanism for the evasion of plant host defenses when virulent mutants emerge from avirulent pathogen populations.

In related work, Staskawicz provided the first definitive demonstration that *avr* genes contribute to the fitness of bacteria for plant colonization and infection. These studies revealed that pathovars of *X. campestris* with mutations in the avirulence gene *avrBs2* were reduced in their ability to colonize cultivars of pepper whether or not the plants contained the corresponding *Bs2* resistance gene. The conclusion that *avrBs2* is an important pathogenicity factor is further supported by evidence that all *X. campestris* cultivars contain a copy of the *avrBs2* gene. Subsequent studies showed that expression of *avr* genes falls under control of regulatory genes within the *hrp* (hypersensitive response and pathogenicity) cluster.

Staskawicz and colleagues also have been in the forefront of those characterizing plant resistance genes. In collaboration with Fred Ausubel’s laboratory, they were the first to clone *RPS2*, an *R* gene that exhibits specificity for *Pseudomonas syringae* strains expressing *avrRpt2*. The cloning of *RPS2* from *Arabidopsis thaliana* demonstrated that this plant could be employed as a model system and that the resistance genes identified in this model plant are similar to those found in major crop species.

Staskawicz was among the first to pioneer *Arabidopsis* as a model system to genetically dissect the signal transduction pathways leading to the expression of plant disease resistance. One of the more notable groundbreaking findings was the cloning of *NDR1*, a gene that functions to coordinate signaling responses of several specific *R* genes that normally confer resistance to *Pseudomonas* and to the fungus *Peronospora*. A model to explain these results suggests that specific resistance genes active against different pathogens intersect at a common signaling gene that activates master genes that mediate general host resistance responses. Staskawicz also has developed powerful genetic tools to study conditional *avr* gene expression in planta. One novel approach now widely used to dissect host factors required for resistance and virulence responses relies on transgenic *Arabidopsis* plants containing the *avrRpt2* gene under the control of tightly regulated, hormone-inducible promoters.

Host research initiated by Staskawicz has proceeded at a rapid pace and has resulted in key accomplishments that include engineering broad-spectrum resistance genes in plants; identification of distinct resistance pathways that are activated by different classes of resistance genes; demonstration that effector proteins injected into plant cells during infection by pathogenic bacteria are processed before interacting with host resistance genes; and the isolation and characterization of a number of components of plant cell death signaling pathways that are activated upon recognition of avirulence gene products. Findings by Staskawicz and colleagues within the past year explain molecular aspects of some *avr:R*

protein interactions during resistance responses that may be applicable to many elicitor:resistance combinations operating in plant disease resistance. According to this model, the effectors produced by pathogens normally function to target host functions whose inactivation is required for virulence of the pathogens. The host has evolved upstream resistance components that function to monitor and interdict the assaults of the pathogen by activating other proteins within the resistance pathway to initiate a cascade that leads to a defense response.

As a leader in the field of molecular plant pathology for more than 20 years, Staskawicz's accomplishments have been recognized on numerous occasions during his career. He received the United States Department of Agriculture Honors Award and the Ruth Allen Award in 1995, was elected a fellow of The American Phytopathological Society and a member of the National Academy of Sciences in 1998, and was made a fellow of the American Academy of Microbiology in 2000. Many of these honors also were bestowed on Noel Keen in recognition of the research arising from their shared and individual efforts. Recognition of Brian Staskawicz as a recipient of the Noel T. Keen Award is based in part on these collaborative studies and in part on his independent research that has resulted in numerous advances in molecular plant pathology. His research achievements have been instrumental in leading us to a new era in plant pathology. His more recent breakthroughs promise to yield even greater insights into the molecular signaling that occurs during the response of plants to pathogens. Not only can we expect a clearer understanding of the molecular basis of gene-for-gene disease resistance, but in the near future this work should contribute to practical efforts to improve disease control by engineering broad-spectrum disease resistance into important crop plants.

**RUTH ALLEN AWARD:** *This award recognizes individuals who have made an outstanding, innovative contribution to research that has changed, or has the potential to change the direction of research in any field of plant pathology.*

#### **Howard S. Judelson**

Howard S. Judelson was born in the Bronx, New York. He received his B.S. degree in biochemistry from Cornell University in 1980 and his Ph.D. degree in molecular biology from the University of Wisconsin in 1985. Seeking experience in plant pathology, he then obtained a position as a postdoctoral fellow in the laboratory of Richard Michelmore at the University of California-Davis. He subsequently worked as an assistant geneticist in the Department of Vegetable Crops and in the Center for Engineering Plants for Resistance Against Pathogens at University of California-Davis until 1994, when he became an assistant professor in the Department of Plant Pathology. In 1998, he moved to the Department of Plant Pathology at the University of California-Riverside, where he is now a full professor.

