APS Fellows

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Carol L. Bender

Carol L. Bender was born in San Antonio, Texas. She received a B.S. degree in agronomy at Texas Tech University in 1978, and then began graduate studies in plant pathology at Oregon State University with Dr. D. Coyier. After finishing an M.S. degree in 1983, she received a Ph.D. in 1986 from the University of California, Riverside (UCR), where she studied the genetic basis of copper resistance in *Pseudomonas syringae* pv. *tomato* under the direction of D. A. Cooksey. After graduating from UCR, Dr. Bender joined the plant pathology faculty at Oklahoma State University (OSU) where she currently holds the title of Regents Professor.

The major goal of Dr. Bender's research has been to understand how bacteria parasitize plants, centered on production of the phytotoxin coronatine and other factors critical to virulence in *P. syringae*. She is recognized for studies that established a novel mixed polyketide and nonribosomal peptide synthetase mechanism for coronatine biosynthesis. Her laboratory cloned and sequenced the relatively large coronatine gene cluster and revealed its similarity to polyketide and peptide biosynthetic mechanisms in bacteria and fungi of pharmaceutical significance. Because coronatine is a functional and structural analog of the phytohormone jasmonic acid, she has helped define the role of the phytotoxin in coordinately repressing the expression of pathogenesis-related defense genes and inducing the expression of jasmonate/wound response genes. Dr. Bender's research program illustrates how fundamental aspects of phytotoxin production and disruption of plant signaling can influence bacterial interactions with plants.

Dr. Bender also has made significant contributions to understanding the role of alginate, an extracellular polysaccharide produced by *P. syringae*, in virulence and epiphytic fitness. Alginate has long been known to be a virulence determinant of the human pathogen *P. aeruginosa* by triggering pulmonary infections in patients afflicted with cystic fibrosis. Her laboratory has characterized the alginate biosynthetic gene cluster of *P. syringae*, demonstrating that it is virtually identical to that of *P. aeruginosa*. Nevertheless, she established that the regulation and signals that activate alginate biosynthesis are different between the two *Pseudomonas* species. These and other studies of alginate by Dr. Bender's laboratory embody a significant milestone in understanding the role of bacterial exopolysaccharides in host–pathogen interactions.

Dr. Bender has an active record of training and mentoring graduate students and post-doctoral associates in plant pathology. Since 1988, she has supervised the research of 10 Ph.D. and five M.S. students, several of whom have been honored with awards for graduate research excellence. She also has guided the research activities of 11 post-doctoral associates. Carol teaches a course on "Physiology of the Host–Pathogen Interaction." In addition, she participates in teaching an undergraduate course on "Applications of Biotechnology in Agriculture" as well as a graduate level course on "Molecular Plant Pathology" taught via Internet II. She was recognized at OSU with a Technology Innovator Award for Teaching in 2004 for her role in the development of "Molecular Plant Pathology via Internet II." This innovative course takes advantage of real-time, interactive Internet II technologies to link collaboratively with classes at Kansas State University and the University of Nebraska-Lincoln.

In recognition of her research accomplishments, Dr. Bender received the James A. Whatley Award for Meritorious Research in Agricultural Science (1993) and the Gamma Sigma Delta Alumni Award from UC-Riverside (1996). Dr. Bender also has been active in service to APS and IS-MPMI, serving as associate editor for *Phytopathology* and *Molecular Plant-Microbe Interactions*, treasurer (1999–2003) for IS-MPMI, and organizer and participant of APS-sponsored symposia including the hot topic "Plant Pathogen Forensics" in 2004. She has served on numerous peer panels for competitively funded research, including NSF. She has co-organized many international scientific sessions, and is frequently invited to speak about her studies of virulence systems of *P. syringae* at national and international meetings. She has participated continuously in the U.S.-Japan Seminar series since 1995. She has collaborated with scientists in New Zealand, Germany, Norway, and England, and with scientists in the United States at Rice University, UC-Riverside, Washington University, University of Florida, and USDA-ARS labs at Ithaca, NY, and Beltsville, MD. In 1994, Dr. Bender spent a study leave at the Mt. Albert Research Centre at Auckland, New Zealand, with Robin Mitchell to expand the research focus on the biochemical mechanism of coronatine synthesis.

In conclusion, Dr. Bender is a pioneer in defining the role of a bacterial toxin in plant pathogenesis through studies of the biosynthesis, regulation, and mode of action of coronatine. Her research program has revealed the mechanisms responsible for coronatine biosynthesis and how the toxin functions by inhibiting host plant defense responses. She is recognized internationally as an authority on bacterial phytotoxins and other virulence systems of plant-pathogenic bacteria and their relationship to analogous systems of mammalian pathogens. She is well known as an excellent collaborator in both research and teaching. She is also co-inventor on a patent where coronatine is used to control abscission in citrus, an achievement that demonstrates how basic science can directly benefit agriculture.

Raghavan ("Charu") Charudattan

Raghavan ("Charu") Charudattan was born on April 7, 1942, in Tanjavur, India. He received his B.Sc. and M.Sc. degrees in botany and chemistry in 1961 and 1963 and Ph.D. degree in plant pathology and mycology in 1968 from the University of Madras, India, under the tutelage of Professors T. S. Sadasivan and R. Kalyanasundarm. Following post-doctoral studies with Dr. James E. DeVay at the University of California-Davis, he joined University of Florida-Gainesville in 1970 as a post-doctoral associate. He was hired in 1973 as an assistant professor in plant pathology at the University of Florida to initiate a unique program of biological control of weeds with plant pathogens. He became a full professor in 1983.

Dr. Charudattan is a recognized leader in the field of biological control of aquatic and upland weeds by using plant pathogens. He has pioneered methods to study diseases of floating and submerged aquatic plants. He is a foremost expert on diseases of waterhyacinth, a weed of global importance. He has collected and studied pathogens of this weed from many countries and described empirical systems for its integrated management by combining pathogens, insects, and chemical herbicides. Colleagues and agencies around the world frequently seek his advice on managing this weed. At the invitation of the United Nations Food and Agricultural Organization (FAO), he organized an expert panel in 1996 to develop management strategies for this weed that are appropriate for the African continent. In 1994, at the request of the WHO/PanAmerican Health Organization and the Mexican Water Technology Institute, he conducted an extensive survey for diseases of waterhyacinth in Mexico to identify pathogens suitable for development as bioherbicide agents at the institute.

Along with his students and post-doctorates, Charu has devised ways to characterize the development, spread, and impacts of fungal diseases on the submerged aquatic weeds hydrilla and Eurasian watermilfoil. He has developed models to describe spore deposition, dispersal, and settling in underwater systems and to assess the effectiveness of microbial herbicides to control submerged weeds. As the centerpiece of his research resource, he has built a collection of about 2,000 microbial cultures that he has personally collected through surveys for weed pathogens. Cultures from this collection are used regularly by his students and cooperators in several countries.

Dr. Charudattan is a founder of the highly ranked, multidisciplinary, refereed journal *Biological Control: Theory and Application in Pest Management*, devoted to the science and technology of biocontrol. As the coordinating editor of the journal since its inception, he helps to set editorial policies and procedures, assembles teams of editors and editorial board members, and edits and selects papers for publication in the area of weed biocontrol. In its 15th year of publication, *Biological Control* has emerged as the leading biocontrol journal with a high impact factor.

In addition to the demands of journal editorship, Dr. Charudattan has maintained a very active and large research program supported by competitive grants and industry support. He has published extensively in the areas of etiology, epidemiology, and host–parasite relationships. His group has discovered and described new pathogens (*Araujia mosaic virus*, a member of the genus *Potyvirus*, and *Phomopsis amaranthicola*) and contributed significant new information on previously unknown or poorly characterized pathogens (*Alternaria eichhorniae*, *Cercospora* spp. on waterhyacinth, *Dactylaria higginsii*, *Fusarium* spp. on hydrilla, *Mycoleptodiscus terrestris*, *Plectosporium tabacinum*, *Puccinia evadens*, *Uredo eichhorniae*, *Uromyces pontederiae*, and others). He and his associates have shown that *Tobacco mild green mosaic virus* (TMGMV), a member of the genus *Tobamovirus*, kills tropical soda apple, a highly invasive noxious weed, by eliciting a host-specific and lethal hypersensitive host response and that this virus could be further developed and registered as the world's first virus-based bioherbicide.

Dr. Charudattan has authored 4 books, a workshop manual, 103 refereed journal articles, 24 book chapters, and 231 nonrefereed publications. His research has also garnered 11 landmark patents in the field of bioherbicides. The most recent patent from his group, on the use of TMGMV to induce a lethal hypersensitive plant response, has helped to launch a private biopesticide company.

Dr. Charudattan directs a graduate program that is unique in being able to train students, post-doctorates, and visiting scientists in principles of plant pathology as well as weed science, microbial production technology, biological control, and integrated control. His students have gone on to successful careers at universities in the United States, Brazil, Egypt, and Malaysia, the USDA-ARS, a Swiss NGO, and private companies. He teaches a course at the graduate and undergraduate levels on microbiological control of plant pathogens and weeds and frequently guest-lectures in his and other departments. International collaboration is a strong component of his program; he has participated in cooperative research in seven countries and hosted visiting scientists to his lab from nine countries. He has chaired the International Bioherbicide Group and Multistate Research Projects on bioherbicides. He has organized and convened symposia at International Weed Science Congresses held in Brazil and South Africa and the International Plant Protection Congresses in Israel and China.

Dr. Charudattan is a recipient of the USDA Superior Service Award and a Fellow of the Weed Science Society of America. He has received a Professorial Excellence Program Award and a University of Florida Research Foundation Professorship from his university. He is an adjunct professor in the Center for Aquatic and Invasive Plants and the School of Natural Resources and Conservation at the University of Florida. He has served on the scientific advisory board of a biotech company and has consulted for USDA-ARS, USDA-APHIS, USDA-CSREES, U.S. Congress Office of Technology Assessment, U.S. National Academy of Sciences-Board on Agriculture, FAO, Mexican Water Technology Institute, Brazilian governmental agencies EMBRAPA and IBAMA, and others.

