



Interdisciplinary
Plant Group
University of Missouri

2009

ANNUAL REPORT

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Letter from the IPG Director



Friends and Colleagues,

Global climate change, constantly evolving plant pathogens and pests, and shifting social conditions, make fulfillment of our strategic vision of “plants for changing environments” more important than ever. This is a time for leadership, a quality we have in abundance in the IPG. I would like to take this opportunity to highlight a few examples of leadership that stand out this year.

Under the leadership of Dr. Robert Sharp, MU has assembled a team of renowned scientists to address one of the most important causes of crop failure worldwide: drought. This year, construction began on a \$1.5 million complex of “rainout shelters,” which will soon allow the team to take their findings from the lab to the field. The team also submitted a proposal to establish a Research Center of Excellence focused on Plant Adaptation to Drought at MU.

The drought research at MU will likely benefit from the newly formed Plant Stress Biology program area in the Division of Plant Sciences. Spearheaded by Dr. Jim Schoelz, this graduate-level program area recognizes that biotic and abiotic problems are frequently intertwined.

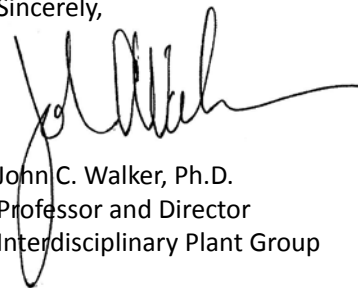
We also have one of the best maize genetics communities in the nation. This community came under the national spotlight this year with publication of findings from the development and application of the maize nested association mapping (NAM) population. This important, new genetic resource, developed in part by a team led by Dr. Mike McMullen, brings the plant science community closer than ever before to unlocking the mysteries of complex traits. Our maize community was also strengthened with the recruitment this year of Drs. Paula McSteen and David Braun, who will join the IPG faculty in 2010.

Our strengths in the area of energy also got a boost with the appointment of Dr. Gary Stacey as chair of the Department of Energy’s Biological and Environmental Research Advisory Committee. This national appointment has tremendous influence over the country’s energy research endeavors.

Our research leadership was also widely recognized in 2009. Drs. Bruce McClure, Karen Cone, Gary Stacey, and Douglas Randall were elected 2009 Fellows of the American Association for the Advancement of Science, bringing to 13 the number of AAAS Fellows in the IPG. Drs. Tom Guilfoyle, Gretchen Hagen, and Melvin Oliver were each bestowed with lifetime achievement awards from the American Society of Plant Biologists (ASPB). Dr. Jim Birchler’s record of outstanding scholarship and his established reputation were also recognized with his appointment as a Curators’ Professor, the highest and most prestigious academic rank awarded by the Board of Curators of the University of Missouri. In a demonstration of his future accomplishments, the National Science Foundation awarded Dr. Dmitry Korin with an NSF CAREER Award. Four IPG graduate students were also singled out with university, state, and national awards.

As director of the IPG, I am grateful to be given the opportunity to facilitate, support, and promote the efforts of such an outstanding cadre of scholars. I look forward to a prosperous and productive 2010.

Sincerely,



John C. Walker, Ph.D.
Professor and Director
Interdisciplinary Plant Group

2009 IPG Executive Committee

Jeff Anderson, Postdoc Representative

Walter Gassmann, Faculty Representative, Plant Sciences

Melody Kroll, Staff Representative, Biological Sciences

Bruce McClure, Faculty Representative, Biochemistry

Kathy Newton, Faculty Representative, Biological Sciences

Amy Replogle, Graduate Student Representative

John Walker, IPG Director



IPG Budget Expenditures (FY09)

Grant Proposals Submitted by IPG (2009)

Title (PI)	Type	Agency	Funded	Amount	Description
Symposium on Root Biology (Gassmann)	Conference	NSF-IOS	Yes	\$10,000	Funds applied toward reduced postdoc/student registration fees & undergraduate recruitment
Symposium on Root Biology (Mitchum)	Conference	USDA	Yes	\$10,000	Funds used to cover speaker costs
Plants for Changing Environments (Walker)	Training	NSF-IGERT	No	preproposal	Funds requested to support IPG graduate students
Enhancing the capacity for research in plant sciences at the University of Missouri (Walker)	Equipment	MLSRB	Pending	\$991,000	Funds requested for growth chambers in Waters Hall, Agriculture Building, Tucker Hall, and Schlundt Annex. Governor "terminated" MLSRB program in October 2009.
Modernization of Plant Growth Facilities at MU (Walker)	Construction	NSF-ARI-RR	No	\$4,562,863	Funds requested to replace Curtis Hall greenhouse with new greenhouse facility south of Ashland Road greenhouse complex

Faculty



Heidi Appel
Senior Research Associate
Division of Plant Sciences



Kristin Bilyeu
Research Molecular Biologist
USDA-ARS
Adjunct Assistant Professor
Division of Plant Sciences



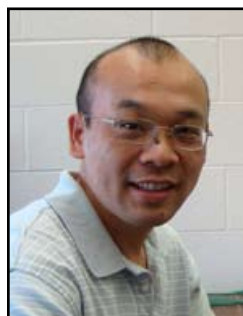
James Birchler
Curators' Professor
Division of Biological Sciences



Dale Blevins
Professor
Division of Plant Sciences



Arun Chatterjee
Professor
Division of Plant Sciences



Jianlin Cheng
Assistant Professor
Department of Computer Science



Edward Coe
Professor Emeritus
Division of Plant Sciences



Georgia Davis
Associate Professor
Division of Plant Sciences



Ye Duan

Assistant Professor
Department of Computer Science



Sherry Flint-Garcia

Research Geneticist, USDA-ARS
Adjunct Assistant Professor
Division of Plant Sciences



David Emerich

Professor & Associate Chair
Director of Undergraduate Studies
Division of Biochemistry



William Folk

Professor
Division of Biochemistry



James English

Professor
Division of Plant Sciences



Felix Fritschi

Assistant Professor
Division of Plant Sciences



Deborah Finke

Assistant Professor
Division of Plant Sciences



Candace Galen

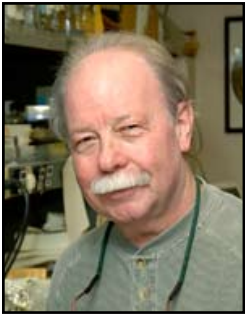
Professor
Division of Biological Sciences



Walter Gassmann
Associate Professor
Division of Plant Sciences



Antje Heese
Assistant Professor
Division of Biochemistry



Thomas Guilfoyle
Professor
Division of Biochemistry



Bruce Hibbard
Research Entomologist, USDA-ARS
Adjunct Associate Professor
Division of Plant Sciences



Perry Gustafson
Research Geneticist, USDA-ARS
Adjunct Professor
Division of Plant Sciences