Judelson has made important contributions to the field of plant pathology by opening an important group of plant pathogens, the oomycetes, to molecular genetic analysis. As of the 1980s, major advances had been made in the development of methods for gene cloning and transformation of DNA into true fungi, but the oomycetes remained recalcitrant to genetic manipulation. Recognizing that oomycetes lacked taxonomic affinity with true fungi, Judelson developed new tools required for transformation by cloning the first oomycetes genes, identifying promoters from those genes that could be used to drive the expression of marker genes, and devising methods for introducing DNA into oomycetes using *Phytophthora infestans* as a model. These studies led to the first report of stable transformation in 1991 and the subsequent improvements to the transformation approach enabling cotransformation, gene silencing, and the transformation of other species of *Phytophthora*.

The development of transformation methods has had a substantial impact on the field of plant pathology. The pace of research on *Phytophthora* is accelerating annually, and many studies are now being published that address genes involved in the growth, pathogenicity, and host specificity of *Phytophthora* species. It is fair to say that without the demonstration that oomycetes are amenable to molecular manipulation, recent efforts to sequence the genomes of *Phytophthora* species would not be underway.

Judelson's research continues to focus on *P. infestans*, primarily involving studies of the development and germination of sexual and asexual spores. Many genes and proteins participating in these processes have been isolated, and transformation-based methods are playing major roles in their analysis. For example,

transformants were generated in which the genes were silenced, which enabled the identification of genes required for sporulation, appressorium formation, and zoospore motility. Transformants expressing fusions of these genes with visible reporters such as green fluorescent protein were used to reveal the subcellular location of their protein products, which aids in understanding the function of the proteins in spore biology. Transformation has also been used to identify promoter sequences required for the specific expression of genes during oosporogenesis, asexual sporulation, and zoosporogenesis, including the definition of binding sites for transcription factors necessary for these developmental stages.

Of the genes being characterized in detail by Judelson's laboratory, many encode regulators such as protein kinases, phosphatases, and transcription factors, and their continued analysis will help reveal the networks of genes required for stages critical to plant disease and lead to improved strategies for crop protection. Such work also is illuminating the novel aspects of oomycete biology. For example, a recent study of a *P. infestans* homologue of the *cdc14* protein phosphatase, which is known to be a central regulator of mitosis in yeast and mammals, challenged dogmas concerning the evolution of eukaryotic mitotic and cell cycles.

While Judelson's work has focused on *P. infestans*, he has helped extend transformation to other species of *Phytophthora*, including *P. parasitica*, *P. sojae*, *P. palmivora*, and *P. phaseoli*, and to other oomycetes (*Saprolegnia*) by providing hands-on training, sharing vectors, and providing advice. He has also maintained a strong record of public, professional, and university service and teaching. His efforts have stimulated studies across a broad range of oomycetes-plant interactions that will impact plant pathology for many years to come.

**LEE M. HUTCHINS AWARD:** *This award is given to the author or authors of published research on basic or applied aspects of diseases of perennial fruit plants (tree fruits, tree nuts, small fruits and grapes, including tropical fruits, but excluding vegetables).*

#### **Mark L. Gleason**

A primary goal of research in Mark Gleason's group at Iowa State University (ISU) is to improve the management of diseases of perennial fruit crops through better understanding of disease ecology. Over the past several years, this work has focused on *Colletotrichum acutatum* on strawberry, the sooty blotch/flyspeck fungal complex on apples, and development of models to facilitate implementation of disease-warning systems.

*Population dynamics of Colletotrichum acutatum on symptomless strawberry leaves.* Anthracnose fruit rot, a devastating disease of strawberry, has become a major challenge to strawberry growers worldwide during the past 15 years. A puzzling aspect of anthracnose fruit rot epidemics is their sudden and widespread appearance in production fields. In studies by former Ph.D. student Leonor Leandro in Gleason's group, spray inoculation and incubation of strawberry leaves revealed not only that the pathogen survived as appressoria on symptomless leaves for extended periods, but also that conidia multiplied there under favorable environmental conditions. This was the first evidence of secondary conidiation of *C. acutatum* in the absence of either symptoms or cuticle penetration. It also hinted that the pathogen might disseminate through a field in the absence of symptoms, setting the stage for epidemics once fruit appeared. A field study by Gleason's group (*Advances in Strawberry Research* 21-22:in press), provided evidence that dissemination of *C. acutatum* from symptomless leaves can set the stage for anthracnose fruit rot epidemics.