An active member of APS since 1969, Dr. Charudattan is one of two founding members of APS' biological control committee. He has served as a member or chair of APS committees and as an associate editor for *Plant Disease*. He has organized and chaired paper sessions, discussions, and symposia at annual meetings and reviewed manuscripts for *Plant Disease* and *Phytopathology*.

Jacqueline Fletcher

Jacqueline Fletcher, born in Wilmington, DE, grew up in Pennsylvania as the daughter of two enthusiastic gardeners who instilled in her a love of plants and soil. She received a B.S. in biology from Emory University, Atlanta, GA, in 1970. Her M.S. in botany (1972; University of Montana, Missoula) was directed by plant virologist Meyer Chessin, and her Ph.D. in plant pathology (1979; Texas A&M University) was directed by virologist Robert Halliwell. A post-doctoral fellowship at the University of Illinois changed the course of her career when she and colleagues demonstrated that a serious "virus" disease in Illinois was caused by the wall-less prokaryote *Spiroplasma citri*. Dr. Fletcher joined the Department of Plant Pathology at Oklahoma State University in 1984, where she currently holds the title of Sarkeys Distinguished Professor.

At OSU, Dr. Fletcher established a strong research program on the molecular biology, genetics, and host–pathogen interactions of phytopathogenic spiroplasmas and phytoplasmas. A long-standing research collaboration with OSU vector entomologist Astri Wayadande and molecular biologist Ulrich Melcher led to synergistic and productive investigations. The team is recognized internationally for contributions to the field of plant mycoplasmology, particularly on molecular determinants mediating transmission by insect vectors. They, with their students and post-doctoral associates, were the first to select and study transmission-defective spiroplasma mutants, identifying several adherence-related genes and proteins, and to develop cultured insect vector cell lines as a model system for studying spiroplasma adhesion. They also examined the mechanisms of genetic variation in spiroplasmas. Current initiatives focus on natural pathogen diversity and niche adaptation.

During the last decade, Dr. Fletcher has been part of another research team investigating cucurbit yellow vine disease, an emerging and damaging disorder in midwest and east coast states. The yellow vine research team, including scientists from the USDA-ARS in Lane, OK, Texas A&M University, Stephenville, and OSU, developed molecular detection tools and showed the agent to be a phloem-inhabiting bacterium, which was identified as a unique strain of the ubiquitous microbe *Serratia marcescens*. The group's work highlighted *S. marcescens* adaptability to diverse ecological niches, and they continue to explore the environmental signals and genetic regulatory cascades that account for it.

Dr. Fletcher has participated in several international research initiatives, including work with the International Soybean Program in Mexico and Costa Rica, on sugarcane whiteleaf disease in Thailand, and on several phytoplasma diseases in Italy.

Teaching and advising graduate students is an important responsibility and pleasure in Dr. Fletcher's career. In addition to teaching a graduate class in phytobacteriology, she and fellow faculty member Robert Hunger developed and teach a graduate class in "Career Skills and Professionalism," designed to help students understand the nonresearch roles of professionals in science. Dr. Fletcher has directed or co-directed the research projects of 9 M.S. students and 10 Ph.D. students, and has served on graduate committees of 23 additional students.

Dr. Fletcher has participated in professional activities at the local, national, and international levels. At OSU, she contributed to the development of a new plant science Ph.D. program, and served on various departmental and college committees. She was a member of both the Agriculture Faculty Council (serving as secretary) and the OSU Faculty Council (chairing the Academic Standards and Policies Committee), and was a 1998–99 ESCOP (Experiment Station Committee on Organization and Policy) leadership intern.

Dr. Fletcher has been very active in professional societies, particularly APS, in which she was a member of the Bacteriology, Women in Plant Pathology, and Biosecurity Standing committees. Ad hoc committees included: Young Professionals, APS Governance, Alliances Strategy, Market Brand Development, and Constitution and Bylaws. She served as senior editor for APS PRESS and as associate editor for *Plant Disease*, and twice co-moderated the annual APS Leadership Workshop. She is a member of APS Southern and Caribbean Divisions. Dr. Fletcher served on APS Council for 10 years, as secretary, as councilor-at-large, and most recently in the 4-year presidential sequence.

During her service in the APS presidential series, Dr. Fletcher has had a significant role in the society's initiatives with respect to plant biosecurity. Working with APS Council, the Public Policy Board and APS's Washington Liaison Eversole Associates, the Biosecurity Committee, the Emerging Diseases and Pathogens Committee, and other APS groups, she participated in a congressional briefing to provide information on plant pathogens and security and helped to develop APS's current proposal for a government-based National Center for Plant Biosecurity. She coauthored APS proposals that resulted in funding from the USDA to host a workshop in Washington, D.C., "Crop Biosecurity: Are We Prepared?" and from the Department of Homeland Security for a second workshop, "Proposal for a National Center for Plant Biosecurity," and helped to prepare the APS white papers that resulted from those events. With other APS leaders, she has met with federal agency administrators and scientists, congressional staff, leaders of other professional societies and commodity groups, and others in the center proposal development. Other national initiatives in which Dr. Fletcher participated include the Public Policy Board's proposal on Component Analysis for Understanding the Sustainable Environment (CAUSE) and, APS's conversations with regulatory administrators on microbe permitting issues. She represented APS at a National Academy of Sciences Council on Scientific Openness and National Security and worked with APS journal editors to frame a publication policy on this issue. She is involved in a national initiative to explore capabilities in microbial forensics as related to plant pathogens, chairs a new ad hoc APS Interest Group on Plant Pathogen Forensics, and was appointed to the FBI's Scientific Working Group on Microbial Genetics and Forensics. Currently, she serves on the APS Public Policy Board and the Office of International Programs.

At the international level, Dr. Fletcher is a member of the International Organization for Mycoplasmology (IOM), the only professional society with a focus on mycoplasmas. She is active in the IOM Spiroplasma and Phytoplasma Working Groups, served on the Meeting Planning Committee, and was recently elected to a 4-year term as IOM treasurer. She also is a cooperator and co-PI on crop biosecurity initiatives in the European Union.

Christopher A. Gilligan

Christopher A. Gilligan was born in Ireland and moved to England in the mid-sixties. He received his B.A. degree from Keble College, Oxford University, in 1974, and his doctorate in plant pathology from Wolfson College, Oxford, in 1978, shortly after taking up a teaching position at Cambridge in the Department of Applied Biology. Professor Gilligan has continued to work in Cambridge, moving in 1989 to the Botany School, now the Department of Plant Sciences.

Professor Gilligan's chief distinction lies in linking epidemiological modeling and experimentation, within which he has made highly influential contributions in the theory of soilborne epidemics while also developing and testing a theoretical framework for the invasion, persistence, and variability of plant disease. Gilligan set out to develop and test a coherent theory for the dynamics and control of soilborne disease using a combination of experimentation, mathematical modeling, and statistical methods. This led him to advance the concept of the pathozone as a unifying concept to interpret the probability of infection and efficiency of control of soilborne plant pathogens around susceptible hosts. By linking the concept of the pathozone with percolation theory, derived from statistical physics, he has shown how partial control by biological or chemical methods can be used to prevent the invasion of soilborne pathogens from introduced inoculum.

Gilligan also developed and tested a theory for the dynamics of soilborne epidemics that introduced the joint dynamics of primary infection, derived from resident inoculum in soil, and secondary infection between infected and susceptible hosts. Here he showed how progress could be made in understanding and predicting the dynamics of epidemics by choosing plant components, such as roots, to represent susceptible host populations, thereby allowing for the interacting dynamics of plant growth and disease in the spread of epidemics. Using experiments on *Rhizoctonia solani*, *Gaeumannomyces graminis*, and *Polymyxa betae*, the vector of rhizomania disease in sugar beet, Gilligan and his collaborators have integrated the results to propose theories that scale from individual (hyphal and plant) to population (patch and field) and regional behavior. This groundbreaking work has identified the principal epidemiological mechanisms that control the dynamics of soilborne disease.

While the initial work lent heavily on nonlinear statistical methods, Professor Gilligan realized that further progress in understanding epidemics of both soil and aerial epidemics required a more rigorous mathematical treatment, not least in accounting for spatial and temporal heterogeneity. This led to a series of seminal papers and reviews that have provided a theoretical framework to understand the invasion, persistence, and variability of epidemics.

Highlights include explanations for the appearance and disappearance of disease patches in successive crops, for invasion of fungicide resistance and the relationships with drug resistance, and for dynamically generated variability in which small effects early on in an epidemic become magnified. Many of the papers opened up new areas of epidemiological and mathematical study. These included methods to deal with transient behavior typical of botanical epidemics and to analyze invasion and persistence of pathogens in variable environments where there are abrupt disturbances due to sowing and harvest. Perhaps the most important advances have been in increasing our understanding of stochasticity in epidemics. While many plant pathologists focus on mean behavior, Gilligan and his collaborators designed a series of microcosm and field experiments to quantify variability within and amongst replicated epidemics. Then using stochastic, temporal or spatiotemporal epidemic models, they showed how to use limited information on variability to predict the risk of disease under different control regimes. The models have been extended to address systems as diverse as the deployment of biological control of Dutch elm disease by hypovirulent isolates of the pathogen and in identifying strategies to restrict the spread of rhizomania disease in the United Kingdom.