Timothy Holtsford
Associate Professor
Division of Biological Sciences



Gretchen Hagen
Research Professor
Division of Biochemistry

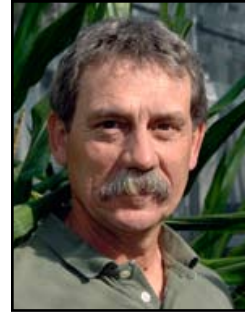


Toni Kazic
Associate Professor
Department of Computer Science



Dmitry Korkin

Assistant Professor
Department of Computer Science



Michael McMullen

Research Geneticist, USDA-ARS
Adjunct Professor
Division of Plant Sciences



Hari Krishnan

Research Molecular Biologist
USDA-ARS
Adjunct Professor
Division of Plant Sciences



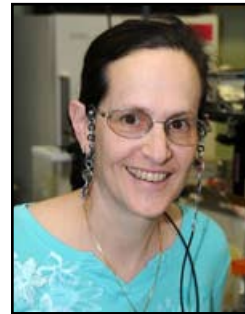
Jan Miernyk

Research Molecular Biologist
USDA-ARS
Adjunct Professor
Division of Biochemistry



Emmanuel Liscum

Professor and
Co-Director of Graduate Studies
Division of Biological Sciences



Jeanne Mihail

Professor
Division of Plant Sciences



Bruce McClure

Professor
Division of Biochemistry



Melissa Mitchum

Assistant Professor
Division of Plant Sciences



Brian Mooney

Associate Director, Proteomics Center
Assistant Professor, Division of
Biochemistry



Stephen Pallardy

Professor
Department of Forestry



Kathy Newton

Professor
Division of Biological Sciences



Scott Peck

Associate Professor
Division of Biochemistry



Henry Nguyen

Endowed Professor
Division of Plant Sciences
Director, National Center
for Soybean Biotechnology



J. Chris Pires

Assistant Professor
Division of Biological Sciences



Melvin Oliver

Supervisory Research Geneticist,
USDA-ARS
Adjunct Professor
Division of Plant Sciences



Joseph Polacco

Professor Emeritus
Division of Biochemistry



Douglas Randall

Professor Emeritus
Division of Biochemistry



Chi-Ren Shyu

Director, MU Informatics Institute
Associate Professor
Department of Computer Science



James Schoelz

Professor &
Director of Graduate Studies
Division of Plant Sciences



David Sleper

Professor
Division of Plant Sciences



Jack Schultz

Professor, Division of Plant Sciences
Director, Bond Life Sciences Center



Gary Stacey

Director, Ctr. for Sustainable Energy
Assoc. Director, National Center for
Soybean Biotechnology
Professor, Divisions of Plant
Sciences and Biochemistry and
Dept. of Molecular Microbiology &
Immunology



Robert Sharp

Professor
Division of Plant Sciences



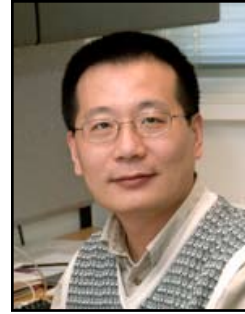
Jay Thelen

Associate Professor
Division of Biochemistry



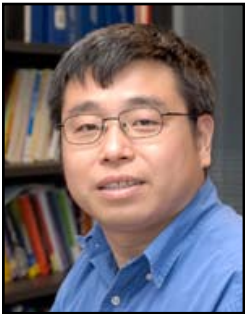
John Walker

Director, IPG
Professor
Divisions of Biological Sciences
and Plant Sciences



Shuqun Zhang

Professor
Division of Biochemistry



Dong Xu

Director, Digital Biology Laboratory
Professor
Department of Computer Science



Zhanyuan Zhang

Director, Plant
Transformation Facility
Associate Professor
Division of Plant Sciences

Plants For Changing Environments



The overarching research theme of the Interdisciplinary Plant Group focuses on understanding how plants respond to changing environments. Within this theme, IPG research projects can be grouped by studies that focus on genetic diversity, on developmental mechanisms, and on biotic and abiotic interactions.

The diversity of approaches being pursued and plants being studied as well as the interactive nature of the group enhance the IPG's opportunity to design unique solutions to current problems as well as pressing problems yet to be recognized. As a part of the Food for the 21st Century Program at the University of Missouri, one of the goals of the IPG is to generate the knowledge base needed to meet the increasing needs for food, fiber, and health for the future.

Graduate Students

Name	Advisor	Name	Advisor	Name	Advisor
Ahmad, Mursaleen	Cheng	Islam, Md Sariful	Nguyen/Sleper	Reneker, Jeffrey	Shyu
Angel, Carlos	Schoelz	Jeong, Sooyoung	Stacey	Replogle, Amy	Mitchum
Arias-Garzón, Tatiana	Pires	Joshi, Sneha	Korkin	Roberts, Diana	Liscum
Becklin, Katie	Galen	Kanawong, Ratchadaporn	Duan	Sexton, Sarah	Sleper
Boardman, Deanna	Fritschi/Wiebold	Kim, Jun Pyo	McMullen	Smith-Hammond, Colin	
Chang, Jia-Fu	Shyu	Kim, Sang Hee	Gassmann	Smith, Dante	Sharp
Cho, In-Jeong	Oliver	Kim, Sung-Yong	Stacey	Son, Geon	Stacey
Choi, Jeongmin	Stacey	Kramer, Robin	Xu	Song, Zhao	Xu
Coffman, Clayton	Schultz/Appel	Langewisch, Tiffany	Newton	Srivastava, Gyan Prakash	Xu
Coleman, Courtney	Gassmann	Le, Mi Ha	Stacey	Stevenson, Severin	Thelen
Deng, Xin	Cheng	Leach, Kristen	Davis	Strodtman, Kent	Emerich
Devaney, Tim	Fritschi/Blevins	Lenis, Julian Mario	Bilyeu	Sun, Lin	Birchler
Dierking, Emily	Bilyeu	Liang, Bo	Folk	Swatek, Kirby	Thelen
Donahue, Janelle	Fritschi	Lin, Guan Ning	Xu	Tah, Tapashree	Schoelz
Edger, Patrick	Pires	Liu, Shengjun	Fritschi	Tegge, Allison	Cheng
Espinoza, Catherine	Sharp/Oliver	Liu, Xiaohong	Mitchum	Thibivilliers, Sandra	Stacey/Nguyen
Ferrieri, Abigail	Schultz/Appel	Lough, Ashley	Newton	Thieu, Thanh	Korkin
Franck, William	Stacey	Lu, Sha	Z. Zhang	Tran, Huong N.	Nguyen
Gao, Fei	Gassmann	Masonbrink, Rick	Birchler	Voothuluru, Priyamvada	Sharp
Gao, Jianjiong	Xu	Meihls, Lisa	Hibbard	Walker, Paul	Holstford
Geib, Jennifer	Galen	Meyer, Louis	Newton	Wan, Ying	Peck
Gerau, Mike	Davis	Michels, Alicia	Galen	Wang, Zheng	Cheng
Green, Jason	Shyu	Nguyen, Hanh	Nguyen	Wheeler, Erica	Pires
Gutierrez, Juan	Nguyen/Sleper	Nguyen, Phuong Dung	Gassmann	Wiltz, Benisha	Cone
Guttikonda, Satish Kumar	Nguyen	Nguyen, Tran	Stacey/Nguyen/Xu	Xi, Yonjian	Duan
Han, Jing	Shyu	Niederhuth, Chad	Walker	Xu, Yang	Xu
Han, Ling	S. Zhang	Ojha, Muneendra	Xu	Yan, Zhe	Stacey
Harnsomburana, Jaturon	Shyu	Pang, Bin	Shyu	Young, Brad	Fritschi
He, Qing	Duan	Patil, Santosh	Korkin	Zhang, Chao	Xu
He, Zhiquan	Xu	Pham, Tung Anh	Bilyeu	Zhang, Ren (Chris)	Stacey
Hertweck, Kate	Pires	Ping, Huang	Gustafson	Zhao, Nan	Shyu
Holland, Jennifer J.	Liscum	Quach, Truyen N	Nguyen	Ziobro, Holly	Peck
Holou, Roland	Stevens	Rehrig, Erin	Schultz/Appel	Zukoff, Sarah	Hibbard
Hoyos Villegas, Valerio	Fritschi	Remley, Melissa	Blevins		