Subsequent papers clarified additional aspects of the behavior of *C. acutatum* on strawberry leaves. The first of these described survival and multiplication of the fungus in response to a range of wetness and temperature environments (*Phytopathology* 93:513-520). The next paper showed that extracts from strawberry flowers, but not leaves, could stimulate secondary conidiation on leaves, suggesting that flower exudates, by spurring increases in epiphytic populations of conidia, could facilitate dissemination of the pathogen (*Phytopathology* 93:1285-1291). This paper also showed that the pathogen could survive epiphytically on dry leaves for several weeks and then produce conidia in response to foliar extracts.

The picture emerging from these studies was of a versatile pathogen that exploits the phyllosphere as a precursor to epidemic development. This new emphasis on phyllosphere events resulted in a reassessment

of the anthracnose fruit rot disease cycle. The findings also have potentially important management implications, since they suggested that epidemics might be suppressed by attacking the pathogen on leaves during periods preceding fruit set. The results also raised the possibility that cultivar resistance to anthracnose could be gauged by assessing epiphytic populations of *C. acutatum*; this question is currently being evaluated at North Carolina State University.

*Sooty blotch and flyspeck on apples.* The sooty blotch and flyspeck (SBFS) fungal complex blemishes the cuticle of apple fruits, leading to substantial economic losses in regions of North America, Asia, and Europe that have moist summers. Gleason's Ph.D. student Jean Batzer, in collaboration with Tom Harrington's lab at ISU, has laid the foundation for a dramatic expansion of taxonomic diversity within the SBFS complex. Evidence from parsimony analysis of ITS and LSU segments of rDNA from more than 300 SBFS isolates from Midwest orchards indicate the presence of more than 30 clades at the genus or species level (Phytopathology 92:S6). This finding is likely to create a new paradigm in our understanding of genetic diversity of the SBFS complex, in which only four species are currently recognized worldwide.

A recent paper published in *Plant Health Progress* (doi:10.1094/PHP-2003-1209-01-RS), resulting from research by former undergraduate intern Tara Barrett in Gleason's lab, provided the first evidence that the newly discovered SBFS clades are physiologically as well as genetically distinct. The study showed that SBFS clades, but not isolates within clades, differed significantly in in vitro sensitivity to the fungicides thiophanate-methyl and ziram, which are commonly sprayed to suppress SBFS. This result supports the hypothesis that the clades are indeed new species and genera in the SBFS complex and suggests that knowledge of the prevalence and incidence of these clades in apple orchards may improve the effectiveness of fungicide-spray programs aimed against the complex.

Gleason's group assessed the value of various postharvest dip treatments for removal of SBFS signs from apples (Plant Disease 86:1325-1332). Work by Jean Batzer advanced a pioneering 1991 study by F. F. Hendrix because it evaluated additional types of dip treatments, showed that removal of SBFS signs differed significantly among apple cultivars, and applied economic analysis to assign a market value to each treatment option. The study also showed that efficacy of removal differed among three SBFS mycelial types and developed a quantitative rating system to assess SBFS severity accurately. This postharvest work has important implications for SBFS management because it offers apple growers a viable, inexpensive, low-technology option to increase the market value of SBFS-blemished apples.

*Developing models to enhance implementation of site-specific weather data in disease-warning systems.* Site-specific weather estimation technology has exciting potential to boost implementation of disease-warning systems by increasing grower access to the weather data inputs for these systems. Adoption of site-specific technology has been slow, however, because the estimated data lack acceptable accuracy—especially for leaf wetness duration (LWD), which is a key input to warning systems for many perennial fruit crops.

Former Ph.D. student Kwang-Soo Kim in Gleason's group was the first to show that modeling could make significant improvements in the accuracy of site-specific LWD estimates. The CART/SLD/Wind model, a hybrid of empirical and physical algorithms, significantly improved accuracy of LWD estimation and reduced variability in estimation errors among sites in the Midwest (Plant Disease 86:179-185). Results of this study offered the first realistic prospect that errors in site-specific estimation could be corrected sufficiently for growers to use them reliably in implementing disease-warning systems.