Though motivated by botanical epidemiology, Professor Gilligan's research has drawn on and contributed to animal and human epidemiology. Working with colleagues in Cambridge and elsewhere, he has identified the risk of resurgence of bubonic plague in large cities as well as showing that reoccurrence of seal distemper virus in the North Sea harbor seal population results from reinvasion because the population is too small to allow seal distemper virus to persist. The work has also made wider contributions in metapopulation theory, in model simplification and in parameter estimation for temporal and spatiotemporal epidemiological models.

Now with well over 120 research papers and reviews in biological and mathematical literature, as well as an edited book, Gilligan's research continues to evolve, tackling major new problems. Recent work has used epidemiological principles to analyze saprotrophic dynamics in soil, while collaborations with economists, together with research at the interface between population genetics, statistical physics, and epidemiology, is directed at analyzing strategies for efficient deployment of disease control in a changing agricultural landscape.

Professor Gilligan has received numerous well-deserved honors. At Cambridge, he was promoted to a personal chair as Professor of Mathematical Biology in 1999 in recognition of his work in botanical epidemiology and modeling. Receiving a personal chair and professorship is rare in the British university system, especially at Cambridge, and it is remarkable that Gilligan did this 4 years before turning 50. He became a Fellow of the Royal Statistical Society in 1995 and was awarded an Sc.D. degree from Cambridge in 1999. He holds a Professorial Fellow appointment at King's College in Cambridge, another major honor. In 1998–1999, he held a prestigious Royal Society Leverhulme Trust Senior Research Fellowship and served as President of the British Society for Plant Pathology (BSPP) in 2001. In 2004, he was awarded the BBSRC Professorial Research Fellowship, the only such award in all of biology in the United Kingdom. Professor Gilligan's breadth of distinction is evident in frequent invitations to lecture for mathematics as well as biology departments and as a speaker at international conferences. He has served on numerous U.K. government committees and is in demand for national and international service. He has chaired visiting groups to assess the performance and future plans of research institutes in the United Kingdom and France and recently chaired a seminal review by BBSRC (analogous to NSF and NRI) of crop science research over the next 20 years. He is an Honorary Research Fellow of Rothamsted Research and a Director of Silsoe Research Institute and is currently a member of the Biotechnology and Biological Research Council, the principal funder of biological and agricultural research in the United Kingdom. For his many scientific and professional contributions, Professor Gilligan clearly deserves being elected as Fellow of APS.

Walter Friedrich Otto Marasas

Walter Friedrich Otto Marasas was born in Boksburg, South Africa on 25 October 1941. On October 30, 1965, he married Hendrika (Rika) Maria Nel in Madison, Wisconsin. Their daughter, Carissa Nalette Marasas, was born in Madison in 1966, and their son, Walter Friedrich Otto Marasas Jr., was born in Pretoria in 1972. Carissa (M.Sc. in plant pathology, Ph.D. in agricultural economics) works for the USDA-APHIS in Washington D.C., and Walter, a businessman, lives in Pretoria with his wife and three children. Wally and Rika live in Durbanville, near Cape Town, South Africa.

Professor Marasas became interested in the natural world at an early age and received a scholarship to study plant pathology. He obtained his B.Sc. in 1962 and M.Sc. in 1965, both from the University of Pretoria. Dr. Chris Rabie, Wally's M.Sc. advisor and a graduate of the University of Wisconsin (UW), recognized Wally's potential and encouraged him to go to his alma mater for his Ph.D. Wally's time in Wisconsin played an important role in setting his career path in mycotoxicology. While at UW, Wally isolated *Fusarium sporotrichioides* from feed grain that had killed livestock in Wisconsin. In collaboration with Jim Bamburg, the trichothecene T-2 toxin was first isolated from this fungus. Wally determined that *F. sporotrichioides* produced sufficient quantities of the toxin in contaminated grain to cause death and the characteristic symptoms. Under the guidance of Professors E. B. Smalley and M. P. Backus, Wally received his Ph.D. in plant pathology in 1969.

Marasas returned to South Africa in 1969 as mycologist with the Plant Protection Research Institute of the Department of Agricultural Technical Services in Pretoria. He had diverse responsibilities at the institute, but was able to initiate new and important mycotoxicological research while there. His collaboration with Dr. Fanie Kellerman, a veterinarian at the Onderstepoort Veterinary Research Institute who also had a degree in plant pathology, was particularly rewarding. They investigated equine leukoencephalomalacia (ELEM), a disease that causes brain lesions in horses. Once again, moldy corn that was used as feed was a suspected cause. In short order, Dr. Marasas identified *F. verticillioides* (previously known as *F. moniliforme*) as the culprit, and showed that it alone could cause symptoms of ELEM. Thus began his decades-long examination of this fungus and its impact on animal and human health.

In 1975, Wally Marasas became a chief specialist scientist with the South African Medical Research Council (MRC) in Tygerberg near Cape Town. He has remained with MRC ever since, becoming the leader of the Programme on Mycotoxins and Experimental Carcinogenesis (PROMEC) in 1992, and director of PROMEC in 2001. His most outstanding and significant contributions have come during his tenure with MRC. With a multidisciplinary group of scientists, he has investigated the high incidences of esophageal cancer (EC) that occur in the Transkei region of the Eastern Cape Province in South Africa. Wally showed that home-grown corn, the staple food for local populations, was contaminated with the fungus that causes ELEM, *F. verticillioides*, and although he could not determine its effect on humans, he did demonstrate that it caused liver cancer in rats. After years of hard work, Wally's team isolated a new group of mycotoxins, the fumonisins, from strains of *F. verticillioides* from the Transkei, determined their chemical structure, and developed

analytical methods for their detection. In animals, fumonisin B1 caused the same symptoms that were induced by *F. verticillioides*-infested moldy maize and *F. verticillioides* by itself. Concentrations as low as 10 ppm caused ELEM and 50 ppm caused liver cancer in rats. Concentrations as high as 117 ppm were found in home-grown corn that was consumed by people in the Transkei and indicated that *F. verticillioides*-infested corn may play a role in the high rates of EC. Since their discovery, the fumonisins have been associated with another hotspot of EC in China, have been shown to induce a third animal disease, porcine pulmonary edema (PPE), and have been associated with serious outbreaks of ELEM and PPE in the United States. The International Agency for Research on Cancer now classifies fumonisins as Group 2B carcinogens, e.g., probably carcinogenic to humans. With Professor Marasas's assistance, the World Health Organization is engaged in an intensive assessment of health risks posed by the consumption of these mycotoxins. Wally Marasas has been called the "world's most well-known mycotoxicologist" and is recognized as one of the outstanding mycologists in South Africa. He has authored three books, 50 book chapters, and over 300 papers in refereed journals on a wide range of mycotoxicological, mycological, and plant pathological topics. His research is published in high-impact journals and is frequently referenced by colleagues; 13 of his publications have been cited over 100 times. He is an Institute of Scientific Information (ISI) "Highly Cited" author, and is in the top 10 for numbers of citations in two different ISI categories, agricultural sciences and plant and animal sciences.

Wally Marasas is a widely sought keynote and plenary speaker (to date, well over 150 have been given at international conferences), is an advisor and consultant with several global health and scientific organizations, and despite having no official academic appointment, is a frequent advisor of M.Sc. and promoter of Ph.D. students. He is a Fellow of the South African Society for Plant Pathology; has received several honorary memberships, professorships, and doctorates; and has received numerous prestigious awards, including the Christiaan Hendrik Persoon Gold Medal for Scientific Excellence and Outstanding Achievements in Plant Pathology, the Wellcome Gold Medal for Medical Research, the Silver Medal for Excellence in Research from the Medical Research Council, the African Academy of Sciences/ CIBA Prize for Agricultural Biosciences, and the MT Steyn Gold Medal for Scientific and Technical Achievement. Wally Marasas has been very effective in integrating the fields of plant pathology and mycotoxicology. He has had a major influence on the fields of mycotoxicology and mycology, as well as the areas of human and animal health. He is clearly a most deserving candidate for the award of APS Fellow.

Bruce A. McDonald

Bruce McDonald was born in Newport Beach, California, in July 1960. He received his B.Sc. in plant science at UC-Riverside in 1982, and his Ph.D. in genetics at UC-Davis in 1987. He joined the Plant Pathology Department at Texas A&M University in 1988 and moved to his current position of professor and chair of plant pathology at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland in 1998.

Throughout his career, Dr. McDonald has taken an interdisciplinary approach combining plant pathology, genetics, and evolutionary biology to elucidate the population genetics of plant pathogens. As part of his Ph.D. training under the supervision of Professors Robert Allard and Robert Webster, he looked for evidence of coevolution between barley composite crosses and the scald pathogen *Rhynchosporium secalis*. He determined how different resistance genes and resistance gene combinations grown in mixtures and pure stands affected epidemic development. In collaboration with his Ph.D. student colleagues Joseph McDermott and Stephen Goodwin, he used isozyme and RFLP markers to characterize the genetic structure of *R. secalis* populations on composite cross populations that had different evolutionary histories. The latter work led him into a very productive line of research on the genetic structure of pathogen populations that he continues to this day.

During his 10 years at Texas A&M, Dr. McDonald worked on seven different fungal pathosystems, including pathogens of wheat (*Mycosphaerella graminicola*, *Phaeosphaeria nodorum*), barley (*Rhynchosporium secalis*), sorghum (*Colletotrichum graminicola*, *Sporisorium reilianum*), rice (*Rhizoctonia solani*), and oak trees (*Ceratocystis fagacearum*). During this period, he popularized the use of hierarchical sampling strategies and neutral DNA-based genetic markers to characterize the genetic structure of pathogen populations. The techniques and strategies he developed during this time have been widely adopted and have driven forward our knowledge of pathogen genetic structure.

After arriving at the ETH in Zurich, Dr. McDonald moved rapidly into the new fields of phylogeography and experimental evolution to elucidate the roles of sexual recombination and immigration as drivers of pathogen evolution and to trace historical pathways of pathogen movement and speciation. He and his colleagues recently began applying tools of evolutionary ecology, in particular using QST analysis, to better understand the connection between variation at neutral loci and variation for selected quantitative characters. This work promises to open important new areas for investigation within plant pathology. Dr. McDonald's work on the population genetics of plant pathogens remains at the forefront of this field.

