

## Curriculum Vitae for Russell J. Rodriguez

US Geological Survey  
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### Education:

Ph.D. – Oregon State University (Corvallis, OR), May 1983

Major – Microbial Physiology Emphasis – Membrane Physiology in Fungi

B.S. – University Of California (Davis, CA), June 1978

Major – Bacteriology Emphasis – General Bacteriology

### Experience:

Microbiologist/Project Leader (GS-403-14-5) – US Geological Survey, 12/92 to present.

Project leader of a research team studying three areas:

1 – Plant/fungal symbiosis: characterizing the genetic and biochemical bases of fungal symbiotic lifestyles (mutualism, commensalism, pathogenesis) and symbiotically conferred stress tolerance; characterizing the role of endophytic fungal symbionts in the adaptation and ecology of plant communities; assessing fungal symbionts as a novel mechanism of invasiveness of non-indigenous plants; developing novel species-specific biological control agents to protect crop plants against fungal pathogens.

2 - Invasive species: development of molecular diagnostic systems to monitor the movement and establishment of non-indigenous species from ship ballast water; analyze genetic and non-genetic elements transferred by hybridization events; ecological interaction between native and non-native species; molecular and biochemical mechanisms of invasiveness.

3 - Mitigating impacts of global warming on plants: utilizing symbiotic technology to decrease irrigation and fertilizer requirements in agriculture to improve water quality in aquatic ecosystems.

Affiliate Associate Professor Dept. Botany, University of Washington 1995 to present.

Assistant Professor – University of California at Riverside, Department of Plant Pathology, 12/88 to 4/93, (Affiliate Status until 6/97).

Principal investigator of a research team studying the evolution of pathogenesis and the genetic bases of pathogenicity in filamentous fungi. Research incorporates aspects of molecular biology, classical genetics, biochemistry, and microbiology. Duties include the training of graduate students, teaching classes in fungal molecular genetics and microbial genetics, obtaining extramural funds, and serving on University committees.

Postdoctoral Fellow – Cornell University, Department of Plant Pathology, 5/85 – 5/88, (with Dr. Olen Yoder).

Research on classical and molecular genetics of the fungal plant pathogen *Colletotrichum lindemuthianum*. Identifying genes involved in race specificity and the infection process for use in studying the molecular mechanisms of plant–fungal pathogenesis.

Postdoctoral Fellow/Research Associate – Oregon State University, Department of Microbiology, 8/83 – 12/84, (with Dr. Leo Parks).

Co-principle investigator of a laboratory involved in fungal membrane physiology. Responsibilities included participation in writing grant applications, supervising dissertation research of five graduate students, supervising one postdoctoral fellow, conducting independent

research, and managing general laboratory operations. Conducted research on: characterization of specific roles for sterols in yeast; physiological regulation of ergosterol biosynthesis; genetic analyses of genes involved in sterol biosynthesis; and the role of sterols and phospholipids in membrane biogenesis and function.

Graduate Research Assistant – Oregon State University, 12/79 – 7/83, (with Dr. Leo Parks).

Dissertation title: Defining roles for sterols in *Saccharomyces cerevisiae*: characterization of bulk membrane and high specificity sparking functions. Also conducted research dealing with: secondary metabolism of 15-azasterol produced by *Geotrichum flavo-brunneum*; mechanisms of inhibition and physiological response of *Saccharomyces cerevisiae* to 15-azasterol; development of a high performance liquid chromatographic system for separation of free sterols; genetic basis of membrane composition.

### **Fellowships And Awards:**

Antarctic Service Medal, 1993, 2003, 2004.

NSF, Postdoctoral Research Fellow in Plant Biology, Cornell University, 1985.

Mark Middlekauf graduate fellowship, Oregon State University, 1982.

American Oil Chemists' Society honored student award, 1981.

N. L. Tartar memorial graduate fellowship, Oregon State University, 1979.

### **Professional Associations:**

American Society for Microbiology

American Phytopathological Society

American Fisheries Society

American Association for the Advancement of Science

Gamma Sigma Delta, Honor Society of Agriculture

International Society for Molecular Plant Microbe Interactions

International Symbiosis Society

Mycological Society of America

### **Professional Leadership:**

President of the International Symbiosis Society (8/15/2009 - 8/15/2012)

Editorial Board of *Symbiosis* (9/1/2009 - present)

Advisory Board for the World Congress of Symbiosis, India 2010

### **Patents:**

U.S. Patent No: 7,232,565, "The use of endophytic fungi to treat plants", issued 7/07

U.S. Patent pending No: 60/950,755, "Stress Tolerance in Plants via Adaptive Symbiosis"

### **Grants Awarded:**

NSF - Plant heat tolerance through cross-kingdom interactions, CoPI. 4/10-3/14. \$520,000.