Completed Master's and Doctoral Students in 2009

Mursaleen Ahmad, M.Sc. (Advisor: J. Cheng)

"A Tool for Finding Allele Specific PCR-Primers for Homologous Gene Sequence"

William Franck, Ph.D. (Advisor: G. Stacey)

"Development and Validation of a DNA Microarray for Analysis of the *Bradyrhizobium japonicum* Transcriptome"

Satish Guttikonda, Ph.D. (Advisor: H. Nguyen)

"Genetic Engineering of Soybean Using Candidate Genes to Improve Drought Tolerance"

Sang Hee Kim, Ph.D. (Advisor: W. Gassmann)

"Innate Immunity in Arabidopsis: Molecular Mechanisms of HopA1 and AvrRps4, Specific Disease Resistance Signaling Pathways"

Xiaohong Liu, Ph.D. (Advisor: M. Mitchum)

"Molecular Characterization of Soybean Resistance to Soybean Cyst Nematode"

Louis Meyer, Ph.D. (Advisor: K. Newton)

"Investigations into the Cause of Pollen Abortion in Maize CMS-C"

Zhao Song, Ph.D. (Advisor: D. Xu)

"Bioinformatics Methods For Protein Identification Using Peptide Mass Fingerprinting"

Gyan Prakash Srivastava, Ph.D. (Advisor: D. Xu)

"Genome-scale Meta analysis of Microarrays for Biological Inferences"

Tapashree Tah, Ph.D. (Advisor: Schoelz/English)

"Chloroplast Gfp Expression in Tobacco Plants Agroinfiltrated with Tobacco Mosaic Virus"

Paul J. Walker, Ph.D. (Advisor: T. Holtsford)

"Understanding Genomic Evolution and Segregation Distortion in Solanaceae: A Cosii Linkage Map in Nicotiana"



Katie Becklin, a doctoral student in Candace Galen's lab in the Division of Biological Sciences, received a \$1,000 predoctoral award from the Educational Foundation of the Association for Women in Science (AWIS). The AWIS predoctoral award recognizes women who are pursuing careers in the sciences and related field. For her doctoral research project, Becklin is exploring mycorrhizal associations in alpine plant communities in the Colorado Rocky Mountains. Her overall goal is to identify factors that influence where these associations occur and how they influence plant populations and communities.



Priyamvada Voothuluru, a doctoral student in Robert Sharp's lab in the Division of Plant Sciences, was appointed a member of the American Society of Plant Biologists (ASPB) Membership Committee in 2009. During her two-year term, Voothuluru will provide input on strategies to recruit and retain members. Voothuluru was also awarded travel awards from the ASPB and from the Division of Plant Sciences to present posters of her research at two international meetings, the ASPB annual meeting in Honolulu, Hawaii, and the Plant ROS 2009 in Helsinki, Finland. She is pursuing studies on how plants respond to biotic and abiotic stresses.



Erica Wheeler, a doctoral student in J. Chris Pires lab in the Division of Biological Sciences, received the 2009 Stanton Hudson Memorial Award from the Missouri Native Plant Society. The \$500 award is given once a year to a deserving student conducting research on any aspect of botany that involves Missouri flora. Wheeler's research focuses on the diversity and evolution of wild onion (*Allium*). Her goal is to create a phylogenetic tree of North America's 87 members of wild onion family based on DNA comparisons.



Catherine Espinoza, a doctoral student in Robert Sharp's lab in the Division of Plant Sciences, received an ASPB travel award to present a poster at the Society's annual meeting in Honolulu, Hawaii. She also received a travel award from the Division. Espinoza uses resurrection plants as a model to study genes that underlie these plants' ability to rehydrate after almost complete dehydration. She hopes to transfer this knowledge to develop drought resistant crops. Her project is co-advised by Melvin Oliver.