**EXCELLENCE IN EXTENSION:** *This award recognizes excellence in extension plant pathology.*

### **James W. Travis**

James W. Travis was born in Gettysburg, Pennsylvania. He received a B.A. degree in biology from Gettysburg College in 1975 and an M.S. degree in entomology in 1978 from The Pennsylvania State University. He received his Ph.D. degree in plant pathology and horticultural science from North Carolina State University, Raleigh, in 1981.

Travis joined the Department of Plant Pathology as assistant professor in 1981 and was promoted to associate professor in 1987 and to professor in 1995. He has primary responsibility for extension programming in tree fruits and grapes. Travis has developed a creative, interdisciplinary program that has resulted in new technologies, improved pest management programs, and efficient delivery systems that benefit both the fruit industry and extension educators. Travis has a clear and modern vision of the extension education mission.

In addition to 21 refereed journal articles, Travis was co-author of a review of expert systems published in the 1991 *Annual Review of Phytopathology*, has co-authored four book chapters, and was section chair for a regional extension publication, the *Mid-Atlantic Orchard Monitoring Guide*. He was instrumental in the development of four copyrighted computer software programs.

Travis's leadership in the design and use of decision support systems led to the development of expert systems used by apple and grape growers. He was the driving force in the development of the Penn State Apple Orchard Consultant Expert System, a sophisticated, user-friendly expert system that integrates cultural, entomological, and pathological information to assist growers in making pest management decisions. Travis was invited to Australia for a sabbatic leave in 1992 to coordinate the development of an Australian vineyard expert system. Travis's pioneering efforts in expert systems were recognized in 1988, when he delivered the plenary address at the APS Annual Meeting.

Travis was also instrumental in the development of environmental monitoring technologies in support of disease management decision making. Travis and his students have evaluated several electronic weather station systems and initiated the use of high spatial resolution weather forecasts to predict disease outbreaks. In the mid-1990s, Travis collaborated with a private company to develop and field test site-specific disease risk ratings for individual orchard sites based on remotely sensed weather information and computer-based disease predictive models. Today this program is commercially available nationwide to fruit growers who receive daily, orchard-specific weather history and forecasts and disease risk forecasts for their farms. Feature articles that highlight Travis's efforts in decision support systems over the last 10 years were published in *Plant Disease* in 2001 and 2002.

Travis places a high priority on educating extension personnel and making information and technology available to fruit growers. He contributed to the conception and development of multistate meetings that brought together experts from across the region to instruct personnel from six states. Travis was in the forefront of efforts to disseminate information electronically, and his efforts provided the impetus for the development of a statewide computer information system. He makes his findings available via traditional media as well, through extension publications and articles in popular, semitechnical, and trade journals.

Most recently, Travis has been a leader in the effort to eradicate plum pox virus from Pennsylvania. In October, 1999, plum pox virus was found for the first time in North America in stone fruit orchards in southern Pennsylvania. He led grower education efforts to improve understanding of the disease, thus reducing grower anxiety and facilitating grower cooperation with the eradication effort. He has conducted local, regional, and state grower and extension agent educational meetings since the virus was first detected in Pennsylvania. He led a team in developing a color fact sheet on the plum pox disease that was published within three months of the first identification of the disease in Pennsylvania. This fact sheet was not only one of the cornerstones of the Pennsylvania grower educational program, but was widely distributed in the United States and Canada to areas that were at risk for the spread of the disease. He directed the development of an educational video that brought to light the devastating impact the disease was having on Pennsylvania fruit growers through personal interviews. The video was released one year after the first identification of the virus and was distributed across the United States and Canada. Travis also supervised a plum pox web site, which kept growers across the United States informed on the daily developments in detection and eradication of the disease. It was frequently utilized by growers to remain up-to-date on the latest plum pox news and developments. An 87-page color field guide titled "Plum Pox Virus and Other Diseases of Stone Fruits" was published by Penn State University within a year and a half of the first detection of plum pox. Travis coordinated the efforts of numerous specialists from the United States land grant institutions, government agencies, and many international institutes. The guide has received worldwide distribution. In recognition of the promptness and quality of the plum pox education program

and the impact it has had on the local and national effort to eradicate plum pox virus, Travis and his cooperators have received several prestigious awards.

He is an active participant in extension activities at Penn State, regionally, and nationally, having served as chair of both the divisional and national APS extension committees. Travis has focused attention on sustainable agriculture issues and has provided dynamic leadership in the development of the Commonwealth of Pennsylvania's sustainable agriculture programming. He not only has coordinated the state efforts, but also has engaged county personnel in research and demonstration projects.