As a result of his work, the population genetics of the wheat leaf blotch pathogen *M. graminicola* is now better understood than any other plant pathogen. This line of inquiry recently culminated in the first complete set of parameter estimates for all five evolutionary forces in any plant pathogen, allowing modeling of the relative contributions of different forces in the evolution of this important pathogen and demonstrating the importance of gene flow as a driver of evolution. Dr. McDonald and his colleagues were the first to conduct a hierarchical analysis of gene diversity in a pathogen using molecular markers. They also were the first to make quantitative estimates of gene flow between pathogen populations; to differentiate and quantify the relative contributions of recombination, immigration, and asexual reproduction to the development of an epidemic in a replicated field experiment; and to conduct microtransect sampling through lesions to illustrate the relative positioning of clones within a lesion on a millimeter scale. His group also made the first quantitative measurements of selection coefficients during a growing season in replicated field experiments, based on mark and recapture strategies. His group recently published the first paper on the population genetics of a fungal avirulence gene (the *NIP1* gene in *R. secalis*).

The work of Dr. McDonald and his colleagues has illustrated the utility of pathogen population genetics to better understand pathogen biology and to implement more sustainable disease management strategies. Their work has contributed fundamentally to our understanding of the nature of pathogen diversity and how it affects disease management. He and his colleagues recently developed and published a simple model for predicting pathogen evolutionary potential. This model shows considerable promise, as it appears to work well for viruses, fungi, and nematodes. It is particularly exciting that this model predicts the development of fungicide resistance much better than existing risk assessment

models developed and promoted by the Fungicide Resistance Action Committee (FRAC) over the last decade.

Dr. McDonald made significant contributions to plant pathology education at several levels. He traveled extensively to raise awareness of the importance of population genetics in the plant pathology community, giving 81 invited lectures over the past 15 years, including at 32 universities in 18 countries. He developed and taught intensive multi-day short courses on pathogen population genetics for Ph.D. students in Nordic countries and Switzerland. Since joining the ETH and assuming his responsibilities as a professor of plant pathology in Switzerland, he began to teach the entire discipline of plant pathology in the only College of Agriculture at a Swiss university. His courses are taught at all university levels, including B.Sc., M.Sc., and Ph.D. students. Through 5 years of steady effort, Dr. McDonald and his co-workers restructured the plant pathology curriculum at the ETH, which now attracts students from other Colleges of the ETH, including the College of Biology and the College of Environmental Sciences. Students also are now attracted from other Swiss universities and other European countries. With assistance from APS, he recently converted a portion of his teaching materials into a web-based platform and donated them to the APS Education Center, where they currently form the largest online course in the Center. Dr. McDonald's teaching will likely influence the next generation of plant pathologists and increase the role of population biology in the plant pathology curriculum.

Robert A. Owens

Dr. Robert A. Owens was born in Providence, Rhode Island. He obtained his B.Sc. degree in botany from the University of Rhode Island (1968) and a Ph.D. in biochemistry and biophysics from the University of California, Davis (1974). After post-doctoral studies at Columbia University, Dr. Owens joined the USDA's Plant Virology Laboratory in Beltsville as a research chemist in 1975.

Building on experience obtained from studies of Dutch elm disease carried out under the direction of Drs. Frank Howard and Carl Beckman (University of Rhode Island), Dr. Owens began his research career as a graduate student at UC-Davis, where he demonstrated that the coat proteins of *Cowpea mosaic virus* are synthesized on cytoplasmic (and not chloroplast) ribosomes. These studies, carried out in the laboratory of George Bruening, highlighted the need to carry out in vitro translation studies with plant viral RNAs in cell-free extracts prepared from eukaryotic rather than prokaryotic cells. Post-doctoral studies in the Department of Biological Sciences at Columbia University focused on the synthesis of histone mRNAs in cell-free extracts of mammalian cells. Dr. Owens then joined the Viroid Investigation Program, headed by T. O. Diener, at the USDA's Beltsville Agricultural Research Center. His early work focused on molecular mechanisms of viroid replication and resulted in the first cloning of cDNA molecules complementary to *Potato spindle tuber viroid* (PSTVd). These cDNAs were then used to create the first nucleic acid hybridization-based diagnostic test for viroids.

Dr. Owens is widely known for his pioneering studies on molecular detection of viroids. Soon after publication of the rapid and sensitive dot blot hybridization assay, he and colleagues began collaborations with the International Potato Center (CIP, Lima, Peru) and Agdia (Elkhardt, IN) aimed at integrating the assay into large-scale disease screening programs. In addition to eliminating PSTVd from the CIP breeding program, these long-term collaborations catalyzed the rapid adoption of dot blot and other nucleic acid-based diagnostic protocols worldwide. Results are now available in hours, rather than the days to months required for conventional bioassays or gel electrophoretic analysis, and offer greatly improved sensitivity. Later studies with Luis Salazar and colleagues at CIP have focused on a series of emerging disease problems threatening U.S. agriculture; accomplishments include identification of avocado as the first woody host for PSTVd, characterization of a whitefly-transmitted closterovirus (*Potato yellow vein virus*) as the causal agent of potato yellow vein disease, and screening U.S. potato varieties for resistance/tolerance to *Potato mop top virus*.

In 1983, Dr. Owens and colleagues reported that greater-than-unit-length cDNA copies of PSTVd were infectious, thereby opening the way for the application of reverse genetics to fundamental questions of viroid molecular biology. Subsequent mutational analyses, including the construction of novel viroid chimeras, have demonstrated the importance of different structural interactions for the ability of viroids to replicate and induce disease in vivo. Pathogenicity of PSTVd and related viroids was shown to be specified not by a single pathogenicity domain but by multiple genetic determinants distributed throughout the molecule. An early collaboration with colleagues at Calgene (Davis, CA) used infectious PSTVd cDNAs as reporter genes to monitor T-DNA transfer from *A. tumefaciens* to susceptible plant hosts, thereby leading to various agroinfection strategies currently used to study gene expression and/or silencing.

As "obligate parasites of the cell's transcriptional machinery," Dr. Owens realized that viroids provide a rich source of molecular signals that could be used to redirect host gene expression. In the mid-1990s, a series of collaborative studies with Biao Ding (Ohio State University) as well as Rosemarie Hammond and Yan Zhao (Beltsville) used PSTVd replication to probe the pathways used by plant cells to transport RNA. This work capitalized on the absence of pathogen-encoded proteins, which makes viroids especially powerful tools to examine RNA import into the nucleus, movement from cell to cell via the plasmodesmata, and long-distance transport via the phloem. The studies showed that fusion with PSTVd sequences redirects RNA molecules to the nucleus and facilitates their movement through the plasmodesmata and that long-distance movement and viroid entry into uninfected host tissues is developmentally controlled. Similar studies led by Dr. Owens are currently underway to identify the signals used by other viroids to enter the chloroplast prior to replication, signals that could be used by plant biotechnologists to redirect mRNAs from the cytoplasm to the chloroplast and greatly increase the amount of protein synthesized.

Dr. Owens' focus on fundamental viroid molecular biology has been accompanied by a consistent determination to apply the knowledge gained to urgent disease problems. In addition to his long-term collaborations with both CIP and the private sector, Dr. Owens' expertise and impartiality proved essential to efforts to resolve a 1996 U.S.-Canada dispute that threatened the ability of Maine growers to export their seed potatoes to Canada. A letter from the commissioner of the Maine Department of Agriculture, Food, and Rural Resources documented his contributions to preserving the $30 million Maine seed potato industry. More recently, RT-PCR protocols developed by Dr. Owens have improved the ability of Florida's Bureau of Citrus Budwood Registration to detect viroid infections, and field studies have been initiated to evaluate the potential of viroid-induced dwarfing to improve the competitive position of Florida citrus producers.

Dr. Owens' achievements have established him as a national and international authority and leader in the field of plant pathology and viroid research. His laboratory has attracted a series of post-doctoral scientists, U.S. and foreign visiting scholars, and graduate students. An invited participant in numerous national and international meetings and coauthor of an undergraduate virology text, Dr. Owens has also served as international expert

and member of NRI, NSF, BARD, and USAID grant review panels and has assisted young faculty members embarking upon careers in viroid research. A past member of the editorial board of *Virology*, he currently serves on the editorial board of *Virus Genes* and reviews manuscripts for several other virology journals, *Phytopathology*, and *Plant Disease*.

Gail Schumann

Gail Lynn Schumann was born in Cincinnati, OH, and grew up in Kalamazoo, MI. She graduated from the University of Michigan with a major in botany in 1972 and received her M.S. and Ph.D. degrees in plant pathology from Cornell University in 1976 and 1978, respectively. She initiated her academic career in 1984 at the University of Massachusetts following the care of a young daughter. She retired from that position in 2003 as professor emeritus and is currently adjunct professor at Marquette University in Milwaukee, WI.

Dr. Schumann's academic appointment at UMass focused on teaching and extension for turfgrass pathology including diagnostic services. She served as the undergraduate curriculum coordinator and advisor for plant pathology until the program was eliminated. She restricted her graduate advising to a few M.S. students and encouraged a number of students to apply to plant pathology graduate programs at other institutions. Her limited research program focused on applied turfgrass pathology.

Each year she taught a course in general plant pathology, a general education biology course based on plant diseases, and several turfgrass pathology courses for both the 2-year and 4-year academic programs. Her current position at Marquette University, a private, Jesuit university, allows her to continue teaching and introduce a new audience of students to plant pathology in a core biology course for nonscience students and the introductory lab course for majors.