P *ostdocs & Research Staff*

Name	Advisor	Name	Advisor	Name	Advisor
Agrawal, Ganesh Kumar	Thelen	Hosman, Kevin	Pallardy	Pike, Sharon	Gassmann
Albert, Patrice	Birchler	Houston, Norma	Thelen	Rajesh, P.N.	Nguyen
Anderson, Jeffrey	Peck	Houx III, James H.	Fritschi	Ratnaparkhe, Milind	English
Aouhal, Ouassim	Schultz/Appel	Hoyos, Elizabeth	Randall	Restrepo, Ricardo	Jaramillo
Barry, Julie	Hibbard	Johnston, Mark	Miernyk	Rubino, Lucy	Schultz/Appel
Bennewitz, Stefan	Walker	Kandoth, Pramod	Mitchum	Shahollari, Bationa	Peck
Bhattacharjee, Saikat	Gassmann	Karpova, Olga	Z. Zhang	Shin, Kyungju	Cone
Bondra, Mary LeNoble	Sharp	Kennon, Angela	Z. Zhang	Singh, Shardendu	Fritschi
Bottoms, Christoper	McMullen	Kenzior, Alexander	Folk	Stacey, Minviluz	Gassmann
Brechenmacher, Laurent	Stacey	Kenzior, Olga	Folk	Tanaka, Kiwamu	Stacey
Brown, Sabrina	Sleper	Kim, Joongho	McClure	Taylor, Isaiah	Walker
Browne, Christopher	McMullen	Kim, Sunran	McClure	Taylor, Susan	Mihail
Bukowsky, Rebecca	Hibbard	Kinney, Michael	Pires	Tella, Pranavi	Mitchum
Chen, Mingjie	Thelen	Krishnaswamy, Lakshmi	Birchler	Tran, Son	Nguyen
Chen, Xinlu	Z. Zhang	Kumar, Aruna	McClure	Valliyodan, Babu	Nguyen
Chudalayandi, Siva	Birchler	Kumar, Rajesh	Nguyen	Vuong, Tri	Nguyen
Clark, Kerry	Sleper	Lee, Christopher B	Mitchum	Wan, Jinrong	Stacey
Cole-Shannon, Christine	Sleper	Li, Hanbing	Guilfoyle	Wang, Jianying	Mitchum
Cui, Yaya	Chatterjee	Libault, Marc	Stacey	Wang, Neng	Z. Zhang
Danilova, Tatiana	Birchler	Little, Paul	Bilyeu	Wang, Ying	Walker
Demartini, Diogo	Thelen	Liu, Yidong	S. Zhang	Wilcox, John A.	Sleper
Elder, Jim	Oliver	Lu, Lu	Folk	Wonseok, Kim	Krishnan
Faries, Kaitlyn	Newton	Lukaszewska, Krystyna	Blevins	Woods, Terry L.	Fritschi
Findley, Seth	Stacey	Manavalan, Lakshmi Praba	Nguyen	Wu, Xiaolei	Nguyen
Gaeta, Robert	Birchler	Mao, Guohong	S. Zhang	Xie, Weiwu	Birchler
Gao, Zhi	Birchler	Mathieu, Melanie	Stacey	Xiong, Zhiyong	Pires
Garnett, Justin	Sharp	Melia-Hancock, Susan	Flint-Garcia	Yamaguchi, Mineo	Sharp
Gillman, Jason	Bilyeu	Morrow, Johanna	Liscum	Yang, Xuejing	Mitchum
Guill, Katherine	McMullen	Musket, Theresa	Nguyen	Yao, Hong	Birchler
Guo, Yiming	Guilfoyle	Neelakandan, Anjanasree	Nguyen	Yin, Xiaoyan	Z. Zhang
Han, Fang Pu	Birchler	Oehrle, Nathan	Krishnan	Zhang, Jingfen	Xu
Hanumappa, Mamatha	Nguyen	Pathan, M.S.	Sleper	Zhang, Zhe (Jenny)	Peck
Heinz, Robert	Mitchum	Patharkar, O. Rahul	Sharp	Zhou, Liwen	Z. Zhang
Higdon, Matt	Hibbard				

Seminar Series

Spring 2009

David J. Weston, Oak Ridge National Lab, Unraveling ecological complexity with molecular systems biology

Mizzou ADVANCE Interactive Theatre Troupe, A knock at the door

Andreas Nebenführ, University of Tennessee, Golgi stack integrity in plant cells

Nick Carpita, Purdue University, Maize: genetic model for the improvement of energy grasses

Bethany Zolman, UMSL, Inside the peroxisome

Joe Chappell, University of Kentucky, The biochemical wizardry of terpene metabolism in plants

Keith Adams, University of British Columbia, Expression and alternative splicing of genes duplicated by polyploidy

Gregory D. May, National Center for Genome Resources, Homoeolog-specific expression in soybean through illumina RNA sequencing

Patrick Masson, University of Wisconsin-Madison, Molecular genetics of root thigmomorphogenesis in *Arabidopsis thaliana*

Kathy Barton, Stanford University, Up and down in leaf development: the regulatory network controlling ad/abaxial polarity in the leaf

Richard T. Sayre, Danforth Plant Sciences Center, Bifortification of cassava for Africa: The BioCassava Plus Program

Mary Wildermuth, UC-Berkeley, Laser microdissection at the site of powdery mildew infection reveals novel regulators of the interaction



Student Organizers:

Jennifer Holland, Diana Roberts, Chad Niederhuth

Fall 2009

Robert Fraley, Monsanto, Meeting Global Demands for Food, Feed and Fuel through Agricultural Biotechnology

Dmitry Korkin, MU, Host-pathogen interactions: detection, characterization, & application to plant systems

Chris Town, J. Craig Venter Institute, Medicago truncatula Genome Project: Past, Present, & Future

John Boyer, University of Delaware, More and Better-Adapted Crops: Fact or Fiction? (co-sponsored by Chancellor's Distinguished Lecture Series)

Hans de Jon, University of Amsterdam, Advanced Cytogenetic Strategies for Genomics & Genetics of Model and Crop Plant Species

Yanhi Yin, Iowa State University, A Family of Receptor-Like Kinases Are Regulated by Brassinosteroids and Required for Optimal Plant Growth

Leon Martinez Castilla, National Autonomous University of Mexico, Dissecting the Evolution of the Arabidopsis MADS-Box Protein Family (videocast)

Veronica Franklin-Tong, University of Birmingham, The Pollen Self-Incompatibility (SI) Determinant for Papaver and Early SI Signaling Events

Michael Luethy, Monsanto, Monsanto's Sustainable Agriculture Initiative: Development of Improved Maize Products for Drought-Prone Environments

Alice Barkan, University of Oregon, A Parallel RNA Universe: The Complex RNA Metabolism in Plant Organelles & the Organelle-Dedicated Protein Families that Do the Job

Javier Plasencia, National Autonomous University of Mexico, Role of Sphinganine Analog Mycotoxins in Pathogenesis of Fungal Necrotrophs

Himadri Pakrasi, Washington University, A Day (and Night) in the Life of a simple photosynthetic organism

Symposium on Root Biology

The 26th Annual Interdisciplinary Plant Group Symposium took place on May 27-29, 2009, on the Columbia campus of the University of Missouri in the Christopher S. Bond Life Sciences Center. This year's symposium focused on root biology. Root development and function are vitally important for plant adaptation to the environment. Understanding of root biology remains limited, however, and increased attention to this critical area is needed to facilitate improvement of crop performance, especially in the face of environmental constraints. Nineteen world-renowned experts came together to address recent advances in studies of root development and root interactions with the abiotic and biotic environment.

2009 Organizing Committee

Chair: Robert Sharp,

Co-Chair: Walter Gassmann, Ph.D., Division of Plant Sciences

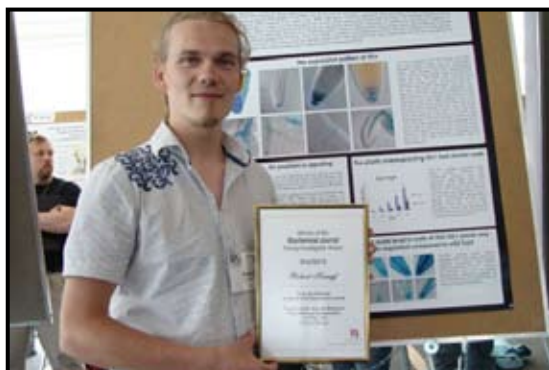
Dale Blevins, Ph.D., Division of Plant Sciences

David Emerich, Ph.D., Division of Biochemistry

Felix Fritschi, Ph.D., Division of Plant Sciences

Melissa Mitchum, Ph.D., Division of Plant Sciences

Henry Nguyen, Ph.D., Division of Plant Sciences



Robert Kumpf, student, University of Oslo, Norway, winner of the 2009 *Biochemical Journal's* Best Poster Award