Travis contributes to the academic life of his department. He now serves as advisor and mentor to graduate students, serves on graduate committees, and has taught a formal course.

**EXCELLENCE IN TEACHING:** *This award recognizes excellence in teaching plant pathology.*

### **Karen-Beth G. Scholthof**

Karen-Beth Goldberg Scholthof is an associate professor in molecular plant virology in the Department of Plant Pathology and Microbiology at Texas A&M University. Karen-Beth grew up in Santa Fe, New Mexico. She divided her B. S. education between Colorado College in Colorado Springs and Montana State University in Bozeman. Karen-Beth obtained her M. S. degree at the University of Nebraska with Myron Brakke and her Ph.D. degree with Bob Shepherd at the University of Kentucky in 1989. She performed postdoctoral studies under the auspices of an NIH Fellowship at the University of California-Berkeley with Andy Jackson. Karen-Beth joined the faculty at Texas A&M University at the end of 1994. Recently, she spent a sabbatical leave as a visiting scholar at the History of Science Department at Harvard University to further explore the disciplinary interface that exists between plant pathology and public health. This linkage, which she recently outlined in an article for the *Annual Review of Public Health*, is largely unknown to the public and even to most professionals in either specialization.

Karen-Beth exemplifies that everything a university professor does revolves around learning and teaching. She actively trains graduate students and postdoctoral associates. She provides undergraduate students with opportunities to work in her research lab. Several of her students have ranked among the top in the college or university and have received a variety of awards and fellowships. She makes enormous contributions through her formal teaching. Her extraordinary contributions as a teacher truly surface in "Pathogens, the Environment, and Society," an undergraduate course she developed for the bioenvironmental sciences program. Karen-Beth also teaches this course as a more advanced series in the undergraduate honors program and through various guest lectures in the honors program. In addition, she team-teaches (with Herman Scholthof) two graduate level courses in plant virology with a hands-on laboratory component and "The Theory of Research," a journal-club discussion course. She receives very good feedback from the graduate students because she pushes them to reach toward their next level of potential.

The overall theme in Karen-Beth's courses is to have students acquire critical thinking skills in areas that bridge disciplines. In her undergraduate course, she achieves this goal by having students read a mix of contemporary popular scientific books and articles, poems, and novels on topics that include diseases of plants, animals, and humans. Her students are expected to prepare topic folders and summaries on contemporary issues in public health, write critiques on assigned books and movies (that they watch at their leisure), and to critique published case studies during in-class writing assignments. During all these activities, Karen-Beth insistently guards effectively against a pesky infiltrator of writing assignments resulting from heavy internet use: plagiarism. Her class often quickly adapts to newly arising topical events. When something new turns up in the media such as SARS, avian influenza, mad cow disease, or food-borne pathogens, Karen-Beth prepares a lecture on this topic and has students read and discuss assigned material. This does mean that she herself has to keep up, but this task is facilitated through her voracious appetite for reading. Despite the rigor associated with the course, Karen-Beth's student evaluations are consistently among the best in the college and the comments by the students are often replete with positive superlatives. Perhaps most telling is that many students ask Karen-Beth to write letters of recommendation and they maintain contact to inform her about their careers or their personal life, just like she herself still stays in touch with her high school biology teacher in Santa Fe.

Karen-Beth's teaching extends into other venues, particularly in association with the history of *Tobacco mosaic virus* (TMV). Around the turn of this century, Karen-Beth was very active in ensuring our collective awareness of a significant scientific event: the centennial of the discovery of TMV that marked the start of virology as a scientific discipline. Toward this purpose, she spearheaded the organization of a symposium in 1999 at the Royal Society of Edinburgh, as well as a symposium at the APS meeting in Montreal. To further mark this momentous occasion, she co-edited *Tobacco Mosaic Virus: One Hundred Years of Contributions to Virology*, an anthology published by APS PRESS that received very favorable criticism, including in a book review in *Science*. In addition, she has developed a lesson on TMV posted online at the APS Education Center and has written a review on TMV as a model system in biology for the forthcoming issue of the *Annual Review of Phytopathology*. Karen-Beth's interdisciplinary interests have allowed her to build both her molecular virology program and to develop a program in the history of virology, plant pathology, and agriculture. Most recently, she took the lead in bringing E. C. Large's classic *The Advance of the Fungi* to APS PRESS to ensure that it will be available to teach a new generation of students about the history of plant pathology.

