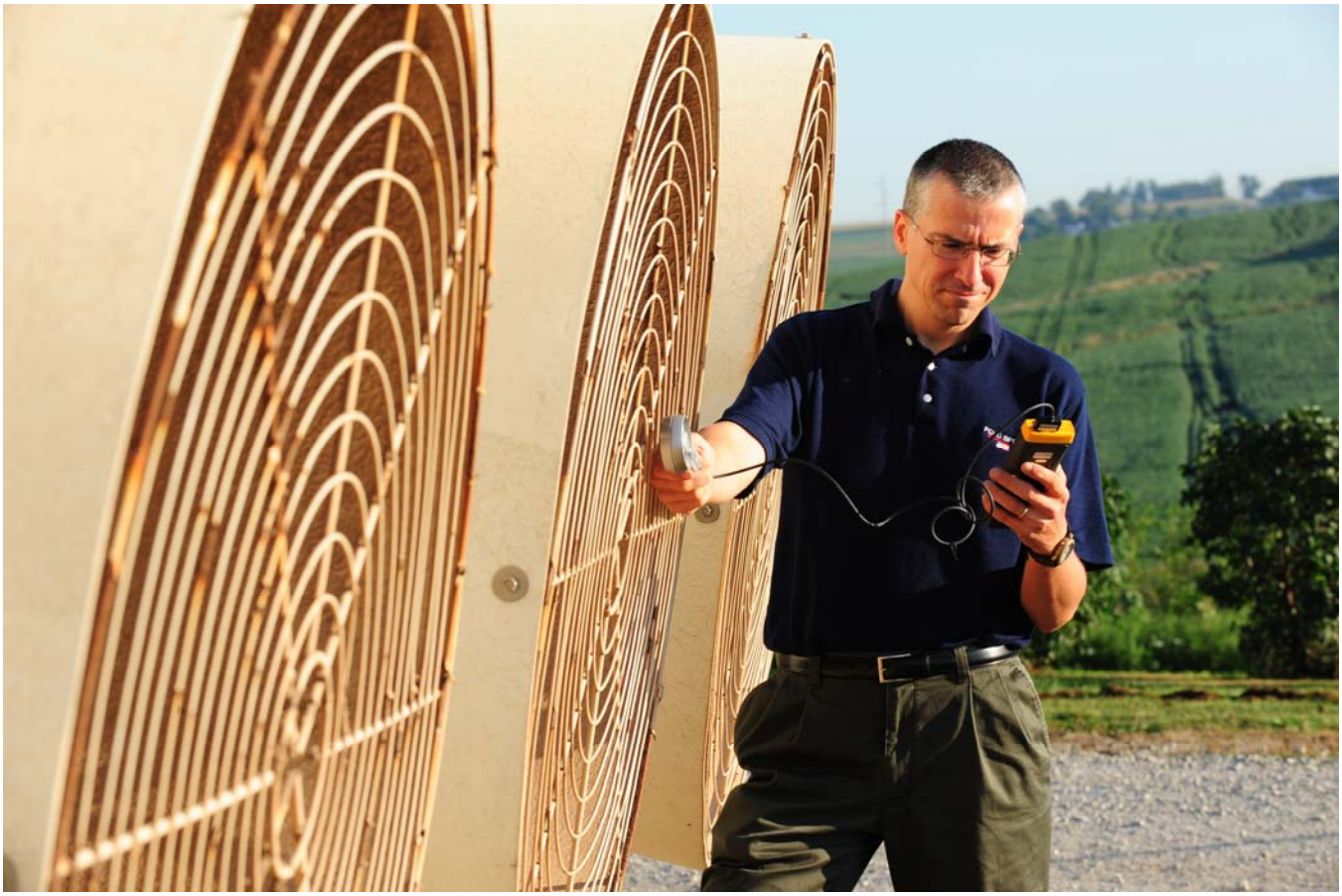
Toxicology

Interdepartmental Graduate Program at Iowa State University December 2008



Toxicology faculty member Jacek Koziel, Agricultural and Biosystems Engineering, monitors air quality at a large swine gestation-farrowing farm in central Iowa. (Photo by Bob Elbert, University Relations)

Toxicology Chair:	Anumantha Kanthasamy, Biomedical Sciences
Supervisory Committee:	Gary Osweiler, Veterinary Diagnostic and Production Animal Medicine
	Patricia Murphy, Food Sciences and Human Nutrition
	Arthi Kanthasamy, Biomedical Sciences
	Richard Martin, Biomedical Sciences
	Joel Coats, Entomology
Program Coordinator:	Linda Wild, Interdepartmental Toxicology

Special Thanks to the Iowa State University Colleges that provide support to our program: ISU Graduate College, College of Veterinary Medicine, and College of Agriculture and Life Sciences.