Speakers and Organizers: Front row (L-R): Graeme Hammer, Priya Voothuluru, Maria Harrison, Sally Smith, Steve Tyerman, Bingru Huang, Phil Benfey. Second Row (L-R): Andrew J. Thompson, Louise Jackson, Joseph Dubrovsky, Won-Gyu Choi, Jonathan Lynch, Benjamin Peret, Len Wade. Third row (L-R): Florian Frugier, Chris Meyer, Eric Kramer. Fourth row (L-R): Walter Gassmann, Robert Sharp, Melissa Mitchum, Valerie Williamson, Michael Udvardi, Simon Gilroy. Last row (L-R): William Davies, Dale Blevins, Felix Fritschi

Sponsors & Exhibitors

National Science Foundation, Missouri Wines, *Journal of Experimental Botany*, *Biochemical Journal*, Pioneer Hi-Bred International, Phenotype Screening, National Center for Soybean Biotechnology, *Functional Plant Biology*, Phenotype Screening, Monsanto, Syngenta Seeds, Conviron, CID

Registration

Industry	9
University, Government, Non-Profit	41
Postdoc/Student	33
MU Faculty	31
MU Staff	5
MU Postdoc/Students	48
Total	167

Countries Represented	9
U.S. States Represented	23

Poster Submissions

Students	29
Postdocs	17
Faculty/Other	7

Faculty Awards

Hagen & Guilfoyle Receive ASPB Life Membership Award

A husband-wife research team in the IPG received the **2009 Charles Reid Barnes Life Membership Award** from the American Society of Plant Biologists (ASPB). The award, which recognizes meritorious work in the field of plant biology by an individual who is at least 60 years old, was given to **Thomas Guilfoyle**, professor of biochemistry, and his long-term research partner and wife **Gretchen Hagen**, research professor of biochemistry. This is the first time the award has been given to a research team.

Guilfoyle and Hagen are best known for their pioneering work on auxin-regulated gene expression. Auxin, a plant hormone, is involved in a wide range of plant growth and development processes, including flowering, fruit set and drop, and root growth. Synthetic auxins are also used as herbicides to control broad-leaved weeds, such as dandelions.

Guilfoyle and Hagen have helped to elucidate the underlying mechanism by which auxin regulates plant growth. Among their contributions is the identification of specific protein coding genes that auxin controls at the level of gene transcription. They also have identified several molecules used by cells to control gene expression in response to auxin and have formulated the current model for auxin-regulated gene expression in plants. A number of their studies have become classics in the field and are cited in plant biology textbooks.

As pointed out by reviewers who supported their nomination, Hagen and Guilfoyle have contributed immensely to the field of plant hormone signaling as well as other aspects of plant biology. Their pioneering work on auxin regulated gene expression and their identification of the Auxin Response Elements (AuxRE) in the promoters of auxin regulated genes was viewed as seminal by all recommenders.



“What is notable about their contributions to plant molecular biology is the breadth of their work, as it includes studies of cauliflower mosaic virus (CaMV) transcription and replication and the analysis of plant RNA polymerase complexes,” said Russell Jones, chair of the award committee and professor of plant and microbial biology at University of California-Berkeley.

The remarkable body of knowledge Guilfoyle and Hagen have contributed to the field of auxin biology points to “their true creative genius,” according to Joe Key, professor emeritus of plant biology at the University of Georgia. “Their findings,” he continues, “point to a unique characteristic of ‘observation’ that often separates the truly excellent scientists from those in the next tier(s).”

Chancellor Larry N. Vanderhoef, University of California-Davis, echoed this sentiment, stating that “of the now rather large group of people in the upper echelons of the field of plant gene expression, there are only a rare few who have such a broad-based, all-around quality.”

In addition to their research accomplishments, Guilfoyle and Hagen have been influential and active members of the American plant biology community, contributing their time and expertise in a number of editorial and professional capacities. They have served on a number of editorial boards and grant panels, and both are long-standing members of the American Society of Plant Biologists and the American Society for Biochemistry and Molecular Biology. Guilfoyle is also a member of the American Association for the Advancement of Science.

The pair is also esteemed for teaching and mentoring. Over the course of three decades, the pair have mentored 10 graduate students and 31 postdoctoral fellows, many of whom have gone on to hold leadership and faculty positions in the plant sciences at universities across the world.

Bruce McClure was a graduate student in the Guilfoyle-Hagen lab in the late 1980s. Today, he is a fellow professor in MU's Division of Biochemistry and an investigator in the IPG.

"My time in Tom and Gretchen's lab was formative," commented McClure. "I gained all of my technical skills in biochemistry and molecular biology from them, not to mention the experimental flexibility and critical abilities that have allowed me to successfully pursue my own research goals."

The Guilfoyle-Hagen lab is also well regarded by their colleagues and collaborators in labs across the world.

Jen Sheen, professor of genetics at Harvard University, commented on Guilfoyle and Hagen's generosity, as displayed by "their willingness to share everything they invented with their colleagues and collaborators."

Bestowment of the award to both Guilfoyle and Hagen recognizes the long-term and collaborative nature of their research partnership. This is the first time the award has been given to a research team. It is also the first husband-wife team to receive recognition for research accomplishment from the ASPB.

John Walker, director of the Interdisciplinary Plant Group, knew that nominating both Guilfoyle and Hagen as a team for the award was unusual. This fact, however, did not hinder him. "We felt it was truer to the spirit of their research to nominate them as a team than to nominate each individually," he said.



Their colleagues, both on and off campus, confirm the synergism of their research. In his letter of support for the joint nomination, Chancellor Vanderhoef commented directly on the partnership, stating that "as a research partner alone, Gretchen has been an invaluable member of the Guilfoyle-Hagen team" and that "it is virtually impossible to separate them in any evaluation."

Guilfoyle and Hagen have been research partners since 1980, when Hagen joined Guilfoyle's lab at the University of Minnesota as an NIH postdoctoral fellow. In 1986, both were recruited to join the faculty of biochemistry at MU as part of the Food for the 21st Century Program.

Douglas Randall, professor in the Division of Biochemistry and former director of the IPG, recruited and hired the couple in 1985.

"When Tom agreed to come to MU, what we really had was a dynamic duo," said Randall, who is also a recipient of the Charles Reid Barnes Life Membership Award. "Tom and Gretchen have been outstanding colleagues and world-class researchers. They have also been crucial in putting MU and the IPG 'on the map' in terms of plant biology."

Guilfoyle has earned distinction as an elected Fellow of the ASPB (2007) and an elected Fellow of the American Association for the Advancement of Science (2007).

Guilfoyle and Hagen were presented with the Charles Reid Barnes Life Membership award at the ASPB's annual meeting in Honolulu in July 2009. The ASPB is the major scientific society in plant biology, and its annual meeting draws about 1,500 of the nation's plant biologists and students.



Tom and Gretchen around the time they came to MU in 1986. (Source: IPG Archives)

Cone, McClure, Randall, and Stacey Elected 2009 AAAS Fellows

Four IPG faculty members were awarded the distinction of Fellows of the American Association for the Advancement of Science (AAAS), bringing the total number of AAAS Fellows in the IPG to 13. The four new AAAS fellows are:

Karen Cone, Division of Biological Sciences, for distinguished contributions in plant genetics and genomics, particularly for analysis of gene regulation and development of resources for structural and functional genomics.