Army Research Office - Bioremediation and Restoration of TNT/RDX Contaminated Soils With Adaptive Symbiosis, CoPI. 7/08 - 6/11. \$340,000 .

USGS - Introduction, Ecological Impacts and Invasiveness of Non-Indigenous Microbial, Plant and Animal Communities in the Pacific Northwest, PI. 1/15/04 – 1/15/10. \$2,000,000.

NSF - Symbiotic modulation: A mechanism for adaptation to environmental stress and habitat expansion by plants, CoPI. 9/04 - 11/07. \$650,000.

US/IS BARD - Gene expression patterns in plants colonized with pathogenic and non-pathogenic gene disruption mutants of *Colletotrichum*, CoPI. 11/05 – 10/08, \$287,000.

US/IS BARD - Characterization of fungal symbiotic lifestyle expression in *Colletotrichum* and generating non-pathogenic mutants that confer disease resistance, drought tolerance, and growth enhancement to plant hosts, CoPI. 1/02 – 1/05, \$300,000.

NSF - Yeast in the Antarctic Dry Valleys: Biological role, distribution, and evolution, Co-PI. 6/02-6/05, \$300,000.

US/IS BARD - Workshop entitled Molecular perspectives on fungal biology and pathology: Current status/future research directions, Co-PI. 10/6/02-10/9/02. \$45,000.

Noble Foundation - Horizontal gene flow in fungi, Co-PI. 6/00 - 6/03, \$60,000.

BOR - Development of novel biological control agents for Klamath Basin crops, PI. 10/99 - 10/03, \$60,000.

USGS/BRD - Effects of stand composition and structure on forest productivity, and species diversity, PI. 6/97-6/99, \$45,000.

USDA - Isolation and Characterization of Pathogenicity Genes from *Colletotrichum magna*, PI. 11/98-11/00, \$125,000.

USGS/BRD/NPS -Genetic analysis of *Brucella* from bison and the generation of a PCR-based diagnostic system for epidemiological and ecological studies, PI. 10/98 - 10/01, \$150,000.

USFS – Population genetics, phylogeny, and ecology of *Bridgeoporus nobilissimus*, CoPI. 1/97–1/98, \$5000.

US/IS BARD - The interaction between nonpathogenic mutants of *Colletotrichum* and *Fusarium*, and the plant host defense system, CoPI. 1/97 – 1/00, \$300,000.

USDA – Identifying pathogenicity genes in *Colletotrichum magna*, PI. 9/94 – 9/96, \$100,000.

NSF, DOE, USDA – joint program on collaborative research in plant biology. Genetic basis for pathogenicity in the genus *Colletotrichum*, CoPI. 10/92 – 10/97, \$250,000.

USDA – Identifying pathogenicity genes in *Colletotrichum magna*, PI. 9/92 – 9/94, \$100,000.

USDA - Genetics of host–parasite interactions between plants and fungal pathogens in the genus *Colletotrichum*, NCR–173 A cooperative grant for annual workshops. CoPI. 11/91–11/95.

NSF - Assessing nematode biodiversity, CoPI. 7/91 – 7/92, \$50,000.

US/IS BARD - Defining the genetic bases of pathogenic specificity in *Colletotrichum* species, CoPI. 3/91 –3/93, \$51,000.

UC Regents Faculty Fellowship - Rapid evolution in fungi, PI. 7/90 – 6/91, \$6,250.

**Invited Talks (last 10 years):**

USGS Directors Seminar, Reston, VA, 3/10. - Symbiogenics: a new Biological Paradigm for Mitigating The Impacts of Climate Change on Aquatic and Terrestrial Ecosystems, Managing Invasive Species and Restoring Habitats.

Universidad De Alicante, Spain, Patron Saint of the Natural Sciences Annual Seminar, 12/09 - Plant Symbiosis: a New Approach to Mitigating Impacts of Climate Change and Initiating a 21<sup>st</sup> Century Green Revolution.

University of Missouri, Columbia, MO, 11/09. - Plant Stress Tolerance Via Adaptive Symbiosis: New Strategies For Habitat Restoration And Mitigating Impacts Of Climate Change.

Bill & Melinda Gates Foundation, Seattle, WA, 9/09. - Novel Approaches For: Stress Tolerance and Bio-fertilization in Crop Plants.