Alumni Updates

Steve Bradbury (Ph.D./Entomology/**Coats**) has been appointed OPP's (Office of Pesticide Programs) new Deputy Director for Programs effective January 4, 2009. Steve brings to his new role a wealth of experience, having served as the Director of two OPP Divisions over the past five years – the Special Review and Reregistration Division from August 2007 to the present, and the Environmental Fate and Effects Division from 2003 to 2007. As Director of these two Divisions, Steve has led scientists who produce state of the art pesticide drinking water exposure characterization and ecological risk assessments, and risk managers who develop regulatory decisions that advance public health and environmental protection.

Kelsey Prihoda (M.S./Entomology/**Coats**) is a Senior Research Scientist in the Regulatory Department at Pioneer Hi-Bred conducting environmental fate/exposure studies to support the registration of Pioneer's products. However, as of January 12, 2009, she will be working at the Lake Superior Research Institute on the campus of the University of Wisconsin-Superior (UWS). She will be a Quality Assurance/Quality Control Manager for various aquatic toxicology research projects there.

Daniel J. Zaffarano Lecture
April 26, 2008

Y. James Kang, DVM, Ph.D.
Departments of Medicine, and Pharmacology and Toxicology
University of Louisville School of Medicine

"Cardiac Toxicology: A New 'Species' in Toxicology"

This lecture series is in honor of Dr. Daniel J. Zaffarano, Dean of the Graduate College, 1971-1988, who was a strong proponent of interdisciplinary research in the 1980s. Dr. Zaffarano recognized the potential for Toxicology to address a growing number of challenges in our society and was very supportive of the formation of the Interdepartmental Toxicology program. Pictured: **Y. James Kang** (left) accepts the Zaffarano Lecuture plaque from **Joel Coats**, Entomology. Dr. Kang was a student in Duane Enger's lab in the Department of Zoology and Genetics and received his Ph.D. in Toxicology.

Keri Henderson (Ph.D./Entomology/**Coats**) works at Pioneer Hi-Bred providing technical and scientific leadership in environmental safety assessment for biotechnology products, including the design and coordination of environmental studies to determine the potential ecological effects and environmental fate of genetically modified crops. She combines data from these studies to understand potential environmental risk and represents the Regulatory Science division within Pioneer and in key industry, academic, and regulatory venues in the environmental safety assessment arena. Keri and her daughter Reese (2.5 years) still live in Ames and enjoy spending time outside and working on home improvement projects.

Present Toxicology Graduate Students

Hailin Tang (pictured at left) (MS/Entomology/**Bonning**) examining baculovirus-infected larvae for symptoms and mortality. Hailin graduated this fall.

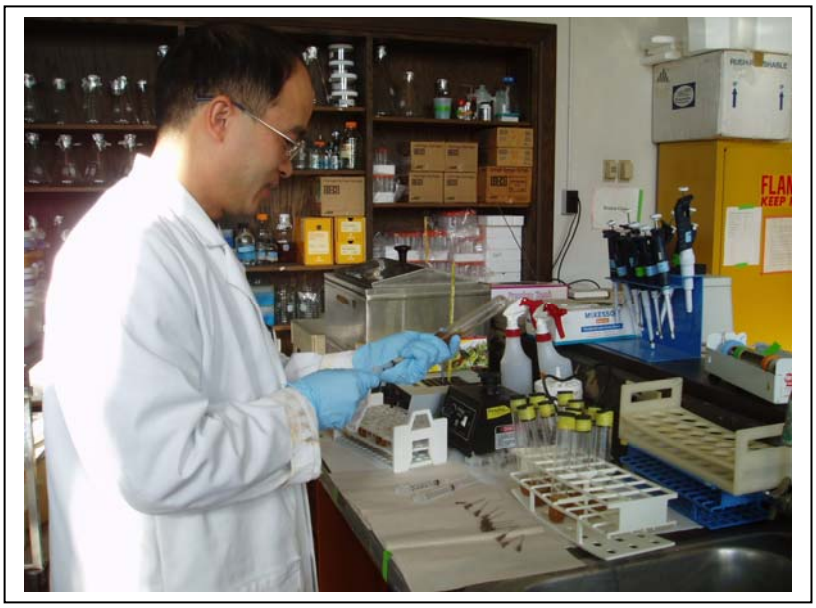
Kevin Johnson, doctoral candidate in entomology with a minor in Toxicology (minor representative is **Joel Coats**), was awarded the Pioneer Hi-Bred International Graduate Student Fellowship through the Entomological Society of America. This is a four-year fellowship awarded to students conducting "innovative research and graduate education in the area of entomology with a focus on key insects or complexes of insects that effect corn, soybeans, canola, alfalfa, or other significant commodity crops." This award will be presented to Johnson at the society's national meeting in November.