She published *Plant Diseases: Their Biology and Social Impact* as a textbook to be used in classes that taught biology to nonscience students. It was designed to help students understand disease biology and its relevance to their lives through practical applications in agriculture. Dr. Schumann's classroom teaching has been recognized by a number of teaching awards including the APS Excellence in Teaching Award, the National Association of State Universities and Land-Grant Colleges Northeast Teaching Award, as well as additional teaching awards at UMass.

Dr. Schumann published many extension bulletins and disease notes and annually presented numerous extension education programs at turfgrass conferences in New England and around the United States. Those who work in extension will appreciate how many turf disease samples, phone calls, e-mails and other communications filled most days and how satisfying it was to help turfgrass managers on a daily basis. From a 2-day workshop taught through the Golf Course Superintendents Association of America, she and her coauthors published *IPM Handbook for Golf Courses*. She was instrumental in initiating the newsletter *Turf Notes* and helped in designing the UMass Turf Program website on which she posted timely disease messages for her extension audiences.

Most of her professional activities have been focused on increasing the awareness of the importance of plant diseases to audiences external to the discipline of plant pathology and to enhancing the value of teaching at academic institutions. In the late 1980s and early 1990s, instructional technology began developing rapidly and this afforded Dr. Schumann with the opportunity to provide quality images and information on plant diseases to a broad range of audiences. With several coauthors, she published both slide sets and a videodisc of 10,000 disease images with accompanying disease lessons and glossaries in English, French, and Spanish. With coauthor James MacDonald, she designed a CD-Rom based on the *Compendium of Turfgrass Diseases* for turfgrass managers and students. For this effort, they received the National Association of Colleges and Teachers of Agriculture Media Award of Excellence in 1998. As chair of the ISPP Teaching Committee, she helped organize the first online Instructional Technology Symposium in 2001.

Dr. Schumann has served APS in many capacities. She was active in the Northeastern Division of APS, serving as president in 1995, and received their Award of Merit in 1996. She was actively involved in the APS Teaching Committee and served as senior editor of APS PRESS.

In 2000, Dr. Schumann was offered the opportunity to help create the APS*net* Education Center and its accompanying online journal *The Plant Health Instructor*. This fulfilled many of the goals that guided her other activities and publications. The K-12 section is designed to educate teachers about plant diseases and to provide them with complete and simple laboratory activities for their classes. The introductory plant pathology section is aimed at students in their first plant pathology course, but many of the laboratories and resources are relevant for students in microbiology and biology courses. To enhance use by international audiences, the first translation of a disease lesson into Spanish was published in 2005. More lessons translated into Spanish and translations in other languages are anticipated. The advanced section is designed to contribute to the education of traditional students as well as provide lifelong learning for working professionals. All instructional materials are peer-reviewed and receive a traditional citation in *The Plant Health Instructor* so the creative efforts of the authors can be listed easily in annual reports. There is also an instructor section designed to enhance communication among plant pathology instructors by providing the opportunity to publish peer-reviewed teaching notes and teaching articles. Dr. Schumann hopes that this website will continue to grow, serve the educational needs of various audiences, enhance the image of APS by providing this free resource, and contribute to the academic prestige of authors who contribute quality instructional materials and teaching scholarship. Although she will complete a second term as editor-in-chief for the Education Center at the end of 2005, she hopes to continue to generate new publications herself and through her relentless nagging of colleagues with quality materials and educational talents.

Xiao-Bing Yang

Dr. Xiao-Bing Yang was born in 1958 in China. He obtained his B.A. and M.S. in plant pathology from China Agricultural University (formally Beijing Agricultural University). He completed his Ph.D. degree in plant pathology in 1989 from Louisiana State University, Baton Rouge. Dr. Yang moved to the U.S. Foreign Disease Laboratory in Fort Detrick as a post-doctoral associate, where his colleagues started to address him as XB. After another post-doctoral stint at the University of Arkansas, he joined the faculty of the Department of Plant Pathology at Iowa State University, where he is currently a full professor. His research focuses on plant disease epidemiology with emphasis on large-scale disease patterns and prediction, impacts of climate change on plant diseases, and disease risk assessment. He has served as both an associate and senior editor of *Phytopathology*. He has also served either as a member or chair of a number of APS committees over the years.

Dr. Yang is a pioneer in disease risk assessment, which now is playing a pivotal role in plant disease epidemiology, regulatory plant pathology, and disease management. As early as 1990 as a post-doc at Fort Detrick, Dr. Yang pioneered the quantitative assessment of disease risk using soybean rust as a model system. In a series of articles, he developed a computer-modeling approach that has been widely used for assessing plant disease risk worldwide. The framework developed by his work has become a standard approach for assessing the risk of exotic or new plant diseases. The principle has also been used in risk assessment for introduced agents for biological control, and use of GM crops, etc. His review articles on this topic were cited by the National Plant Pathology Board in 1995 as one of the directions of future plant pathology research. His pioneering work in modeling exotic disease risk has been cited in many review articles and textbooks. In 2000, before the importance of biosecurity was widely recognized by the scientific community, he foresaw the importance and role of plant pathologists in this area and wrote a widely regarded article on disease risk assessment and biosecurity.

A second area of Dr. Yang's seminal and widely acclaimed contributions has come from his determination of the impact of climate change on plant diseases. Dr. Yang and Dr. Harold Scherm were the first to establish a link between the El Niño climate pattern and disease epidemics. Using plant disease as a model system, in a letter to *Science*, they proposed a general paradigm linking the El Niño climatic cycle to infectious diseases in humans, animals, and plants. In collaboration with Harvard Medical School, he has studied climate impacts on crop diseases and pests in the world and was invited twice to speak at Capitol Hill by the Senate Agriculture Committee on climatic change research. His studies were covered by national media (e.g., Washington Post, ABC News, Associated Press, Public Radio, and C-SPAN). He was invited to develop future scenarios in the United Nations Development Program (UNDP) at UN headquarters and by Swiss Refund, the largest global reinsurance company, in Switzerland.

A third area of plant pathology with an impressive array of accomplishments has come from Dr. Yang's study of macroscale disease patterns. To establish the theoretical framework for risk assessment, together with Professor S. M. Zeng at China Agricultural University, Dr. Yang proposed a framework for the study of large-scale disease patterns, which is the study of large-scale statistical patterns of disease occurrence in time and space. He was the first to detect the long-term patterns (time series) of disease outbreaks after studying wheat stripe rust pandemic records in China. Ten years later, he was the first to find large-scale spatial distribution patterns of plant diseases using U.S. soybean production region.

Finally, Dr. Yang's contributions have come from his determination of the risk of deploying GM crops. Concerns have been raised regarding the adoption of glyphosate-tolerant soybeans and its impact on increased prevalence of sudden death syndrome. Dr. Yang and his associates assessed the effects of herbicides on the phenology of causal agent of sudden death syndrome and on the development of the diseases in the glyphosate-tolerant soybean. His studies revealed that increased prevalence of sudden death syndrome was not related to the glyphosate tolerance gene. This body of work has helped ensure the successful deployment of this new technology in the United States and South America.

Dr. Yang has achieved so much so early in his career that have brought him the well-deserved, wide recognition. He has given 30 invited plenary addresses, lectures, or symposia in 13 countries on the topic of risk assessment and macroscale disease pattern study. Nationally, he has given 52 invited talks at national conferences, symposia, institutes, or organizations, including twice in the U.S. Congress. He has served as a spokesman on a variety of issues for private and public institutions and has been consulted on various issues by international companies, foreign countries, national commodity boards, federal agencies, and the UNDP. He has been a board member on four journals, and a reviewer for 24 journals. He has also been awarded honorary professorships by China Agricultural University and Kasetsart University in Thailand. His research and views have been covered 12 times by national media, 8 times by international media, and over 50 times by regional newspapers.

Dr. Yang has had a prolific publication record with over 80 refereed journal articles, reviews in *Annual Review of Phytopathology*, *Science*, *Bioscience* and other influential journals, invited book chapters, and numerous articles in trade journals. He has also overseen a research group consisting of staff, post-docs, undergrads, and graduate students working toward M.S. or Ph.D. degrees. He enjoys the intensified intellectual exchanges with his post-docs and has had 13 post-docs from diverse cultural backgrounds. His former associates are pathologists in governments, industry, and academy with four being faculty in land grant universities. He is also a very amiable person imbued with a fine human nature and cooperative attitude. His outstanding, awe-inspiring achievements so early in his career eminently qualify him for the APS Fellow Award.

Excellence in Extension

This award recognizes excellence in extension plant pathology.

Melodie Putnam

Melodie Putnam was born and raised in Portland Oregon. She received two B.S. degrees (agronomy and botany and plant pathology) from Oregon State University (OSU) in 1981, and an M.S. in plant pathology from the University of Wisconsin in 1984. As an undergraduate student, she worked in the laboratory of Dr. Mary Powelson, who was instrumental in sparking her developing interest in plant pathology. After graduate school, she spent a short time with the Institute for Scientific Information in Philadelphia, PA, and with the USDA in Beltsville, MD. In 1986, Putnam began her career first as a plant disease diagnostician (1986), and later as supervisor (1988–1990) of the Plant Pest Survey and Support staff with the Maryland Department of Agriculture. She then took the position of director (1990–1993) of a newly established integrated plant diagnostic facility at Purdue University. In 1993, Putnam began working at OSU as an extension plant pathologist and chief plant disease diagnostician. Her responsibilities are to provide plant disease diagnosis and management recommendations for all samples submitted to the OSU Plant Disease Clinic. She was promoted to senior instructor with tenure in 2001.