International Symbiosis Society, Madison, WI, 8/09. - A Symbiogenic Mechanism For Stress Tolerance In Plants And Mitigating Impacts of Climate Change.

Noble Foundation, Ardmore, Ok 4/09 - Symbiotic Lifestyle Expression: An Interplay Between Genotypes, Environmental Stresses And 400 Million Year Old Relationships.

New Mexico State University, Las Cruces, NM, 4/09 - A Symbiogenic Mechanism For Phenotypic Plasticity And Mitigating The Impacts Of Climate Change On Plant Communities.

Universidad De Alicante, Spain, 11/08 - Plant Stress Tolerance Via Symbiosis: Changing Paradigms In Plant Biology.

USGS Microbiology Workshop, Estes Park, CO, 10/08 - Endosymbiotic Fungi in Plants: Ecology and Implications for Climate Change.

Botanical Society Of America, Vancouver B.C., 7/08 - Symbiotic Modulation: A Mechanism For Plant Distribution Patterns.

Cordon Conference, Fungal Cell And Molecular Biology, 6/08 - Symbiotic Crossroads: The Interplay Between Habitat-Adapted Symbiosis, Symbiotic Modulation And Plant Adaptation To Stress.

University Of Saskatoon, Saskatchewan, Canada, 11/07 - Adaptation Of Plants To High Stress Habitats Via Symbiosis: Where Phenotype Does Not Equal Genotype.

University Of Minnesota, Plant Pathology Graduate Student Symposium, St. Paul, MN, 11/07 - It's A Very Thin Line Between Love And Hate: Symbiotic Adaptation, Modulation And Lifestyle Switching.

Western Washington University, Bellingham, WA, 10/07 - Adaptation Of Plants To High Stress Habitats Via Symbiosis: Where Phenotype Does Not Equal Genotype.

International Congress Of Insect Biotechnology, Daegu, Korea, 8/07 - Conferring Stress Tolerance And Yield Enhancement To Crops Via Symbiosis As A Strategy For Diminishing Regulatory Processes.

Postech University, Pohong, Korea, 8/07 - Adaptive Symbiosis: Plant Stress Tolerance Via Fungal Symbiosis.

Fungal Genomics And Genetics Conference, Seoul, Korea, 8/07 - Ecological Genomics And The Symbiotic Continuum.

Korean National Congress, Seoul, Korea, 8/07 - Adaptive Symbiosis: Plant Stress Tolerance Via Fungal Symbiosis.

USFWS Spotlight On Science Series, Portland, 7/07 - Developing Automated Diagnostic Systems To Monitor Invasive Species And Characterizing Invasion Mechanisms For Predictive Tools And New Control Strategies.

NOAA/NMFS, Seattle, 5/07 - Using A 400 Million Year Old Biological Tool To Mitigate The Impacts Of Climate Change On Aquatic And Terrestrial Ecosystems.

Society For Experimental Biology, Glasgow, 4/07 - More Than 400 Million Years Of Evolution And Plants Still Can't Make It On There Own: Plant Stress Tolerance And Habitat Expansion Via Fungal Symbiosis.

Brown University 4/06. - Visualizing Darwin's Blind Spot: Plant Adaptation Via Fungal Symbiosis.

Texas A&M 4/06. - Fungal Flexibility: Gaming Environmental Systems.

University Of Washington, Biology, 1/06. - To Be Darwinian Or Not To Be - How Fungal Endophytes Confer Stress Tolerance To Plants And Drive Community Structure.

US/IS Bard Workshop, San Fransisco, Ca, 3/05. - The Interplay Between Symbiotic Modulation And Fungal Symbiotic Lifestyle Expression: A Pathologists Nightmare And An Ecologists Dream.

Fungal Genetics Conference, Asilomar, Ca, 3/05 - Isolation Of A Novel Dna Sequence Required For Pathogenicity Of *Colletotrichum* Species.

Fungal Workshop, Usda/Ncr-173, Lincoln City, Or, 10/04. - Fungal Endophytes As Drivers Of Biodiversity In Plant Communities.

International Spartina Conference, 11/04. - Fungal Symbiosis: A Potential Mechanism Of Plant Invasiveness.

University Of Washington, Seattle, 8/04. Using Molecular Biological Tools To Study Plant Symbioses.

Oregon State University, Corvallis, 5/04. The Role Of Fungal Endophytes In The Physiology, Ecology And Evolution Of Plants.

Ohio State University, Wooster, 4/04. Symbiotic Lifestyle Expression By Fungal Endophytes And The Adaptation Of Plants To Stress: Unraveling The Complexities Of Intimacy.