Bruce McClure, Division of Biochemistry, Fellow of the American Association for the Advancement of Science, for distinguished contributions to plant biology, particularly S-RNase-based self-incompatibility, and for distinguished contributions to public understanding of science.

Douglas Randall, professor emeritus of biochemistry, for distinguished research contributions to the understanding of reversible enzyme phosphorylation in plant cells and administrative contributions supporting the advancement of plant biology research.

Gary Stacey, professor of plant sciences, for distinguished contributions to the field of plant biology and plant-microbe interactions, particularly for advancements in our understanding of symbiotic nitrogen fixation and soybean genomics.

Oliver Receives Fellow of ASPB Award

In addition to bestowing its coveted Charles Reid Barnes Life Membership award to two IPG faculty (see previous pages), the ASPB also named **Melvin Oliver**, a research geneticist with the U.S. Department of Agriculture's Agricultural Research Service and an adjunct professor in the Division of Plant Sciences, a **Fellow of the ASPB**. The award recognizes long-term contributions to both research in plant biology and service to the Society. Oliver was recognized for his research on the mechanism of desiccation tolerance and its importance in the evolution of the land plants and for his roles in recruitment of students and minorities by the ASPB. Oliver is the third IPG faculty member to earn distinction as a Fellow of the ASPB. Douglas Randall and Thomas Guilfoyle were named ASPB Fellows in 2007.



James Birchler, Curators' Professor of Biological Sciences

Pires Awarded 2009 Margaret Menzel Award

Chris Pires was awarded the **2009 Margaret Menzel Award** by the Genetics Section of the Botanical Society of America (BSA). The award is presented for the outstanding paper presented in the contributed papers sessions of the annual meetings. Pires received the award for his paper titled "Homoeologous chromosome pairing and rearrangements identified in allopolyploid *Brassica napus* by an integrated BAC-FISH karyotype of diploid *Brassica*."

Campus Recognitions

James Birchler was awarded one of the University of Missouri's most prestigious appointments, a **Curators' Professorship**. Birchler is recognized around the world as an expert in the area of maize and *Drosophila* genetics.

In 2009, **Shuqun Zhang** was promoted to full professor. **Jay Thelen** received tenure and was promoted to associate professor. **Scott Peck** also received tenure. All three faculty members are in the Division of Biochemistry.

Bruce McClure was awarded the **2009 Biochemistry Faculty Fellowship** "for excellence in science education and community outreach, specifically for his sustained interest in science education as most recently exemplified by his role in nurturing the Saturday Morning Science series and his recent efforts to take this series around the State."

One A-Maize-ing Study

Michael McMullen led a team of Agricultural Research Service (ARS) scientists at MU in a multi-year, multi-institutional project to develop a new resource for unlocking the genetic basis of complex traits in maize. The scientists found that most natural genetic variation in maize is the product of numerous genes working together, each with a small effect that could be manipulated by breeders.

The resource is a specially created maize population, called the nested association mapping (NAM) population. NAM was created by crossing 25 different maize lines with a common parent to generate 5000 recombinant inbred lines. These 5000 lines were then genotyped, using 1100 genetic markers, to create a high-resolution genetic “map” of the entire population.

NAM combines two approaches for studying complex traits, linkage analysis and association mapping. The bridging of these two approaches represents a novel development for trait analysis.

McMullen and his colleagues subsequently used the NAM population to uncover the genetic architecture that underlies flowering time. Flowering time influences whether a plant can adapt to new environments and is the main hindrance to exchanging crops internationally.

In their research, the scientists planted and visually assessed close to 1 million maize plants--the largest published genetic study to date. The researchers found that flowering time is influenced by the combined effects of more than 40 genes.

Sherry Flint-Garcia, plant geneticist with the USDA-ARS, also participated in the study. McMullen and Flint-Garcia also teamed up with ARS colleagues Ed Buckler at the Robert W. Holley Center for Agriculture and Health in Ithaca, NY, and Jim Holland at the ARS Plant Science Research Unit in Raleigh, NC.



Missouri's NAM Team: (kneeling, r-l) Susan Melia-Hancock, Chris Browne, Kate Guill; (standing, r-l) Mike McMullen, Sherry Flint-Garcia, Christopher Bottoms, Jason Cook

Major funding for the project was provided by the National Science Foundation.

Findings from the NAM population and flowering time study were reported in three articles in *Science* in 2009:

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The articles can be viewed at <http://www.sciencemag.org>

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MU Receives \$1.5M to Build Drought Simulators

Felix B. Fritschi, assistant professor in the Division of Plant Sciences, received \$1,558,125 from the Missouri Life Sciences Research Board for his project “Drought Simulators Critical to Translational Research in Plant Science.”

With this funding, Fritschi will create a network of state-of-the-art drought simulators that will allow scientists to conduct a broad range of drought-related translational research. The simulators will be built in regions of the state with different environments, crop species, and soil types that are agriculturally important to the state. This strategic placement will allow researchers to accommodate any crop, forage, and turf species grown in Missouri and surrounding states.

Korkin Receives NSF CAREER Award to Study Molecular Mimicry

Dmitry Korkin, assistant professor in the Department of Computer Science, was awarded the prestigious CAREER Award from the Division of Biological Infrastructure of the National Science Foundation. Korkin will use the approximately \$600,000 award to apply his computational research to the study of molecular mimicry in soybean cyst nematode.

Molecular mimicry is a biological mechanism that a pathogen uses to trick a host organism into accepting it and, in some cases, to alter the host’s function to its own benefit. Scientists speculate this molecular-level sabotage is the modus operandi of a small parasitic roundworm that infects the roots of soybean plants. However, detecting it experimentally is difficult due to the sheer volume of proteins involved. Using advanced computational techniques, Korkin will narrow the field of protein candidates by identifying binding sites in the soybean that match those in the nematode. Potential binding sites will then be tested experimentally. The goal is to speed the pace of discovery on resistance to this devastating pathogen.



New Grants

Birchler, J. (PI). **Inhibition of RNAi by Cell Death Signaling.** National Science Foundation, \$150,000.

Birchler, J. (PI). **Functional Genomics of Maize Centromeres.** University of Georgia (flow-through from National Science Foundation), \$894,701.

Birchler, J. (PI). **Dosage Compensation in Drosophila.** National Institutes of Health. \$1,161,345.

Blevins, D. (PI). **Optimum Timing of Nitrogen and Phosphorus Application for Improved Tall Fescue Seed Production.** Missouri Fertilizer and Lime Board, \$29,125.

Buckler, E. (PI), Doebley, J., McMullen, M., Holland, J., Flint-Garcia, S. **Genetic Architecture of Maize and Teosinte.** National Science Foundation. \$5,365,430.