Hilary Afeseh Ngwa (Biomedical Sciences/**Kanthasamy**) was selected as a Fellow in the 2008 Minority Fellows Program in San Diego, California. As part of this program, he attended the Biotechnology Institute Education Conference in San Diego, CA, June 15-17, 2008 with his industry mentor. He received complimentary access to the Biotechnology Industry Organizations (BIO) 2008 International Convention June 17-20, 2008, with over 20,000 industry attendees and 175 informative breakout sessions across 22 tracks.

Arunkumar Asaithambi (Biomedical Sciences/**Kanthasamy**) received the best paper presentation award at the Society of Toxicology meeting in Seattle awarded by Association of Scientists of Indian Origin in America (ASIOA).

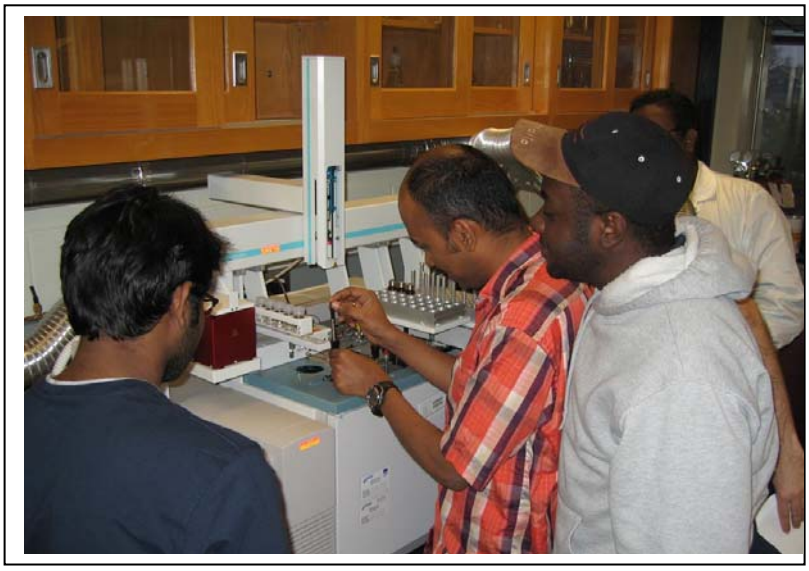
Zaffarano Prize - Honorable Mention

Keri Henderson graduated from Iowa State in May 2008 with a Ph.D. in Toxicology from the Entomology Department. Her research area was environmental toxicology and the chemistry of agrichemicals. Throughout her graduate studies, Keri has been an exceptionally productive researcher. She has eight papers in high quality journals. She has presented her work at numerous symposia and also assisted in organizing some, including editing the resulting book. She has written successful grant proposals and secured a graduate fellowship from the U.S. Environmental Protection Agency. Her major professor, Dr**. Joel Coats**, writes “Her research accomplishments and productivity make her one of the best graduate students I have mentored over the past 29 years.” Keri works at Pioneer Hi-Bred in Johnston Iowa as an Environmental Safety Assessor. Congratulations Keri on this award!



Zhong Ye (FSHN/**Hendrich** lab) performing incubation studies.