Noble Foundation, Ardmore, Ok, 10/03. Symbiosis: A Strategy To Mitigate The Impacts Of Abiotic And Biotic Stress On Plant Communities.

University Of Nebraska, 9/03. Adaptive Symbiosis: Adaptation Of Plants To Habitat Specific Stressors.

International Symbiosis Society, Halifax, 8/03. The Role Of Symbiotic Fungi In The Adaptation Of Plants To Environmental Stress.

Noble Foundation, Ardmore, Ok 4/03. The Role Of Symbiotic Fungi In The Adaptation Of Plants To Environmental Stress.

McMurdo Station, Antarctica 1/03. The Yin And Yang Of Unlikely Partnerships: The Role Of Symbiotic Fungi In The Adaptation Of Plants To Extreme Environments.

Fungal Workshop, Usda/Ncr-173, Seattle, Wa 9/02. To Disease Or Not To Disease, That Is The Question.

Mycological Society Of America, Corvallis, Or 6/02. Friend Or Foe: Fungi That Express Multiple Symbiotic Lifestyles.

Salmonid Genetics Workshop, Moscow, Idaho, 3/02. Molecular Differentiation Of Gender In Salmonids. Salmon Recovery Workshop.

Borok, Russia, 8/01. The Potential Role Of Symbionts In The Invasion Of Non-Indigenous Plants. Us/Russia Invasive Species Workshop.

Michigan State University , 4/01. To Kill Or Not To Kill: The Genetics Of Pathogenicity, Mutualism, And Commensalism Of Plant Symbiotic Fungi.

Michigan State University , 4/01. Staying Cool, Unwrinkled, And Hydrated In Geothermal Soils, Salt Marshes, And Rain Shadows: Plant Adaptation To Environmental Stresses And The Role Of Symbiotic Fungi.

Fungal Workshop, Usda/Ncr-173, Volcano Np, Hi. 10/00. Adaptive Responses Of Fungal Symbionts To Pressures Imposed On Plants.

Texas A&M, 3/00. Fungal Symbiotic Lifestyles, A Continuum Of Mutualism To Parasitism But Who Sits In The Drivers Seat, Host Or Invader?

University Of Florida, 9/99. Fungal Symbiotic Lifestyles: Isolation Of Genes Responsible For Mutualism, Commensalism, And Parasitism

International Botanical Conference, St. Luis, 8/99. Host Specificity, Disease Specificity, And Host Jumps; A Question Of Choice, Alternative Lifestyles, Or Coevolution.

International Botanical Conference, St. Luis, 8/99. Fungal Symbiotic Lifestyles: Isolation Of Genes Responsible For Mutualism, Commensalism, And Parasitism.

USFS, Hawaii, 5/99. Plant /Microbe Interactions And Community Dynamics: Toward Understanding The Ecological Balance Between Indigenous And Non-Indigenous Plants.

University Of Kentucky, 4/99. Understanding Fungal Symbiotic Lifestyles: Isolation Of Pathogenicity Genes From *Colletotrichum* Species And Defining The Basis Of Plant Protection Afforded By Non-Pathogenic Mutants.

Fungal Genetics Conference, Asilomar, 3/99. Understanding Fungal Symbiotic Lifestyles: Isolation Of Pathogenicity Genes From *Colletotrichum* And Deciphering The Basis Of Plant Protection Afforded By Non-Pathogenic Mutants.

University Of Nebraska, 3/99. Isolation Of Genes Responsible For Parasitism, Mutualism, And Commensalism Of *Colletotrichum* On Plant Hosts.

Novartis, Raleigh Nc, 2/99. Genetics Of Pathogenesis In Fungi.

North Carolina State U, 2/99. Isolation Of Novel Pathogenicity Genes From *Colletotrichum* Species And Defining The Genetic Basis Of Fungal Symbiotic Lifestyles.

Oregon State University , 2/99. Understanding Fungal/Plant Symbioses.

Washington State University , 2/99. Genetic Bases Of Fungal Symbiotic Lifestyles.

Washington State University , 2/99. Genetic Discrimination Of Sex, Run, And Hybridization In Slamonids.

Western Horticulture Society, Wa, 1/99. Biological Alternatives To Chemical Fungicides.

Noble Foundation, Ardmore, Ok., 10/98. Fungal Symbiotic Lifestyles: Pathogenicity Genes From *Colletotrichum* Species And The Basis Of Plant Protection Afforded By Non-Pathogenic Mutants.

International Mycology Conference, Israel. 8/98. Biochemical Analysis Of The Interaction Between A Non-Pathogenic, Endophytic Mutant Of *Colletotrichum Magna* And Cucurbit-Host Defenses.

