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 Korkin 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

Grant Proposals Submitted by IPG (2009)

<table>
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<tr>
<th>Title (PI)</th>
<th>Type</th>
<th>Agency</th>
<th>Funded</th>
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<td>Symposium on Root Biology (Gassmann)</td>
<td>Conference</td>
<td>NSF-IOS</td>
<td>Yes</td>
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<td>Funds applied toward reduced postdoc/student registration fees &amp; undergraduate recruitment</td>
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<td>Symposium on Root Biology (Mitchum)</td>
<td>Conference</td>
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<td>Plants for Changing Environments (Walker)</td>
<td>Training</td>
<td>NSF-IGERT</td>
<td>No</td>
<td>preproposal</td>
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<td>Enhancing the capacity for research in plant sciences at the University of Missouri (Walker)</td>
<td>Equipment</td>
<td>MLSRB</td>
<td>Pending</td>
<td>$991,000</td>
<td>Funds requested for growth chambers in Waters Hall, Agriculture Building, Tucker Hall, and Schlundt Annex. Governor “terminated” MSLRB program in October 2009.</td>
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<td>Modernization of Plant Growth Facilities at MU (Walker)</td>
<td>Construction</td>
<td>NSF-ARI-RR</td>
<td>No</td>
<td>$4,562,863</td>
<td>Funds requested to replace Curtis Hall greenhouse with new greenhouse facility south of Ashland Road greenhouse complex</td>
</tr>
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</table>
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
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

Emmanual 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
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.
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Graduate Students
**Completed Master’s and Doctoral Students in 2009**

**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.

---

**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”
<table>
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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

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

Student Organizers:
Jennifer Holland, Diana Roberts, Chad Niederhuth
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

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 ...........................................33
Postdoc/Student ........................................................................31
MU Faculty ................................................................................5
MU Staff .................................................................................48
MU Postdoc/Students ................................................................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.
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.

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.

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


The articles can be viewed at http://www.sciencemag.org
Journal Articles


Chege PG, Clark TL, Hibbard BE: Initial larval feeding on an alternate host enhances western corn rootworm (Coleoptera: Chrysomelidae) beetle emergence on Cry3Bb1-expressing maize. *Journal of the Kansas Entomological Society* 2009, 82:63-75.


Dierking EC, Bilyeu KD. *New sources of soybean seed meal and oil composition traits identified through TILLING.* *BMC Plant Biology* 2009, 9.

Dierking EC, Bilyeu KD. *Raffinose and stachyose metabolism are not required for efficient soybean seed germination.* *Journal of Plant Physiology* 2009, 166(12):1329-1335.


Ko HS, Jin RD, Krishnan HB, Lee SB, Kim KY: Biocontrol ability of lyso bacter antibiotic HS124 against phytophthora blight is mediated by the production of 4-hydroxyphenylacetic acid and several lytic enzymes. *Current Microbiology* 2009, 59(6):608-615.


New Grants

**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.


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


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

**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.


Hibbard, B. (PI); Sappington, Thomas; Gassmann, Aaron. Risk of Western Corn Rootworm Adaptation to Transgenic Corn. U.S. Department of Agriculture, $400.00.


Hous, J. (PI), Fritschi, F. Nitrogen Dynamics of Standard and Enhanced Urea Fertilizer in Corn. Missouri Fertilizer and Lime Board, $81,728.


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.


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.


**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 for 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.”