Fan Tong, a graduate student in the Joel Coats lab, along with fellow Cyclone Table Tennis Team members placed 21st in the 2008 College Table Tennis National Championships. The National competition was held in Rochester, Minnesota.



This photo was taken in the Atmospheric Air Quality Laboratory during the SPME Theory and Practice lab (part of TOX502). The lab was prepared and run by Dr. Lingshuang Cai and **Jacek Koziel**, Agricultural Biosystems. Pictured are tox students **Arunkumar Asaithambi, Hariharan Saminathan, and Hillary Afeseh Ngwa**.

Sampling of Recent Publications (some in progress) of Tox Students and Faculty demonstrating a wide range of toxicological research at Iowa State

Tang, Hailin., Li, H., Lei, S., Harrison, R.L. and **Bonning, B.C.** 2007. Tissue specificity of a baculovirus-expressed, basement membrane-degrading protease in larvae of *Heliothis virescens*. Tissue and Cell 39: 431-443

Li, H., **Tang, Hailin,** Sivakumar, S., Philip, J., Harrison, R.L. Gatehouse, J.A. and **Bonning, B.C**. 2008. Insecticidal activity of a basement membrane-degrading protease against *Heliothis virescens* (Fabricius) and *Acyrthosiphon pisum* (Harris). Journal of Insect Physiology 54(5): 777-789.

Paluch Gretchen, Miller F, Zhu J, and **J. Coats.** 2008. Influence of Elm Foliar chemistry on the Host Plant Suitability lf the Japanese Beetle, Popillia japonica, and the Gypsy Moth, Lymantria dispar. Journal of Agricultural and Urban Entomology. 23(4): 209-223.

Zhu J, X Zeng, B. Tucker, M. O'Neal, **Gretchen Schultz**, **J R Coats**, L Bartholomay, and R Xue. 2008. Mosquito Larvicidal Activity of Botanical-Based Mosquito Repellents. Journal of the American Mosquito Control Association. 24(1): 161-168.

Paluch Gretchen. JR Coats, J Zhu, and L. Bartholomay (in press). Amyris and Siam-wood Essential Oils: Insect Activity of Sesquiterpenes in Household, Structural and Residential Pest Management. American Chemical Society, Washington, D.C.

Laor, J., **J.A. Koziel**, L. Cai, U. Ravid. 2008. Enhanced characterization of dairy manure odor by time-increased headspace solid phase microextraction and multidimensional gas chromatography-mass spectrometry-olfactometry. Journal of the Air & Waste Management Association, 58, 1187-1197.

Zhong Ye, C-O Hong, K Lee, J Hostetter, M Wannemuehler, and Suzanne Hendrich. 2008. Variability in caffeic acid protection from dextran sulfate sodium-induced colitis in mice. FASEB J. 22:701.2.

Jovanovic, Boris, Mihaaljev Z, Maletin S, and **Palic D**. (submitted). Water quality assessment of river Nisava based upon concentrations of heavy metals from chub (*Cyprinidae-Leuciscus cephalus*) liver. Journal of Freshwater Ecology.

Xu Q, **Kanthasamy AG, Reddy MB**. (2008). Neuroprotective effect of the natural iron chelator, phytic acid in a cell culture model of Parkinson's disease. ***Toxicology.*** 245(1-2):101-8.

Carvour V, Song C, Kaul S, **Anantharam V, Kanthasamy AG, Kanthasamy A.** (2008) Chronic low dose oxidative stress induces caspase-3 dependent PKC proteolytic activation and apoptosis in a cell culture model of dopaminergic neurodegeneration. Ann N Y Acad Sci. 1139:197-205.

Weinkauf, Heidi A, **BF Brehm-Stecher**. Sodium polyphosphate and ployethylenimine enhance the antimicrobial activities of plant essential oils. Submitted to Applied and Environmental Microbiology.

Kanthasamy, A, Kitazawa, M, Yang, Y**., Anantharam V. and Kanthasamy, AG**. (2008) Environmental Neurotoxic chemical induces apoptosis in mesencephalic dopaminergic neuronal cells via caspase-3-dependent proteolytic activation of protein kinase C. Implications for molecular mechanisms of dopaminergic degeneration in Parkinson's disease. ***BMC Molecular Brain***. 1(1):12.