As an extension plant pathologist, Putnam has a remarkable set of accomplishments. First, she has heightened the level of professionalism in the Plant Clinic. Soon after arriving at OSU, Putnam modernized the Plant Clinic by redesigning operations, halving turn around time of samples, and introducing new diagnostic services in response to changing client needs. The latter

have included assaying nursery water for *Phytophthora* spp., testing isolates of *Botrytis* and *Phytophthora* for resistance to fungicides, isolating and testing pathogenicity of *Agrobacterium tumefaciens* (=*Rhizobium radiobacter*) from symptomatic plants, and providing 24-h turn around for urgent samples. She has also updated and improved the ability to diagnose and identify various pathogens by implementing rapid diagnostic techniques, including molecular assays. As part of the National Plant Diagnostic Network (NPDN), Putnam has responsibility for morphological and molecular detection of pathogens on the APHIS "Select Agent" list. Putnam has a reputation as a careful, thorough, and knowledgeable diagnostician. One colleague characterized her as "the type of diagnostician we all strive to be." Her efforts and the knowledge of her being a top notch diagnostician have resulted in the elevation of the OSU Plant Clinic from a simple local facility to one known regionally as a strong diagnostic laboratory with unique services. Over the years, there has been an increase in the number of samples received from clients around the country, as well as the number of samples received from and referred to by other diagnosticians. Most recently, the OSU Plant Clinic has been designated by the Western Region of the NPDN as a resource laboratory for the Pacific Northwest and Alaska and has provided back-up diagnostic services to 11 states, including those in other regions.

Extension/teaching is an important and effective component of her program, and her leadership and knowledge in this area is quite evident. The OSU Plant Clinic is her top priority and her expertise in the field of plant pathology becomes clear when reviewing the diversity of plants and diseases related to samples submitted. Putnam has, during her tenure at OSU, personally processed over 19,000 samples representing more than 400 plant species from 297 genera and 110 families. Causal agents identified from these samples were from 226 genera of fungi representing 20 orders and 12 classes. In addition, in a state with little viral or bacterial diversity, she has identified 33 virus species, 25 bacteria species, and three phytoplasmas. Each of these samples provided a teaching opportunity and a means to impart information to the client regarding disease cycles, management strategies, and the best means of preventing further disease problems. In addition, Putnam has been extensively involved with other teaching, primarily related to the understanding and diagnosing of plant diseases. She has been the guest lecturer in a number of credit classes at OSU, in the Departments of Horticulture, Crop and Soil Sciences, and Botany and Plant Pathology. She has had the opportunity to share her skills of diagnosing with those graduate students who have shown interest in learning practical plant pathology. Her teaching has not been confined to campus opportunities. Putnam is in high demand each year to make presentations to growers throughout the state, and gives over a dozen talks annually covering a wide range of subjects. She has been a driving force behind the education of master gardeners regarding plant diseases, teaching over 55 half-day and day-long workshops over the years in 15 of Oregon's 21 counties with master gardener programs. Her gift of being an effective teacher is recognized by the excellent teaching evaluations received from her master gardener classes. Her high level of achievement was recognized when Putnam received the OSU College of Agricultural Sciences Award for Excellence in Extension in 2000.

With a 100% extension appointment, Putnam has maintained an exceptional record of scholarly accomplishments through publication of articles covering issues pertinent to her position. She has 35 refereed publications, has contributed an encyclopedia article, book chapters, and conference proceedings. She has also presented at two international and 62 national and regional meetings. This is all in addition to the extension publications she has authored, coauthored, and contributed to.

Putnam has served many roles within The American Phytopathological Society. She is currently senior editor of APS PRESS and has served as senior editor of *Plant Health Progress*, past president of the APS Pacific Division, and newsletter editor of the division. She has also served on the Diagnostics, Regulatory, and Standardization of Common Names for Plant Diseases committees.

Excellence in Teaching

This award recognizes excellence in teaching plant pathology.

Caitilyn Allen

Caitilyn Allen, professor of plant pathology at the University of Wisconsin (UW)-Madison is the 2005 recipient of The American Phytopathological Society Excellence in Teaching Award. Professor Allen earned her Ph.D. in plant pathology at Virginia Polytechnic Institute and State University in 1987 and joined the faculty at UW in 1992. In addition to her appointment in the Department of Plant Pathology, Professor Allen has an appointment in the UW Women's Studies Program. She is unusual, perhaps unique, in her proven ability to integrate disciplines in the classroom by bringing her scholarly activities in biology and the social sciences to bear on each other. Her superb teaching for majors and nonmajors, for undergraduate and graduate students, and both in and out of the classroom make Allen an exceptional member of APS and worthy of the society's teaching award.

In Professor Allen's classroom, three themes emerge. First, she integrates across disciplines—biology with social sciences, applied agriculture with basic biology. Second, she is creative and innovative, using teaching techniques that actively involve students in evaluating science. Since every cohort of students is unique, she constantly adjusts and evaluates to find the best fit between her methods and her students. Third, she has the magic of a great teacher. She is facile with language, has incisive intuition about learning and students' needs, is responsive to student feedback, and is flexible enough to do a midcourse correction if necessary. She has the knack of impeccable timing, introducing humor, questions, challenges, and debates at just the right moment to facilitate learning, keep the interest of her students, and maintain a rigorous, congenial classroom community. Her magic is enhanced by her sharp intellect and composure. She is simply a compelling person who draws scientists and nonscientists alike to listen to her, interact with her, and learn from her.

Professor Allen brings rigorous science to "Plants, Parasites, and People," an undergraduate course for nonmajors. Here she uses plants and microbes to teach the scientific method and experimental design. She emphasizes the role of plant diseases in

shaping history and their relevance to modern society. Most students take this course to fulfill what they consider to be a nasty life science requirement and expect to hate it. However, the glowing evaluations reveal that plant pathology and its social impacts are fascinating and relevant when taught by Caitilyn Allen.

Upper-level undergraduate and graduate students praise Allen's enthusiasm and ability to communicate difficult concepts clearly in the courses "Plant–Microbe Interactions" and "Plant–Bacterial Interactions." They appreciate her accessibility and believe that this reflects her genuine interest in their well-being. In her upper-level undergraduate course, "Biology and Gender," students learn to debunk myths, separate prejudice from principle, and evaluate scientific studies with confidence. Many of these students eventually work in social sciences, law, or politics—fields in which understanding biology, biotechnology, and the scientific underpinnings of bioterrorism has never been more important than it is now. One student remarked, "This class changed the way I think. I am now much more critical of science news I hear in the media, and I am no longer intimidated by scientific readings." Her numerical ratings in this course are well above the averages for the Women's Studies Program, a program noted for its extraordinary teachers.

Allen's outstanding teaching is recognized and admired by her colleagues at the UW and from other institutions. In 1998, as an assistant professor, she received a prestigious UW Chancellor's Distinguished Teaching Award, an honor usually reserved for more seasoned faculty. She is a much sought after speaker on teaching and mentoring, having given 29 presentations throughout the state and nation, as well as dozens of presentations to schoolchildren and the local media. She teaches others how to use ethics, writing, and group discussion in the teaching of biology. Colleagues attend her classes to get new ideas for their own teaching.

Allen's teaching is not bound by classroom walls or by the safety of what has proven successful. Most noteworthy is her success in directing the Women in Science and Engineering (WISE) Residential Program, an award-winning and nationally recognized mentoring program for college freshmen and sophomores. This challenging task had foiled other successful biology teachers on campus. However, Allen set up special sections of science courses (after numerous deans declared that "it can't be done"), organized cultural events, and taught a seminar course for the residents. The WISE program was funded largely through grants obtained by Allen and a college dean.

In the areas of service and outreach, Caitilyn Allen has been exemplary, especially in matters related to teaching and mentoring. She has served on and chaired the Department of Plant Pathology's Curriculum and Academic Affairs committees. In the latter post, she revamped the department's graduate recruiting efforts, injecting the process with rigor and creativity. At the campus level, her efforts earned her the Provost's Research-Service Award in 2000. Seventy participants benefited from the 1-day graduate teaching symposium she organized in 2001 in conjunction with the 10th International Congress of the International Society for Molecular Plant-Microbe Interactions. She then wrote a chapter on teaching molecular aspects of plant pathology, which is published in the proceedings from that conference. In 2003, she garnered funds and organized a workshop focused on developing U.S.-African training and research collaborations. Allen's internationally recognized research program on the molecular genetics of virulence in *Ralstonia solanacearum* has provided a fruitful arena for training researchers from the undergraduate to post-doctoral level who are employed in research and teaching throughout the world. She has generously opened her lab to dozens of undergraduates for independent projects or employment.

We agree with the undergraduate who opined, "Professor Allen is what a professor should be on this campus." Indeed, APS is privileged to have this superb teacher and dedicated scholar educating both the future professionals in our discipline as well as the citizens who depend on our discipline without realizing it.

International Service Award

This award recognizes outstanding contributions to plant pathology by an APS member for a country other than his or her own.

James R. Steadman

James R. Steadman was born in a suburb of Cleveland, Ohio, and worked in a family landscape business while attending Westlake High School and Hiram College. After graduating from Hiram with a B.A. degree in biology in 1964, he obtained an M.S. and Ph.D. in plant pathology from the University of Wisconsin-Madison, sponsored by an NIH Pre-doctoral Fellowship. Dr. Steadman began his position as an assistant professor at the University of Nebraska-Lincoln in 1969 immediately after finishing his doctorate. He has remained at UN-L in a teaching/research appointment for the past 36 years, serving as acting department head for 2.5 years beginning in 2000. Dr. Steadman has been active in APS, serving in the Office of International Programs for the past 12 years, Office of Public Affairs and Education, officer and president of APS North Central Division, and Public Policy Board.