Karen-Beth also has a very productive and well-funded research program to characterize the interactions between *Panicum mosaic virus* (PMV), a satellite RNA, a satellite virus (SPMV), and a new entity: a defective interfering RNA associated with SPMV that was discovered by her group. In addition to dissecting the molecular interactions between these viral agents and the host that lead to disease, Karen-Beth also is exploring a biotechnological opportunity. She is testing the use of the SPMV as a novel vehicle for epitope display, with a particular interest in producing vaccines for veterinary medicine and to improve the safety of the food supply. Karen-Beth's scientific contributions are illustrated by an impressive publication list that contains more than 40 peer-reviewed research papers.

Karen-Beth is a very active member of APS; she has served on a number of committees and as a senior editor for APS PRESS. Currently she is an associate editor for *Phytopathology* and *Molecular Plant-Microbe Interactions*.

From her activities as an instructor as well as through her professional and scientific contributions and by outreach activities to the public at large, it is evident that Karen-Beth is a scholar of exemplary breadth whose impact is often noted far beyond commonly observed academic boundaries. It seems very appropriate for APS to recognize Karen-Beth's efforts with the APS Excellence in Teaching Award.

**INTERNATIONAL SERVICE AWARD:** *This award recognizes outstanding contributions to plant pathology by an APS member for a country other than their own.*

### **Henryk (Hanokh) Czosnek**

Henryk (Hanokh) Czosnek was born in Lodz, Poland, in 1947. He immigrated to Israel in 1972. He received his B.S. degree in biology from the Faculté des Sciences de Paris, France, in 1969 and his M.S. degree from the Institut de Biologie Moleculaire, Faculté des Science de Paris, Paris, France, in 1971. Czosnek received a diploma in chemistry teaching from the School of Education, The Hebrew University of Jerusalem, Israel, in 1976 and a Ph.D. degree in biochemistry from the Department of Biological Chemistry, The Hebrew University of Jerusalem, Israel, in 1978.

In 1985, Czosnek joined the Faculty of Agriculture, The Hebrew University of Jerusalem, as a senior lecturer. He was promoted to associate professor in 1989 and professor in 1996. In 1998 and 1999, Czosnek served as the department head, and he was the head of the genetics studies of the Faculty of Agriculture from 2000 to 2003.

Czosnek was trained as a biochemist, and his research from 1971 to 1985 dealt with the properties of rough endoplasmic reticulum, tubulin and neurofilaments, and muscle-specific genes in mammals. In 1985, Czosnek initiated his plant virology research program, which focused on the geminivirus *Tomato yellow leaf curl virus* (TYLCV), the causal agent of the most devastating disease of tomatoes in the Middle East. Czosnek's research program has made significant contributions in several areas of plant pathology and plant virology. The most noteworthy of these accomplishments have dealt with the biology, molecular characterization, and virus-vector relationships of TYLCV. Czosnek's group was the first to discover that

unlike whitefly-transmitted geminiviruses with bipartite genomes, TYLCV has a monopartite genome. Furthermore, Czosnek's research group was first to utilize DNA hybridization and PCR assays for TYLCV detection. He has shown that TYLCV has deleterious effects on the whitefly vector and could be transmitted among whiteflies during mating. Together with researchers from the USDA and from the University of Arizona, Czosnek has recently initiated a functional genomics project aimed at understanding the development patterns of the whitefly vector and at discovering the genes involved in virus vectoriality, plant detoxification, and resistance to insecticide.

Czosnek's expertise in whitefly-transmitted geminiviruses and virus detection methods has attracted widespread international interest and led to the establishment of meaningful research collaborations with scientists in the Middle East (Egypt, Jordan, Lebanon, and the Palestinian Authority), North Africa (Morocco and Tunisia), Africa (Mozambique and South Africa), Asia (India and Taiwan), Caribbean Region (Jamaica), and Central America (Guatemala). Czosnek's tireless efforts to foster scientific interactions among Israeli scientists and those of the Arab world during this most difficult time are uplifting and highly commendable. In this regard, it is noteworthy that Czosnek serves as the coordinator and main Israeli contributor to two substantial USAID-MERC (Middle East Research and Cooperation) projects. One of the projects involves development of virus detection methods and standardization of protocols among certification and quarantine laboratories in the Middle East. This effort has involved scientists from Jordan, Egypt, Lebanon, the Palestinian Authority, Tunisia, Morocco, and the United States and has resulted in the development of over 30 virus-detection protocols that were published on the pertinent web sites. The second USAID-MERC project focuses on breeding tomatoes for resistance to TYLCV using both marker-assisted selection and genetic engineering.