Anantharam V, Kanthasamy A, Choi CJ, Martin DP, Latchoumycandane C, Richt JA, **Kanthasamy AG.** (2008) Opposing roles of prion protein in oxidative stress- and ER stress-induced apoptotic signaling. Free Radic Biol Med**.** 45(11):1530-41.

Selections: Toxicology Faculty and Research

◆**Gary Munkvold**, plant pathology and Seed Science Center Endowed Chair, has been appointed chair of the Graduate Program in Seed Technology and Business (STB). The program combines seed science and technology with essential courses in business management into a single graduate program that is not offered anywhere else in the world. It was approved by the State of Iowa, Board of Regents in March 2006.

"The objective of the program is to educate seed professionals to better address the challenges and opportunities in delivering value to seed users," said Manjit Misra, director of the Seed Science Center. "It is designed to prepare them for management roles and emphasizes the development of problem-solving and analytic skills." Misra said Munkvold was the perfect choice for heading up the program committee. "He has considerable expertise in both the public and private sector. Because of that, we feel he will offer great insights into curriculum development, planning and evaluation." "The Seed Technology and Business Program offers a unique opportunity for seed business professionals," Munkvold said. "Chairing the program will be a great chance for me to work with students and maintain close ties to what I think is one of the most dynamic industries around."

◆In May, ScienceWatch.com reported that an Iowa State-authored paper was the 12th most citied paper in mycotoxins research over the past 10 years. Its citation analysis featured the 1999 paper by **Gary Munkvold**, plant pathology and Seed Science Endowed Chair; Rick Hellmich, entomology and USDA; and **Larry Rice**, USDA-NVSL. The paper, "Comparison of fumonisin concentrations in kernels of transgenic Bt maize hybrids and nontransgenic hybrids" (Plant Disease 83:130), was the first to describe the mycotoxin-reducing capacity of transgenic insect resistance. The documentation of this benefit in Iowa has since been confirmed by other researchers in dozens of states and numerous other nations.

◆A paper written by **Pat Murphy** (FSHN), Kobita Barua and Catherine Hauck (Solvent extraction selection in the determination of isoflavones in soy foods) was one of the Top-50 most cited articles published in Journal of Chromatography B from 2002 to 2007.

◆ISU food science and human nutrition scholars received seven awards from American Oil Chemists' Society during the annual meeting on May 20, 2008, in Seattle. Nicholas Deak, a post doctorate research associate, **Patrica Murphy**, a university professor, and Lawrence Johnson were the collective recipients of the Archer Daniels Midland Award for Best Paper in Protein and Co-Products in the engineering/technology category. College of Human Sciences MATTERS, a newsletter for alumni and friends of the College of Human Sciences, Summer 2008.

◆**Toxicology Foundation Account**. Several toxicology faculty contributed to starting an ISU Foundation Account for Toxicology this year. Funds have been used in support of the very active Toxicology Graduate Student Organization (TGSO) projects and to recognize Alumna Sheryl Beauvais' (Ph.D./Animal Ecology/Atchison) significant contributions to the teaching of present toxicology graduate students through the on-line course TOX 515 Risk Assessment. If you would like to contribute to this fund, checks can be made out to Interdepartmental Toxicology and sent to the program: 2102 Molecular Biology Ames IA 50011-3260. Please indicate how you would like the funds to be used or "as needed by the program".

◆**Pat Murphy**, University Professor of Food Science and Human Nutrition, is one of those researchers who looks for evidence that the consumption of certain foods can benefit human health. She has been studying isoflavones for more than 30 years, well before the compounds were recognized as health-promoting phytochemicals. Phytochemicals are nonnutrient chemicals found in plants. "I started studying soy isoflavones because they were originally considered toxic constituents of plants," Murphy says. "Now they are considered health protective.

Isoflavones are found naturally in some plants, most notably soy. The only other sources eaten by humans are garbanzo beans and alfalfa sprouts. Soy nuts, edamame, soy milk, tofu and many other soy protein foods contain isoflavones. Three isoflavones in soy – Einstein, daidzein and glycietein—act like natural estrogens. Nutritionists believe these compounds reduce the risk of cardiovascular disease, osteoporosis and age-related cancers of the breast, prostate and colon. But they don't entirely understand how or why.