Dr. Steadman's international career began when he was invited to present a lecture on the influence of plant architecture on diseases and consult with the bean program scientists at Centro International de Agricultura Tropical (CIAT), Cali, Colombia, in 1978. From this interaction with CIAT scientists, the need for and opportunities to do research in the developing countries of the Americas became apparent. In 1979, an exploratory trip to the Dominican Republic was made to assess possibilities of establishing a USAID Collaborative Research Project there. Dr. Steadman was one of the initial group of bean scientists to work in what has become the Bean/Cowpea Collaborative Research Support Program (CRSP), a unique component of the predominantly development-oriented USAID Agriculture Mission. The initial thrust of the Bean/Cowpea CRSP was in bilateral agreements with individual countries. Dr. Steadman worked with Dr. Dermot Coyne, a plant breeder/geneticist, along with Dr. James Beaver and other scientists at the University of Puerto Rico-Mayaguez who were responsible for advances in bean and other research and training in the Dominican Republic. In the initial stages of the project, the research concept was not understood either by the Dominican Republic Ministry of Agriculture or the local USAID Mission. Dr. Steadman was a member of a delegation of USAID-Washington and Caribbean Region officials who, in 1989, negotiated successfully with the local USAID Mission to retain the Bean/Cowpea CRSP bean research effort in the Dominican Republic when

macroeconomics was driving USAID officials to abandon portfolio objectives that supported local bean producers. It was through training of Dominican scientists, release of improved varieties with higher yields and development of disease management strategies that led to the Dominican Republic becoming self-sufficient in bean production in the late 1990s. Dr. Steadman through the Bean/Cowpea CRSP has been contributing to Dominican Republic agriculture for over 25 years. The UN-L/UPR CRSP project has trained two Ph.D. and 18 M.S. scientists who are now contributing to all aspects of Dominican agriculture. To recognize his role in these outstanding contributions, Dr. Steadman was presented the Award of Recognition by the Agricultural Producers of San Juan de la Maguana. Dr. Steadman is the only remaining principal investigator from the first Bean/Cowpea CRSP 5-year project 25 years ago and now serves as the chair of the Technical Committee that has oversight responsibilities of the research activities in East, West, and Southern Africa, as well as Latin America and the Caribbean, and he serves as chair of the LAC Regional project.

In a similar way, Dr. Steadman had a seminal role in Sclerotinia workshops. In 1974, he was one of four scientists who organized the first International Sclerotinia Workshop in Beltsville, MD, and has served on the organizing committee or was the organizer of the 12 additional workshops that were presented over the past 30 years, most recently in England and New Zealand and scheduled for Monterrey, CA in 2005. He is the only member of the first organizing committee who has continued work with *Sclerotinia* for 30 years and is still active. He also was a co-convener of the first Australasian Sclerotinia Workshop in Tasmania and has served as external examiner of *Sclerotinia*-related Ph.D. theses in Canada and Sweden. Dr. Steadman presently serves as chair of the Sclerotinia Subject Matter Committee of the International Society of Plant Pathology.

Dr. Steadman has dedicated 30 years to international research training and outreach. He has had an impact on in-country research infrastructure, research impact such as disease management strategies, disease resistant germ plasm and variety releases. In addition, the funding generated for this international research has had an impact on Nebraska and U.S. agriculture. For example, the nearly $3 million in USAID funding over the past 25 years has enabled the Nebraska bean breeding and disease management programs to continue to make contributions and impacts to local and national bean improvement. A rust resistant pinto variety released by UN-L was estimated at a $5 million value for the central high plains of the United States. Invited lectures and talks in places as distant as Argentina, Australia, Costa Rica, Sweden, England, South Africa, Egypt, Morocco, and Tanzania also have brought information to many foreign scientists.

Dr. Steadman has supervised 25 graduate and post-doctoral students, with over half of them from outside the United States. He also has taught a "Principles of Plant Pathology" course from an international perspective for the past 20 years. Short-term plant pathology training for scientists from developing countries has been conducted both in Dr. Steadman's lab and at meetings/workshops outside the United States.

In research, Dr. Steadman has contributed more than 100 journal articles and book chapters and more than 150 scientific articles and extension publications. A mobile nursery method was developed to simplify the tracking of bean rust pathogen races/pathotypes in Africa and the Americas. Understanding the variation in virulence for bean rust, web blight, and white mold pathogens has led to disease management strategies such as resistance gene deployment that reduces losses in developed and developing countries. Recent research is focusing on population structure of the bean rust and web blight pathogens and coevolution of these pathogens with wild, weedy, and landrace *Phaseolus* spp.

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.

Andrew O. Jackson

Dr. Andrew Otis Jackson was born on April 14, 1941, in Enterprise, Alabama. He obtained his B.S. degree in botany and plant pathology in 1964, and an M.S. degree in plant pathology in 1967 at Oklahoma State University. He went on to obtain a Ph.D. in plant pathology and microbiology from the University of Manitoba in 1970 with Drs. D. J. Samborski and Roland Rohringer. This was followed by post-doctoral appointments with Drs. Albert Siegel and Milt Zaitlin at the University of Arizona and Dr. Myron Brakke at the University of Nebraska. He was hired at Purdue University as assistant professor of botany and plant pathology in 1973, advanced to full professor in 1983, and moved to the Department of Plant Pathology at UC-Berkeley in 1985. These appointments have been interspersed with sabbatical periods with Dr. Roger Hull at the John Innes Institute in Norwich England and with Dr. Jialin Yu at China Agricultural University.

Thomas Jack Morris

Dr. Thomas Jack Morris was born on April 28, 1947, in Montreal, Canada. He completed a B.S. degree in agriculture in 1968 and an M.S. degree in plant pathology with Dr. Richard Hamilton at McGill University in 1970. He completed a Ph.D. in plant pathology at the University of Nebraska in 1973 with Dr. Joe Semancik. This was followed by post-doctoral fellowships at UC-Riverside and The University of British Columbia and an assistant professor appointment in the Department of Biology at the University of New Brunswick. In 1976, Dr. Morris was appointed as assistant professor in the Department of Plant Pathology at UC-Berkeley and rose to full professor in 1986. In 1990, he moved to the University of Nebraska as director and distinguished professor of biological sciences.

Drs. Jackson and Morris are two of the most widely recognized plant virologists in the world. Both began their scientific careers in plant pathology departments when using molecular biology to

study plant viruses was in its infancy. Independently, both recognized the power and potential of molecular genetics and realized that it was essential to emphasize molecular research to understand fundamental aspects of viral pathogenesis. Developing these approaches was crucial at that time because it allowed plant virologists to communicate with scientists studying animal virology and compete for federal research dollars supporting cutting edge research. Both Drs. Jackson and Morris developed strong national and international working interactions and encouraged other virologists to foster development of molecular genetic techniques. Their influence was a particularly important component in bridging the gap between basic and applied plant pathology approaches. This gap is almost nonexistent today, but it was wide and sometimes contentious 25 to 30 years ago. Both also provided important directions within APS by serving on committees, particularly the Plant Virology Committee, to advance molecular plant virology and to encourage molecular applications to plant pathology. These early efforts had a significant impact on applied plant virology research and training. They also trained numerous graduate students and post-doctoral research associates who have gone on to have productive careers in plant virology and plant pathology in the United States and abroad. These individuals have emphasized the research philosophies promoted by Drs. Jackson and Morris; thus, their teaching has influenced the careers of many young scientists. Each individual has received prestigious awards including the APS Fellow and AAAS Fellow awards for excellent independent and collaborative scientific accomplishments, and each has been designated to carry out important administrative duties by their respective universities.

Drs. Jackson and Morris have maintained productive research programs throughout their careers. Their combined research efforts have been remarkable and have had great impact on our understanding of plant–virus interactions. Dr. Jackson's early research demonstrated his ability to communicate effectively and to interact with basic and applied scientists. His early record includes publications in diverse journals such as *Plant Disease Reporter*, *Plant Physiology*, *Phytopathology*, and *Virology*. Dr. Morris' early publication record shows a similar range of expertise and includes publications in *The American Potato Journal*, *Phytopathology*, *The Journal of Invertebrate Pathology*, and *Virology*, as well as *Science* and *Cell*. Both popularized emerging technologies that could be applied to resolve practical plant pathological problems, including early application of ELISA for maize and carnation virus discrimination and use of polyacrylamide gel electrophoresis to index for viroid diseases as well as to detect viral-specific dsRNA for disease diagnosis. They also developed innovative protocols for isolating polyribosomes and virus purification procedures generally useful for isolating RNA viruses from plants and insects. Both devised cloning strategies that could be applied to genetic analyses of viruses as well as detection and diagnosis of virus and mycoplasma diseases. As their careers developed, Drs. Jackson and Morris emphasized fundamental studies of hordeiviruses, rhabdoviruses, carmoviruses, and tombusviruses and developed these into models for research. Their efforts have contributed substantially to the advancement of virology and have answered a number of important questions in pathology, such as which virus genes elicit host defense responses, what features distinguish plant- and vertebrate-infecting rhabdoviruses, and how virus-infected plants evolve defective-interfering RNAs that ameliorate the disease phenotype. They were also among the first to use recombinant viruses to dissect virus–plant interactions, and their research has made great strides in understanding virus replication and the determinants that elicit host responses.

In summary, the accomplishments of Drs. Jackson and Morris have encouraged other plant pathologists to use molecular genetic techniques and have helped foster recognition of plant virology by the nonplant community. During their early training at the University of Nebraska, Drs. Jackson and Morris became close friends and subsequently overlapped professionally at UC-Berkeley from 1985 to 1990. Throughout their careers, they have collaborated actively in research and have trained a large number of scientists who now are leaders in academia, industry, and government in the United States and abroad. Thus, their combined and individual commitments to integrating molecular approaches into applied and fundamental plant pathology and their overall leadership and influence in plant virology have had a major impact on our profession. These research, teaching, and leadership activities are highly deserving of recognition by APS and receipt of the Ruth Allen Award.

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.