International Mycology Conference, Israel. 8/98. Fungal Community Structure And Dynamics In Geothermal Soils Of The Yellowstone Caldera.

International Mycology Conference, Israel. 8/98. Genetic Analysis Of *Cantharellus Cibarius* Populations In Rain Forests Of The Pacific Northwest..

Walla Walla College, Biology, 4/98. Decreasing Agrichemical Pollution Of Ground Waters.

### **Publications: (77)**

Rodriguez RJ, Woodward C, and Redman RS. 2010. Adaptation And Survival Of Plants In High Stress Habitats Via Fungal Endophyte Conferred Stress Tolerance. In, Cellular Origin, Life In Extreme Habitats And Astrobiology, Cooperation And Stress In Biology, Eds. Seckbach J. and Grube M., The Netherlands, Springer, *In Press*.

Hoy MS, Kelly K, Rodriguez RJ. 2010. Development of a Molecular Diagnostic System to Discriminate *Dreissena polymorpha* (zebra mussel) and *Dreissena bugensis* (quagga mussel). *Molecular Ecology Resources*. **10**, 190-192.

Rodriguez RJ, Woodward C, Kim YO, Redman RS. 2009. Habitat-Adapted Symbiosis as a Defense against Abiotic and Biotic Stresses. In, Defensive Mutualism in Microbial Symbiosis, Eds. J. White and M. Torres, Boca Raton, FL. CRC Press, pg 335-346.

Rodriguez RJ, Freeman DC, McArthur ED, Kim YO, Redman RS. 2009. Symbiotic Regulation Of Plant Growth, Development And Reproduction. *Communicative & Integrative Biology*, **2**(2): 1-3.

Harvey JBJ, Hoy MS, Rodriguez RJ. 2009. Molecular detection of native and invasive marine invertebrate larvae present in ballast and open water environmental samples collected in Puget

- Sound. *Journal of Experimental Marine Biology and Ecology*, **369**(2): 93-99.
- Rodriguez RJ, White JFJ, Arnold AE, Redman RS. 2009. Fungal endophytes: diversity and functional roles. *Tansley Review, New Phytologist*, 182:314-30.
- Kim YO, Rodriguez RJ, Lee EJ, Redman RS. 2008. *Phytolacca americana* from contaminated and noncontaminated soils of South Korea: effects of elevated temperature, CO<sup>2</sup> and simulated acid rain on plant growth response. *Journal of Chemical Ecology*, **34**(11):1501-1509.
- Connell, L., Iszard, M., Redman, R., Craig, S., Scorzetti, G., and Rodriguez, R. 2008. Diversity of soil yeasts isolated from South Victoria Land, Antarctica. *Microbial Ecology*, **56**:448-459.
- Rodriguez R.J. and Redman R.S. 2008. More Than 400 Million Years Of Evolution And Some Plants Still Can't Make It On Their Own: Plant Stress Tolerance Via Fungal Symbiosis. *Journal of Experimental Botany*, **59**:1109-1114.
- Rodriguez R.J., Henson J., Van Volkenburgh E., Hoy M., Wright L., Beckwith F., Kim Y., Redman R.S. 2008. Stress Tolerance in Plants via Habitat-Adapted Symbiosis. *ISME-Nature*, **2**:404-416.
- Márquez L.M., Redman R.S., Rodriguez R.J., Roossinck M.J. 2007. A virus in a fungus in a plant – three way symbiosis required for thermal tolerance. *Science*, **315**:513-515.
- Miglia K.J., McArthur E.D., Redman R.S., Rodriguez R.J., Zak J.C. and Freeman, D.C. 2007. Genotype, soil type and locale effects on reciprocal transplant vigor, endophyte growth and microbial diversity of an *artemisia tridentate* (asteraceae) hybrid zone in salt creek canyon, Utah. *American Journal of Botany*, **94**:425-436.
- Ostberg C.O. and Rodriguez R.J. 2006. Hybridization and cytonuclear associations among native westslope cutthroat trout, introduced rainbow trout and their hybrids within the Stehekin River drainage, North Cascades National Park. *Transactions of the American Fisheries Society*. **135**:924-942.
- Connell L., Redman R.S., Craig S, and Rodriguez R.J. 2006. Distribution and Abundance of Fungi in the Soils of Taylor Valley, Antarctica. *Soil Biology and Biochemistry*, **38**:3083-3094.
- Redman R., Ranson J. and Rodriguez R. 2006. Genetic structure of *Cantharellus formosus* populations in a second-growth temperate rain forest of the Pacific Northwest. *Pacific Northwest Fungi*. **1**(7):1-13.
- Rodriguez, R.J. and Redman R.S. 2005. Balancing the generation and elimination of reactive oxygen species. Commentary in the *Proceeding of the National Academy of Sciences*, **102**:3175-3176.
- Henson, J.M., Redman R.S., Rodriguez, R.J. and Stout R. 2005. Fungi in Yellowstone's geothermal soils and plants. *Yellowstone Science*, **13**:25-30.
- Rodriguez, R.J., Redman R.S., and Henson, J.M. 2005. Symbiotic Lifestyle Expression by Fungal Endophytes and the Adaptation of Plants to Stress: Unraveling the Complexities of Intimacy. In *The Fungal Community: Its Organization And Role In The Ecosystem*, Ed. J. Dighton, P Oudemans & J. White. Boca Raton, FL. Taylor & Francis/CRC Press, pg 683-96.
- Ostberg C.O., Dufree, S., and Rodriguez R.J. 2004. Analyzing the molecular ecology of hybridization between rainbow and cutthroat trout in two Puget Sound streams. *Molecular Ecology*. **13**:2773-2788.
- Rodriguez, R.J., Cullen, D., Kurtzman, C., Khachatourians G. and Hegedus D. 2004. Molecular methods for discriminating taxa, monitoring species, and assessing fungal diversity. In "Biodiversity of Fungi: Inventory and Monitoring Methods." Mueller, G. M., G. F. Bills, and M. S. Foster, eds. Elsevier Academic Press, Oxford, U.K. pp77-102.