Murphy was a leader in the development of a database of U.S. foods that contain isoflavones. She also developed a method to measure isoflavones in foods, has found a way to produce the compounds for research purposes and developed a soy protein processing system to maintain isoflavone content when designing food products. From Stories in Agriculture and Life Sciences Fall 2008.

◆**Suzanne Hendrich,** FSHN, was awarded the Regents Award for Faculty Excellence. In addition, she was one of twelve women whose leadership has made a difference at Iowa State University honored by the Carrie Chapman Catt Center for Women and Politics on the third annual "Women Impacting ISU" calendar. "We received more than 70 letters of nomination for some 50 different individuals this year, so it's clear that interest is growing in this annual recognition of women's leadership at Iowa State," said Greta Johnson, a junior political science major and one of two Catt Associates who served on the selection committee. "The committee was impressed with the overall quality of the nominations and enjoyed reading about the truly amazing women leaders on this campus."

◆**George Kraus**, Chemistry, was named a AAAS Fellow by the American Association for the Advancement of Science.

◆**Richard Colin Ewan**, a former faculty member in Toxicology and retired ISU professor, passed away Thursday, October 30, 2008. Dr. Ewan began with the Animal Science Department at Iowa State in 1966. He received his Ph.D. in a joint major in meat and animal science from the University of Wisconsin. Dr. Ewan was born in 1934 in Cuba, Illinois, and received his BS in agricultural science from the University of Illinois and his master's degree in animal nutrition in 1957.

◆Research Seed Funding Available from the Iowa Center for Advanced Neurotoxicology

The **Iowa Center of Advanced Neurotoxicity** (ICAN) at Iowa State University is pleased to announce the availability of new seed funding. A total of $100,000 is available to fund four to five research grants, depending upon the number, size and quality of proposals received. The competition is open to all ISU faculty.

Research that may be conducted under this funding opportunity is intended to promote, in a general way, the research goals of the Iowa Center for Advanced Neurotoxicology. These goals focus on the specialty areas of toxicology, neuroscience and related fields. Proposals should contain innovative ideas of high quality, foster multi-disciplinary team research, and be competitive for funding at the national level. The director of ICAN is **Anumantha Kanthasamy**, Biomedical Sciences.

◆A feature in Nature magazine's October issue examines the livestock odor work of **Jacek Kozie**l, agricultural and biosystems engineering. Koziel, who is on faculty improvement leave at Wageningen University in the Netherlands, describes himself as a "smelling weirdo" in the article. Erik Vance indicates in the Nature article: “Koziel is an analytical chemist in the Department of Agricultural & Biosystems Engineering, where he specializes in finding and identifying trace volatile organic compounds responsible for odor. His lab teases apart all kinds of odors, including maize (corn), wine, and the bitter fluids that insects use to defend themselves. But his "bread and butter" is livestock leavings, an incredibly complex chemical matrix. Koziel's lab is a leading authority, having catalogued almost 300 ingredients in swine manure — some of which exist only at concentrations of a few parts per million.” Published online 8 October 2008 | Nature 455, 726-728 (2008) | doi:10.1038/455726a. In the picture to the right, Koziel stands inside a large air scrubber system for the removal of odor and ammonia at one of the swine farms in Holland. He stands next to the particulate matter monitor and more than ankle deep in the slight acidic solution that is being used to remove ammonia, some airborne particulate matter and some odor.

◆**Anumantha Kanthasamy,** W. E. Lloyd Chair in Neurotoxicology, Biomedical Sciences, has been awarded the Clarence Hartley Covault Distinguished Professor in Veterinary Medicine. An internationally renowned neuroscientist, Kanthasamy's research focus is the cellular and molecular mechanisms of Parkinson's disease and other neurodegenerative disorders, and the development of novel therapeutic agents to treat such disorders. He also studies mechanisms underlying prion diseases such as Kuru and Jacobs/Kreutzfelt disease. His laboratory has become a major site for training of Ph.D. students in the field of neurotoxicology.