Thomas J. Wolpert

Thomas J. Wolpert was born and raised in eastern Nebraska. He received his B.S. degree in psychology with a minor in zoology from the University of Nebraska in 1973. After graduation, he worked in a number of jobs culminating in a position as a research technician in the laboratory of Dr. Larry Dunkle. Due to Dr. Dunkle's tutelage, his interest in plant pathology was initiated, cultivated, and encouraged, resulting in his attending graduate school at Purdue University. He received his M.S. in plant physiology in 1979 and his Ph.D. in plant pathology in 1983. In that same year, he began a post-doctoral position in the laboratory of Dr. Vladimir Macko, an exceptional natural products chemist at the Boyce Thompson Institute, and worked on the structural characterization of the host-selective toxin victorin. At the end of 1989, he joined the Department of Botany and Plant Pathology at Oregon State University where he currently holds the rank of professor. His initial work with victorin coincided with the work of Dr. Noel Keen on the same pathosystem, resulting in numerous interactions. This experience led to a personal appreciation of the enormous scope and quality of Dr. Keen's scientific contributions and Dr. Keen's unique ability to simultaneously challenge, encourage, and collaborate in the pursuit of scientific excellence.

Dr. Wolpert is being honored with the Noel Keen Award for Research Excellence in Molecular Plant Pathology in recognition of his outstanding contributions toward understanding the structure/function of the host-selective toxin victorin. Made by the

fungus *Cochliobolus victoriae*, this cyclized peptide induces rapid cell death in susceptible, victorin-sensitive oat cultivars, and is absolutely required for pathogenesis. The interaction between *C. victoriae* and oat represents one of the earliest examples of diseases where race specificity and host resistance could be attributed to a specific mechanism, namely an essential role in virulence for host-selective toxins. Dr. Wolpert has enormous enthusiasm for science and a tenacity that has proven essential in his search for new approaches and techniques in the face of very difficult problems that have surfaced during studies of this disease. His research has resulted in key contributions and seminal papers characterizing this host–pathogen interaction, and has garnered Dr. Wolpert and his colleagues national and international recognition in the area of molecular plant pathology.

The first of these accomplishments was achieved during his post-doctoral work with Dr. Macko, where in a collaborative effort, the structure of victorin was solved. This highly acclaimed accomplishment provided not only basic information about the long, sought-after structure of victorin, but it also enabled Dr. Wolpert and his colleagues to learn about reactive sites in the host through biochemical modifications of the molecule. Structural/functional characterization provided the means to tag the molecule at specific sites for studies of its binding to host proteins. This feat was accomplished where others over many decades had failed.

The identification of the proteins that bind victorin was another significant advance in the understanding of this complex problem. Initially, working with Dr. Macko, Dr. Wolpert demonstrated that a 100-kDa protein from oats specifically binds victorin. Subsequently, Dr. Wolpert and his students cloned and sequenced the cDNA for the 100-kDa protein and also for a 15-kDa protein that binds victorin. From these studies, they determined that the 100-kDa protein was the P protein (pyridoxal phosphate-containing enzyme) of the multienzyme glycine decarboxylase complex (GDC), and that the 15-kDa protein corresponded to the lipoamide-containing enzyme or the H protein of the GDC. They also demonstrated that victorin was a potent inhibitor of GDC. These seminal efforts by Dr. Wolpert and his students resulted in a clean, unambiguous demonstration of the host proteins that bind victorin.

The characterization of victorin-binding proteins as components of the mitochondrial matrix presented the first indication that the probable mechanism by which victorin induces death in susceptible cultivars is not by a simple necrotic response, but through the induction of an apoptotic-like form of programmed cell death (PCD). A key feature in this discovery was the demonstration that victorin induces mitochondrial depolarization and additional specific events characteristic of PCD, such as the hallmark laddering effect of internucleosomal DNA cleavage and protease activation. In publications on this subject, Dr. Wolpert and his students were the first to demonstrate both in vivo and in vitro evidence for a mitochondrial permeability transition in plants and to characterize serine proteases that exhibit caspase-like activity. These phenomena are analogous to those observed in animal cells, where they play crucial roles during PCD. Dr. Wolpert's studies also pointed to a new hypothesis that victorin interacts at a site of action upstream of binding to the GDC. Presently, he and his colleagues are defining the initiation phase of the PCD response with the hypothesis that the upstream site involves the product of the *Vb* gene, the oat gene that encodes sensitivity to victorin and susceptibility to disease.

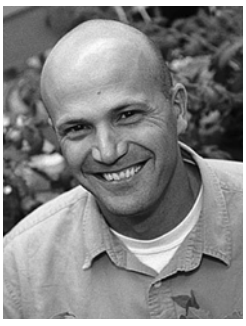
In an effort to develop a genetic system for the identification of the upstream site of interaction of victorin, Dr. Wolpert and his colleagues conducted a large-scale screening effort of ecotypes of the model plant, *Arabidopsis thaliana*. Through this effort, victorin sensitivity was identified and found to be conferred, as in oats, by a single dominant gene designated *LOV* (for locus orchestrating victorin effects). Further, as in oats, this locus confers both victorin sensitivity and disease susceptibility to toxin-producing isolates of the fungus. The locus has been mapped, and efforts are underway to characterize both the *LOV* gene and additional loci required for victorin sensitivity. These efforts will undoubtedly lead to a clearer understanding of the mode-of-action of victorin and the implicit role of PCD in both disease resistance and susceptibility.

Beyond Dr. Wolpert's studies of the molecular interactions that occur in Victoria blight of oats, he has published on studies involving toxins produced by *Periconia circinata*, *Cephalosporium gramineum*, and *Pyrenophora tritici-repentis*. His knowledge of fungal toxins is shared in close, professional interactions with numerous colleagues, and his work has been continuously supported by grants from the USDA/NRICGP and the NSF. Additionally, Dr. Wolpert teaches an undergraduate plant physiology course and a graduate course in plant microbe interactions. He is highly regarded as an advisor and mentor of graduate students.

Syngenta Award

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

James R. Alfano



James R. Alfano grew up in Ventura County, California, where he enjoyed typical pursuits such as camping, days at the beach, and playing baseball. After high school, he attended Moorpark Junior College from 1981–1983 studying biology while working full-time at a local sporting goods store. He transferred to San Diego State University in 1983 where he majored in microbiology and received his B.S. degree in 1986. For his Ph.D. studies, he worked with Michael Kahn in the Institute of Biological Chemistry at Washington State University where he studied the symbiotic nitrogen-fixing relationship between rhizobia bacteria and legume plants and obtained his Ph.D. degree in microbiology in 1993. For his post-doctoral research, he decided to switch from studying a beneficial host–microbe interaction to a destructive one and joined Alan Collmer's research group at Cornell University in 1997 where he studied the gram-negative bacterial pathogens *Erwinia chrysanthemi* and *Pseudomonas syringae* and the protein secretion systems employed by these bacteria to deliver virulence factors to the plant cell.

While in Alan Collmer's research group, Alfano contributed to the initial research that indicated that the *P. syringae* type III protein secretion system was capable of delivering bacterial proteins into plant cells. Many of these effector proteins are Avr proteins. Thus, Alfano helped solve the riddle of how bacterial Avr proteins were perceived by plant cells—that is they need to be injected into the plant cell by the pathogen's type

III secretion system before they can be detected by plant resistance proteins.

In 1997, Alfano joined the Department of Biological Sciences at the University of Nevada, Las Vegas, as an assistant professor where he taught bacterial genetics and general microbiology. His research group continued to elucidate how the *P. syringae* type III secretion system affected plants to favor pathogenesis. A notable research accomplishment by his research group in Nevada was the realization that the *hrp* genes, the genes that encoded the type III apparatus, actually were part of a pathogenicity island, which are clusters of virulence genes within pathogens that are horizontally acquired. This led to the discovery of several genes in the flanking regions of the Hrp pathogenicity island that encoded type III-secreted substrates. Another accomplishment while in Nevada was the optimization of the assays to allow for the detection of the secretion of Avr proteins via the *P. syringae* type III system.

In fall 2000, Alfano joined the Plant Science Initiative and the Department of Plant Pathology at the University of Nebraska, Lincoln, as an assistant professor, where he notes that he gained a lot more greenhouse space but lost some entertainment opportunities. In Nebraska, Alfano continued to teach microbiology and his research group has remained productive in advancing our knowledge of type III protein secretion systems. His group was the first to identify the use of type III chaperones in bacterial plant pathogens. Alfano also was part of the research consortium led by Alan Collmer that completed sequencing of the *P. syringae* tomato DC3000 genome. Using the DC3000 genome, Alfano's group, with collaborators, identified many type III-secreted proteins from *P. syringae* using bioinformatic approaches in conjunction with experimental testing. The confirmed inventory of *P. syringae* type III-secreted proteins is now larger than any other reported type III system. And recently, Alfano has been one of the first scientists to show that individual type III effectors from plant pathogens can suppress the plant innate immune system.

Alfano has communicated his research by publishing 25 research articles in referred journals. Moreover, he has been very active in writing reviews and book chapters on bacterial pathogenicity, type III systems, and other related topics. For example, he wrote several highly cited reviews on plant-pathogenic bacteria. One of these is a general review on different aspects of phytopathogenic bacteria entitled "Bacterial Pathogens in Plants: Life Up Against the Wall" that he wrote for *The Plant Cell*, which was the first review to note that plant pathogens inject bacterial proteins into plant cells. More recently, he co-wrote a review on type III effectors that suppress plant innate immunity entitled "Disabling Surveillance: Bacterial Type III Secretion System Effectors that Suppress Innate Immunity" for *Cellular Microbiology*. Alfano is a senior editor of the *Molecular Plant Pathology* journal and an associate editor of *Microbiology*. He maintains a relatively well-funded research program at the University of Nebraska. Alfano's nonscientific interests include travel, exercise, his dog Tucker, and good microbrews. The latter he tries to sample regularly in the Haymarket district of Lincoln with his wife Karin and friends.