- Rodriguez, R.J., Redman R.S., Henson, J.M. 2004. The Role of Fungal Symbioses in the Adaptation of Plants to High Stress Environments. *Mitigation and Adaptation Strategies for Global Change*, **9**:261-272.
- Ostberg C.O. and Rodriguez R.J. 2004. Bi-parentally inherited, species-specific markers identify hybridization between rainbow trout and cutthroat trout subspecies. *Molecular Ecology Notes*. **4**:26-29.
- Rasmussen, C., Ostberg, C.O., Clifton, D.R., Holloway, J.L., and Rodriguez, R.J. 2003. Identification of a genetic marker that discriminates ocean and stream-type chinook in the Columbia River basin. *Transactions of the American Fisheries Society*, **132**:131–142.
- Yarden, O., Ebbole, D. J., Freeman, S., Rodriguez, R. J. and Dickman, M.B. 2003. Fungal Biology and Agriculture: Revisiting the Field. *Molecular Plant Microbe Interactions*, **16**:859-866.
- Redberg, G.L., Hibbett, D.S., Ammirati, J.F., and Rodriguez, R.J. 2003. *Bridgeoporus nobilissimus*: Phylogeny and genetic diversity through PCR amplification of mitochondrial and nuclear rDNA. *Mycologia*, **95**:836-845.
- Redman, R.S., Sheehan, K.B., Stout, R.G., Rodriguez, R.J. and Henson, J.M. 2002. Thermotolerance generated by plant/fungal symbiosis. *Science*, **298**:1581.
- Redman, R.S. and Rodriguez, R.J. 2002. Characterization and Isolation of an Extracellular Serine Protease from the Tomato Pathogen *Colletotrichum coccodes* (Wallr.), and it's Role in Pathogenicity. *Mycological Research*, **106**:1427-1434.
- Redman, R.S., Rossinck, M.R., Maher, S., Andrews, Q.C., Schneider, W.L. and Rodriguez, R.J. 2002. Field performance of cucurbit and tomato plants infected with a nonpathogenic mutant of *Colletotrichum magna* (teleomorph: *Glomerella magna*; Jenkins and Winstead). *Symbiosis*, **32**:55-70.
- Ostberg, C. and Rodriguez, R.J. 2002. Species specific molecular markers differentiate *Oncorhynchus mykiss* (steelhead and rainbow trout) from *Oncorhynchus clarki clarki* (coastal cutthroat trout) and identify hybridization between the species. *Molecular Ecology Notes*, **2**:197-202.
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- Colletotrichum magna* (teleomorph: *Glomerella magna*; Jenkins and Winstead, 1964). *Plant Physiology*, **119**:795-803.
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- Freeman, S., Pham, M.H., and Rodriguez, R.J. 1993 Genotyping *Colletotrichum* species using a nuclear DNA repetitive element, restriction enzyme digestion patterns of A + T rich DNA, and arbitrarily primed PCR. *Experimental Mycology*, **17**:309–322.
- Freeman, S. and Rodriguez, R.J. 1993 A rapid reliable technique for assessing pathogenicity of *Fusarium oxysporum* f. sp. *niveum* and *Fusarium oxysporum* f. sp. *melonis* on cucurbits. *Plant Disease*, **77**:1198-1201.
- Perring, T.M., Cooper, A.D., Rodriguez, R.J., Farrar, C.A. and Bellows, T.S. 1993. Genomic and behavioral studies identify a white fly species critical to agricultural ecosystems. *Science*, **259**:74–77.
- Perring, T.M., Farrar, C.A., Bellows, T.S., Cooper, A.D., and Rodriguez, R.J. 1993. Evidence for a new species of whitefly: UCR findings and implications. *California Agriculture*, **47**:7–8.
- Rodriguez, R.J. 1993. Polyphosphate present in DNA preparations from fungal species of *Colletotrichum* inhibits restriction endonucleases and other enzymes. *Analytical Biochemistry*, **209**:291–297.
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### **Highlighted Research:**