◆**Ravindra Singh** was named the John G. Salsbury Endowed Chair in Veterinary Medicine**.** Ravi is conducting research on alternative splicing, a process that allows synthesis of multiple proteins from a single gene. The process of alternative splicing is associated with spinal muscular atrophy, Alzheimer's disease, Parkinson's disease and other neuronal and mental disorders. Alternative splicing has been linked to various cancers, cardiovascular disease, obesity and diabetes. Singh's research could lead to a better understanding of these diseases and provide novel targets for therapies. (ISU Biotechnology Update, January 2008)

◆**Diane Birt**, FSHN, is the Interim Director for the Nutrition and Wellness Research Center—the first facility in Iowa for testing the impact of foods on human wellness. The Center focuses on conducting practical research and promoting partnerships with food-related industries throughout the state. "Researchers affiliated with the Nutrition and Wellness Research Center will investigate the relationships amongst dietary components, physical activity, and lifestyle that influence chronic disease risk. Our primary missions are to provide healthy foods and food ingredients to optimize health throughout the lifecycle and to enhance the economic value of agricultural commodities grown in Iowa," says Diane F. Birt.

◆**Ruth McDonald**, professor and chair of Food Sciences and Human Nutrition has been named a member of Soy for Life Foundation's new advisory council. The council's advisors will guide the Soy for Life Foundation's research and help determine critical issues to address. They will help identify educational and research opportunities for a wise range of audiences, increasing awareness of the many health benefits of soy and human consumption.

Dr. MacDonald was also appointed to the Iowa Department of Economic Development Board by Governor Chet Culver. "Ruth's leadership in life sciences and agriculture will be invaluable as we create thousands of new jobs, and I look forward to working with her as we transform Iowa into the renewable energy capital of the world," said Culver.

Dr. MacDonald is a member of the project team: DEEP-C's Diet and Exercise Education for Cancer Survivors**.** The goal of project: The goal of DEEP-Cs is to create educational programs for cancer survivors to be incorporated into the curriculum for students in Food Science and Human Nutrition and Health and Human Performance (HHP) that will improve overall health and enhance the quality of life for cancer survivors living in central Iowa. For additional information see: http://www.nwrc.iastate.edu/healthycancersurvivors/homepage.html

◆Slow starch—starch or maltodextrins that are broken down more slowly or not at all in our digestive tract—could benefit individuals suffering from diabetes by preventing surges in blood sugar levels. It also could help individuals struggling with weight gain issues. "In theory, glucose released over a longer period of time should help individuals feel less hungry and, therefore, help control appetites," explains **Suzanne Hendrich** (above left), professor in the Department of Food Science and Human Nutrition. Hendrich is working to test this hypothesis. Because blood glucose levels typically spike after eating, individuals consuming "slow" starch should experience a less dramatic spike. "Starch is just glucose put together in different kinds of granules, with different kinds of branches," says Hendrich. The body is adept at digesting some forms of starch, while others flummox our natural enzymes. So the more difficult the starch is to digest, the longer it takes and the less glucose is released into the blood at a given time.

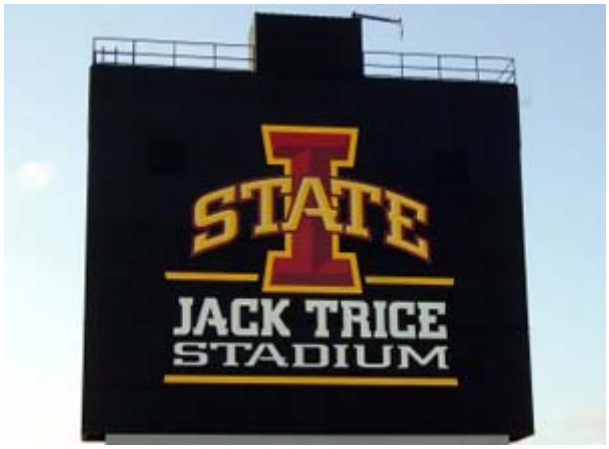
Two different "slow" starches were developed at Iowa State to determine whether they slowed digestion. Hendrich is testing their relative rate of digestion with the help of some healthy young male Iowa State students. Youth is important because "impaired tolerance to glucose comes with age," explains Hendrich. Hendrich's first concern is to establish a base level of success. Because the changes she is working to detect are small, Hendrich's initial starch digestion studies must exclude diabetics, people trying to lose weight and young women (because blood glucose levels naturally fluctuate with the menstrual cycle) due to the abundance of uncontrollable variables. 2007 Plant Sciences Institute Annual Report

◆The ISU Toxicology program will host the 2009 Central States Society for Toxicology (CS-SOT) meeting in late September, 2009. The 2008 CS-SOT was held September 24-25 at the University of Kansas Medical Center in Kansas City. Dr. **Anumantha G. Kanthasamy**, Biomedical Sciences is the 2008-2009 Vice President/President Elect. Several of the Interdepartmental Toxicology graduate students attended the 2008 meeting. The ISU Toxicology program paid for their travel and conference registration.