Czosnek served as the principal investigator in significant binational grants with scientists from the United States. These included the studies "Transovarial transmission of TYLCV" with D. Ullman at the University of California-Davis, "Resistance to TYLCV by combining expression of a natural tolerance gene and a defective viral movement protein in a single cultivar" with W. Lucas and R. Gilbertson, University of California-Davis, and "Functional genomics characterization of the whitefly *Bemisia tabaci* begomovirus interaction: An EST and array-based transcript profiling approach" with R. Shatters and C. McKenzie, USDA-ARS at Fort Pierce, Florida, and J. Brown, University of Arizona, Tucson.

Czosnek was also involved in binational projects with scientists from France, Germany, India, Japan, and China.

Czosnek was part of a team that mapped the first gene for TYLCV resistance, the *Ty 1* gene. Czosnek's group was successful in producing a hybrid tomato with resistance to TYLCV that was distributed to colleagues throughout the world. The hybrid was found to be resistant in India, South Africa, Egypt, Morocco, Spain, Jamaica, Guatemala, and Honduras and is now serving as the geminivirus-resistant germ plasm for breeding programs. This is a highly significant accomplishment, considering the devastation of whitefly-transmitted geminiviruses in these countries. Czosnek is held in the highest esteem by his international colleagues, and he has unselfishly and bravely devoted his professional career to assist others in the Middle East and developing countries.

In addition to his international research activities, Czosnek has been active in training scientists from other countries. He developed a 7-day laboratory course on plant molecular biology and genetic engineering, in the framework of an international course in biotechnology in agriculture, which he taught in 1996, 1998, 2000, 2002, and 2004. About 25 students, mostly from developing countries, participated in each course, which included representatives from Bolivia, Burkina Faso, Bulgaria, Cameroon, China, Czech Republic, Egypt, Ethiopia, India, Ivory Coast, Kenya, Mexico, Myanmar, Nepal, Nigeria, Poland, Rumania, Senegal, Serbia-Montenegro, Slovenia, Sri Lanka, Taiwan, Thailand, the Philippines, Turkey, Venezuela, and Vietnam. Furthermore, visiting scientists/students from Ethiopia, India, the Palestinian Authority, Guatemala, China, and Nigeria have received training in his laboratory.

Czosnek is a frequent invited speaker to international virology and plant pathology meetings. He was instrumental in organizing several international meetings including the first Israel-France meeting in plant

virology in Paris in 1993 and the second International Congress on Geminiviruses and Whiteflies in Puerto Rico in 1998 and the Third International Geminivirus Symposium in Norwich, United Kingdom, in 2001.

Czosnek's publications are numerous and of the highest quality. He is an active member of The American Phytopathological Society, Israel Society of Plant Molecular Biology, Israel Phytopathological Society, European Whitefly Study Network, and the International Working Group on Vegetable Viruses.

**SYNGENTA AWARD:** *This award is given by Syngenta to an APS member for an outstanding contribution to teaching, research, or extension in plant pathology.*

### **Krishna V. Subbarao**

Krishna V. Subbarao was born in Mysore, India, in 1958. He received his B.S. degree in chemistry, botany, and zoology in 1976 and his M.S. degree in plant pathology in 1978 from the University of Mysore, India. He was awarded a Ph.D. degree in plant pathology in 1989 from the Louisiana State University. Short postdoctoral appointments at the Louisiana State University and University of California-Berkeley were followed by his appointment to the faculty at the University of California-Davis in 1992. He was promoted to associate (1996) then to full professor (2001).

Subbarao's Ph.D. thesis research centered on characterizing wheat leaf rust epidemics in Louisiana and understanding the contributions of individual wheat leaves to yield. Prior to Subbarao's research, Louisiana was not considered part of the "Puccinia Pathway." He demonstrated that leaf rust epidemics in Louisiana contribute inoculum to wheat crops in other areas. Furthermore, through elegant experiments, he determined the contributions of individual wheat leaves to yield in the presence or absence of leaf rust. This work revealed that the flag and penultimate leaves on the tiller are primary contributors to yield and that protecting these leaves from leaf rust reduced yield losses by more than 95%. He further developed a model to estimate rust on different cereal leaves from the tiller/whole plant severity values. This work demonstrated that disease ratings from routine crop surveys could be used to estimate disease on individual leaf layers and to enhance coupling and application of crop-pest interaction models.