- The textbook "Biology: Concepts and Investigations" by Marielle Hoefnagels, includes a description of the three way symbiosis (fungal, virus, plant) that we described (*Science*, **315**:513-515).
- Faculty of 1000, 2008 - rated our manuscript "Rodriguez R.J., Henson J., Van Volkenburgh E., Hoy M., Wright L., Beckwith F., Kim Y., Redman R.S. 2008. Stress Tolerance in Plants via Habitat-Adapted Symbiosis. *ISME-Nature*, **2**, 404–416" as must read (F1000 factor 6).
- Undergraduate textbook recognition, 2008 - a new biology text by Marielle Hoefnagels published by McGraw-Hill includes a description of our symbiosis work in chapter 40 (Communities and Ecosystems).
- Nature (**450**, 1130-1133, 20 December 2007) - describes our manuscript "Márquez L.M., Redman R.S., Rodriguez R.J., Roossinck M.J. 2007. A virus in a fungus in a plant – three way symbiosis required for thermal tolerance. *Science*, **315**:513-515" as one of the favorite research highlight for 2007.
- Nature Reviews Microbiology, 2007 v.5, 168-169 - describes our manuscript "Márquez L.M., Redman R.S., Rodriguez R.J., Roossinck M.J. 2007. A virus in a fungus in a plant – three way symbiosis required for thermal tolerance. *Science*, **315**:513-515" in a research highlight.

Faculty of 1000, 2007 - rated our manuscript "Márquez L.M., Redman R.S., Rodriguez R.J., Roossinck M.J. 2007. A virus in a fungus in a plant – three way symbiosis required for thermal tolerance. *Science*, **315**:513-515" exceptional and listed it in the top ten manuscripts.

AAAS, 2006 - Description of research published in Science News (<http://sciencenow.sciencemag.org/cgi/content/full/2006/810/4>) based on work presented at the International Symbiosis Society, Vienna (8/06) entitled "Visualizing Darwin's Blind Spot: Salt, Heat and Disease Tolerance in Plants Via Adaptive Symbiosis".

AAAS, 2003 – Description of research published in Science (**302**:774-775, 2003) based on work presented at the International Symbiosis Society in Halifax (8/03) entitled "Friend or foe: fungi that express multiple symbiotic lifestyles".

AAAS, 2003 – Description of research published in Science (**301**:1466, 2003) based on work presented at the International Symbiosis Society, Halifax (8/03) entitled "The Role of Symbiotic Fungi in the Adaptation of Plants to Environmental Stress".

American Society for Microbiology, 2003 - Radio interview for *MicrobeWorld* broadcast on NPR (<http://www.microbeworld.org/home.htm>) based on work published in Science (2002, **298**:1581) about stress tolerance conferred by a fungal mutualist.

CNN, 1993 – TV interview focusing on single gene conversion of fungal plant pathogens to mutualists (Science, 1993, **260**:75–78).

### **Mentored Students, Postdoctoral Fellows and Technicians:**

Graduate Students, total - 8

Last 5 years - Gail Redberg (Walla Walla College)  
Fleur Beckwith (University of Washington)  
Rhonda Schmit (University of Washington)  
John Murphy (University of Washington)

Postdoctorals, total - 6

Last 5 years - Julio Harvey (University of Washington)  
Charlotte Rasmussen (University of Washington)  
Yong-Ok Kim (Montana State University)  
Claire Woodward (University of Washington)

Technicians, total - 12

Last 5 years - Marshal Hoy (U.S. Geological Survey)  
Lees Wright (University of Washington)  
Misty James (University of Washington)  
Carl Ostberg (U.S. Geological Survey)  
Jessara Schroeder (University of Washington)  
Jill Walters (U.S. Geological Survey)

### **Editorial Activities:**

Currently serving on the editorial board of the journal "Symbiosis".