◆**ISU Racing Chemistry Program**. Iowa State University researchers have been working with the Kentucky Derby for six years, and during that time drug testing has become a household topic. "All the attention the subject has gotten in the past three or four years in all the human sporting endeavors has really raised people's awareness of drug testing and cheating in general," said **Walter Hyde**, director of ISU's Racing Chemistry Program, in the College of Veterinary Medicine. In addition to checking all the samples for the big race, they test all horses in all races in Kentucky, Iowa, Virginia, New Mexico and the Caribbean nation of Trinidad and Tobago. In all, Hyde and his staff of 18 to 20 in the Racing Chemistry Program test about 35,000 samples each year. But nothing is ever routine. "The cheaters are always looking for something they think we can't find," he said. "We work very hard to minimize this happening." Hyde, who is a past president of the Association of Official Racing Chemists, is passionate about protecting the sport, the animals and the jockeys.

"I am in it for the safety of the animal. I don't think animals that can't speak for themselves should be abused chemically for the sake of somebody who wants to win money. I'm also in it for the safety of the jockey who might have their safety at risk due to the effects of the drug," says Hyde. Dan Kuester, ISU News Service

◆**Biosafety Institute**. Genetically modified crops are a fact of our future. While the benefits can be foreseen, there is concern that the altered plant genomes of GM crops may provoke consequences that flow throughout the ecosystem, with a scope that ranges from trivial to critical. "Here in Iowa we hear a lot about bioenergy and the goals for a bioeconomy," says **Jeff Wolt**, member of the Biosafety Institute for Genetically Modified Agricultural Products (BIGMAP) and professor in the Department of Agronomy. "What goes unstated is the underlying assumptions that modern plant biotechnology will be involved and so, too, will the regulatory process." Whether the altered or introduced genes turn plants into biopharmaceutical factories, thwart pests or alter lignin's digestibility, "the issue is the same—there are regulatory obligations to assure product safety that must be met," says Wolt. "Regulations developed ten to fifteen years ago can't keep pace," explains Wolt. "Out of necessity, policies that regulate genetic modification of crops are conservative and based on well-established science." Anticipating, evaluating and weighing the risks and benefits crucial to environmental, ecological and human health are what scientists and regulators will address before new technologies are adopted. Plant Sciences Institute Annual Report 2007



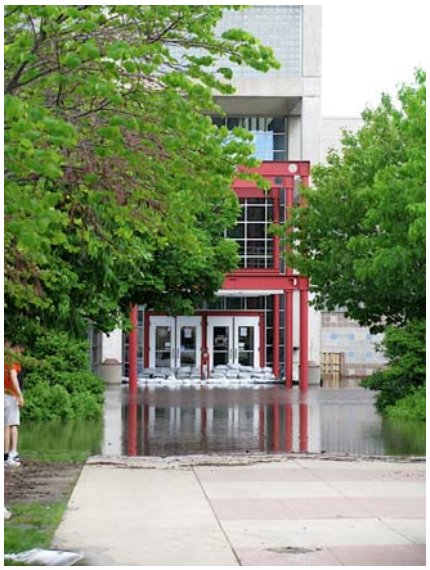
AMES and IOWA STATE

With work on the first phase of renovations at Jack Trice Stadium nearly complete, the university has added new signage to welcome Iowa Staters and guests to the venue. The new athletics logo has been placed on the back side of the stadium's scoreboard facing University Blvd.

Photo by Robert Elbert, 2008.

RAGBRAI runs through campus. This photo is looking south towards Bessey Hall.

RAGBRAI is the Des Moines Register's Great Bike Ride Across Iowa held the last week in July. RAGBRAI goes from the Missouri River to the Mississippi River by bicycle.



(left) Some flooding on campus this summer; entrance to the Recreation Center.

(left)

VEISHEA was cold and snowy in mid April.