Davis, E. L. (PI), Mitchum, M., Baum, T. **Collaborative research on soybean cyst nematode parasitism genes.** Pioneer Hi-Bred International, \$310,000,

Davis, G. (PI), Moose, S. **51st Annual Maize Genetics Conference.** National Science Foundation, \$52,240.

Diers, B. (PI), Nguyen, H. **Identification and Utilization of Resistance to Soybean Rust.** United Soybean Board, \$72,763.

Duan, Y. (PI). **Collaborative Research: Extracting 3-D Fracture Orientations for Rock Failure Analysis by Combining Optical Imaging and LIDAR Scanning Technologies.** National Science Foundation, \$143,975.

Fritschi, F. (PI). **Evaluating Genotypic Variation in Early Vigor of Cotton.** Cotton Inc., \$44,046.

- Fritschi, F. (PI). **Effect of Increased Night Temperatures During Reproductive Development on Soybean Yield and Physiology Under Field Conditions.** MU, \$7,500.
- Fritschi, F. (PI), Sharp, R., Kallenbach, R., Shannon, J.G. **Drought Simulators Critical to Translational Research in Plant Sciences.** Missouri Life Sciences Research Board, \$1,558,125.
- Glascocock, M. (PI), Stacey, G., Nabelek, P., Robertson, J.D., Appold, M. **MRI: Acquisition of Laser Ablation-Multicollector-Inductively Coupled Plasma Mass Spectrometer (LA-MC-ICPMS) for Interdisciplinary Research.** National Science Foundation, \$713,930.
- Gassmann, W. (PI). **Vitis Gene Discovery Program.** U.S. Department of Agriculture, \$394,992
- Gassmann, W. (PI). **26th Annual Interdisciplinary Plant Group Symposium on Root Biology, in Univ. of Missouri-Columbia May 27-29, 2009.** National Science Foundation, \$10,000.
- Hibbard, B. (PI); Sappington, Thomas; Gassmann, Aaron. **Risk of Western Corn Rootworm Adaptation to Transgenic Corn.** U.S. Department of Agriculture, \$400,000.
- Hibbard, B. (PI). **Selection Intensity and Resistant Colony Development.** Syngenta, \$154,200.
- Hous, J. (PI), Fritschi, F. **Nitrogen Dynamics of Standard and Enhanced Urea Fertilizer in Corn.** Missouri Fertilizer and Lime Board, \$81,728.
- Korkin, D. (PI). CAREER: **A Computational Approach to Study Molecular Mimicry in Host-Pathogen Interactions.** National Science Foundation, \$613,490.
- Mitchum, M. (PI), Wang, X. **Mechanisms of Cle Peptide Mimicry in Plant-Cyst Nematode Interactions.** U.S. Department of Agriculture, \$300,000.
- Mitchum, M. (PI), Blevins, D., Emerich, D., Fritschi, F., Nguyen, H., Sharp, R., Gassmann, W. **26th Annual Interdisciplinary Plant Group Symposium on Root Biology.** U.S. Department of Agriculture, \$10,000.
- Newton, K. (PI), Mooney, B. **Proteins Altered in Maize Hybrids Exhibiting Different Levels of Heterosis.** National Science Foundation, \$499,978.
- Nguyen, H. (PI), Shannon, J.G., Vuong, T. **Identification of Genes for Resistance to Multi-Soybean Nematode Species.** Missouri Soybean Merchandising Council, \$70,128.
- Pires, J.C. (PI). Collaborative Research: **Comparative Investigation of Incipient Sex Chromosome Evolution in the Genus Asparagus.** National Science Foundation, \$10,000.
- Schoelz, J. (PI). **Defense Peptides To Protect Soybean From Rust.** Missouri Soybean Merchandising Council, \$79,900.
- Schoelz, J. (PI). **Detection and Elimination of Sweet Potato Viruses from Sweet Potato.** Vietnam Ministry of Agriculture, \$20,000.
- Schoelz, J. (PI). **Understanding Virus Intra- And Inter-Cellular Movement and Its Application to Virus Resistance in Plants.** Samuel Roberts Noble Foundation, \$75,394.
- Schultz, J. (PI), Appel, H., Fan, X., Frye-Mason, G. **EAGER: Interrogating Plant Volatile Reports About the Environment.** National Science Foundation, \$148,473.
- Shannon, J.G. (PI); Nguyen, H. **Evaluation of Elevated Oleic Acid Germplasm for Development of Soybeans with High Oleic Acid Hi.** Missouri Soybean Merchandising Council, \$64,628.
- Sharp, R. (PI), Nguyen, H., Shannon, J.G., Fritschi, F. **Drought Tolerance in Soybean: Plasticity of Root System Development.** Missouri Soybean Merchandising Council, \$129,959.
- Siegel, M. (PI), McClure, B., Freyermuth, S. **Addressing the Assessment Gap in Undergraduate Science: Development of Innovative Assessments for Learning in Biotechnology.** National Science Foundation, \$149,980.
- Stacey, G. (PI). **9th International Congress of Plant Molecular Biology 2009.** National Science Foundation, \$40,200.
- Stevens, W. E. (PI); Schoelz, J. **In-line Quality Measurements & Efficient Transient Expression in Nicotiana.** Philip Morris International, \$794,369.
- Syce, J. (PI), Folk, W., Gangopadhyay, S., Dasgupta, P., Tipton, P. **Development of Simple Diagnostic Devices that Will Allow Individuals To Manage Use of Traditional and Complementary and Alternative Medicines and Dietary Supplements by Detecting Induction of CYP3A4 Using a Natural Metabolite.** Tibotec BVBA, 50,000.
- Walker, J. (PI). **Signal Transduction and the Regulation of Organ Abscission in Arabidopsis.** National Science Foundation, \$553,000.
- Wrater, A. (PI), Mitchum, M., Nguyen, H., Shannon, J.G., Sleper, D. **Biology and Management of Heterodera glycines.** National Institute of Food and Agriculture, \$551,890.

Other Notables

IPG Awards

Diana Roberts and **Tran Hong Nha Nguyen**, second-year graduate students in the Divisions of Biological Sciences and Plant Sciences, respectively, were each awarded an IPG Certificate of Achievement on September 21, 2009, for demonstrating a commitment to the interdisciplinary study of plant biology.

IPG Certificates of Recognition were awarded to **Chad Niederhuth** (Biological Sciences, Walker lab), **Jennifer Holland** (Biological Sciences, Liscum lab), and **Sandra Thibivilliers** (Plant Sciences, Stacey lab), for their support, creativity, and many hours of service organizing the 2008-2009 IPG seminar series. **Sunran Kim** (Biochemistry, McClure lab) and **Priya Voothuluru** (Plant Sciences, Sharp lab) were also awarded Certificates of Recognition for organizing the 2008-2009 Plant Talks series.

Carlos Angel (Plant Sciences, Schoelz lab) was awarded an IPG travel stipend to attend a real-time polymerase chain reaction workshop for applied pathologists held from January 20-22, 2009, at the University of Kentucky, Lexington. Angel shared what he learned at the workshop with fellow IPG graduate students and postdocs at the May 7, 2009, Plant Talks seminar.