Routinely asked to peer-review material for scientific journals and granting agencies. During the last five years, I have reviewed numerous manuscripts for several peer-reviewed scientific journals including: Proceedings of the National Academy of Science, Applied and Environmental Microbiology, New Phytologist, Federation of the European Microbiological Society, Physiological and Molecular Plant Pathology, Phytopathology, Mycologia, Mycological

Research, Canadian Journal of Microbiology, Fish Physiology and Biochemistry, Ecology, Northwest Science, Encyclopedia of plant Pathology, Transactions of the American Fisheries Society, Symbiosis, Genetica, and The American Naturalist.

I have mentored several graduate students, technicians and postdoctoral fellows from Mexico, Viet Nam, Israel, Germany and South Korea and been an advisor on several committees for graduate students from China, Africa, and Brazil. This has not only required scientific mentoring but also extensive editorial involvement in the preparation of manuscripts for peer-reviewed science journals, graduate theses, book chapters and review articles. Recently, I have been asked to provide editorial assistance to correct and modify manuscripts written by students at Chinese universities. Although editorial assistance is very time-consuming, it is important to the development of young scientists and therefore the scientific community.

### **Scientific Leadership**

Invasive Species Research - I am PI on several projects and provide leadership in the form of scientific direction to address the USGS mission and programs. I have initiated collaborative projects around the world (Montana, Oklahoma, Oregon, Michigan, Utah, Alabama, California, New Zealand, Czech Republic, United Kingdom, Costa Rica, Canada, South Africa, and Israel) to increase the efficiency of addressing very complex issues associated with defining mechanisms of plant invasions. This has included training agency biologists, graduate students (including underrepresented groups), postdoctoral fellows and senior scientists. I have funded most of this research with competitive extramural funds from governmental agencies (NSF, USDA, BARD, NPS, USFWS, BOR) and the Noble Foundation. From 2000-2004 I organized annual USDA funded workshops (NCR-173) to bring researcher together and discuss the involvement of symbiosis to plant invasions.

Other Federal and State Agencies – I routinely interact with the Washington State Department of Ecology, USFS, BOR, EPA and NPS biologists to discuss emerging invasive species issues and to prepare proposals to initiate new projects. For example, I am involved in the preparation of a U.S. Department of the Interior (BOR, USGS, USFWS, NPS) initiative to address zebra mussel issues in the west. Using seed money from USGS I have generated preliminary data and prepared a NPS/USGS proposal to study invasive plants invading parks, refuges and preserves throughout the western states.

Scientific Community – Many of the projects I have led involve working with university scientists, students and postdoc's. I give invited seminars as part of symposia and departmental programs around the country (see #14). As a result of these project I also give invited presentations at national and international conferences. I am asked annually to provide expert advice on deciding the fate of science proposals (NSF, USDA, BARD, DOE) and manuscripts (various journals). I supervise graduate students and postdoc's from different institutions and have worked to include underrepresented groups. As a form or outreach I give lectures about my research program to high school students from around Washington state. I have contributed several book chapters which serve as resources to the scientific community. Several of the projects I direct have been highlighted by science and general news sources (See #17).

Technical Leadership - To assist the National Park Service efforts on managing Bison due to Brucellosis, the I initiated and coordinated a multiagency, multidisciplinary research project with scientists at the Idaho National Environmental and Engineering Lab (INEEL) and USDA/APHIS. The project involved genetic studies to compare bacterial pathogens (*Brucella abortus*) from bison, elk, and cattle, and to generate a series of species-specific PCR-based genetic markers to develop a diagnostic system. Concomitantly, the INEEL lab developed methodologies to apply the diagnostic system to blood and tissue samples and the USDA/APHIS lab generated cultures for my lab to extract DNA and genetically analyze. This has helped the NPS redirect efforts to different management strategies.

As part of a continuing effort to establish international partnerships I served as a USGS representative at an international workshop focused on invasive species. I initiated an international effort with Russian scientists to study native plants that have been moved between our countries and have become invasive in non-native habitats. This effort led to the development of the invasive species projects described in #11 and #12.

When BRD was established in USGS there was a need to derive a policy concerning scientific quality. I served as the only active research scientist on a USGS advisory panel tasked with establishing Science Quality Policy. The policy generated by the panel is regarded as the science quality guidelines for BRD researchers.