At Davis, Subbarao has concentrated his efforts on two host-pathosystems: lettuce drop and Verticillium wilt of several cool-season vegetable crops. Initially, he focused on understanding why certain lettuce drop management tactics were ineffective. He showed that the benefits of deep plowing to bury pathogen propagules were often less than assumed because continued soil tillage after the initial burial redistributed the propagules in the vertical soil profile. This study is one of the best-documented examples linking the effects of farming practices on the distribution of pathogen propagules. He then determined the influence of irrigation practices on lettuce diseases as California growers had begun adapting subsurface drip irrigation to reduce water utilization and nitrate leaching. He compared furrow versus subsurface drip irrigation on the occurrence and severity of lettuce drop, corky root, and downy mildew. He demonstrated that the two soilborne diseases (lettuce drop and corky root) were significantly reduced by subsurface drip irrigation. Indeed, the control achieved through drip irrigation alone was superior to furrow irrigation plus fungicides. As a direct consequence of a lower incidence of lettuce drop under subsurface drip irrigation and the minimum tillage, fewer sclerotia were added to the soil. In a follow-up study, he found that the disease suppression was the result of differences in the distribution of soil moisture and temperature in the top 5 cm of the soil profile rather than shifts in the soil microbial community. The current status of lettuce drop management methods was summarized in his *Plant Disease* feature article that was heralded as an outstanding classroom teaching tool.

Subbarao is perhaps best known for his work on the innovative use of a broccoli rotation to suppress Verticillium wilt of cauliflower. When Verticillium wilt first became a major problem on cauliflower, he observed that disease incidence approximated 100% with as few as 10 microsclerotia  $g^{-1}$  of soil but broccoli crops showed no symptoms even when microsclerotia levels were 10 times higher. Preplant amendments of broccoli significantly reduced both soil populations of *V. dahliae* and disease incidence in cauliflower, regardless of temperature. Benefits of broccoli, however, were greatest when the soil temperatures were at least 20°C or above. Armed with this knowledge, Subbarao conducted a series of field experiments to test the efficacy of rotating broccoli with cauliflower for suppression of Verticillium wilt. He demonstrated that incorporating broccoli residue immediately after harvest reduced soil populations of *V. dahliae* by >90%

within two years and suppressed wilt on cauliflower by >60%. He further demonstrated that the infected cauliflower root systems in soil previously cropped to broccoli had significantly fewer microsclerotia than those in control soil. Determination of the ID–DI relationship and how the root and shoot growth dynamics of cauliflower are affected at these densities further facilitated the recommendations on the length of rotations. To understand why broccoli was immune to infection by *V. dahliae*, Subbarao and colleagues studied *V. dahliae* colonization of the root cortex using a specific staining assay. Even though *V. dahliae* colonized broccoli roots, the number of root infections was significantly lower than in cauliflower and no vascular infection in broccoli was observed. These results have contributed to the successful management of Verticillium wilt in cauliflower in central California. Owing to this seminal research, Subbarao has become an important spokesperson in the area of soilborne diseases, as is evident from numerous invited talks he has given at national and international conferences.

Subbarao has also undertaken an ambitious effort to better characterize host specificity and genetic relationships among isolates of *V. dahliae*. He demonstrated that isolates originating from bell pepper, cabbage, cauliflower, cotton, eggplant, and mint were host specific whereas isolates from other hosts were not. Related genetic studies revealed that cabbage and cauliflower isolates were distinct, with smaller differences separating isolates from other hosts. These findings not only contribute to the understanding of the evolution of this important group of pathogens, but also provide valuable practical information on which crop rotation recommendations can be based.

His recent research accomplishments on lettuce downy mildew are equally impressive. It is not necessary to expand on these because it is clear from the foregoing that Subbarao has a versatile ability to identify research needs in any chosen area and make thorough progress not only in our basic understanding of the system, but also in transforming this knowledge into successful disease management methods.

Subbarao has overseen the research of two Ph.D. students and 10 postdoctoral research associates. His many scientific articles are highly respected by his peers. He has served on USDA NRI grant panels, as editor of the *Journal of Sustainable Agriculture*, and as associate and senior editor for *Phytopathology*. He has also served APS in various capacities: as coeditor of the *Compendium of Lettuce Diseases* and as a member of the Plant Disease Losses and the Soil Microbiology and Root Diseases Committees, the latter of which he chaired. He is also a member of the Steering Committee of the International Verticillium Symposium and is the next host of this symposium.