Chad Niederhuth Deploys to Afghanistan

In October 2009, Chad Niederhuth, a third-year graduate student in John Walker's lab, deployed to Afghanistan with the 810th Engineer Company of the Georgia National Guard. Niederhuth, a USDA National Needs Scholar, was called up from Individual Ready Reserve in August 2009.

International Plant Molecular Biology Congress

The IPG sponsored the 9th Annual International Plant Molecular Biology Congress (IPMB), which was held in St. Louis, Mo, from October 25-30, 2009.

The IPMB brings together experts from around the world and from a variety of fields to highlight current research and advances in plant biology. Among those invited to speak or organize symposium were a number of IPG faculty, including Jim Birchler, Robert Sharp, Chris Pires, Mel Oliver, Michael McMullen, Jan Miernyk, Bruce McClure, Gary Stacey, and Bill Folk.

IPG faculty were also represented on conference committees. Perry Gustafson, Adjunct Professor in the Division of Plant Sciences, chaired Congress, and Gary Stacey, Douglas Randall, and Jim Birchler served on conference committees.





Colleagues Say Farewell to Karen Cone

Karen Cone, Division of Biological Sciences, retired at the end of December 2008, after accepting a position as Program Manager with the Directorate of Biological Sciences at the National Science Foundation. Friends and colleagues from across campus came out to wish her well at a reception held in her honor on May 29, 2009, as part of the closing receptions of the 2009 IPG Symposium. A member of the IPG since 1988, Cone's research focused on how gene expression is regulated at the chromatin level and how that expression is controlled in maize. Cone was elected to the AAAS in 2009 for her distinguished contributions in plant genetics and genomics, particularly for analysis of gene regulation and development of resources for structural and functional genomics.



IPG Reaches Out to Colleagues in Mexico

In an effort to promote collaborative interactions between MU and UNAM plant researchers, two faculty members from Biochemistry, **Jay Thelen** and **Bruce McClure**, along with two graduate students from Biological Sciences, **Erica Wheeler** and **Kate Hertweck**, visited the National Autonomous University of Mexico (UNAM) over spring break. While at UNAM, the group participated in a mini-symposium, toured the Mexico City and Cuernavaca campuses, and met individually with plant researchers and graduate students. This visit was followed by two videocast seminars with UNAM plant faculty in fall 2009 as part of the IPG seminar series.

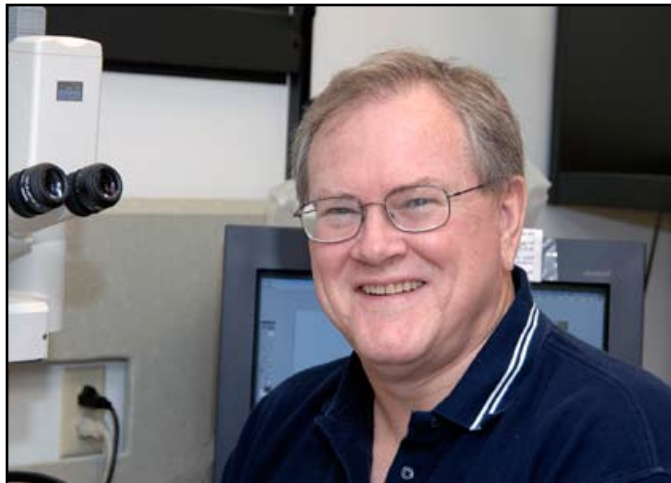


Sharp, Nguyen, and Oliver Present at InterDrought III

Robert Sharp, **Henry Nguyen**, and **Mel Oliver** were invited to present results from their research at InterDrought III, the Third International Conference on Integrated Approaches to Improve Crop Production under Drought-Prone Conditions, held in Shanghai, China, from October 11-16, 2009. Sharp's talk was titled presented on "Root growth at low water potentials: complexity and coordination of cellular responses." Sharp and Nguyen also gave talks at a satellite workshop titled "Rice and Drought," held on October 17 and organized by the International Rice Research Institute (IRRI). Prof. Nguyen also served as a member of the conference's organizing and program committees.

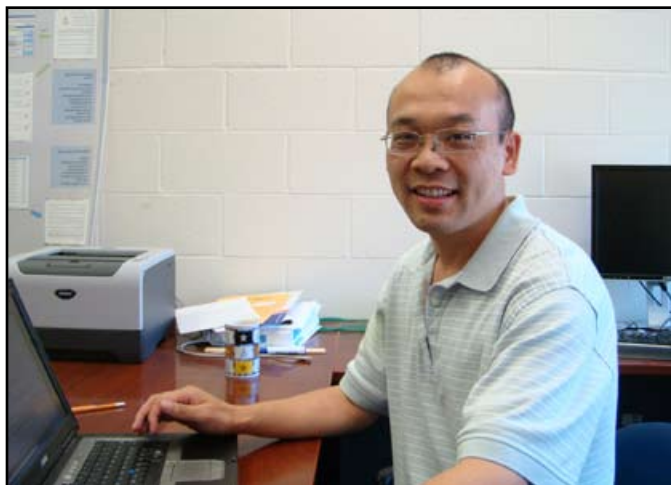
Stacey Appointed to Lead DOE Advisory Committee

Gary Stacey, director of MU's Center for Sustainable Energy, was appointed chairman of the Department of Energy's Biological and Environmental Research Advisory Committee (BERAC). BERAC advises the Biological and Environmental Research (BER) office of the Department of Energy on complex biological and environmental research technical issues. These issues can include developing biofuels, determining the impact of climate change, assessing options for carbon sequestration, predicting the fate and transport of subsurface contaminants, and developing tools to explore the interface of biological and physical sciences.



Two Protein Prediction Teams Rank High at CASP8

The ability to accurately predict protein structure from sequence data is one of the most challenging problems in biology today. At the Eighth Critical Assessment of Techniques for Protein Structure Prediction (CASP8), a competition that pits protein prediction computer modeling methods against each other, two MU servers, MULTICOM and MUFOLD, ranked high in both template-free and template-based categories. The MULTICOM team was led by Jianlin Cheng and the MUFOLD team by Dong Xu, both with MU's Department of Computer Science. Cheng and Xu use their technologies to help determine the structure and function of proteins in a number of important crop plants, including corn and soybean.



NAS Fellow John Boyer Visits Students & Faculty

National Academy member, Dr. John Boyer, E.I. Du Pont Professor Emeritus of Biochemistry/Biophysics from the University of Delaware, visited IPG faculty and students from September 26-30, 2009. During his visit, which was sponsored in part by the Chancellor's Distinguished Lecture Series, Dr. Boyer gave a public lecture on developments made in the plant sciences toward closing the gap between agricultural productivity and the biological potential for productivity in the U.S. In addition to visiting with a number of plant research teams, Boyer also talked to graduate students about future research directions in plant adaptation to drought during a guest lecture in PLTSCI 8530, "Research with Plant Stress Agents."





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